

Exchange rate re-examined: The varying impact of import and export on exchange rate volatility

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Abstract: *This paper examines the varying impact of the Import and Export on the impulsiveness nature of the Exchange Rate in four EU (European Union) economies such as Austria, Germany, France and Italy for a period of 56 years from 1960 – 2015. In achieving an accurate result for testing this competing null hypothesis, variables are pooled by regression and the computation of random effects model is found to be rational upon which, the ultimate conclusion is drawn. The statistical results obtained from random effects model show that export is not a significant variable to impact the exchange rate while the import is found to be significant to impact the impulsiveness of the exchange rate across the economies over the concerned period of time. The validity and non-existence of cross sectional independence is further documented by statistical results obtained from the Hausman test.*

Keywords: *Fixed Effects; Random Effects; Impulsiveness; Export; Import; Exchange Rate*

1. INTRODUCTION

Exchange rate is one of the macroeconomic variables that exhibits volatility and elasticity both in aggregate and disaggregate form majorly caused by import and export over time. This elasticity mostly moves through a transition process from the developed and industrial economies within the EU (European Union) bound (Vita & Abbott, 2004)[20] and UK is one of those economies which remains mostly unaffected by such elasticity both at aggregate and sectorial levels in short runs though, various southern and new EU member states suffer from this phenomenon. On the other hand, open economies hosting the exchange rate trading in addition to other economic commodities are also prone to such elasticity and their exchange rate pass through a frequent volatility (Hairault & Sopraseuth, 2004[11]; Chue & Cook, 2008)[6].

Bauer & Herz (2005)[1] state that EU accession countries have strong incentives to stabilize their exchange rates with respect to the euro as the nominal anchor and most of the central and eastern EU countries enjoy a stabilized management though, other monetary participants must pay due care in managing their exchange rate elasticity at short and long runs (see also, Beirne & Bijsterbosch, 2011[3]; Hairault & Sopraseuth, 2004[11]; Mattsson, et al., 2008[15]; Rey, 2006)[17].

Walter (2008) argues that on the political economy of exchange rate, import and export, it is essential to understand that who will endorse and who will oppose certain exchange rate policies and how the global trades (import and export) change over time and how well this can be managed.

Jimboean (2013)[14] investigates a dynamic panel data and finds that inflation volatility is a significant driver to

varying impact of exchange rate in the EU countries and concludes on import dependence as an output gap in the EU and global outlook.

Fidrmuc & Horváth (2008)[9] examine a set of daily exchange rate observations related to new EU member states (Czech Republic, Hungary, Poland, Romania, and Slovakia) from 1999 – 2006 and find that the low credibility of exchange rate management implied higher volatility of exchange rates when it is substantially deviated from the implicit target rates for all countries.

Bernhard & Leblang (1999) [4]examine the exchange rate arrangements adopted by industrial democracies in twenty EU countries as a time series concern and find that arguments concerning the volatility of exchange rate is grounded by legitimate political institutions driving the EU economies within and in between them (see also, Dominguez & Tesar, 2006[7]; Chkili & Nguyen, 2014)[5] in addition to critiques raised on trading deals of EU with Russia and its impulsiveness by Russian currency (see for instance, Van, 2009[19]; Hughes, 2006)[13].

In this paper, I re-examine the import and export as explanatory variables with regards to their varying impacts on exchange rate on a set of time series panel data relating to Austria, Germany, France and Italy. The remainder part of this article is organized as follow. Section 2 presents the Data and Research Methodology, section 3 reiterates the research findings and results and section 4 concludes the paper followed by author's acknowledgement and list of references.

2. DATA AND METHOD

2.1 Data

This paper uses a set of time series panel or longitudinal data for four countries like Austria, Germany, France and Italy presenting their exchange rate (Euro to US\$) as an endogenous variable, export and import as explanatory variables expressed in Euro currency. The data covers the annual observations for the period 1960 – 2015 and is retrieved from European Commission: Directorate General ECFIN Economic and Financial Affairs [2015].

Table 1: Descriptive Statistics

Var	Mean	St. Dev.	Min.	Max.
Ex(log)	12.3032	10.5917	[.97494]	21.60404
Exp(log)	12.7801	2.82717	[.30954]	15.22606
Imp(log)	12.8109	2.98388	[.37264]	15.51607
		Arch 1-2 Test:		0.693101
		Arch 1-1 Test:		0.851772
		Hetero-X Test:		0.659556

Sample: 1960 – 2015, Observation: 224

[] Denotes negative sign

Table 1 presents the descriptive statistics for three variables used in this paper. The variables are statistically analyzed in their logarithmic form which is shown by (log) in the above table.

