AN EVALUATION OF UNITED STATES' TRADE BALANCE WITH SELECTED TWO COUNTRIES INCLUDING A DEMOGRAPHIC VARIABLE

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Abstract

The purpose of research study is to estimate the determinants of USA's trade balance with Australia and Germany including a demographic variable and testing the relationships in the long run. Engle – Granger test showed a weaker relationship between Australia's import share and GDP ratio. Also, showed a positive long run relationship between net exports (NE) and exchange rate (ER). USA and Australia regression showed that the most important determinant of net export is the GDP ratio, followed by the price deflator ratio, money supply ratio, lending rate ratio and the real exchange rate, which explains 89.7% of the variation in net exports. USA and Germany regression showed that the most important determinant of net export is the real exchange rate, followed by GDP ratio and youth dependency ratio which explains 76.9% of the variation in net exports. We run F – Test, that net exports depend on rising and falling exchange rate regimes for both pairs. Results based on the error correction model (ECM) suggests that there exists a positive long-run relationship between expected exchange rate (ER) and USA's net export (NE) at 5% level of significance, for both pair of countries.

Keywords: Demographic, Determinant, Trade balance.

1. Introduction

This study looks into the determinants of the United States of America's trade balance with Australia and Germany. Shedding some light on the determinants and the level of influence they have on the USA's trade balance is essential as it helps these countries develop a better relationship in terms of their international trade and financial affairs. Accordingly, the economic effects of the USA's trade deficit have been a topic of long-standing congressional interest of the USA and the rest of the world because the USA's economic policies have an impact on all other countries to the extent of small or big.

Understanding the determinants and their level of influence on the US trade balance is essential, as it helps policymakers develop better relationships in terms of international trade and financial affairs. This study examines the determinants of the United States' trade balance with Australia and Germany.

Over a certain time, the monetary value of a nation's exports minus imports is called the trade balance. If a nation's export value is greater than its import value, it is called a trade surplus, positive, or favourable balance. Conversely, if a nation's import value is greater than its export value, it is called a trade deficit, negative, or unfavorable balance. Political and economic factors, such as gross domestic product rate, nominal exchange rate, money supply, lending rate, real exchange rate, price deflator ratio, and youth dependency ratio, affect the growth of international trade (Factors Influencing International Trade, 2021).

The United States of America gains in many ways from its trade relationship with Australia, such as by expanding the production of its powerful competitive industries and products and shifting production to attractive areas. Australia's economy helps to increase the productivity of the average United States employee, and the income that the US earns from its ability to serve a well-developed global market encourages investment in Australia's expanding export sectors. This expansion of scale helps to reduce the mean of production costs, which in turn helps to boost the US economic growth rate.

The United States and Australia are highly developed mixed economies. They have benefited from a long period of cooperation between their governments and people. The relationship between the two countries is dynamic, not static. The United States is the world's leading global trader and owns the largest national economy. The trade balance of Australia with the USA in 2019 was $8.0 billion in favour of Australia.

Germany has run a trade surplus due to stronger exports of vehicles and other machinery since 1952. In 2019, Germany's trade surplus amounted to 209.21 billion U.S. dollars, making it the world's largest exporter after China and the United States. In that same year, the United States exported 96.7 billion U.S.

dollars' worth of goods and services to Germany and imported 162.9 billion U.S. dollars' worth of goods and services from Germany, according to the U.S. Department of State.

1.1. Research Problem and Justification

The research problem of the study was "What key factors affect the evaluation of the United States trade balance with Australia and Germany, including a demographic variable?

1.2. Research Objectives

As our objective was,

- To determine these factors that influence the trade balance between the USA /Australia and the USA /Germany.
- To analyze the symmetry of the effects of rising and falling US dollar rates with respect to the Australian dollar and Euro.
- To test the long and the short-run relationships among Australia's/Germany's import and Australia's /Germany's export shares.
- To analyze the long and short-run relationship between the exchange rate and the country's trade balance.

2. Literature Review

Kumar (2020) studied the results of India's trading on the growing economy of neighboring countries Sri Lanka, Bhutan, Bangladesh, and Nepal. The negative effects of imports and positive effects of exports were found in a pair of countries. This research study focuses on the importance of exports and positive economic performance.

Yugang He (2017) studied the trade balance between China and USA based on cointegration analysis. A cointegration test was used for the analysis. The outputs show that the number of exports, the nominal exchange rate and the USA's disposable income have a positive effect on the trade balance. Similarly, China's disposable income and imports have a negative effect on that. To maintain a better trade balance, China's government should open more domestic markets to the world.

