

## Analyzing the Determinants of Trade Balance: An Empirical Investigation of Indonesia's Economic Dynamics



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**ABSTRACT:** The study investigates the determinants of Indonesia's trade balance focusing on five key factors: money supply, foreign direct investment, exchange rate, carbon dioxide emissions, and government expenditure. Utilizing secondary time-series data from 1990 to 2022 and employing vector error correction model analysis, the research reveals significant insights. In the short term, only the money supply notably influences trade balances, while the other factors show no significant impact. However, in the long term, foreign direct investment, exchange rate, carbon dioxide emissions, and government expenditure positively affect the trade balance, with the money supply displaying an insignificant impact. The study's conclusions offer policy suggestions to address these findings. These suggestions include putting policies in place to lower carbon emissions and encourage sustainable growth, making sure government funding for sustainable development initiatives is used effectively, luring foreign direct investment, keeping exchange rates stable, and being cautious when controlling the money supply to preserve price stability. The objective of these recommendations is to improve Indonesia's trade balance sustainability. However, the analysis admits its limitations in not accounting for all macroeconomic factors, such as GDP, interest rates, and industrial production, that affect trade balance. Notwithstanding these drawbacks, the study provides insightful information to help policymakers develop plans for enhancing the dynamics of Indonesia's trade balance.

**KEYWORDS:** Trade balance, Exchange Rate, Foreign direct investment, Money supply, Carbon dioxide emissions, and Government expenditure.

### 1. INTRODUCTION

A vital component of the balance of payments, the trade balance is a vital indicator of a country's health. The difference between a country's overall import and export values during a given period is known as its trade balance. When import expenses are less than export income, a nation has a trade balance deficit; when the reverse is true, it has a trade balance surplus. Nonetheless, the trade balance is balanced when a country's imports and exports are equal. Therefore, shifts in the trade balance are quite worrying, especially for countries where a trade deficit persists.

The trade balance is a crucial sign of a nation's ability to compete in the world economy, so anything that has an uneven effect on imports and exports has the potential to affect the trade balance. According to the World Trade Organization (2018), the 2030 Agenda recognizes the WTO's potential contribution to sustainable development and places a strong emphasis on trade's role in advancing it. Trade has historically been shown to be a growth-promoting engine for development and the alleviation of poverty. According to research by Adi Cristanto and Ari Bowo (2021), the economy is negatively impacted by the declining trade balance.

Globally, trade is out of balance. In 2021, China continued to hold the highest surplus position, followed by Germany, Ireland, and the Russian Federation at a considerable distance. The United Arab Emirates and Switzerland both displayed sizable surpluses. India and the United States, on the other hand, continued to have the highest deficit positions. These imbalances frequently have a modest level of the GDP of the nation, even though they can occasionally be substantial in magnitude. Nonetheless, many African nations have trade deficits that are significant to their GDP but not so significant globally (United Nations, 2021).

Over the past few decades, Indonesia, the largest economy in Southeast Asia, has seen significant shifts in its trade balance. According to World International Trade Statistics, with total imports of 196,189,955.59 and total exports of 231,522,458.13 in thousands of US dollars, Indonesia had a positive trade balance of 35,332,502.54 in thousands of US dollars. For Indonesia, the Most Favored Nation (MFN) Weighted Average is 5.65%, while the Effectively Applied Tariff Weighted Average (customs duty) is

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1.83%. In contrast to the global growth rate of 12.59%, trade growth is 18.65%. In current US dollars, Indonesia's GDP is 1,186,505,455,720.81. Services imports are 28,549,785,477.57 in balance of payment, current US dollars, and services exports from Indonesia are 13,951,271,376.21 in balance of payment, current US dollars. In terms of goods and services, Indonesia exports 21.41% of its GDP and imports 18.79%, respectively. (WITS, 2021).

Moreover, the Central Statistics Agency (BPS) reported that in August 2023, Indonesia's trade balance showed a USD 3.12 billion surplus. The non-oil and gas sector had a USD4.46 billion trade surplus last month, compared to a USD1.34 billion trade loss in the oil and gas sector. The nation's trade surplus increased in August 2023 as compared to the previous month. From January to August, Indonesia's trade balance totaled USD 24.34 billion. Compared to the same period last year, when USD 34.89 billion, this amount fell. The overall trade balance surplus for August in 2023 was less than it was for the same period the previous year (IDXChannel, 2023).

