

***The Relationship between imports, GDP and  
CPI/Inflation in UK***

*An empirical study using Eviews*

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## **Introduction**

The relationship between imports, GDP and CPI has been controversial among researchers, economists and how they would affect each other. Here in my research paper I brought up the same research issue and analyzing their effects on economic growth of UK. I would consider the impact of GDP and inflation on imports of UK. I would expand and review some pre researches done in this field and then would run the data into Eviews package program.

### **Literature review**

#### *Inflation*

A general increase in overall prices of all goods and services in an economy is called inflation. Inflation is an upward movement in price levels which is opposed to deflation. An extreme inflation can be called hyperinflation.

#### *GDP (Gross domestic product)*

The value of all the finished goods and services produced within a country's borders in a specific time period. GDP includes all private and public consumption, government outlays, investments, private inventories, paid-in construction costs and the foreign balance of trade exports are added, imports are subtracted. GDP is calculated annually or quarterly. GDP is commonly used as an indicator of the economic health of a country, as well as a gauge of a country's standard of living.

#### *Import*

Imports is the flow of goods and services from foreign country to home country. GDP is commonly used as an indicator of the economic health of a country, as well as a measure of a country's standard of living

Now coming to the main research problem; Ariful Islam, 2013 Argues that there is no country in this world which is completely self-sufficient. So each nation has needs that their own country cannot produce it so they have to obtain it through international trade which import is involves here. He finds after his research that inflation has a little impact on imports which is very insignificant. He states that import of a country doesn't rely on inflation alone but is influenced by

economic stability, market demand and so on and so forth. He considers in his paper a correlation analysis.

According to Uğur, 2008 he considers a VAR analysis to determine the relationship between imports and GDP. He applies a granger causality test and his test states a bidirectional relationship between GDP and IMP.

## **Methodology and Empirical Analysis**

Now concerning my methodology and data analysis, once again I would like to mention my research topic here which is the relationship between GDP, CPI and imports of UK. The data used in my paper are yearly covering from 1990-2015. The variables given in equation is imports (Imp), gross domestic product (GDP), and Consumer price index (CPI). Both Imports and GDP are measured in US dollars and the CPI is measured by its growth percentage. I have picked my data from World Bank and OECD.org.

$$\text{LNIMP} = C + \beta_1 \text{LNGDP} + \beta_2 \text{LNCPI} + e_i \dots \dots \text{ (I)}$$

In equation I our dependent variable is imports in left hand and the independent variables are GDP and CPI in right hand. This is a log-log form; we transformed to log variables because it normalizes more our data and reduce skewness. *Data is shown is appendix part*

I would run my data and my equation into Eviews package program and orderly would do my statistical tests and hypothesis.

$H_0: \beta_1 = 0$  (slope coefficients are statistically significant)

$H_1: \beta_1 \neq 0$

Although I will not be able to encompass every statistical tests, or graphs due to broadness of area and time consuming.

The study used OLS estimation method to find out the relationships between variables...

- First stationary test
- Secondly cointegration
- later regression results

- lastly causality test results and heteroscedasticity

My regression result appears below as

Dependent Variable: LNIMP

Method: Least Squares

Date: 12/11/17 Time: 18:06

Sample: 1990 2015

Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.108374	1.117011	-3.678008	0.0012
LNGDP	1.011716	0.056668	17.85353	0.0000
LNCPI	0.554977	0.125544	4.420580	0.0002
R-squared	0.991953	Mean dependent var	26.96357	
Adjusted R-squared	0.991253	S.D. dependent var	0.449657	
S.E. of regression	0.042053	Akaike info criterion	-3.391587	
Sum squared resid	0.040675	Schwarz criterion	-3.246422	
Log likelihood	47.09063	Hannan-Quinn criter.	-3.349785	
F-statistic	1417.627	Durbin-Watson stat	1.399306	
Prob(F-statistic)	0.000000			

### Regression output analysis

My regression output appearing above is divided into three parts. The top panel summarizes the input into regression and the middle part gives information about each regression coefficient and the bottom part provides summary statistics about the whole regression equation. The most important elements of my EViews regression output are the estimated regression coefficients and the statistics associated with each coefficient. Which are my std.Error, t-statistics and prob.

