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EUROPEAN UNION AND THE UNITED STATES OF AMERICA: AN ECONOMETRIC INVESTIGATION ON THE PARADIGM SHIFT IN THE GDP'S GROWTH RATE TREND

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ABSTRACT

The recent war between Ukraine and Russia is yet another instance that emphasizes that economic overdependence may destroy the economic fabric of a nation. Taking this premise into consideration, this study aims to examine the long-term and short-term connection between the European Union and the United States GDP growth rates using tools like linear regression, Granger causality test, and impulse response function. Quarterly GDP figures of the European Union and the United States were taken for the period spanning 22 years, starting from quarter 2 of the financial year 1998-1999 to quarter 4 of the financial year 2018-2019. The Regression model and the Granger Causality test prove that the United States' GDP growth rate is influenced by that of the European Union in the short-run as well as in the long-run, but the EU's GDP is independent and does not follow the former. The possible explanation can be the trade surplus of the European Union over the United States in the recent past. Hence, the authors are of the opinion that a much more balanced trade between these two powerful economies would ensure the stabilization of the global trade and stability of the global power equation.

INTRODUCTION

The world has seen a lot of examples that have proven the fact that trade and economic growth dictate the hierarchy of power. Gone are the days, when military power alone could make a nation a global leader. Now, the globe is driven by the quantum of trade and export advantage. For instance, the Chinese hegemony in global affairs is because of her strong trade policies and her having 15% of the overall global trade pie (China: The Rise of a Trade Titan | UNCTAD, n.d.). Likewise, with a nominal GDP of 22.89 trillion dollars, the United States of America's economy is the largest in the world and is a leader in terms of armed power as well as representations in important global bodies. The European Union on the other hand is a powerful block that was established in the year 1993 after signing the Maastricht treaty. The nominal GDP of the European Union is 15 trillion dollars and they constitute 15 percent of the global trade.

The archive collection of the European Union (Comission, 2008) that was released in 2008 quotes the following: The richness and diversity of American society owe a great deal of debt to the successive arrivals of immigrants from all over Europe over the past 500 years. This results in the degree to which Europeans and Americans share common values and maintain close cultural, economic, social, and political ties. Of course, this is reflected in the close transatlantic relationship. In addition, the USA has been a strong supporter of integration among European nations. The EU and the USA are major trading partners (taking goods and services together) and account for the world's largest trade relations: when combined, they make up about 40% of world trade. Transatlantic relations define the state of the global economy as the EU or USA and are a major trading and investment partner in almost every other country.

The above-given extract showcases the historical relationship between these power blocs. However, the latest economic figures (BEA, 2021) of the United States showcase a changing trend. For instance, the goods and services deficit

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of the United States in 2020 stood at $678.7 billion and was the highest since 2008. With 2.1 trillion dollars, her export figures were also in decline. Above all, the 2020 deficit with the European Union ($182.2 billion) was the highest on record and is the core reason behind the current research. This research is an attempt to understand the changing dynamics in GDP of the two of the most important and powerful blocs in the world; The United States of America and the European Union (hereafter called the US and EU respectively)

The Below Discussed Related Literature Throws Light on Similar Areas of Research

Bywalec (2020) aims to identify and evaluate trade exchange between the European Union and India, as well as provide an indicator of the process' primary factors. The findings suggest that trade between the EU and India is very crucial for India, as exports to the EU account for roughly 17-20% of overall Indian exports. Konovalova and Ushanov (2019) examines the trade and economic ties between the United States and the European Union. The purpose of this paper was to identify the key qualities and characteristics of this collaboration. The research led to the coining of the term "economic anamorphosis," whose concept is the critical dominance of the weight and share of a limited list of partners in a system of bilateral cooperation, when one of the partners is regional economic integration, and these determined limited lists of countries attract the largest share of trade, capital, human, and other flows. According to Cabedo (2017), the E.U. and the United States account for over 60% of global GDP, and the E.U.'s investment in the United States is more than 8 times that of China and India combined. While the United States invests more than three times as much in the European Union as it does in the rest of Asia. The article went on to say that the trade flow between the EU and the US accounts for one-third of all global trade. In their study, Hussain and Haque (2016) concluded that there is a link between foreign direct investments, trade, and Bangladesh's per capita GDP growth rate. The research was carried out using annual time series data from 1973 to 2014. The Vector Error Correction Model (VECM) research revealed that these variables have a long-term association. The researchers ran a few post-estimation diagnostic tests to see if the VECM model was valid, and discovered that the regression residuals had a normal distribution and no auto-correlation. The variables of trade and foreign investment had a considerable impact on the GDP per capita growth rate, according to the findings.

