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Determinants of Coffee Export Performance in Ethiopia

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Abstract
The paper developed with the objective of investigating the major determinants of coffee export supply in Ethiopia for the period of 1981-2011. It employs Vector Auto Regressive and Error Correction approach to identify the major determinants. It further used the granger causality test so as to find the direction of causality between coffee export supply and some of the independent variables. The findings of the study indicated that real export price of coffee, domestic production of coffee, physical infrastructure, and world supply of coffee affects coffee export supply significantly. The ratio of export plus import to GDP which is a proxy for openness to trade affects coffee export supply only in the long run. Finally the study found that the impact of real exchange rate in the long run as well as in the short run is statistically insignificant. Granger causality test established bidirectional causality of coffee exports with domestic production of coffee, but the direction of causality of coffee exports supply with real export price and world production of coffee is unidirectional. The policy implication is that improvement in the quality of coffee export, expansion in domestic production of coffee and road sector are believed to provide significant effect on export supply of coffee.
Keywords: Ethiopia, Export supply, Coffee, Vector Auto Regressive, Error Correction Mechanism

1. Introduction

The varieties of distinctively flavored coffee beans produced in Ethiopia, based on their contribution to the country's export, are Jimma, Gimbi, Lekempti, Sidamo, Yirgacheffe and Harar. These coffee types are internationally recognized and they command better prices (MoARD, 2009). Ethiopia produces around 4% of world production and more than 30% of the total production in Sub-Sahara Africa and the government favors the export of high grade coffee and restricts its sale on the domestic market (MoARD, 2009).

The production of coffee has an enormous relevance for Ethiopia, playing a dominant role in economy, ecology, socio-cultural and spiritual terms. The agriculture based Ethiopian economy is highly dependent on coffee since it accounts for more than 25% of the GNP and 65% foreign currency of all export earnings (MoARD, 2009). Coffee production in Ethiopia is the driving force since over a million coffee farming households and about 25% of the total population of the country is dependent on production, processing, distribution & export of coffee (World Bank, 2009).

The current government of Ethiopia encourages private investment in the coffee industry to promote a market economy including liberalization of the coffee sector, lifting price ceiling of any kind, streamlining of export licensing procedures, removal of price control, currency devaluation, foreign exchange auctioning, creation of relatively better investment environment through new investment code and regulations , launching of new export promotion strategy, suspending all the export taxes, the recent establishment of the Ethiopian Commodities Marketing Authority and the Ethiopian Commodity Exchange (ECX). This was undertaken as a means of increasing producer prices, Thereby encouraging production, reducing smuggling and maximizing export earnings.

Currently coffee generates less than 35 percent of the total export earnings. For the last several years its relative predominance in the export sector is decreasing because of increased contribution of other agricultural products like horticulture and floriculture. Consequently, only a little over 26% percent of the total export earnings is contributed by coffee during the year of 2011 (FDRE, 2011). This is the lowest share earned from export of coffee in the history of economy of the country and the trend for the last several years shows that the share of coffee in foreign exchange earnings will further decline. Coffee also contributes for sizeable amount of government tax revenue. It seems that Ethiopia will, to some certain extent, continue to rely on this item for its export earnings in the coming future.

The instabilities in export supply are usually defined in terms of short run deviation around a trend. Since export earning is a product of export supply, instability in export earnings is taken as a function of instability in export supply. Rise and fall in earnings from the export of primary commodities, partly due to instability in export supply, has long been a major cause of concern for primary producing countries. It has been argued that a high degree of instability in export supply would imply large fluctuations in export income of the country in question. Such fluctuations can have a negative effect on the economy of a primary commodity exporting countries. Behrman (1982) has been justified that if there is a large fall in export income, then there could be a shortage of foreign exchange, which limits the capacity to import. It follows that a decline in the

imports of capital goods which have an adverse effect on the rate of growth of investment, which in turn will reduce the overall economic growth. That is, as we know, many developing countries are technologically backward and have poor capacity to produce capital goods which are crucial for their economic development. As the result it makes developing countries to depend on the importation of these goods from the industrialized countries. At times of shortfalls in their foreign exchange earnings as a result of primary commodity export supply fluctuations, their capacity to import will be limited, which in turn means lower investment and thereby affects various sectors of the economy through the multiplier.

