# The Interdependence of the US and European Economies

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**Abstract**

This paper analyzes the interdependence of the economies of the US and Western European countries, using panel data from the years 1979 to 2011. The model specified uses the GDP per capita of the European nation as the dependent variable, and the components of US GDP as testing variables. The countries used include the UK, France, Germany, Spain, and Italy. The model seeks to establish a relationship between the developed economies of Europe and the United States, in order to better show the correlation between world economies. After developing the model and corrected it for error term violations, the testing variables of US personal consumption, government expenditures, and net exports were found to be significant.

**Introduction**

Globalization has become a driving force of the world economy and for our understanding of international economics. Through technological advance and the desire of firms to expand their markets, the economies of nations are becoming increasingly interconnected with one another. The US economy has long been the leader of innovation and trade in the world through the past several decades since the end of the Second World War. Its position as the world's largest economy lends itself well to the assumption that if any nation were to be impactful on the rest of the world, it would be the US. This can be seen during periods of economic crisis like the recession in 2008, but should also be true the other way around, and indeed, as the US economy has grown and developed over the past decades, so have many others. The benefits of trade and globalization has resulted in real economic growth over the past century, but it is not fully understood how interdependent that this globalization has made the world become. In an attempt to understand some of the interdependence of world economies, data from several major Western European nations will be used along with US data to model economic interdependence. The European nations are the UK, France, Germany, Spain, and Italy, and were selected mainly due to the size of their economies as well as their longstanding status as trade partners of the US. The model is therefore panel data, with data ranging from 1979 to 2011 for each nation, with the years of data selected based on data availability from the FRED data source, and also due to the globalization that occurred during that period. The goal of the model is to quantify global economic interdependence by using the components of U.S. GDP as predictors of the GDP per capita of the European nations, and to offer insight into the effects that globalization has had on the world economy.

**Review of the Literature**

My thesis is in the field of international economics and globalization, in which there are a multitude of differing opinions and approaches. Yet examining the interdependence of global economies is nothing new, and there is much research that already exists in the field. In a broad approach, Gomez, Torgler, and Ortega (2013) attempt to measure the economic interdependence that has arisen as a result of the globalizing forces present since the 1950s by examining convergence in the business cycles of various countries and regions. One interesting result of their work is the conclusion that global periods of crisis noticeably increase the co-movement of the global economy.

In his article in the *Atlantic Economic Journal,* Rusek (1990) analyzes economic policy interdependence between the United States and Canada. In the article, Rusek uses two statistical tests to examine his hypothesis, the Granger test and the Geweke, Meese, and Dent test. His hypothesis is that because the U.S. and Canadian economies are so heavily correlated with one another that their economic policies are interdependent as well.

While Rusek's question focuses on only the United States and Canada, Belke and Cui (2010) ask a similar question about economic policy interdependence, but with respect to the U.S. and the EU. Specifically, they examine the monetary policy relation between the Federal Reserve and the European Central Bank (ECB). Belke and Cui examines data from 1999-2006 using vector error correction models, or VECMs. Through their research, they were able to establish a policy interdependence of the two banks, and were even able to conclude a leader-follower relationship between the Fed and ECB under one model. Such a conclusion furthers

the notion that the U.S. and European economies would be dependent on one another, specifically the idea that the U.S. is the leading indicator of the two.

Interdependence of the European economies themselves should not be forgotten either. In his paper titled *Structural Interdependence of European Economies*, Morselli (2014) presents a model to demonstrate the effects that the interdependent nature of the current European economic reality has on the countries involved. His model allows for analysis of policies in the context of the effect that they have between nations, and takes into account the decisions of consumers and producers throughout the EMU (European Monetary Union) as well as the conditions of financial markets. Unsurprisingly, nations within the EMU experience a higher degree of interdependence with one another compared to nations outside of it.

Understanding the impacts that this has on the nations themselves has been the work of many researchers. In the paper *Europe, Trade and Globalisation*, [sic] (Sally, 2007) the author examines the role that the European Union has played as a facilitator of trade between Europe and the rest of the world, and indeed one of the few key powers that the EU has is to be able to regulate the trade that flows to and from the bloc to the larger world. This in turn has affected the cultural views of many Europeans on trade and globalization, which has been addressed by researchers such as Teney, Lacewell, and De Wilde (2014) in their paper on the winners and losers of globalization in Europe. While this paper may soon be out of date with current political trends, it, and research like it, plays an important role in identifying popular opinion to the forces of globalization that would drive the economies of the world together. Conventional economic wisdom says that there is much to gain from movement towards globalization. However, as the literature has shown, that interdependence doesn't come without costs.

Interdependence between the United States and Europe may be a measurable phenomenon and a signal of the globalization that has occurred over the past decades. Nonetheless, analyzing the real impacts that such interdependence has and the extent of the interdependence is important research that should not be overlooked.

**The Model**

Panel data of the real GDP per capita of the nations of the UK, France, Germany, Spain, and Italy from 1979 to 2011 will be modeled on the components of US GDP, with factors such as the unemployment rate, short and long term interest rates, and recession periods for each country as controls, along with binaries for US recession periods and for the formation of the European Union.

Real GDP Per Capita = $\beta_0$ + $\beta_1$(US Personal Consumption) + $\beta_2$(US Government Expenditures) + $\beta_3$(US Private Investment) + $\beta_4$(US Net Exports) + $\beta_5$(Unemployment) + $\beta_6$(Short Term Interest Rate) + $\beta_7$(Long Term Interest Rate) + $\beta_8$(Recession) + $\beta_9$(US Recession) + $\beta_{10}$(European Union) + u

The following are the assumptions about the disturbance term:

1. $E(u_{it}) = 0 \ \forall \ i, t$
2. $E(u_{it}u_{jt}) = 0 \ \forall \ i \neq j, given \ that \ E(u_{it}u_{it-1}) = 0 \ \forall \ i \ given \ i$
3. $E(u_{it}x_{it}) = 0 \ \forall \ t, i$
4. $E(u_{it}|x_{it}) = \sigma^2 \ \forall \ i, t$
5. $u_{it}$ is normally distributed

**Dependent Variable**

*Real GDP Per Capita:* Real GDP divided by population for each country. [gdppercap]

**Independent Testing Variables**

- *US Personal Consumption (Billions USD):* Positive impact expected. Increases in US consumption will increase demand for goods produced both domestically and abroad,

and increases in demand for goods from abroad will increase the GDP of other nations, since we are assuming that the economies are significantly connected. [uspc]

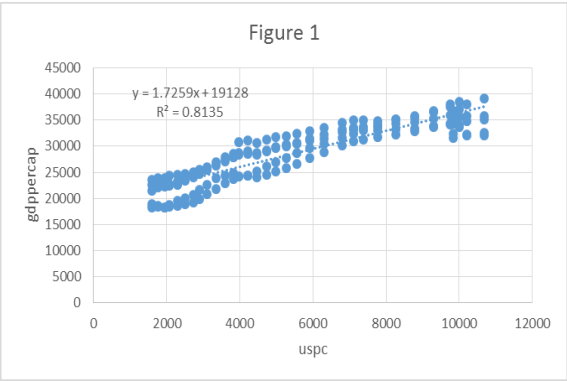
- *US Government Expenditures (Billions USD):* Positive impact expected. Increases in government spending could increase demand, which could illicit economic growth in other nations assuming the impact of the US economy on other nations is large enough. [usge]
- *US Private Investment (Billions USD):* Positive impact expected. Factors that would encourage private investment in the US should be present in similar economies, which would result in an increase in GDP. [uspi]
- *US Net Exports (Billions USD):* (Data is negative, so an increase in the trade deficit corresponds to the number becoming more negative.) Negative impact expected. Increases in exports mean that other nations are importing more American goods, which could lead to a decline in their trade component of GDP. [usne]

