



**Shockwaves: The Invisible Impact of the Global Economy
on Inflation in Colombia**

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Dissertation submitted as partial requirement for the conferral of Degree in
Economics

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Abstract

This study examines the impact of external factors on inflation in Colombia using a VAR (Vector Autoregressive) model. It investigates how global inflation, particularly in the aftermath of the COVID-19 pandemic, influences domestic inflation in Colombia. Key determinants include commodity prices, exchange rates, and inflation expectations. The objectives include assessing the effects of exchange rate fluctuations, analyzing macroeconomic shocks, and developing an econometric model to identify the main drivers of inflation. The research highlights the importance of understanding these external influences for effective monetary policy in an interconnected global economy. The methodology involves constructing a database of both local and international macroeconomic variables and estimating their relationships to determine their impact on Colombia's Consumer Price Index (CPI).

Keywords: Inflation dynamics, external shocks, Colombian economy, Vector Autoregressive (VAR) model, exchange rate fluctuations, commodity price shocks, monetary policy spillovers.

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Introduction

Since the beginning, the globalization phenomenon has grown exponentially thanks to rapid technological developments that have drastically changed social dynamics in a short period of time. While the growth of the interconnectedness of the world brings benefits such as more economic growth, increased global cooperation, or increased cross-border investments among others, it also generates some drawbacks such as increased competition among countries and businesses, disproportionate growth between developed and developing countries, increased in the contagion risks of economies and financial markets, or more environmental concerns (Paskaleva & Stoykova, 2021; Stobierski, 2021).

The disadvantages of globalization were specially evident during and after the COVID-19 pandemic, which had irreversible consequences in both the consumption and production structures, causing a period of high global inflation. In fact, based on the data from (World Bank, 2023), global inflation experienced a significant increase since 2020 (1.9%), reaching almost two-digit levels (7.9%) in 2022, representing an increment of more than 3.8 standard deviations above its historical mean according to (Aguilar, Guerra, & Martinez, 2024). In spite of the reduction of global inflation since 2022, the Ukraine-Russia war and recently the ongoing trade and tariff war between the USA and the rest of the world have prevented the return of global inflation to pre-COVID-19 levels.

As (Rogers, Wang, et al., 1993) mentioned, high inflation rates are usually associated with higher transaction and adjustment costs, increased uncertainty translated into higher financial costs and misallocation of production inputs, goods outputs, and time devoted to various economic activities. These issues are mostly critical for developing countries as they exhibit more vulnerability in stabilizing their economies after external shocks than the developed ones (Guerra, Kamin, Kearns, Upper, & Vakil, 2024), reducing their opportunities to narrow the development gap with the latter. Specifically, Colombia has shown this monetary instability over the years. During the last quarter of the 20th century, inflation remained at double-digit levels, averaging 23.5% due to indexation schemes. Although inflation began to decline significantly, reaching single digits (around 5%) in the early 21st century (Bems, Caselli, Grigoli, Gruss, & Lian, 2018), it reached peaks of 7% and 7.51% during 2007-2008 and 2015-2016 respectively due to increasing prices of commodities in international markets. After the COVID-19 pandemic, the Colombian economy has followed the international trend of persistent high inflation averaging approximately 9.5%.

For this reason, the main objective of this study is to analyze and measure the impact of external factors such as the exchange rate between the Colombian peso and the US dollar, the influence of the US economy, the deficit of the trade balance, oil prices, and global inflation on inflation in Colombia. To do this, we use a VAR model (Vector Autoregressive) that allows us to determine the effect of external variable shocks through an impulse-response analysis.

Our findings reveal that Colombian inflation demonstrates limited responsiveness to modest external shocks, with most impulse-response functions showing statistically insignificant effects, except for the relationships between Brent oil prices and currency devaluation, and between U.S. inflation and Colombian exchange rates.

This article is divided in four sections: first, we present a review of previous studies conducted on the subject; next, we show an analysis of the data collected on local and international macroeconomic variables and introduce an explanation of the methodology used and the theoretical foundation of the econometric model; third, we discuss the estimation results of the proposed model and their implications for policy makers.

1 Literature review

As (Adeleye, Ogundipe, Ogundipe, Ogunrinola, & Adediran, 2020) identified, the literature has divided the analysis of the inflation phenomenon into two approaches: the monetarist and the

structuralist views. The monetarist approach is based on the opinion of its proponent, Milton Friedman, who stated that inflation was a monetary phenomenon caused mainly by the expansion of the monetary supply. On the other hand, the structuralist viewpoint suggests that inflation is caused by supply-sided dynamics, usually due to heavy import dependency, and the pass-through effect from a volatile exchange rate associated with excessive exposure to external shocks as a result of a weak industrial-based economy, political instability, and structural rigidities in the agricultural sector (Alagidede, Simeon, & Adu, 2014).

The structuralist approach has been proved to be more suitable to address the inflation phenomenon in developing countries (Adeleye et al., 2020; Aguilar et al., 2024), mainly because of the recent international events such as the COVID-19 pandemic, the Russia-Ukraine war or the trade and tariffs war between the US and the rest of the world. The first to launch the idea of external shocks being directly accountable for small open economies' dynamics were (Dornbusch, Branson, & Cline, 1985) who analyzed the impact of developed economies on world prices and, in consequence, on business cycles in developing economies. This idea was later confirmed and extended by (Calvo, Leiderman, & Reinhart, 1993) whose results suggest that the majority of the dynamics of the real exchange rate volatile for Latin American countries are due to external shocks, which potentially translates into higher inflation rates as a result of the pass-through effect. This evidence has led many authors to recognize the cause of the exchange rate volatile in emerging economies: mainly, commodity prices and the influence of the US among others (Krznar & Kunovac, 2010).

1.1 Commodity prices

According to (Auer, Levchenko, & Sauré, 2017), price shocks in commodities such as oil are transmitted through global supply chains and synchronize inflation across countries via a pass-through effect. This is not a surprising idea, since the literature agrees on it. However, regarding the size of the effects, there are contrary conclusions. On one hand, some authors such as (Chen, 2009) and (Jácome et al., 2009) suggest that this effect is mitigated by the role of the monetary policy. They find that countries with greater central bank independence and inflation targeting regimes have lower pass-through effects from oil price to domestic inflation. On the other hand, the results of (Zoli, 2009) and (Caceres, Poplawski-Ribeiro, & Tartari, 2013) indicate that the size of the pass-through effect is more related to regional-specific factors. Furthermore, (Álvarez, Hurtado, Sánchez, & Thomas, 2011) and (Gelos & Ustyugova, 2017) attribute the effect of oil prices on domestic inflation to domestic factors, for example, high fuel intensities or pre-existing high inflation levels.

The case of Colombia is particularly interesting because it is a country characterized by having great central bank independence among Latin American countries, but it also has a strong dependence on primary goods such as oil and agricultural products, making the country highly vulnerable to external shocks of commodity prices. For example, (L. E. Arango, 2013) shows that oil prices serve as a key indicator of inflation given their influence on the basic cost structure, such as transportation and energy. (Rodríguez Pinzón, 2011) further explores this analysis, showing that global increases in oil prices directly impact consumer prices due to import structures and energy costs. Furthermore, studies such as the one carried out by (Espinosa & Vaca, 2012) highlight the exposure of low-income households during periods of global food price volatility. In this context, increases in food prices represent a significant inflationary factor, especially when combined with supply constraints or increases in transportation costs driven by high oil prices.

1.2 The US influence

The impact of policies implemented by the Federal Reserve System (FED) on emerging economies, as noted by (Eichenbaum & Evans, 1995), shows that interest rate hikes in the U.S. can generate inflationary pressures in developing countries through the exchange rate pass-through mechanism. In this context, a dollar appreciation increases the costs of imported goods, generating additional inflationary pressures domestically. (Schmitt-Grohé & Uribe, 2007) also highlights that dependence on strong currencies such as the U.S. dollar amplifies the vulnerability of emerging economies to

U.S. interest rate adjustments, raising credit costs and forcing these countries to adjust their own interest rates to mitigate capital outflows. According to ([Bank for International Settlements, 2022](#)), this volatility in capital flows is particularly pronounced in economies with high external debt denominated in U.S. dollars, such as Colombia, where financing conditions are affected by U.S. interest rate cycles, increasing local inflationary pressures ([Alagidede et al., 2014](#)).

Moreover, recent studies by the International Monetary Fund (IMF) emphasize how economic news and monetary policy announcements in the U.S. trigger adjustments in financial markets of emerging economies, affecting not only exchange rates and interest rates but also the prices of imported consumer goods ([Engler, Piazza, & Sher, 2023](#)). These adjustments in global financial conditions directly impact external financing costs for countries like Colombia, which in turn generate inflationary pressures. This effect is particularly pronounced during periods of monetary tightening in the U.S., when investors tend to withdraw from emerging markets in search of higher returns in lower-risk assets.

Finally, the study by ([Bems et al., 2018](#)) for the IMF provides evidence that while domestic factors play a more significant role in determining inflation in emerging economies, external shocks can amplify the effects of internal conditions and, in some cases, reverse stability trends. This effect becomes evident during periods of high global inflation, where the combination of high international prices and heightened inflation expectations in advanced economies creates a persistent and challenging inflationary environment for central banks in emerging markets.

The literature review has allowed us to identify two predominant approaches to studying external sources of inflation in emerging economies: the monetarist and the structuralist. While both recognize the effects of the international environment, they differ in the relative importance they assign to it. While monetarist suggest that the transmission of external shocks to domestic inflation depends on the independence of the central bank and other internal monetary factors. The structuralist such as ([Gelos & Ustyugova, 2017](#)) emphasize domestic structural factors.

2 Data and Methodology

As far as we know, the issue of measuring and analyzing the impact of internal and external shocks on domestic inflation has been addressed through two different approaches. The first is a theoretical approach, in which various authors develop economic models—usually Dynamic Stochastic General Equilibrium (DSGE) models—depending on the size of the economy (see, for example, ([L. Arango, Chavarro, & González, 2015](#); [Fasani, Mumtaz, & Rossi, 2023](#); [Ravenna & Walsh, 2003](#))).

The second is an empirical approach, in which explanations are driven by data rather than by a theoretical framework. This approach includes models from the VAR (Vector Autoregressive) family (VAR, VEC, SVAR, SVEC), as well as machine learning algorithms, among others. For instance, the recent work by ([Szafranek, Szafranski, & Leszczyńska-Paczesna, 2024](#)) employs Bayesian techniques to estimate an SVAR model that captures the effects of internal and external shocks in the Polish economy.

Based on these findings, we favor the empirical approach, as it allows the data to guide our analysis without imposing a rigid theoretical structure. Therefore, we use VAR models to estimate the potential effects of external shocks on Colombian inflation, focusing on changes in commodity prices, the trade balance, and the broader context of the U.S. economy. Here we present the data used in our empirical approach

2.1 Data

The series used in this research correspond to both national and international macroeconomic variables that capture economic behavior from different perspectives. These variables were selected

based on a review of the literature and prior analysis conducted within the framework of this research. They constitute the dataset used in the development of the study.

- Inflation in Colombia, based on data from *Banco de la República de Colombia*, reflects the monthly percentage variation of the Consumer Price Index (CPI), fluctuating over time due to internal and external macroeconomic factors.
- Exchange Rate, sourced from *Banco de la República de Colombia*, tracks the value of the Colombian peso against the U.S. dollar, showing fluctuations due to supply and demand dynamics and monetary policies.
- Currency Devaluation represents the monthly variation in the exchange rate compared to the previous month, where positive values indicate a depreciation of the Colombian peso and negative values indicate appreciation. This variable is constructed based on exchange rate data.
- Nominal Exports, reported by *Departamento Administrativo Nacional de Estadística* (DANE), measure the value of Colombia's exports of goods and services in nominal terms, expressed in millions of Colombian pesos, fluctuating based on external demand and export product prices.
- Nominal Imports, also provided by the DANE, represent the value of Colombia's imports of goods and services, expressed in millions of Colombian pesos, and depend on domestic consumption and exchange rate variations. Finally building the Trade balance between these two variables.
- Federal Reserve Interest Rate, taken from TradingView, reflects the U.S. Federal Reserve's federal funds rate, which remained low during the initial years of the dataset due to stimulus policies following the 2008 financial crisis.
- Brent Oil Price, taken from Investing, represents the international price of Brent crude oil per barrel in U.S. dollars, varying due to global supply and demand and geopolitical factors.
- Food Price Index, as reported by Food and Agriculture Organization of the United Nations (FAO), reflects global food prices and fluctuates based on changes in agricultural supply and demand.
- Industrial Production Index, based on data from the Federal Reserve (FRED) ¹, measures industrial activity within an economy, expressed as an index, and is crucial for assessing the manufacturing sector's dynamism and economic growth.
- Consumer Price Index in the United States, also sourced from the Federal Reserve (FRED), measures the general price level for consumer goods in the U.S., evolving based on inflation and Federal Reserve monetary policies.
- CPI Variation in the United States measures the monthly percentage change in the U.S. Consumer Price Index, where positive values indicate rising consumer prices, while negative values suggest deflation or a decline in price levels. This variable was retrieved from the US Bureau of Labor Statistics, calculated from the CPIAUCSL (Consumer Price Index for All Urban Consumers: All Items) ².

