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Analyzing the impact of the economic crisis in Greece on the U.S.

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ABSTRACT: The aim of this study is to find the effect of Greece crisis on the exports of the U.S. Major variables like the exports of the U.S. to the European Union, the real exchange rates of dollar viz-a-viz Euro, the Index of Industrial Production of the Euro zone are used for analysis. The econometric methodology applied in this paper follows the methodology followed by Dua (2008). The methodology in terms of the model is similar to that used by Alam (2010); with the difference that whereas Alam analyses the effect of currency on exports, this analysis goes further by assessing the impact of not only the change in currency but also the effect of the economic activity in the Euro zone which would reflect the demand for the U.S. exports.

KEYWORDS: Economic crisis, public debt, budget deficit, trade and finance, financial flows, contagion effects, spillover effects

1. INTRODUCTION

The objective of the paper is to find the effects of the economic crisis in Greece on the economy of the United States of America via the trade channel.

Greece adopted Euro as its currency on January 1, 2001. In 2003 the economy was boosted by public savings and private spending. But its FDI did not meet the standards of the European Union (Akram et al, 2011). The European zone was experiencing growth up till 2007 but the investor confidence was shaken up after the 2009 sub-prime lending crisis in the U.S. The European Union accumulated fiscal as well as the current account deficit. In 2010, Greece started facing public debt problems followed by Portugal, Spain and Ireland. All this ultimately resulted in the European debt crisis (Dua and Tuteja, 2015). As the Greek Government was easily able to access capital after adopting Euro as the currency, it started issuing bonds in the international capital markets at very low interest rates . The investors perceived Euro as a strong currency and the government used the funds to finance its deficits. Gradually the budget deficit of Greece reached 12.7 % of the GDP in 2009 which was double of the previous level. Other factors which augmented the crisis were reckless spending by the Government and poor tax collection (Akram et al, 2011).

The crises in the developed countries have severe repercussions on the Emerging market economies. The two broad channels affected are trade and finance. The Emerging market economies experience fall in trade and fall in financial flows (Blanchard et al, 2010). Dua and Tuteja (2015) use Blanchard's theoretical model for their empirical study. The demand of goods from EMEs falls due to a crisis in the developed nations. Instead, it may also cause a reduction in the price of goods resulting in the TOT decline. On the financial channel there is a fall in the capital inflows. The amount of debt repayment also gets enhanced significantly due to depreciation of the exchange rate (Dua and Tuteja, 2015). This study would follow Dua and Tuteja's approach.

The impact of the Greece crisis on a developed nation like the U.S. should not be underestimated. Anaraki (2012) identifies five channels of transmission of the Euro crisis to the U.S. Firstly, the lower GDP growth in Europe along with a weaker Euro would reduce the demand of exports of the U.S. Secondly, EMEs would experience a rise in the capital flows instead of the U.S.

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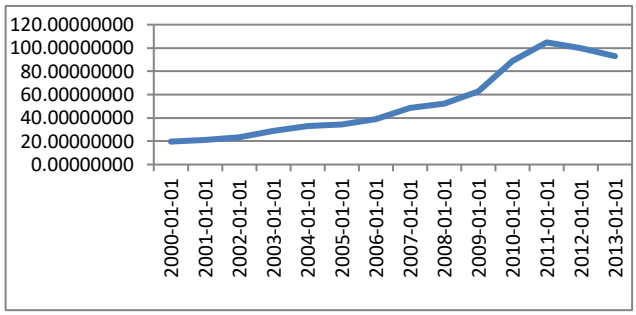
Thirdly, there would be a slump in the stock market indices of the U.S. Fourthly, the U.S. foreign owned assets abroad would be adversely affected. Lastly, the bank claims of the U.S. on European banks would be undermined. Reviewing

Lachman (2015) observes that the immediate effect of the Greece crisis may mean a depreciation of Euro. This means a corresponding appreciation of dollar. This could create hurdles in the recovery of the U.S. and could lead to a downward pressure on the inflation in the U.S. Also the crisis could spread to Italy, Spain and Portugal which would severely affect the investor confidence (Mittal, 2020a, 2020b).