The substantial changes in the Indonesian trade balance have been impacted by various factors. Determining and comprehending these factors is essential to developing trade policies that work and advancing sustainable economic growth. Numerous research studies demonstrate how different factors impact Indonesia's trade balance. According to Adi Cristanto and Ari Bowo (2021), direct investment has a positive impact on trade balances, while exchange rates have a significant negative impact. Also, Ektiarnanti et al. (2016) note that exports have no direct impact on the trade balance, imports have a major impact on the trade balance, the BI rate has a significant indirect impact on the trade balance, inflation has a significant impact on the trade balance in Indonesia, and GDP indirectly affects trade balance through inflation. Furthermore, over 35 years (1980–2015), Laksono et al. (2020) show that GDP, export value, import value, and exchange rate had a substantial impact on the trade balance. The study by Wahyudi and Sari (2020) observes that there is a significant relationship between the exchange rate and trade balance in Indonesia. Moreover, according to research by Adi Cristanto and Ari Bowo (2021) fluctuations in the value of the rupiah have an impact on Indonesia's trade balance by causing variations in total imports and exports.

Despite having been a lot of research on the factors influencing Indonesia's trade balance, some factors, like government spending and carbon dioxide emissions, have not been included. This study fills this gap by including these variables and examining how they affect trade balances in Indonesia. As a result, the study's primary objective is to evaluate the short- and long-term effects on the trade balance of the exchange rate, money supply, foreign direct investment, carbon dioxide emissions, and government spending.

## 2. LITERATURE REVIEW

### *Theoretical Literature*

Why a nation's trade balance fluctuates is explained by different theoretical approaches, which are:

**The Marshal Learner Condition (M-L)** is a cornerstone of international economics. It states that a country's trade balance can only be improved by a devaluation or depreciation of its currency if the total of its import and export price elasticities is greater than one. This idea is backed by a variety of empirical studies, such as Turkay's (2014), which calculated Turkey's M-L condition and discovered that the M-L condition is only effective over the long term. According to Caporale et al. (2015), there is a long-term correlation between the real exchange rate and trade balance, and the M-L criterion is met for Kenya. The M-L condition is supported by empirical estimation and the linear and nonlinear impulse response functions (Moura & Silva, 2005). Tochitskaya (2007) also looked at the M-L condition being met and how depreciation can eventually improve the trade balance. Additionally, Kakar et al. (2010) found that, in the instance of Pakistan, exchange rate depreciation had a positive and significant influence on trade balance, which is consistent with the M-L condition. Furthermore, the M-L requirement for the bilateral trade balance between the US and the G-7 countries was empirically assessed by Brooks (1999). The study's findings show that, except for Canada, the US satisfies the M-L requirement for bilateral trade with all seven G-7 nations. Using cointegration and ECM approaches, Ahearn (2002) empirically examined the effects of currency depreciation on the balance of trade of South-east Asian nations, which include Malaysia, Singapore, the Philippines, and Korea. The study's empirical results demonstrate that only the Philippines and Malaysia have permanently improved their trade balances, indicating that they are the only nations that meet the M-L criteria and have elasticity larger than one.

**J-Curve Phenomenon:** A key idea in contemporary economic theories of trade balance, the J-curve phenomenon characterizes the pattern of response of a nation's trade balance after a currency depreciation. Due to current contracts and price rigidities, a short-term decline in the trade balance may result from currency depreciation when import volume initially surpasses export volume. The trade balance may improve over time as trade volumes adjust and new contracts take into account the altered exchange rates, giving rise to the distinctive "J" shape. This idea is backed by a variety of empirical studies, such as Bahmani-Oskooee and Ratha (2004) Research by Bahmani-Oskooee and Ratha explores the particulars of the J-curve phenomenon in

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developing nations. In "The J-Curve: A Survey of Theoretical and Empirical Research," they contend that structural elements, like export diversification and import composition, are critical in determining how the J-curve effect behaves in emerging markets. Their results emphasize how crucial it is to take into account national characteristics when examining the J-curve. Mundell (1968) - Theoretical Underpinnings of the J-Curve: The theoretical framework for comprehending the J-curve phenomenon was established by Mundell's groundbreaking research. In his paper "International Economics," Mundell explains how price inertia causes a currency devaluation to first worsen the trade balance before trade volumes eventually improve it. The conceptual framework serves as the foundation for further empirical studies.