The information was obtained from January 2009 to December 2024, for a total of 192 observations for each variable. This monthly frequency of data allows capturing short-term dynamics in macroeconomic variables, avoiding excessive volatility of daily or weekly data, while maintaining sufficient granularity to identify trends and relationships between variables that could be lost with quarterly or annual data. Figures 1, 2 and 3 show the temporal evolution of the main series in levels and their variations throughout the study period.

¹For further information, please visit <https://fred.stlouisfed.org/series/INDPRO/>

²For more details on the methodology used for the index calculation, please visit <https://fred.stlouisfed.org/series/CPIAUCSL>

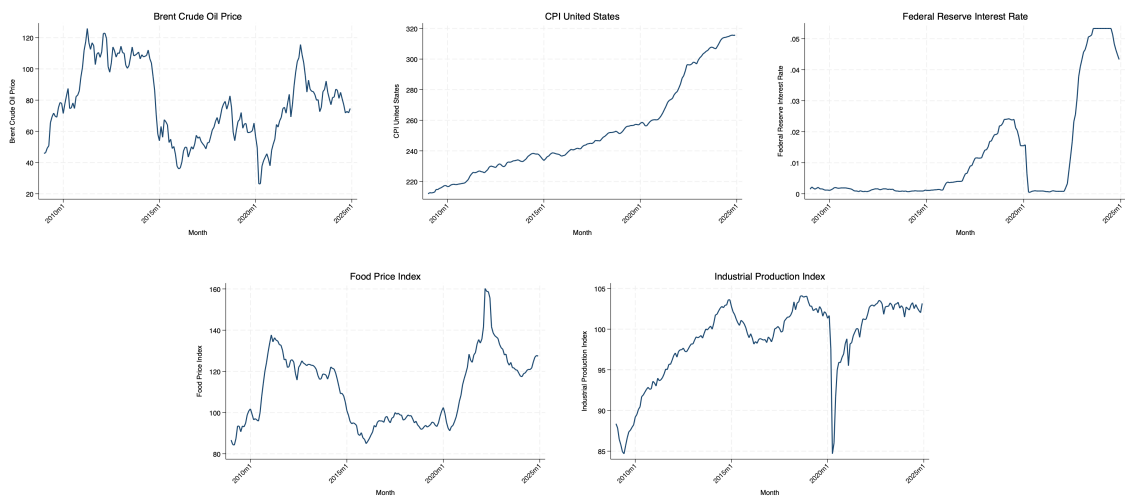


Figure 1: External macroeconomic variables.

When examining the time series of macroeconomic variables between January 2009 and December 2024, significant patterns and events can be identified that reflect the vulnerability of the Colombian economy to external shocks. The evolution of the Brent oil price shows marked fluctuations, with a first bullish cycle between 2009 and 2014, reaching levels above 120 USD/barrel, followed by a dramatic collapse in late 2014, when prices fell below 50 USD/barrel. (Rodríguez Pinzón, 2011) demonstrated how these price fluctuations create ripple effects throughout production chains and drive up transportation costs, transmitting inflationary pressures to the Colombian economy. Particularly notable is the historic collapse observed in 2020, when the price reached levels close to 20 USD/barrel during the COVID-19 crisis, generating a 60% drop in less than three months, followed by a gradual recovery until stabilizing around 80 USD/barrel in recent periods.

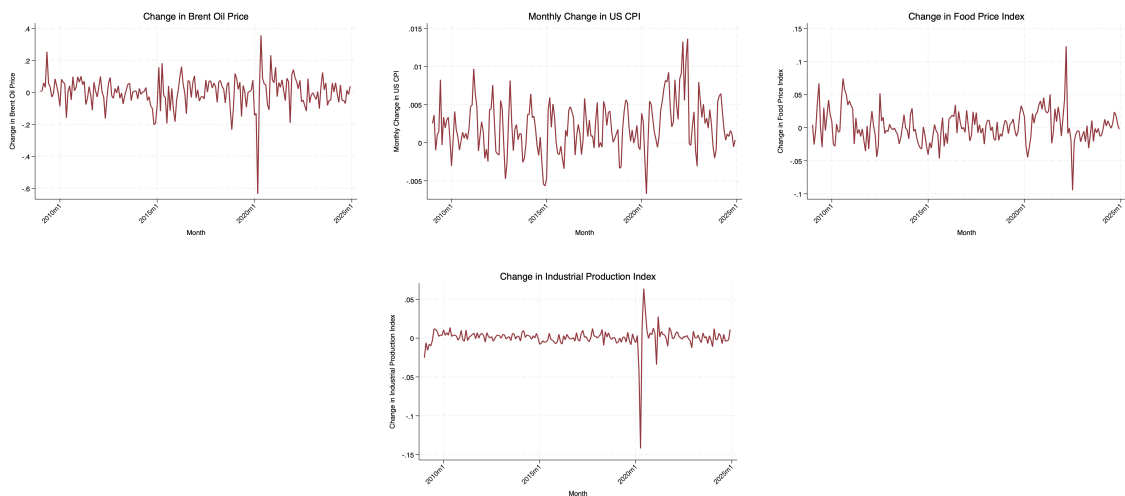


Figure 2: Logarithmic change of external macroeconomic variables.

Similarly, the FAO food price index exhibits two pronounced bullish cycles: one between 2010-2012, when it reached values close to 140, and another more recent and abrupt one in 2022-2023, where it exceeded 160 points. This behavior is consistent with the findings of (Espinosa & Vaca, 2012), who highlights how increases in this index disproportionately affect low-income households, amplifying inflationary pressures in emerging economies such as Colombia.

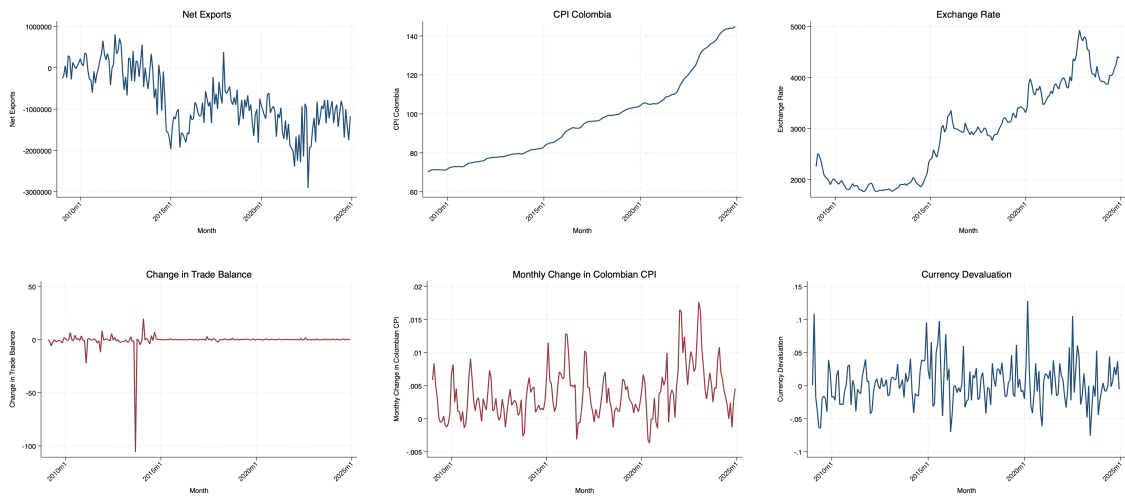


Figure 3: Domestic macroeconomic variables.

Meanwhile, the market representative rate (TRM) shows a sustained upward trend, with notable accelerations coinciding with periods of falling oil prices, especially evident in 2015 and 2020, when the Colombian peso depreciated significantly against the dollar, exceeding 4,000 pesos per dollar in 2022. This inverse correlation between oil prices and the TRM confirms what was proposed by (Banco de la República de Colombia, 2025) regarding Colombia’s structural dependence on oil revenues and its impact on the trade balance and, consequently, on the exchange rate. Additionally, it is revealing to observe how periods of expansive monetary policy by the Fed, evidenced in the interest rate graph, coincide with exchange rate stabilization episodes, while post-2021 monetary tightening cycles exacerbated exchange rate volatility.

The COVID-19 pandemic marked a critical turning point in Colombia’s inflationary dynamics, as clearly evidenced in the analyzed graphs. The Industrial Production Index shows an unprecedented drop during the second quarter of 2020, reaching levels close to 85, the most severe contraction of the studied period. Simultaneously, we observe a historic collapse in Brent oil prices, which fell to lows of 20 USD/barrel, generating a negative variation of nearly 60% in less than three months. This synchronization of external shocks intensified pressures on the exchange rate, which experienced notable volatility during this period. As (Aguilar et al., 2024) points out, the transmission of external shocks during the pandemic significantly increased the global component of inflation, reaching levels 3.8 standard deviations above its historical average. This phenomenon corroborates the hypothesis that, in periods of high global volatility, emerging economies like Colombia experience greater vulnerability to external factors, limiting the effectiveness of domestic monetary policies to contain inflationary pressures of international origin.

These complex and changing interrelationships between external and internal variables fully justify the adoption of a VAR econometric model, as (Aguilar et al., 2024) points out, the transmission of external shocks has proven to be more intense during periods of high global volatility, while their relative impact varies over time depending on the prevailing macroeconomic conditions.

Table 1: Descriptive Statistics for 2009-2024.

Variable	Mean	Std. Dev.	Minimum	Median	Maximum	N
Exchange Rate	2914.67	905.66	1761.59	2953.26	4926.66	192
Currency Devaluation	0.0035	0.0323	-0.0757	0.0003	0.1281	192
Fed Interest Rate	0.0116	0.0167	0.0005	0.0018	0.0533	192
Trade Balance	-774777.9	719767.0	-2908888.0	-867197.5	808647.8	192
Change in Trade Balance	-0.6214	8.1302	-105.5614	-0.1160	19.7395	192
Brent Oil Price	77.41	23.57	26.35	75.12	125.89	192
Change in Brent Oil Price	0.0026	0.0954	-0.6339	0.0094	0.3570	192
Food Price Index	111.05	17.16	84.25	111.06	160.22	192
Change in Food Price Index	0.0020	0.0245	-0.0947	-0.0008	0.1231	192
Industrial Production Index	98.73	4.78	84.67	100.04	104.10	192
Change in IPI	0.0007	0.0137	-0.1421	0.0012	0.0638	192
US CPI	251.66	29.18	211.93	242.28	315.66	192
US monthly inflation rate	0.0021	0.0034	-0.0067	0.0018	0.0136	192
Colombia CPI	96.45	21.09	70.21	93.59	144.88	192
CO monthly inflation rate	0.0038	0.0038	-0.0037	0.0030	0.0176	192

Source: Author's calculations.

Tables 1-4 present an exhaustive statistical analysis of the macroeconomic variables relevant to the study of inflation in Colombia during the 2009-2024 period. Table 1 shows the descriptive statistics for the complete period, where considerable variability is observed in key variables such as the exchange rate (standard deviation of 905.66) and Brent oil prices (standard deviation of 23.57). Tables 2 and 3 segment the analysis into pre and post COVID-19 periods, revealing significant structural differences: the average exchange rate increased from 2427.64 to 4039.89, while the FED interest rate rose from 0.0059 to 0.0248, evidencing the impact of restrictive monetary policies following the pandemic. Table 4 specifically focuses on inflation determinants, where Colombia's average monthly rate (0.0038) slightly exceeds that of the United States (0.0021). Finally, Table 5 presents correlations between key variables, highlighting the strong positive and statistically significant relationship between the Colombian CPI and the exchange rate (0.9166), as well as with the US CPI (0.9878), suggesting an important influence of external factors on Colombian inflationary dynamics.

