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Export performance of oilseeds and its determinants in Ethiopia

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This research examines export performance of oilseeds in Ethiopia using macroeconomic time series data from annual reports of NBE (National Bank of Ethiopia) over the period 1974 to 2009. Analyses of oilseeds export performance through time divulges that the country has not yet diversified the commodity composition and structure of its export, in that its export earnings depend on only a few agricultural products. The findings of the study reveal that the country needs to break away from it's heavily depends on traditional export commodities for which it is a marginal exporter, thus a price taker. The results also show that the estimated coefficients of real output (Ry) and nominal exchange rate (e) are statistically significant. This discloses that real output and nominal exchange rate have positive brunt on the export performance of oilseeds in Ethiopia.

Key words: Africa, Ethiopia, export performance, oilseeds.

INTRODUCTION

Nations' of the world differ in their resource endowments and level of technology applied in the production of goods and services. The engagement of nations in the international trade depends upon a nation's specialisation in the production of goods in which they have comparative advantages constructs room for improvement of the welfare of the society as a whole. This theory traces back to the last half of the 18th century, the time when Adam Smith realized the importance of specialization and trade in his Wealth of Nations. Subsequently, many economists advocated the contribution of international trade for welfare of nations (as the engine of growth) in the overall process of economic development (Onafowora and Owoye, 1998; Arndt, 1999). The international trade of SSA (Sub-Saharan African) countries are mainly based on exporting primary agricultural commodities in which they have comparative advantages due to cheap labor and tropical climate. In the context of Ethiopia, coffee alone constitutes more than 50% of the total agricultural export of the country. Accordingly, different studies show that diversifying the export sector towards non-traditional agricultural commodities is crucial to attain stability in export earnings of a country (Alwang and Siegel, 1994).

Agriculture is the mainstay of the Ethiopian economy. Its share accounts for more than 40% of the total GDP, 50% of foreign currency earnings and above 80% of employment creation. Both industry and services are dependent on the performance of agriculture, which provides raw materials, generates foreign currency for the import of essential inputs and food for the fast growing population. In spite of its importance in the national economy, agriculture is based on subsistence farm households, whose modes of life and operation have remained unchanged for centuries.

The objective of this study is to scrutinise oilseeds export performance in Ethiopia with the application of adopted Goldstein and Khan (1985) imperfect substitution model and annual macroeconomic time series data from the annual reports of NBE for the period 1974 to 2009. However, as results of this study reveal, despite this research attempt in examining the export performance of oilseeds in Ethiopia, there has been no study conducted on export performance of oilseeds in the country. The basis for the analyses is to validate empirically the hypothesis that exports from Ethiopia is rising since the reform was launched.

WORLD OILSEEDS PRODUCTION AND MARKETING

The worldwide major oilseeds are: Soybean, rapeseed, cottonseed, safflower seed, groundnut, palm, copra, sesame, Castro seed, maize oil and coconut oil. The major producers of oilseeds are USA, China, Brazil, India, Malaysia, Indonesia, EU-15 Countries, Central Europe, Canada, and Argentina. According to FAO database, the world oilseeds production is 449 million tons for 2010. Ethiopia has altitudes from below sea level up to more than 4,500 m above sea level with very different climates. This enables Ethiopia to grow a wide range of oilseeds, in which it has a long tradition. Oilseeds are the second largest export earner for the country after coffee in which more than 3 million smallholders are involved in its production. Exports actually consist of sesame and Niger seed, for which there is a growing demand in the world market. Ethiopia ranks among the top 5 world producers of sesame seed and linseed. It is also an important producer of Niger seed. Castoro, linseed and safflower have good export potential. The growing demand in the world market for these specialty products and the available capacity to expand production could make oilseeds turn into one of the engines of economic growth of Ethiopia. Groundnuts, safflower, rapeseed and many other oilseeds are produced on a limited scale. The main production regions of sesame seed are Tigray, Amhara, Oromia and Benshangul Gumuzi (Bennet, 2004).

DOMESTIC USE, IMPORT AND EXPORT OF OILSEEDS IN ETHIOPIA

Sesame seed is the main oilseed export product. Niger seed, as second, is exported mainly to the US as bird seed. In 2005 and 2006 Ethiopian exports further increased, whereby China came up as a new market. Export of sesame seed has grown in double digits each year from 1998 to 2006:50,000 tons in 1998 and more than 100,000 tons in 2006. In the second half of 2006, the main export markets for Ethiopian sesame seed were China, Israel and other countries in the Middle East and Turkey. The EU had a market share of 8% (CSA, 2006). The major importers of Ethiopian sesame seed in the EU are Greece, Germany, the Netherlands and the UK. Japan is the biggest world importer of sesame seed. Sesame oil, particularly from roasted seed, is an important component of Japanese cooking. Traditionally, this is the principal use of the seed. Japanese are very critical of quality. Because of quality problems in the past, Ethiopia is not an important exporter for Japan. However, it seems that via China, the volume of Ethiopian oilseeds exported to Japan is increasing. All other oilseed crops (soybeans, groundnuts, cottonseed etc.) grown in Ethiopia are almost entirely used domestically. Reliable figures of domestic use are not available. Most of the oil is consumed as crude oil. Ethiopia is a net importer of refined oil, mainly refined soybean and palm oil. Palm oil is mainly imported from Malaysia, Singapore and the United Arab Emirates. Italy is the major supplier (75%) of soybean oil, followed by Turkey (10%) (FAO, 2008).

OILSEEDS EXPORT PERFORMANCE AND ITS DETERMINANTS IN ETHIOPIA

Export performance is the relative success or failure of the efforts of a firm or nation to sell domestically produced goods and services in other nations. Export performance can be described in objective terms such as sales, profits, or marketing measures or by subjective measures such as distributor or customer satisfaction. Determinants of export performance can be split into external and internal components. External components include market access/entry conditions and a country's location which include international markets. Internal components are related to supply-side conditions. Foreign demand is influenced by various elements. Firstly, it is strongly linked to geography (the structural component). Typically, countries at the center of a fast growing region are more likely to benefit than countries situated outside that region. Second, it is likely to be related to competition and trade policy (the market access/entry component), which could have, in principle, a similar impact on trade than geography. Finally, both the quantity and quality of physical infrastructures (the development component) are expected to play important roles (Lages et al., 2004).