Atif Ali Jaffri et al. (2016) studied the impact of demographic changes on inflation in Pakistan. The Autoregressive Distributed Lag (ARDL) model was used for this analysis. Population growth, middle age working population proportion, consumer price index, inflation, real GDP, and changes in terms of trade and money supply growth were used in this study. Results concluded that the population growth positively impacts inflation, and the middle-aged working population portion negatively impacts inflation. Also, negative

coefficients of the Error correction model (ECM) show a long run relationship analysis exists between variables.

Arize (2017) studied the USA's trade balance and real effective exchange rate relation. ARDL method was used for this analysis. This study investigated not only the long run relationship but also the short run dynamics between the USA's trade balance and the given real effective exchange rate.

3. Methodology

Our interest is in learning about the United States' trade balance with selected two countries, especially Australia and Germany, including a demographic variable. The researchers intend to estimate the factors affecting the United States' trade balance with two selected countries, Australia and Germany, and the long run relationship between the selected variables.

Further, non-stationary variables should not be used in regression models to avoid the problem of spurious regression. However, there is an exception to this rule. (Hill, Griffiths, and Lim, n.d.). fY_t and X_t are non-stationary I (1) variables, then we expect their difference, or any linear combination of them, sh as $e_t = Y_t - \beta_1 - \beta_2 X_t$ to be I (1) as well. Also, Y_t and X_t are said to be cointegrated. Cointegration implies that Y_t and X_t has similar stochastic trends. (Hill, Griffiths, and Lim, n.d.).

Further, all the variables are in first order, and I (1) mean nonstationary. The cointegration for all the non-stationary variables were tested and fitted the multiple linear regression model. Here the results are super consistent, but only a few variable results are included under the empirical analysis. When nonstationary variables are used in regression analysis, such regression is said to be spurious if the variables are not co-integrated. Then, it will be a false consistency.

Augmented Dickey–Fuller test (ADF) and Phillips – Perron tests (PP) were used to investigate especially the stationarity of the regression study variables. In all the cases, the result provided by Phillips – Perron (PP) tests is consistent compared to Augmented Dickey – Fuller (ADF) tests. All the variables are I (1), which means they are non-stationary. Since the variables are non-stationary, the cointegration test is run to identify the relationship. Also, cointegration tests showed the relationship between variables, then ran the multiple linear regression model to identify the determinants of the USA's trade balance. These results are called super consistent.

Cointegration methods are used to observe the short and the long run relationship between the United States trade balance with the selected two countries. Engle and Granger suggested the simple ordinary level least squares

(OLS) based estimation procedure and maximum likelihood methods advocated by Johansen have been used. Johansen's method integrates both the long and short run dynamic. The number of cointegrating vectors can be determined by Johansen's method. A cointegrating relationship amongst the I (1) series exists if the residual series is stationary.

The multiple linear models were used to determine the factors affecting the United States' trade balance compared to Australia and Germany. The following variables are used in the multiple linear regression model: GDP per capita (GR) ratio, nominal exchange rate (ER) ratio, youth dependency (DE) ratio, money supply (MR) ratio, lending rate (LR) ratio, real exchange rate (RER) ratio, and GDP price deflator (PR) ratio.

Error correction method (ECM) is applied to analyze multivariate time series data that is not stationary, but cointegration occurs between the variables used in the model. This method will also be used to see how much influence the independent variable has on the dependent variable in the long run. Error correction model allows for the existence of an underlying or fundamental link between variables (the long run relationship) as well as for short run adjustments.

4. Results and Discussion

4.1. Descriptive Statistics

Table 1: Summary Statistics on Variables for the Pair of USA and Australia.

Variables	Mean	S. D	C. V (%)
Per person real GDP Ratio (GR)	1.031172	0.291868	11.25
Nominal Exchange rate (ER)	1.324304	0.231657	17.49
Real Exchange rate (RER)	0.787184	0.144815	18.40
GDP Price Deflator ratio (PR)	1.324304	0.231657	17.49
Money Supply ratio (MR)	13.14542	7.180663	34.62
Lending rate ratio (LR)	0.813294	0.290770	25.75
USA net exports to Australia (NE)	10.51929	1.950362	18.54
Export share of Australia (ES)	0.567918	0.066483	11.71
Import share of Australia (IS)	0.666237	0.099671	14.96
Youth Dependency (DE)	1.004260	0.066118	6.58

Source: Output of Data Analysis

The Coefficient of variation (CV) selected values describe the real considerable volatility level of the regression variables considered in percentages. For the USA and Australia pair, the very low-level relevant variability of 6.58% is also depicted by the youth dependency ratio and determinants followed by the GDP ratio and export share of Australia. For the the USA and Germany pair, the low-level relevant variability of 5.28% is also depicted by the youth dependency ratio and determinants followed by the GDP price deflator ratio.