The Ethiopian export supply of agricultural products has subject to large fluctuations mainly because of the price and non price factors. And the economic growth of the country is too weak to absorb the effect of these exogenous shocks; it is less flexible to deal with both internal and external disturbances. Therefore the instabilities and decline in export of agricultural commodity has led the country to an adverse economic growth and macroeconomic imbalances, such as, budget deficits, balance of payments and debt problems. And there is a need for large foreign exchange reserve in the short run while trade and exchange rate policies reforms would be the long run instruments to reduce the instabilities in the export earnings (Amin, 2001).

Coffee is the major source of foreign currency in Ethiopia and it contributes more than 35% of the total export earnings of the country (MoARD, 2009). However coffee export of the country is instable for instance between the year of 1997 and 2001 export of coffee from the country declines by 9.11% but in contrast from the year of 2007 to 2011 the export supply grows by 4.3% (ICO, 2011). In addition to its fluctuation the growth of coffee export supply in the last two decades (1991-2010) is too low; it grows on average only by 0.041 percent per annum (ICO, 2010).

As the result the researcher seeks to examine and analyze the effect of those possible major determinant factors that hinder the growth and the overall performance of coffee export sector and tries to addresses issues that enhance the export growth and to make that growth sustainable, competitive in the international markets and eventually maximize the benefit that could be earned from the coffee sector. The overall success of any strategy to increase coffee export supply will depend on the knowledge of what factors constrain coffee export growth and the responsiveness of exporters to changes in both price and non-price conditions. Accordingly, a better understanding of the determinants of past performance, and the direction and magnitude of the relevant elasticity is desirable.

So far some studies have been undertaken in Ethiopia related to the export performance of coffee. Teshome (2009) study determinants of coffee export supply equation by taking coffee arrival as dependent variable sing a time series data. The major finding of his study indicates that world price and producer price of coffee affects coffee export negatively. The impact of rainfall is significant in both short run and long run. However credit access and extension service are insignificant in the long run but significant in the short run. The study also indicates gross domestic product and real exchange rate does not have any impact on the export supply of coffee. Yoseph (2009) investigated export supply response of coffee in Ethiopia for the years of 1975-2008 by employing Autoregressive Distributive Lag (ARDL) model. world price of coffee affects coffee export positively its export price elasticity was 2.48, while the impact of producer and export price is insignificant in the long run as well as in the short run. The estimated elasticity for domestic supply of coffee, exchange rate and GDP were 1.07, .891 and 1.35 respectively.

Although, some studies analyze the impact of various variables on the export of coffee but in general most of the studies are not incorporated the effects of infrastructure and openness to trade into the export supply model. But in this study explicit recognition is made to avoid the problem of omitted variable bias by including road sector development and openness to trade as a major determinant for coffee export supply of the country. Beside this past studies conducted in Ethiopia related to coffee export supply are used coffee arrivals to auction centers as dependent variable. But this study uses quantity of coffee exported to all destinations as a dependant variable. Broadly speaking, the objective of this study is to investigate determinants of coffee export performance in Ethiopia. More specifically, the study has the following objectives.

- To assess empirically the major determinant for coffee export performance of the country.
- To determine the causal nexus between the dependent variable (coffee export supply) and coffee export price, domestic production of coffee, and world production of coffee.

2. Methodology of the study

2.1Data Type and Source

The study used only secondary data and the data was collected from International monetary fund, World Bank development indicator, International coffee origination, National bank of Ethiopia, Ministry of Agriculture and rural development, Ethiopian Revenue and Customs Authority, Ethiopian Coffee Producers and Exporters Association, Central Statistics Agency, Ethiopian road authority, united state department of agriculture, and Africa development bank. The sample period for the econometric analysis covered from 1981 to 2011.