Trade policy is always controversial in its impact on the overall economy. Advocates of free trade believe all nations benefit from eliminating import tariffs, quotas, and export subsidies. The Ethiopian government has been moving toward a freer trade policy ever since the liberalization. New trade agreements for agricultural commodities and other manufactured goods have reduced tariffs and quotas in the last 10 years. As a consequence, the most competitive and productive sectors of the economy benefit the most from a liberalized trade policy.

Access to foreign markets is a critical determinant of export performance. It relates directly to the characteristics of the trading partner countries, such as the size of their market and transport facilities, and inversely to their own internal transport costs. It also depends positively on the size of the export basket and the number of differentiated items and their prices, which in turn are affected by market entry conditions. Transborder costs, which also include tariff and non-tariff barriers, have the expected negative impact on foreign market access (Anderson, 2004, Fugazza, 2004).

Despite the worldwide fall in trade barriers that has occurred in the last two decades, export performance has varied substantially across countries. World exports increased almost 220% in twenty years. The figure jumps to 720% for East Asian and Pacific countries and falls to 80% for Sub-Saharan countries. The exports of “best performers”, such as the Republic of Korea, China, Cambodia and Vietnam, have grown by more than 15% annually over the whole period. “Worst performers”, mostly African and Latin American countries, have negative annual growth rate records in at least one decade. As a result of various trade negotiations and autonomous reforms, access to international markets has improved in the last twenty years. Nonetheless, it is likely that there is still much to gain from further improvements in market access conditions. Concerns have also been raised about the necessity to improve supply conditions. Supply conditions are fundamental in defining the export potential of an economy. For a given level of access to international markets, countries with better supply conditions are expected to export more (Redding and Venables, 2004).

Recently, Redding and Venables (2004) investigated the relative contribution towards export performance of international linkages relative to internal geographical factors. They found that most of the differential in export performance of various countries and over the last three decades can be due to differences in the evolution of external components. Nevertheless, they found that internal components related to supply capacity such as internal geography and institutional quality also have played a significant role in explaining the observed differential in export performance. Accounting for unobservable heterogeneity should allow the identification of any differences in the effect of and importance of export performance components, which are linked to the degree of development of the external sector itself. In other words, the techniques used here allow for the testing for non-linearities in the relationship between export performance and its components. While dynamic panel techniques would seem to be the most desirable approach, data availability is likely to restrict their implementation. In this context, cross-sectional analysis proves to be a viable alternative. Regression techniques which are able to account for unobserved heterogeneity across countries, namely quantile regressions, are used. Moreover, more emphasis is put on the determination and impact assessment of variables related to supply conditions. This is done with the aim of determining as clearly as possible what are policy implications. The study revealed important differences across countries and regions when looking at their respective determinants of export performance. External and internal components prove to have played an equal role in determining export performance for Asian countries. Their improvement in the South East and Pacific region appears to be high relative to that observed in any other region. Sub - Saharan African countries owe their export performance to the evolution of external components. The latter were strong enough to more than offset a relative deterioration of their internal production conditions. Further investigation also indicates that good internal conditions are necessary to obtain good export performance. Particular attention should be paid to the macroeconomic dimension. Good infrastructures and non-stringent institutions are also necessary to put the export sector on a durable development path.In addition; there is scope for promoting a dynamic process of diversification across and within sectors. Constant efforts to support diversification are particularly relevant for commodities exporters’ when a secular downward trend is observed in volatile commodities prices (Redding and Venables, 2004).

ETHIOPIAN OPPORTUNITIES FOR SPECIALTY OILSEEDS

Most oilseed crops -soybeans, cotton seed, rapeseed etc. - grown in Ethiopia are also grown in many other countries in large volumes. For these oilseed crops, it will be very difficult for Ethiopia to compete on the world market due to its relatively low volumes and high handling and transport costs. The Ethiopian production for these crops is mostly less than 0.1% of the world production. To achieve a beneficial market position on the world market huge efforts are required, which will be out of scope for Ethiopia in the near future. These crops, however, can be of high importance for the domestic market, as food crop. Most potential for the Ethiopian oilseeds sector concerns the following specialty Oilseeds: sesame seed, safflower seed, linseed, Niger seed and castor beans (Abate, 2006).

METHODS

The study was persistence on secondary data sources. When a close look was made at the time-series estimates of Ethiopia's major macroeconomic variables, it shows that different sources report different values for the same variables. In order to avert this problem and ensure the consistency as well as comparatively of results annually published time- series data were extracted from the published annual reports of the NBE (National Bank of Ethiopia). Annual data were favoured to the purpose of precision for most of the variables. Long term data are not available for the variable considered in the study in the case of Ethiopia. The ideal national account data available to undertake time series based studies is from 1963 onwards which still lack accuracy.

Data coverage

The study covers 36 years, from 1974 to 2009. Review of the different publications of the NBE (Annual Reports and Quarterly Bulletins) reveals that data are available on the export earnings,

Table 1. ADF unit root tests.

Variables	ADF test statistics	Order of integration	Critical values at 5%	Critical values at 10%
$\log p_t^d$	-5.725716	I(2)	3.55	3.21
$\log p_t^w$	-5.161600	I(2)	3.55	3.21
$\log Ry_t$	-6.640211	I(2)	3.55	3.21
$\log e_t$	-5.039660	I(2)	3.55	3.21

price (unit values), and quantities of major export commodities since 1973. The latest available data on the external trade of the country are 2009, the last year of study period (Annex Tables 1 to 3).

Definitions of export performance

A conceptual definition of export performance addresses two parts:

Export and performance: Export is the international marketingrelated decisions and activities of internationally active firms (Cavugil and Neviv, 1981). The overtone of the word performance, in the literature sense, does not pose any problem for it is the act of carrying out or accomplishing something such as a task or action. When it comes to economics, this word has been defined in many ways and no unifying principle has underlined its quantification. However, in the context of current study, 'Export performance'is defined as:

1. The success or failure of the efforts of a nation to sell domestically produced goods and services in other nations markets (Zou and stan, 1998);
2. The composite outcome of a nation's international sales (Shoham, 1996), and
4. The three sub-dimensions which encompasses sales, profit and growth (Madsen, 1987).