**Absorption Approach:** The absorption approach states that the effect of devaluation on the balance of trade of the devaluing country depends upon the resultant change in its income, the unabsorbed portion of its income (that is, exports), and the portion of absorbed income in the form of imports. A method of determining the balance of trade (BOT) of a given country that holds that the balance of trade is equal to real national income minus absorption. In turn, the balance of payments (BOP) is determined by real national income and absorption, that is by how much is produced and how much is consumed. Furthermore, this approach emphasizes that changes in real domestic income is a determinant of a country's balance of payments and exchange rate. Numerous empirical studies have applied the absorption approach to analyze trade balances in various countries and regions. For example, Rose and Yellen (1989) investigated the relationship between exchange rate policies and trade balances using the absorption approach, finding that currency devaluations initially lead to a worsening of the trade balance, followed by an improvement over time. Marquez (2002) conducted a comprehensive empirical analysis of the absorption approach, examining data from multiple countries to assess the impact of domestic absorption on trade balances.

**According to the Pollution Haven Hypothesis,** nations with stringent environmental laws risk losing their dirty businesses to those with less stringent laws. This could result in a general increase in global pollution levels. In this argument, production may move from countries with stronger environmental restrictions to others with lower regulations, increasing carbon emissions in the latter nations. This may influence the trade balance since nations with laxer regulations may export more since their production costs are cheaper, while those with more stringent restrictions may export less. Similarly, it was discovered by Gani (2013) that commerce and industrial activity significantly affect pollution in Arab states. Actici (2012) also found that the export of dirty goods was the main determinant of CO<sub>2</sub> emissions in ASEAN countries for the period 1970–2000. Moreover, he also found that imports of Japan from ASEAN do not cause pollution in ASEAN countries, while imports of China stimulate pollution per capita in these countries. (Chakraborty and Mukherjee, 2013) examined the relationship between trade and the environment in 114 nations from 2000 to 2011, providing additional evidence in favor of the Pollution Haven Hypothesis. They gauged pollution using the environmental performance index. Additionally, they discovered that the export of manufactured and primary items from developing nations has led to environmental degradation in those same nations. Lopez et al. (2013) examined bilateral commerce between Spain and China and found compelling evidence to support the Pollution Haven Hypothesis once more. They discovered that China has turned into a pollution sanctuary for Spain's energy-intensive sectors.

### **Empirical literature**

Many scholarly works have elucidated the determinants of trade balances in different countries. The factors influencing the West African and Monetary Union's (WAEMU) trade balance from 1975 to 2017 are also examined in a study by Keho (2021). The study employs the Mean Group (MG) estimator in conjunction with the grouped mean versions of Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) to address endogeneity and cross-country heterogeneity. The findings show that while real effective exchange rate depreciation eventually improves the trade balance, the trade balance is negatively correlated with both domestic and foreign income.

The study conducted in Turkey uses a structural VAR framework to examine the impact of government spending shocks on Turkey's real exchange rate and foreign trade balance between 2002:01 and 2012:04. According to the analysis, a positive shock to government expenditure often causes the real exchange rate to appreciate and the trade balance to worsen. We also discover that it matters how the government spends its money. Shocks to government nonwage consumption cause the trade balance to worsen and the real exchange rate to appreciate, whereas the impacts of shocks to government investment are negligible. Additionally, the study shows that increases in taxes are linked to shocks to government spending, suggesting that Turkey's tax adjustment process is driven by spending (Tiganasu et al., 2022).