2.2 Model Specifications

The theoretical framework of this study is the imperfect substitutes export supply equation model developed by Goldstein and Khan (1985).The fundamental assumption underlying on the imperfect substitutes model is that neither imports, nor exports can be considered perfect substitutes for the domestic products. Perfect substitutes model, on the other side, assumes perfect substitutability between domestic and foreign goods and is typically used in the case of highly disaggregate data set. Since under the key assumption of the perfect substitutes model each country would be only an exporter or an importer of a traded good but not both, which is not observed in the real world, this model has attracted much less attention in the empirical studies than the imperfect substitutes model. And according to imperfect substitutes model export supply traditionally depends on the real export prices, Real exchange rate, and productive capacity. Consequently, the general form of the export supply function is expressed as:

$$EXs = f(REP, RER, PC) \qquad (1)$$

Where EX_s represents the volume of exports, REP is real export price[1], RER is real exchange rate, and PC is the capacity of production. The model outlined in equation (1) is a standard export supply function that is used in many empirical works in the literature to an extent. But in this study the researcher extended the above theoretical model by including openness to trade, road infrastructure, and world production of coffee as additional determinants for coffee export supply of Ethiopia.

$$LTEXC_t = \beta_0 + \beta_1 LREP_t + \beta_2 LRER_t + \beta_3 LDPC_t + \beta_4 LRON_t + \beta_5 LOP_t + \beta_6 LWPC_t \qquad (2)$$

Where,
LTEXC = Log of Total Export Supply of Coffee
LREP = Log of Real Export Price of Coffee
LRER = Log of Real Exchange Rate
LDPC = Log of Domestic Production of Coffee measured in tons
LRON= Log of Road Network measured in kilometers
LOP = Log of Openness to Trade, which was captured by taking the value ratio of Imports and exports to GDP
LWPC = Log of World Production of Coffee
β_i = (i = 0, 1, 2, 3, 4, 5, 6 and 7) are parameters to be estimated and t is time period.
To estimate equation (2) Vector Auto Regressive and Error Correction method of time series was employed

3. Results and Discussions

3.1Unit Root Test

The estimation starts by checking either the variables are stationery or not and Augmented Dickey-Fuller test was used for testing stationery of variables. Table (1) and (2) presents the results of Augmented Dickey Fuller (ADF) test. The result showed that all the variables were non stationary at level. But they become stationary at their first difference.

Table 1: Unit Root Test of Variables at a Level

Variables	Non Trended Model	Trended Model
LTEXC	-1.106	-2.573
LREP	-0.7289	-1.945
LRER	-2.526	-2.473
LDPC	0.1617	-1.499
LRON	-0.0067	-2.425
LOP	-0.4481	-2.011
LWPC	0.05492	-2.416
Critical values	5%=-2.97	5%=-3.57

Source: Author's own estimation

[1] Export prices divided by domestic absorption deflator. Domestic price deflator can be consumer price index (CPI), producer price index (PPI) or GDP deflator. But in this study CPI was used as domestic price deflator.

Table 2: Unit Root Test of Variables at First Difference

Variables	Non Trended Model	Trended Model
ΔLTEXC	-4.533	-4.54
ΔLREP	-3.312	-3.26
ΔRER	-4.3	-4.222
ΔDPC	-5.121	-5.959
ΔRON	-3.742	-3.716
ΔOP	-3.14	-3.094
ΔWPC	-4.9	-5.039
Critical values	5%=-2.97	5%=-3.58

Source: Author's own estimation

3.4 Co-integration and Error Correction Models

In the first stage of this analysis, order of VAR was identified using Schwarz Information Criterion (SBC), Hannan-Quinn Information Criterion (HQ), Akaike Information Criterion (AIC), and Final prediction error (FPE) criteria with a maximum of three lags. As Table (3) indicates out of the four criteria's HQ, AIC and FPE recommend to use one lag but SC criteria recommends to use two lags, so it is better to use one lag in the system equation model that is in the Johansson test of co-integration and vector error correction model since out of four criteria the three criteria advise to use one lag.

