Lisbon School of Economics & Management
Universidade de Lisboa

MASTER

MASTERS IN MANAGEMENT AND INDUSTRIAL STRATEGY

MASTER´S FINAL WORK

DISSERTATION

EXTERNAL DETERMINANTS OF ECUADORIAN FRESH-CUT ROSE EXPORT PRICES: A GRAVITY MODEL ANALYSIS

CATHERIN SAMANTA LOOR MURILLO

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SUPERVISION:
PROF. NUNO FERNANDES CRESPO

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To my parents, sister, aunts and friends, for believing in me even when I doubted myself, and for being my strength from across the distance...

ERRATUM

GLOSSARY

FOB – Free on Board

GDP – Gross Domestic Product.

MFW – Master's Final Work.

BCE – Ecuador Central Bank (Spanish).

ABSTRACT

Over the decades, on international business export prices has become significant and also show a significant fluctuation driven by changes in global demand and macroeconomic dynamics in the different destinations around the globe, this price dimension remains underexplored despite its strategic importance for exporting economies. This study addresses the external determinants of the FOB unit price of Ecuadorian fresh-cut roses across 137 international destination markets over the period 2010-2025. Using an augmented gravity model with random Effects GLS panel data estimation, this FMW analyses how macroeconomic variables such as: GDP per Capita, Total GDP, real Exchange rate, and domestic inflation, alongside global shock events, specifically the Covid -19 pandemic and Russia- Ukraine war. The results demonstrate that structural macroeconomic variables do not exert a statistically significant effect on export prices, suggesting that Ecuador operates as a price taker in global flower markets, consistent with the Law of Once price and the Prebisch - Singer Hypothesis. The real exchange rate shows a marginally significant native effect, providing partial support for the price competitiveness. On the other hand, both global shock dummies are highly significant: the Covid -19 Pandemic reduced the FOB unit price by 14.2% in 2020, while Russia-Ukraine war led to an average decline of 7.3% from 2022 onwards. These findings remark the vulnerability of the non-essential agricultural commodities to external demand disruptions and underscore the importance of contingency strategies for exporters and policymakers in the Ecuadorian floriculture sector.

During the creation of this document, the author used Claude Code for the purpose of constructing the model of analysis and translating the Resumo in Portuguese. After using this tool, the author reviewed and edited the content as needed and assumed full responsibility for the content of the work.

Keywords: Fresh cut roses; FOB unit Price; Gravity model; Ecuador; COVID -19; Panel Data.

RESUMO

Ao longo das últimas décadas, os preços de exportação de produtos agrícolas têm registado flutuações significativas impulsionadas pela evolução da procura global e pela dinâmica macroeconómica nos diferentes mercados de destino. Para os produtos não essenciais, esta dimensão dos preços permanece pouco explorada, apesar da sua importância estratégica para as economias exportadoras. Este estudo analisa os determinantes externos do preço unitário FOB das rosas frescas cortadas do Equador em 137 mercados internacionais de destino, no período 2010–2025. Utilizando um modelo de gravidade aumentado com estimação por GLS de efeitos aleatórios em dados de painel, este trabalho examina variáveis macroeconómicas como o PIB per capita, o PIB total, a taxa de câmbio real e a inflação doméstica, bem como eventos de choque global, nomeadamente a pandemia de Covid-19 e a guerra Rússia-Ucrânia. Os resultados demonstram que as variáveis macroeconómicas estruturais não exercem um efeito estatisticamente significativo sobre os preços de exportação, sugerindo que o Equador atua como tomador de preços nos mercados globais de flores, o que é consistente com a Lei do Preço Único e a Hipótese de Prebisch-Singer. A taxa de câmbio real apresenta um efeito negativo marginalmente significativo, oferecendo suporte parcial à hipótese de competitividade-preço. Ambas as variáveis dummy de choque global são altamente significativas: a pandemia de Covid-19 reduziu o preço unitário FOB em 14,2% em 2020, enquanto a guerra Rússia-Ucrânia gerou um declínio médio de 7,3% a partir de 2022. Estes resultados evidenciam a vulnerabilidade dos produtos agrícolas não essenciais às perturbações externas da procura e sublinham a importância de estratégias de contingência para exportadores e decisores políticos no setor floricultor equatoriano.

Palavras-chave: Rosas frescas cortadas; Preço unitário FOB; Modelo de gravidade; Equador; COVID-19; Dados em painel.

1. Done by AI, used translation

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First, I wish to express my deepest gratitude to God and the Virgin Mary, whose protection guides me through every step of my life.

To my parents and my sister, thank you for being present, and for being my greatest support and inspiration throughout this incredible journey. You are my pillars that keep me standing; without you, I would not be where I am today. I would also like to thank my aunts, cousin and friends, as well as those who are no longer with us; your encouragement provides the strength I needed to pursue this master's degree far from home.

Finally, I would like to extend my sincere thanks to my supervisor, Nuno Fernandes Crespo, for his valuable guidance and dedication during the preparation of this Final Master Work, his constant feedback and invaluable insights were an essential to the successful completion of this work.

1. INTRODUCTION

Exporting is the most traditional and frequently strategic path for companies to integrate themselves in Global Value Chains. This will allow countries, particularly developing ones, to rely on competitive and comparative advantages of goods and offer a premium product to the international market. According to the World Bank data, exports of goods and services account for roughly 29.1% of the Gross Domestic Product (World Bank, 2024).

Currently, international trade has become an important and key engine for economic stability for many nations, and one clear example of this dynamic is Ecuador. In its economy, exports represent more than a standard commercial activity, reaching the 30.3% of the GDP (World Bank 2024). Exports have a very important role in allowing the country to mitigate the domestic volatility, meaning that it has helped to overcome different internal challenges, for instance the ones experienced this last years, such as: energy crisis, security and political instability and more factors that tend to reduce the local consumption and private investment (Ministry of Production, Foreign Trade, Investment and Fisheries 2024).

Nations that have a competitive and comparative advantage have a higher degree of protection because consumers prioritize quality and excellence over price, as demand for premium goods is less sensitive to price fluctuations than demand for undifferentiated goods (Porter 1990; Siggel 2006). Ecuador has successfully reached recognition because of the experience gained through the years by focusing on the key export products such as shrimp, cocoa, and fresh roses. According to The Central Bank of Ecuador (BCE), in its last report the non-oil exports have increased by 8.6% (Central Bank of Ecuador 2026a). These exports increased at an exponential level while maintaining the quality, demonstrating that despite the domestic volatility, the products remain with a premium positioning in international markets.

