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TRADE BALANCE AND UNEMPLOYMENT IN EURO REGION: A VECTOR ERROR CORRECTION MODEL APPROACH

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ABSTRACT

Discussing the various aspects of the growing unemployment rate, the debate of protectionism vs free trade, the rising call for "trade is bad", and "trade is eating jobs", we tried to finally establish a bivariate model linking trade balance and unemployment rate in the Euro Area by taking the quartile time-series data from 2008: Q1 – 2021: Q3. The paper studies the impact of the trade balance on the unemployment rate in the short as well as long-run using the VEC model. The estimation of Johansen's cointegration test resulted that the model is cointegrated in the long and with a 1 percent rise in the trade balance, the unemployment is reduced by 2.52 percent with the statistical significance of 1 percent. However, the Wald test rejected the presence of any short-run causality between the considered variables.

Keywords: Trade Balance, Unemployment, Euro Area, Cointegration, and VECM.

INTRODUCTION

Since its inception, international trade has faced so many critical calls where experts put forward numerous disadvantages such as unemployment, inequality, and poverty. At the time of the establishment of various economic incorporations such as the "North American Free Trade Agreement" (NAFTA), and the European Union, the debate on unemployment and trade gained a renewed momentum (Stepanok, 2016). Since the Euro Area is full of a heterogeneous population, geography, gross

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regional product, and employment levels, and therefore considering *Global Financial Crisis (GFC) 2008* several economists call it one of the causes of higher unemployment levels for regional labor markets of the Euro Area (Andersson et al., 2015). As estimated, 22 million more people were unemployed globally in October 2009 because of the GFC, which began in 2008 (Shaikh and Shaikh, 2021). The rise of unemployment in the Euro area is majorly connected with the 2008 global financial crises. It was estimated that the unemployment rate decreased from previous 9.7 percent to 7.5 percent in 2007 but after the 2008 crisis it began to rise and in 2017 it was over 11.6%. (Ghoshray et al., 2016).

At the same time the trade in that region also fell, moreover, the economic integration in the region also helped in transmitting shocks in euro area countries itself which has worsened the situation (Eaton, 2016).

However, there are limited empirical studies that oppose economic integration in the Euro Area and suggest protective measures to have better employment rates. Moreover, economists have generally given labor market inefficiency among the few reasons as the cause of rising unemployment in the EU or the Euro Area. According to (Heimberger, 2019) post-global financial crisis, unemployment remained high, however, with consistent welfare-economic policies, the region can see a significant improvement in the unemployment situations both at the national as well as Euro Area level. The policies he suggested were to have abundant public investments and to have an active labor market policy framework to reduce the rising unemployment levels. However, modern economists with substantial competence in their fields have differing opinions and take a different approach to many of these important topics (Shaikh, 2020).

This study is needed because as discussed above there is a debate going on in various Euro-Area countries including Germany and France in support of protectionism and against openness due to rising unemployment levels. Therefore, it became necessary to empirically study the effect of free trade perse trade balance which is the supreme indicator of international trade on the rate of unemployment in the Euro Area. Our paper discusses and analyzes the impact of Trade Balance on Unemployment in the Euro Area. Taking motivation from the statistically significant and rigorous work of (Alawin, 2013) where he found that the Trade Balance and Unemployment are negatively related and there exists bidirectional causality between the two in the case of

Jordan. Meaning trade balance has improved the employment levels in Jordan and vice-versa.

Thus, the study aims at empirically analyzing the impact of Trade Balance on unemployment post-2008 Global Financial Crisis forming a bivariate model relating the two variables and using vector error correction model as the econometric model for its effective capability to avoid biases and give estimates for both: the short-run and the long-run integration between the employed variables simultaneously.