Table 3: Selecting the Order of VAR

Order	SC	HQ	AIC	FPE
0	-9.1373	-9.9726	-10.271	1.085
1	-8.677	-10.45*	-11.785*	0.985*
2	-9.3373*	-9.9726	-10.271	1.02
3	-7.6957	-9.9301	-10.949	1.05

Source: Author's own estimation
* indicates lag order selected by the criterion

Table 4: Numbers of Co-Integration Vector Based On Maximal Eigen Values

Hypothesized NO of CE(s)	Eigen value	Max – Eigen Statistic	0.05 Critical Value	Prob
None**	0.8023	47.0102	40.0775	0.0071
At most 1	0.6406	29.6818	33.8768	0.1461
At most 2	0.4741	18.6367	27.5843	0.4430
At most 3	0.3407	12.0833	21.1316	0.5394
At most 4	0.2302	7.5904	14.2646	0.4218
At most 5	0.0044	0.1293	3.8414	0.7191
At most 6	0.0026	0.0774	3.7673	0.0624

Source: Author's own estimation
** denotes rejection of the hypothesis at 0.05 level

Table 5: Numbers of Co-Integration Vector Based On Trace Values

Hypothesized NO of CE(s)	Eigen Value	Trace Statistic	0.05 Critical value	Prob
None**	0.8023	115.1318	95.7536	0.0012
At most 1	0.6406	68.1216	69.8188	0.0677
At most 2	0.4741	38.4398	47.8561	0.2831
At most 3	0.3407	19.8031	29.7970	0.4362
At most 4	0.2302	7.71979	15.4947	0.4958
At most 5	0.0044	0.1293	3.8414	0.7191
At most 6	0.0026	0.1772	3.7693	0.6741

Source: Author's own estimation
** denotes rejection of the hypothesis at 0.05 level

3.5 Estimates of Long run and Error Correction Model

Table 6: Estimation of Long Run Elasticity

Variable	Coefficient	Std. Error	t-Statistic	Prob
Constant	14.002	0.776	18.03	0.0000*
LREP	0.126	0.0399	3.14	0.0279*
LRER	-0.531	0.5168	-1.028	0.2749
LDPC	2.046	0.4910	4.167	0.0106*
LRON	1.87	0.215	8.69	0.0012*
LOP	1.765	0.243	7.26	0.0024*
LWPC	-0.879	0.104	-8.42	0.0015*

Source: Author's own estimation
*denotes significance of parameters

Table 7: Estimation of Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob
Constant	1.14	0.0312	36.44	0.0000*
ΔLREP	0.099	0.0375	2.65	0.0371*
ΔLRER	-0.153	0.242	-0.63	0.4106
ΔLDPC	0.68	0.104	6.5	0.0048*
ΔLRON	0.71	0.34	2.11	0.0387*
ΔLOP	0.49	0.315	1.55	0.2113
ΔLWPC	-0.27	0.0353	-7.53	0.0021*
ECM(-1)	-0.44367	0.084	-5.3046	0.0093

Source: Author's own estimation
*denotes significance of parameters

In the estimation of an ECM for coffee exports, we included the same number of lags as were taken in the tests of co-integration that is one lag. The parameters from the Johansen co-integration regression were the estimates of the long run elasticity whereas the coefficients of the differences terms in the error correction model were the estimates of the short-run elasticity.