Golinelli and Parigi (2014) suggested a straightforward approach for examining monthly estimates of quarterly world GDP and trade short-run views. Through bridge models, it combines high-frequency data from emerging and advanced nations to explain quarterly national accounts variables. In their study, Abosedra et al. (2020) used a portfolio technique to look at GDP growth volatility spillovers across 120 countries from 1960 to 2017. A study was done to discover the sources of growth volatility dynamics in the world in terms of volatility proportions from and to others using a spillover index based on variance decompositions under a vector autoregressive framework. They discovered that high-income growth nations were net transmitters of growth volatility, while low-income growth countries were net recipients.

The literature relating to the GDP-based econometric study on EU and USA was not much to be seen which makes this study relatively unique. From the literature, it could be seen that most of the studies in the related area make use of tools like the Granger causality test and regression to find out the GDP-based relationship. This study has developed the following hypotheses using similar techniques:

H1a: EU's long-term quarterly GDP growth rates can be explained using US's quarterly GDP growth rates.
H1b: US's long-term quarterly GDP growth rates can be explained using EU's quarterly GDP growth rates.
H2a: EU's short-term quarterly GDP growth rates can be explained using US's quarterly GDP growth rates.
H2b: US's short-term quarterly GDP growth rates can be explained using EU's quarterly GDP growth rates.

METHODS

Data Description

The study is secondary in nature and the data used for the study was collected from the World Banks' official website. The quarterly GDP growth rate figures of the U.S. and E.U. for 20 years from 1998 June to 2019 June comprising 85 observations were used for the analysis.

Regression

The data fulfilled the criteria of stationarity, and hence the simple linear regression model has been used to estimate the effect of E.U's GDP growth rate on the U.S. The regression model was primarily used to explain the dependence of the U.S. Economy's GDP growth rate on E.U.

Granger Causality Test

Granger said in 1969 that a time series Yt produces another time series Xt, which can be anticipated knowing Yt's and Xt's prior values. The F-statistics aid in the interpretation of causality data. The Granger causality test utilised in this study is based on the VAR framework, and the methodologies used follow Granger (1969) and Engle and Granger's protocols (1987).

Impulse Response Function

In Econometric analysis, the impulse response is a crucial technique that uses Vector autoregressive models. This response allows you to trace the impact of a shock on the independent variable to the dependent variable, making it a useful tool for economic analysis. The Impulse Response Function (IRF) and Variance Decomposition are two prominent methods for depicting the dynamic behaviour of a VAR model and identifying the causes of variability. Pesaran and Shin (1998) proposed generalised impulse response functions, which were proven to be more effective. As a result, the generalised impulse response function is used to assess the dynamic behaviour of the variables in this study.

DISCUSSION

Stationarity Test

To check for the long-term relationship using the regression model, it is essential to ensure the stationarity of the data. The Augmented Dickey-Fuller Test (ADF) shows that both U.S. and EU GDP data points are stationary at level.

Table 1. Test for Stationarity
Null Hypothesis: EU_GDP has a unit root

Augmented Dickey-Fuller test statistic	t-Statistic:	Prob.*
Test critical values: 1% level: -3.510259	-4.013220	0.0022
5% level: -2.896346		
10% level: -2.585396		

Null Hypothesis: US_GDP has a unit root

Augmented Dickey-Fuller test statistic	t-Statistic:	Prob.*
Test critical values**: 1% level: -3.510259**	-6.260726	0.0022
5% level: -2.896346		
10% level: -2.585396		

Inference at I(0)
Source: Authors data, EViews output

Regression Model

Now that the essential condition of stationarity has been fulfilled, it is crucial to run the regression model to test for the long-term relationship between the variables. The regression model results show that the E.U's growth figures explain the U.S. GDP growth rate. The researcher could not build a regression model that explained the E.U.'s GDP growth rates using the US GDP figures.

$$\mathbf{Y\ US\_GDPt = a + bX\ EU\_GDPt + } \varepsilon_t \qquad (1)$$

Table 2. Test for Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EU	2.728743	0.370298	7.369045	0.0000
C	0.387076	0.084833	4.562828	0.0000

R-squared	0.395497	Mean dependent var	0.761961
Adjusted R-squared	0.388214	S.D. dependent var	0.800184
S.E. of regression	0.625878	Akaike info criterion	1.923927
Sum squared resid	32.51308	Schwarz criterion	1.981401
Log likelihood	-79.76690	Hannan-Quinn criter.	1.947045
F-statistic	54.30282	Durbin-Watson stat	1.864780
Prob(F-statistic)	0.000000		

Source: Authors data, EViews output

Residual Diagnostic Test

The Regression model cannot be considered successful without running the residual diagnostic tests. Hence, the Breusch-Godfrey Serial Correlation L.M. Test, Breusch-Pagan-Godfrey test for checking the heteroskedasticity, and the residual normality test was also run for checking the normality principle. The model has successfully met all of the above-given conditions.