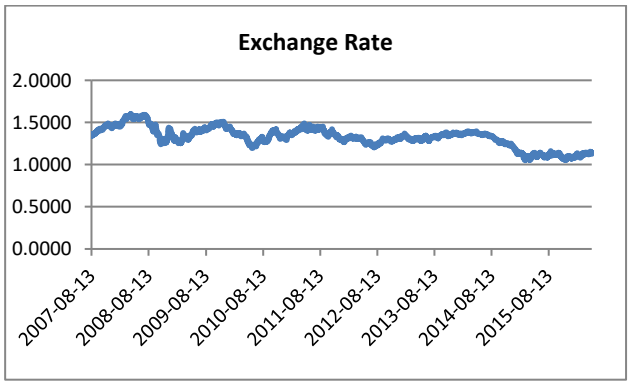
Nelson et al (2015) find that the diverging monetary policy between Japan and Europe (accommodative) and the U.S. (tightening) could lead to appreciation of dollar and further push down the falling interest rates in the U.S. The appreciation of dollar viz-a-viz yen and Euro could dampen the exports from the U.S. and boost the exports from Japan and Europe.

Outstanding Total International Debt Securities to GDP for Greece



Data source: World Bank. Units - percent.

The graph shows that there has been a constant rise in the international debt securities to GDP of Greece, reaching a moderately high level during the subprime lending crisis which adversely affected Greece and a peak level around 2012.



Data source: Federal Reserve economic data

The second graph shows the US/Euro foreign exchange rate that is, U.S. Dollar to one Euro. The overall trend is that the Euro is depreciating. The value of Euro in terms of U.S. dollar falls sharply around 2008 when the ripples of the sub-prime lending crisis on Europe were felt and the crisis became the European debt crisis. Then around 2013 a sharp decline is observed when the crisis totally absorbed Greece and Greece became a debtor.

REVIEW OF LITERATURE

Dua and Tuteja (2015) analyze the impact of the European Debt crisis on the EMEs like India and China by concentrating on the trade channel for the transmission of crisis. Through their empirical study they find that in the exports of India and China the share of E.U. and U.S. has been declining during the period 2007-2013. Also they found that the crisis led to a worsening of the current account deficit and falling reserves of India and China along with the depreciation of Rupee and deterioration of the terms of trade of India.

Tim Christensen (2012) finds that the crisis in the Euro zone led to a stronger dollar and a reduction in export growth. The trade deficit in 2012 rose to $52.7 billion and also witnessed a further fall because of the fall in the demand from the Euro zone.

Nelson et al (2015) evaluate the impact of the Greece crisis on the U.S. They find that the impact is uncertain because of two contrasting factors. The direct exposure of Greece to the U.S. is not that large because the Euro zone institutions own more than three-fourths of its debt and the banks which don't lie in Greece have cut their exposure by almost two-thirds. But on the other hand the crisis might affect the investor confidence and may affect the U.S.

Georgantopoulos and Tsamis (2011) investigate the causal link between the budget deficit and other variables like Consumer Price Index, Nominal Exchange rate and GDP for Greece via the VAR-VECM approach. They find causal links from budget deficit to GDP and NEER to Budget Deficit. They find no links between inflation and budget deficit of Greece. As the NEER has significant impact on the budget deficit of Greece, the government of Greece must monitor the effects of NEER on Greek budget deficit.

Huang (2013) points out that the cause of the European debt crisis was that countries used more than available resources for social programs etc. and all this resulted into a recession in Greece and Spain. Raising taxes or cutting spending may be a good short run approach but the best long run approach is the economic growth. Although cutting taxes may initiate long run growth but it leads to a worsening of the immediate problem.

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Borrowing from the U.S. or China is not a sustainable solution.

Dornbusch et al (2000) define contagion as the spread of the market disturbances from one nation to the other. This process is observed via co-movements in stock prices, exchange rates, capital spreads and sovereign spreads. Contagion can be divided into two categories. The first are the spillover effects which arise due to interdependence of economies (Mittal, 2019; Gupta et. al. 2021). Due to the financial and real linkages the shocks are transmitted from one country to another. The other is a financial crisis which is only related to the behavior of the investor and is not linked to macroeconomic changes.

Pericoli and Sbracia (2003) claim that contagion can be experienced if in one country the probability of crisis rises with the outbreak of crisis in another nation, the rise in volatility of asset prices is cross national, asset price co-movements are not driven fundamentally, conditional on the crisis in one nation the transmission mechanism in other countries change.

Missio and Watzka (2011) claim that although the Euro crisis had originated in Greece but it had soon spread to the other European nations as well. They use the dynamic conditional correlation models to analyze if there were contagious effects or there were country specific fundamental problems. They find that indeed there were contagion effects within the Euro Area. The rating downgrades in Greece had contagious effects on some of the European countries.