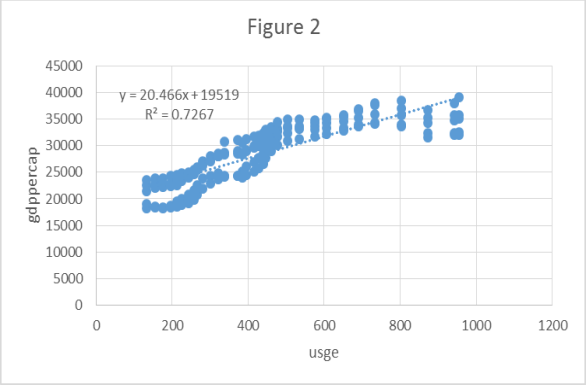
**Independent Control Variables**

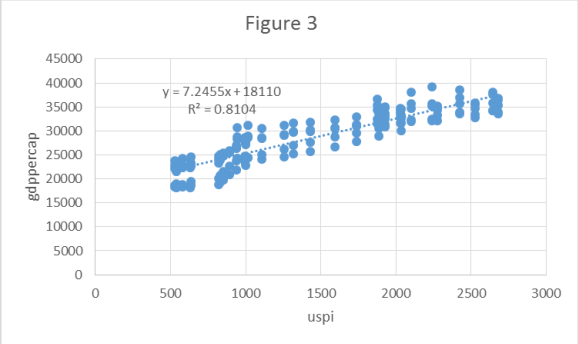
- *Unemployment:* Negative impact expected. Increases in the unemployment rate would result in a decrease in GDP per capita. [unemploy]
- *Short Term Interest Rate:* Negative impact expected. Low interest rates, in general, stimulate economic growth which would increase GDP. [stir]
- *Long Term Interest Rate:* Negative impact expected. A higher long term interest rate could stimulate investment which would grow the economy. [ltir]

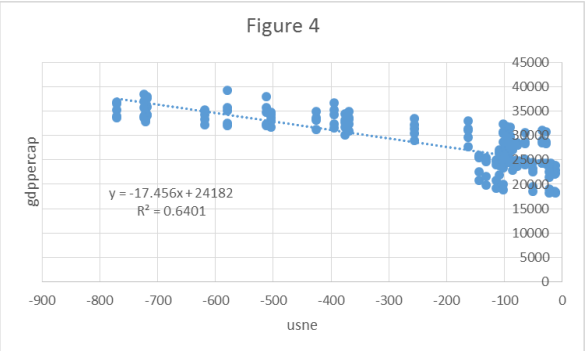
- *Recession:* (Binary) Negative impact expected. Per capita GDP would be expected to decrease during a recessionary period, so long as population remains relatively constant. [recess]
- *US Recession:* (Binary) Negative impact expected. Recession in the US could trigger contractions in other areas of the global economy, as a result of the economic position of the US, which could result in decreases in the GDP per capita of the other nations. [usrecess]
- *European Union:* (Binary) Positive impact expected. One would expect that the common laws, regulations, and economic reduction of barriers of the EU would allow for real economic growth for countries part of the union. [EU]

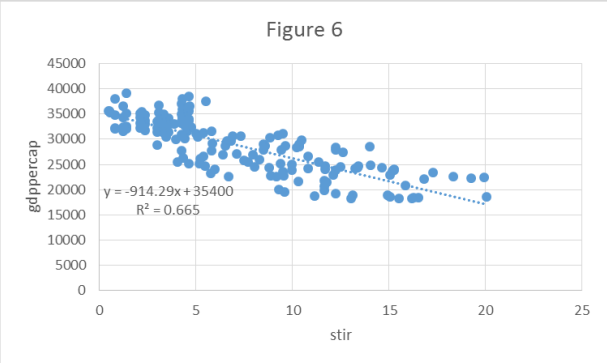
Following are the plots of each variable against the dependent variable.

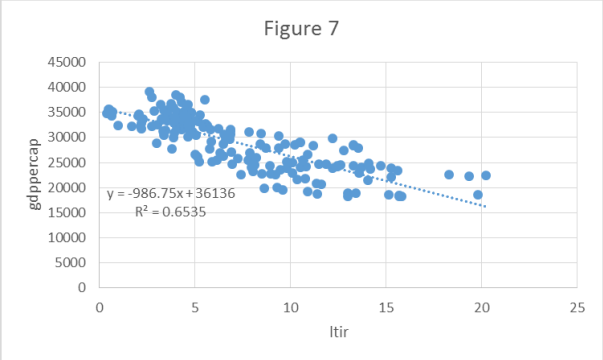


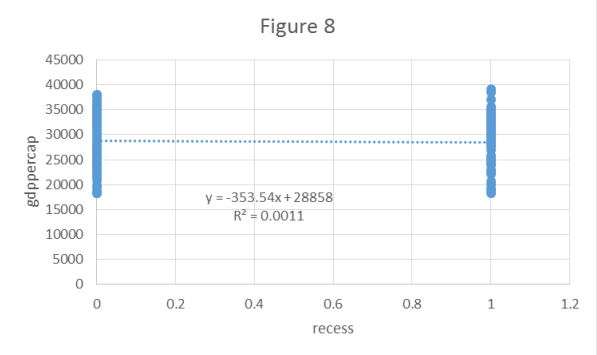



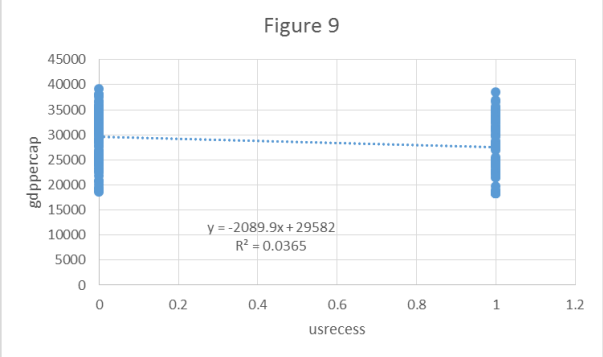



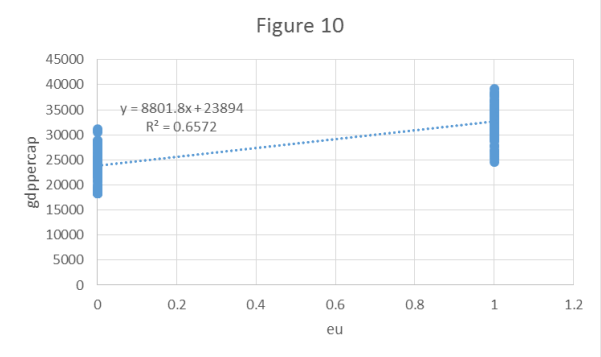




All of our expectations were correct with regards to the scatter plots. Each slope is the sign that we expected it to be. USPC, USGE, USPI, and EU were all positive, while USNE, unemployment, stir, ltir, recess, and USrecess were all negative. The U.S. GDP components, with the exception of net exports, appear highly correlated. Based on the scatterplots, no transformation was required, and so the model remains as follows:

Real GDP Per Capita = $\beta_0$ + $\beta_1$(US Personal Consumption) + $\beta_2$(US Government Expenditures) + $\beta_3$(US Private Investment) + $\beta_4$(US Net Exports) + $\beta_5$(Unemployment) + $\beta_6$(Short Term Interest Rate) + $\beta_7$(Long Term Interest Rate) + $\beta_8$(Recession) + $\beta_9$(US Recession) + $\beta_{10}$(European Union) + u

**Initial Estimation and Hypothesis Testing**

With the model and the variables defined, the regression can now be run. The initial regression is shown in Appendix B. The results are as follows:

| Variable | Expected Sign | Estimated Coefficients | Standard Error | T-Statistic |
|---|---|---|---|---|
| Intercept | | 20932.88 | 1310.081 | 15.97831*** |
| USpc | + | 2.799135 | 1.101078 | 2.542176** |
| USge | + | -14.32548 | 8.532268 | -1.678977* |
| USpi | + | 4.424468 | 2.215435 | 1.997110** |
| USne | - | 11.64656 | 1.993413 | 5.842519*** |
| unemploy | - | -294.1425 | 42.49195 | -6.92231*** |
| stir | - | -268.89106 | 137.7487 | -1.952038* |
| ltir | - | 114.0789 | 147.0813 | 0.775618 |
| recess | - | 554.9652 | 303.4003 | 1.829152* |
| USrecess | - | -277.5636 | 354.563 | -0.782833 |
| EU | + | -1789.416 | 748.2077 | -2.391603** |
| | | | | |
| F-Statistic | 143.8508 | | | |
| R2 | 0.903297 | | | |
| Adj. R2 | 0.897018 | | | |
| Standard Error | 1740.216 | | | |

*Statistically significant at 10% significance level

**Statistically significant at 5% significance level

***Statistically significant at 1% significance level

Overall, the results were very promising, as nearly all of the variables and all of the testing variables were significant. There were several variables whose signs were unexpected, however.