Model specification

The study signifies export performance of oilseeds in Ethiopia as a function of domestic price, world price, real output and nominal exchange rate. The analysis is expressed with the adopted Goldstein and Khan (1985) imperfect substitution model expressed as follows:

$$OilseedsE\exp ort\ performance(OlsXP) = f\,(P^d, p^w, Ry, e) \quad (1)$$

where, OlsXP refers oilseeds export performance; p^d, domestic price; p^w , world price; Ry, real out put and e, nominal exchange rate.

At estimation stage, taking logs of the variables in Equation (1) and differentiating with respect to time gives the trend of exports as:

$$\log OlsXP_t = \beta_0 + \beta_1 \log p_t^d + \beta_2 \log p_t^w + \beta_3 \log Ry_t + \beta_4 \log e_t + \varepsilon_t \quad (2)$$

where β's are unknown parameters to be estimated, t is time in years (1974 to 2009) and ε is random terms that are independently and identically distributed with mean zero and variance[2] (δ^2). To estimate Equation (2) the time-series approach was applied. The empirical results were tested using Eviews 3 and SPSS 15.

RESULTS AND DISCUSSION

Empirical estimation

The classical linear regression model (CLRM) and ECM (error correction model) are used to estimate the data. Prior to running the estimation, model diagnostic tests and corrections are made. These include heteroscedasticity, autocorrelation, multicollinearity and non stationary in the data. In order to detect heteroscedasticity, a plot of OLS residuals against the dependant variable ($\log OlsXP$) is made (Annex Figures 1 to 4). Although the model passes ANOVA[1] test, plot of OLS residuals against time and formal test to detect autocorrelation using partial autocorrelation function (PACF) are done. The estimation begins with the testing of variables for unit roots to determine whether they can be considered as a stationary or non-stationary process. Table 1 presents the Augmented Dickey Fuller (ADF) tests of variables. The tests showed that all the variables were non-stationary at level. The variables were stationary at second difference. Critical values for tests were found to be -3.55 and -3.21 at 5 and 10%, respectively. Annex Tables (4a to 4e) gives details of unit root test outputs of variables.

To examine whether the integrated variables are cointegrated, it was modelled using variables to achieve stationarity which leads to loss of long-run information. The concept of cointegration implies that if there is a long-run relationship between two or more non-stationary variables, deviations from this long-run path are stationary. Johansen's cointegration multivariate procedure is used to establish whether the variables are cointegrated in the long run. As result, the likelihood ratio indicates one co-integrating equations at 5% significance

[1] ANOVA-Analysis of Variance

Table 2. Co-integration tests for logrxt, logpdt, logpwt, logryt and loget.

Hypothesized no. of (CE)	Eigen value	Likelihood ratio	5% critical value	1% critical value
r=0	0.70	85.18	68.52	76.07
r≤1	0.51	43.98	47.21	54.46
r≤2	0.35	19.80	29.68	35.65
r≤3	0.10	5.34	15.41	20.04
r≤4	0.05	1.87	3.76	6.65

The test assumes linear deterministic trend in the data.

Table 3. Estimations results using ECM.

Variables	Coefficient	t-statistic	Sign.
Constant	-0.0051(0.02)	-0.285472	0.78
$\log p_t^d$	-0.5192(0.71	-0.731061	0.47
$\log p_t^w$	0.7811(0.72)	1.077986	0.29
$\log Ry_t$	0.2678(0.12)**	2.218024	0.03
$\log e_t$	2.004(0.75)*	2.683676	0.01
ECT	1.6621(3.72)	0.446621	0.66
R^2 =0.56; F= 7.41 (0.00)*(**)			

*(**) shows significance at 1% (5%) significance level and the number in the brackets refers standard error.

level. In other words, it accepts alternative hypothesis of having one co-integrating vector. Since the test statistic (85.18*)* is greater than the 95% critical value (68.52) of the likelihood ratio test, it is possible to reject the null of more than one co-integrating vector (Annex Table 5). The maximum Eigen value test starts with the null hypothesis of at most r co-integrating vector against the alternative of r+1. The result for maximum Eigen value test confirms the rejection of the null hypothesis; that is, no co-integrated vectors. Therefore, both maximum Eigen value and likelihood ratio indicate that there is one co-integrating equations at 5% significance levels (Table 2). After identifying the co-integrating equation, unit root test carried for the equation indicates that the equation is integrated of order AR I (2). Furthermore, unit root test with intercept shows that the equations pass's ADF test (Annex Table 6).Then equation entered into the final ECM estimation model (Annex Table 7). The equation is:

ECT=logpdt-0.997538*LOGPWT-0.000323*LOGRYT-1.003508*LOGET +0.004729

Estimation is done for the equation using ECM. The results indicate that $\log Ry_t$ and $\log e_t$ are significant and positive while others were insignificant. The significance of real output and nominal exchange rate highlight that these variables as the imperative factors of oilseeds export performance. Thus, 0.2678 and 2.004 of $\log Ry_t$ and $\log e_t$ respectively indicate the short run impact of real output and nominal exchange rate which implies that in the short run, real output and nominal exchange rate cause export growth of oilseeds. Although, other variables are insignificant that can not explain explicitly the short run impact on export performance. The long runs estimates suggest that logpwt*,* logryt and loget are positively related to $\log Olsxp_t$ while logpdt negatively. The insignificance of error correction term (ECT) shows that this variable is exogenous in the given model. Since all the variables are in their logarithmic form, it is possible to attach a suppleness meaning to the coefficients. Consequently, a percentage change in $\log p_t^w$, $\log Ry_t$ and $\log e_t$ are associated with 0.7811, 0.2678 and 2.004 in the same direction with $\log olsxp_t$, while $\log p_t^d$ is associated with 0.0051 in different direction with $\log olsxp_t$. The result of R^2 is 0.56 (56%) which reveals that 56% of Ethiopian oilseeds export performance is caused by real output and nominal exchange rate, while 44% is by other variables which were not included in the model. Furthermore, F-statistic is significant which implies that the model; $\log OlsXP_t = \beta_0 + \beta_1 \log p_t^d + \beta_2 \log p_t^w + \beta_3 \log Ry_t + \beta_4 \log e_t + \varepsilon_t$ fit (Table 3).