Arezki et al (2011) analyze the spillover effects of the downgrades of the sovereign rating on the European countries during 2007-10. They use the event study approach. They find evidence in favor of contagion effects. The spillover effects are dependent on the source country which has experienced the downgrade, on the rating announcement's type, the rating agency from where the announcement originates.

Adel and Salma (2012) analyse the contagious effects of the Greek crisis. They use GARCH modeling for marginal distribution and for joint distributions they use student t copula. They find empirical evidence in favor of market dependence in Europe but the dependence is weaker and significant for most stock markets after the crisis in Greece.

A study by USAID (2012) analyzes the effect of the crisis in Greece on Albania. The report mainly concerns the Albania migrants' return, the economic impact of the remittances, the trade balance and the FDI. They find that the return of Albania migrants would pose a pressure on the public services. If the Euro is abandoned by Greece and drachma (depreciated) is reintroduced then this could adversely affect the Albanian exports to Greece. If Greece plans to exit the Euro zone then this could initiate a bank panic as the Albanians may withdraw their assets which may have adverse repercussions for the Greek economy.

As there seems to be a dearth of studies which econometrically analyze the effect of Greece crisis on the economy of the United States, the present study aims to break some ice.

THEORETICAL MODEL

In the Gerlach and Smets model (1994) where in case of high amount of bilateral trade a financial crisis in one nation has negative impact on its trading partners because of two factors. One is because of the loss in competitiveness and the other is a decline in demand.

This paper is based on the theoretical model proposed by Gerlach and Smets (1994). They evaluate the turmoil in the European exchange market around 1992-93 where the speculative attack on the Finnish markka led to a speculative attack on Swedish krona. They present a model for the contagion analysis. They use the two country model of Flood and Garber (1984) and also include sticky wages like done in William (1988). The depreciation of one country has effects on the price and income of the other country through a loss in competitiveness. The model is as follows where except interest rate all the variables are in logarithms. The two countries are represented by F and S for Finland and Sweden, respectively. (Gerlach and Smets,1994)

The demand for money function is,

$$m_i - p_i = \phi\, y_i - \gamma r_i \quad , \text{i= F,S} \qquad (1)$$

where m is the money stock, P is the price level, r is the nominal rate of interest and y is the real income level.

Uncovered interest parity means,

$$r_i = \text{E}\, \dot{s}_i + \text{r}^* \qquad (2)$$

where r* is the nominal interest rate of the third country and s_i is the one unit price of the currency of country 3 in terms of the i^{th} country's currency.

The domestic price level is given by the following equation:

$$p_i = \alpha\, w_i + \epsilon\, (w_j + s_{i,j}) + (1-\alpha-\epsilon)\, (s_i + \text{p}^*) \qquad (3)$$

where w_i is the wage in a country , $s_{i,j} = s_i - s_j$, p* the rice level of third country and ϵ and α are the weights of the Swedish and the Finnish goods.

$$\dot{\text{w}} = c_i + \Psi\, (y_i - \bar{y}) \qquad (4)$$

Ψ is the adjustment speed of wages to excess demand.

$$\dot{c}_i = \delta\, (p_i - c_i\,) \qquad (5)$$

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δ is the sensitivity of the inflation of the core inflation to the actual level of inflation.

$$y_i = \beta\ (s_{i,j} - w_i + w_j) \qquad (6)$$

B is the degree of substitutability of the goods of the two countries.

The money supply is equal to

$$m_i = \eta\ D_i + (1-\eta)\ R_i \quad \text{(Log linear approximation)} \qquad (7)$$

Where D_i is domestic currency holdings, R_i is the foreign exchange reserves in terms of domestic currency, η is equilibrium fraction of the assets of the central bank which are held in the form of assets (domestic). The domestic credit growth is exogenous and is given by

$$\dot{D}_i = \mu_i \qquad (8)$$

Under the perfect foresight the following holds

$$E\ \dot{s}_i = \dot{s}_i,$$

Put $\bar{y} = i^* = p^* = 0$ and combine 1, 2 and 3.

$$m_i = \alpha\ w_i\ + \epsilon\ (w_j + s_j) + (1-\alpha)\ s_i + \phi\ y_i - \gamma \dot{s}_i \qquad (9)$$

Under fixed exchange rates,

$s_i = \bar{s}_i$ and $\dot{s}_i = 0$.