LITERATURE REVIEW

Alawin, (2013) used the VEC model by taking the rate of unemployment and trade balance growth rate quartile time-series data from 2000: Q1- 2012: Q2 to estimate and analyze the long-run effect of the trade balance growth rate on the rate of unemployment. There is a bi-directional causality between trade balance and unemployment during short run but an association between the two in Jordan in long run is not found. Thus, if was concluded that unemployment is caused by the existence of deficit in the balance of trade and vice versa in short.

Loganathan et al, (2011) conducted an asymmetric empirical analysis to study the relationship amongst the balance of trade and the rate of unemployment for the Malaysian economy for a brief time-period of 30 years from 1980 to 2010. The Granger Causality test is used to determine the causality between the variables. An inverse or the negative relationship was discovered between the variables trade balance and unemployment rate, and positive trends in trade balance has significantly reduced the unemployment levels for the Malaysian economy.

Klein and Weirowski (2011) in a highly rigorous working paper scrutinizes in the context of Germany the effect of trade balance on the unemployment rates by taking the panel data from distinct states within Germany. Using simple OLS regression, the paper found the statistically significant negative association between the balance of trade and unemployment rates in the states of Germany.

Krugman (1981) used intra-industry trade and assumed homogeneous workers with a full level of employment and discovered that trade liberalization significantly impacted the workforce as a whole and concluded: “all workers win from trade liberalization”.

King and Stähler (2014) in their research paper developed a simple model that is directed towards achieving the general equilibrium between trade and unemployment. The model tries to predict how unemployment rates are affected by trade in a scenario where countries have different technology and endowments. It has been concluded that when the countries differed in endowments, the countries will experience lower rates of unemployment if the trade happens between and among the capital abundant counties and even lowered rates in the labor-abundant country. However, if the countries in consideration differ in the technological state, then when a trade occurs, the country which has relatively greater productivity for making the capital-intensive goods will experience a rise in unemployment levels.

Stepanok (2016) developed an asymmetric country model with economic growth as an endogenous- variable to examine the influence of trade liberalization on the unemployment rates, it considers innovation as one of the factors that affect the trade and thereby unemployment. In the long run, empirical estimates suggest that trade liberalization significantly affects the unemployment rate. The countries which have a larger level of Research & Development (R&D) have experienced lower rates of unemployment with trade liberalization. However, a different trend was seen in countries with lower R&D. The data suggests that unemployment levels increase with a parallel increase in trade liberalization.

Felbermayret al., (2011) investigates how trade and unemployment are related by taking the data of 20 OECD rich countries. The study was limited to panel and cross-sectional data only. Empirical regularity was established, and it was concluded that the trade openness does not ultimately result in a rise in structural unemployment. According to the benchmark specification, a 10%-point increase in overall trade openness would lead to a 0.75 percentage point decrease in aggregate unemployment.

In the work of Arouri (2007), unemployment in Jordan was examined and the possibility of foreign direct investment lifting the country up was studied. The empirical findings showed that foreign direct investment was not contributing to the Jordan's declining unemployment rate, in part because these investments were capital-intensive and heavily dependent on foreign labor.

Awad (2011) investigated the topic of unemployment in Jordan from 1977 to 2010. According to this estimate, Jordan would need to have real economic growth of 25%

for unemployment rates to revert to the country's average level (4%). The empirical findings supported the notion that unemployment and inflation have a strong positive relationship.

The association between trade liberalization and rate of unemployment across 19 countries was examined by (Papageorgiou et. al, 1990). According to their findings, trade liberalization did not in the short term raise the rate of unemployment. These findings were consistent with the (Krugman, 1981) and (Melitz, 2003), wherein, assuming homogeneity in working labor force and fuller level of employment, prominent models of intra-industry trade conclude that trade liberalization benefits all workers. Hence, it is true for even specific sectors like manufacturing and agriculture.