The variable of real export price of coffee was significant both in the long run and short run since the t-critical values (2.064) were less than t- statics values for the long run and short run 3.14 and 2.65 respectively. The direction of this variable in the long run as well as in the short run was consistent as it showed positive sign with the coffee exports, but its effect to the total export of coffee was inelastic in the short run and long run Table (6 & 7). A relatively larger long run elasticity coefficient for coffee exports with respect to real export price is logical as coffee production requires one additional year to respond to any price change and there need to grow an entire new crop which takes several years. Real exchange rate was insignificant both in the long run and short run since the t- critical values (2.064) were greater than t- statics values for the long run and short run 1.028 and 0.63 respectively. Moreover the direction of this variable in the long run as well as in the short run was inconsistent with the hypothesis of the study as it shows negative impact of real exchange rate on the coffee exports supply of the country Table (6 & 7).

The variable of domestic coffee production provides a base to develop a strong coffee export supply from Ethiopia. This variable was significant in the short run and long run. The direction of this variable in the short run as well as in the long run was consistent as it showed positive sign with the coffee exports, and its effect is elastic in the long run and inelastic in the short run Table (6 & 7). A relatively larger long run elasticity coefficient for coffee exports with respect domestic coffee production is quite logical as coffee harvesting cannot respond to increased exports from Ethiopia by increasing production in the short run due to time lag involved in the production process but this is possible in long run by developing new coffee trees. The effect of infrastructure development on coffee exports was captured using road network as proxy variable. This variable was significant both in the short run and long run. World supply of coffee was significant both in the long run and short run. The direction of this variable in the long run as well as in the short run was consistent as it showed negative sign with the coffee exports, and its effect to the total export of coffee was inelastic in the short run and long run Table (6 & 7). Finally the effect of openness to trade on coffee exports was captured using the share of the value of import and export to GDP as proxy variable. This variable was insignificant in the short run but significant in the long run.

The coefficient of the error correction term showed negative sign, which was according to the theory, and it explained adjustment process and speed to any short run shock towards long-run equilibrium. The error correction term has the coefficient of -0.44, which was highly significant. The value of error correction term suggested that 44 percent of any disequilibrium in the short run would be adjusted with is one year Table (7). So

this means that any short run adjustment was fully compensated within almost two years time period for coffee exports supply.

3.6 Granger Causality Test

A regression was run separately for each of the explanatory variable which is of *I*(1) with the dependent variable of coffee export supply and check the Granger-Causality. First a regression between coffee export supply (TEXC) and real export price (REP) was conducted separately on each other. Results suggested unidirectional causality from real export price (REP) to total export supply of coffee (TEXC) since the estimated F-value (7.91) was significant and also the respective P-value was less than 0.05. On the other hand no reverse causation was found from coffee supply exports (TEXC) to real export price of coffee (REP) Table (8). Since the share of Ethiopia coffee export supply to the international market is too smell and Ethiopia is price taker from international coffee market it seemed logical that real export price of coffee should affect the coffee exports supply.

Secondly, causative relationship between coffee exports (TEXC) and domestic production of coffee (DPC) was checked by running a regression separately on each other. Results suggested bi-directional or bilateral causality between domestic production of coffee (DPC) and coffee export supply (TEXC) (Table 8).

Table 8: Results of Granger Causality Test

Null Hypothesis	F-Statistics	P-Value	Direction
REP does not Granger cause TEXC	7.9112	0.005	
TEXC does not Granger cause REP	2.9849	0.084	Unidirectional
DPC does not Granger cause TEXC	11.387	0.001	
TEXC does not Granger cause DPC	7.353	0.03	Bi directional
WPC does not Granger cause TEXC	7.5038	0.006	
TEXC does not Granger cause WPC	2.4175	0.165	Unidirectional

Source: Author's own estimation

3.7 Diagnostic Tests

Diagnostics test are usually undertaken to detect model misspecification and as a guide for model improvement. And it is a must to test the data for different diseases which would mislead the output and end up with wrong interpretations and conclusions. To this end different tests namely: Breusch-Godfrey LM test for autocorrelation, Jarque-Bera Normality test, Chow Breakpoint Test for stability of parameters, Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity, Ramsey RESET test and ARCH, were employed to assure the robustness of the model.