Additionally, using yearly time series data spanning the years 1980 to 2020, Tarawalie & Kpana (2022) studied the impact of monetary policy and exchange rate fluctuations on trade balance in Sierra Leone using the autoregressive distributed lag (ARDL) bound testing technique. The results show that the money supply and real effective exchange rate harm trade balances in the long term. However, real GDP, government spending, and foreign direct investment have a short-run effect on trade balance.

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Furthermore, a study on the dynamic relationship between India's macroeconomic variables and trade balance was undertaken by Laksono et al. (2020). The link is investigated using the autoregressive distributed lag model in this study. The study employs the Mean Group (MG) estimator in conjunction with the grouped mean versions of Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) to address endogeneity and cross-country heterogeneity.

Also, Utama and (Agesy,2016) carried out research on the analysis of the primary factors influencing trade balances. The research variables included inflation, currency rates, and foreign direct investment (FDI). The Ordinary Least Squares method (OLS) was employed in this study, and the sample period included the years 1970–2010. The outcome of the regression analysis indicated that the sole variable having an impact on Somalia's trade balance is foreign direct investment. The trade balance of Somalia was negatively impacted by foreign direct investment. The other variables, such as inflation and exchange rates, had no significant impact on Somalia's trade balance. Besides, (Adi Cristante & Ari Bowo, 2021) looked at the factors that affected Indonesia's trade balance between 2010 and 2019. Investment, exchange rate to the rupiah, economic growth, and trade balance are the variables considered. The results of the vector error correction model method indicate that direct investment has a positive short- and long-term impact on trade balances, while exchange rates have a significant negative short- and long-term impact. Economic growth has no significant short- or long-term impact on trade balances.

A study conducted by Ektiarnanti et al. (2020) looked at the GDP, imports, exports, BI rate, and inflation as intervening variables to analyze Indonesia's trade balance performance. Five years of monthly data was used in the research methodology. Path analysis techniques were employed as the methodology, and the results show that the BI rate has a significant impact on trade balance indirectly, inflation has a significant impact on trade balance in Indonesia, exports do not affect trade balance directly, imports have a significant impact on trade balance directly, and GDP indirectly affects trade balance through inflation.

### 3. METHODOLOGY

#### *Data*

The type of data used in this study is time series data (1990–2022) from the World Bank. Due to its reliability, accessibility, and thoroughness, the researcher opted to use data from the World Bank. Also, the study used a quantitative research approach to investigate the determinants of Indonesia's trade balance. Furthermore, the research employed EViews statistical software for data analysis, including both time series and descriptive statistical methods. The goal of descriptive analysis was to provide an overview of the study variables' descriptive statistics. The time series model estimations involve the unit root test, the lag order selection criterion, the co-integration test, and the causality test.

#### *Variable's description*

##### **Dependent variable**

**Trade balance:** The difference between an export and an import for a nation is known as its trade balance. This variable is also used as a dependent variable by Adi Cristante and Ari Bowo (2021) and Ektiarnanti et al. (2020).

##### **Independent Variables**

**Exchange rate:** This is the price at which one currency can be exchanged for another, and it has an impact on international trade and money transfers. It's utilized because it has an impact, such as shifting the trade balance towards a surplus or deficit. The variable was also utilized by Adi Cristante and Ari Bowo (2021) and Utama and Agesy (2016) as an independent variable.

**Foreign direct investment** is an investment incurred to purchase a permanent interest in a firm that operates in a country other than that of the investor. It is significant because it has the potential to improve a nation's exports and have a positive or negative impact on the trade balance by raising imports. (Tarawalie & Kpana, 2022) and Laksono et al. (2020) also used this variable as an independent variable.

**Money supply** is the total amount of money that the public possesses at any given time. It's employed since it affects the trade balance in ways like if there is an excess of money, the trade balance will get better. This variable was used as a predictor in the study conducted by Tarawalie and Kpana (2022).

**Carbon dioxide emissions:** According to a World Bank report, emissions from burning fossil fuels and making cement are known as carbon dioxide emissions. The carbon dioxide generated from gas flaring and the usage of solid, liquid, and gas fuels are among them. This variable was also used by Gani (2013) in his study.

**Government expenditure:** All current government spending on the purchase of goods and services is referred to as government expenditure (including employee salaries). The majority of government military spending that is included in capital creation is not included in the spending on national security and defense (World Bank, 2023).