Table 2: Descriptive statistics before COVID-19: 2009-2020.

Variable	Mean	Std. Dev.	Skewness	Kurtosis	N
Exchange Rate	2427.64	577.27	0.2732	1.4082	134
Currency Devaluation	0.0031	0.0307	0.6628	4.3091	134
Fed Interest Rate	0.0059	0.0074	1.3681	3.3667	134
Trade Balance	-525885.5	659143.7	-0.1598	2.1210	134
Change in Trade Balance	-0.9325	9.7327	-9.4462	102.3117	134
Brent Oil Price	78.39	25.00	0.2531	1.6784	134
Change in Brent Oil Price	0.0006	0.0808	-0.3919	3.6988	134
Food Price Index	105.56	14.60	0.5645	1.9397	134
Change in Food Price Index	0.0011	0.0224	0.5919	3.5738	134
Industrial Production Index	97.97	4.93	-1.0536	3.2392	134
Change in IPI	0.0009	0.0057	-0.6943	5.4102	134
US CPI	235.42	12.65	-0.0239	2.1366	134
US monthly inflation rate	0.0015	0.0029	0.0548	2.9959	134
Colombia CPI	85.08	10.76	0.3510	1.6962	134
CO monthly inflation rate	0.0030	0.0030	0.8042	3.7581	134

Source: Author's calculations with data from 2009m1 to 2020m2.

Table 3: Descriptive statistics after COVID-19: 2020-2024.

Variable	Mean	Std. Dev.	Skewness	Kurtosis	N
Exchange Rate	4039.89	353.47	0.8301	2.9589	58
Currency Devaluation	0.0043	0.0361	0.8119	4.8533	58
Fed Interest Rate	0.0248	0.0235	0.1135	1.1550	58
Trade Balance	-1349805.0	490018.4	-0.8785	3.4039	58
Change in Trade Balance	0.0920	0.4784	1.3467	5.7847	58
Brent Oil Price	75.16	19.91	-0.6200	3.1560	58
Change in Brent Oil Price	0.0070	0.1235	-1.9991	14.6158	58
Food Price Index	123.72	15.99	-0.0445	3.3185	58
Change in Food Price Index	0.0042	0.0290	0.5579	8.0925	58
Industrial Production Index	100.48	3.94	-2.2752	8.6392	58
Change in IPI	0.0003	0.0234	-3.6561	25.6133	58
US CPI	289.19	20.65	-0.2848	1.5732	58
US monthly inflation rate	0.0034	0.0040	0.3343	3.2455	58
Colombia CPI	122.74	14.60	0.1716	1.4602	58
CO monthly inflation rate	0.0056	0.0048	0.5366	3.1899	58

Source: Author's calculations with data from 2020m3 to 2024m12.

Table 4: Correlation between Colombian CPI and the other variables.

Variable	Colombian CPI	Colombian inflation rate
Exchange Rate	0.9166*	0.4016*
Currency Devaluation	0.0262	0.0296
Fed Interest Rate	0.8387*	0.2266*
Brent Oil Price	-0.1677*	-0.0008
Change in Brent Oil Price	-0.0347	-0.0346
Food Price Index	0.2967*	0.2598*
Change in Food Price Index	-0.0325	-0.0840
US CPI	0.9878*	0.3436*
US monthly inflation rate	0.1709*	0.3303*
Trade Balance	-0.6043*	-0.3375*
Change in Trade Balance	0.0775	0.0216

* Indicates significance at the 5% level

2.2 Empirical Model: Vector Autoregressive (VAR)

Unlike traditional single-equation linear regressions—which require a clear distinction between dependent and independent variables and are prone to endogeneity and simultaneity issues—a VAR treats all variables symmetrically. In this system, each variable is modeled as a function of its own past values as well as the past values of all other variables in the model. This symmetric treatment naturally extends transfer function analysis to cases where the exogeneity of a variable is questionable, thereby mitigating the simultaneous equation bias that can compromise the validity of causal inference in conventional regression approaches (Enders, 2015).

In our research, the VAR framework is initially appealing as it allows us to empirically map the dynamic interactions between domestic inflation and key external determinants without imposing a priori restrictions on the causal direction. By incorporating the lagged behaviors of all relevant variables, the VAR model provides a comprehensive picture of the interdependent feedback effects that characterize the evolution of inflation dynamics, which is essential given the complex external influences affecting the Colombian economy.

A VAR model is a model in which variables are specified as linear functions of their p lags and p lags of the other variables, and possibly exogenous regressors. Generally, a p -order VAR, $VAR(p)$ is given by:

$$Y_t = c + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t,$$

where Y_t is an $(n \times 1)$ vector of endogenous variables at time t , c is an $(n \times 1)$ vector of constant terms or deterministic trends, A_i 's are $(n \times n)$ coefficient matrices that capture the relationships between variables at different lags, p is the number of lags in the model, ε_t is an $(n \times 1)$ vector of error terms with $E[\varepsilon_t] = 0$, $E[\varepsilon_t \varepsilon_t'] = \Sigma$, $E[\varepsilon_s \varepsilon_t'] = 0$ ($t \neq s$).

Before estimating the VAR model, it is necessary to ensure the stability of the model. The first step is to analyze the order of integration of the individual series. Table 5 shows the results of the Dickey-Fuller and Phillips-Perron tests for the logarithmic level series. The results indicate that the null hypothesis of non-stationarity cannot be rejected for all the macroeconomic variables considered.

Table 5: P-value of unit root tests for level series.

Variables	Dickey-Fuller Augmented	Phillips-Perron
Exchange Rate	0.0306	0.1294
FED Interest Rate	0.0317	0.8721
Interest Rate	0.6017	0.8517
Trade Balance	0.0764	0.0000
Brent Price	0.3177	0.3560
Food Price	0.5278	0.7010
IPI	0.2110	0.2602
US CPI	0.9901	0.9914
Colombia CPI	0.9907	0.9963

Source: Author's calculations.

Notes: With 2 lags and trend.

Similarly, Table 6 reports the results of the tests, but considering logarithmic returns or monthly percentage changes. In this case, the null hypothesis of non-stationarity is rejected, which implies that the differenced series are stationary, and therefore, the level variables are integrated of order 1 ($I(1)$), as expected *a priori*.

Table 6: P-value of unit root tests for changes or differences.

Variables	Dickey-Fuller Augmented	Phillips-Perron
Currency Devaluation	0.0000	0.0000
Change in FED Interest Rate	0.0000	0.0000
Change in Trade Balance	0.0000	0.0000
Change in Brent Price	0.0000	0.0000
Change in Food Price	0.0000	0.0000
Change in IPI	0.0000	0.0000
US monthly inflation rate	0.0000	0.0000
CO monthly inflation rate	0.0000	0.0000

Source: Author's calculations.

Notes: With 2 lags and trend

Given the stationarity of the logarithmic returns series we estimate different VAR model with the variables in Table 6. The lag order selection criteria for the VAR model are presented in Table 7. The results show that all information criteria—FPE, AIC, HQIC, and SBIC—consistently indicate an optimal lag order of 1. This suggests that a relatively parsimonious model with a single lag is

appropriate for capturing the dynamics between Colombian inflation and its external determinants. The likelihood ratio test, however, suggests a lag order of 12, which would result in a significantly more complex model.

Table 7: Lag-order selection criteria for VAR model.

Lag	LL	R	df	p	FPE	AIC	HQIC	SBIC
1	2608.51	399.44	49	0.000	9.7e-22*	-48.463*	-48.109*	-47.591*
2	2636.34	55.652	49	0.239	1.2e-21	-48.227	-47.519	-46.481
3	2660.86	49.047	49	0.471	1.6e-21	-47.953	-46.892	-45.335
4	2676.89	32.062	49	0.971	2.4e-21	-47.585	-46.169	-44.095
5	2707.77	61.745	49	0.105	3.0e-21	-47.382	-45.613	-43.019
6	2739.29	63.054	49	0.086	3.7e-21	-47.187	-45.064	-41.952
7	2779.51	80.429	49	0.003	4.3e-21	-47.089	-44.612	-40.981
8	2805.69	52.368	49	0.345	5.8e-21	-46.834	-44.003	-39.854
9	2845.49	79.597	49	0.004	6.9e-21	-46.731	-43.547	-38.878
10	2896.24	101.50	49	0.000	7.4e-21	-46.751	-43.213	-38.025
11	2968.45	144.42	49	0.000	6.4e-21	-47.010	-43.118	-37.412
12	3020.02	103.14*	49	0.000	7.2e-21	-47.039	-42.793	-36.568

Note: * indicates the optimal lag order selected by the criterion. LL = log likelihood, LR = likelihood ratio, FPE = final prediction error, AIC = Akaike information criterion, HQIC = Hannan-Quinn information criterion, SBIC = Schwarz-Bayesian information criterion.

3 Results

The results from our Vector Autoregression (VAR) with one lag model reveal complex interactions between macroeconomic variables affecting the Colombian economy. Our analysis incorporates multiple lag specifications (VAR(6) Table 16, and VAR(12) Table 17) to capture both immediate and longer-term dynamics of external shocks on domestic variables. Below, we present a detailed analysis of the most significant findings, focusing on the results that provide insights into the external determinants of Colombian inflation and exchange rate dynamics.

Our VAR(1) analysis suggests potential relationships between certain external factors and Colombian variables, though these relationships require careful interpretation given the model's limitations. First, examining the Currency Devaluation equation on Table 8, we observe that U.S. inflation significantly influences exchange rate dynamics in Colombia. The relationship between U.S. inflation and Colombia's exchange rate dynamics reveals a compelling pattern: when inflation rises in the United States, the Colombian peso tends to lose value substantially in subsequent trading periods. This significant transmission mechanism (coefficient=2.932, $p < 0.001$) illustrates how Colombia's financial markets rapidly internalize inflation expectations from its main trading partner, creating short-term currency volatility that the central bank must navigate. This supports the hypothesis that inflation differentials between countries are a crucial determinant of exchange rate movements, as suggested by purchasing power parity theory. It is interesting that the negative and significant coefficient of the lagged Currency Devaluation variable (-0.3795, $p < 0.001$) suggests a natural correction mechanism in the foreign exchange market, where periods of depreciation tend to be followed by appreciation, reflecting market adjustments toward equilibrium. When examining the extended VAR(6) model 16, this pattern becomes more pronounced. The first 4 lags of Currency Devaluation are all negative and significant.

Besides the impact of U.S. inflation maintains significance with a negative effect in the VAR(6) and VAR(12) model, reinforcing the importance of this external factor. The same happens with oil prices; the coefficients for Brent oil price changes (-0.1354, -0.2396, -0.1653 for lags 1-3, all with $p < 0.05$) become more consistently significant in the VAR(12) model, indicating that oil price effects on the exchange rate manifest over a longer horizon than captured in the VAR(1) model.

Table 8: Estimation Results for Currency Devaluation Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.380	0.071	-5.329	2.91e-07***
Change in Fed Interest Rate (t-1)	0.956	1.885	0.507	0.613
Change in Trade Balance (t-1)	2.09e-04	2.33e-04	0.899	0.370
Change in Brent Oil Price (t-1)	-0.041	0.023	-1.756	0.081
Change in Food Price Index (t-1)	-0.166	0.107	-1.559	0.121
Change in Industrial Production (t-1)	0.016	0.162	0.097	0.923
US Inflation Rate (t-1)	2.932	0.869	3.375	0.001***
Colombia Inflation Rate (t-1)	-0.313	0.962	-0.326	0.745
Trend	-1.76e-06	2.45e-05	-0.072	0.943

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.037 on 181 degrees of freedom
Multiple R^2 : 0.208, Adjusted R^2 : 0.169
F-statistic: 5.28 on 9 and 181 DF, p-value: 2.17e-06

The Trade Balance equation on Table 9 demonstrates limited responsiveness to external factors, with only its own lag showing statistical significance (-0.5196, $p < 0.001$). This negative coefficient suggests a cyclical pattern in Colombia's trade balance, where improvements tend to be followed by deteriorations and vice versa. The absence of significant coefficients for external variables like Fed Interest Rate, U.S. Inflation, or commodity prices is particularly noteworthy, as it suggests that Colombia's trade performance maintains a degree of resilience against external monetary and inflationary pressures in the short run, possibly due to structural characteristics of its exports and imports impelled by internal policy or industrial behavior.

