AN ECONOMETRIC MODELING OF THE NET PAYMENT OF THE FOREIGN TRADE OF ETHIOPIA

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Abstract

The aim of this study is to apply the time series analysis using higher order polynomial, exponential, power and growth regression models and Cp statistics to estimate the trends of the revenue, expenditure and net payment of the foreign trade of Ethiopia based on annual import export data from 1970 to 2007. The Ethiopian foreign trade of export is dependent on the export of agricultural products across the continents of Africa, Asia, Europe and North America and skin and leather to the continent of Europe. And the import trade of Ethiopia is dependent on the import of industrial products, consumer and capital goods, fuel and transportation equipment and accessories from continents of Asia and Europe. The results indicates that the best fit for the trend of the revenue from the export trade and the expenditure to import goods are growing with a cubic trend while the net payment is showing deficit with time with a cubic trend.

Key words: Foreign trade, revenue, expenditure and net payment and trend analysis.

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1. Introduction

1.1 International trade and its importance

Most countries in the world need to participate in international trade to make up various deficiencies and obtain resources necessary to produce goods and services desired by the citizens of the country. Both, the exporting nations as well as importing nations, enjoy benefit of international trade. Some feel that the commodities imported is the actual benefit of international trade, whereas, export activities involve many expenses.

International trade has reduced inequalities and facilitated growth in economy of different countries. Due to international trade, a new trend has been observed. Countries, all over the world are making all efforts to adhere to monetary policies, which have zero inflation, thereby reducing restrictions in trade worldwide. After conducting research on international trade, it was found out that if a particular nation reduces its tariffs; it is enough to boost long term growth of the other economies as well. However, if there is a unanimous reduction in tariffs, the growth is even faster. It was also observed that, majority of the countries, adopted methods of ensuring growth on a long-term basis. These countries manifested a trend, where the levels of income were also high.

International trade has positively influenced the economic growth of a country in the following ways: International trade injects global competitiveness and hence the domestic business units tend to become very efficient being exposed international competition. Due to the integration with the world economy the entrepreneurs can have easy access to the technological innovations. They can utilize the latest technologies to enhance their productivity.

International trade has also brought in a reduction in the poverty level. India was a closed economy in the 1960s and 70s. There was not even 1% decline in the poverty level (Daeton el at, 2000). The entire scenario changed with globalization and international trade. The economic growth brought about by international trade can generate financial resources. Such resources can be used to set up anti-poverty programs. Better education and health facilities can also be provided to the poor.

The developing countries have higher trade protectionism measures as compared to the developed countries. The countries that have adopted such measures are seen to reap the benefits of an open trade regime. The products that are labor intensive like clothing, footwear, textiles etc are exported by the developing countries to both developed and underdeveloped countries.

1.2 Net Payment and Balance of Trade

The balance of trade (or *net exports*, sometimes symbolized as *NX*) is the difference between the monetary value of exports and imports of output in an economy over a certain period. It is the relationship between a nation's imports and exports. A positive or favorable balance of trade is known as a trade surplus if it consists of exporting more than is imported; a negative or unfavorable balance is referred to as a trade deficit or, informally, borrowed prosperity, living beyond a nation's means, or a trade gap. The balance of trade is sometimes divided into a goods and a services balance. The balance of trade forms part of the **current account**, which includes other transactions such as income from the international investment position as well as international aid. If the current account is in surplus, the country's net international asset position increases correspondingly. Equally, a deficit decreases the net international asset position.

1.3 Trade Imbalances and its Implications on Country's Economy

Trade imbalances evaluated in terms of their momentary effects and their long-term economic consequences can be good, bad or immaterial, depending on the circumstances. Trade deficits may signal excessive borrowing that could in the future lead to possible default, or even worse, an excessive reduction in living standards needed to repay the accumulated debt. In this case, the trade deficit is clearly bad for the nation. Alternatively, trade deficits may represent a country that is merely drawing down previously accumulated foreign savings or selling other productive assets, in which case, there is no potential for default or reduced living standards in the future. Here the trade deficit is either immaterial or even beneficial in that the nation is able to achieve a higher current living standard because of the deficit. Trade deficits might also make possible an expansion of domestic investment that could spur future economic growth sufficiently to make repayment consistent with growing living standards. In this case, trade deficits are clearly good as they stimulate future economic prosperity. Finally, in a free market economy, trade deficits may simply reflect the aggregated choices of

numerous individuals to forgo future consumption in order to achieve consumption that is more current. In this case the trade deficit should be viewed as immaterial since it merely reflects the free choices of the nation's people.