Despite the strategic importance of the fresh-cut rose sector for Ecuador's economy, the empirical literature on the determinants of agricultural export prices remains limited compared to studies on trade volumes or aggregated export values. The fresh-cut rose FOB unit price as dependent variable, represents a relevant but underexplored dimension of exports, especially for luxury or non-essential goods exposed

to global shocks that have occurred in the recent time. This study contributes to this line of research by applying an augmented gravity model to analyse the external determinants of the FOB unit price across 137 destinations over a 16-year period (2010-2025). The augmented gravity model is selected as the analytical framework because it captures the simultaneous effects of economic size, geographical distance and bilateral trade conditions on trade outcomes. The panel data within this model allows the control of unobserved country-specific heterogeneity across the different destination markets, making it particularly suited for analysing price determinants across a large and heterogenous set of importers over an extended period of time (Anderson and van Wincoop 2003; Baltagi 2021). This time frame groups major changes in global trade, such as the COVID-19 pandemic and the Russia-Ukraine war. Moreover, understanding these export determinants will help potential exporters, industry associations, and policymakers to anticipate price fluctuations and strengthen the competitive positioning of Ecuador's rose sector in international markets.

Within this background, the fresh-cut rose sector represents one of Ecuador's most important export industries. As the world's second largest exporter of cut flowers, Ecuador participates in a highly competitive global market in which the FOB unit price, measured in USD per kilogram, reflects the pricing conditions of each destination market. This price has been shaped by external macroeconomic determinants, geographical factors, and global disruptions that have influenced the commercial environment of each importing country. Therefore, identifying these external determinants across multiple destination markets over the period 2010-2025 is the main objective of this Master Final Work.

The main research question of this study is: What are the external determinants of the FOB unit price of Ecuadorian fresh – cut roses across international destination markets over the period 2010-2025? To address this research question, the following specific objectives are established. (i) To review the theoretical and empirical literature on international competitiveness and external determinants of agricultural export prices with a gravity model scope. (ii) To quantify the effect of macroeconomic conditions of destination markets through variables such as: GDP Per capital, total GDP and the Real Exchange Rate (RER) with it structural variables like: Geographical distance and the domestic macroeconomic variable of inflation on the FOB unit price of Ecuadorian fresh-

cut roses; (iii) to assess the impact of the global shocks on specific Covid 19 and the Russia – Ukraine war on the export price of a non-essential agricultural commodity; (iv) to derive practical implication for exporters, industry associations and policymakers in the Ecuadorian industry based on the empirical findings

To address these questions, the study is structured as follows: Chapter 2 presents the literature review on international competitiveness, the external determinants of FOB unit price, and how the global shocks can affect agricultural commodities. Chapter 3 describes data, variables and the econometric methodology used. Chapter 4 presents and discusses the results and finally, Chapter 5 provides the main conclusions of this work.

2. LITERATURE REVIEW

2.1. International Competitiveness

The concept of competitiveness has been studied extensively across economic theories, but it remains complex and difficult to define because this concept operates at different levels, such as the country, industry and firm levels, meaning that it can vary depending on the analytical view adopted. Based on the work of Siggel (2006), this concept lacks a single accepted definition and can operate at two levels: the macro level, where countries and regions compete through trade balances and market share, and the micro level where firms compete through product differentiation and profitability. For the purposes of this study, international competitiveness is understood at the industry and product level, in the capacity of a commodity to sustain and strengthen its price positioning in international markets relative to competing origins.

The classical approach of international competitiveness starts with Adam Smith (1776; 2002) who argued in the *Wealth of Nations* that nations should specialize in producing goods in which they are more efficient than others, calling this absolute advantage. This early theory introduced the idea that specialisation and product exchange between nations create gains from trade, demonstrating that not all nations compete on equal terms. From this, Ricardo ([1817] 2004) developed the theory of comparative advantage, which states that countries can gain from the exchange of goods when production costs differ between sectors. Subsequently, the Heckscher-Ohlin model complemented these theories by explaining that countries tend to export goods that

intensively use their abundant production factors, such as natural resources and labour (Robale, Ballesteros, and Camaro 2024).

On the other hand, Michael Porter (1990) proposed the Diamond Model, that recognized that, beyond natural resources, competitive advantage can be affected by other conditions related to industry structure, rivalry, government policy , global crises and geopolitical shocks. These factors represent external disruptions that the diamond framework considers fundamental in altering the competitive conditions of an industry and prices in international markets. This last determinant is particularly crucial given the major external disruptions that have affected global commodity markets in recent years.

Taking these theoretical frameworks into account, international competitiveness at the industry and product level is shaped by the interaction of several factors and external conditions under which industries compete in global markets. It is important to note that competitiveness and comparative advantage are complementary concepts, because the former captures how a sector maintains its price positioning in international markets, while the latter explains the specialization in a given sector based on its resource endowment (Siggel 2006). The external macroeconomic factors that shape the FOB unit price are examined in the following sections.

2.2. Export Determinants

To properly conceptualize and understand what drives a country to participate in and sustain its position in global markets within the context of international trade, export determinants can be defined as a set of factors that influence participation in international markets not only in terms of volume and value of goods, but also in terms of destinations and negotiated prices, making this a main concern in international trade. As Amor & Attouch (2022) note, export determinants have evolved significantly over the years, reflecting the complexity of international trade and the increasing importance of different trade-environment conditions in shaping the trade outcomes.

The literature review separates the export determinants into two different categories: internal and external. Internal determinants of exports are managerial features, characteristics, or capabilities of the enterprise and the marketing strategy applied. On the other hand, external determinants are related to the environment in which the company is encouraged to participate (Amor and Attouch 2022). This latter category includes the

economic size and income level of destination markets, geographical distance, exchange rates, trade agreements, and other macroeconomic conditions of the exporting country.

With respect to external determinants, it is important to distinguish that most studies focus on explaining export volumes, which are represented by the total exported quantity between two nations. However, the price received per unit of output in each destination market is also important because the empirical literature shows that the same external factors can have a different effects on volumes and prices, depending on the nature of the commodity and the behaviour of the destination market (Abdullahi et al. 2022; Leitão 2024). Thus, the price per unit of exported commodity by destination represents a separate and useful dimension of trade. The study by Fiankor (2024) argues that the analysis of FOB export prices across destinations is a valuable research topic worthy of further examination.

2.3. External Determinants

Beyond the classical theories presented in the previous section, the empirical literature on export price determination adds theoretical frameworks that connects with the formation of commodity prices in international markets. The Prebisch- Singer hypothesis, firstly formulated by Prebisch (1950) and Singer (1950) which state that prices of trade of primary commodities tend to deteriorate over the years relative to manufactured goods. This effect occurs because of the demand of the primary goods, or agriculture-related ones, grows more slowly than manufactured goods as income rise and commodity markets are recognized by the high level of competition among producing countries. This will put pressure on prices. As a result, countries that specialize in primary commodities have a significant disadvantage in price position in global markets, with a limitation to negotiate the price they receive. A recent study confirms that soft commodities, such as agricultural products are exposed to this dynamic, as they face both real exchange rate appreciating pressures and long-run terms of trade deterioration (Geronimi and Taranco 2018). In the same topic, the Law of One Price establishes that in competitive international markets, identical goods have a single price once adjusted by exchange rate and transport costs. For agricultural commodities, however, the export price is linked to the international reference price, making exporters in developing countries more dependent on a global price than on economic characteristics of individual

destination markets (Emediegwu and Rogna 2024). Together, these theoretical frameworks provide the foundation for the inclusion of external determinants examined in the following paragraphs.