- *US Personal Consumption:* The variable's sign was as expected, and was significant at the 1% level.
- *US Government Expenditures:* The variable's sign was not as expected, and was significant at the 10% level.
- *US Private Investment:* The variable's sign was as expected, and was significant at the 5% level.
- *US Net Exports:* The variable's sign was not as expected, and was significant at the 1% level.
- *Unemployment:* The variable's sign was as expected, and was significant at the 1% level.
- *Short Term Interest Rates:* The variable's sign was as expected, and was significant at the 10% level.
- *Long Term Interest Rates:* The variable's sign was not as expected, and was not significant.
- *Recession:* The variable's sign was not as expected, and was significant at the 10% level.
- *US Recession:* The variable's sign was as expected, and was not significant.
- *European Union:* The variable's sign was not as expected, and was significant at the 5% level.

US government expenditures could be negative as a result of government expenditures increasing during recessionary periods, or possibly as a result of the fiscal policy that was conducted over the time period. US Net Exports could be positive due to the fact that the US

importing more goods would be beneficial to the GDP's of foreign nations exporting goods to the US. Long term interest rates were a different sign than expected, but that could be due to its lack of relevance to GDP per capita, as the variable was insignificant. The recession binary, however, was positive and significant, which could be because GDP per capita is not as intuitively correlated with regular GDP during recessionary periods, potentially due to migration, especially considering European countries where migration is easier. The European Union variable was negative, which was very surprising, but could be because the US has done well, or at least better than Europe, over the period of years since the EU has been in existence and not necessarily an indicator of a structural problem within the EU.

**Specification Error Testing**

The model was then tested to ensure the estimators were BLUE. The model was tested for endogeneity, zero mean, autocorrelation, and normality, and corrected if and when necessary and possible, resulting in a new model.

*Endogeneity*

Endogeneity is a problem that arises when an explanatory variable is correlated with the error term, which can happen when there is a causality between the dependent variable and an independent variable. Unemployment and short term interest rates were identified as possibly being endogenous, as unemployment could easily be said to be a function of GDP or GDP per capita, and short term interest rates are often set in response to the economic expansion or contraction. Output per hour in manufacturing (oph) was used as an instrument for unemployment and money supply was used as an instrument for short term interest rates.

After running each regression separately and then running an artificial regression, it was determined that the unemployment variable was endogenous but that short term interest rate was not, as seen in Appendix B. The model was then estimated using two-staged least squares, with oph used as the instrumental variable for unemployment. Thus, the model was corrected for Endogeneity and the results can been seen in Appendix B. The new model now satisfies the assumption $E(u_{it}x_{it}) = 0 \ \forall \ t, i.$

*Zero Mean/RESET*

Next, a Ramsey Reset Test was conducted to test for non-zero mean, and to identify any potential misspecification issues. The purpose of the test is to ensure that the model has the correct form, i.e. whether any variables should be logged, etc. The values of yhat were calculated and a fitted model estimated. After that, a Wald test was conducted on the fitted variables, all of which can be found in Appendix B. With an F-statistic of 1.25 and a p-value of .3, the model passed the RESET test and no evidence of misspecification was found. Thus, the assumption $E(u_{it}) = 0 \ \forall \ i, t.$ was upheld.

*Autocorrelation*

The model then had to be corrected for autocorrelation, which is the correlation between observations of a series as a function of the time lag between them. Because it was panel data, each nation was regressed using the model separately in order to check for autocorrelation, with the results found in Appendix B. Each nation showed no real signs of autocorrelation except for Spain, which had first order correlation. The AR(1) variable was then added to the Spanish model, giving the rho coefficient necessary to correct the data for

autocorrelation manually in the data file and re-estimate the model. A binary AC was added to model to indicate the presence of corrected autocorrelation, with it being 1 for Spain and zero for all the other nations. The model was then able to satisfy the assumption that $E(u_{it}u_{jt}) = 0 \ \forall \ i \neq j, given \ that \ E(u_{it}u_{it-1}) = 0 \ \forall \ i \ given \ i.$

*Heteroscedasticity*

Heteroscedasticity occurs when the variability of a variable changes throughout its range, which would violate the assumption that $E(u_{it}|x_{it}) = \sigma^2 \ \forall \ i, t$. Since each nation had be estimated separately and the standard error of each model readily available, correcting for heteroscedasticity, which was readily apparent, was a relatively simple task. The variable SEweight was added to the data file, and was taken from the standard error of the regression output of each individual nation. The model was estimated using the standard error for each nation as a weight in weighted two-staged least squares, neatly correcting for heteroscedasticity, and regaining asymptotic efficiency.

*Normality*

Lastly, the model was tested for normality i.e. that the residuals are normally distributed. Unfortunately the model failed the test for normality, with a p-value of .025, a skewness of -.5, and a kurtosis of 2.75. As a result, the residuals cannot be said to be normally distributed, which is a problem for the efficiency of the model. The histogram can be found in Appendix B.

**Final Model and Hypothesis Testing**

With all of the specification errors tested for the final model could be estimated. It is a weighted two-staged least squares model and is as follows:

Real GDP Per Capita = $\beta_0$ + $\beta_1$(US Personal Consumption) + $\beta_2$(US Government Expenditures) + $\beta_3$(US Private Investment) + $\beta_4$(US Net Exports) + $\beta_5$(Unemployment) + $\beta_6$(Short Term Interest Rate) + $\beta_7$(Long Term Interest Rate) + $\beta_8$(Recession) + $\beta_9$(US Recession) + $\beta_{10}$(European Union) + $\beta_{11}$(AC) + u

With uspc, usge, uspi, usne, oph, stir, ltir, recess, usrecess, eu, and ac as instruments and the variable seweight as a weight for weighted least squares.