From 6, 7, 8 and 9 and solve R_i .

$$R_i\ (t) = \frac{(1-\alpha)\bar{s}_i - \eta\ D_{Oi}}{1-\eta} + \frac{\eta}{1-\eta}\ \mu_i t + \frac{\alpha}{1-\eta} w_i(t)\ + \frac{\epsilon}{1-\eta}$$
$$(w_j(t) - \bar{s}_j) + \frac{\phi}{1-\eta}\ y_i(t) \qquad (10)$$

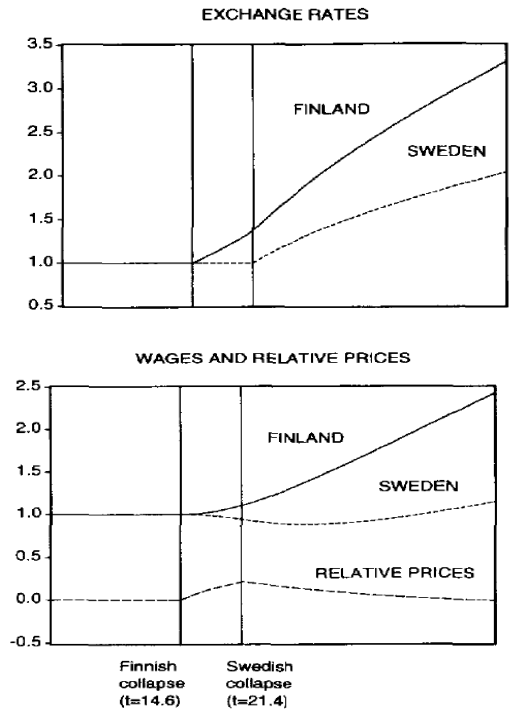
Source: Gerlach and Smets ,1994, pp. 6-9

As the central bank expands credit the reserve stock falls. For understanding the causes of contagion look at equation 10. The Swedish international reserves depend on the wages and output of Sweden and the exchange rate of Finland. The depreciation of the Finnish currency reduces the prices of the goods of Finland in Sweden. Because of sticky wages the floating of markka of Finland leads to Swedish loss of competitiveness. Hence, in case of crisis the trading partner's exports would be affected adversely due to a fall in demand and the loss of competitiveness.

In the benchmark simulation case following are the values of the structural parameters.

$\Psi = 0.1$, $\mu_F = 0.10$, $\mu_s = 0.06$, $\bar{s}_S = \bar{s}_F = 1$, $D_{FO} = D_{SO} = 0.5$, $\beta = 0.5$, $\alpha = 0.4$, $\epsilon = 0.2$, $\phi = 1$, $\gamma = 0.5$, $\eta = 0.5$.

The Benchmark simulation case



Source: Gerlach and Smets ,1994, p.14

In the figure it is evident that the condition of no arbitrage means that there is no loss of the competitiveness of Sweden instantaneously when there is a collapse of the Finnish parity (panel B). The exchange rate in Finland begins to depreciate because of the speculative attack. The Finnish nominal wages adjust sluggishly to the increased inflation rate (panel B), so the price of goods of Finland in terms of Swedish currency falls. This results to reduced consumer prices and money demand in Sweden. Loss in competitiveness of Sweden is caused because of dropping unit cost of labor. For assessing as to how the collapse of the Finnish currency accelerates the timing of the Swedish collapse, the benchmark case is compared with other cases.

Some deviations from the benchmark scenario

Scenarios *	Finnish collapse time	Swedish collapse time
0. Benchmark	14.53	21.31
1. $\mu_F = 0.05$	28.82	28.82
2. $\phi = 0$	14.19	23.31
3. $\mu_S = 0.10$	13.82	13.82
4. $\mu_F = 0.05$, $D_{F0} = 0.8$	23.53	26.69
5. $\delta = 1$	14.51	27.56
6. $\delta = 0.01$	14.53	20.55
7. $\psi = 1$	14.47	22.56
8. $\psi = 0.01$	14.54	21.00
9. $\beta = 1$	14.67	20.65
10. $\beta = 0$	14.18	23.74
11. $\alpha = 0.2$, $\epsilon = 0.1$	14.60	23.95
12. $\alpha = 0.6$, $\epsilon = 0.3$	14.38	16.73
13. $\beta = 0$, $\delta = 0$	14.16	22.62
14. $\epsilon = 0$, $\alpha = 0.6$, $\psi = 0$, $\delta = 0$	14.44	20.76

* Only the values of the parameters that deviate from the benchmark scenario are given.

