# Determinants of Trade Balance in Peru: An Empirical Analysis Using Multiple Linear Regression

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**ABSTRACT**

This study presents a summary overview of the trade balance and its determinants in Peru. To better understand the case, previous studies, and other bibliographic sources were used. To examine the effect of the Real Effective Exchange Rate (REER), net Foreign Direct Investment (FDI), real Gross Domestic Product (GDP), domestic income, and inflation on the behavior of the trade balance of the country, the Multiple Linear Regression model (MLR) was utilized. The data was obtained from the following databases: Worldbank, and Federal Reserve Bank of St. Louis (FRED). The main conclusion is that REER, domestic income, and inflation negatively influence the trade balance. Inflation is proven to have little impact on the trade balance. The recommendations of the paper are to stabilize REER and imply export-boosting policies.

## 1. Introduction

Trade balance determines the external competitiveness of the country and international commerce is very important for the country's economic well-being and development. Hence, volatility in international trade is highly problematic for countries with trade deficits, particularly for developing ones.

Peru is the 3rd largest country in the continent with a population of nearly 34 million people. Consumer items, food, industrial machinery, transportation technology, and spare parts have made up the majority of imports in Peru (Britannica, 2023). Significant exports have included agricultural products like sugar, cotton, and coffee as well as raw materials like ores such as copper, gold, lead, zinc, and silver (Burr et al., 2023). Peru's 2 biggest trading partners are the U.S. and China (Britannica, 2023).

The country, in recent years, is facing difficulties in boosting the economy via the development of non-traditional export industries and the production of consumption goods to satisfy domestic demands. Moreover, periodical landslides, El Nino rains, earthquakes, and other natural catastrophes cause significant damage to transportation and agriculture. As a result, there are not enough agricultural resources to supply the fast-growing population. Hence, it is causing continual rises in food imports. The government nationalized many big industries in 1960-1970 to address these issues. Nonetheless, other economic issues, such as high inflation and a trade deficit, appeared due to nationalization (Britannica, 2023).

The trade balance of the country has always been facing fluctuations since 2001. For instance, between 2001 and 2003 there was a trade deficit. Then, up to 2012, Peru witnessed a trade surplus every year. However, from 2013

to 2016, the value of exports was less than imports. Particularly, the trade deficit reached its maximum of nearly $5 billion in 2015 (Worldbank, 2022) (See appendix A).

Thus, by analyzing the factors that affect the trade balance, this paper can contribute to the development of policies that would reduce Peru's trade deficit.

The purpose of this paper is to briefly examine the variables influencing Peru's trade balance.

The rest of the paper is structured as follows: section 2 highlights the appropriate empirical literature, section 3 describes the data sources used and the model of data analysis, section 4 presents the discussion and interpretation of empirical results, section 5 makes brief conclusions, gives some policy recommendations and identify opportunities for further study.

## 2. Literature Review

This section provided a thorough literature review of the trade balance and its determinants. In the literature, there is no agreement on any particular determinants and their impacts on the trade balance. For example, the exchange rate is described as a minor factor in the trade balance by Rose and Yellen (1989), Rose (1990), and Rose (1991). The real exchange rate, however, is found to be an important factor in the trade balance by Singh (2002) and Onafowora (2003).

The study conducted by Magee in 1973 employed a graphical and intuitive method to evaluate the impacts of inflation of the U. S. dollar on the trade balance of this country. According to his theory, the dollar devaluation that took place in 1971 was the reason for the U.S. trade balance fall. However, it is stated that this analysis was short-term in nature (Magee, 1973). As well as this, Krugman and Baldwin (1987), after evaluating several reduced form equations, came to the conclusion that the lagged effects of a strong dollar and the United States' faster rate of demand growth compared with other nations accounted for most of the trade deficit of the U.S.

Aziz (2012) also conducted research aiming to determine the impact of a real effective exchange rate on Bangladesh's trade balance. Annual data from 1976 to 2009 was used for

that research. Different methods were tested, and the overall conclusion was that currency depreciation appears to be a successful strategy to increase the competitiveness of Bangladeshi goods throughout the world which leads to an increase in exports (Aziz, 2012).

Farfan and a group of researchers (2021) also studied the economic variables that may have an impact on the Peru-Chile trade balance. They estimated the probable effect of both countries' GDP, Real Effective Exchange Rates (REER), and trade agreements between countries. The time period for this study was chosen between 1992 - 2015. The researchers concluded that the bilateral real effective exchange rate is the most influential factor among chosen variables in that research. According to the results, a 1% increase in REER will cause a 10.02% reduction in the trade balance. As well as this, other variables like GDP and trade agreements have also been proven to have an impact on Peru's trade balance (Farfan et al., 2021).