Studies carried out by (Moore & Ranjan, 2005) and (Davidson et. al, 1999) remarked that it is unclear how trade actually affects unemployment. (Dutt et al., 2009) presents a trade and search-induced model of unemployment. The study examines how trade affects unemployment. It assumes that trade emerges from (H-O) "*Heckscher-Ohlin and Ricardian comparative advantage"*. Vigorous evidence for the Ricardian prediction is presented. A negative correlation as established by Ricardian prediction between unemployment and trade openness is shown. It uses cross-country data. The time-period taken is 1990-2000. The variables used are trade policy, unemployment, and some controls are added including control for measurement error and endogeneity problems. For countries with ample capital, this effect is greater than the positive H-O effect of trade openness on the unemployment rate, which becomes negative for those with ample labor.

Additionally, the relation among the variables of trade, wage inequality, and unemployment in Norway was researched by (Bjrnstad & Skjerpen, 2006). The rising demand of skilled labor has displaced unskilled labor in developed countries, which is the motivation for this study.

For the 20 wealthy OECD countries, (Felbermayr et. al., 2011) examined the connection between trade and the unemployment rate. It demonstrates an empirical regularity that trade openness doesn't imply a rise in structural unemployment. This means it holds up well to distinct definitions of openness and unemployment rates. According to the yardstick specification, an increase of 10-percent point in overall

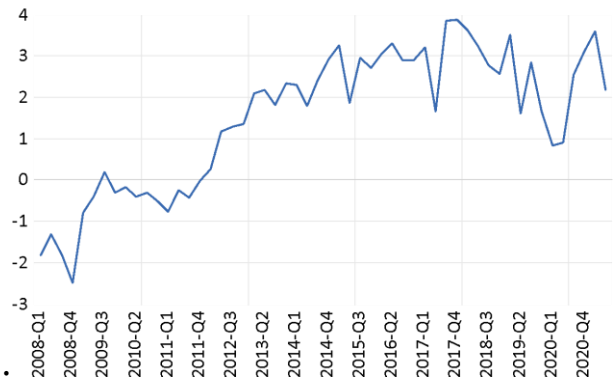
trade openness lowers aggregate level of unemployment by roughly 0.7 percent points.

(Ahmad & Nasser, 2022) examined the long-term association between the US current account balance to GDP ratio and the country's unemployment rate by taking the quarterly data of the time-period 1948: Q1 to 2020: Q1. Cointegration is undetectable by conventional cointegration assays. A threshold cointegration was found by the threshold cointegration test. The calculated threshold VEC model shows that the rate of unemployment is declining, and the current account balance is getting worse, which is statistically significant. This result implies that the current account balance deteriorates as unemployment rates decrease. It may be argued that imports grow faster than exports when the unemployment rate decreases, worsening the current account balance. Several other literatures relating trade and unemployment can be followed from the rigorous scientific works of (Rogoff, 2017), (Banerji et al., 2014), and (Zemanek et al., 2010).

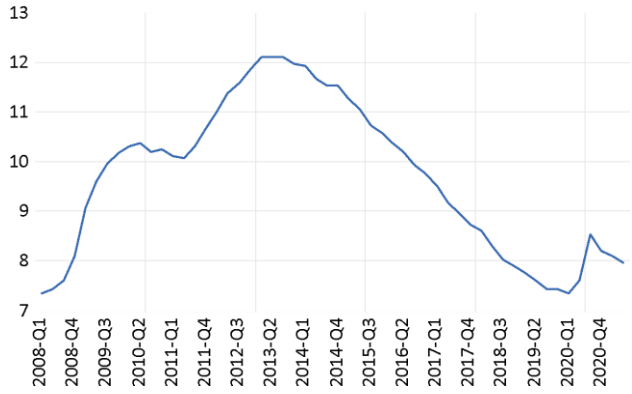
Graphical representation of Trade Balance and Unemployment in Euro Region

The Euro region is a highly integrated region in all spheres and more importantly in international trade. Therefore, it is important to investigate how its trade balance is behaving and how is it impacting its other economic indicators such as the unemployment level. The time-series graph of trade balance data as the percentage of GDP taken from (OECD, 2021) of Euro-region is shown below.