The final model differs from the original model in several ways. One is that it includes a new variable, AC. It is also estimated using weighted two-staged least squares. Hence, selected data has also been altered to correct for autocorrelation, and instruments have been added to deal with endogeneity. Overall, the model has improved greatly. The regression output for the final model is as follows:

Dependent Variable: GDPPERCAP
Method: Two-Stage Least Squares
Date: 12/10/16 Time: 18:54
Sample: 1 164
Included observations: 164
Weighting series: SEWEIGHT
Weight type: Standard deviation (average scaling)
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU AC

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 20028.88 | 1314.192 | 15.24045 | 0.0000 |
| USPC | 3.972431 | 0.876018 | 4.534647 | 0.0000 |
| USGE | -25.42139 | 7.218465 | -3.521717 | 0.0006 |
| USPI | 1.709532 | 1.695429 | 1.008318 | 0.3149 |
| USNE | 7.499329 | 1.809837 | 4.143648 | 0.0001 |
| UNEMPLOY | 0.850802 | 103.3433 | 0.008233 | 0.9934 |
| STIR | -175.1895 | 133.1934 | -1.315302 | 0.1904 |
| LTIR | 37.77309 | 137.0474 | 0.275621 | 0.7832 |
| RECESS | 347.2957 | 228.1974 | 1.521909 | 0.1301 |
| USRECESS | 135.5460 | 299.2346 | 0.452976 | 0.6512 |
| EU | -1916.872 | 561.8345 | -3.411809 | 0.0008 |
| AC | 2156.678 | 1159.030 | 1.860761 | 0.0647 |

Weighted Statistics

| | | | |
|---|---|---|---|
| R-squared | 0.955400 | Mean dependent var | 28737.75 |
| Adjusted R-squared | 0.952173 | S.D. dependent var | 13117.96 |
| S.E. of regression | 1327.557 | Sum squared resid | 2.68E+08 |
| F-statistic | 296.0155 | Durbin-Watson stat | 0.273799 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 2.68E+08 |
| Weighted mean dep. | 30988.14 | J-statistic | 1.70E-35 |
| Instrument rank | 12 | | |

*Intercept: ****

*US Personal Consumption: ****

*US Government Expenditures: ****

*US Private Investment:* not significant

*US Net Exports: ****

*Unemployment:* not significant

*Short Term Interest Rate:* not significant

*Long Term Interest Rate:* not significant

*Recession:* not significant

*US Recession:* not significant

*European Union: ****

*AC (Binary): **

*=10% significance

**=5% significance

***=1% significance

These results suggest that the U.S. variables are better predictors of the GDP per capita of each country than the variables for the countries specific economic data.

**Wald Test**

A Wald test was used to test the joint significance of the testing variables in the final model: USPC, USGE, USPI, and USNE. Conducting the test in EViews resulted in an F-statistic of 83 and an effectively zero p-value, meaning that we were able to reject the null hypothesis of the Wald test and can conclude that the testing variable are jointly significant and that the model is definitively better than the sample mean.

**Testing for Stability**

Additionally, a chow test was conducted to test the model for stability. The stability in question was if the current model provides the best fit for all nations, or if there are separate models contained within the current one that would better fit individual or selected naitons. The model was tested using the estimates for each nation separately as the restricted models, while the final model was used as the pooled model. The calculations for this test can be found in Appendix C. The result was an F-statistic of 30.83, which was very significant, and indicates that the model is not stable, and that there could potentially be up to 5 different models. Further testing would be required to verify which nations are indeed separate models.

**Multicollinearity**

Multicollinearity is almost certainly present in the model, due to the nature of time series data. This may skew the model's standard errors slightly and should be taken into consideration when evaluating the model.

**European Interdependence**

An additional step was taken to attempt to apply the model to look for interdependence between the European nations themselves. The model was used to try to observe the impact that changes in unemployment of other European nations had on the GDP per capita of the UK, which was selected due to their unique position economically and politically. However, this exercised proved to be largely ineffective, as the resulting outputs were highly insignificant. Future adjustments and modifications could potentially be made to the model to better answer questions regarding European interdependence, of which there are many. In its current state, European interaction is hard to measure.

**Conclusion**

In conclusion, the question of whether the US economy can be used as a predictor of the economies of other developed nations was answered. In the final model, the testing variables were jointly significant, and all but one were individually significant at the 1% level, indicating that yes, the economies of the nations in the model are interdependent with the US economy. To develop the final model, the initial model was corrected for endogeneity, which it had in the unemployment variable. Next, a RESET test was conducted for zero mean, which the model passed. Then, the model was corrected for autocorrelation and heteroscedasticity and

examined for normality. After that, the model was tested for stability, and was found to reject the null hypothesis and conclude that there is more than one model contained within the existing model.

Overall, the results of the model were successful, but future opportunities for improvement and refinement remain. The variable USNE (U.S. net exports) is perhaps misleading/misnamed, as net imports may have been a better variable, for then the variable would have been positive and more intuitive. One of the main problems remaining with the model is that it doesn't satisfy the normality assumption, so it is possible that more observations are needed to achieve normality. Potential options include adding additional nations or expanding the range of years.

In the final model, the variable with the greatest significance was USPC (U.S. personal consumption), indicating the importance that consumers have in the modern economy. The positive impact that European GDP experiences when U.S. consumption increases is likely though foreign direct investment by European firms driven to the U.S. market by stronger consumer demand. USNE was also highly significant, as well as USGE (U.S. gov't expenditures). That the USNE coefficient was positive makes sensed when considering U.S. exports as a function of foreign GDP per capita (as foreign nationals become wealthier, they consume more U.S. goods). This does however indicate that the USNE variable may have an endogeneity problem which it was not tested for. What was interesting about USGE is that the coefficient was negative, which would imply that expansionary fiscal policy in the U.S. has an adverse effect on the European nations in question. This could be as a result of a sort of "international crowding-out" that would pull economic activity and consumption away from foreign nations

and products and favor domestic growth and consumption. Such an implication would be consistent with more traditional economic views of discretionary policy having a distorting effect on markets, only in this case the market is the global economy and nations are playing the role of firms. The USGE coefficient was also the largest of the testing variables, and a one billion increase in government spending would have, according to the model, a larger effect than a similar increase in all of the other testing variables combined, making USGE one of the more interesting outcomes from the model. The coefficients are not beta weights, so it is difficult to draw concreate conclusions in this regard. USPC and USPI behaved as expected, and although USPC is much more significant than USPI (which is not statistically significant at the accepted alpha level), both have positive coefficients. As USPC is the largest component of U.S. GDP, this is a benefit for the argument for economic cooperation and globalization. The only control variable that was statistically significant was the EU binary, which surprisingly had a negative value.

The model indicates that the world economy is an interconnected affair, and that other citizens can benefit and suffer even when nations that are not their own succeed or fail. To this end, the results advocate the benefits of trade and economic cooperation, and reject the idea that the world is a zero-sum game. The output shows that both the U.S. and Europe benefit from the consumer focused American economy as a driver of the world economy, and that several components of U.S. GDP have a real statistically significant impact on the European nations. The fact that the majority of the control variables selected were insignificant despite being logical choices (i.e. unemployment) further supports the idea that globalization has resulted in a world where we have the potential to be more impacted by forces outside of our

nation than forces within. Although this is precisely the world that some fear, it is also an opportunity to build upon the progress that we as a civilization have made in the past to shape and create a better and more productive world overall.

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**Appendix A**

Data Source: Federal Reserve Economic Database (FRED)

## Appendix B

### Initial Regression

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: GDPPERCAP
Method: Least Squares
Date: 12/06/16 Time: 12:28
Sample: 1 165
Included observations: 165

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 20932.88 | 1310.081 | 15.97831 | 0.0000 |
| USPC | 2.799135 | 1.101078 | 2.542176 | 0.0120 |
| USGE | -14.32548 | 8.532268 | -1.678977 | 0.0952 |
| USPI | 4.424468 | 2.215435 | 1.997110 | 0.0476 |
| USNE | 11.64656 | 1.993413 | 5.842519 | 0.0000 |
| UNEMPLOY | -294.1425 | 42.49195 | -6.922311 | 0.0000 |
| STIR | -268.8906 | 137.7487 | -1.952038 | 0.0527 |
| LTIR | 114.0789 | 147.0813 | 0.775618 | 0.4392 |
| RECESS | 554.9652 | 303.4003 | 1.829152 | 0.0693 |
| USRECESS | -277.5636 | 354.5630 | -0.782833 | 0.4349 |
| EU | -1789.416 | 748.2077 | -2.391603 | 0.0180 |

| | | | |
|---|---|---|---|
| R-squared | 0.903297 | Mean dependent var | 28695.30 |
| Adjusted R-squared | 0.897018 | S.D. dependent var | 5422.782 |
| S.E. of regression | 1740.216 | Akaike info criterion | 17.82575 |
| Sum squared resid | 4.66E+08 | Schwarz criterion | 18.03281 |
| Log likelihood | -1459.624 | Hannan-Quinn criter. | 17.90980 |
| F-statistic | 143.8508 | Durbin-Watson stat | 0.256681 |
| Prob(F-statistic) | 0.000000 | | |