Source: Gerlach and Smets, 1994, p.16

Scenario 1 represents the case where the credit creation rate is the same in both the nations. Because the timing of the collapse of the two exchange rates is the same there is no contagion. In the second case of

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simulation the Swedish parity doesn't collapse at time 21 (benchmark case) but at time 29. The difference is the contagion effect. In the second scenario the Swedish currency collapses at time 23, so greater than two-thirds of the acceleration of the collapse of Sweden from time 29 to 21 is because of the impact of the fall in prices on money demand. Next higher the rate of expansion of credit in Finland (scenario 3), greater is the speed of the collapse of the Swedish currency. (Gerlach and Smets, 1994)

Dornbusch et al (2006) state that the exports of a country are a function of the real exchange rate and the income of foreign country. A real depreciation of the currency boosts up exports. And a rise in the income levels abroad increases the demand of exports. So basically the real exchange rate (R) is ratio of the prices abroad to price level in the home country. It is measured in same currency. At purchasing parity R is equal to 1. If R for U.S. rises above 1 then it means a rise in competitiveness of goods in the U.S. or the commodities are expensive abroad. So the people would shift their spending towards the goods produced in the U.S., that is, the relative demand of U.S.'s exports would rise. (Dornbusch et al 2006).

Hence, economic theory states that a real exchange rate appreciation of a country would reduce the export growth of that country. This study would explore the impact of the crisis in Greece on the exports from the U.S. to the Euro zone.

OBJECTIVES OF STUDY

The aim of the study is to test the effect of the crisis in Greece on the U.S. Economic theory suggests that exports depend positively on income of the foreign country and negatively on the real exchange rate (Blanchard, 2010). So the aim is to find the effect of Greece crisis on the exports of the U.S.

Major variables for data collection and data sources

Major variables like the exports of the U.S. to the European Union, the real exchange rates of Dollar viz-a-viz Euro, the Index of Industrial Production of the Euro Zone are used for analysis. The data for U.S. exports is collected from the United States International Trade Commission, data for IIP Europe and REER U.S. are utilized from Eurostat.

ECONOMETRIC METHODOLOGY

The econometric methodology applied in this paper follows the methodology followed by Dua (2008). The methodology in terms of the model is similar to that used by Alam (2010); the difference lies in the fact that whereas Alam analyses the effect of currency on exports, this analysis goes further by assessing the impact of not only the change in currency but also the effect of the economic activity in the Euro zone which would reflect the demand for the U.S. exports. For proxying the economic activity in the Euro zone the methodology adopted by Dua and Tuteja (2015) is applied, that is, the Index of Industrial production in the Euro zone is taken as a proxy. So a fall in IIP would be interpreted as a deterioration of economic conditions due to crises and this may lead to fall in the demand of exports from the U.S.

Nonstationarity tests

The dependent and the independent variables must be stationary to avoid the problem of 'spurious regressions' (Granger and Newbold, 1974) where although the R^2 is high and the t-statistics are significant but the results are meaningless. (Dua, 2008). The variables would be checked for stationarity via the application of various tests like the Augmented Dickey Fuller test, the Phillips and Perron test, the DFGLS test, the KPSS test and the ERS test. The appropriate lag length is found by applying the LM Test of serial correlation.

Cointegration Test

Cointegration is a long-run relationship amongst nonstationary variables which together yield a linear combination which is stationary. Although for a while the variables might be away from the equilibrium but the economic forces help to restore the equilibrium (Dua, 2008). Next the paper applies the Johansen multivariate cointegration tests to check if the variables share a long run relationship. The VECM is capable of capturing both the long run and the short run relationships.

Dua (2008) explains the Johansen procedure for testing cointegration. Following is the vector autoregressive model (p-dimensional) with Gaussian errors:

$y_t = A_1 y_{t-1} + \ldots\ldots\ldots\ldots + A_p y_{t-p} + A_0 + \epsilon_t$

y_t vector of I(1) variables (m x 1).

Following is the VECM

$\Delta y_t = -\Pi y_{t-1} + \sum_{i=1}^{p-1} \Upsilon_i \Delta y_i + A_0 + \epsilon_t$

Where $\Upsilon_i = -\sum_{j=i+1}^{p} A_j$, i=1,……,p-1 and Π = Im $-\sum_{i=1}^{p} A_i$.