Unemployment rate time series data is taken from (OECD, Data, 2022) as our dependent variable certainly for the reason to estimate the impact of the trade balance on it. The time-series graph of unemployment of the euro-region is shown below.



Trade Balance



Unemployment Rate

Source: Author's Calculation

DATA AND METHODOLOGY

The quartile time series data for our variables Trade Balance data as a percent of GDP and Unemployment rate in Euro Region is taken from the OECD web database from the quartile 2008: Q1 till 2021: Q3. All the data is taken from a single source to maintain the reliability of the estimates. Moreover, the quartile data is chosen for it provided better estimates.

Following (Alawin, 2013) where he described the interdependence of unemployment and trade balance in the following manner.

Descriptively, it can be written as

$$U_t = f(TB_t) \quad (1)$$

which says that unemployment is a function of trade balance, where trade balance TB is our independent variable and unemployment is the dependent variable.

Moreover, to test the long run as well short association between out dependent and independent variable in the case of Euro-Region between the 2008Q1-2021Q3, we are using the VEC model followed by Wald Test to check short run causality and CUSUM stability test to check the problem of structural breaks in the model.

Following are the steps of the vector error correction model. Firstly, we conduct the ADF unit roots test given by Dickey and Fuller in 1979 to detect the problem of roots in the data and make sure that the data series is found to be stationary. The ADF unit roots test hypothesis:

$H0: \alpha = 0$ (There are unit roots in the data)

$H1: \alpha < 0$ (Alternatively, there are no unit roots, and the data is stationary)

Secondly, we find the number of optimal lags for estimating VECM is a prerequired condition is found by using the following formula,

$$AIC = n\log(s^{2)} + 2K \quad (2)$$

Where, n is size of sample, K is number of parameters, and s^2 is equal to RSS/n.

Thirdly, the cointegration test given by (Engle & Granger, 1987) determines whether a long-term relationship exists between the dependent and independent variable or not. Moreover, Johansen's cointegration test is estimated by following statistics.

(a) Trace Test

By measuring the linear combinations of the data, this test has following hypotheses.

$H_0 : K = K_0$ and $H_a : K > K_0$

The null hypothesis is rejected if $K = K_0$ and long run cointegration is confirmed between the variables at 5% significance level.

(b) Max Eigen Value Test

Using a non-zero vector on a linear transformation to make it scalar unit, this test thus has slightly different hypothesis setting.

$H_0: K = K_0$ and $H_a : K = K_0 + 1$

In the case of the rejection of H_0 we draw the conclusion that only one linear combination is possible.

And on rejection of H_a, we say that K linear combinations are possible between variables.

Finally, in case where a and b are found stationary at levels but non-stationary at first difference, and cointegration exists between them, the VECM can be constructed for the two variables as follows

$$\Delta Bt = \beta 0 + \sum^{n} i=1 \beta i \Delta Bt\text{-}i + \sum^{n} i_{=0} \delta_i \Delta At\text{-}1 + \varphi Z_{t-1} + \mu t \quad 3$$

Z indicates error correction term (ECT).

Moreover, the above equation is the representation of residual of OLS for the long run cointegrating equation. which is shown as

$$Bt = \beta_0 + \beta 1 A_t + e_t \quad 4$$

it can be defined as,

$$Z_{t-1} = ECT_{t-1} = B_{t-1} - \beta 0 - \beta_1 A_{t-1} \quad 5$$

The ECT manifests that the short-run fluctuations of the dependent variables are affected by the previous period deviating from the long-term equilibrium. The rate at which b adjusts itself to reach equilibrium after the change in *a* is measured by the coefficient of adjustment φ. In case of both *b* and *a* being stationary at I(1) i.e. at first difference and cointegrated in the long-run, the (VEC) model is established. The long-run coefficients of cointegrated equations are estimated via the VEC model.