The research carried out by Ari and Cergibozan(2017) examined Turkey's trade balance using the vector error correction model, impulse-response analysis, and Johansen cointegration test for the period from 1987 and 2015. According to their calculations, in the long run, a rise in the REER enhances the trade balance. Increases in domestic income improve the trade balance, however, increases in foreign income have a negative impact on it. Furthermore, in the short run, REER has no significant influence on Turkey's trade balance, although rises in both domestic and foreign income deteriorate it (Ari and Cergibozan, 2017).

To understand the root causes of the trade deficit that took place in Ethiopia in the period of the last 50 years, Ambe (2019) conducted research on the trade balance, its structure, value, volumes, and determinants affecting it and the direction of the country's export and import. The co-integration methods, unit root test, error correction model, and Engel-Granger test were used in this research. The results of this study show that, in the long run, the trade balance is negatively influenced by the foreign exchange rate. The relationship between REER and trade balance is positive in the long run,

however, the real gross domestic product turns out not to be important. The analysis of the short-term factors of the behavior of Ethiopia's trade balance shows that REER has a negative impact on the trade balance while real GDP, available foreign exchange, trade liberalization, and lag trade balance are not significant (Ambe, 2019).

Tarawalie and Kpana(2022) tested the impact of monetary policy and fluctuations in the exchange rate on the trade balance of Sierra Leone. Annual time series data with the period 1980-2020 was used. The method of autoregressive distributed lag(ARDL) bound testing framework based on OLS was utilized. According to the long-term findings, the primary drivers of the trade balance in Sierra Leone are REER, money supply, and real GDP. It is stated that the effect of REER and money supply is negative, however, real GDP has a positive impact on the trade balance. On the other hand, in the short run, the main determinants of Sierra Leone's trade balance are government expenditure, real GDP, and FDI (Foreign Direct Investment) (Tarawalie and Kpana, 2022).

Yemeni professor, Essa Alhanom (2016), studied factors of the behavior of Jordan's trade balance using a co-integration test within ARDL from 1970 through 2010. Oppositely to the studies of Tarawalie and Kpana (2022), Ambe (2019) and other researchers mentioned above, the results of the empirical analysis revealed that REER had little impact on Jordan's trade balance in either the long or short run. As well as this, foreign income is influential to the trade balance, while domestic income has no impact (Alhanom, 2016).

Duasa (2007) studied determinants of trade balance such as income, REER, and money supply in the short and long-run using the approach of ARDL and annual data between 1974 and 2003 in Malaysia. It is found that money supply and income are influential to the trade balance, but REER is not (Duasa, 2007).

Maende et al. (2018) researched macroeconomic factors affecting Kenya's trade balance during the period from 1963 to 2016. Vector Error Correction Model (VECM) was employed. It is found that the trade balance has a positive relationship with FDI and trade liberalization in the long run. Moreover, REER appears to be negatively linked with the trade balance (Maende et al., 2018).

In the research carried out by Ray (2012), the long and short-run determinants of the trade balance for the country of India were examined, using annual data in the period 1972-2011. VECM was utilized. According to the results, there is a negative relation between trade balance and REER and consumption (Ray, 2012).

The research, conducted by Lucy et al. (2015), studied the effect of REER on the trade balance of Ghana, using annual data from 1980-2013 and VECM. According to the results, the trade balance declines as a result of REER depreciation (Lucy et al., 2015). Eke et al. (2015) investigated the impact of the REER on Nigeria's trade balance from 1970 to 2012. The Johansson technique was used for the research. According to Eke et al. (2015), during that period, the trade balance was negatively influenced by the REER.

## 3. Methodology

To examine the determinants of trade balance, a Multiple Linear Regression (MLR) model was employed. MLR applies a straight line to calculate the link between several independent variables and a dependent variable. According to Molnar (2022), linearity is the main benefit of this model. It simplifies the process of estimation, consequently making the interpretation of results simple (Molnar, 2022). Therefore, its simplicity is the reason for choosing this model for the case. The conclusions are made on the base of the results of the regression analysis. Stata_15 software is used for the research. All results are explained in graphs and tables. The MLR model is used to examine the effect of REER, FDI, real GDP, adjusted net national(domestic) income, and inflation rate on the trade balance of Peru. Respectively, REER, FDI, real GDP, national income, and inflation rate are independent variables and trade balance is a dependent variable. The dependent variable is estimated as the difference between exports and imports of the country. The choice of the variables is explained by the fact that the effect of REER, FDI,

GDP, national income, and inflation on trade balance was studied by the majority of researchers. The model of the research takes the following form:

$$TB = \beta_0 + \beta_1 * REER + \beta_2 * FDI + \beta_3 * GDP + \beta_4 * INC + \beta_5 * INF + u$$