Table 4. Coefficient diagnosis.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
	Constant	4.041	0.208		19.453	0.000
1	$\log p_t^d$	-0.803	0.865	-0.613	-0.929	0.360
	$\log p_t^w$	1.205	0.924	0.368	1.304	0.202
	$\log Ry_t$	0.350	0.057	0.327	6.129	0.000
	$\log e_t$	1.899	0.878	1.204	2.163	0.038

The constant (β_0= 4.041) states that there are others variables that were not comprised in the model to explain export performance. The estimators of $\log p_t^d$ (β_1=-0.803), $\log p_t^w$ (β_2=1.205), $\log Ry_t$ (β_3=0.350) and $\log e_t$ (β_4=1.899) signify that $\log p_t^w$, $\log Ry_t$ and $\log e_t$ positively and significantly explain oilseeds export performance of Ethiopian, while $\log p_t^d$ negatively (Table 4).

Conclusions

This paper has evaluated the magnitude of trends of oilseeds export performance in Ethiopia over the period 1974 to 2009. This study investigates empirically the trends of export performance by analysing prices (domestic and world), real output and nominal exchange rate. The evidence from this study suggests that real output and nominal exchange rate significantly influence oilseeds export performance. It was also revealed that during the reform period, oilseeds export showed improvement. It was inferred that oilseeds export performance demands an appropriate macroeconomic incentive environment and complementary structural policies. Thus, Ethiopia's oilseeds export performance will be determined primarily by its domestic policies. It was scrutinised that despite the generally open trade regime, industrial countries tend to have restrictions on imports of agricultural products, where much of Ethiopia's export potential is concentrated. Further, it is argued that a country's oilseeds export may fail to grow as rapidly as the world average for three reasons. First, exports may be concentrated in commodity groups for which demand tends to grow relatively at a low rate. Second, export may be going mainly to relatively stagnant regions/blocs. Third, the country in question may have been unwilling or unable to compete effectively with other sources of supply in the international market. For this purpose, exports from rest of the world are treated as competitor to Ethiopia. Therefore, regional trading arrangements (within Africa) should be set to put in economic efficiency, trade, investment, and growth in the region.

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ANNEX

Table 1. Area, yield, production and export of oilseeds in Ethiopia (1974-2009).

Year	Oilseeds					
	Area (000' ha)	Yield qt/ha	Production (in metric tones)	Export (in metric tones)	Value of exports (000's birr)	Share of export as percentage of production
1974	529.20	4.60	241,300	103,280	95,862	43
1975	145.00	6.46	93,700	79,351	83,985	85
1976	308.00	3.30	108,500	32,120	31,242	30
1977	173.00	3.10	46,000	21,624	17,505	47
1978	146.50	4.67	53,900	13,835	12,245	26
1979	159.50	3.23	49,100	5,198	9,270	11
1980	187.00	4.77	891,160	9,305	13,814	1
1981	223.39	4.56	1,020,580	16,128	28,371	2
1982	230.38	3.58	823,860	12,173	19,533	1
1983	259.97	4.68	1,216,770	11,546	15,349	0.9
1984	256.19	3.85	985,290	33,610	27,859	3
1985	284.15	3.64	1,035,130	12,466	15,640	1
1986	293.20	3.46	1,014,270	5,630	7,686	0.5
1987	212.34	3.98	844,910	8,219	9,793	0.9
1988	190.38	4.25	808,670	17,795	22,014	2
1989	215.49	3.64	785,020	5,389	11,030	0.6
1990	238.00	4.08	972,930	6,914	8,388	0.7
1991	243.14	12.89	3,133,320	1,459	3,633	0.1
1992	208.15	4.18	870,030	176	383	0.0
1993	*	*	*	392	1,186	*
1994	457.67	4.15	1,901,280	10,188	44,187	0.5
1995	335.69	3.43	1,152,530	12,132	50,130	1
1996	391.58	4.99	1,952,610	7,832	41,938	0.4
1997	478.45	4.46	2,132,790	14,069	74,239	0.7
1998	410.01	4.48	1,836,960	66,554	314,660	4
1999	396.22	4.26	1,688,740	51,366	271,462	3
2000	424.26	4.49	1,902,840	43,131	255,328	2
2001	574.89	4.28	2,463,370	55,051	269,598	2
2002	438.17	4.88	2,138,160	76,604	278,738	4
2003	*	*	*	82,801	395,565	*
2004	570.78	5.48	3,128,630	105,945	712,738	3
2005	824.43	6.38	5,263,960	170,796	1,082,215	3
2006	797.34	6.10	4,866,100	265,649	1,835,270	5
2007	741.80	6.70	4,970,840	234,976	1,654,707	5
2008	707.06	8.73	6,169,280	152,091	2,037,090	2
2009	855.15	7.67	6,557,040	286,987	3.819,429	4

* (No Annual Report). Source: CSA (Central Statistics Agency of Ethiopia); various years' annual reports.

Table 2. Percentage share of oilseeds export value in total values of exports.

Year	Total values (in 000 birr)	percent share of oilseeds	Year	Total value (in 000 birr)	Percent share of oilseeds
1974	556,230	17.2	1992	318,356	0.1
1975	497,824	16.9	1993	948,983	0.1
1976	580,568	5.4	1994	1,419,468	3.1

Table 2. Contd.

1977	688,961	2.5	1995	2,835,179	1.8
1978	633,629	1.9	1996	2,607,288	1.6
1979	864,327	1.1	1997	3,901,671	2
1980	950,667	1.5	1998	4,141,582	7.4
1981	851,509	3.3	1999	3,637,280	7.5
1982	778,083	2.5	2000	3,957,802	6.5
1983	809,625	1.4	2001	3,866,606	7
1984	929,625	0.3	2002	3,864,320	7.2
1985	744,572	2.1	2003	4,142,356	9.6
1986	942,700	0.8	2004	5,176,644	13.8
1987	809,800	1.2	2005	7,331,258	14.5
1988	788,100	2.8	2006	8,685,376	21.1
1989	918,200	1.2	2007	10,457,615	15.8
1990	756,860	1.1	2008	13,643,332	14.9
1991	542,485	0.7	2009	15,217,730	25.1
Total	13,643,765	63.9	Total	96,152,850	159.1
Average	100.0	3.5	Average	100.0	8.8

Source: Authors' computation from data obtained from National Bank of Ethiopia.