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## Model Estimation

This section used the time-series analysis technique, which is the vector error correction model, which entails several procedures and tests.

## Stationarity

Since the study made use of time series data, it was necessary to ascertain if the variables under investigation were stationary or non-stationary. This is because estimates derived from nonstationary time series data will have a non-constant mean and variance, which can lead to erroneous conclusions when utilized for analysis. The series stationarity was tested using the Augmented Dickey-Fuller (ADF) test.

## Lag order selection criteria

The choice of lag length for the model was made before beginning the analysis of the time series data. When choosing the lag to be used in the model, Akaike (AIC) is better than other criteria in the case of a small sample size of sixty (60) observations and below because it increases the likelihood of determining the actual lag length.

## Cointegration

This method is used to determine if there is a long-term relationship between non-stationary variables. The study used Johansen's co-integration to investigate the relationship between government spending, trade balance value, money supply, exchange rate, and carbon dioxide emissions about foreign direct investment.

## Vector Error Correction Model

Is a system of vectors with at least two exogenous variables. It can be applied when the variables are integrated in the same order, which indicates that a long-term relationship exists between them. The error term was then incorporated into the short-run coefficients and treated as the equilibrium error. The model equation is represented below:

$$TOB = \beta_0 + \beta_1MS + \beta_2FDI + \beta_3EXCH\_RATE + \beta_4CO2\_Emm + \beta_5Gov\_Exp + \epsilon_t$$

Where TOB represents trade balance and MS represents money supply

FDI represents foreign direct investment; EXCH\_RATE represents the exchange rate. CO2\_Emm carbon dioxide emissions, Gov\_Exp government expenditure

$\epsilon_t$  Error term,  $\beta$  represents the coefficient of the variables

## Residual diagnostic test

To make sure the model utilized was appropriate, the study used a stability test. The table of moduli and the stability of the variance circle were used in the stability test. The modulus value must be smaller, and all the companion matrix's root moduli must be smaller than one and fall inside the circle for the model to be stable.

## 4. RESULTS AND DISCUSSION

### Descriptive statistics

Table 1 below shows the statistical summary of the factors used in the study, with a total of 32 observations for each variable. The results further show that the average trade balance over the period was about 0.47%, with a maximum of 16.4% and a minimum of -22.6%. On average, the money supply was about 16.7% over the period, with a maximum value of 62.7% and a minimum value of 4.75%. Also, the result suggests that on average, foreign direct investment was about 1.27% over the period, with a maximum value of 2.91% and a minimum value of 0.75%. Moreover, the results show that the exchange rate on average was about 8812.75 local currency units relative to U.S. dollars over the period, with a maximum value of 14849 local currency units relative to U.S. dollars and a minimum of 1842 local currency units relative to U.S. dollars. Additionally, on average, foreign carbon dioxide emissions were about 357367.7 kt over the period, with a maximum value of 605290.6 kt and a minimum value of 148342.9 kt. Finally, the results reveal that on average, government expenditure over the period was about 3.96%, with a maximum of 15.67% and a minimum of 15.37%.

Table 1: describe the summary statistics of the variables

	BOT	MS	FDI	CO2_e	G_ex	EX_RATE
Mean	-0.47	16.7	1.2	357367	3.96	8812.7
Maximum	16.4	62.7	2.9	605290	15.67	14849
Minimum	-22.7	4.7	-2.7	148342	-15.3	1842

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### Inferential statistics

#### Stationarity test

The null hypothesis, which states that the data are not stationary, was tested against the alternative. From Table 2 below, the results revealed that variables Balance of Trade, Money Supply, and Foreign Direct Trade Investment were stationary in level. This is because their p value was less than the level of significance. However, the exchange rate proved to be not stationary at this level. This is because the ADF test statistic p value was shown to be greater than the p value of 5%, which means the null hypothesis that the variables are not stationary was accepted at the 5% level of significance.