Where: TB = trade balance of Peru (current U.S.D., in billions),

REER = real effective exchange rate of Peru (%, 2020=100%),

FDI = net foreign direct investment of Peru (current U.S.D., in billions),

GDP = real GDP of Peru (current U.S.D., in billions),

INC= Adjusted net national income (current U.S.D, in billions),

INF= Inflation (%),

$\beta_0$ = intercept, constant number in the model, when independent variable is 0, value of the dependent variable

$\beta_1$ ; $\beta_2$ ; $\beta_3$ ; $\beta_4$ ; $\beta_5$= coefficient that demonstrates change of the TB, when the independent variable changes by 1 unit

$u$ = error term

Annual time-series data from 1994 to 2021 were employed in the study. The data for the research is gained from the following institutions: Federal Reserve Bank of St. Louis (FRED) and Worldbank.

## 4. Interpretation and discussion of the results

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| TB | 28 | 1.526 | 3.88 | -4.92 | 8.62 |
| REER | 28 | 94.798 | 4.634 | 86.108 | 101.391 |
| FDI | 28 | -4.333 | 2.968 | -11.87 | 0.9 |
| GDP | 28 | 124.717 | 69.289 | 44.88 | 228.32 |
| INC | 28 | 105.335 | 58.271 | 39.28 | 197.59 |
| INF | 28 | 4.518 | 4.646 | 0.2 | 23.7 |

The number of observations in the model is 28. According to the results of descriptive analysis above, the average value of Peru's trade balance is $1.526 billion. The standard deviation of TB is equal to $3.88 billion. The greatest trade deficit in the period was $4.92 billion and the greatest trade surplus was $8.62 billion. The mean of REER is 94.798% and the standard deviation is 4.634%. Its value ranges from 86.108% to 101.391%. FDI's mean is -$4.333 billion and the standard deviation is $2.968 billion, FDI's maximum is $0.9 billion and its minimum equals -$11.87 billion. GDP has a mean of 124.717 billion and a standard deviation of 69.289 billion. Its maximum and minimum are $44.88 billion and $228.32 billion, respectively. INC's mean is 105.335 billion and the standard deviation is 58.271 billion. Its maximum is $197.59 billion, and the minimum is $39.28 billion. INF has a mean of 4.518% and a standard deviation of 4.646%. Its value ranges from 0.2% to 23.7%.

| VARIABLES | TB |
|---|---|
| REER | -0.475*** |
| | (0.123) |
| FDI | 0.114 |
| | (0.239) |
| GDP | 0.482*** |
| | (0.140) |
| INC | -0.534*** |
| | (0.163) |
| INF | -0.0350 |
| | (0.121) |
| Constant | 43.27*** |
| | (10.96) |
| | |
| Observations | 28 |
| R-squared | 0.678 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

According to the results of multiple linear regression analysis, the equation of the model appears as follows:

$$TB = 43.27 - 0.475 * REER + 0.114 *$$
$$FDI + 0.482 * GDP - 0.534 * INC - 0.035 *$$
$$INF + u$$

It can be concluded that the variables REER, INC and INF have a negative impact on TB, while FDI, and GDP positively influence TB. Results show that a 1% increase in REER decreases TB by $0.475 billion. As for the FDI effect, an increase of $1 billion in FDI leads to a $0.114 billion increase in TB. A $1 billion increase in real GDP causes only a $0.482 billion increase in TB. A $1 billion increase in domestic income decreases TB by $0.534 billion. Moreover, inflation appears to have little impact on TB as a 1% increase in inflation causes Peru's TB to decrease by only $0.035 billion. The R-squared value is equal to 0.678, meaning that the regression analysis explains 67.8% of all variations of TB.

## 5. Conclusion

The focus of this paper is to examine the determinants of the trade balance in Peru. The regression analysis is used and REER, FDI, GDP, domestic income, and inflation are the main independent variables. The choice of variables can be justified by the fact that many studies in this field consider these variables as the main determinants of the trade balance. The study uses time-series data from 1994 to 2021. According to the results, REER, INC, and INF have a negative impact on the trade balance, while FDI with GDP positively influence it. It is also proven that inflation has little impact on trade balance compared to other variables.

The main policy recommendation of the paper is that the government of Peru should maintain stronger and stable exchange rates to increase the international competitiveness of Peru's economy which consequently generates the desired effect on the trade balance. Furthermore, export-boosting policies are recommended to implement to improve Peru's trade balance.

The study used the MLR model to examine the effect of 5 variables on the trade balance over 21 years. To fully interpret all the variations in the trade balance, it is recommended to use more complicated regression models, examine more variables, and cover longer periods.