Table 2: Summary Statistics on Variables for the Pair of USA and Germany.

Variables	Mean	S. D	C. V (%)
Per person real GDP Ratio (GR)	1.261190	0.226050	17.92
Nominal Exchange rate (ER)	1.075316	0.145844	13.56
Real Exchange rate (RER)	0.875694	0.150930	17.24
GDP Price Deflator ratio (PR)	0.909772	0.073267	8.05
Money Supply ratio (MR)	5321561	2777186.	52.18
Lending rate ratio (LR)	0.033124	0.067426	203.56
USA net exports to Germany (NE)	1.463750	0.217931	14.89
Export share of Germany (ES)	0.322457	0.116404	36.10
Import share of Germany (IS)	0.299626	0.082823	27.64
Youth Dependency (DE)	1.407715	0.074334	5.28

S. D = Standard deviation
C. V = Coefficient of variation = (S. D / Mean) * 100
Source: Output of Data Analysis

4.2. Cointegration Test

Table 3: Engle – Granger Cointegration test for Australia's ES/IS shares and GR.

Cointegration Vector	ADF Test	MacKinnon Critical values at 1%	5%	10%	Cointegrated at 1%	5%	10%
. No trend							
GR, ES	-3.5461	-4.65	-3.93	-2.59	NO	NO	YES
ES, GR	-3.8271	-4.65	-3.93	-2.59	NO	NO	YES
GR, IS	-0.6454	-4.65	-3.93	-2.59	NO	NO	NO
IS, GR	-2.4311	-4.65	-3.93	-2.59	NO	NO	NO
. With Trend							
GR, ES, T	-3.5947	-5.11	-4.42	-3.18	NO	NO	YES

ES, GR, T	-3.7905	-5.11	-4.42	-3.18	NO	NO	YES
GR, IS, T	-4.7866	-5.11	-4.42	-3.18	NO	YES	YES
IS, GR, T	-3.6238	-5.11	-4.42	-3.18	NO	NO	YES

Source: Output of Data Analysis

It's shown in Table 3 that when the trend term is removed/excluded in the model, there isn't any strong cointegration. However, when the trend is included, there is a cointegration analysis between Australia's import value of the share (IS) and the output growth (GR), and Australia's export value of the share (ES) and the output growth (GR) at 10% level of significance.

Table 4: Engle – Granger Cointegration test for ER and Trade Balance (NE).

Cointegration Vector	ADF Test	MacKinnon Critical values at 1%	5%	10%	Cointegrated at 1%	5%	10%
. No trend							
LNNE, LNER	-0.9854	-4.65	-3.93	-2.59	NO	NO	NO
LNER, LNNE	-2.9944	-4.65	-3.93	-2.59	NO	YES	YES
NE, ER	-0.8433	-4.65	-3.93	-2.59	NO	NO	NO
ER, NE	-3.2117	-4.65	-3.93	-2.59	NO	YES	YES
. With Trend							
LNNE, LNER, T	-3.5794	-5.11	-4.42	-3.18	NO	NO	YES
LNER, LNNE, T	-2.9264	-5.11	-4.42	-3.18	NO	NO	NO
NE, ER, T	-3.2923	-5.11	-4.42	-3.18	NO	NO	YES
ER, NE, T	-3.0751	-5.11	-4.42	-3.18	NO	NO	NO

Correlation relationship between nominal exchange rate (LNER) (US/AUS) and USA's trade balance (NE) with ADF test statistic and MacKinnon critical values. When the trend is excluded, there is a correlation between the nominal exchange rate (LNER)/real exchange rate (LNRER) and the USA's net export (LNNE) at a 10% significance level.

Source: Output of Data Analysis

Table 5: Engle – Granger Cointegration Test for Germany's ES/IS Shares and Output Growth (GR).