**Table 2: summarizes the results of the Unit Root Tests (ADF) for the level I(0) research variables.**

5% level of significance		
VARIABLES	P VALUES IN LEVEL	STATIONARY IN LEVEL
Bot	0.000	Stationary
Ms	0.0010	Stationary
Ex_rate	0.7060	Not stationary
Fdi	0.2031	Not Stationary
CO <sub>2</sub> Emissions	0.000	Stationary
Govern_Exp	0.0400	Stationary

*Source: Author's compilation from EViews output*

Table 3 below shows that the balance of trade, money supply, exchange rate, and foreign direct trade investment were stationary in the first difference. This is because their ADF test statistic p-value was less than the level of significance at 5%, which means that the null hypothesis that the variables are not stationary was not accepted.

**Table 3: summarizes the results of the Unit Root Tests (ADF) for the first difference I(1) research variables.**

5% level of significance		
VARIABLES	P VALUES AT 1 <sup>st</sup> DIFFERENCE	STATIONARY AT 1 <sup>st</sup>
Bot	0.0000	Stationary
Ms	0.0000	Stationary
Ex_rate	0.0000	Stationary
FDI	0.0000	Stationary
CO <sub>2</sub> Emissions	0.0000	Stationary
Govern_Exp	0.000	Stationary

#### Lag selection criteria

The lag candidates were estimated with LR, AIC, FPE, SC, and HQ. The lag selected was the one (1) with the lowest AIC value because AIC is superior to other criteria.

**Table 4: summarize the results of the Lag selection criteria**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-951.0122	NA	1.86e+21	66.000	66.283	66.089
1	-842.8007	164.182*	1.35e+19*	60.0207*	63.0009*	61.6409*
2	-803.2232	43.671	1.51e+19	59.700	64.4515	61.925

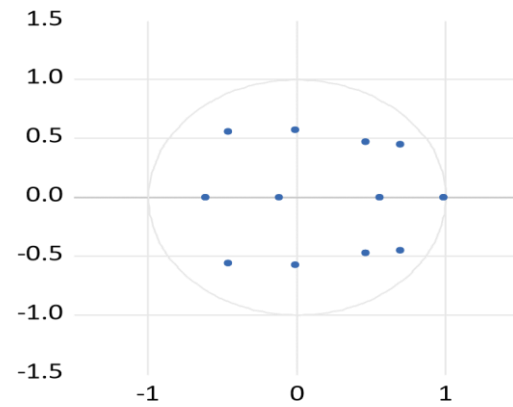
#### Stability test

The stability of the model is justified by the research test findings, which are displayed in Table 5 below and indicate that the matching Eigenvalue for modulus ranged from 0.118507 to 0.989843. Also, the chart shows that modulus results were less than 1 and fell inside the circle. *Table 5: show the summary of the stability test*



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Root	Modulus
0.989843	0.989843
0.696794 - 0.447566i	0.828153
0.696794 + 0.447566i	0.828153
-0.460873 - 0.562712i	0.727357
-0.460873 + 0.562712i	0.727357
0.459307 - 0.470009i	0.657169
0.459307 + 0.470009i	0.657169
-0.615244	0.615244
-0.011166 - 0.571302i	0.571411
-0.011166 + 0.571302i	0.571411
0.556474	0.556474
-0.118507	0.118507



Inverse Roots of AR Characteristic Polynomial

### Johansen Cointegration Rank Trace test

Table 6 below indicates that there are three cointegrating vectors since their statistical value is higher than the trace's critical value. Therefore, the result reveals there is a long-term association, and the vector error correction model can be continued.

Table 6: shows Johansen Cointegration Rank Trace test

Hypothesized No. of CE(s)	0.05 critical value	Trace statistic	Prob **
None	95.7536	194.9203	0.0000
At most 1*	69.818	117.6233	0.0000
At most 2*	047.85	62.526	0.0012
At most 3	29.797	17.38	0.6369
At most 4	15.49	7.27	0.5460
At most 5	3.841	0.045	0.8309

### Johansen Cointegration Maximum Eigen Value test

Also, Table 7 below indicates that there are two cointegrating vectors since their statistical value is higher than the critical value in the Eigen test. Therefore, the results reveal a long-term association, and the vector error correction model can be continued.