Table 9: Estimation Results for Change in Trade Balance Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.433	19.650	-0.022	0.982
Change in Fed Interest Rate (t-1)	138.900	520.100	0.267	0.790
Change in Trade Balance (t-1)	-0.520	0.064	-8.097	8.05e-14***
Change in Brent Oil Price (t-1)	-3.051	6.383	-0.478	0.633
Change in Food Price Index (t-1)	0.598	29.450	0.020	0.984
Change in Industrial Production (t-1)	-31.020	44.690	-0.694	0.488
US Inflation Rate (t-1)	-36.000	239.700	-0.150	0.881
Colombia Inflation Rate (t-1)	-238.400	265.500	-0.898	0.370
Trend	-3.61e-04	6.77e-03	-0.053	0.958

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 10.13 on 181 degrees of freedom
Multiple R^2 : 0.270, Adjusted R^2 : 0.234
F-statistic: 7.46 on 9 and 181 DF, p-value: 3.06e-09

Perhaps surprisingly, our examination of inflation determinants challenges conventional wisdom about external vulnerability. Despite Colombia's deep integration into global markets, domestic price formation appears remarkably insulated from external pressures. The transmission channels that we initially hypothesized – from commodity prices, U.S. monetary policy, and global inflation through to Colombian consumer prices – fail to demonstrate statistically meaningful relationships in our model (see Table 10). This apparent resilience could partially reflect the inflation-targeting framework implemented by Banco de la República, which may help anchor price expectations during periods of external volatility, though other institutional and structural factors likely contribute as well. This finding contrasts with the strong correlations reported in the descriptive statistics

(Table 4) and lends support to the monetarist view that inflation in Colombia is primarily driven by domestic monetary conditions. Even the U.S. inflation rate, which showed a notable correlation with Colombian inflation (0.3303) and made us expect it would have a significant effect, fails to demonstrate a statistically significant relationship within the VAR framework.

While these variables may move together over the long term as we seen descriptively, short-term (month-to-month) variations in Colombian inflation are not directly driven by external shocks when we model with time dependence. A partial exception is found in the VAR(6) and VAR(12) specifications, where a few lags of international food prices exhibit marginal significance, indicating limited and possibly delayed transmission effects.

The hunt for inflation’s determinants yields strikingly different results depending on our temporal perspective. When we focus only on immediate relationships (VAR(1)), the model struggles to capture inflation’s complexity, explaining a mere 3.1% of price variations. However, extending our analytical horizon to incorporate medium-term dynamics (VAR(6)) substantially enhances our understanding, more than quadrupling the explanatory power to 13.6%. This dramatic improvement underscores how inflation processes in Colombia operate through delayed transmission mechanisms rather than instantaneous adjustments—a crucial insight for central bankers who must anticipate these lagged effects when calibrating monetary policy responses. Notably, the second lag of inflation is significantly negative (-0.2024 , $p < 0.05$), pointing to potential cyclical behavior. The VAR(12) model further improves the model’s explanatory capacity (adjusted R-squared of 0.369) and uncovers pronounced seasonal patterns. Specifically, it identifies significant negative effects at lags 1, 2, 3, 5, and 10, followed by a strong positive effect at lag 12 (0.4056 , $p < 0.001$), suggesting that Colombian inflation follows an annual cycle not captured in shorter specifications.

With the exception of a few marginally significant lags for food prices, no external variable exerts a robust or consistent influence on domestic inflation in either the VAR(6) or VAR(12) models. The lack of significance and the low R-squared support the idea that inflation in Colombia is drive by monetary or internal factor rather tan external.

Table 10: Estimation Results for Colombia Inflation Rate Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	9.54e-04	5.53e-03	0.172	0.863
Change in Fed Interest Rate (t-1)	0.192	0.146	1.311	0.192
Change in Trade Balance (t-1)	2.58e-05	1.81e-05	1.427	0.155
Change in Brent Oil Price (t-1)	7.37e-04	1.80e-03	0.410	0.682
Change in Food Price Index (t-1)	-0.005	0.008	-0.589	0.557
Change in Industrial Production (t-1)	0.011	0.013	0.847	0.398
US Inflation Rate (t-1)	-0.021	0.067	-0.311	0.756
Colombia Inflation Rate (t-1)	0.019	0.075	0.253	0.800
Trend	-4.67e-07	1.91e-06	-0.245	0.807

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.003 on 181 degrees of freedom
Multiple R^2 : 0.031, Adjusted R^2 : -0.017
F-statistic: 0.64 on 9 and 181 DF, p-value: 0.758

Surprisingly, Colombian inflation appears to influence U.S. inflation (Table 13) (coefficient: 0.3025, $p < 0.001$), hinting at a two-way relationship between these economies. But hold on—this finding likely exposes a limitation in our VAR approach rather than a genuine causal link. The exogeneity assumptions probably don’t hold here. Nonetheless, this finding challenges the conventional view that inflationary pressures typically flow from larger to smaller economies and raises the possibility that inflation in Colombia could influence global inflation dynamics through channels such as commodity exports.

Table 11: Estimation Results for Change in Brent Oil Price Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.322	0.208	-1.550	0.123
Change in Fed Interest Rate (t-1)	-22.060	5.491	-4.018	8.61e-05***
Change in Trade Balance (t-1)	-4.46e-05	6.78e-04	-0.066	0.948
Change in Brent Oil Price (t-1)	-0.413	0.067	-6.122	5.58e-09***
Change in Food Price Index (t-1)	0.019	0.311	0.061	0.951
Change in Industrial Production (t-1)	-1.356	0.472	-2.874	0.005**
US Inflation Rate (t-1)	-4.394	2.531	-1.736	0.084
Colombia Inflation Rate (t-1)	-0.106	2.803	-0.038	0.970
Trend	6.25e-05	7.15e-05	0.874	0.383

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.107 on 181 degrees of freedom
Multiple R^2 : 0.286, Adjusted R^2 : 0.251
F-statistic: 8.07 on 9 and 181 DF, p-value: 4.99e-10

Table 12: Estimation Results for Federal Reserve Interest Rate Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	2.27e-03	2.13e-03	1.070	0.286
Change in Fed Interest Rate (t-1)	0.680	0.056	12.093	2e-16***
Change in Trade Balance (t-1)	-4.08e-06	6.94e-06	-0.587	0.558
Change in Brent Oil Price (t-1)	1.61e-03	6.91e-04	2.335	0.021*
Change in Food Price Index (t-1)	-9.73e-04	3.19e-03	-0.305	0.761
Change in Industrial Production (t-1)	-4.73e-03	4.83e-03	-0.978	0.330
US Inflation Rate (t-1)	-0.029	0.026	-1.114	0.267
Colombia Inflation Rate (t-1)	-0.039	0.029	-1.344	0.181
Trend	7.21e-07	7.33e-07	0.984	0.326

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.0011 on 181 degrees of freedom
Multiple R^2 : 0.482, Adjusted R^2 : 0.456
F-statistic: 18.68 on 9 and 181 DF, p-value: $< 2.2e - 16$

Our findings paint a more complex picture than we initially expected. External shocks don't simply cascade through Colombia's economy in a straightforward manner. While exchange rates serve as an immediate transmission channel for external pressures (particularly U.S. inflation), these shocks appear to dissipate before significantly affecting domestic inflation or trade performance. This finding supports the effectiveness of Colombia's inflation targeting framework and monetary policy autonomy in insulating domestic price levels from external disturbances.

To further investigate these relationships and capture dynamic responses beyond the immediate coefficient effects, we now turn to impulse-response function (IRF) analysis, which will allow us to trace the propagation of external shocks through the Colombian economy over time.

3.1 Commodity Shocks

Commodity prices have historically been a significant source of macroeconomic fluctuations in resource-dependent emerging economies (Auer et al., 2017). Lora, Powell, and Tavella (2011) found that inflation in Latin American countries is highly susceptible to commodity price shocks.

Table 13: Estimation Results for US Inflation Rate Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.008	0.006	-1.486	0.139
Change in Fed Interest Rate (t-1)	-0.168	0.147	-1.143	0.254
Change in Trade Balance (t-1)	1.44e-05	1.81e-05	0.794	0.428
Change in Brent Oil Price (t-1)	0.011	0.002	6.139	5.12e-09***
Change in Food Price Index (t-1)	0.001	0.008	0.166	0.868
Change in Industrial Production (t-1)	0.018	0.013	1.429	0.155
US Inflation Rate (t-1)	-0.183	0.068	-2.699	0.008**
Colombia Inflation Rate (t-1)	0.303	0.075	4.032	8.13e-05***
Trend	3.46e-07	1.91e-06	0.181	0.857

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.003 on 181 degrees of freedom
Multiple R^2 : 0.273, Adjusted R^2 : 0.237
F-statistic: 7.55 on 9 and 181 DF, p-value: 2.31e-09

Table 14: Estimation Results for Change in Food Price Index Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.054	0.048	-1.121	0.264
Change in Fed Interest Rate (t-1)	-1.641	1.279	-1.283	0.201
Change in Trade Balance (t-1)	7.35e-06	1.58e-04	0.047	0.963
Change in Brent Oil Price (t-1)	0.027	0.016	1.750	0.082
Change in Food Price Index (t-1)	-0.318	0.072	-4.387	1.95e-05***
Change in Industrial Production (t-1)	0.161	0.110	1.467	0.144
US Inflation Rate (t-1)	-0.777	0.590	-1.317	0.189
Colombia Inflation Rate (t-1)	1.014	0.653	1.552	0.122
Trend	4.40e-06	1.67e-05	0.264	0.792

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.025 on 181 degrees of freedom
Multiple R^2 : 0.144, Adjusted R^2 : 0.101
F-statistic: 3.37 on 9 and 181 DF, p-value: 7.63e-04

Table 15: Estimation Results for Change in Industrial Production Index Model

Variable	Estimate	Std. Error	t-value	Pr(> t)
Currency Devaluation (t-1)	-0.057	0.029	-1.994	0.048*
Change in Fed Interest Rate (t-1)	0.113	0.760	0.148	0.882
Change in Trade Balance (t-1)	-2.65e-05	9.38e-05	-0.282	0.778
Change in Brent Oil Price (t-1)	0.059	0.009	6.352	1.67e-09***
Change in Food Price Index (t-1)	-0.038	0.043	-0.894	0.373
Change in Industrial Production (t-1)	-0.210	0.065	-3.214	0.002**
US Inflation Rate (t-1)	0.165	0.350	0.471	0.638
Colombia Inflation Rate (t-1)	-0.547	0.388	-1.410	0.160
Trend	7.25e-07	9.90e-06	0.073	0.942

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.015 on 181 degrees of freedom
Multiple R^2 : 0.300, Adjusted R^2 : 0.265
F-statistic: 8.61 on 9 and 181 DF, p-value: 1.06e-10

Our results contribute to this literature by providing new evidence on the transmission mechanisms of these shocks in the case of Colombia for the time period of analysis. In this section we will discuss how commodity price shocks affects Colombia’s economy.

3.1.1 Oil Price Shocks

As a net oil exporter, Colombia exhibits a particular vulnerability to fluctuations in international Brent prices. As shown in Figure 4, a positive one-standard deviation shock in oil prices generates a complex exchange rate dynamic: an initial and insignificant appreciation of the Colombian peso (reduced depreciation) in the second month, followed by a significant depreciation in the third month, and another strong appreciation by the fourth month. This dynamic response aligns with Colombia’s position as an oil exporter, where higher international prices ultimately strengthen external accounts and, consequently, its currency, albeit with short-term volatility.

This transmission channel can be explained by the nature of oil shocks, which typically originate from disruptions in global supply (geopolitical conflicts, OPEC+ decisions) or changes in world demand. The pronounced volatility observed during our study period, particularly the historic price collapse during the COVID-19 pandemic and its subsequent recovery (as seen in Figure 1), illustrates the magnitude these shocks can reach and their potential impact on emerging economies.