Several authors mention a broad set of external factors that shape a country's export participation and pricing outcomes, such as economic, geographical, technological, political, cultural, foreign trade policy factors (Abreo, Bustillo, and Rodriguez 2021; Amor and Attouch 2022; Erdil and Özdemir 2016)

According to Abreo et al. (2021), factors such as taxation, labour promotion policies, and institutional distance play a key role in achieving economic, legal, social and international success. Similarly, Alvarez et al. (2018) also remark that institutional quality is highly related to trade agreement results, meaning that weaker institutions lead to lower trade flows.

Despite the fact that governance quality and distance are strong pillars of international trade performance, there are other factors that can affect exports that need to be taken into account. For instance, in a study on the determinants of FOB export prices of palm oil exports (Lugo-Arias et al., 2024), the authors found that the exchange rate is the most important factor affecting the FOB export prices.

Other authors (Vo, Yang, and Dung Tran 2024) carried out a study showing that exports are positively influenced by gross domestic product (GDP) and population, whereas exports are negatively impacted by exchange rate, free trade agreements, trade barriers, and tax rates. On the same topic, a study on the determinants of India's cotton export prices and volumes determined that promotion by policymakers not only benefits exports but also the stakeholders such as farmers. Furthermore, Yadav & Chattopadhyay (2024) emphasize that it is necessary to carry out additional research focusing on export price dynamics within the context of climate changes and geopolitical tensions.

A study about the export determinants of Uzbekistan, concluded that Gross Domestic Product per capita and gross savings are key drivers for export prices, meaning that they have a positive correlation. However, the findings also show that the exchange rate negatively affects export volumes (Maxamadnosir qizi 2025).

In small exporting economies, export revenues are closely linked to fluctuations in external demand and international prices, as the export sector responds asymmetrically

to demand expansions versus contractions (Cologni and Manera 2014). In this context, the income level of destination markets becomes an important external determinant because it drives the demand curve that importing countries face and defines the operational conditions under which the export sector sets prices.

The positive relationship between destination country income and agricultural export prices has been studied for different commodities and exporting countries. Jain et al. (2025) studied the macroeconomic determinants of Indian black pepper exports to ten different destinations over a 34-year panel, finding that GDP per capital of importing countries has a positive and statistically significant effect on quantity and value. The study finds that a one-percent increase in destination-country income leads to approximately a three-percent increase in crushed pepper exports, supporting the notion that higher income levels at the destination expand demand for agricultural goods.

While the GDP per capita captures the purchasing power and income level of the average consumer, the total GDP represents the overall economic size and absorptive capacity of the destination market, that is, the potential for importing goods. Abdullahi et al. (2022), using an augmented gravity model of China's agricultural exports, found that the economic size of exporting and importing countries is positively related to trade flows. Similarly, María-Isabel Ayuda et al. (2022), in a gravity model analysis of Latin American agri-food exports to 185 partners, find that importer GDP is positive and significant, concluding that growth in external demand is a fundamental factor, explaining the expansion of Latin American agricultural trade.

Among external determinants, the real exchange rate (RER) represents a fundamental factor in the agricultural sector. According to Mien (2021), exchange rate fluctuations can trigger the "Dutch disease" phenomenon, which consists of an overvalued currency leading to the displacement of local production in favour of foreign imports. In small economies, the RER acts as an exogenous barrier that erodes the price advantage of export commodities, despite sector-level operational efficiency. Therefore, the exchange rate acts as a macro regulatory determinant that conditions the limits between export feasibility and market exclusion. Regarding the exchange rate, Jain et al. (2025) find that results can be either positive or negative, depending on the currency

movements, which reflect price competitiveness gains or increased import cost at destination (Lugo-Arias et al. 2024; Mien 2021).

Beyond the market-side determinants, the domestic macro-economic conditions in the exporting country also shape export price levels in international markets. Regarding inflation, domestic price increases, raising production costs, such as labour inputs and logistics. Exporters tend to pass higher costs on to international buyers, which results in higher FOB unit prices. According to a study of agricultural producer prices across 28 Asian countries from 1991 to 2020, Nugroho et al. (2024) find that inflation is a positive and statistically significant determinant of agricultural producer prices, confirming that domestic cost pressures are transmitted into the price structure of agricultural products. Similarly, Nthebe & Teboho (2024), analysing agricultural exports in the SADC region, confirm that when inflation exceeds a critical threshold, its effects on exports becomes negative and significant, meaning that rising domestic cost can influence export price levels in international markets. Jain et al (2025) also include inflation in their panel model study. In the case of this study, Ecuador, as a dollarized economy with no monetary autonomy, experiences domestic inflation as a broader cost pressure on prices and internal logistics that may translate directly into the FOB price charged to international buyers.

The empirical literature also identifies supply-side factors as relevant drivers of agricultural export outcomes, including production volume, domestic consumption, cultivated area, and market structure (Wisenthige et al. 2025). However, these factors operate through domestic production constraints rather than the demand and pricing conditions of destination markets, which are the main focus of the present study.

Within the augmented gravity model framework, geographical distance between the importers represents one of the most robust determinants of bilateral trade flows, because its role act as a proxy for transportation costs, time in transit, and logistical complexity (Anderson and van Wincoop 2003; Mayer and Zignago 2011). However, for the FOB price exports, the theoretical relationship between distance and export prices differs from its effect on volumes. Since the FOB price is measured at the point of origin and does not include post shipment transportation costs, the price of transportation is received by the exporter, in this case is theoretically weaker and often not significant in empirical studies (Leitão 2024).

Therefore, in line with the arguments set out in the previous paragraphs, the following hypotheses are advanced:

Hypothesis 1:

Geographical distance has no statistically significant effect on the FOB unit price of Ecuadorian fresh-cut roses.

Hypothesis 2:

The GDP per capita of the destination country has a positive effect on the FOB unit price of Ecuadorian fresh-cut roses.

Hypothesis 3:

The total GDP of the destination country has a positive effect on the FOB unit price of Ecuadorian fresh-cut roses.

Hypothesis 4:

The real exchange rate has a negative effect on the FOB unit price of Ecuadorian fresh-cut roses.

Hypothesis 5:

The domestic inflation rate has a negative effect on the FOB unit price of Ecuadorian fresh-cut roses.