4. Conclusion

Coffee is the major source of foreign currency in Ethiopia and it contributes more than 35% of the total export earnings of the country. However coffee export of the country is instable for instance between the year of 1997 and 2001 export of coffee from the country declines by 9.11% but in contrast from the year of 2007 to 2011 the export supply grows by 4.3%. In addition to its fluctuation the growth of coffee export supply in the last two decades (1991-2010) is too low; it grows on average only by 0.041 percent per annum.

The central question of this paper was which variable makes the growth of export supply of coffee to be low and instable. To address this question the researcher is used a time series data over the period of 1981-2011. The study used quantity of coffee exported to all destinations as dependent variable and selected price and non price factors as independent/explanatory variables. Prior to the estimation of the specified model, tests for stationary were carried out using the Augmented Dickey-Fuller tests. The results from the unit root testing revealed that all the variables used in the estimation are integrated of order one. The order of Vector Auto Regressive (VAR) was identified using Schwarz Information Criterion (SBC), Hannan-Quinn Information Criterion (HQIC), Akaike Information Criterion (AIC), and Final prediction error (FPE) criteria and the result reveled to use one lag. Johansen's procedure is used to test the presence and the number of co-integrating vectors among the series in the model, and results of Maximal Eigen values and Trace values suggested a single co-integrating vector, the existence of this single co-integrating vector leads to the estimation of the model using an error correction model.

The empirical result obtained from this study indicates that among the price factors, export price and world price of coffee are found to be statistically significant with their respective expected sign that is the supply of coffee export responds positively to the change in real export price of coffee and negatively to world supply of coffee. However, the short run as well as long run effect of both variables to the total export of coffee are inelastic. The other price factor which is included in the model is real exchange rate and its impact to the coffee export of the country is found statistically insignificant.

Regarding the non price factors domestic production of coffee and road network which is proxy for

infrastructure, positively and significantly affects the coffee export supply of the country. This is in line with the expectation of the study that is expansion in domestic production of coffee and road sector will have positive effects on coffee export of the country. The short run impact of both variables on coffee export is inelastic whereas their long run effect is elastic.

Finally openness to trade which is captured by the percentage share of export and import to GDP is statistically different from zero to explain the variation in supply of coffee exports in the long run. While the short run the effect of openness to trade is statistically insignificant.

The granger causality test is employed to find the direction of causality between the dependent variable of coffee export supply and some of the independent variables. And the empirical result indicated bidirectional causality of coffee exports with domestic coffee production while unidirectional causality of coffee exports supply with real export price as well as world production of coffee.

The study indicated that domestic coffee production provides a base for the development of coffee exports supply of the country as the result government of Ethiopia should have to increase the quantity of national production of coffee through new plantings and/or intensification (higher productivity).

Development in road sector has a significant and positive impact on coffee export supply of Ethiopia and it is suggested to make the road sector better through Construction of roads to each coffee growing rural area in collaboration with farmers & cooperatives so as to increase export performance of coffee.

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ANNEX

Appendix-II: Chow's Breakpoint Test
Chow Breakpoint Test: 1991
Null Hypothesis: No breaks at specified breakpoints
Varying repressors: All equation variables
Equation Sample: 1981 2011

F-statistic	**0.701560**	**Prob. F(7,17)**	**0.6709**
Log likelihood ratio	**7.866930**	**Prob. Chi-Square(7)**	**0.3445**
Wald Statistic	**4.910923**	**Prob. Chi-Square(7)**	**0.6708**

Appendix-III: ***Serial Correlation LM Test***
Breusch-Godfrey Serial Correlation LM Test:

F-statistic	**1.200974**	**Prob. F(2,22)**	**0.3199**
Obs*R-squared	**3.051412**	**Prob. Chi-Square(2)**	**0.2175**