VECM under cointegration is

$\Delta y_t = -\alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \Upsilon_i \Delta y_{t-i} + A_0 + \epsilon_t$

If there exist non-zero cointegrating vectors then a few of the values of α will be non zero. Johansen and Julius suggested a test of likelihood ratio based on the trace statistics and maximum eigenvalue for finding the number of cointegrating vectors. If the variables are found to be cointegrated then an error correction

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model is estimated where the residual term's lagged value from the cointegrating vector is used as an independent variable along with the other variables. The short-term dynamics is captured by an error correction model. (Dua, 2008).

VECM and the Granger causality

Next, in order to investigate if the crisis in Greece had an impact on the exports of the United States, the Granger causality tests are applied. Granger causality reveals as to what amount of y_t can be accounted by the its past values. It also tests if the addition of the other variables' lagged values could enhance the forecasting power (Dua, 2008). Dua et al (2003) claim that if the variables are stationary in two variable VAR then in VAR if the first variable's lags are not jointly significant from zero then the second variable is not Granger caused by the first variable. In a VECM framework this concept includes the error correction term also. Now Granger causality is tested by adopting (1) a t test for the significance of the error correction term (lagged). (2) A Wald chi-square or an F test for the joint significance of the sum of the lags of every explanatory variable. (3) Or joint significance of all terms in 1 and 2. This paper deploys (3).

Impulse responses

For determining the feedback effects of one variable to another the Innovation accounting technique is applied.

The impulse response function measures the impact of one standard deviation shock to a variable on the present and future values of endogenous variables. A shock to a variable affects that variable directly and also gets transmitted to every endogenous variable via the dynamic modeling of VAR. Usually the innovations are correlated, hence the innovations cannot be linked with a single variable as they share a common component. A solution to this problem is to assign all the impact of a common component to the first variable in VAR. The variance-covariance matrix of errors are Cholesky decomposed for orthogonalizing the shocks to VAR. Hence, in the new sequence the errors are orthogonal to one another and the effects of a shock to an orthogonalized error are unambiguous (Dua, 2008).

Variance decomposition

Variance decomposition segregates the forecast error's variance into sub-parts that could be attributed to the endogenous variables. Hence, it provides a "break down of the variance of the n- step ahead forecast errors of variable i which is accounted for by the innovations in variable j in the VAR." (Dua, p.343, 2008)

EMPIRICAL RESULTS

Stationarity test results

Before proceeding with the econometric analysis it is crucial to whether the variables are stationary or non-stationary. Various tests of stationarity mentioned above are applied to the three series that is, Exports, IIP and the REER. All the tests suggest the presence of a unit root that is, the series are I(1).

Variable	ADF test statistics	Prob.
Exports	-2.518046*	0.3168
IIP	-2.254159*	0.4374
REER	-2.006613*	0.5568
Variable	Philips Perron Test Statistic	Prob.
Exports	-2.461391*	0.3410
IIP	-2.006487*	0.5628
REER	-2.400888*	0.3679

NOTE: * Suggests the acceptance of the hypothesis of unit root at 5% level of significance.

Variable	KPSS test statistic
Exports	0.591880**
IIP	0.162960**
REER	0.156000**
Variable	DF-GLS test statistic
Exports	-2.575910*
IIP	-2.313155*
REER	-2.819676*

NOTE: * Suggests the acceptance of the hypothesis of unit root at 5% level of significance. **Suggests the rejection of Null hypothesis of no unit root.

Cointegration results

Since all the variables are integrated of order one it is suspected that the variables may be cointegrated. Hence, exports were regressed on the Index of Industrial Production of Europe and the Real Effective Rate Index. Then the residual series was checked for the presence of unit root. The residual series was found to be stationary, hence the variables have a long run relationship.

Next, the Johansen procedure of cointegration is applied. The lags are found by the majority criterion. The optimum number of lags comes out to 2. Next I run the Johansen test of cointegration. Following are the results of the test.

No. of cointegrating equations	**Trace statistics**	**Maximum Eigenvalue statistics**
R=0	47.58089 (29.79707)	35.08332 (21.13162)
R<=1	12.49757 (15.49471)	12.31683 (14.26460)
R<=2	0.180740 (3.841466)	0.180740 (3.841466)

Note: the values in the brackets show 5% critical value.