2.4. Global Shocks

Apart from the macroeconomic determinants reviewed in the previous section, the empirical literature recognizes that global shock crises constitute a relevant category of factors that can influence export prices in ways that the previous structural variables cannot capture. Global shocks are defined as large-scale external disruptions that simultaneously affect destination markets, modifying the demand environment and commercial conditions faced by exporters across their market portfolios (Glauben et al. 2022; Hayakawa and Mukunoki 2021). While macroeconomic variables, such as GDP or RER, capture global structural effects, global crises produce discontinuous breaks in trade patterns, which can affect prices or export volumes In ways that standard gravity variables cannot fully absorb (Engemann and Jafari 2022)

To better understand the impact of global shocks on agricultural commodities, it is important to categorize export commodities into essential and non-essential goods. The first group includes primarily food and basic necessities, which tend to exhibit inelastic demand during global shocks, as consumers maintain their consumption despite uncertainty and income reductions. By contrast, non-essential products are characterized by high demand elasticity, meaning that when uncertainty rises, consumption of these products is among the first to declide (Silva and Duarte 2021). Hayakawa & Mukunoki (2021) documented that non-essential goods experienced significantly larger trade contractions than essential goods during the COVID-19 pandemic, because during that period of time consumer expenditure was redirected towards critical necessities.

Complementing this evidence, Engemann & Jafari (2022) analyzed the resilience of global agri-food trade during the COVID-19 shock and found that primary products showed relative resilience, while luxury commodities such as flowers were severely affected. The authors show that live plants and cut flowers experienced import value declines of 28% in April 2020, making them the most effected category of agri-food products. The pandemic simultaneously disrupted supply chains through logistical bottlenecks and reduced demand through income and mobility restrictions, creating strong downward pressure on export prices, particularly for perishable products (Ke, Cho, and Su 2025).

Regarding other global shocks, Glauben et al. (2022) documented that after the invasion related to the Russia-Ukraine war, the FAO food price index surged by 21% compared to 2021, surpassing all historical records, with the most significant price effects observed in grain and oilseed markets. By contrast, luxurious products such as flowers were affected by disputed logistics, reduced purchasing power in affected markets, and the restructuring global trade routes.

Overall, the literature reviewed shows that global shocks represent a distinct category of disruptions that generate sudden breaks in trade patterns, which macroeconomic variables alone cannot fully capture. The evidence documented across both the COVID-19 pandemic and Russia-Ukraine conflict demonstrates that non-essential agricultural goods experience significant impacts during these episodes. Hence, the following additional hypotheses are advanced:

Hypothesis 6:

The COVID-19 pandemic had a negative effect on the FOB unit price of Ecuadorian fresh-cut roses.

Hypothesis 7:

The Russia-Ukraine war had a negative effect on the FOB unit price of Ecuadorian fresh-cut roses.

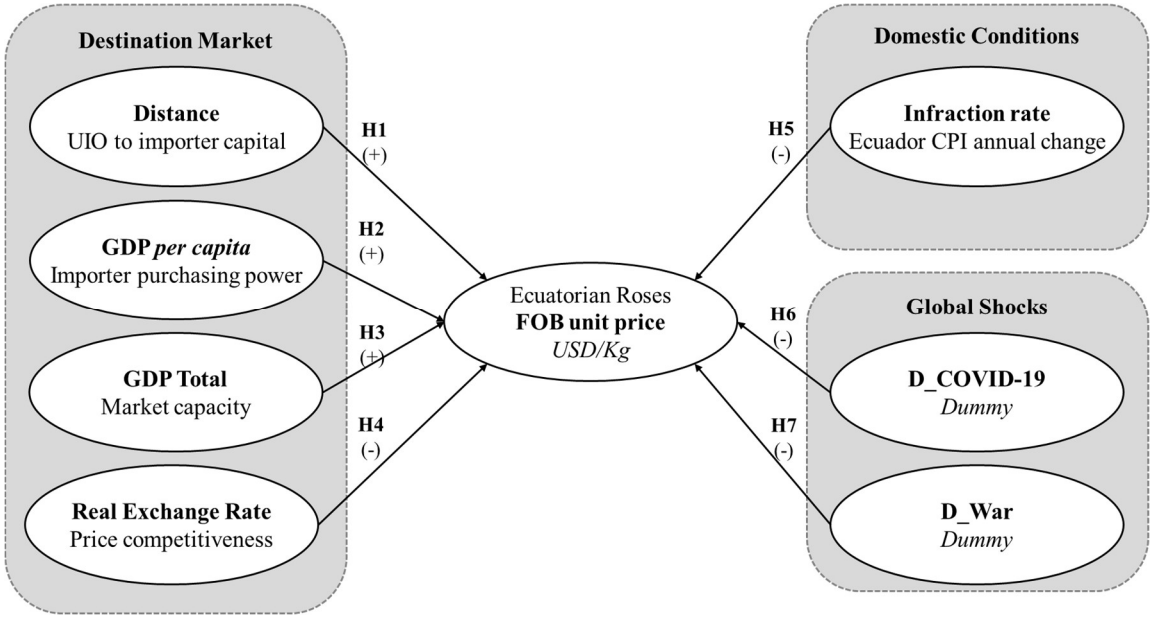
2.5. Conceptual Framework

The literature review shows that export prices depend on the interaction between macroeconomic conditions in destination markets and structural factors of the trading relationship. While certain authors take into consideration institutional quality, governance, and industry-level capacities as key drivers of international trade success, others focus on exogenous factors such as global demand (GDP), real exchange rates (RER), and global disruptions as significant forces that shape the export price outcomes in small exporting economies.

The reviewed evidence supports the view that these external determinants, operating through demand channels, price-setting mechanisms, and geopolitical disruptions, are the primary drivers of FOB prices in agricultural commodity exports. To understand these relationships, this study proposes an integrated conceptual framework that connects destination market macroeconomic conditions (GDP per capita, total GDP, RER), structural gravity variables (distance), domestic macroeconomic conditions (inflation) and global shock events (COVID -19 and Russia-Ukraine war) as the key external determinants that shape the FOB unit price of Ecuadorian fresh-cut roses across international markets during 2010-2025.

The conceptual framework of this research captures the relationship between these external determinants of the FOB unit price of Ecuadorian fresh-cut roses across 137 destination countries over the period 2010-2025. This framework contributes to understanding how these factors affect the price of the commodity in international markets, providing empirical support for the model presented in the following chapter.

FIGURE 1: ***Conceptual Framework***



3. METHODOLOGY

3.1 Sample and Data Description

This study aims to identify the external determinants of the FOB Unit price of Ecuadorian fresh roses (HS. 0603110000) in international markets. To do this, an annual panel dataset covering the period 2010-2025 was constructed. The time period for this analysis (2010-2025) was selected based on data availability from both the BCE and some other international organizations. It was possible to include 137 export destination countries in the analysis, with a total of 1,627 observations. The data on export flows in Total FOB Value and Metric Tonnes was obtained from the official Ecuador Central Bank statistics (Central Bank of Ecuador 2026b).