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 21/05/13 Time: 16:07
Sample: 1981 2011
Included observations: 31
Presample missing value lagged residuals set to zero.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	**0.639657**	**3.198733**	**0.199972**	**0.8433**
LREP	**0.061457**	**0.086622**	**0.709487**	**0.4855**
LRER	**-0.039117**	**0.090325**	**-0.433067**	**0.6692**
LDPC	**0.016352**	**0.098119**	**0.166658**	**0.8692**
LRON	**-0.080866**	**0.180231**	**-0.448681**	**0.6581**
LOP	**0.003957**	**0.131169**	**0.030165**	**0.9762**
LWPC	**-0.018012**	**0.183774**	**-0.098014**	**0.9228**
RESID(-1)	**-0.061442**	**0.241902**	**-0.253995**	**0.8019**
RESID(-2)	**-0.390819**	**0.253142**	**-1.543870**	**0.1369**

R-squared	**0.098433**	**Mean dependent var**	**-2.13E-16**
Adjusted R-squared	**-0.229410**	**S.D. dependent var**	**0.066804**
S.E. of regression	**0.074072**	**Akaike info criterion**	**-2.129859**
Sum squared resid	**0.120706**	**Schwarz criterion**	**-1.713540**
Log likelihood	**42.01281**	**Hannan-Quinn criter.**	**-1.994149**
F-statistic	**0.300244**	**Durbin-Watson stat**	**2.112006**
Prob(F-statistic)	**0.958023**		

Appendix-IV: ***Ramsey's RESET Test***

Ramsey RESET Test
Equation: UNTITLED
Specification: LTEXC C LREP LRER LDPC LRON LOP LWPC
Omitted Variables: Powers of fitted values from 2 to 3

	Value	df	Probability
F-statistic	0.675189	(2, 22)	0.5193
Likelihood ratio	1.846692	2	0.3972

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.007743	2	0.003871
Restricted SSR	0.133885	24	0.005579
Unrestricted SSR	0.126142	22	0.005734
Unrestricted SSR	0.126142	22	0.005734

LR test summary:

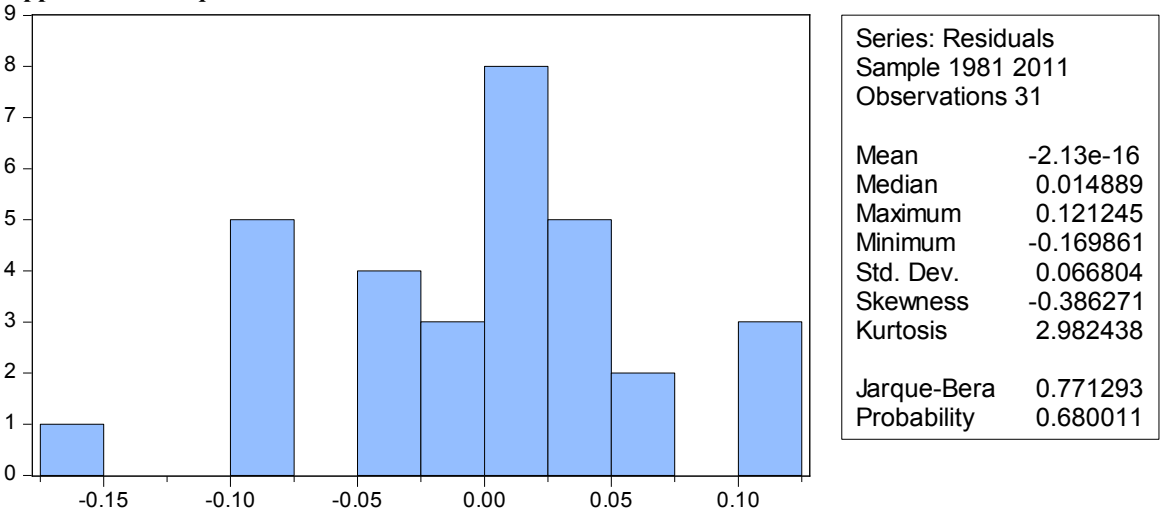
	Value	df
Restricted LogL	40.40669	24
Unrestricted LogL	41.33003	22