The coefficients are positively related with dependent variable. We see here that the p-value for GDP is 0.0 and for CPI is 0.002 which is less than 0.05 and we can call that these variables as

significant in our regression analysis. Although the probability of our whole regression is 0 which states the significance of our model. The t-stat for GDP is higher than 2 both for CPI and GDP which shows the significance of our variables.

R<sup>2</sup> (R squared) measures the overall fit of the regression, if it is close to 1 means the regression fits the data perfectly and if it is close to 0 it's in contraire. It measures what fraction of left hand side variable is explained by regression. Our regression accounts for 99 % of variation in dependent variables which means that approximately 99% of variation in imports are explained by GDP and CPI.

The estimated standard deviation of the error term is 0.04%. We shouldn't confuse ourselves with the standard error of coefficients and the regression they both account for different purposes.

The "Mean dependent var" and S.D dependent var report the sample mean and standard deviation of left hand side variable.

The F-statistic shows the F-test of all joint hypothesis of independent variables which means whether GDP or CPI can jointly influence the IMP. And for the test of F-statistics we need F (probability) or p-value which in my regression it is 0.0 which is less than 0.05 it shows the significance of the two independent variables which influence jointly the dependent variable

**Interpretation of equation** can be summarized as; holding CPI fixed a 1% increase in GDP will increase the imports by 1.01% and holding GDP fixed a 1% increase in CPI would lead to an increase of imports by 0.55%. Here we see the units are considered as dollars because it's a growth model we took log of this equation and there is positive relationships between variables.

### **Descriptive statistics**

The descriptive statistics shown in appendix, talks about the mean, median, prob and so on. Well this is not our concern so we would leave it for qualitative data.

### **Hypothesis test (Wald Test)**

The **Wald test** (also called the Wald Chi-Squared Test) is a way to find out if explanatory variables in a model are significant. "Significant" means that they add something to the model; variables that add nothing can be deleted without affecting the model in any meaningful way. . According to Wald we name the coefficients as c1 c2 c3 c4 and so on. For example, in our

regression c2 is 1.011 and c3 is 0.554. So let's do our hypothesis test, assuming that our null hypothesis is  $C(2) = 0$ ; although we know that our C2 is 1.011 but just it's a hypothesis test

Wald Test:

Equation: EQ01

Test Statistic	Value	df	Probability
t-statistic	17.85353	23	<b>0.0000</b>
F-statistic	318.7485	(1, 23)	<b>0.0000</b>
Chi-square	318.7485	1	<b>0.0000</b>

Null Hypothesis:  $C(2)=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	<b>1.011716</b>	0.056668

Restrictions are linear in coefficients.

We have here our null hypothesis is  $C(2) = 0$  but if we check the prob, we have 0 p-value which is less than 0.05 and we reject this hypothesis our C2 is not 0. But if we give the exact value of C2 which is 1.011716 then we would have a prob of 1 which is bigger than 0.05 and we do not reject the null hypothesis which states that  $C2=1.011716$

Wald Test:

Equation: EQ01

Test Statistic	Value	df	Probability
t-statistic	-6.98E-06	23	1.0000
F-statistic	4.87E-11	(1, 23)	1.0000
Chi-square	4.87E-11	1	1.0000

Null Hypothesis: C(2)=1.011716

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1.011716 + C(2)	-3.95E-07	0.056668

Restrictions are linear in coefficients.

### Stationarity and non-stationarity of variables

A *stationary* time series is one whose statistical properties such as mean, variance, autocorrelation, etc. are all constant over time. If the time series is not stationary, we can often transform it to stationarity with one of the following techniques. But all these techniques would be done by in Eviews package program.

#### *Correlogram and stationarity*

Now we want to know if our variables are stationary or not. By applying the correlogram we would find their correlation. Let us write our null hypothesis H1: variable has stationarity.