On the other hand, a trade surplus may correspond to prudent foreign saving and purchases of foreign productive assets that may be used to support a growing retired population in the future. In this case the trade surplus is a good thing for the nation. The trade surplus might also represent a period of repayment of past debt. This outcome may be acceptable if achieved together with growing living standards. However, if the surplus arises in a period of slow growth or falling GDP, then the surplus would correspond to painful reductions in living standards, which is clearly a bad outcome for the country. Finally, the trade surplus may occur because of the aggregated choices of numerous individuals who have acquired greater past consumption by forgoing current consumption. In this case, the surplus should be viewed as immaterial to the nation as a whole.

The major importance of this study is to estimate the trends of the revenue from export, the expenditure to import goods and the net payment of the foreign trade of Ethiopia. In the case of this study, great emphasis is given to the net payment of the foreign trade of Ethiopia across continents. In the assessment of the variation, we are concerned with the identification of the least and most influential items of import/ export that have impact on the foreign trade of Ethiopia based up on the amount of money to run the trade.

2. Methodology

2.1 General Assumptions

The following are taken as the general assumptions for our econometric analysis.

- The endogenous variable is continuous.
- The endogenous variable is multivariate normal.
- There is no structural break on the foreign trade of Ethiopia (existence of war, foreign policy of the country, fluctuation of the price of items in the international market, or other barriers of foreign trade are not included in the study).

2.3 Analysis of Trend using the Polynomial Regression Models

The polynomial regression models are one typical form of the multiple linear regression models that contains the powers of at least one of the independent variables. The performance of the polynomial regression models in practice is that it creates flexibility to get correlations between dependent variable and the powers of the independent variable. In addition, this leads the researcher to see the degree of association how the dependent variable associates with the independent variable.

The polynomial regression model, which contains a single exogenous variable, is given as:

$$y_t = \beta_0 + \beta_1 z_t + \beta_2 z_t^2 + \ldots + \beta_k z_t^k + \varepsilon_t \qquad \textbf{(1)}$$

By Letting $x_{1i} = z_i$, $x_{2i} = z_i^2 \ldots$. $x_{ki} = z_i^k$ Equation 1 is expressed as:

$$y_i = \beta_o + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} + \varepsilon_i \qquad \textbf{(2)}$$

Further if we let: $Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}$, $X = \begin{bmatrix} 1 & x_{11} & x_{21} \cdots & x_{k1} \\ 1 & x_{12} & x_{22} \cdots & x_{k2} \\ \vdots & \vdots & \vdots \cdots & \vdots \\ 1 & x_{1n} & x_{2n} \cdots & x_{kn} \end{bmatrix}$, $\beta = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix}$ and $\varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{bmatrix}$ then Equation 2 can be expressed as:

$$Y = X\beta + \varepsilon \qquad \textbf{(3)}$$

Model Assumptions

1. The X matrix is non-stochastic.
2. The X matrix is full column rank.
3. The conditional expectation of the random error given that the X-matrix is zero
4. The random error terms are homoscedastic
5. The random error terms are non-autocorrelated
6. The random error terms are multivariate normal

Under the fulfillment of the above assumptions, the Best Linear Unbiased Estimator (BLUE) of the model parameters is the Ordinary Least Square Estimator (OLSE).

$$\hat{\beta} = (X'X)^{-1}X'Y \quad \textbf{(4)}$$

2.4 Model Adequacy Checking and Diagnosis

It is always necessary to examine the fitted model to verify that none of the assumptions of the models are violated. This is our crucial step to get enough information about the precision of our inference that we are working for. Our econometric model is better if any of the assumptions of the model are not violated. When we are going to investigate the model adequacy checking, we need to consider both the data and the statistical problem. If we find at least one violation of the assumption of the model, then we need to diagnose it. The model diagnosis for the data and the statistical problems in this case is done by the analysis of the residuals. Residuals are the differences of the observed and the predicted values of the observations, i.e.

$$e_i = y_i - \hat{y}_i \quad \textbf{(5)}$$

where y_i and $\hat{y}_i$ are the i^{th} observed and predicted values respectively.

1. Checking the existence of outliers

Outliers arise due to changes in system behavior, fraudulent behavior, human error, instrument error or simply through natural deviations in populations. A sample may have been contaminated with elements from outside the population being examined. Alternatively, an outlier could be the result of a flaw in the assumed theory, calling for further investigation by the researcher.