Table 3. List of Ethiopian oilseeds and pulses exporters.

S. no.	Name of exporters
1	Amal trading ltd co.
2	Omar and Awad Baobed
3	Bajeba private ltd co,
4	J.J kotari ltd.co.
5	Antypas and brothers ltd
6	Ambassel trading house
7	Guna trading
8	Dina trading plc
9	Yahia Sayed Omar
10	Al-eman trading
11	Ethiopian grain trading enterprise
12	Oda share co.
13	K. A.S. international trading
14	Warka trading plc
15	Nazreti trading co.
16	Taye Belay general import- export
17	Hawas agri business pvt ltd co.
18	Ali Abdu Ali import- export
19	Beyen Teka general import- export
20	Malima plc
21	Ajli international trading pvt ltd co.
22	Mandura Ethiopia
23	Asnake Addissu Negash exporter

Table 4a. ADF test on logOLSXP$_t$ at 2nd difference with intercept and trend.

ADF test statistic	-5.312820	1% Critical value*	-4.2712
		5% Critical value	-3.5562
		10% Critical value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller test equation
Dependent Variable: D(LOGolsxpt,3)
Method: Least squares
Date: 08/16/10 time: 16:06
Sample(adjusted): 1978 2009
Included observations: 32 after adjusting endpoints

Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
D(LOGolsxpt(-1),2)	-1.737246	0.326991	-5.312820	0.0000
D(LOGolsxpt(-1),3)	0.124239	0.185909	0.668278	0.5094
C	-0.009994	0.065868	-0.151728	0.8805
@TREND(1974)	0.000539	0.003053	0.176690	0.8610
R-squared	0.775552	Mean dependent var		-0.002500
Adjusted R-squared	0.751504	S.D. dependent var		0.319778
S. E. of regression	0.159407	Akaike info criterion		-0.718237
Sum squared resid	0.711501	Schwarz criterion		-0.535020
Log likelihood	15.49180	F-statistic		32.25012
Durbin-Watson stat	2.045163	Prob(F-statistic)		0.000000

Table 4b. ADF unit root test on logpdt at 2nd difference with intercept and trend.

		1% Critical value*	-4.2712
ADF test statistic	-5.725716	5% Critical value	-3.5562
		10% Critical value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller test equation
Dependent Variable: D(LOGPDT,3)
Method: Least Squares
Date: 08/15/10. Time: 15:25
Sample(adjusted): 1978 2009
Included observations: 32 after adjusting endpoints

Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
D(LOGPDT(-1),2)	-2.032778	0.355026	-5.725716	0.0000
D(LOGPDT(-1),3)	0.131845	0.187279	0.704001	0.4872
C	-0.045336	0.053502	-0.847370	0.4040
@TREND(1974)	0.002026	0.002476	0.818522	0.4200
R-squared	0.899852	Mean dependent var		0.001250
Adjusted R-squared	0.889122	S.D. dependent var		0.383984
S. E. of regression	0.127861	Akaike info criterion		-1.159285
Sum squared resid	0.457753	Schwarz criterion		-0.976068
Log likelihood	22.54856	F-statistic		83.86183
Durbin-Watson stat	2.055184	Prob(F-statistic)		0.000000

Table 4c. ADF unit root test on logpwt at 2nd difference with intercept and trend.

		1% Critical value*	-4.2712
ADF test statistic	-5.161600	5% Critical value	-3.5562
		10% Critical value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller test equation
Dependent Variable: D(LOGPWT,3)
Method: Least squares
Date: 08/15/10 Time: 15:27
Sample(adjusted): 1978 2009
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. error	t-statistic	Prob.
D(LOGPWT(-1),2)	-1.779718	0.344800	-5.161600	0.0000
D(LOGPWT(-1),3)	0.069771	0.188261	0.370606	0.7137
C	-0.035330	0.060499	-0.583971	0.5639
@TREND(1974)	0.001322	0.002803	0.471408	0.6410
R-squared	0.826963	Mean dependent var		-0.003125
Adjusted R-squared	0.808424	S.D. dependent var		0.332551
S.E. of regression	0.145555	Akaike info criterion		-0.900050
Sum squared resid	0.593219	Schwarz criterion		-0.716833
Log likelihood	18.40080	F-statistic		44.60516
Durbin-Watson stat	2.036182	Prob(F-statistic)		0.000000

Table 4d. ADF unit root test on logryt at 2nd difference with intercept and trend.

		1% Critical value*	-4.2712
ADF test statistic	-6.640211	5% Critical value	-3.5562
		10% Critical value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LOGRYT,3)
Method: Least squares
Date: 08/16/10. Time: 19:12
Sample(adjusted): 1978 2009
Included observations: 32 after adjusting endpoints

Variable	Coefficient	Std. Error	t-statistic	Prob.
D(LOGRYT(-1),2)	-2.020305	0.304253	-6.640211	0.0000
D(LOGRYT(-1),3)	0.375854	0.177677	2.115378	0.0434
C	-0.000636	0.064040	-0.009929	0.9921
@TREND(1974)	0.000126	0.002970	0.042288	0.9666
R-squared	0.766518	Mean dependent var		-0.007187
Adjusted R-squared	0.741502	S.D. dependent var		0.304909
S. E. of regression	0.155024	Akaike info criterion		-0.774007
Sum squared resid	0.672907	Schwarz criterion		-0.590790
Log likelihood	16.38411	F-statistic		30.64115
Durbin-Watson stat	2.059745	Prob(F-statistic)		0.000000

Table 4e. ADF test on loget at 2nd difference with intercept and trend.