Table 3. Serial Correlation Test and Heteroskedasticity Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
Particulars	F-statistic	Probability	
F-statistic	0.316873	Prob. F (2,81)	0.7293
Obs*R-squared	0.659879	Prob. Chi-Square (2)	0.7190
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	0.919345	Prob. F (1,83)	0.3404
Obs*R-squared	0.931184	Prob. Chi-Square (1)	0.3346
Scaled explained SS	0.902871	Prob. Chi-Square (1)	0.3420

Source: Authors data, EViews output

Normality Test

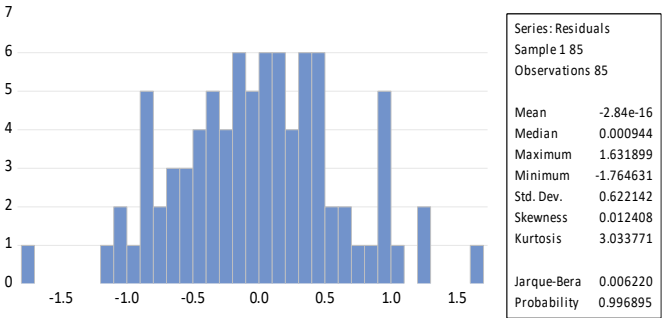

Figure 1. Normality test (residuals)

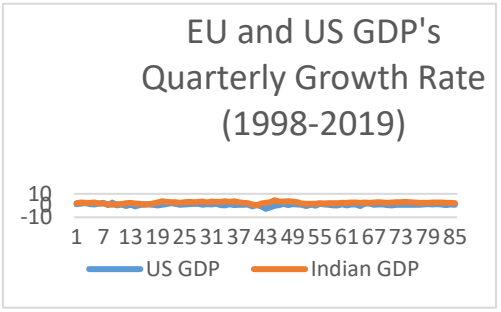

Figure 2. Line plots of variables studied over the period

The regression model has fulfilled all the necessary conditions like normality, stationarity, serial correlation, and homoskedasticity. The model states that 40% of the U.S. economy's growth can be explained using the GDP growth rates of E.U.

Since the late 1800s, the U.S. has been treated as a World Power, and the economic size stood at 21 trillion dollars (World Bank, 2022). These data emphasize her economic supremacy, but overdependence on a particular regional bloc alone for economic activities may threaten economic superiority in the long run. The study has duly explained that these two economies move in tandem in the long run. The primary reason for this could be the ever-growing trade relations. The U.S. government data states that the U.S. goods and services trade with the E.U. 27 totaled an estimated $1.1 trillion in 2019. The Exports accounted for $468 billion, and imports were a whopping $598 billion. U.S. goods imports from the E.U. 27 totaled $452.0 billion in 2019, up 6.0 percent ($25.8 billion) from 2018 and up 93 percent from 2009. U.S. imports from the E.U. 27 account for 18.1 percent of overall U.S. imports in 2019. The U.S. goods and services trade deficit with the E.U. 27 was $130 billion in 2019. U.S. Goods trade (exports plus imports) with the E.U. 27 was $720 billion in 2019. Goods exports were $268 billion; goods imports totaled $452 billion. The U.S. goods trade deficit with The E.U. 27 was $184 billion in 2019 (European Union, 2020). These figures substantiate the views given earlier that claimed the U.S.'s overdependence on a particular regional block. Trade relations can be a two-edged sword; overdependence on a specific block or nation may be undue leverage to other countries or trade blocs.