EMPIRICAL ESTIMATES

The empirical estimates of our bivariate modeled VECM with data of unemployment rate as a dependent variable and trade balance as an independent variable from the time-period of 2008: Q1- 2021: Q3 are shown below.

ADF Unit Roots Test

To determine whether unit roots exist, we perform an ADF unit root test. The values pertaining to the t-statistics are as under. To start the VAR modeling, we must first investigate the data's stationarity. The result indicates that at level I (0) the series is not stationary.

Table 1. ADF unit root test estimates

	Level		**First Difference**	
Variables	**T-stat**	**Prob.**	**T-stat**	**Prob.**
UN	-1.47	0.53	-3.46	0.01*
Trade Balance	-1.87	0.34	-9.88	0.00*

In view of the above results, it's clear that the p-values are not significant, the null hypothesis here cannot be rejected. Hence, at level I(0) it is non-stationary. However, we find that both the series becomes stationary at first difference i.e., at I(1). The p-values of both unemployment rate and trade balance gives statistically significant estimates at 1 percent.

Lag Selection Criteria

A default number of lags are selected (h=2) and the lag selection is carried out by estimating the VAR on them. The lag selection is based on SC, AIC, and HQ. Statistically significant values are denoted by a * and therefore indicates reliable estimates. Here 2 is disclosed as an optimal lag in the criteria of lag selection.

Table 2. Lag Selection Criteria

Lag	LR	FPE	AIC	SC	HQ
0	NA	4.42	7.16	7.23	7.19
1	244.94	0.02	2.00	2.23	2.08
2	16.97*	0.02*	1.77*	2.16*	1.92*

Hence, the statistically significant number of lags for our VEC model is 2.

Cointegration Tests

After ADF unit roots test declares that unemployment rate and trade balance are differenced-stationary. The presence of long-run cointegration between the unemployment rate and trade balance of the Euro Area was examined using the Johansen cointegration test. The null hypothesis of this test argues that there is no long-term relationship between trade balance and unemployment rate in Euro Area. The findings of Johansen's test are as under.

Table 3. Johansen cointegration test estimates

Hypothesis	Trace Statistics	Max Eige-Value
None (R=0)	18.24 15.48 (0.01) *	17.50 14.25 **(**0.01) *
At most (R= 1)	0.73 3.83 **(**0.39)	0.73 3.83 **(**0.39)

A test of both the integrated series to check cointegration in the long run is required. It is because both the series are stationary at I(1) which implies that they are both integrated at I(1). We find that the p-values are less than 5 percent in the Trace and Max EigenValue Test. This infers that both the series are cointegrated ar I(1). However, error correction mechanisms should exist in such cases. (Shimul, Abdullah, & Siddiqua, 2009). We now turn to the VEC modeling at I(1) cointegrated series.

Normalized cointegrating coefficients

Trace and Max Eigen tests suggest one cointegrating equation. Hunter (2015) put forward the idea that the cointegrating vector can be set to zero for reformulating the long run cointegrating equation.

The equation in long run for the normalized relation of Trade Balance and Unemployment is given as

$$UN = -2.52GDP + 13.87 \quad (6)$$

The equation reflects that if there is a unit rise (1%) in trade balance the unemployment rate lowers by 2.52 percent in Euroregion.

Coefficients of Vector Error Correction Model

Now, using the framework for vector error correction, we estimate the long-term rate of adjustment by taking unemployment rate (UN) as the dependent variable. The bivariate VECM equation of our econometric model is shown below.

$$D(UN) = C(1)*(UN(-1) + 2.52*TB(-1) - 13.87) + C(2)*D(UN(-1)) + C(3)*D(TB(-1)) + C(4)*D(UN(-2)) + C(5)*D(TB(-2)) + C(6) \quad (7)$$

The short-run coefficients are C(2), C(3), C(4), C(5), and C(6), while the cointegrating coefficient is C(1)*. The equation above is used to obtain coefficients and their p-values.