### Endogeneity Testing

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: UNEMPLOY
Method: Least Squares
Date: 12/09/16 Time: 12:55
Sample: 1 165
Included observations: 165

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 1.233083 | 2.685083 | 0.459235 | 0.6467 |
| USPC | -0.002470 | 0.002019 | -1.223280 | 0.2231 |
| USGE | 0.015760 | 0.015331 | 1.028008 | 0.3056 |
| USPI | 0.000922 | 0.003992 | 0.231004 | 0.8176 |
| USNE | 0.006802 | 0.003566 | 1.907693 | 0.0583 |
| STIR | 0.539058 | 0.254691 | 2.116516 | 0.0359 |
| LTIR | -0.524213 | 0.265541 | -1.974136 | 0.0502 |
| RECESS | -0.277683 | 0.546268 | -0.508327 | 0.6120 |
| USRECESS | -1.163861 | 0.633924 | -1.835961 | 0.0683 |
| EU | 1.385756 | 1.346529 | 1.029132 | 0.3050 |
| OPH | 0.178896 | 0.043692 | 4.094509 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.286929 | Mean dependent var | 9.637424 |
| Adjusted R-squared | 0.240626 | S.D. dependent var | 3.596411 |
| S.E. of regression | 3.133987 | Akaike info criterion | 5.186829 |
| Sum squared resid | 1512.569 | Schwarz criterion | 5.393893 |
| Log likelihood | -416.9134 | Hannan-Quinn criter. | 5.270884 |
| F-statistic | 6.196737 | Durbin-Watson stat | 0.290435 |
| Prob(F-statistic) | 0.000000 | | |

Dependent Variable: STIR
Method: Least Squares
Date: 12/09/16 Time: 13:02
Sample: 1 165
Included observations: 165

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -0.809855 | 0.851122 | -0.951514 | 0.3428 |
| USPC | -0.000385 | 0.000647 | -0.595736 | 0.5522 |
| USGE | 0.000653 | 0.005071 | 0.128842 | 0.8977 |
| USPI | 0.001682 | 0.001295 | 1.298672 | 0.1960 |
| USNE | -0.000406 | 0.001178 | -0.344880 | 0.7307 |
| UNEMPLOY | 0.087422 | 0.023738 | 3.682802 | 0.0003 |
| LTIR | 0.974641 | 0.034192 | 28.50476 | 0.0000 |
| RECESS | 0.283537 | 0.176482 | 1.606600 | 0.1102 |
| USRECESS | 0.303109 | 0.205067 | 1.478103 | 0.1414 |
| EU | -1.362692 | 0.421369 | -3.233960 | 0.0015 |
| MS | -0.036414 | 0.027709 | -1.314174 | 0.1907 |

| | | | |
|---|---|---|---|
| R-squared | 0.958862 | Mean dependent var | 7.333667 |
| Adjusted R-squared | 0.956191 | S.D. dependent var | 4.836744 |
| S.E. of regression | 1.012357 | Akaike info criterion | 2.926781 |
| Sum squared resid | 157.8296 | Schwarz criterion | 3.133844 |
| Log likelihood | -230.4594 | Hannan-Quinn criter. | 3.010835 |
| F-statistic | 358.9539 | Durbin-Watson stat | 0.696657 |
| Prob(F-statistic) | 0.000000 | | |

## Artificial Regression

Dependent Variable: GDPPERCAP
Method: Least Squares
Date: 12/09/16 Time: 12:59
Sample: 1 165
Included observations: 165

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 18693.41 | 2277.656 | 8.207305 | 0.0000 |
| USPC | 3.709484 | 1.230876 | 3.013694 | 0.0030 |
| USGE | -23.32146 | 8.662184 | -2.692330 | 0.0079 |
| USPI | 1.791630 | 3.205401 | 0.558941 | 0.5770 |
| USNE | 7.234051 | 2.215413 | 3.265329 | 0.0014 |
| UNEMPLOY | 126.2134 | 173.4536 | 0.727649 | 0.4679 |
| STIR | 189.8384 | 1261.892 | 0.150440 | 0.8806 |
| LTIR | -390.8175 | 1236.168 | -0.316153 | 0.7523 |
| RECESS | 460.3543 | 493.2968 | 0.933220 | 0.3522 |
| USRECESS | 215.7977 | 539.4688 | 0.400019 | 0.6897 |
| EU | -1498.896 | 1904.067 | -0.787208 | 0.4324 |
| RESUNEMPLOY | -553.6579 | 136.4267 | -4.058281 | 0.0001 |
| RESSTIR | -922.8648 | 1256.592 | -0.734419 | 0.4638 |

| | | | |
|---|---|---|---|
| R-squared | 0.913272 | Mean dependent var | 28695.30 |
| Adjusted R-squared | 0.906425 | S.D. dependent var | 5422.782 |
| S.E. of regression | 1658.835 | Akaike info criterion | 17.74113 |
| Sum squared resid | 4.18E+08 | Schwarz criterion | 17.98584 |
| Log likelihood | -1450.643 | Hannan-Quinn criter. | 17.84047 |
| F-statistic | 133.3830 | Durbin-Watson stat | 0.309861 |
| Prob(F-statistic) | 0.000000 | | |

## TSLS

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: GDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 13:03
Sample: 1 165
Included observations: 165
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 17440.93 | 2193.562 | 7.950963 | 0.0000 |
| USPC | 3.243986 | 1.533058 | 2.116023 | 0.0360 |
| USGE | -21.55267 | 12.08944 | -1.782767 | 0.0766 |
| USPI | 3.555800 | 3.083662 | 1.153109 | 0.2507 |
| USNE | 7.060460 | 3.200506 | 2.206045 | 0.0289 |
| UNEMPLOY | 211.1489 | 187.8253 | 1.124177 | 0.2627 |
| STIR | -728.2363 | 250.3795 | -2.908530 | 0.0042 |
| LTIR | 508.4404 | 246.7306 | 2.060711 | 0.0410 |
| RECESS | 751.7371 | 425.9117 | 1.765007 | 0.0795 |
| USRECESS | 492.3580 | 561.2618 | 0.877234 | 0.3817 |
| EU | -2783.286 | 1094.046 | -2.544030 | 0.0119 |

| | | | |
|---|---|---|---|
| R-squared | 0.814502 | Mean dependent var | 28695.30 |
| Adjusted R-squared | 0.802457 | S.D. dependent var | 5422.782 |
| S.E. of regression | 2410.201 | Sum squared resid | 8.95E+08 |
| F-statistic | 72.61989 | Durbin-Watson stat | 0.285129 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 6.04E+08 |
| J-statistic | 5.08E-36 | Instrument rank | 11 |

RESET/Zero Mean

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: GDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 15:42
Sample: 1 165
Included observations: 165
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU YHAT^2 YHAT^3 YHAT^4