## References

1. Alhanom, E. (2016). Determinants of Trade Balance in Jordan. *NG-Journal of Social Development*, 5 (2), 24–34. Available from https://doi.org/10.12816/0031165.
2. Ambe, M.E. (2019). Determinants of Trade Balance in Ethiopia. *Research Journal of Finance and Accounting*,10(3).Available from https://doi.org/10.7176/rjfa/10-3-06
3. Ari, A. and Cergibozan, R. (2017). Determinants Of The Trade Balance In The Turkish Economy. *KnE Social Sciences*, 1 (2), 160. Available from https://doi.org/10.18502/kss.v1i2.654 [Accessed 22 February 2023].
4. Aziz, N. (2012). Does real devaluation improve the balance of trade? Empirics of the Bangladesh economy. *The Journal of Developing Areas*, 46 (2), 19–41. Available from https://www.jstor.org/stable/pdf/2321 5361.pdf?refreqid=excelsior%3A37bbc bf3f31fb5db67af173629f4a55f&ab_seg ments=&origin=&initiator=.
5. Britannica. (2023). Peru - Resources and power | Britannica. *Encyclopædia Britannica*. Available from https://www.britannica.com/place/Per u/Resources-and-power
6. Burr, R., Kus, J. and Davies, T. (2023). Peru - Amazonia | Britannica. *Encyclopædia Britannica*. Available from https://www.britannica.com/place/Per u/Amazonia [Accessed 21 February 2023].
7. Duasa, J. (2007). Determinants of Malaysian Trade Balance: An ARDL Bound Testing Approach. *Global Economic Review*, 36 (1), 89–102. Available from https://doi.org/10.1080/12265080701 217405 [Accessed 2 August 2020].
8. Eke, I.C., Eke, F.A. and Obafemi, F.N. (2015). Exchange Rate Behavior and Trade Balances in Nigeria: An Empirical Investigation. *International Journal of*

*Humanities and Social Science*, 5 (1), 71–78.

9. Farfan et al. (2021). Determinants of the Trade Balance in The Case of Peru -Chile. *Turkish Journal of Computer and Mathematics Education*, 12 (13), 710–722.

10. Krugman, P.R. et al. (1987). The Persistence of the U.S. Trade Deficit. *Brookings Papers on Economic Activity*, 1987 (1), 1. Available from https://doi.org/10.2307/2534513 [Accessed 22 February 2023].

11. Lucy, A., Sunday, R.J. and Pacific, Y.K.T. (2015). Exchange Rate and Trade Balance in Ghana-Testing the Validity of the Marshall Lerner Condition. *International Journal of Development and Emerging Economics*, 3 (1), 35–52.

12. Maende, S., Mutana, J. and Munga, M. (2018). Analyzing High Interest Rate Spreads in Kenya: Panel Data Approach. *International Journal of Academic Research in Business and Social Sciences*, 8 (7). Available from https://doi.org/10.6007/ijarbss/v8-i7/4343 [Accessed 18 April 2020].

13. Magee, S.P. (1973). Currency Contracts, Pass-Through, and Devaluation. *Brookings Papers on Economic Activity*, 1973 (1), 303. Available from https://doi.org/10.2307/2534091 [Accessed 22 February 2023].

14. Molnar, C. (2022). 5.1 Linear Regression | Interpretable Machine Learning. *Github.io*. Available from https://christophm.github.io/interpretable-ml-book/limo.html [Accessed 25 February 2023].

15. Onafowora. (2003). Exchange rate and trade balance in East Asia: is there a J-Curve? *Economics Bulletin*, 5 (18), 1–13.

16. Ray, S. (2012). An Analysis of Determinants of Balance of Trade in India. *Research Journal of Finance and Accounting*, 3 (1), 271–275.

17. Rose. (1990). Exchange rates and the trade balance - Some evidence from developing countries. *Economics Letters*, 34 (1), 271–275.

18. Rose. (1991). The role of exchange rate in a popular model of international trade: Does the Marshall_Lerner condition hold? *Journal of International Economics*, 30 (1), 301–316.

19. Rose and Kellen.(1989).Is there a J-curve?*Journal of Monetary Economics*, 24(1), 53–68.

20. Singh, T. (2002). India's trade balance: the role of income and exchange rates. *Journal of Policy Modeling*, 24 (5), 437–452. Available from https://doi.org/10.1016/s0161-8938(02)00124-2 [Accessed 22 February 2023].

21. Tarawalie, A.B. and Kpana, K.A. (2022). Monetary Policy, Exchange Rate Fluctuations and Trade Balance: The Sierra Leone Experience. *Modern Economy*, 13 (03), 425–441. Available from https://doi.org/10.4236/me.2022.133023

22. Worldbank. (2022). Imports of goods and services (current US$) - Peru | Data. *Worldbank.org*. Available from https://data.worldbank.org/indicator/NE.IMP.GNFS.CD?end=2021&locations=PE&start=2001 [Accessed 26 February 2023].