Date: 12/06/17 Time: 19:15

Sample: 1990 2015

Included observations: 26

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
.  *****	.  *****	1	<b>0.912</b>	0.912	24.211	<b>0.000</b>
.  *****	.**  .	2	<b>0.795</b>	-0.215	43.389	<b>0.000</b>
.  *****	.   .	3	<b>0.680</b>	-0.028	58.040	<b>0.000</b>
.  *****	.*  .	4	<b>0.554</b>	-0.150	68.184	<b>0.000</b>
.  ***	.   .	5	<b>0.435</b>	-0.007	74.742	<b>0.000</b>
.  ** .	.   .	6	<b>0.344</b>	0.069	79.047	<b>0.000</b>

We see above that the auto correlations of the dependent variable (LNIMP) is gradually shrinking

and changing vastly. From their p-value we can easily derive that they are all 0 which is less than 0.05 so we reject the null hypothesis and our variable has not stationarity. But this was at level which means at the same value of data but now we take the first difference we would find that

Date: 12/06/17 Time: 19:21

Sample: 1990 2015

Included observations: 25

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
.  * .	.  * .	1 <b>0.092</b>	0.092	0.2389	<b>0.625</b>
.   .	. *  .	2 <b>-0.062</b>	-0.071	0.3518	<b>0.839</b>
. *  .	. *  .	3 <b>-0.084</b>	-0.073	0.5707	<b>0.903</b>
. *  .	. *  .	4 <b>-0.132</b>	-0.124	1.1329	<b>0.889</b>
. **  .	. **  .	5 <b>-0.241</b>	-0.236	3.0930	<b>0.686</b>
.  * .	.  * .	6 <b>0.086</b>	0.105	3.3528	<b>0.763</b>
.   .	.   .	7 <b>0.064</b>	-0.003	3.5082	<b>0.834</b>
.  * .	.  * .	8 <b>0.166</b>	0.137	4.5959	<b>0.800</b>
.   .	. *  .	9 <b>-0.008</b>	-0.075	4.5985	<b>0.868</b>

All of the above p-values are bigger than 0.05 which state that we cannot reject the H1 and our variable is now become stationary by taking the first difference. I would not apply it for the other variable (CPI & GDP) because the procedure is all same that we have to take the first difference.

second way by ADF having unit test, null hypothesis it has unit root which means is non stationary at the level it's all stationary for all the 3 models but at 1<sup>st</sup> difference its becoming stationary and rejecting the null one which says It has unit root. After this we have to use the difference of variables if we want to have stationary

### ***Unit Root Test***

Another way of transforming a non-stationary variable to stationary is unit root test. In statistics, a **unit root test** tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root (non-stationarity) and the alternative hypothesis is the presence of stationarity. The famous and commonly used test is ADF Augmented dickey-fuller test. Now applying for LNGDP to test the unit root. First we have to concern about the null hypothesis H1 which says that variable has unit root or non-stationary. Let's draw it. the table below is at level or the original form of data which is LNGDP

#### **Null Hypothesis: LNGDP has a unit root**

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.047965	<b>0.7195</b>
Test critical values: 1% level	-3.724070	
5% level	-2.986225	
10% level	-2.632604	

\*MacKinnon (1996) one-sided p-values.

So we check the p-value which is 0.71; is bigger than 0.05 so we do not reject the null hypothesis and LNGDP has unit root or is non-stationary.

Now applying the first difference of LNGDP we would have

#### **Null Hypothesis: D(LNGDP) has a unit root**

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
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Augmented Dickey-Fuller test statistic	-3.579296	<b>0.0143</b>
Test critical values: 1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

We have our p-value 0.01 which is smaller than 0.05 so we reject the null hypothesis and now DLNGDP has stationarity. After this we would use the first difference our all variables for further test such causality and etc.

### Johansen Cointegration Test

For Johansenn test we need the data at level not the 1<sup>st</sup> or 2<sup>nd</sup> difference. So here we have

#### Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.636051	36.40115	29.79707	<b>0.0075</b>
At most 1	0.333633	12.14336	15.49471	<b>0.1502</b>
At most 2	0.095216	2.401422	3.841466	<b>0.1212</b>

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

For the trace test type we have the null hypothesis bolded in table which states the number of cointegrated equations. We see here that there is only one cointegration equation because we reject the null hypothesis for the first H1 which is 0.0075 and for the rest p-values are bigger that 0.05 which we do not reject them. Now coming the second type which is Maximum Eigenvalue

### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.636051	24.25779	21.13162	<b>0.0175</b>
At most 1	0.333633	9.741937	14.26460	<b>0.2294</b>
At most 2	0.095216	2.401422	3.841466	<b>0.1212</b>