However, it is notable that despite the significant effect on the exchange rate, the transmission to domestic inflation and trade balance remains statistically non-significant, as evidenced in Figure 4. This finding suggests robust compensatory mechanisms within Colombia’s economic framework—including strategic fuel subsidies and effective central bank interventions—that successfully attenuate the conventional inflationary consequences of oil price fluctuations. This outcome contrasts with earlier findings by (Rodríguez Pinzón, 2011), who identified direct transmission channels from oil prices to consumer prices, and instead supports hypothesis proposed by (Chen, 2009), which argues that pass-through effects diminish significantly when central banks maintain strong independence, as is the case in Colombia. Additional robustness tests using VAR(6) and VAR(12) specifications corroborate these findings, demonstrating consistent patterns for both trade balance and inflation responses to Brent price shocks (see Figures 9 and 14 in the Appendix).

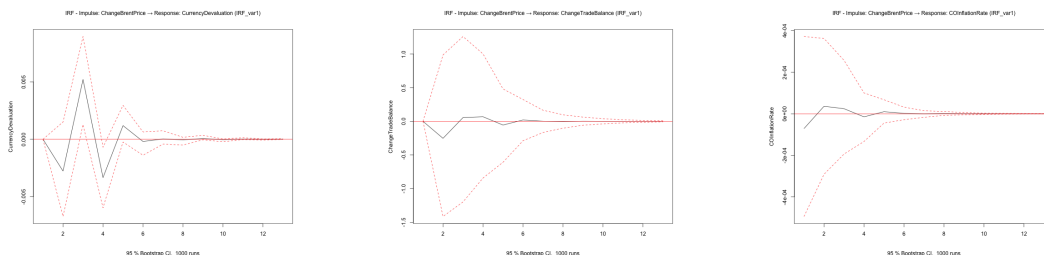


Figure 4: Effects of a shock in Brent Oil price over domestic Colombian variables: the COP/USD exchange rate, trade balance and inflation rate.

3.1.2 Food Price Shocks

Food constitutes a significant component of consumer baskets in emerging economies, making international food prices a critical external factor for Colombia’s macroeconomic stability (Vallejo Zamudio, 2022) and as our VAR(6) and VAR(12) shows on Table 16 and 17 . As illustrated in Figure 5, a positive one-standard deviation shock in global food prices generates a visible yet statistically non-significant response in the Colombian peso exchange rate. The pattern shows an apparent depreciation in the second month followed by partial recoveries and mild fluctuations in subsequent periods. However, the confidence intervals consistently include zero throughout the forecast

horizon, indicating that these effects lack statistical significance.

The transmission mechanism of food price shocks theoretically differs from oil price dynamics due to Colombia’s position as a net food importer for several key commodities despite its agricultural potential. While rising international food prices would typically be expected to deteriorate terms of trade and weaken the currency, our empirical results suggest these theoretical channels are not manifesting as statistically significant effects for this case.

The IRF for both the trade balance and domestic inflation shows no statistically significant response to food price shocks, as illustrated in Figure 5. These findings suggest that inflation in Colombia may not be significantly affected by global food price fluctuations, again supporting the hypothesis that domestic inflation is primarily driven by monetary factors. The robustness of these results is confirmed by alternative specifications using VAR(6) and VAR(12), which exhibit consistent (although more volatile) patterns of non-significant responses (see Figures 10 and 15 in the Appendix). This insulation effect may be partly explained by Colombia’s domestic agricultural production capacity, which serves as a buffer against international price volatility.

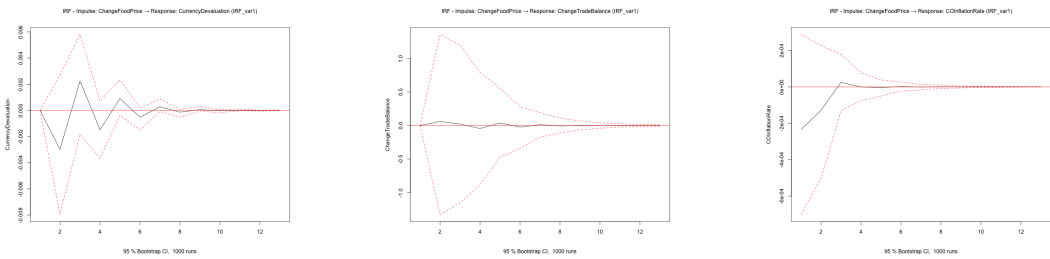


Figure 5: Effects of a shock in international food prices over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

The findings discussed here have significant implications for Colombia’s policy makers. For example it suggests that the Central Bank of Colombia (*Banco de la República*) has developed effective mechanisms to secure domestic inflation from external oil and food price volatility, supporting the importance of maintaining central bank independence. Second, policy makers should consider developing additional stabilization tools to complement existing mechanisms, particularly in the context of oil prices as the country navigates energy transition challenges that may alter its oil export dependency and the economic diversification strategy becomes increasingly relevant as a long-term objective to reduce vulnerability to oil price fluctuations, especially given the documented exchange rate sensitivity to oil shocks that persists despite inflation insulation.

These results also show some insights for Colombia’s food inflation. For example, they might highlight the resilience of Colombia’s food industry in the face of global food price volatility, demonstrating its ability to insulate the domestic economy through local production response. However, this finding does not imply that the food component is irrelevant for Colombia’s inflation; rather, it suggests that food inflation is primarily driven by domestic factors. On the other hand, unlike oil price shocks, which show significant effects on the exchange rate for our VAR(1) specification, food price shocks appear to have a limited impact on key macroeconomic variables showing more energetic than alimentary external dependence in Colombia ³. Finally, relative to food security, Colombian policymakers should strengthen domestic agricultural production and keep promoting food self-sufficiency as strategic priorities to preserve this resilience, especially as climate change is expected to intensify global food price volatility in the coming decades (Haile, Wossen, Tesfaye,

³This align with our initial thoughts, as we expect Colombia to be more susceptible to energy prices changes than food prices changes. However, the country experience show us that some food supply chain shocks as the one triggered by Ukraine-Russian war may increase inflation due to the dependence of some inputs in national agriculture industry

& von Braun, 2017) and because it is clear that the food component is absolutely important for price levels in Colombia.

3.2 U.S. Economic Influence

Given that the United States is Colombia’s largest trading partner, accounting for 27% of Colombia’s exports and 25% of its imports in 2022, the transmission of U.S. economic shocks to the Colombian economy warrants particular attention (World Bank, 2022) when we want to study external shocks. Here, we will point the main results for U.S economic shocks in Colombia.

3.2.1 Federal Reserve Monetary Policy

As emerging economies become increasingly integrated into global financial markets, U.S. monetary policy decisions have gained importance as potential external shock transmitters (Eichenbaum & Evans, 1995). As shown in Figure 6, Federal Reserve interest rate shocks produce visible but statistically non-significant responses across Colombian macroeconomic variables.

Examining the IRF in detail, we observe that when there is a positive one standard deviation shock in the Fed interest rate, Colombian inflation confidence intervals consistently include zero, indicating these effects, even though positive, lack statistical significance.

For the exchange rate, we observe an oscillatory pattern with an initial positive response in the first two months (reflecting peso depreciation of up to 0.02%) supporting the volatility in capital flows discussed in the literature (Bank for International Settlements, 2022), followed by alternating positive and negative movements that diminish in amplitude over time. While the pattern suggests an initial capital outflow effect that temporarily weakens the peso against the dollar, followed by market corrections, the wide confidence intervals encompassing zero indicate that Colombia has not suffered against U.S. monetary policy shocks.

The trade balance shows minimal response to Fed interest rate shocks, with the impulse response function remaining close to zero throughout the forecast horizon, further supporting the conclusion that Colombia maintains relative insulation from direct U.S. monetary policy transmission.

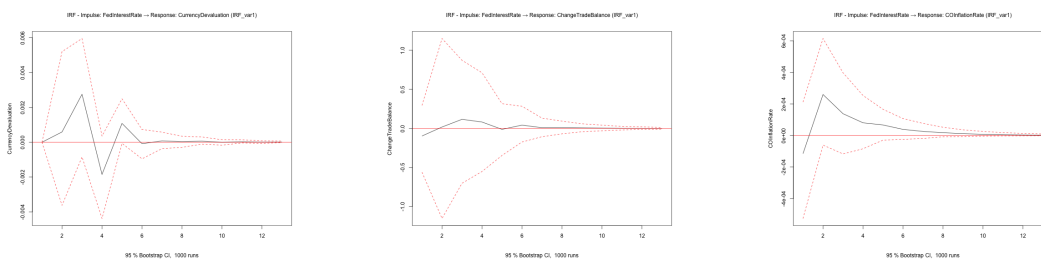


Figure 6: Effects of a shock in the U.S. monetary policy over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

The nature of these monetary policy shocks has evolved significantly during our study period. The Federal Reserve maintained near-zero interest rates for most of the post-2008 period before embarking on an aggressive tightening cycle after 2021 in response to post-pandemic inflation. The descriptive statistics in Tables 2 and 3 clearly show this structural break, with the Fed interest rate rising from an average of 0.0059 pre-COVID to 0.0248 post-COVID. This significant monetary policy shift has been accompanied by increasing uncertainty in global markets and may change the

scope of these findings.

It suggests that Colombia has developed relevant monetary and financial frameworks that provide effective insulation against external monetary shocks, even during periods of significant policy shifts in the United States and when we use a big period of analysis (+10 years).

3.2.2 U.S. Inflation

The shadow of U.S. inflation looms large over Colombian financial markets, creating distinct ripple effects in the peso's valuation. When American consumers face rising prices, Colombian currency traders respond with remarkable consistency—first nudging the peso downward by about 0.04%, then accelerating this depreciation to 0.08% as market participants fully absorb the implications as shown in Figure 7. Intriguingly, this initial reaction typically overshoots, triggering a partial correction by the third month as the market recalibrates. This predictable choreography of currency movements illustrates the asymmetric power relationship between the world's largest economy and its emerging market trading partners, creating recurring arbitrage opportunities that sophisticated investors have undoubtedly noticed. This oscillatory response is statistically significant during the first few months and suggests a complex adjustment mechanism whereby Colombian financial markets immediately react to U.S. inflation news before adjusting toward equilibrium levels.

The trade balance exhibits minor fluctuations in response to U.S. inflation shocks, but these remain statistically non-significant throughout the forecast horizon, with confidence intervals consistently including zero. This pattern suggests that while exchange rates serve as an immediate transmission channel for U.S. inflation shocks, these external pressures do not significantly disrupt Colombia's external balance.

For domestic inflation, we observe a small positive response of approximately 0.002% following a U.S. inflation shock, though this effect lacks statistical significance as confidence intervals include zero across all periods. This finding is particularly interesting given the recent surge in U.S. inflation, which reached multi-decade highs following the pandemic. Despite the high correlation between U.S. CPI and Colombian CPI (0.9878, significant at the 5% level, as shown in Table 4), our impulse-response analysis indicates limited direct transmission of U.S. inflation shocks to Colombian inflation.

The divergence between the significant exchange rate response and the non-significant inflation response highlights a pattern that may suggest that Colombia's inflation targeting framework plays a role in stabilizing price expectations against external pressures, though additional factors could also contribute to this resilience. These results align with findings from (Urrutia, Hofstetter Gascón, & Hamann S, 2014) for the period 2002-2012, who documented the success of Colombia's monetary policy in maintaining inflation rates despite external shocks after the Central Bank improved its instruments. Our findings continue to support the monetary hypothesis that suggests inflation is primarily a domestic monetary phenomenon rather than being determined by external factors, even in an increasingly interconnected global economy.

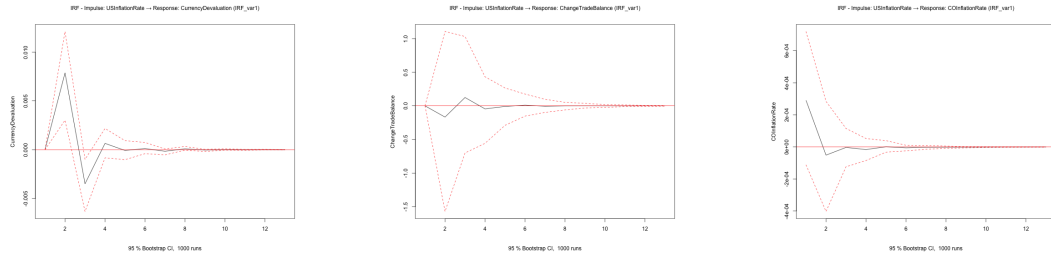


Figure 7: Effects of a shock in the U.S. inflation over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

3.2.3 U.S. Industrial Production

The industrial production index (IPI) serves as a key indicator of economic activity in the United States, with potential implications for trading partners like Colombia. As shown in Figure 8, changes in U.S. industrial production generate modest and statistically non-significant effects on Colombian macroeconomic variables.