		1% Critical value*	-4.2712
ADF test statistic	-5.039660	5% Critical value	-3.5562
		10% Critical value	-3.2109

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller test equation
Dependent variable: D(LOGET,3)
Method: Least squares
Date: 08/24/10. Time: 22:23
Sample(adjusted): 1978 2009
Included observations: 32 after adjusting endpoints

Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
D(LOGET(-1),2)	-1.531692	0.303928	-5.039660	0.0000
D(LOGET(-1),3)	0.235216	0.191938	1.225478	0.2306
C	-0.004046	0.028623	-0.141346	0.8886
@TREND(1974)	0.000430	0.001327	0.324168	0.7482
R-squared	0.623785	Mean dependent var		0.003125
Adjusted R-squared	0.583476	S.D. dependent var		0.107296
S.E. of regression	0.069248	Akaike info criterion		-2.385787
Sum squared resid	0.134267	Schwarz criterion		-2.202570
Log likelihood	42.17260	F-statistic		15.47516
Durbin-Watson stat	2.041389	Prob(F-statistic)		0.000004

Table 5. Johansen cointergration test on logolsxpt, logpdt, logpwt, logryt and logret .

Date: 08/24/10. Time: 19:15
Sample: 1974 2009
Included observations: 34
Test assumption: Linear deterministic trend in the data
Series: LOGOLSXPT LOGPDT LOGPWT LOGRYT LOGET
Lags interval: 1 to 1

Eigenvalue	**Likelihood Ratio**	**5% Critical value**	**1% Critical value**	**Hypothesized No. of CE (s)**
0.702286	85.17737	68.52	76.07	None **
0.509022	43.98222	47.21	54.46	At most 1
0.346297	19.79614	29.68	35.65	At most 2
0.096985	5.342674	15.41	20.04	At most 3
0.053629	1.874108	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Unnormalized cointegrating coefficients:

LOGOLSXPT	**LOGPDT**	**LOGPWT**	**LOGRYT**	**LOGET**
-1.620127	-42.51544	43.03450	0.703449	44.38415
-2.240353	11.69520	-10.80391	0.949989	-9.358385
0.070290	-5.465979	7.054629	0.080156	5.116791
0.237543	3.504041	-4.060736	0.324888	-4.603558
0.931814	2.099893	-2.551611	0.218778	-3.146213

Normalized cointegrating coefficients: 1 cointegrating equation(s)

LOGOLSXPT	**LOGPDT**	**LOGPWT**	**LOGRYT**	**LOGET**	**C**
1.000000	26.24204(5.12476)	-26.56243 (5.12129)	-0.434194(0.05269)	-27.39548(5.13797)	-3.625986

Table 5 Contd.

Log likelihood	285.7394				
		Normalized cointegrating coefficients: 2 cointegrating equation(s)			
LOGOLSXPT	**LOGPDT**	**LOGPWT**	**LOGRYT**	**LOGET**	**C**
1.000000	0.000000	-0.384984 (0.10833)	-0.425721(0.04828)	-1.061369(0.05652)	-3.750092
0.000000	1.000000	-0.997538 (0.00551)	-0.000323 (0.00246)	-1.003508 (0.00287)	0.004729
Log likelihood	297.8324				
		Normalized cointegrating coefficients: 3 cointegrating equation(s)			
LOGOLSXPT	**LOGPDT**	**LOGPWT**	**LOGRYT**	**LOGET**	**C**
1.000000	0.000000	0.000000	-0.400125(0.06344)	-1.130787 (0.07572)	-3.882873
0.000000	1.000000	0.000000	0.065999 (0.11225)	-1.183379 (0.13398)	-0.339322
0.000000	0.000000	1.000000	0.066485 (0.11228)	-0.180314(0.13401)	-0.344900
Log likelihood	305.0591				
		Normalized cointegrating coefficients: 4 cointegrating equation(s)			
LOGOLSXPT	**LOGPDT**	**LOGPWT**	**LOGRYT**	**LOGET**	**C**
1.000000	0.000000	0.000000	0.000000	-1.933868 (0.55967)	-5.093612
0.000000	1.000000	0.000000	0.000000	-1.050915 (0.18301)	-0.139617
0.000000	0.000000	1.000000	0.000000	-0.046874 (0.18329)	-0.143723
0.000000	0.000000	0.000000	1.000000	-2.007076 (1.36071)	-3.025900
Log likelihood	306.7934				

ECT= logpdt-0.997538* LOGPWT-0.000323*LOGRYT-1.003508* LOGET +0.004729.

Table 6. ADF test on ECT at level with intercept.

		1% Critical value*	-3.6353
ADF test statistic	-7.115321	5% Critical value	-2.9499
		10% Critical value	-2.6133

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller test equation
Dependent Variable: D(ECT3)
Method: Least squares
Date: 08/24/10 Time: 21:44
Sample(adjusted): 1976 2009
Included observations: 34 after adjusting endpoints

Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
ECT3(-1)	-1.282956	0.180309	-7.115321	0.0000
D(ECT3(-1))	0.035629	0.034403	1.035641	0.3084
C	-0.000194	0.000763	-0.253940	0.8012
R-squared	0.627061	Mean dependent var		-6.89E-05
Adjusted R-squared	0.603001	S.D. dependent var		0.006973
S. E. of regression	0.004393	Akaike info criterion		-7.933344
Sum squared resid	0.000598	Schwarz criterion		-7.798665
Log likelihood	137.8668	F-statistic		26.06180
Durbin-Watson stat	2.029297	Prob(F-statistic)		0.000000

Table 7. Equation estimation with ECM.

Dependent variable: D(LOGRXT)
Method: Least squares
Date: 08/24/10. Time: 21:52
Sample(adjusted): 1975 2009
Included observations: 35 after adjusting endpoints
D(LOGOLSXPT)= C(1)+ C(2)*D(LOGPDT)+C(3)*D(LOGPWT)+C(4)
*D(LOGRYT)+C(5)*D(LOGET) +C(6)*ECT3

	Coefficient	Std. error	t-statistic	Prob.
C(1)	-0.005071	0.017762	-0.285472	0.7773
C(2)	-0.519185	0.710181	-0.731061	0.4706
C(3)	0.781067	0.724561	1.077986	0.2899
C(4)	0.267825	0.120749	2.218024	0.0345
C(5)	2.004283	0.746842	2.683676	0.0119
C(6)	1.662131	3.721573	0.446621	0.6585
R-squared	0.560853	Mean dependent var		0.040857
Adjusted R-squared	0.485139	S.D. dependent var		0.126011
S. E. of regression	0.090417	Akaike info criterion		-1.813955
Sum squared resid	0.237084	Schwarz criterion		-1.547324
Log likelihood	37.74421	F-statistic		7.407438
Durbin-Watson stat	1.970283	Prob(F-statistic)		0.000140