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The Trace Level test as well as the Maximum Eigenvalue test suggests one cointegrating relationship. The estimated long run relationship is:

$$\text{Exports}_{t-1} = -10.45011\ \text{IIP}_{t-1} + 5.394604\ \text{REER}_{t-1}$$

The complete VECM model is represented in table 2, Appendix 1. The above equation suggests that there exists a negative association between the exports from the U.S. to the European Union and the IIP of the European union. The IIP was used as a proxy for the economic conditions in the European Union. The negative sign suggests that a fall in IIP would lead to a rise in Exports from the U.S. This is a surprising result as the results are expected otherwise. But going deep into the scenario reveals that major imports include machinery goods and industrial products and their demand remains high even in crisis situation. The demand for defence equipment is very high especially in Greece. Secondly, the positive coefficient of REER suggests that as the competitiveness of the goods of the U.S. increases the exports also experience a rise. Similarly, if due to the economic crisis in Greece the exchange rate of dollar versus Euro falls the real exchange rate might fall as a consequence the Exports from the U.S. to the European Union may fall. So, basically the real exchange rate channel and not the demand channel is the one which might have a negative impact on the U.S. Hence, the analysis suggests that economic crisis in Greece may have a negative impact on the exports of the U.S.

The estimated VECM is as follows:

$\Delta Exports_t$ = -0.829$e_{exports\ t-1}$-2.2575$\Delta Exports_{t-1}$-1.7366$\Delta Exports_{t-2}$+3.4550ΔIIP_{t-1}+2.6906ΔIIP_{t-2}+3.0914 $\Delta REER_{t-1}$-2.7284$\Delta REER_{t-2}$+ 30.5781

ΔIIP_t = -0.09605$e_{exports\ t-1}$-0.4216 $\Delta Exports_{t-1}$ +0.8264$\Delta Exports_{t-2}$+0.8311ΔIIP_{t-1} -0.3570ΔIIP_{t-2}+0.5795$\Delta REER_{t-1}$+-0.8632$\Delta REER_{t-2}$ + 5.10358

$\Delta REER_t$ =0.0560 $e_{exports\ t-1}$ +0.12018$\Delta Exports_{t-1}$ +0.208824ΔIIP_{t-1} +0.20054 $\Delta REER_{t-1}$ +0.0940 $\Delta Exports_{t-2}$ + 0.04123ΔIIP_{t-2} -0.16435 $\Delta REER_{t-2}$ + -2.0079

VECM Granger Causality Results

Null hypothesis	Number of lags	Chi-square value	Conclusion
Exports are not Granger caused by IIP	2	7.540039 (0.0231)*	Reject the Null Hypothesis**
Exports are not Granger caused by REER	2	8.946601 (0.0114)*	Reject the Null Hypothesis**

*p-value in parenthesis. ** At 5 % level of significance

The Granger causality results reveal that the Null Hypothesis is rejected in both the cases at 5% level of significance. There is a causality running from IIP to exports. It means that the economic conditions in Greece have significant effects on the United States. And for REER also the Null Hypothesis is rejected at 5% level of significance. Hence, there is a causality running from the real exchange rate to the Exports.

Although the primary aim was to analyze the causal effects of IIP and REER on Exports but evaluating the other causal links would also be illuminating.

Null hypothesis	Number of lags	Chi-square value	Conclusion
IIP is not Granger caused by exports	2	7.812088 (0.0201)*	Reject the Null Hypothesis**
IIP is not Granger caused by REER	2	2.180870 (0.3361)*	Don't reject the Null Hypothesis

*p-value in parenthesis. ** At 5 % level of significance

The null hypothesis in the first case is rejected. Hence, there is a causality running from the exports to the IIP. This is quite intuitive as the exports from the U.S. to the European Union will have effects on the BOP of Europe as well on the real economy of Europe. The Null Hypothesis is not rejected in the second case.