The exchange rate wobbles slightly after a U.S. industrial production shock, but these movements lack statistical significance. The confidence bands spread wide enough to include zero, making it difficult to conclude any meaningful relationship exists. This finding suggests that Colombia’s exchange rate dynamics are not substantially influenced by fluctuations in U.S. manufacturing activity. Colombia demonstrates substantial resilience to U.S. manufacturing fluctuations, a strength directly linked to the country’s export diversification strategy over recent decades. While the U.S. remains Colombia’s largest trading partner, economic buffers have developed through expanded market access and product diversification. And finally, for domestic inflation, we observe minimal response to U.S. industrial production shocks, with slight movements (approximately 0.002% at maximum) that also lack statistical significance.

The minimal and non-significant nature of these responses, particularly when compared to the more pronounced effects of other external factors such as oil prices and U.S. inflation as we saw before, suggests that Colombia has considerable resilience to cyclical fluctuations in U.S. manufacturing activity. This resilience could be attributed to Colombia’s economic diversification efforts in both export markets and products over recent decades, reducing dependency on the U.S. industrial sector despite the overall importance of the United States as a trading partner. To illustrate this, since the pandemic, China has been becoming a more important partner of Colombia, providing more imports than the U.S. for example, in 2021 ([Observatory of Economic Complexity, 2021](#))⁴.

These results further reinforce the monetary hypothesis regarding Colombian inflation, as they demonstrate that even direct real economic activity shocks from its principal trading partner have limited transmission to domestic price levels, underscoring the primacy of domestic monetary factors in determining inflation outcomes.

⁴Although Colombia is one of the few Latin American countries that still have U.S as his primary trade partner, the China increasing relationship is needed to keep in eyes for future external analysis of inflation dynamics, as it would be interesting to evaluate the changes on this findings relative to China’s trade expansion (especially promoted since first Trump administration)

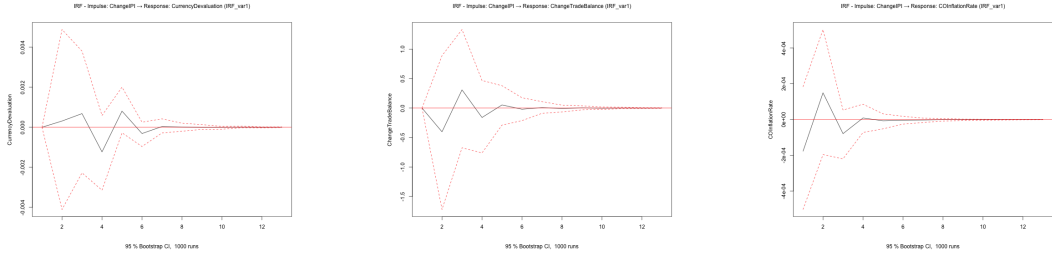


Figure 8: Effects of a shock in the U.S. industrial sector over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

3.3 Implications for Monetary Policy and Economic Management

Some of our findings challenge the traditional theory of external effects on inflation for emergent economies and have several key implications for Colombia’s monetary policy in the current international context of uncertainty. The limited or almost null sensitivity of domestic inflation to external shocks—despite observable effects on the exchange rate—suggests that the *Banco de la República’s* inflation-targeting framework has played an important role in anchoring expectations and shielding the economy from international pressures⁵. This supports maintaining the current policy approach and Central Bank independence, which has helped keep inflation under control even amid considerable global volatility.

At the same time, the significant exchange rate responses to oil price movements and U.S. inflation shocks reveal the importance of exchange rate flexibility as a buffer. Since this flexibility has allowed Colombia to adjust more smoothly to external conditions without resorting to disruptive monetary interventions—something that would be more challenging under a fixed exchange rate regime.

For policymakers confronting contemporary inflation challenges, our findings highlight a critical insight: while external shocks may not directly drive Colombian inflation, they significantly impact exchange rates, creating potential indirect pressures that require monitoring. This nuanced relationship refines our understanding of inflation dynamics in small open economies.

4 Conclusion

This study examined how external factors have influenced inflation dynamics in Colombia using a VAR model covering the period from 2009 to 2024. This timeframe encompasses major global events like the COVID-19 pandemic, the war in Ukraine, and a surge in global inflationary pressures. Our findings carry both theoretical and practical significance.

First, Colombia’s inflation appears relatively insulated from moderate external shocks. Most impulse-response functions point to statistically insignificant direct effects on domestic prices. This is notable given the large structural shifts observed between pre- and post-COVID periods—like the exchange rate jumping from 2,427.64 to 4,039.89, and the Fed’s interest rate rising from 0.0059 to 0.0248. Despite these shifts, inflation outcomes remained largely unaffected in the short run.

Second, the significant connections we found between oil prices and the exchange rate (Figure 4), and between U.S. inflation and the peso-dollar rate (Figure 7), suggest that the main channel for external shock transmission is through currency movements, rather than direct price-level effects. This supports theoretical models in which exchange rate flexibility acts as a key shock absorber

⁵In Colombia the inflation-targeting framework is the current regime since 1990

for small open economies.

Third, the results add weight to the monetarist perspective in debates about inflation in developing countries, specially on those with central Bank independence. The lack of strong external effects on inflation suggests that Colombia's price dynamics are primarily influenced by domestic monetary factors, rather than by structural international forces. This reinforces the appropriateness of an inflation-targeting framework focused on domestic conditions.

Overall, while Colombia's economy is clearly exposed to global developments, as seen in the exchange rate, it still maintains considerable control over its inflation process. This points to the effectiveness of current monetary institutions and policy tools. For policymakers, the takeaway is clear: maintaining exchange rate flexibility while focusing monetary efforts on domestic stability remains the right approach. That said, the external environment continues to evolve. Persistent inflation abroad, tightening global liquidity, and shifting trade policies—particularly from the U.S.—pose ongoing risks.

One caveat of this study is that it relies on a linear VAR framework. It's possible that the weak transmission effects we observe are due to model limitations rather than true economic insulation. Future work could explore non-linear dynamics or asymmetric effects. A Bayesian VAR with time-varying parameters, for example, could offer a more nuanced view, or an SVAR (Structural VAR) could deal with the exogenous assumption of external shocks. Also, we are aware that including some monetary variables that might drive inflation in Colombia would allow us to control for these sources and may have a different or cleaner effect on external factors. Although all of these improvements are out of the scope of this study due to time constraints, we are willing to keep investigating this phenomena further.

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5 Appendix

Table 16: VAR(6) Model Estimation Results Key Variables

Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
<i>Lag 1</i>						
Currency Devaluation (t-1)	1.28e-02	0.112	-7.14e-01	0.000***	-5.88e+00	0.844
Fed Interest Rate (t-1)	2.79e-01	0.216	2.34e+00	0.383	3.23e+02	0.699
Change in Trade Balance (t-1)	4.98e-05	0.028*	8.35e-05	0.755	-8.47e-01	0.000***
Change in Brent Oil Price (t-1)	1.74e-03	0.535	-8.99e-02	0.008**	-7.94e+00	0.446
Change in Food Price Index (t-1)	6.01e-03	0.560	-4.65e-02	0.705	3.63e+01	0.345
Change in Industrial Production (t-1)	-2.27e-03	0.914	-9.93e-02	0.691	-1.16e+01	0.881
US Inflation Rate (t-1)	-3.25e-03	0.973	3.67e+00	0.002**	2.99e+01	0.934
Colombia Inflation Rate (t-1)	-1.10e-01	0.187	-1.17e+00	0.237	-2.92e+01	0.924
<i>Lag 2</i>						
Currency Devaluation (t-2)	1.76e-02	0.074	-6.38e-01	0.000***	1.83e+01	0.616
Fed Interest Rate (t-2)	4.13e-01	0.161	2.35e+00	0.502	2.07e+02	0.850
Change in Trade Balance (t-2)	3.82e-05	0.188	-7.19e-05	0.835	-6.45e-01	0.000***
Change in Brent Oil Price (t-2)	-2.69e-04	0.945	-1.53e-01	0.001**	-1.62e+01	0.268
Change in Food Price Index (t-2)	7.93e-03	0.471	1.30e-01	0.321	4.80e+01	0.240
Change in Industrial Production (t-2)	8.42e-04	0.973	-3.96e-01	0.187	-3.62e+00	0.969
US Inflation Rate (t-2)	-2.03e-01	0.058	2.14e+00	0.094	4.48e+02	0.258
Colombia Inflation Rate (t-2)	-2.02e-01	0.021*	-2.59e+00	0.013*	2.53e+02	0.433
<i>Lag 3</i>						
Currency Devaluation (t-3)	1.31e-02	0.219	-4.57e-01	0.000***	-1.58e+01	0.690
Fed Interest Rate (t-3)	-3.49e-01	0.250	1.91e+00	0.597	-2.80e+02	0.804
Change in Trade Balance (t-3)	1.40e-05	0.662	6.24e-05	0.870	-5.31e-01	0.000***
Change in Brent Oil Price (t-3)	2.46e-03	0.558	-8.43e-02	0.094	-2.49e+01	0.112
Change in Food Price Index (t-3)	2.35e-02	0.035*	5.83e-02	0.657	3.40e+01	0.408
Change in Industrial Production (t-3)	-2.85e-02	0.299	-4.66e-01	0.155	-4.99e+01	0.624
US Inflation Rate (t-3)	-2.12e-01	0.060	-4.30e-02	0.974	2.63e+02	0.528
Colombia Inflation Rate (t-3)	-1.02e-01	0.279	-2.23e+00	0.049*	5.04e+01	0.886

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Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
<i>Lag 4</i>						
Currency Devaluation (t-4)	8.79e-03	0.406	-3.62e-01	0.005**	-2.81e+01	0.475
Fed Interest Rate (t-4)	-2.35e-01	0.424	-4.49e+00	0.201	2.70e+01	0.980
Change in Trade Balance (t-4)	-4.39e-06	0.891	-1.24e-05	0.974	-3.78e-01	0.002**
Change in Brent Oil Price (t-4)	1.65e-03	0.693	-3.74e-02	0.453	-1.84e+01	0.237
Change in Food Price Index (t-4)	2.08e-02	0.064	1.98e-01	0.137	2.69e+01	0.516
Change in Industrial Production (t-4)	8.63e-03	0.734	-3.52e-01	0.245	-4.66e+01	0.621
US Inflation Rate (t-4)	-1.51e-01	0.183	1.07e+00	0.428	1.31e+02	0.755
Colombia Inflation Rate (t-4)	-1.40e-02	0.878	-1.43e-01	0.895	-5.10e+01	0.880
<i>Lag 5</i>						
Currency Devaluation (t-5)	1.32e-02	0.167	-1.83e-01	0.109	-1.32e+01	0.709
Fed Interest Rate (t-5)	-1.85e-01	0.541	-2.50e-01	0.945	-7.02e+02	0.533
Change in Trade Balance (t-5)	-1.67e-05	0.571	-3.96e-04	0.262	-3.84e-01	0.001***
Change in Brent Oil Price (t-5)	5.18e-04	0.893	-5.47e-02	0.234	-1.05e+01	0.461
Change in Food Price Index (t-5)	2.49e-02	0.023*	-3.51e-02	0.786	7.89e+00	0.845
Change in Industrial Production (t-5)	-2.25e-02	0.278	-3.48e-01	0.161	-1.11e+01	0.886
US Inflation Rate (t-5)	-1.75e-01	0.079	6.66e-01	0.574	7.21e+02	0.052
Colombia Inflation Rate (t-5)	-8.65e-02	0.346	-3.01e+00	0.007**	-1.07e+02	0.754
<i>Lag 6</i>						
Currency Devaluation (t-6)	1.28e-02	0.093	2.68e-02	0.766	1.29e+00	0.964
Fed Interest Rate (t-6)	8.70e-02	0.755	-2.59e+00	0.436	5.65e+02	0.585
Change in Trade Balance (t-6)	1.16e-05	0.616	-2.43e-04	0.379	-2.05e-01	0.018*
Change in Brent Oil Price (t-6)	1.63e-03	0.577	-1.10e-02	0.753	-1.33e+01	0.222
Change in Food Price Index (t-6)	1.68e-02	0.086	8.37e-02	0.471	-1.58e+01	0.662
Change in Industrial Production (t-6)	7.35e-03	0.658	-5.30e-01	0.008**	-4.96e+01	0.421
US Inflation Rate (t-6)	-1.80e-01	0.022*	1.27e+00	0.175	3.49e+02	0.230
Colombia Inflation Rate (t-6)	-7.71e-02	0.406	-6.58e-01	0.551	-1.56e+02	0.650
Trend	-9.42e-08	0.959	6.89e-06	0.754	-1.19e-04	0.986