Cointegration Vector	ADF Test	MacKinnon Critical values at 1%	5%	10%	Cointegrated at 1%	5%	10%
1. No trend							
GR, ES	-2.3470	-4.65	-3.93	-2.59	NO	NO	NO
ES, GR	-0.5437	-4.65	-3.93	-2.59	NO	NO	NO
GR, IS	-2.2258	-4.65	-3.93	-2.59	NO	NO	NO
IS, GR	-0.3108	-4.65	-3.93	-2.59	NO	NO	NO
2. With Trend							
GR, ES, T	-2.2959	-5.11	-4.42	-3.18	NO	NO	NO
ES, GR, T	-1.9983	-5.11	-4.42	-3.18	NO	NO	NO
GR, IS, T	-2.2037	-5.11	-4.42	-3.18	NO	NO	NO
IS, GR, T	-2.5235	-5.11	-4.42	-3.18	NO	NO	NO

Correlation relationship between Germany's import/export share (IS/ ES) and output growth (GR) with ADF test statistic and MacKinnon critical values. There is no strong correlation between Germany's import/export share (IS/ ES) and output growth (GR) when the trend is excluded and included.
Source: Output of Data Analysis.

Table 6: Engle–Granger Cointegration test for Germany's ER and Trade Balance (NE)

Cointegration Vector	ADF Test	MacKinnon Critical values at 1%	5%	10%	Cointegrated at 1%	5%	10%
1.No trend							
LNNE, LNER	-2.8454	-4.65	-3.93	-2.59	NO	NO	YES
LNER, LNNE	-4.2250	-4.65	-3.93	-2.59	NO	YES	YES
NE, ER	-2.5103	-4.65	-3.93	-2.59	NO	NO	NO
ER, NE	-4.6529	-4.65	-3.93	-2.59	YES	YES	YES
2.With Trend							
LNNE, LNER, T	-3.1082	-5.11	-4.42	-3.18	NO	NO	NO
LNER, LNNE, T	-4.1617	-5.11	-4.42	-3.18	NO	YES	YES
NE, ER, T	-3.8924	-5.11	-4.42	-3.18	NO	NO	YES
ER, NE, T	-4.5821	-5.11	-4.42	-3.18	NO	YES	YES

Correlation relationships between nominal exchange rate (LNER) (US/ EURO) and USA's trade balance (NE) with ADF test statistic and MacKinnon critical values. When the trend is excluded, there is a correlation analysis between the nominal exchange rate (LNER), the real exchange rate (LNRER) and the USA's net export (LNNE) at a 10% significance level.
Source: Output of Data Analysis

4.3. Multiple Linear Regression

$$lnNE = f\ (lnGR, lnER, lnMR, lnLR, lnDE, \varepsilon_t) \quad \text{---------- (1)}$$

The negative nominal exchange rate (ER) sign suggests that when other external factors are equal, the nominal exchange rate (ER) ratio rises by 1%, explaining that the US dollar rate weakens against the Australian dollar. As ER rises by 1%, the net exports (NE) ratio falls by 0.46% because even though the USA's exports increase, imports also increase by a bigger value than the exports, leading to a decline in net exports (NE).

$$lnNE = f\ (lnGR, lnRER, lnPR, lnMR, lnLR, lnDE, \varepsilon_t) \quad \text{---------- (2)}$$

Nominal exchange rate substitution is done to find out if the inflation differential or price deflator between two countries significantly explains the trade flow and if the real value of the exchange rate significantly explains trade flows, given that the value of the nominal exchange rate was floating during the selected survey period. The floating nominal rate makes the nation's monetary policy control inflation rather than serve the exchange rate.

This strong significance of the price deflator ratio implies that the researchers and the policymakers are interested in the USA's and Australia's trade issues together with other macroeconomic fundamentals to include the nation's trade balance among other countries throughout the time. Since Australia and the USA are known as low inflation countries, these dominance level of relative price index effects with the exchange rate considered is consistent over time. 1% rise in the price deflator ratio in a 0.91% fall in the United States of America's net exports to Australia. The price deflator ratio and real exchange rate were significant since the USA/Australia rate was a floating exchange rate.

As a result of the model (2) shown in Table 8, a 1% rise in the GDP ratio results in a 0.72% fall in the United States of America's net export to Australia. The USA's imports increased more relative to exports, the reducing the trade gap. Hence, a negative value of the GDP ratio (GR) seems reasonable. While other factors are equal, the negative sign of the money supply ratio (MR) shows that M_2 in the followed USA relative to Australia rises by 1% outputs in a 0.21% reduction in the USA's net export. Even though there is a rise in the USA's exports, the increase in the USA's imports exceeds the rise in the USA's exports.