Before constructing the database, a data cleaning process was conducted. Some countries were excluded from the study because the economic data related to the determinant factors were not found. That was the case of North Korea, Libya, Myanmar, the Netherlands Antilles and the British Indian Ocean. After the extensive process of preparing the data, the final dataset contained no missing values in any variable. However, in cases where there was a single purchase, such as Syria, Yemen, Cambodia and the Salomon Islands, these observations were maintained because their data represent trade flows and removing them could introduce selection bias into the estimation (Abdullahi et al. 2022).

The dependent variable is the average FOB unit price (USD/Kg), defined as the ratio between the Total FOB value exported and the Volume in metric tonnes per destination country in each year.

The explanatory variables of the model are based on the augmented gravity model framework. Accordingly, this study groups macroeconomic variables such as the real exchange rate, and inflation rate, in addition to the common variables that explain the trade flows in function of the economic size of trading partners (GDP) and geographical distance. Furthermore, event dummy variables are included to account for external shocks, and all these variables allow to capture the complexity of the export price formation in agricultural commodities.

The model takes into account four continuous variables. The first one is the bilateral distance between Quito and the capital of the importing country (Distance), measured in kilometres using the CEPII GeoDist database (Mayer and Zignago 2011). Quito was selected as the starting point because fresh-cut roses, as a perishable commodity, are shipped by air cargo to the different destinations. The model also includes GDP per capita and total GDP at purchasing power parity, measured in constant 2021 international dollars. Both these variables were obtained from the World Bank's World Development Database (World Bank 2025). It is important to mention that the use of constant values eliminates the effect of inflation, allowing for a better comparison over these 16-year panel period. In addition, this model integrates the Real Exchange Rate, published by the Central Bank of Ecuador (BCE). This ratio captures the export country (Ecuador) price competitiveness vis-à-vis each importing country. Additionally, one more macroeconomic variable from Ecuador is included, namely the inflation rate, which was compiled from Ecuador's Central Bank.

The next step in managing this data followed the standard procedure for the gravity model, whereby a natural logarithm transformation was applied to all continuous positive variables: FOB unit price, Distance, GDP per Capita, Total GDP, and Real exchange Rate (RER). This change is a standard practice in gravity model estimators as it linearizes the multiplicative structure of the gravity equation, permitting the model to be estimated using standard linear regression methods. Also, it reduces the influence of extreme values and corrects for the right skewed distribution commonly observed in trade and income variables (Yotov et al., 2016). In addition, it allows each coefficient to be interpreted directly as an elasticity, that is the percentage change in the FOB unit price associated with a 1% change of the explanatory variable, which facilitates the comparison of effects across the variables measured in the different units (Anderson and van Wincoop 2003; Baltagi 2021). The inflation variable was not log transformed because it is expressed in percentage terms and can take a negative value, which makes the logarithm mathematical undefined.

To understand the FOB price, two additional dummy variables representing major external shocks were included. The first corresponds to the COVID-19 pandemic, taking the value "1" for the year 2020 and "0" for all other periods, this allows the study to capture the impact of COVID-19 on fresh cut roses demand. The second shock

corresponds to the Russia-Ukraine was, taking the value "1" from 2022 onwards and "0" for previous years. This dummy captures the effect of the Russia-Ukraine war on Ecuadorian rose trade flows. As noted in the literature review, Yadav & Chattopahyay (2024) emphasise the importance ofanalysing export price dynamics within the context of geopolitical tension. The inclusion of these dummies is also supported by the empirical study of Ridley et al. (2023), who found that agricultural commodities experienced important shifts in costs and logistics stability during these periods. Including these variables reflects the fact that global disruptions can affect trade and supply chain reliability in the agricultural sector.

Table I presents all the variables included in the model, their measurement, and their sources.

TABLE I : VARIABLES, MEASURES, AND DATA SOURCES.

Variable	Measure	Source
FOB unit price	Natural logarithm of Total exports divided Tons.	Central Bank of Ecuador, 2010–2025
Distance	Natural logarithm of bilateral distance (km) between Quito (UIO) and the capital of the importing country	CEPII GeoDist database (Mayer & Zignago, 2011)
GDP p.c.	Natural logarithm of importer's GDP per capita, PPP (constant 2021 international $)	World Bank, WDI (World Bank, 2025)
GDP total	Natural logarithm of importer's total GDP, PPP (constant 2021 international $)	World Bank, WDI (World Bank, 2025)
Variable	**Measure**	**Source**
RER	Natural logarithm of Real Exchange Rate index (base year 2018 = 100), measuring Ecuador's price competitiveness relative to each importing country	Central Bank of Ecuador
Inflation	Annual percentage change of Ecuador's CPI	Central Bank of Ecuador / INEC
D_COVID2020	Dummy variable = 1 if year = 2020; 0 otherwise	Own construction

D_WAR	Dummy variable = 1 if year ≥ 2022; 0 otherwise	Own construction

3.2 Methodology and Method of Analysis

Since the dataset contains 137 importing countries over 16 annual periods (2010 -2025), this defines it as a panel data structure. Panel data, or longitudinal data, simultaneously track multiple countries across several years (Baltagi 2021; Davidescu, Popovici, and Strat 2022). This modelling approach offers several advantages, such as greater model stability by controlling for unobserved country-specific characteristics that remain constant over time, an increases number of observations available for estimation, and improved statistical reliability of the results.

To determine the most suitable estimation method, a two-stage procedure was applied, which is standard in panel data studies because it helps to identify whether the dataset should be treated using fixed or random effects (Davidescu et al. 2022; Hayat et al. 2024)

In the first stage, the Breusch-Pagan Lagrange multiplier test was used to determine whether a simple pooled OLS regression (treating all the observations as identical) is appropriate or whether country-specific features or characteristics need to be taken into account. The null hypothesis of this test states that countries are homogeneous and Pooled OLS is sufficient. If this hypothesis is rejected, it implies that each country has its own individual characteristics that influence the FOB price, and an alternative estimator must be used.

In the second stage, once the polled OLS was discarded, the Hausman Test was applied to choose between two panel estimators: fixed effects or random effects. The main question for this test is whether the individual characteristics are correlated with the explanatory variables. If they are, the fixed effects estimator is appropriate, if not, the random effects is preferred, as it is more efficient and allows the model to include time-invariant variables such as distance (Hausman 1978).

The clear results of these tests guide the model selection, which are summarized in Table 2.The Breusch-Pagan test yielded LM = 43.24 (p = 0.000), indicating a clear

rejection of Pooled OLS, meaning that countries behave differently from one another in ways that a simple regression cannot capture. On the other hand, the Hausman test yielded H= 1.856 (p = 0.869), confirming that the random effects estimator is the most appropriate choice for this dataset. This result is particularly important because the random effects estimator allows the inclusion of distance, which does not change over time, as a variable in the augmented gravity model framework, and its retention in the model is theoretically essential.