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Here we have the same history, all the p-values are bigger than 0.05 except for the H1 which is 0.01(smaller than 0.05) we should reject and the rest meaning that we shouldn't reject the H2 and H3. As a result, we can say both trace

### Correlation analysis

Applying the correlation analysis is very simple. We want to consider the correlation between LNIMP, LNGDP & LNCPI. And here we go

	LNIMP	LNGDP	LNCPI
LNIMP	1	0.9925	0.9383
LNGDP	0.9925	1	0.9110
LNCPI	0.9383	0.9110	1

<input type="checkbox"/> .00-.19	"very weak"
<input type="checkbox"/> .20-.39	"weak"
<input type="checkbox"/> .40-.59	"moderate"
<input type="checkbox"/> .60-.79	"strong"
<input type="checkbox"/> .80-1.0	"very strong"

Now analyzing the correlation between these variables: as the black box above states about the correlation weaknesses and strengths.

The correlation between imports and GDP is cited in “very strong”, the correlation between imp and CPI locates in “very strong “. Because both cites in above 0.9

### Granger Causality test

**Definition review:** *Causality* is closely related to the idea of cause-and-effect, although it isn't exactly the same. A variable X is causal to variable Y if X is the cause of Y *or* Y is the cause of X. However, with Granger causality, you aren't testing a true cause-and-effect relationship; what you want to know is if a particular variable comes before another in the time series

**Running the test:** for us to run the test first we have to make it sure that our variables are in stationarity mode if not then we have to change it to stationary mode but we have done it previously so no need to do it again. Here we consider 2 lags in our observation.

#### Pairwise Granger Causality Tests

Date: 12/12/17 Time: 07:08

Sample: 1990 2015

Lags: 2

<b>Null Hypothesis:</b>	Obs	F-Statistic	Prob.
<hr/>			
DLNGDP does not Granger Cause			
DLNIMP	23	2.32470	<b>0.1265</b>
DLNIMP does not Granger Cause DLNGDP		1.32441	<b>0.2907</b>
<hr/>			
DLNCPI does not Granger Cause			
DLNIMP	22	0.12617	<b>0.8823</b>
DLNIMP does not Granger Cause DLNCPI		0.08424	<b>0.9196</b>
<hr/>			
DLNCPI does not Granger Cause			
DLNGDP	22	0.01011	<b>0.9900</b>
DLNGDP does not Granger Cause DLNCPI		1.43097	<b>0.2665</b>
<hr/>			

As we can see in bolded data in table above, our null hypothesis are written there and our p-values as well. All our p-values are bigger than 0.05 which means that we do not have to reject the null hypothesis H1. So none of them cause each other or no existence of granger causality.

### Heteroscedasticity and homoscedasticity

The word “heteroscedasticity” comes from the Greek, and quite literally means data with a different (*hetero*) dispersion (*skedasis*). In simple terms, heteroscedasticity is any set of data that isn’t homoscedastic, homoscedasticity means the variance of errors are constant. And homoscedasticity is always desirable, our null and alternative hypothesis

H1=Homoscedasticity

H2= heteroscedasticity

#### Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.028050	Prob. F(2,23)	0.9724
Obs*R-squared	0.063264	Prob. Chi-Square(2)	<b>0.9689</b>
Scaled explained SS	0.026067	Prob. Chi-Square(2)	0.9871

Concerning the R-squared, we have to see its p-value which is 0.96 (larger than 0.05) so we do not reject the null hypothesis and our residuals are homoscedastic which is desirable. We have to make it sure that we have the log of our variables if we don’t have we have to convert them to log.

### Results and conclusion

After a brief analysis of my regression output and my equation now I would like to express my equation in mathematical format for better understandings

$$\text{Lnimp} = -4.1 + 1.01\text{gdp} + 0.55\text{cpi}$$

T-stat	-3.678	17.853	4.420
Std Error	1.11	0.056	0.125
P-value	0.001	0	0.0002

We conclude that between the left hand and right hand or between dependent and independent variables there is positive relationships and between all these dependent and independent, there is significance and our model regression is fitting good.