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -8135459. | 4881632. | -1.666545 | 0.0977 |
| USPC | -2507.208 | 1504.529 | -1.666441 | 0.0977 |
| USGE | 16658.80 | 9993.904 | 1.666896 | 0.0976 |
| USPI | -2759.030 | 1655.415 | -1.666669 | 0.0977 |
| USNE | -5493.731 | 3297.677 | -1.665940 | 0.0978 |
| UNEMPLOY | -163538.0 | 97838.13 | -1.671516 | 0.0967 |
| STIR | 562808.4 | 337474.9 | 1.667705 | 0.0974 |
| LTIR | -393237.2 | 235777.2 | -1.667834 | 0.0974 |
| RECESS | -581529.0 | 348861.8 | -1.666932 | 0.0976 |
| USRECESS | -379813.0 | 227501.7 | -1.669495 | 0.0971 |
| EU | 2151226. | 1290018. | 1.667594 | 0.0975 |
| YHAT^2 | 0.041386 | 0.024760 | 1.671536 | 0.0967 |
| YHAT^3 | -9.67E-07 | 5.78E-07 | -1.673880 | 0.0962 |
| YHAT^4 | 8.33E-12 | 4.97E-12 | 1.675407 | 0.0959 |

| | | | |
|---|---|---|---|
| R-squared | 0.562978 | Mean dependent var | 28695.30 |
| Adjusted R-squared | 0.525354 | S.D. dependent var | 5422.782 |
| S.E. of regression | 3736.002 | Sum squared resid | 2.11E+09 |
| F-statistic | 24.29518 | Durbin-Watson stat | 1.336992 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 4.14E+08 |
| J-statistic | 2.10E-17 | Instrument rank | 14 |

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Wald Test:
Equation: Untitled

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| F-statistic | 1.248077 | (3, 151) | 0.2944 |
| Chi-square | 3.744232 | 3 | 0.2904 |

Null Hypothesis: C(12)=C(13)=C(14)=0
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(12) | 0.041386 | 0.024760 |
| C(13) | -9.67E-07 | 5.78E-07 |
| C(14) | 8.33E-12 | 4.97E-12 |

Restrictions are linear in coefficients.

Separate models by nation/Autocorrelation/Heteroskedasticity

UK

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: UKGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 18:27
Sample: 1979 2011
Included observations: 33
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 7716.853 | 13191.55 | 0.584984 | 0.5645 |
| USPC | 7.560688 | 4.956604 | 1.525377 | 0.1414 |
| USGE | -48.40715 | 37.67504 | -1.284860 | 0.2122 |
| USPI | -3.631905 | 6.502493 | -0.558540 | 0.5821 |
| USNE | 3.892914 | 2.058798 | 1.890868 | 0.0719 |
| UNEMPLOY | 473.3753 | 901.3335 | 0.525194 | 0.6047 |
| STIR | 4665.055 | 4556.324 | 1.023864 | 0.3170 |
| LTIR | -4354.207 | 4140.494 | -1.051615 | 0.3044 |
| RECESS | -5.279154 | 336.1712 | -0.015704 | 0.9876 |
| USRECESS | -299.1493 | 430.3575 | -0.695118 | 0.4943 |
| EU | 778.2800 | 2468.664 | 0.315264 | 0.7555 |

| | | | |
|---|---|---|---|
| R-squared | 0.989663 | Mean dependent var | 27740.97 |
| Adjusted R-squared | 0.984964 | S.D. dependent var | 6423.162 |
| S.E. of regression | 787.6122 | Sum squared resid | 13647327 |
| F-statistic | 211.6541 | Durbin-Watson stat | 1.916376 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 7263661. |
| J-statistic | 1.85E-31 | Instrument rank | 11 |

Correlogram of Residuals Squared

Date: 12/09/16 Time: 18:44
Sample: 1979 2011
Included observations: 33

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob* |
|---|---|---|---|---|---|---|
| | | 1 | -0.089 | -0.089 | 0.2862 | 0.593 |
| | | 2 | 0.316 | 0.311 | 4.0139 | 0.134 |
| | | 3 | -0.012 | 0.039 | 4.0192 | 0.259 |
| | | 4 | 0.312 | 0.240 | 7.8857 | 0.096 |
| | | 5 | -0.056 | -0.029 | 8.0161 | 0.155 |
| | | 6 | 0.230 | 0.088 | 10.283 | 0.113 |
| | | 7 | -0.041 | -0.015 | 10.356 | 0.169 |
| | | 8 | -0.005 | -0.181 | 10.357 | 0.241 |
| | | 9 | -0.065 | -0.073 | 10.563 | 0.307 |
| | | 10 | -0.067 | -0.144 | 10.787 | 0.374 |
| | | 11 | -0.117 | -0.100 | 11.500 | 0.402 |
| | | 12 | -0.114 | -0.079 | 12.217 | 0.428 |
| | | 13 | -0.133 | -0.086 | 13.243 | 0.429 |
| | | 14 | -0.144 | -0.037 | 14.500 | 0.413 |
| | | 15 | -0.157 | -0.074 | 16.080 | 0.377 |
| | | 16 | -0.126 | -0.028 | 17.154 | 0.376 |

*Probabilities may not be valid for this equation specification.

France

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: FRGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 18:31
Sample: 1979 2011
Included observations: 33
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 17490.21 | 5526.958 | 3.164526 | 0.0045 |
| USPC | 4.410004 | 2.228376 | 1.979021 | 0.0605 |
| USGE | -28.04710 | 18.71603 | -1.498561 | 0.1482 |
| USPI | -1.274184 | 6.018044 | -0.211727 | 0.8343 |
| USNE | 3.751462 | 7.169447 | 0.523257 | 0.6060 |
| UNEMPLOY | 402.1247 | 818.9325 | 0.491035 | 0.6283 |
| STIR | -541.6608 | 888.1781 | -0.609856 | 0.5482 |
| LTIR | 604.1500 | 789.5018 | 0.765229 | 0.4523 |
| RECESS | -183.7425 | 415.5419 | -0.442176 | 0.6627 |
| USRECESS | 436.5420 | 536.7813 | 0.813259 | 0.4248 |
| EU | -1139.831 | 531.7245 | -2.143650 | 0.0434 |

| | | | |
|---|---|---|---|
| R-squared | 0.992518 | Mean dependent var | 29947.45 |
| Adjusted R-squared | 0.989118 | S.D. dependent var | 4141.484 |
| S.E. of regression | 432.0359 | Sum squared resid | 4106411. |
| F-statistic | 292.2939 | Durbin-Watson stat | 2.435855 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 3279103. |
| J-statistic | 2.67E-34 | Instrument rank | 11 |

Correlogram of Residuals Squared

Date: 12/09/16 Time: 18:45
Sample: 1979 2011
Included observations: 33

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob* |
|---|---|---|---|---|---|---|
| | | 1 | 0.305 | 0.305 | 3.3532 | 0.067 |
| | | 2 | -0.052 | -0.160 | 3.4553 | 0.178 |
| | | 3 | 0.034 | 0.115 | 3.4996 | 0.321 |
| | | 4 | -0.022 | -0.091 | 3.5182 | 0.475 |
| | | 5 | -0.087 | -0.041 | 3.8297 | 0.574 |
| | | 6 | -0.119 | -0.101 | 4.4364 | 0.618 |
| | | 7 | -0.059 | 0.005 | 4.5885 | 0.710 |
| | | 8 | -0.107 | -0.125 | 5.1173 | 0.745 |
| | | 9 | -0.097 | -0.019 | 5.5698 | 0.782 |
| | | 10 | -0.131 | -0.151 | 6.4266 | 0.778 |
| | | 11 | -0.079 | -0.002 | 6.7565 | 0.818 |
| | | 12 | -0.053 | -0.093 | 6.9125 | 0.863 |
| | | 13 | -0.134 | -0.127 | 7.9562 | 0.846 |
| | | 14 | -0.173 | -0.177 | 9.7836 | 0.778 |
| | | 15 | -0.104 | -0.084 | 10.483 | 0.788 |
| | | 16 | 0.119 | 0.099 | 11.447 | 0.781 |

*Probabilities may not be valid for this equation specification.