TABLE II : MODEL SPECIFICATION TESTS

Test	Statistic	P-value	Decision
Breusch-Pagan (LM)	43.24	0,000	Reject Pooled OLS
Hausman	1.856	0.869	Reject Fixed Effects
Selected model			**Random Effects (GLS)**

To ensure the reliability of the estimates, two additional tests where applied, as shown in Table 3.

First, the heteroscedasticity robust test was applied. This correction is necessary because, in the panel data with 137 countries of different sizes and income levels, the variability of the error term may not be constant across the observations (Davidescu et al. 2022). Second, multicollinearity was tested using the Variance Inflation Factor (VIF). This measure detects whether the explanatory variables are closely related to each other, an affect that could make it difficult to separate their individual effects. As a result of this exercise, all variables returned VIF values below 2, which is acceptable and confirms that each variable contributes independently to the model (Baltagi 2021). The models were estimated in Python using the *Linearmodels* and *Statsmodels* libraries.

The econometric specification of the model is:

$$\ln(\text{FOB price})_{it} = \beta_0 + \beta_1 \cdot \ln(\text{Distance})_i + \beta_2 \cdot \ln(\text{GDP p.c.})_{it} + \beta_3 \cdot \ln(\text{GDP total})_{it} + \beta_4 \cdot \ln(\text{RER})_{it} + \beta_5 \cdot \text{Inflation}_t + \beta_6 \cdot \text{D\_COVID2020}_t + \beta_7 \cdot \text{D\_WAR}_t + u_i + \varepsilon_{it}$$

In this equation, (i) denotes the importing country, (t) the year, (u_i) the country-level random effect, and (ε_{it}) the idiosyncratic error term for each country-year observation.

TABLE III : VARIANCE INFLATION FACTOR (VIF)

Variable	VIF	Assessment
ln Distance	< 2	No multicollinearity
ln GDP per capita	< 2	No multicollinearity
ln GDP total	< 2	No multicollinearity
ln RER	< 2	No multicollinearity
Inflation	< 2	No multicollinearity
D_COVID2020	< 2	No multicollinearity
D_WAR	< 2	No multicollinearity

4 DATA ANALYSIS AND DISCUSSION OF RESULTS

The objective of this chapter is to analyse the relationships between the variables described in the previous section and to discuss the results obtained from the Random effects estimations. This chapter is divided into two sections, with the first part providing a descriptive and correlational analysis of the data, and the second part discussing the regression results and linking them to the hypothesis formulated in the literature review.

4.1 Data Analysis

Table 4 presents the descriptive statistics for all variables included in the model. The dependent variable FOB price (Y), has a mean of 1.689 and a standard deviation of 0.493, reflecting significant variation in the price across destination countries and over the trade years. The price range varies between -7.601 to 4.878, confirming that differences across markets are substantial, which supports the use of a panel data model that takes country-specific differences into consideration.

For the explanatory variables (x), Distance presents a mean of 8.968, demonstrating the long-distance nature of the rose exports. This indicates that Ecuador serves markets in Europe, North America, Asia and the Middle East. The GDP per capita variable shows a mean of 10.132 with a standard deviation of 0.802, which represents the wide range of income levels in the importing markets, including economies such as USA, Germany and Japan. Total GDP has a mean of 26.214, capturing substantial variation in market size across the 137 destination countries. The RER has a mean of 4.6242, which corresponds to an average index value of 103.8, slightly above the base year of 100. The

inflation variable shows a mean of 2.135%, which is consistent with Ecuador's dollarized economy. Finally, the dummy variables indicated that COVID-19 accounts for 6.2 % of the observations, while the war dummy covers 24.7% of the observation (from 2022 onwards).

TABLE IV: DESCRIPTIVE STATISTICS

Variable	Mean	Std. Dev.	Min	Max
ln(FOB unit price)	1.689	0.493	−7.601	4.878
ln(Distance)	8.968	0.782	6.496	9.891
ln(GDP per capita)	10.132	0.802	7.110	11.954
ln(GDP total)	26.214	1.923	20.819	31.245
ln(RER)	4.642	0.085	4.304	5.142
Inflation (%)	2.165	1.670	−0.340	5.100
D_COVID-19	0.062	0.241	0.000	1.000
D_WAR	0.247	0.431	0.000	1.000

The following data in Table 5 show the correlation matrix in its log transformed form. The correlations between the explanatory variables are generally low, which is consistent with the VIF results shown in Table 3, confirming the absence of multicollinearity. The highest correlation observed is between the real exchange rate (RER) and inflation (r = 0.572), which reflects the relationship between Ecuador's domestic price levels and its real exchange rate index. Despide being the strongest correlation, the value is still below the conventional threshold of 0.80, which would signal a multicollinearity concern. All remaining correlations are below 0.30, confirming that each variable contributes independently to the model.

For the dependent variable, the FOB unit price demonstrates the strongest correlations with D_COVID-19 (r = -0.067) and D_War (r = -0.043). Both of these results are negative and directionally consistent with the hypothesis that external shocks reduce export prices. The correlation with distance is positive (r=0.077), indicating that more distant markets have a higher FOB price, while the other correlations, such as those with total GDP and GDP per capita, are small and mixed in sign.

TABLE V : PEARSON CORRELATION MATRIX

	ln(FOB)	ln(Dist)	ln(GDPpc)	ln(GDPtot)	ln(RER)	Inflation	COVID	WAR
ln(FOB)	1.000							
ln(Distance)	0.077	1.000						
ln(GDP pc)	−0.013	0.176	1.000					
ln(GDP total)	0.033	0.253	0.291	1.000				
ln(RER)	−0.012	−0.022	−0.028	−0.008	1.000			
Inflation	0.023	0.001	−0.053	−0.025	0.572	1.000		
D_COVID-19	−0.067	−0.001	0.009	−0.014	−0.202	−0.386	1.000	
D_WAR	−0.043	−0.003	0.069	0.058	−0.147	0.026	−0.147	1.000

4.2 Discussion of Results

For the results of the model random effects GLS estimation, Table 6 reports that the model is jointly significant (f = 22.18, p = 0.000), confirming that the set of chosen explanatory variables is statistically significant for the FOB unit price. The overall R^2 is 0.099, which indicates that about the 9.9% of the total variation of the FOB price is explained by the model. This result is consistent with the literature on gravity models applied to agricultural commodity prices, where cross-country differences are capture through the random effects structure. The discussion that follows examines each variable in relation to the hypotheses stated in Chapter 2.

Following the suggestion to assess the robustness of the results, two model specifications are estimated. Model 1 does not include the global shocks dummies and explains only the structural macroeconomic determinants of the FOB unit price. Model 2 incorporates Covid-19 and War dummies as additional explanatory variables. The comparison between both models allows us to evaluate whether the inclusion of global shocks modifies the significance of the structural variables and provides a more complete picture of the determinants of export prices.