Unless it can be ascertained that the deviation is not significant, it is ill advised to ignore the presence of outliers. Outliers that cannot be readily explained demand special attention. There is no rigid mathematical definition of what constitutes an outlier; determining whether an observation is an outlier is ultimately a subjective exercise. Outlier detection has been used for centuries to detect and, where appropriate, remove

anomalous observations from data. Outlier detection can identify system faults and fraud before they escalate with potentially catastrophic consequences. The original outlier detection methods were arbitrary but now, there are three fundamental approaches to the problem of outlier detection:

Type 1: Determine the outliers with no prior knowledge of the data. This is essentially a learning approach analogous to unsupervised clustering. The approach processes the data as a static distribution, pinpoints the most remote points, and flags them as potential outliers. In this case checking the existence of the outliers is done by transforming the residuals into standardized residuals, that is, $\hat{e}_i$ transformed into $d_i = \frac{\hat{e}_i}{\sqrt{MSE}}$ where MSE is the mean square error of the regression. And, if $|d_i| > 3$, then the observation in which the respective standardized residual creates the outlier problem.

Type 2: Model both normality and abnormality. This approach is analogous to supervised classification and requires pre-labeled data, tagged as normal or abnormal.

Type 3: - Model only normality (or in a few cases model abnormality). This is analogous to a semi-supervised recognition or detection task. It may be considered semi-supervised as the normal class is taught but the algorithm learns to recognize abnormality.

If there are outliers, some of the remedies include:

I. Using transformations like the log transformation, the square root transformation, the arcsine transformation, the inverse transformation…etc.
II. Using other alternative models
III. Leaving out the observations which create the outliers and do the analysis using the remaining observations

2. Detection of multicollinearity

According to G. S. Maddala (1992), multicollinearity refers to a situation in which two or more explanatory variables in a multiple regression model are highly linearly related. Indicators that multicollinearity may be present in a model:

a. Large changes in the estimated regression coefficients when a predictor variable is added or deleted.
b. Insignificant regression coefficients for the affected variables in the multiple regressions, but a rejection of the joint hypothesis that those coefficients are all zero (using an F-test).
c. Some authors M. Hashem (1987), Fumio (2000), Judea (2000) and others have suggested a formal detection-tolerance or the variance inflation factor (VIF) for multicollinearity: where is the coefficient of determination of a regression of explanatory variable *j* on all the other explanatory variables. A tolerance of less than 0.10 and/or a VIF of 10 and above indicates a multicollinearity problem.

3. Checking the normality assumption

The normality assumption is one of the most important assumptions in statistical and econometric analysis. If this assumption fails, then all the statistical or econometric inference is wrong. If the normality assumption has failed, then there are alternative methods that we can use for our inference. These alternative methods are the non-parametric model, the robust regression model or other parametric models. The normality assumption can be tested by the Bowman and Shenton tests of normality, among others.

The null and the alternative hypotheses are:

H_0: *The random error terms follow the normal distribution.*

H_1: *The random error terms do not follow the normal distribution.*

We estimate the kurtosis $\hat{k}ur$ and the skewness $\hat{s}kw$ of the estimated residuals and calculate the test statistic:

$$L = n\left[\frac{\hat{s}kw^2}{6} + \frac{(\hat{k}ur - 3)^2}{24}\right] \qquad \textbf{(6)}$$

L is distributed as χ^2 with 2 degrees of freedom. Then our null hypothesis is rejected if $L > \chi^2_{2,\alpha}$

4. Checking the existence of autocorrelated random error terms

The traditional test for the presence of first-order autocorrelation is the Durbin–Watson statistic or, if the explanatory variables include a lagged dependent variable, Durbin's h statistic. A more flexible test, covering autocorrelation of higher orders and applicable whether or not the regressors include lags of the dependent variable, is the Breusch–Godfrey test. This involves an auxiliary regression, wherein the residuals obtained from estimating the model of interest are regressed on (a) the original regressors and (b) *k* lags of the residuals, where *k* is the order of the test. The simplest version of the test statistic from this auxiliary regression is TR^2, where *T* is the sample size and R^2 is the coefficient of determination. Under the null hypothesis of no autocorrelation, this statistic is asymptotically distributed as χ^2 with *k* degrees of freedom.

2.5 The Selection Criteria of the Best-fitted Model

1. The coefficient of determination $\left(R^2\right)$

The coefficient of determination is computes as:

$$R^2 = 1 - \frac{SSE}{SST} \qquad \textbf{(7)}$$

The interpretation is that, we can determine the 100 $R^2\%$ variation of the Endogenous variable from the model. If our R^2 is close to 1 then our model is the best fit.

The weakness in this case is that, whenever we use more regressors our R^2 increase by losing precision.