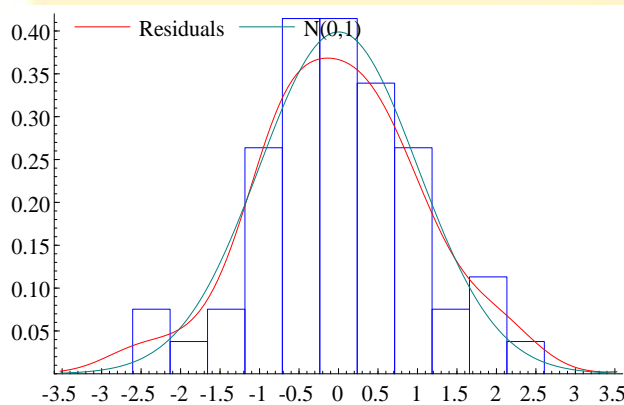


Fig. 1: Test of Normality

In addition to non-existence of ARCH 1,1 and 1,2 effects in the residuals of the variables, the randomness and normal distribution of the residuals is also documented by the corresponding p-value of 0.6013 being > 0.05 which concludes the acceptance of null hypothesis being the residuals are normally distributed among the series.

2.2 Method

The variables are pooled by regression for all the represented observations throughout the period to investigate the significance of independent variables explaining the endogenous variable for which, the following regression model is initially computed:

$$y_i = \beta_0 + \beta_1 X_i + \dots + \varepsilon_i \quad (\text{Eq. 1})$$

where $i = 1, \dots, n$ and ε_i is the error term of estimator. The above regression model neglects the panel and time series nature of the data and their heterogeneity of the panels that may exist among the countries. To determine the individuality of the data by panel, the following models are subsequently applied.

2.2.1 Fixed Effects Model

Since, the data used herein is a longitudinal time series data hypothesizing its varying impact over time, the model I fit is to control for the time effect of variables in addition to investigate for their varying impacts by allowing the heterogeneity among the countries and to facilitate in having their own intercept values. The fixed effects so called the LSDV model equation is therefore:

$$Y_{it} + \beta_0 + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + Y_2 E_2 + \dots + Y_n E_n + \bar{O}_t \bar{T}_t + \dots + \bar{O}_n \bar{T}_n + u_{it} \quad (\text{Eq. 2})$$

where Y_{it} is the exchange rate being the endogenous variable, i is the country affect and t is the time series affect, $X_{k,it}$ presents the explanatory variables being the export and import, β_k is the estimator of coefficient for independent variables. $\bar{O}_n \bar{T}_n$ are the coefficient for the binary and time variable. The fixed effects model controls for all time-invariant differences between the individuals, so the estimated coefficients of the fixed effects models cannot be biased because of omitted time-invariant characteristics (Reyna, 2007)[18].

2.2.2 Random Effects Model

A random effects model is further computed with an assumption that the heterogeneities may not be correlated among the countries and that they are random with the independent variables being the export and import (see for instance, Greene, 2008). The random effects equation is given as:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it} \quad (\text{Eq. 3})$$

where u_{it} is the innovation or error term between the country and ε_{it} is the innovation term within the country. Since, the assumption of uncorrelated and randomness of the predictors must be tested, I use the Hausman Test to determine whether to use the fixed effects or the random effects model under the null hypothesis of random effects model is rational verses the alternative being the fixed effects model is rational. The equation of Hausman Test is written as:

$$H = (b_1 - b_0)' (Var(b_1))^\dagger (b_1 - b_0) \quad (\text{Eq. 4})$$

where † is the moore-penrose pseudoinverse (Moore, 1920) for testing the b_1 on whether it is inconsistent in the regression above (see also, Durbin, 1954[8]; Hausman, 1978)[12]. The acceptance of null hypothesis against the alternative proposition leads to compute the random effects model as the base of analysis for the panel data used herein.

2.2.3 Test of Cross Sectional Independence

As an ultimate step in data analysis on which to draw the final conclusion of the paper, I test the computed model for investigating the existence of any cross sectional independence within the series for which, the Pesaran CD test is used and the equation of which can be written as:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \right) \quad (\text{Eq. 5})$$

Testing the null hypothesis of being no cross sectional independence against the alternative hypothesis being there is a cross sectional independence at $\partial 0.05$, determines whether or not the model is valid and reliable. Specifically, the null = no cross sectional independence $dN(0,1)$ for $N \rightarrow \infty$ and T is sufficiently large (Baum, 2001) and the acceptance of which supports the validity and reliability of the testing models applied to analyze the data in this paper though, the test Lagrange Multiplier model is also computed to test for any serial correlation under the following hypothesis:

H_0 : There is no autocorrelation in the series.