TABLE VI : RANDOM EFFECTS GLS — MODEL 1 (NOT INCLUDING GLOBAL SHOCKS)

Variable	Coefficient	Std. Error	z-statistic	P-value	Significance	Expected Sign
ln(Distance)	0,044	0,038	1,153	0,250		n.s.
ln(GDP per capita)	-0,023	0,052	-0,440	0,669		+
ln(GDP total)	-0,002	0,024	-0,065	0,949		+
ln(RER)	-0,264	0,183	-1,444	0,149		−
Inflation	0,015	0,009	1,699	0,089	*	−
Constant	2,767	1,051	2,631	0,008	***	
R^2 Overall	0,090					
R^2 Within	0,003					
R^2 Between	0,042					
Observations	1.627					

Note: Robust standard errors. *** p<0.01 ** p<0.05 * p<0.10 Green = p<0.01 | Yellow = p<0.05 | Orange = p<0.10

TABLE VII : RANDOM EFFECTS GLS — MODEL 2 (WITH GLOBAL SHOCKS)

Variable	Coefficient	Std. Error	z-statistic	P-value	Significance	Expected Sign
ln(Distance)	0,041	0,037	1,091	0,275		n.s.
ln(GDP per capita)	-0,016	0,053	-0,297	0,767		+
ln(GDP total)	0,001	0,024	0,025	0,980		+
ln(RER)	-0,346	0,188	-1,841	0,066	*	−
Inflation	0,010	0,010	1,054	0,292		−
D_COVID2020	-0,153	0,041	-3,704	0,000	***	−
D_WAR	-0,076	0,022	-3,422	0,001	***	−
Constant	3,089	1,053	2,933	0,003	***	
R^2 Overall	0,099					
R^2 Within	0,013					
R^2 Between	-0,004					
Observations	1.627					

Note: Robust standard errors. *** p<0.01 ** p<0.05 * p<0.10 Green = p<0.01 | Yellow = p<0.05 | Orange = p<0.10

The comparison between model 1 and model 2 shows two main findings regarding the role of the global shocks in the determination of the FOB unit price. When the global shocks are excluded from the specification, the inflation rate becomes marginally significant at the 10% level, suggesting that without controlling for shock events, domestic costs particularly capture the variation of the FOB unit prices that is in fact driven by demand disruptions. In the other hand, when shock dummies are included in

the second model, the inflation rate loses its importance, indicating that it was absorbed by Covid-19 and the Russia-Ukraine war. The real exchange rate only reaches significance when these dummies are included, while in model 1 remains non-significant. This suggests that controlling for global disruptions permits the model to isolate the effect of exchange rate movements on export prices. The improvement in R^2 overall from 0.090 in model 1 to 0.099 in model 2 further confirms that the inclusion of global shocks enhances the explanatory significance of the model. Taken together, these results confirm that global shocks are not only important determinants but also condition the detectability of structural macroeconomic effects on the FOB unit price.

The coefficient of distance is positive but not statistically significant ($\beta = 0.041$; $p = 0.276$), supporting H1. This result is consistent with the expectation, since the FOB unit price is measured at the point of origin, in this case of Ecuador, and does not include the freight, insurance or other transport costs after the good has left the country. Consequently, distance does not affect the price. This finding is consistent with the gravity model literature, which states that the effect of distance on trade volumes operates through freight costs. By contrast, for FOB prices, the effect is weaker and often not significance (Leitão 2024). The positive result may indicate that more distant markets, such as Asia or the Middle East, demand premium varieties or different quality attributes, which can influence price; however, this effect is not statistically detectable in the sample.

The coefficient of GDP per Capital is negative and, also, not statistically significant ($\beta = -0.016$; $p = 0.767$, which does not support the H2. A positive relationship was expected, as higher income levels in importing countries would imply a greater willingness to pay higher prices for Ecuadorian Fresh-cut roses. However, this expectation is not confirmed by the results, which suggests that the purchasing power of the acquisition of the average consumer does not influence higher FOB prices. A possible explanation is that Ecuador acts as a price taker in the global rose market, meaning that prices are determined by the global supply and demand dynamics rather than by the income level of customers in destination markets. This result is consistent with the low R^2 value, indicating that cross-country income differences do not explain variations in prices between countries (Abdullahi et al. 2022).

The coefficient of the GDP total is positive but not significant (β = 0.001; p = 0.980), which does not support H3, despite the expected positive sign between the market size and FOB price. These results suggest that the overall economic size of the destination market does not influence the prices received by Ecuadorian exporters. As with GDP per capita, this finding may reflect Ecuador's price-taking behaviour in global markets, where the prices are set by international market conditions rather than by the size of individual destination markets (María-Isabel Ayuda et al. 2022)

The coefficient of the real exchange rate is negative and marginally significant at the 10% level (β = -0.346; p = 0.066), supporting H4. The negative sign indicates that a real appreciation of Ecuador's currency relative to its trading partners – that is, an increase in the RER – is associated in lower FOB prices. This result is consistent with the "Dutch disease" mechanism described by Mien (2021), in which an overvalued currency erodes the price competitiveness of export sectors. In simple words, when Ecuador becomes relatively more expensive compared with its competitors, exporters face pressure to reduce prices in order to maintain market share, which is reflected in lower FOB values. The marginal significance of this coefficient suggests that, while the effect operates in the expected direction, it is not very strong across all destination markets (Jain et al. 2025; Lugo-Arias et al. 2024).

The coefficient of inflation is positive and not statistically significant (β = 0.010; p = 0.292), which does not support H5. The expected relationship was negative, as higher inflation in Ecuador would be expected to damage the price competitiveness and reduce FOB prices. The positive sign on this variable, although statistically not significant, may suggest a partial cost pass-through effect, whereby increases in domestic cots are reflected in higher international prices rather than in reduced competitiveness. However, given the lack of statistical significance, no definitive conclusion can be drawn. This result may also reflect Ecuador's dollarized economy, in which the absence of monetary autonomy limits the transmission of inflation through exchange rate adjustments and, consequently, into export price dynamics (Nthebe and Teboho Jeremiah Mosikari 2025; Nugroho et al. 2024).

The coefficient of D_COVID-19 is negative and highly statistically significant (β = -0.153; p=0.000), strongly supporting H6. This result indicates that in 2020, the FOB

price of Ecuadorian roses was 14.2% calculated as (e^β − 1) × 100 = (e^−0.153 − 1) × 100. This way of calculus is a more precise estimate of the percentage change than the direct coefficient approximation 15.3%. Having as a result, lower than in non-shocks years, holding all other variables constant. This result is consistent with the literature, which classifies roses as non-essential goods, whose demand declines during periods of uncertainty and income loss. The result aligns with Engemann & Jafari (2022), who found that 28% of flower imports were reduced during April 2020, and with Hayakawa & Mukunoki (2021), who also confirmed that non-essential goods experienced trade contractions during the pandemic. Supply-chain disruptions and reduced consumer demand placed downward pressure on the FOB prices received by Ecuadorian exporters during this period.