Germany

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: DEGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 18:33
Sample: 1979 2011
Included observations: 33
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 18764.82 | 4860.557 | 3.860631 | 0.0008 |
| USPC | 2.930162 | 1.899042 | 1.542969 | 0.1371 |
| USGE | -16.70124 | 15.69723 | -1.063961 | 0.2989 |
| USPI | 12.97236 | 9.150223 | 1.417710 | 0.1703 |
| USNE | 24.12065 | 10.32968 | 2.335082 | 0.0291 |
| UNEMPLOY | -1164.137 | 1105.097 | -1.053426 | 0.3036 |
| STIR | -816.2168 | 868.2147 | -0.940109 | 0.3574 |
| LTIR | 997.2054 | 1038.873 | 0.959891 | 0.3475 |
| RECESS | 1425.761 | 895.2156 | 1.592646 | 0.1255 |
| USRECESS | -1291.872 | 1176.396 | -1.098161 | 0.2840 |
| EU | -2820.172 | 2166.807 | -1.301533 | 0.2065 |

| | | | |
|---|---|---|---|
| R-squared | 0.958324 | Mean dependent var | 30854.06 |
| Adjusted R-squared | 0.939380 | S.D. dependent var | 5372.032 |
| S.E. of regression | 1322.657 | Sum squared resid | 38487290 |
| F-statistic | 52.17324 | Durbin-Watson stat | 1.364825 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 10749143 |
| J-statistic | 0.000000 | Instrument rank | 11 |

Correlogram of Residuals Squared

Date: 12/09/16 Time: 18:47
Sample: 1979 2011
Included observations: 33

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob* |
|---|---|---|---|---|---|---|
| | | 1 | 0.012 | 0.012 | 0.0055 | 0.941 |
| | | 2 | 0.108 | 0.108 | 0.4436 | 0.801 |
| | | 3 | -0.134 | -0.138 | 1.1325 | 0.769 |
| | | 4 | -0.149 | -0.161 | 2.0173 | 0.733 |
| | | 5 | -0.113 | -0.083 | 2.5398 | 0.770 |
| | | 6 | 0.012 | 0.032 | 2.5455 | 0.863 |
| | | 7 | -0.149 | -0.178 | 3.5354 | 0.831 |
| | | 8 | -0.006 | -0.067 | 3.5370 | 0.896 |
| | | 9 | -0.097 | -0.096 | 3.9869 | 0.912 |
| | | 10 | -0.209 | -0.280 | 6.1701 | 0.801 |
| | | 11 | -0.062 | -0.146 | 6.3704 | 0.848 |
| | | 12 | -0.116 | -0.203 | 7.1052 | 0.851 |
| | | 13 | 0.135 | -0.006 | 8.1559 | 0.833 |
| | | 14 | 0.200 | 0.053 | 10.594 | 0.718 |
| | | 15 | 0.169 | 0.020 | 12.423 | 0.647 |
| | | 16 | -0.039 | -0.171 | 12.525 | 0.707 |

*Probabilities may not be valid for this equation specification.

Spain

Dependent Variable: SPGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 18:35
Sample: 1979 2011
Included observations: 33
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 13784.77 | 1334.868 | 10.32669 | 0.0000 |
| USPC | 5.921319 | 0.748789 | 7.907856 | 0.0000 |
| USGE | -39.53046 | 6.492665 | -6.088479 | 0.0000 |
| USPI | -0.831297 | 1.365972 | -0.608575 | 0.5490 |
| USNE | 6.496840 | 1.469834 | 4.420118 | 0.0002 |
| UNEMPLOY | 35.87369 | 53.40340 | 0.671749 | 0.5087 |
| STIR | -41.19358 | 133.0900 | -0.309517 | 0.7598 |
| LTIR | 64.04299 | 127.6505 | 0.501706 | 0.6209 |
| RECESS | -129.0002 | 186.5393 | -0.691544 | 0.4965 |
| USRECESS | 141.5903 | 229.2436 | 0.617641 | 0.5432 |
| EU | -1236.040 | 529.5761 | -2.334017 | 0.0291 |

| | | | |
|---|---|---|---|
| R-squared | 0.995310 | Mean dependent var | 26014.21 |
| Adjusted R-squared | 0.993178 | S.D. dependent var | 5612.631 |
| S.E. of regression | 463.5670 | Sum squared resid | 4727676. |
| F-statistic | 467.0195 | Durbin-Watson stat | 2.075653 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 4453769. |
| J-statistic | 0.000000 | Instrument rank | 11 |

Correlogram of Residuals Squared

Date: 12/09/16 Time: 18:48
Sample: 1979 2011
Included observations: 33

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob* |
|---|---|---|---|---|---|---|
| | | 1 | 0.447 | 0.447 | 7.2187 | 0.007 |
| | | 2 | 0.104 | -0.121 | 7.6179 | 0.022 |
| | | 3 | 0.032 | 0.043 | 7.6575 | 0.054 |
| | | 4 | 0.012 | -0.011 | 7.6631 | 0.105 |
| | | 5 | -0.123 | -0.158 | 8.2861 | 0.141 |
| | | 6 | -0.059 | 0.088 | 8.4340 | 0.208 |
| | | 7 | -0.003 | -0.015 | 8.4345 | 0.296 |
| | | 8 | -0.062 | -0.083 | 8.6105 | 0.376 |
| | | 9 | -0.107 | -0.040 | 9.1637 | 0.422 |
| | | 10 | -0.114 | -0.085 | 9.8140 | 0.457 |
| | | 11 | -0.139 | -0.076 | 10.833 | 0.457 |
| | | 12 | -0.131 | -0.031 | 11.779 | 0.464 |
| | | 13 | -0.129 | -0.095 | 12.744 | 0.468 |
| | | 14 | -0.096 | -0.027 | 13.300 | 0.503 |
| | | 15 | -0.009 | 0.044 | 13.305 | 0.579 |
| | | 16 | -0.003 | -0.064 | 13.305 | 0.650 |

*Probabilities may not be valid for this equation specification.

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: SPGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 20:13
Sample (adjusted): 1980 2011
Included observations: 32 after adjustments
Convergence achieved after 42 iterations
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU
Lagged dependent variable & regressors added to instrument list

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 14047.76 | 1280.565 | 10.96997 | 0.0000 |
| USPC | 6.377526 | 0.656166 | 9.719383 | 0.0000 |
| USGE | -42.84818 | 5.449545 | -7.862707 | 0.0000 |
| USPI | -1.410641 | 1.284104 | -1.098541 | 0.2850 |
| USNE | 7.017080 | 1.207771 | 5.809943 | 0.0000 |
| UNEMPLOY | 33.44968 | 42.76912 | 0.782099 | 0.4433 |
| STIR | -83.14383 | 137.1922 | -0.606039 | 0.5513 |
| LTIR | 97.43947 | 124.7223 | 0.781252 | 0.4438 |
| RECESS | -154.1440 | 196.7510 | -0.783447 | 0.4425 |
| USRECESS | 98.76483 | 229.2936 | 0.430735 | 0.6713 |
| EU | -1530.670 | 528.4267 | -2.896654 | 0.0089 |
| AR(1) | -0.313385 | 0.269564 | -1.162562 | 0.2587 |

| | | | |
|---|---|---|---|
| R-squared | 0.995229 | Mean dependent var | 26257.44 |
| Adjusted R-squared | 0.992605 | S.D. dependent var | 5522.916 |
| S.E. of regression | 474.9483 | Sum squared resid | 4511517. |
| Durbin-Watson stat | 1.832058 | J-statistic | 18.07772 |
| Instrument rank | 22 | Prob(J-statistic) | 0.053667 |
| Inverted AR Roots | -.31 | | |