Table 7: shows Johansen Cointegration Maximum Eigen Value test

Hypothesized No. of CE(s)	Max Eigen statistic	0.05 critical value	Prob **
None	77.297	40.077	0.0000
At most 1*	55.097	33.876	0.0000
At most 2*	45.483	27.584	0.0001
At most 3	9.7688	21.131	0.7660
At most 4	7.2282	14.264	0.4625
At most 5	0.0455	3.8414	0.8309

### Vector Error Correction Model

VECM is an equation model that can be used to create the model once the classical assumptions have been tested and met, such as nonstationary series that are cointegrated. Therefore, using the limited VECM model was necessary. The following are the outcomes of the VECM model: **Short-run effect result**

Table 8 below reveals that, given that the t-statistic is 2.427, which is greater than 1.96, the coefficient of error correction term lagged (ECTt-1 = -0.6456) is negative and statistically significant at the 5% significance level. This showed that the variables were convergent towards the long-run equilibrium at a rate of 64.56 percent, as well as indicating the validity of the model specification. Additionally, the result reveals that only the exchange rate has a positive effect on the trade balance at 5% in the short run since the t statistic was 2.5664, which is greater than 1.96. Since their coefficient value was 0.0041, meaning that when the exchange

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rate in the previous year increased by one unit, the current value of the trade balance would increase by 0.41% in the short period. This study was also observed by Adi Cristanto and Ari Bowo (2021), who found that the exchange rate significantly and favorably affects trade balance. However, money supply, foreign direct investment, carbon dioxide emissions, and government spending do not have a significant effect on the trade balance at 5% in the short run since their t statistic is less than 1.96.

**Table 8: summarize short run result, dependent variable is balance of trade**

	Coefficient	St. Error	t-statistics
ECT (-1)	-0.6456	0.266	-2.427
D (MS (-1))	0.3206	0.189	-1.689
D (FDI (-1))	1.7882	1.572	1.137
D (Ex_RATE(-1))	0.0041	0.0016	2.566
D(Gov_Exp(-1))	-0.5192	0.3450	-1.504
D(CO <sub>2</sub> _Emission(-1))	2.52e-05	8.3e-05	0.3044
CONSTANT	-2.450	2.182	-1.122

### Long-run effects result

According to Table 9 below, the following are the results of the long run:

#### The effect of foreign direct investment on trade balances

According to the ECM estimates, foreign direct investment has a long-term, significant impact on Indonesia's trade balance at the 5% level, since the t statistic is 4.764, which is higher than 1.96. The foreign direct investment coefficient is 0.3722, meaning that when there is a one percent increase in foreign direct investment in the previous year, the current value of the trade balance will increase by 37.22%. As a result, the money supply is a crucial factor in Indonesia's trade balance. The results are similar to those of a study by Adi Cristanto and Ari Bowo (2021), which found that foreign direct investment significantly and favorably affects trade balances. However, the study by Nga (2020) observed that foreign direct investment has a significant and negative effect on trade balances.

#### The effect of the exchange rate on trade balances

Given that the t statistic value is 3.346, which is greater than 1.96, the results also show that the exchange rate has a long-term, positive, and significant impact on the trade balance at the 5% level of significance. The result indicates that for every unit increase in the exchange rate in the previous year, the current value of the trade balance will increase by 0.187%, given that the exchange rate coefficient is 0.001879. This result is in line with that of Wahyudi & Sari (2020) and Falk (2008), who discovered that the exchange rate favorably affects the trade balance at a significance level of 5%.

#### The effect of government expenditures on trade balances

Moreover, the results suggest that government expenditure has a long-term, negative, and significant impact on Indonesia's trade balance at the 5% level, since the t statistic is 2.5139, which is higher than 1.96. The government expenditure coefficient is 0.532, meaning that when there is a one percent increase in government expenditure in the previous year, the current value of the trade balance will decrease by 53.2%. As a result, the money supply is a crucial factor in Indonesia's trade balance. The results are like those of a study conducted in Turkey by Tiganasu et al. (2022).