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Table 16 – Continued from previous page

Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
<i>Model statistics</i>						
Residual standard error	0.0026		0.0315		9.807	
Multiple R^2	0.365		0.534		0.485	
Adjusted R^2	0.136		0.366		0.299	
F-statistic	1.595		3.178		2.613	
p-value	0.019*		0.000***		0.000***	
Degrees of freedom	136		136		136	

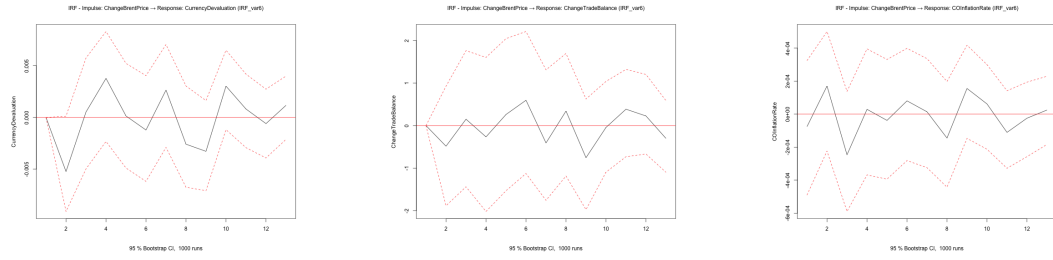


Figure 9: VAR(6) Effects of a shock in Brent Oil price over domestic Colombian variables: the COP/USD exchange rate, trade balance and inflation rate.

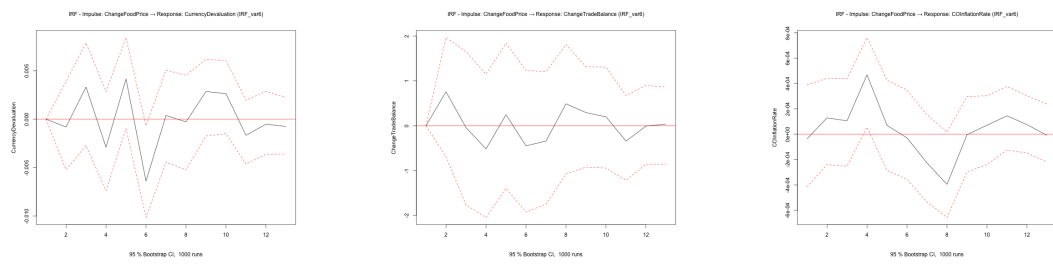


Figure 10: VAR(6) Effects of a shock in international food prices over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

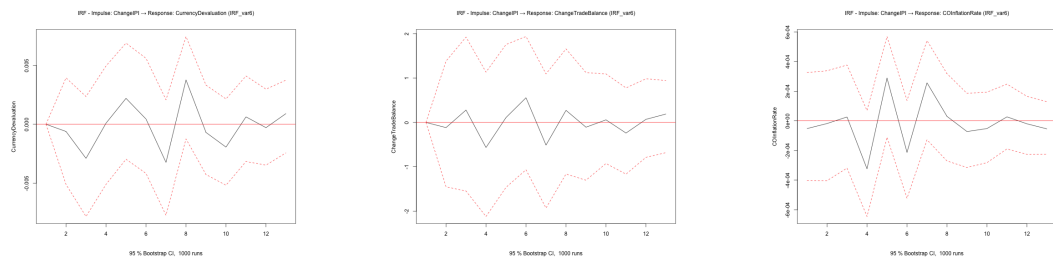


Figure 11: VAR (6) Effects of a shock in the U.S. industrial sector over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

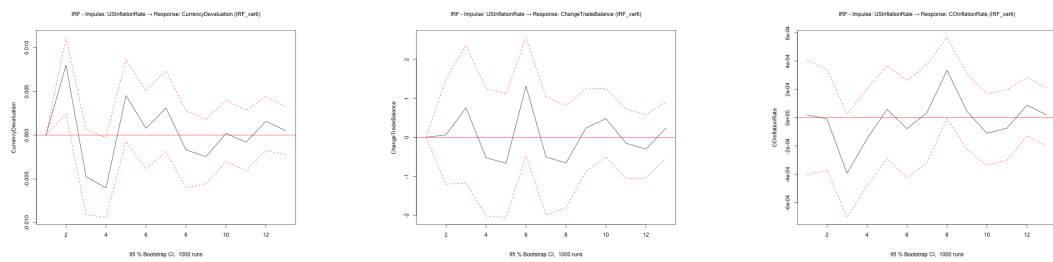


Figure 12: VAR (6) Effects of a shock in the U.S. inflation over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

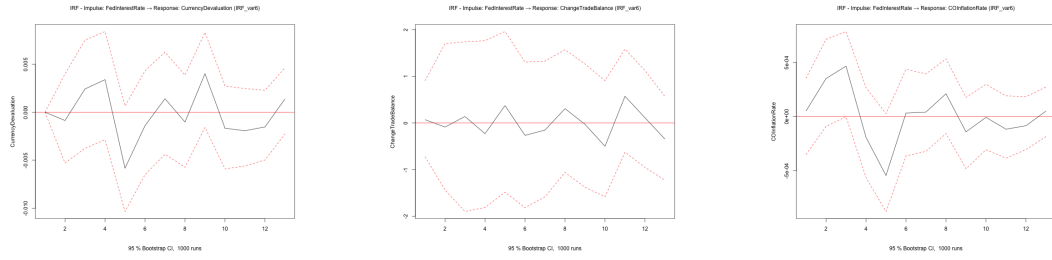


Figure 13: VAR (6) Effects of a shock in the U.S. monetary policy over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

Table 17: VAR(12) Estimation Results for Key Variables

Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
<i>Lag 1</i>						
Currency Devaluation (t-1)	8.90e-03	0.367	-8.73e-01	0.000***	-3.06e+01	0.520
Fed Interest Rate (t-1)	2.49e-01	0.291	3.90e+00	0.213	2.03e+02	0.858
Change in Trade Balance (t-1)	4.51e-05	0.049*	4.75e-05	0.875	-9.66e-01	0.000***
Change in Brent Oil Price (t-1)	-2.37e-04	0.942	-1.35e-01	0.002**	-2.02e+00	0.897
Change in Food Price Index (t-1)	4.37e-03	0.708	1.36e-01	0.381	-1.72e+01	0.760
Change in Industrial Production (t-1)	3.25e-03	0.900	7.28e-02	0.832	-9.53e+01	0.447
US Inflation Rate (t-1)	1.77e-01	0.167	4.94e+00	0.004**	-3.89e+00	0.995
Colombia Inflation Rate (t-1)	-2.95e-01	0.004**	-1.20e+00	0.369	-4.05e+02	0.405
<i>Lag 2</i>						
Currency Devaluation (t-2)	5.40e-04	0.966	-8.49e-01	0.000***	-1.18e+01	0.848
Fed Interest Rate (t-2)	2.93e-01	0.328	2.40e+00	0.547	8.84e+02	0.614
Change in Trade Balance (t-2)	4.08e-05	0.203	-6.85e-05	0.871	-7.41e-01	0.000***
Change in Brent Oil Price (t-2)	-5.09e-03	0.356	-2.40e-01	0.001**	-1.24e+01	0.640
Change in Food Price Index (t-2)	-1.07e-02	0.420	2.08e-01	0.236	5.42e+01	0.395
Change in Industrial Production (t-2)	2.43e-02	0.449	-2.98e-01	0.484	-5.43e+01	0.726
US Inflation Rate (t-2)	7.24e-02	0.649	3.78e+00	0.076	9.02e+02	0.242
Colombia Inflation Rate (t-2)	-2.46e-01	0.023*	-3.08e+00	0.032*	-3.14e+02	0.542
<i>Lag 3</i>						
Currency Devaluation (t-3)	-2.52e-03	0.866	-6.12e-01	0.003**	-6.48e+01	0.371
Fed Interest Rate (t-3)	-3.70e-01	0.259	3.44e+00	0.428	-4.77e+02	0.762
Change in Trade Balance (t-3)	7.51e-06	0.839	1.14e-04	0.817	-5.88e-01	0.001**
Change in Brent Oil Price (t-3)	-5.33e-03	0.467	-1.65e-01	0.091	-3.94e+01	0.266
Change in Food Price Index (t-3)	7.12e-03	0.612	1.26e-01	0.498	2.40e+01	0.723
Change in Industrial Production (t-3)	2.05e-02	0.584	-5.42e-01	0.277	-3.83e+01	0.832
US Inflation Rate (t-3)	1.27e-01	0.494	3.43e+00	0.165	4.45e+02	0.618
Colombia Inflation Rate (t-3)	-3.50e-01	0.003**	-2.30e+00	0.131	-3.79e+02	0.491

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Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
<i>Lag 4</i>						
Currency Devaluation (t-4)	-1.04e-03	0.947	-4.83e-01	0.022*	-1.03e+02	0.177
Fed Interest Rate (t-4)	-8.12e-02	0.815	-3.25e+00	0.482	-5.00e+01	0.976
Change in Trade Balance (t-4)	-4.66e-06	0.909	-1.15e-04	0.831	-4.84e-01	0.016*
Change in Brent Oil Price (t-4)	-7.93e-03	0.358	-1.12e-01	0.327	-3.54e+01	0.396
Change in Food Price Index (t-4)	1.63e-02	0.266	1.99e-01	0.308	3.97e+00	0.955
Change in Industrial Production (t-4)	4.46e-02	0.264	-4.52e-01	0.393	-6.33e+01	0.742
US Inflation Rate (t-4)	9.39e-02	0.644	4.38e+00	0.107	5.24e+01	0.957
Colombia Inflation Rate (t-4)	-2.20e-01	0.079	-7.53e-01	0.648	-2.57e+02	0.668
<i>Lag 5</i>						
Currency Devaluation (t-5)	7.92e-03	0.623	-2.64e-01	0.219	-1.12e+02	0.152
Fed Interest Rate (t-5)	1.16e-03	0.997	-6.65e-03	0.999	-9.18e+02	0.588
Change in Trade Balance (t-5)	-1.11e-05	0.793	-3.47e-04	0.537	-6.04e-01	0.004**
Change in Brent Oil Price (t-5)	-7.03e-03	0.447	-1.01e-01	0.410	-2.77e+01	0.534
Change in Food Price Index (t-5)	1.46e-02	0.355	2.20e-01	0.292	-6.70e+00	0.930
Change in Industrial Production (t-5)	1.65e-02	0.685	-8.54e-01	0.118	-1.09e+01	0.956
US Inflation Rate (t-5)	4.71e-02	0.821	3.34e+00	0.227	9.85e+02	0.328
Colombia Inflation Rate (t-5)	-3.60e-01	0.006**	-3.15e+00	0.068	-7.85e+01	0.900
<i>Lag 6</i>						
Currency Devaluation (t-6)	1.47e-02	0.350	-6.94e-02	0.739	-8.59e+01	0.258
Fed Interest Rate (t-6)	1.31e-01	0.710	3.97e-01	0.933	6.64e+02	0.697
Change in Trade Balance (t-6)	2.33e-05	0.594	7.90e-05	0.891	-5.97e-01	0.006**
Change in Brent Oil Price (t-6)	-3.31e-03	0.727	-8.85e-02	0.482	-3.84e+01	0.402
Change in Food Price Index (t-6)	1.20e-02	0.457	1.25e-01	0.558	1.98e+00	0.980
Change in Industrial Production (t-6)	2.98e-02	0.475	-8.51e-01	0.127	-2.96e+01	0.883
US Inflation Rate (t-6)	3.76e-02	0.838	4.72e+00	0.056	6.29e+02	0.479
Colombia Inflation Rate (t-6)	-2.69e-01	0.048*	1.27e-01	0.943	-5.14e+02	0.430
<i>Lag 7</i>						
Currency Devaluation (t-7)	2.09e-02	0.182	-1.72e-01	0.406	-7.20e+01	0.340