Italy

Dependent Variable: ITGDPPERCAP
Method: Two-Stage Least Squares
Date: 12/09/16 Time: 18:36
Sample: 1979 2011
Included observations: 33
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 9588.180 | 2585.446 | 3.708521 | 0.0012 |
| USPC | 5.063899 | 1.257284 | 4.027648 | 0.0006 |
| USGE | -37.18705 | 9.455928 | -3.932671 | 0.0007 |
| USPI | -2.018063 | 2.468150 | -0.817642 | 0.4223 |
| USNE | -1.634625 | 3.519052 | -0.464507 | 0.6468 |
| UNEMPLOY | 1039.491 | 200.1891 | 5.192548 | 0.0000 |
| STIR | -31.45994 | 155.6641 | -0.202101 | 0.8417 |
| LTIR | 234.7382 | 171.7301 | 1.366902 | 0.1855 |
| RECESS | 624.7537 | 362.8886 | 1.721613 | 0.0992 |
| USRECESS | 194.9565 | 350.4103 | 0.556366 | 0.5836 |
| EU | -1440.710 | 725.1857 | -1.986677 | 0.0596 |

| | | | |
|---|---|---|---|
| R-squared | 0.976590 | Mean dependent var | 28919.82 |
| Adjusted R-squared | 0.965950 | S.D. dependent var | 4136.735 |
| S.E. of regression | 763.3410 | Sum squared resid | 12819170 |
| F-statistic | 93.75778 | Durbin-Watson stat | 1.542225 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 1285603. |
| J-statistic | 1.66E-37 | Instrument rank | 11 |

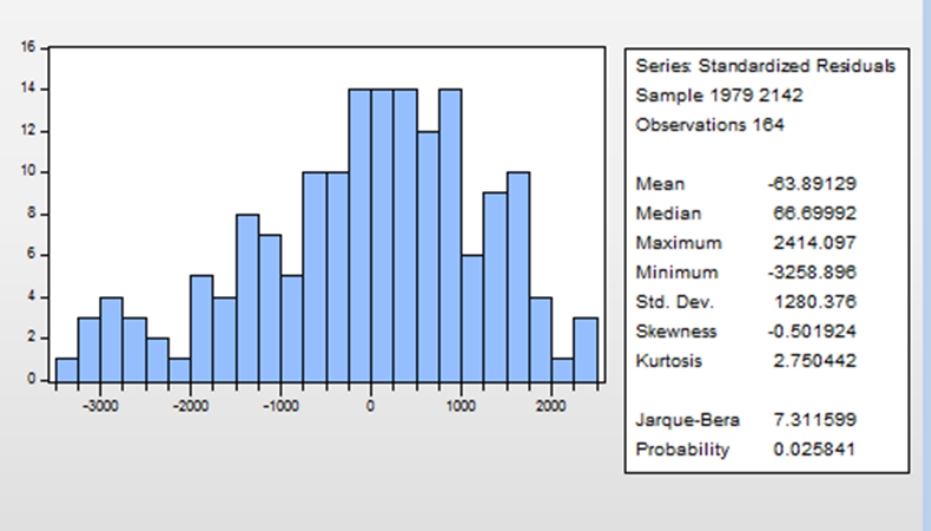
Correlogram of Residuals Squared

Date: 12/09/16 Time: 18:50
Sample: 1979 2011
Included observations: 33

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob* |
|---|---|---|---|---|---|---|
| | | 1 | 0.065 | 0.065 | 0.1502 | 0.698 |
| | | 2 | 0.084 | 0.081 | 0.4154 | 0.812 |
| | | 3 | 0.129 | 0.120 | 1.0512 | 0.789 |
| | | 4 | -0.008 | -0.029 | 1.0537 | 0.902 |
| | | 5 | -0.100 | -0.121 | 1.4646 | 0.917 |
| | | 6 | 0.075 | 0.076 | 1.7034 | 0.945 |
| | | 7 | -0.070 | -0.057 | 1.9194 | 0.964 |
| | | 8 | -0.074 | -0.055 | 2.1742 | 0.975 |
| | | 9 | -0.073 | -0.080 | 2.4275 | 0.983 |
| | | 10 | -0.117 | -0.097 | 3.1183 | 0.979 |
| | | 11 | 0.013 | 0.072 | 3.1266 | 0.989 |
| | | 12 | 0.165 | 0.189 | 4.6293 | 0.969 |
| | | 13 | -0.061 | -0.073 | 4.8440 | 0.978 |
| | | 14 | 0.015 | -0.039 | 4.8569 | 0.988 |
| | | 15 | -0.097 | -0.162 | 5.4635 | 0.987 |
| | | 16 | -0.057 | -0.008 | 5.6876 | 0.991 |

*Probabilities may not be valid for this equation specification.

Normality




Final Model

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: GDPPERCAP
Method: Two-Stage Least Squares
Date: 12/10/16 Time: 18:34
Sample: 1979 2142
Included observations: 164
Weighting series: SEWEIGHT
Weight type: Standard deviation (average scaling)
Instrument specification: C USPC USGE USPI USNE OPH STIR LTIR RECESS USRECESS EU AC

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 20028.88 | 1314.192 | 15.24045 | 0.0000 |
| USPC | 3.972431 | 0.876018 | 4.534647 | 0.0000 |
| USGE | -25.42139 | 7.218465 | -3.521717 | 0.0006 |
| USPI | 1.709532 | 1.695429 | 1.008318 | 0.3149 |
| USNE | 7.499329 | 1.809837 | 4.143648 | 0.0001 |
| UNEMPLOY | 0.850802 | 103.3433 | 0.008233 | 0.9934 |
| STIR | -175.1895 | 133.1934 | -1.315302 | 0.1904 |
| LTIR | 37.77309 | 137.0474 | 0.275621 | 0.7832 |
| RECESS | 347.2957 | 228.1974 | 1.521909 | 0.1301 |
| USRECESS | 135.5460 | 299.2346 | 0.452976 | 0.6512 |
| EU | -1916.872 | 561.8345 | -3.411809 | 0.0008 |
| AC | 2156.678 | 1159.030 | 1.860761 | 0.0647 |

| Weighted Statistics | | | |
|---|---|---|---|
| R-squared | 0.955400 | Mean dependent var | 28737.75 |
| Adjusted R-squared | 0.952173 | S.D. dependent var | 13117.96 |
| S.E. of regression | 1327.557 | Sum squared resid | 2.68E+08 |
| F-statistic | 296.0155 | Durbin-Watson stat | 0.273799 |
| Prob(F-statistic) | 0.000000 | Second-Stage SSR | 2.68E+08 |
| Weighted mean dep. | 30988.14 | J-statistic | 1.70E-35 |
| Instrument rank | 12 | | |

| Unweighted Statistics | | | |
|---|---|---|---|
| R-squared | 0.930175 | Mean dependent var | 30337.44 |
| Adjusted R-squared | 0.925122 | S.D. dependent var | 5961.608 |
| S.E. of regression | 1631.321 | Sum squared resid | 4.05E+08 |
| Durbin-Watson stat | 0.236642 | | |

Wald Test

Wald Test:
Equation: Untitled

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| F-statistic | 83.04663 | (4, 152) | 0.0000 |
| Chi-square | 332.1865 | 4 | 0.0000 |

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=0
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(2) | 3.972431 | 0.876018 |
| C(3) | -25.42139 | 7.218465 |
| C(4) | 1.709532 | 1.695429 |
| C(5) | 7.499329 | 1.809837 |

Restrictions are linear in coefficients.

**Appendix C**

*Chow Test*

$F = \{[SSRp – (SSR1 + SSR2 + SSR3 + SSR4 + SSR5)] / (SSR1 + SSR2 + SSR3 + SSR4 + SSR5)\} * \{[n – 2(k + 1)] / (k + 1)\}$

SSRp= 268000000

SSR1= 13647327

SSR2= 4106411

SSR3= 38487290

SSR4= 4511517

SSR5= 12819170

n= 164

k= 11

$F(11,164) = 30.83$

p-value = <.0001

All other tests were conducted in EViews. All t-statistic p-values are two-tailed. Results can be found in Appendix B.