The coefficient of D_WAR is negative and highly statistically significant (β = -0.076; p=0.001), strongly supporting H7. This result demonstrates that from 2022 onwards, the FOB unit price of this commodity was, on average, 7.3% estimated as *(e^−0.076 − 1) × 100*, giving the result as lower than the pre-war period. This finding reflects the impact of the Russia-Ukraine conflict on this commodity's exports. The first impact is the loss of the Russian market, which in previous years had been one of the largest destinations, while the second effect was the reduction in purchasing power and the reconfiguration of logistics across European and Central Asian markets (Glauben et al. 2022). Compared to the pandemic shock, this impact appears to be more contained, possibly because exporters were able to redirect trade flows to alternative markets.

TABLE VIII: HYPOTHESIS TESTING SUMMARY

H	Variable	Expected	Observed	Sig.	Result
H1	ln(Distance)	n.s.	+	—	Supported
H2	ln(GDP per capita)	+	−	—	Not Supported
H3	ln(GDP total)	+	+	—	Not Supported
H4	ln(RER)	−	−	*	Partially Supported
H5	Inflation	−	+	—	Not Supported
H6	D_COVID-19	−	−	***	Supported
H7	D_WAR	−	−	***	Supported

The findings of this chapter reveal that the FOB unit price of Ecuadorian roses is shaped by global shocks rather than the macroeconomically conditions on destination markets. The non-significant results in GDP per capital, GDP total and Inflation shows that Ecuador is a price taker in global flower markets, while the effect of the Real Exchange Rate is partial transmission of competitiveness into export prices. The strong negative and significant effect of the constructed dummies of the global shocks as D_ COVID and D_WAR confirm that roses as non-essential goods are vulnerable of the uncertainty that global shocks offer, reenforcing the literature viewed. In the following chapter is going to be presented the main conclusions from these results.

5 CONCLUSIONS

This Master's Final Work was developed in order to answer the following question: What are the external determinants of the FOB unit price of Ecuadorian Fresh cut roses across destination markets over the period 2010-2025? The empirical evidence that has been gathered through the Random Effect GLS reveals that global shock events, specifically the Covid-19 and Russia-Ukraine War, are the external determinants that influence the FOB unit price, while the structural macroeconomic variables, such as GDP per Capital, GDP Total and inflation, don't have a statistical impact. The real exchange rate shows a marginally significant negative effect, giving partial support for the price competitiveness hypothesis. These results suggest that Ecuador operates as a price taker in global markets, where export prices respond primarily to global crises rather than unique economic characteristics of importers. Also, this study contributes to the empirical literature for agricultural product price determination by applying panel data analysis to a non-essential commodity in a small developing economy, in which the majority of the studies are based on export volumes rather than prices.

The results reveal a clear pattern: the FOB unit price of Ecuadorian roses is driven primarily by global shocks (crises) rather than by macroeconomic characteristics of destination countries. Across the seven hypotheses tested, three were supported, and one was partially supported. Distance was found to have no statistically significant effect on the FOB price, which is consistent with the fact that the price is measured on an FOB basis, excluding transportation costs. The COVID-19 pandemic resulted in a highly significant average price reduction of 14.2% in 2020, demonstrating a strong contraction in demand during this global crisis. The Russia-Ukraine war led to a significant price decline of 7.3% from 2022 onwards, reflecting the effects of logistical disruptions and the reduction in purchasing power in one of the largest destination markets. The Real Exchange Rate (RER) showed a negative and marginally significant effect, providing partial support for the hypothesis that Ecuador's currency conditions affect the export sector.

On the other hand, GDP per capita, GDP total, and Inflation did not show statistically significant effects on the FOB unit price. These results suggest that Ecuador behaves as a price taker in global flower markets, where export prices are determined by

global supply-and-demand conditions rather than by the economic size or characteristics of the destination countries. This trend supports the theoretical predictions of the Law of One Price and The Prebisch-Singer hypothesis, which suggest that a developing country´s export of primary commodities has limited capacity to influence the prices they receive in international markets, as these are largely determined by global dynamics rather than bilateral demand conditions.

5.1 Theoretical Implications

The results of this study carry several theoretical implications. First, the non-significance of GDP per capital and Total GDP across 137 destinations markets gives empirical evidence for the Law of One Price and the price taker hypothesis, suggesting that in competitive agricultural commodity markets, FOB prices are determined by global supply and demand dynamics rather than bilateral demand conditions. Second, the disadvantage stated by Prebisch – Singer finds indirect support in the results because Ecuador, as a developing country exporter of primary and luxurious products cannot translate the income or economic size of the destination markets into prices which matches with the long run deterioration of terms of trade for primary commodity exporters. Third, the exchange rate marginal significance confirms that real currency appreciation generates downward pressure on FOB prices eve in dollarize economics through indirect competitiveness channels. Finally, the strong and significant effects of both global shock dummies confirm the relevance of demand shock theory, underscoring the vulnerability of the non-essential agricultural products to discontinuous external disruptions that structural gravity variables cannot capture (Emediegwu and Rogna 2024; Geronimi and Taranco 2018)

5.2 Practical Implications

The findings of this study also carry practical implications for exporters, industry associations and policy makers in the Ecuadorian Floricultural sector. First, the key role of global shocks in determining the FOB price suggest that exports and associations such as EXPOFLORES should built contingency strategies that can anticipate demand contractions during periods of uncertainty rather than relying on macroeconomic conditions of destination markets. Second, the significant of the Real Exchange rate

indicates that monitoring Ecuador's real competitiveness index relative to key competitors, Colombia and Kenya, is relevant for anticipating price pressure, even within the limitation of a dollarized economy. Third, the non-significance of destination market income, that reinforces that exporter need to focus on product differentiation, quality and market diversification as strategies that can improve or avoid the price taker dynamic. Finally, the impact of global shocks on non-essentials goods highlights the importance of portfolio diversification in the destinations with a wide and diverse demand sensitive, reducing concentration risks in markets that are more exposed to demand issues.

5.3 Limitations and Future Research

In this study, there are several limitations. The first is that the model focuses on external determinants, leaving out supply-side factors such as production costs, cultivated area, and domestic logistics costs. The inclusion of these variables in future research can provide a broader and more complete picture of the price formation process. Second, the dependent variable, FOB unit price, is constructed as an average across the rose varieties exported to each destination market, and therefore, this variable does not capture the entire heterogeneity of the market. Third, the values used are annual averages, meaning that seasonal variability was not considered. Using more detailed data at the monthly, weekly, or daily level could increase the richness of the dataset and improve the robustness of the results. Another limitation is that, as the period of time has been stablished, changes occurring before or after the analysed period, are not captured in the study. Finally, the gravity model framework does not include bilateral trade agreements or non-tariff barriers, which can also affect the price conditions of this commodity.

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