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Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
Fed Interest Rate (t-7)	2.26e-01	0.515	-9.38e+00	0.044*	-5.68e+01	0.973
Change in Trade Balance (t-7)	1.81e-05	0.679	4.67e-04	0.420	-4.51e-01	0.035*
Change in Brent Oil Price (t-7)	-3.01e-03	0.747	-6.62e-02	0.593	-2.37e+01	0.599
Change in Food Price Index (t-7)	9.24e-03	0.570	-1.06e-01	0.624	2.60e+01	0.740
Change in Industrial Production (t-7)	2.26e-02	0.575	2.06e-02	0.969	-7.43e+01	0.702
US Inflation Rate (t-7)	-2.07e-05	1.000	4.36e+00	0.066	-4.84e+02	0.571
Colombia Inflation Rate (t-7)	-2.41e-01	0.072	-1.63e+00	0.356	-4.82e+02	0.452
<i>Lag 8</i>						
Currency Devaluation (t-8)	7.99e-03	0.598	-2.55e-01	0.206	-5.21e+01	0.476
Fed Interest Rate (t-8)	-8.66e-02	0.807	-4.47e+00	0.344	7.38e+02	0.667
Change in Trade Balance (t-8)	2.51e-06	0.952	6.34e-04	0.257	-2.31e-01	0.255
Change in Brent Oil Price (t-8)	9.08e-04	0.916	-2.65e-02	0.816	-5.82e+00	0.889
Change in Food Price Index (t-8)	2.54e-03	0.874	-2.66e-01	0.211	2.34e+01	0.762
Change in Industrial Production (t-8)	-9.81e-03	0.794	6.37e-01	0.203	-6.44e+01	0.722
US Inflation Rate (t-8)	6.41e-02	0.700	2.46e+00	0.266	-2.13e+02	0.791
Colombia Inflation Rate (t-8)	-2.03e-01	0.120	-1.47e+00	0.394	-3.25e+01	0.959
<i>Lag 9</i>						
Currency Devaluation (t-9)	1.98e-02	0.162	-1.92e-01	0.306	-5.81e+01	0.394
Fed Interest Rate (t-9)	-1.31e-01	0.726	-1.24e+00	0.803	5.12e+02	0.777
Change in Trade Balance (t-9)	4.16e-05	0.307	7.76e-04	0.153	-1.30e-01	0.508
Change in Brent Oil Price (t-9)	4.12e-03	0.592	-1.30e-02	0.898	2.90e+00	0.938
Change in Food Price Index (t-9)	8.99e-04	0.954	-2.55e-01	0.219	-4.22e+00	0.955
Change in Industrial Production (t-9)	1.05e-02	0.766	9.23e-01	0.051	-1.26e+02	0.457
US Inflation Rate (t-9)	7.49e-02	0.622	3.60e+00	0.077	2.13e+02	0.772
Colombia Inflation Rate (t-9)	-1.38e-01	0.277	-1.77e+00	0.295	8.69e+01	0.887
<i>Lag 10</i>						
Currency Devaluation (t-10)	1.82e-02	0.167	5.63e-02	0.746	-8.02e+01	0.206
Fed Interest Rate (t-10)	-2.78e-01	0.396	7.55e+00	0.085	-2.41e+02	0.879
Change in Trade Balance (t-10)	1.48e-05	0.686	9.23e-04	0.061	-1.30e-01	0.463

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Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
Change in Brent Oil Price (t-10)	2.31e-03	0.729	-5.34e-03	0.952	-1.47e+01	0.648
Change in Food Price Index (t-10)	-5.56e-03	0.701	-2.31e-01	0.232	-9.42e+00	0.893
Change in Industrial Production (t-10)	5.82e-02	0.075	4.03e-01	0.351	-9.14e+01	0.560
US Inflation Rate (t-10)	1.58e-01	0.271	2.60e+00	0.174	8.45e+02	0.223
Colombia Inflation Rate (t-10)	-3.00e-01	0.015*	1.26e+00	0.436	-2.42e+02	0.680
<i>Lag 11</i>						
Currency Devaluation (t-11)	2.20e-02	0.044*	-2.82e-02	0.844	-5.18e+01	0.321
Fed Interest Rate (t-11)	-4.39e-01	0.168	7.97e+00	0.061	-1.99e+03	0.196
Change in Trade Balance (t-11)	1.73e-05	0.583	7.32e-04	0.083	-7.64e-02	0.616
Change in Brent Oil Price (t-11)	4.98e-03	0.353	-1.90e-03	0.979	-2.61e+01	0.315
Change in Food Price Index (t-11)	2.20e-03	0.867	-2.07e-01	0.241	4.41e+01	0.490
Change in Industrial Production (t-11)	4.32e-02	0.076	2.85e-01	0.375	-7.25e+01	0.534
US Inflation Rate (t-11)	-1.26e-02	0.922	2.70e-01	0.874	1.22e+03	0.051
Colombia Inflation Rate (t-11)	-1.53e-02	0.893	-4.55e-01	0.762	-1.57e+02	0.774
<i>Lag 12</i>						
Currency Devaluation (t-12)	1.79e-02	0.035*	5.65e-02	0.612	-1.23e+01	0.762
Fed Interest Rate (t-12)	5.14e-01	0.106	-6.27e+00	0.137	4.66e+02	0.759
Change in Trade Balance (t-12)	3.59e-05	0.116	2.64e-04	0.381	-1.08e-01	0.327
Change in Brent Oil Price (t-12)	5.39e-03	0.125	2.84e-02	0.541	-1.12e+01	0.507
Change in Food Price Index (t-12)	9.93e-03	0.374	4.83e-03	0.974	-3.25e+00	0.952
Change in Industrial Production (t-12)	3.70e-02	0.044*	2.91e-01	0.231	-7.39e+01	0.401
US Inflation Rate (t-12)	2.80e-02	0.763	1.19e+00	0.334	6.37e+02	0.158
Colombia Inflation Rate (t-12)	4.06e-01	0.000***	9.84e-01	0.504	-8.06e+02	0.134
Trend	-2.39e-08	0.989	1.18e-06	0.958	1.36e-03	0.869
<i>Model statistics</i>						
Residual standard error	0.0023		0.0300		10.92	
Multiple R^2	0.711		0.737		0.615	
Adjusted R^2	0.369		0.425		0.159	
F-statistic	2.078		2.363		1.348	

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Variable	Colombia Inflation		Currency Devaluation		Trade Balance	
	Coef.	p-value	Coef.	p-value	Coef.	p-value
p-value	0.000***		0.000***		0.082	
Degrees of freedom	82		82		82	

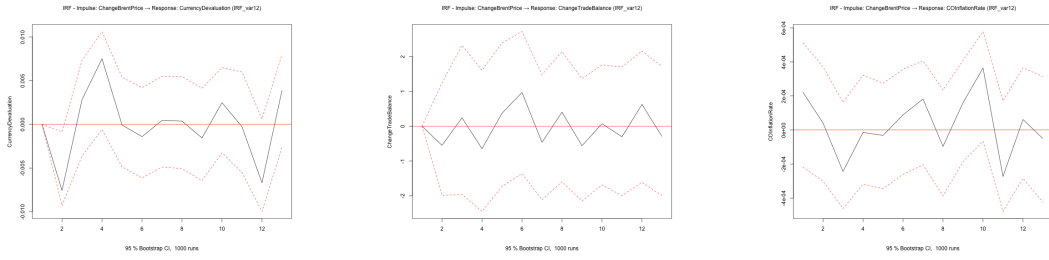


Figure 14: VAR (12) Effects of a shock in Brent Oil price over domestic Colombian variables: the COP/USD exchange rate, trade balance and inflation rate.

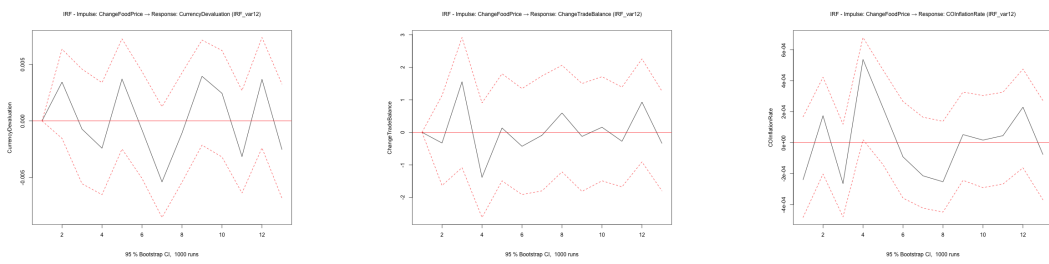


Figure 15: VAR (12) Effects of a shock in international food prices over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

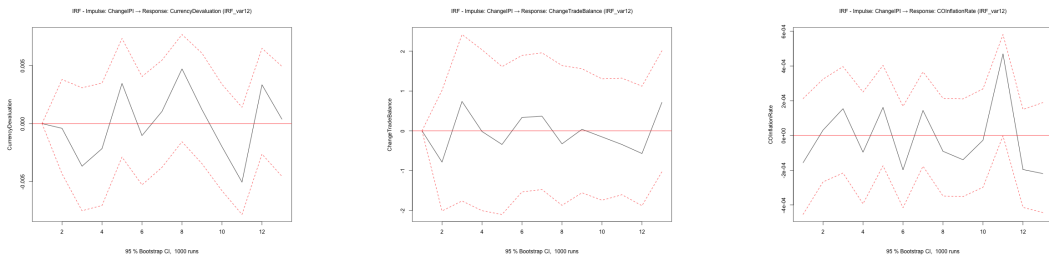


Figure 16: VAR (12) Effects of a shock in the U.S. industrial sector over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

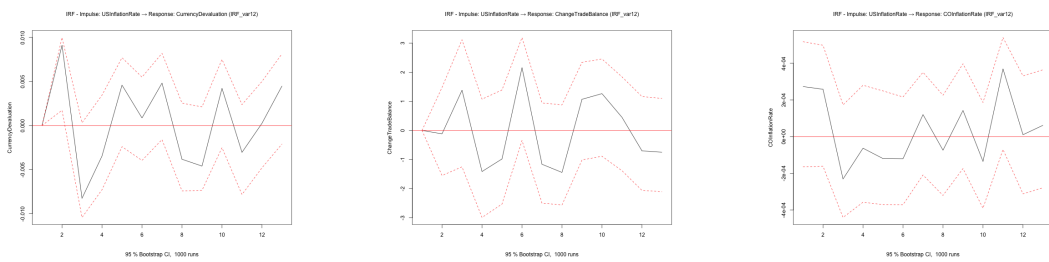


Figure 17: VAR (12) Effects of a shock in the U.S. inflation over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.

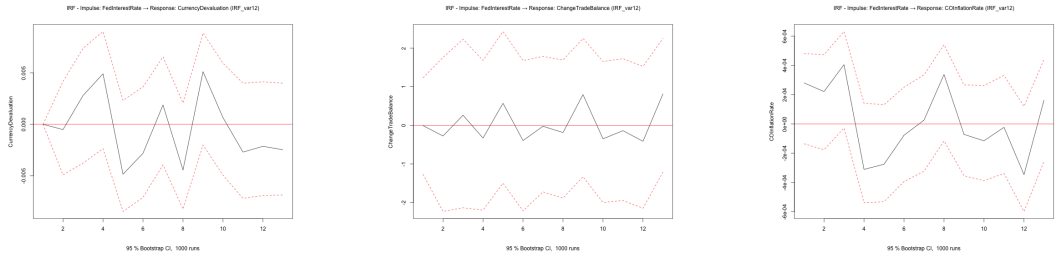


Figure 18: VAR (12) Effects of a shock in the U.S. monetary policy over Colombian domestic variables: the COP/USD exchange rate, trade balance and inflation rate.