## Appendix

1- data ( Lnimp,Lngdp and Lncpi )

	lnimp	lngdp	lncpi
1990	26.30952	27.7201	4.133565
1991	26.26149	27.7645	4.206184
1992	26.32197	27.79625	4.248495
1993	26.27986	27.6906	4.272491
1994	26.38691	27.76248	4.291828
1995	26.52838	27.90885	4.318821
1996	26.60901	27.96247	4.342506
1997	26.67864	28.06091	4.360548
1998	26.71788	28.11564	4.377014
1999	26.75992	28.13311	4.389499
2000	26.80836	28.12293	4.398146

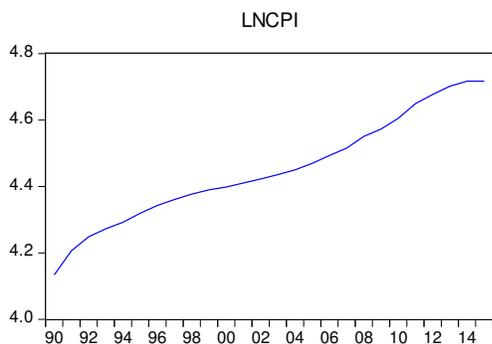
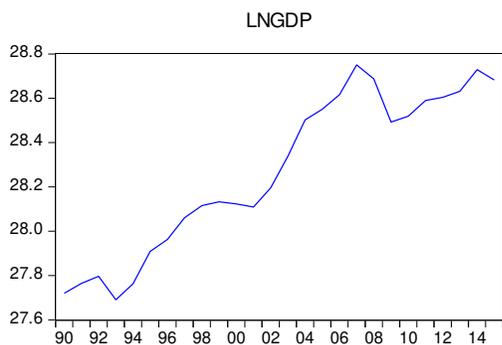
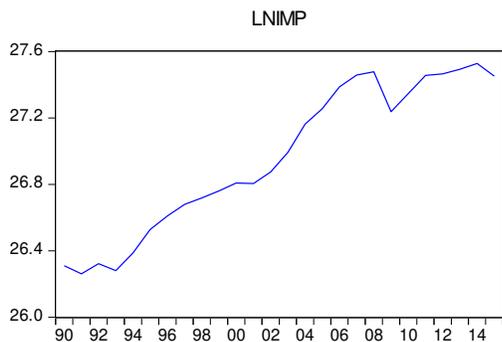
2001	26.80515	28.10914	4.410371
2002	26.87406	28.19495	4.422449
2003	26.99288	28.33831	4.435567
2004	27.16202	28.5019	4.449685
2005	27.25557	28.55055	4.46935
2006	27.38721	28.6162	4.493121
2007	27.45846	28.75042	4.515245
2008	27.47838	28.68723	4.550714
2009	27.23718	28.4927	4.572647
2010	27.34648	28.51878	4.60517
2011	27.45623	28.58992	4.649187
2012	27.4655	28.60407	4.67656
2013	27.49243	28.63147	4.701389
2014	27.52734	28.72924	4.716712
2015	27.45196	28.68222	4.716712

## 2- Descriptive analysis

	LNIMP	LNGDP	LNCPI
Mean	26.96357	28.27058	4.450922
Median	26.93347	28.26663	4.429008
Maximum	27.52734	28.75042	4.716712
Minimum	26.26149	27.69060	4.133565
Std. Dev.	0.449657	0.359938	0.162467
Skewness	-0.202126	-0.228718	0.090784
Kurtosis	1.573492	1.594647	2.184596
Jarque-Bera	2.381539	2.366288	0.756005

Probability	0.303987	0.306314	0.685229
Sum	701.0528	735.0350	115.7240
Sum Sq. Dev.	5.054784	3.238885	0.659892
Observations	26	26	26

### Graphical Visual



## References

- 1- *Ahmet Uğur,(2008), Import and Economic Growth in Turkey: Evidence from Multivariate VAR Analysis, Journal of Economics and Business Vol. XI – 2008, No 1 & No 2*
- 2- *Md. Ariful Islam,(2013), Impact of inflation on import: An empirical study, International Journal of Economics, Finance and Management Sciences, BASIC Bank Limited, Khulna, Bangladesh*
- 3- *Vincent Moyo and Alexander Mapfumo, Causal relationship between import and economic growth in Zimbabwe: An empirical study, The economic and finance letters,*