VAR Granger Causality Test

As the variables were found to have a long-term relationship, the VAR-based Granger Causality Test was run to understand the short-run relationships between the GDP growth rates. The variables were found stationary at the level. A bi-directional granger causality test was carried out using the Granger causality in a VAR environment.

$$\Delta \mathbf{US}\ \boldsymbol{GDPt} = \mu + \sum_{i=1}^{n} \boldsymbol{\alpha_i}\, \Delta \boldsymbol{US\ GDPt_{-1}} + \sum_{j=1}^{n} \boldsymbol{\beta_j}\, \Delta \boldsymbol{EUGDP_{j_{-1}}} + \boldsymbol{\varepsilon_t} \qquad (2)$$

Table 4. Granger Causality Test

VAR Granger Causality Block Exogeneity Wald Tests
Sample: 1998 Q2 -2019 Q2
Included observations: 84

Dependent Variable: US GDP			
Variable	Chi-square value	Degree of Freedom	Probability
EU_GDP	21.3667	1	0.0000
Dependent Variable: EU GDP			
US_GDP	0.6949	1	0.4045

Source: Authors data, EViews output

Table 5. VAR Granger Causality test (Sub-periods)

Dependent Variable	Sub-Period	Ch-sq	Probability
US GDP	1998, Q2 -2002, Q2	0.8400	0.6570
EU GDP	1998, Q2 -2002, Q2	0.4283	0.8072
US GDP	2002, Q3-2006, Q3	0.4596	0.4978
EU GDP	2002, Q3-2006, Q3	0.3229	0.5698
US GDP	2006, Q4 – 2010, Q4	26.0158	0.0000*
EU GDP	2006, Q4 – 2010, Q4	2.9547	0.3987
US GDP	2011, Q1 – 2015, Q1	0.6484	0.8853
EU GDP	2011, Q1 – 2015, Q1	4.4173	0.2198
US GDP	2015, Q2 – 2019, Q2	0.2665	0.6057
EU GDP	2015, Q2 – 2019, Q2	0.3811	0.5370

Source: Authors data, EViews output

The granger causality test had proved the short-run relationship between the above-stated variables when taken as a whole. However, the results turned out a bit different when the short-term split-ups of the periods were used for understanding the short-term relationships of GDP figures. The granger causality test was run for five different split-ups:- F.Y.1998-2002, F.Y.2002-2006, FY.2006-2010, F.Y.2011-2015, and F.Y.2015-2019 and proves that baring in the 2006-2010 sub-period wherein US GDP had depended on the E.U.'s GDP, the GDP growth rates do not explain each other.

Impulse Response Function

The impulse response function was done to determine the U. S's GDP growth response to a unit of risk or shock in E. U's GDP growth rate.

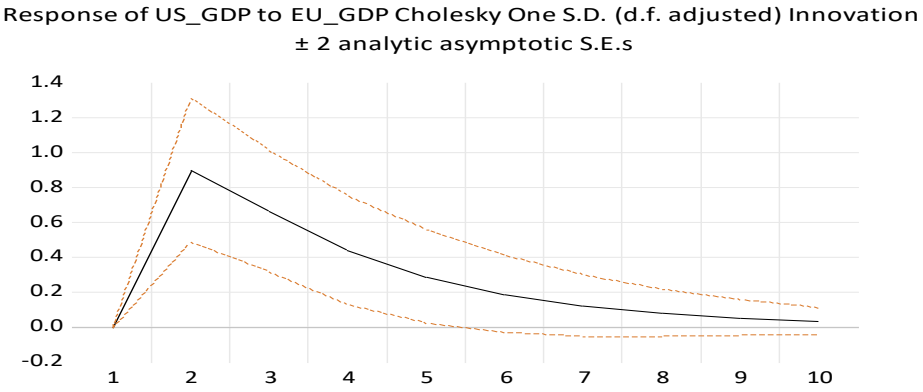

Figure 3. Impulse Response Graph

One standard deviation shock in E.U.'s GDP growth rate causes an increase in the GDP rates of the U.S. The growth peaks at period two (0.8) and then declines gradually becomes close to zero by the 9th period. Hence, the shock to E.U.'s GDP may positively impact the U.S.'s GDP growth rate in the Short-run and Long-run.

CONCLUSION AND FURTHER SCOPE OF THE STUDY

The research tries to talk about the interdependence of the two of the World's most significant trade blocs, the United States of America and the European Union. The study has pointed out that the E.U's GDP can explain the U.S. economy's GDP growth rates. The possible reason is the trade volume between these two trade blocs and the trade surplus position of the E.U. Regression analysis, the Granger Causality test, and the Impulse response function had duly substantiated the research with positive findings. As previously mentioned, Global trade can be a double-edged sword, and the U.S. is found dependent on a block like E.U. on trade Hence, it is advisable to either bring down the trade deficit or diversify the scope of trade by searching for other trade blocs so that the U.S. remains economically consistent and stable in the long run. Else, other economic giants like China may overtake the U.S. as an economic power that would change the World's power equation. The author feels that the World is not ready to accept this change. Further studies in this area should include more economic indicators like unemployment rates, central bank policy rates, and inflation and build an econometrics-based model that fully clarifies the interdependence aspect.

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