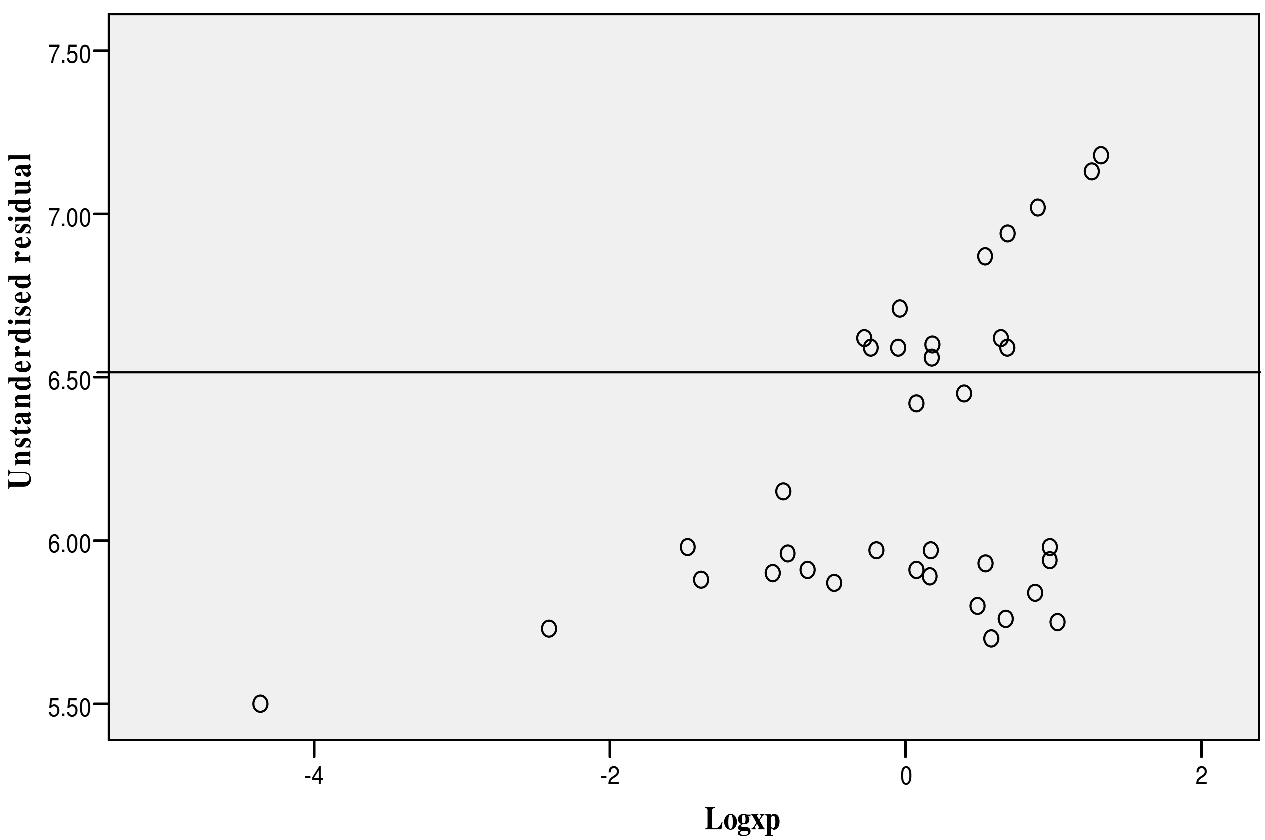

Figure 1. Heteroscedasticity diagnosis.

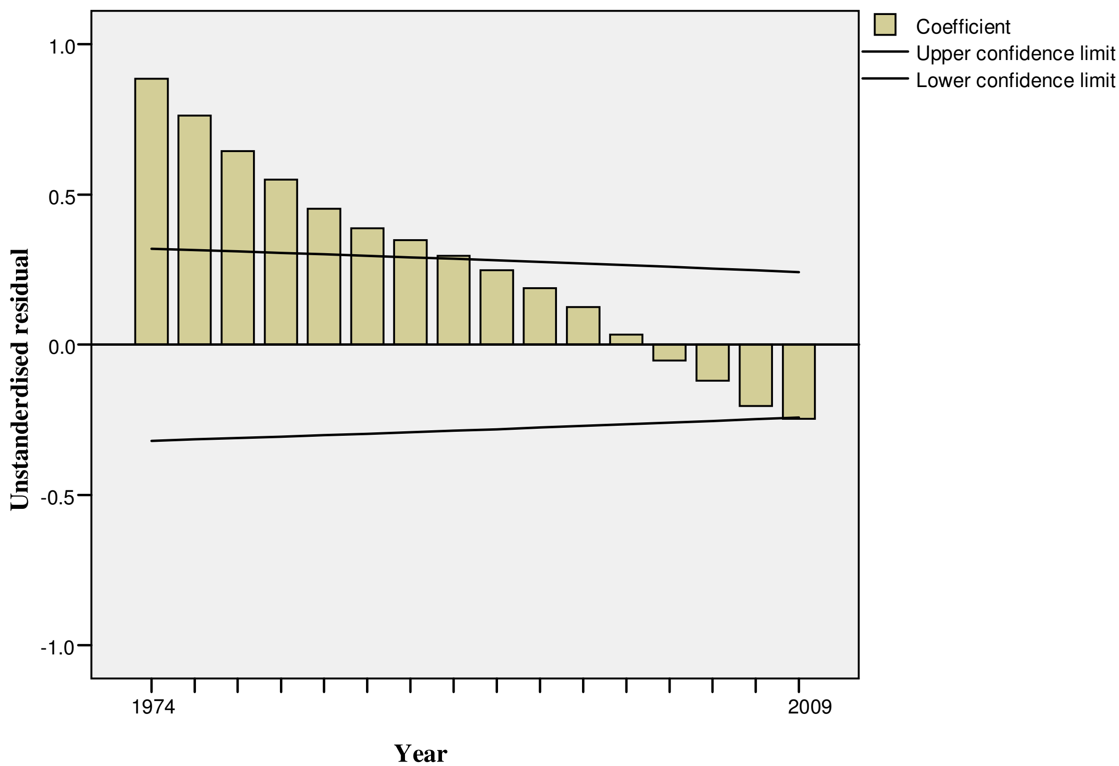

Figure 2. Autocorrelation diagnosis.