#### The effect of carbon dioxide emissions on trade balance

The findings demonstrate that carbon dioxide emissions have a negative and significant impact on the trade balance at the 5% level of significance in the long term since 3.206 is the t statistic value, which is more than 1.96. Given that the carbon dioxide emission coefficient is 6.47E05, the result suggests that the current value of the trade balance will decrease by 0.00647% for every unit increase in carbon dioxide emissions in the prior year. A similar result was observed by Chakraborty and Mukherjee (2013): there is a relationship between trade and environmental pollution in 114 nations from 2000 to 2011.

#### The effect of money supply on trade balances

The money supply has no discernible impact on trade balance over the long run at the 5% level of significance, according to the results, because the t statistic is less than 1.96, at 1.276. Nonetheless, the results corroborate the finding that, over time, the money supply has a positive and significant impact on the trade balance, in contrast to research by Kieu et al. (2020) and Tarawali et al. (2022).



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Table 9: summarize long run result, dependent variable is balance of trade

	Coefficient	St. Error	t-statistics
MS (-1))	0.2125	0.1664	1.2769
FDI (-1)	0.37229	0.7814	4.7644
Ex_RATE(-1)	0.001879	0.00056	3.3464
General_Gov	-0.5321	0.21169	-2.5139
CO <sub>2</sub> _Emmision	-6.47 e-05	2.0e-05	-3.2068
CONSTANT	1.3510		

### 5. CONCLUSIONS AND RECOMMENDATIONS

To investigate the determinants of Indonesia's trade balance, this research developed the vector error correction model. According to the short-term estimation result, only the money supply significantly improves trade balances at a rate of 5%, making them crucial variables to consider. However, foreign direct investment, exchange rate, carbon dioxide emissions, and government expenditure have no discernible impact on the trade balance, so in the short run, they do not play a big role. Furthermore, the long-term estimation output indicates that, at 5%, the foreign direct investment and exchange rate have a substantial positive impact on the trade balance, while carbon dioxide emissions and government expenditure negatively impact the trade balance. The result also suggests that the money supply has an insignificant effect on the trade balance.

Considering the study findings, the research study recommends the following for policy implications:

- i The study indicates that carbon dioxide emissions negatively impact trade balance. The researcher recommends that the government put into practice laws that encourage sustainable growth and lower carbon emissions, such as encouraging the use of energy efficient practices, supporting the deployment of renewable energy sources, and providing incentives for businesses to lessen their carbon footprint. In the long run, this can improve the trade balance and lessen the damaging effects of carbon emissions on the environment.
- ii Having identified the long-term negative effect of government expenditure on trade balances, the government should make sure that public funds are used wisely and effectively to assist projects that promote sustainable development. Also, to maximize resource allocation, put policies in place to analyze and monitor how government spending affects the trade balance.
- iii Moreover, the study shows that foreign direct investment has a positive effect on trade balance, so the government should advocate for measures that will bring in FDI to Indonesia. This can be accomplished by taking steps like providing tax breaks, facilitating corporate transactions more easily, and strengthening investor protection. FDI inflows have the potential to improve the trade balance overall, boost exports, and generate job opportunities.
- iv With the result indicating a positive effect of the exchange rate on trade balances, the government should keep the exchange rate regime steady, such as by executing strategies designed to preserve the stability of exchange rates. A steady exchange rate can boost confidence among importers and exporters and provide international commercial transactions with certainty. The government may also take steps, including keeping a sizable foreign exchange reserve, enacting cautious monetary policies, and applying exchange rate management techniques that strike a compromise between stability and competitiveness.
- v Additionally, if the money supply in the short run seems to have a positive effect on trade, then the government is advised to handle the money supply with caution since an overabundance of money can cause a currency's value to decline and make exports less competitive. To preserve price stability, the government should use efficient monetary policies, such as keeping an eye on inflation rates, exercising careful budget management, and enacting suitable interest rate policies.

#### Limitations of the study

There is a need for similar research conducted in diverse contexts because the findings of this study may not be directly transferable to other nations due to its focus on Indonesia. Also, not all macroeconomic factors influencing trade balances were considered in this analysis. By acknowledging these limitations, future researchers will be better able to determine the areas that warrant improvement or expansion of the current study as well as the scope for additional research.

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