This positive value lending rate ratio (LR) shows that the USA in relative to Australia, falls by 1%, outputs as a 0.13% reduction of America's net exports, because the USA's imports rise by a bigger amount than the USA's exports rise. These estimated trade patterns characterize the trade balance between the USA and Australia until this balanced trade is achieved.

$$lnNE = f\ (lnGR, lnRER, lnMR, lnLR, lnDE, \varepsilon_t)$$ ---------- (3)

The researchers present Model (3) to explore the significance level of the real value exchange rate if the price deflator ratio is excluded. The variable GDP ratio (LNGR) is significant at the 5% level. The real value of the exchange rate is insignificant, and the significance level of other regressors is also reduced sufficiently. The adjusted coefficient of determination reduces from 0.897 to 0.871.

$$lnNE = f\ (lnGR, lnRER, lnPR, lnMR, lnLR(-1), lnDE, \varepsilon_t)$$ ---------- (4)

The researchers present the result of the model (4): lending rate ratio exhibited more importance than the other variables. The lending rate ratio describes the interest rates in net exports determination. These lending rate ratios are important factors of relative level growth potential between these two countries monetary tensions may not be fully captured to influence trade flows.

$$lnNE = f\ (lnGR, lnER, lnMR, lnLR, lnDE, \varepsilon_t)$$ ---------- (5)

The negative youth dependency ratio (LNDE) sign suggests that when other external factors are equal, youth dependency increases by 1%, which explains that the USA's net exports weakened against the youth dependency ratio. GDP per capita (LNGR) and youth dependency (LNDE) have a negative relationship. Youth dependency is likely to reduce economic growth. As the youth dependency ratio (LNDE) rises by 1%, the USA's net export falls by 1.37% because higher youth dependency is referred to as higher investment, which is necessary to be made in childcare and schooling for higher improvements.

$$lnNE = f\ (lnGR, lnRER, lnPR, lnMR, lnLR, lnDE, \varepsilon_t)$$ ---------- (6)

When other external factors are equal, a real exchange rate (RER) increases by 1%, which explains that the USA's US dollar weakens relative to the German Euro. As RER rises by 1%, net export falls by 1.12%. Imports increase by a larger amount. As shown in Table 7. A 1% rise in GDP ratio output shows a 0.62% fall in the USA's net value export to Germany, USA's; USA's imports increase more than exports, reducing the trade gap. Hence, a negative GDP ratio (GR) seems reasonable.

4.4. F-Tests

These F–tests were used to test the significant and asymmetric parameter shifts in the given model with dummy and model with dummy interactions for the pair of USA and Australia vs USA and Germany because of the rising and falling the value of the exchange rate. That implies net export responds to falling and rising exchange rate regimes symmetrically.

4.5. Error Correction Model

Error correction model (ECM) is a part of Engle and Granger's two step procedure, short-run value and long run value adjustments. If all these variables are I (1) and the error, is I (0), it means cointegration or a long run relationship exists. The negative and significant sign of the error correction coefficient suggest the presence of a long run relationship. The Error correction statistical model (ECM) is run for both pairs, USA/ Australia and USA/Germany.

5. Conclusion

For the pair of USA and Australia, Eagle and Granger tests shows that Australia's import share (IS) and the output growth (GR) are cointegrated at a 10% significance level when the trend is included/excluded. When the trend is included, there is a cointegration between the nominal exchange rate (LNER)/ real exchange rate (LNRER) and the USA's trade balance (LNNE) at 10% significance level.

Regression based on Model (1), Gross domestic product (LNGR), money supply (LNMR), nominal rate (LNER), and lending rate (LNLR) are taken as ratios in descending order explain 88.9% of observed variation, and Model (2), GDP (LNGR), money supply ratio (LNMR), price deflator ratio (LNPR), real exchange rate (LNRER) and lending ratio (LNLR) in descending order explain 89.7% of the level of variations in the United States net value exports with Australia.

F test suggests that for both intercept and slope change, net exports respond to both regimes in a symmetric manner. There is no significant difference between the effects of falling and rising exchange rate regimes at a 10% significant level.

For the pair of USA and Australia, the error correction model shows the long run effect of exchange rate changes shown on the level of USA's net value exports (NE) is positive, USA dollar weakens relative to Australia, implying that the exchange rate (ER) expected to rise than expected net exports (NE) rises. The short run dynamics depict a positive relationship between USA's net value export (NE) and the exchange rate (ER).

Linear regression of USA and Germany obtained based on Model (5) given that GDP ratio (LNGR), money supply ratio (LNMR), nominal rate ratio (LNER),

lending rate ratio (LNLR), and youth dependency ratio (LNDE) explain 44.64% of the observed variation, which model is not significant at 5% level. Model (6) shows that the real exchange rate ratio, GDP ratio and youth dependency ratio explain 76.88% of the observed variation; the model is significant at a 5% level. The real exchange ratio, GDP ratio and youth dependency ratio have a negative relationship with net export.

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