H_A : There is autocorrelation in the series.

The test is computed at $\partial 0.05$ larger the p-value than the interval confidence at 5% leads to reject the null against the alternative hypothesis.

3. RESULTS

In contrast with a sheer number of papers, a sequential approach is used to present the results obtained and the discussion made in this section. To initialize the statistical computation in achieving the results, the variables are pooled together by regression with no constant as shown below.

Table 2: Pooled Regression Analysis

			Prob > F:	0.000***
			R-Squared:	0.6150
			Ad. R-Squared:	0.6115
			Observation:	224
Var	Coeff.	St. Err.	t-stat.	p-value
Ex.				
Exp(log)	.7845246	.856063	0.92	0.360
Imp(log)	.1866713	.8518548	0.22	0.827

***Significant if p-value ≤ 0.05

Sample: 1960 – 2015

Although, the pooled regression ignores the varying impact of longitudinal nature of the data regressed, the statistical values of the coefficients both for Exp (log) and Imp (log) are positive with corresponding probability values of 0.360 and $0.827 > \partial 0.05$ meaning that both the explanatory variables are not significant to explain the dependent variable Ex. though, ultimate reliance upon this cannot be placed and I continue to test the variables by computing the fixed effects and random effects models as given below.

Table 3: Fixed Effects Model

			Prob > F:	0.000***
			R-Squared [within]:	0.4158
			R-Squared [between]	0.6115
			Overall:	0.0917
			Number of Groups:	4
			Observation:	224
Var	Coeff.	St. Err.	t-stat.	p-value
Ex.				
Exp(log)	.1659643	.4855817	0.34	0.733
Imp(log)	1.451087	.4634734	3.13	0.002***
Constant	[8.40764]	1.761953	[4.77]	0.000***

***Significant if p-value ≤ 0.05

[] Denotes negative sign

The fixed effects model computation exhibits that the variable export [exp] is not a significant variable to explain the Exchange rate across the countries while the corresponding p-value for import [Imp] is $0.002 < 0.05$ meaning that it is significant to explain the dependent variable.

Table 4: Random Effects Model

			Prob > F:	0.000***
			R-Squared [within]:	0.4158
			R-Squared [between]	0.6115
			Overall:	0.0917
			Number of Groups:	4
			Observation:	224
Var	Coeff.	St. Err.	t-stat.	p-value
Ex.				
Exp(log)	.1695529	.4848519	0.35	0.727
Imp(log)	1.445352	.4627613	3.12	0.002***
Constant	[8.38004]	5.912315	[1.42]	0.156

***Significant if p-value ≤ 0.05

[] Denotes negative sign

The same as fixed effects model results shown in table 4, the corresponding p-value of Export is not significant while the p-value for Import is $0.002 < 0.05$ being significant in explaining the Exchange rate impulsiveness across the panel.

Table 5: Hausman Test

	[b]	[B]	[b-B]	Sqrt
Var	FE	RE	Diff.	S.E.
Exp(log)	.165964	.169552	[.003588]	.02661
Imp(log)	1.45108	1.44535	.0057348	.02568

P-value = 0.9412

$$chi^2(2) = (b - B)' (V_b - V_B)^{-1} (b - B) = 12$$

The computation of Hausman test shows a corresponding probability value of $0.9412 > \partial 0.05$ in the account of which, the null hypothesis cannot be rejected and it is rather

accepted. It concludes that the appropriate model specification is the random effects model on which I relay my research findings.

Lastly, the cross sectional independence test of Pesaran is computed that the result of which shows a corresponding probability value of 0.8957 with an average absolute value of the off-diagonal element of 0.545 meaning that there is no cross sectional independence. Of this, the null hypothesis cannot be rejected. Returning to pooled regression analysis, the residuals are Arch effects-free and they are also normally distributed within the series.

4. CONCLUSION

The impulsiveness of exchange rate is the central focus of many research papers across the globe and this phenomenon is of high concentration in economies where import and export of goods and services are substantially carried out. In this paper, I investigate the varying impact of import and export on the exchange rate of four countries like Austria, Germany, France and Italy throughout 56 years from 1960 – 2015. To investigate this competing null hypothesis, variables are pooled by regression and random effect model is preferably computed in which, the statistical results show that export is not a significant variable to influence the exchange rate while the import is a significant variable which impacts the exchange rate across the stated economies over time.

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Author's Biography

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