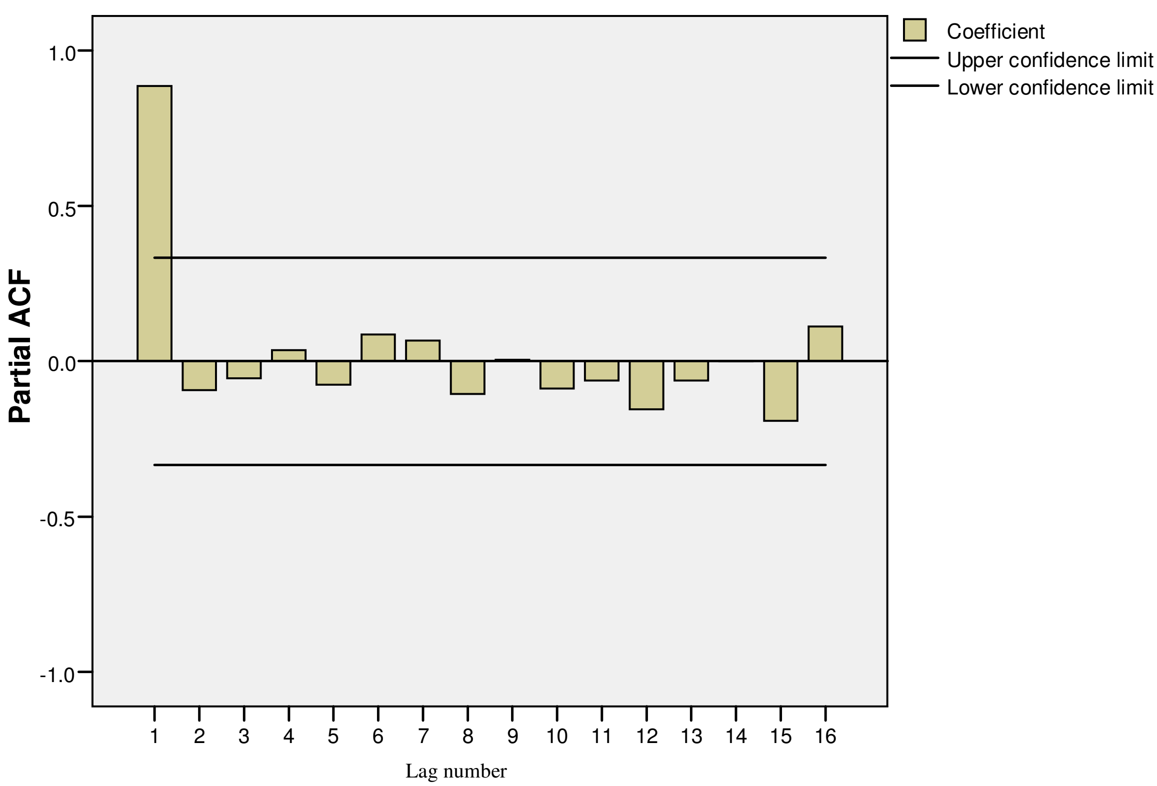

Figure 3. Partial Autocorrelation (before correction).

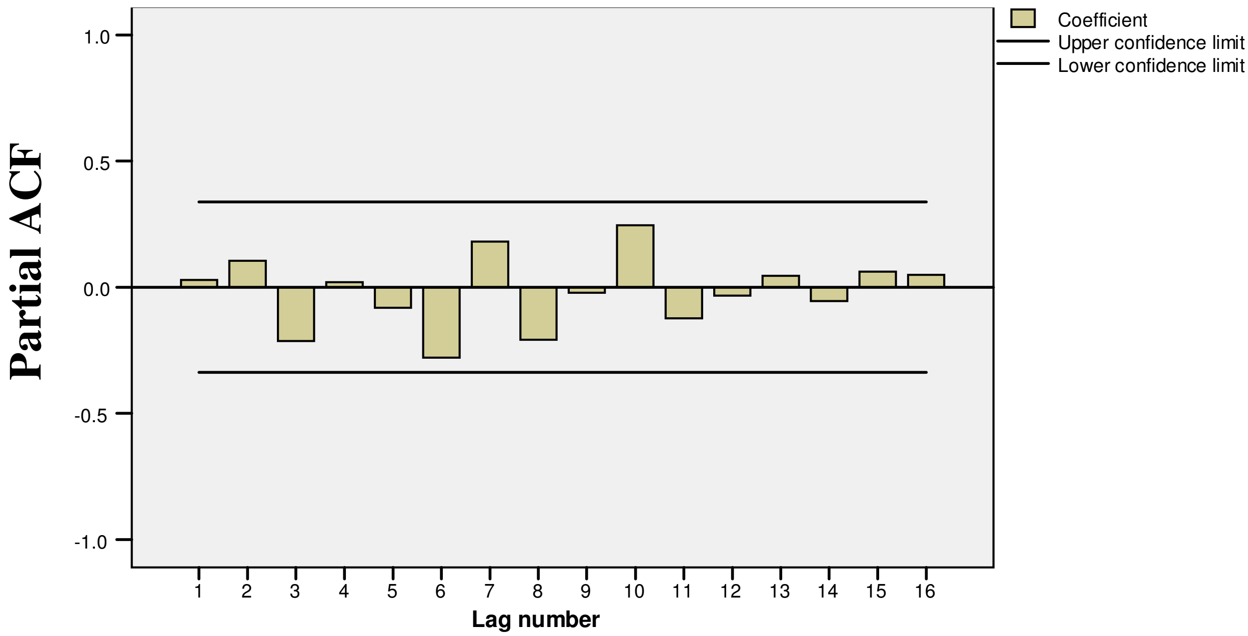

Figure 4. Partial autocorrelation function (after autocorrelation problem corrected).