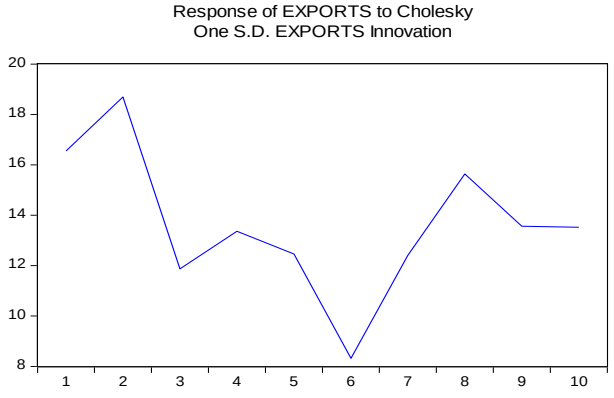
Null hypothesis	Number of lags	Chi-square value	Conclusion
REER is not Granger caused by exports	2	0.350843 (0.8391)*	Don't reject the Null Hypothesis
REER is not Granger caused by REER	2	0.801857 (0.6697)*	Don't Reject the Null Hypothesis

*p-value in parenthesis. ** At 5 % level of significance

The Granger causality results reveal that the real exchange rate is not caused by any of the specified variables.

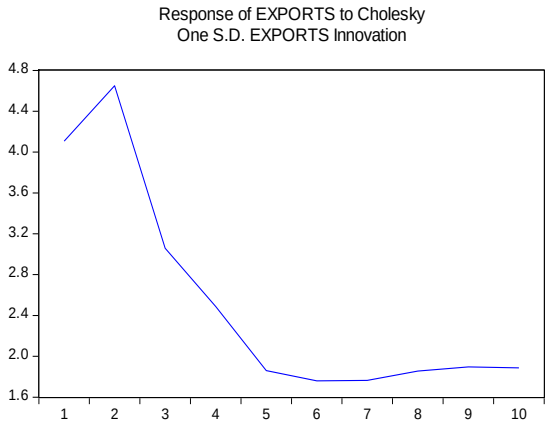
Innovation Accounting Analysis

The innovation accounting tells the impact of a one standard deviation shock to a variable on another variable in future periods. The graphs show the impulse response functions of IIP and REER on Exports.



DOI: https://doi.org/10.48001/jbmis.2021.0802003

The graphs show the impact of a shock to Exports, IIP and REER to Exports. The impact is forecasted for the next 10 years. The impact of a shock to Exports and IIP is positive throughout the next 10 years. This impact would be maximum about two years from 2015. Overall the impact is quite positive. This is supported by economic theory as well because a rise in IIP means good economic condition and hence an increase in demand for imports from the U.S.



The impact of a one standard deviation shock to REER is positive on Exports. This result is fully in tandem with economic theory as the impact must be positive because with an increase in the competitiveness of a country the demand for its exports tends to rise and hence the exports also rise.

Variance Decomposition of Exports

Period	S.D	Exports	IIP	REER
1	16.55094	100.0000	0.000000	0.000000
2	27.73752	81.03486	15.41882	3.546315
3	31.59571	76.56524	18.56518	4.869579
4	35.30799	75.63061	15.96704	8.402351
5	39.82934	69.22024	16.01539	14.76437
6	41.42864	68.01577	16.05217	15.93206
7	43.58796	69.54374	14.99042	15.46583
8	47.36120	69.81032	15.06912	15.12056
9	50.19033	69.46637	15.58845	14.94518
10	52.75215	69.45499	15.28860	15.25640

The variance decomposition analysis would help to draw more light on the variance relations of the three variables. The analysis has been done for ten periods. In the short run that is in period 3, impulse to Exports account for about 76.56 percent of the variation or fluctuation in Exports. Shock to IIP and REER cause about 18.56 percent and 4.86 percent fluctuation to Exports. The contribution of IIP to variation in Exports remains almost the same. The contribution of the own shock falls. But the notable finding is that the contribution of a shock to REER to the fluctuation in Exports increases from about 3.54 percent to 15.256 percent. This is almost 330 percent! Hence, it is not the demand side proxyied by IIP but the REER channel through which the fluctuations to the exports are transmitted.

CONCLUSIONS

The paper aimed at finding the consequences of the economic crisis in Greece on the U.S. The major channel through which the fluctuations could be transmitted is the trade channel. Due to the crisis in the European Union the euro is expected to depreciate and the dollar is expected to appreciate. Also because of the crisis the demand for American exports is expected to fall. Hence, both the factors have an adverse impact on the Exports of the U.S. The study found that exports, IIP and REER share long run relationship. REER adversely affects Exports. The VECM Granger causality results suggested that there is a causality running from IIP and REER to Exports. Also there is a causality from exports to IIP. The impact of a shock to REER to the fluctuation in Exports is phenomenal. Hence, the study shows that economic crisis in Greece could have an adverse impact on the Exports from the U.S. and hence the economy of the U.S. as a whole.

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