Table 4. Coefficients of VEC model

	Coefficient	Std. Error	t-statistic	P-Value
C(1)	-0.0375	0.00	-3.76	0.00*
C(2)	0.2365	0.14	1.65	0.10
C(3)	0.0037	0.05	0.06	0.94
C(4)	0.1466	0.13	1.06	0.29
C(5)	-0.0508	0.04	-1.06	0.29
C(6)	0.0061	0.02	0.21	0.82

The table above shows that the error correction term coefficient (ECT = C(1) = -0.03) is negative and is between 0 and -1, which suggest that model will converge towards equilibrium in long-run if there are any external shocks in the trade balance or in the unemployment rate of the Euro Area. Therefore, in one quartile the model will converge 3.75% of its value towards equilibrium when there are any external

shocks. For the model to converge to equilibrium it will take more than 6.5 years to get back to equilibrium if there are any external shocks in our variables.

Wald Test

The null hypothesis in this test is that Trade Balance does not directly affect Unemployment in the Euro-Region, and it examines the short-run causality between the variables.

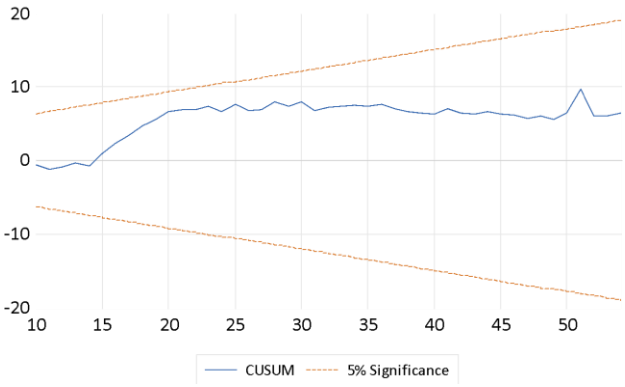
Table 5. Walt Test

T-Statistic	Value	df	P-value
F-statistic	0.93	(2,45)	0.40
Chi-Square	1.86	2	0.39

From the p-value of chi-square is more than 5 percent level so, we can conclude that the null hypothesis cannot be rejected. Therefore, the short run causality between Trade Balance and Unemployment rate in Euroregion does not exist.

CUSUM Stability Test

CUSUM test detects the problem of structural breaks in the model within the specified significance level of 5%.



From graph above we can see that the blue line lies between the red line of statistical significance of five percent, which suggests that the model does not have the structural breaks. Thus, we can conclude that our model is stable.

Concluding Remarks and Future Research

The primary objective of our study is to test the long- and short-term relationships between trade balance and unemployment rate in the Euro Region. The key claim

was that the trade balance and unemployment in the euro region do not cointegrate in the long-term. The estimated results confirmed that using the ADF unit roots test, we found series is differenced stationary, and using Johansen Test, we found series are cointegrated in long run. Also, the cointegrating equation suggests a statistically significant negative relationship between Trade Balance and Unemployment and concluded that a 1% rise in TB caused a 2.52% fall in unemployment quarterly in the Euro Area between the considered period. The coefficient of error correction term tells that the after any economic shocks in unemployment or in trade balance model is converging towards equilibrium at 3.75% rate quarterly and full equilibrium is attained in over six years. Moreover, the WALD test suggests that there do not exist short-run causality between Unemployment rate and Trade Balance. Furthermore, the CUSUM test suggested that the model is free from the presence of any structural breaks and thus the estimated model is statistically significant. Hence, we can say that there is no spurious estimation in the model, but future researchers can add some other variables which affect the unemployment rate such as the effectiveness of labor market policy, foreign direct investment, minimum wage, or can obtain the regional country-wise panel data of Euro Area and thus can conduct multivariate cointegrating analysis to make readers understand better, the fiasco of ongoing unemployment in Euro Area.

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