Unrestricted Test Equation:
Dependent Variable: LTEXC
Method: Least Squares
Date: 21/05/13 Time: 16:05
Sample: 1981 2011
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1187.993	1121.635	-1.059162	0.3010
LREP	-40.44531	37.96156	-1.065428	0.2982
LRER	62.04826	58.24101	1.065370	0.2983
LDPC	105.6230	99.16743	1.065098	0.2984
LRON	64.57670	60.62116	1.065250	0.2983
LOP	4.093461	3.845933	1.064361	0.2987
LWPC	-1.513989	1.421133	-1.065340	0.2983
FITTED^2	-10.14562	9.549573	-1.062416	0.2996
FITTED^3	0.297553	0.278423	1.068710	0.2968

R-squared	0.968513	Mean dependent var	11.51483
Adjusted R-squared	0.957063	S.D. dependent var	0.365430
S.E. of regression	0.075722	Akaike info criterion	-2.085809
Sum squared resid	0.126142	Schwarz criterion	-1.669490
Log likelihood	41.33003	Hannan-Quinn criter.	-1.950099
F-statistic	84.58745	Durbin-Watson stat	1.812081
Prob(F-statistic)	0.000000		

Appendix-V: ***Jarque-Bera Test***



Appendix-VI: Breusch-Pagan-Godfrey test
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	**1.113332**	**Prob. F(6,24)**	**0.3839**
Obs*R-squared	**6.749665**	**Prob. Chi-Square(6)**	**0.3446**
Scaled explained SS	**4.010061**	**Prob. Chi-Square(6)**	**0.6753**

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 21/05/13 Time: 15:43
Sample: 1981 2011
Included observations: 31

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	**0.284264**	**0.259701**	**1.094580**	**0.2846**
LREP	**0.004355**	**0.005859**	**0.743224**	**0.4646**
LRER	**-0.007408**	**0.006770**	**-1.094310**	**0.2847**
LDPC	**-0.017425**	**0.008041**	**-2.166887**	**0.0404**
LRON	**-0.001056**	**0.013780**	**-0.076628**	**0.9396**
LOP	**0.007296**	**0.010796**	**0.675781**	**0.5056**
LWPC	**-0.003636**	**0.015128**	**-0.240345**	**0.8121**

R-squared	**0.217731**	**Mean dependent var**	**0.004319**
Adjusted R-squared	**0.022164**	**S.D. dependent var**	**0.006181**
S.E. of regression	**0.006113**	**Akaike info criterion**	**-7.161260**
Sum squared resid	**0.000897**	**Schwarz criterion**	**-6.837456**
Log likelihood	**117.9995**	**Hannan-Quinn criter.**	**-7.055708**
F-statistic	**1.113332**	**Durbin-Watson stat**	**2.106432**
Prob(F-statistic)	**0.383902**		

Appendix-VII: ***ARCH LM Test***

ARCH Test:

F-statistic	**0.025093**	**Probability**	**0.875273**
Obs*R-squared	**0.026861**	**Probability**	**0.869815**

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/20/13 Time: 10:24
Sample(adjusted): 1982 2011
Included observations: 30 after adjusting endpoints

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	**0.004312**	**0.001423**	**3.029647**	**0.0052**
RESID^2(-1)	**0.029786**	**0.188035**	**0.158407**	**0.8753**
R-squared	**0.000895**	**Mean dependent var**		**0.004443**
Adjusted R-squared	**-0.034787**	**S.D. dependent var**		**0.006248**
S.E. of regression	**0.006356**	**Akaike info criterion**		**-7.214586**
Sum squared resid	**0.001131**	**Schwarz criterion**		**-7.121173**
Log likelihood	**110.2188**	**F-statistic**		**0.025093**
Durbin-Watson stat	**2.005571**	**Prob(F-statistic)**		**0.875273**

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