2. The adjusted coefficient of determination (R^2_{adj} *)*

The adjusted coefficient of determination is computed as:

$$R^2_{adj} = 1 - \frac{SSE}{SST}\frac{n-1}{n-k} \quad \text{、} \qquad \textbf{(8)}$$

where: SSE=the sum of squares of the residuals

SST= the total sum of squares

The interpretation is that, we can determine the 100 R^2_{adj} % variation of the Endogenous variable by inclusion of k-exogenous variables from the model. This means the adjusted coefficient of determination include information about precision. If our R^2_{adj} is close to 1 then our model is the best fit. The adjusted coefficient of determination is much helpful than the coefficient of determination because it reflect the precision of our estimates of the model parameters. The weakness in this case is that it could not tell us how many regressors we use in the model.

3. The Cp statistic

C.L. Mallows introduced a statistic called the Cp statistic, which is helpful for the selection of the best model. The Cp statistic have information about the coefficient of determination (R^2) and the adjusted coefficient of determination (R^2_{adj}). Moreover, the Cp statistic contains information about the number of exogenous variables that we include in the model.

The Cp statistic is computed as:

$$Cp = \frac{SSEp}{MSE} - (n - 2p) \qquad \textbf{(9)}$$

where: p is the number of regressors we use at a time.

n is the total number of observations

SSEp is the sum squares of residuals by including the p-exogenous variables.

MSE is the mean square error of the original regression model.

According to Mallows, $E[Cp] = p$ therefore the best-fitted model is e model having negative or small Cp.

2.6 How to Evaluate Trade Imbalances

One of the most notable is the widespread conviction that trade deficits are a troubling economic condition which indicates weakness in an economy while trade surpluses are a sign of strength and rising prominence for an economy. Although these beliefs are well

founded in some circumstances, they are not valid as a general principle. A careful look at the implications of trade imbalances reveals that trade deficits can, at times, be an indicator of rising economic strength, while trade surpluses can be a sign of economic disaster. In many other cases, perhaps most, trade imbalances are benign. That is, they do not represent a serious threat or indicate rising prominence.

We define a variable called domestic spending (DS) as the sum of all domestic residents spending on consumption, investment, and government goods and services regardless of whether those products originated domestically or abroad. Simply stated, domestic spending is the value of the products that domestic households, businesses, and governments purchase during the year regardless of country of origin.

We can show the relationship between GDP and domestic spending by using the national income identity.

GDP = private consumption + gross investment + government spending + (exports − imports), or

GDP = C + I + G + EX - IM

Domestic spending is defined as DS = C + I + G therefore,

GDP = DS + (EX - IM)

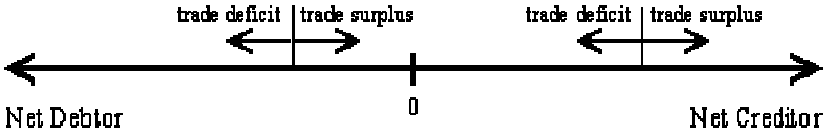
When a country runs a trade deficit, (EX - IM) is negative which implies that domestic spending exceeds GDP. Thus, when a country runs a trade deficit, total expenditures on consumption, investment and government goods and services is greater than the total value of domestic production. When a country runs a trade surplus, (EX - IM) is positive which implies that GDP exceeds domestic spending. This means that when a country runs a trade surplus, the total value of domestic production is greater than total expenditures on consumption, investment and government goods and services. In any case, a trade imbalance, whether a surplus or a deficit corresponds to a net purchase or a net sale of foreign assets only during the year in question.

A country might face four possible situations in any particular year. It may be:

1) A debtor nation with a trade deficit
2) A debtor nation with a trade surplus
3) A creditor nation with a trade deficit
4) A creditor nation with a trade surplus

Figure 1 below depicts a range of possible international asset (or investment) positions. On the far left a country would be a net debtor nation while on the far right it would be a net creditor nation. A trade deficit or surplus run in a particular year will cause a change in the nation's asset position assuming there are no capital gains or losses on net foreign investments (more on that later). A trade deficit would generally cause a leftward movement in the nation's investment position implying either a reduction in its net creditor position or an increase in its net debtor position. A trade surplus would cause a rightward shift in a country's investment position implying either an increase in its net creditor position or a decrease in its net debtor position.

Figure 1: International Asset Positions



An exception to this rule occurs whenever there are changes in the market value of foreign assets and when the investment position is calculated using current market values rather than original cost.

Evaluation Procedures

Case 1) Net Debtor Nation Running a Current Account Deficit

Such characteristic on the balance of payment of the given nation is the most common situation in the world. The main reason is that large trade deficits run persistently by countries that are also larger debtor nations will eventually be unmanageable. Examples of international debt crises are widespread. They include the third world debt crisis of the early 1980s, the Mexican crisis in the 1994, and the recent world crisis (Angrist et. al, 2010).

However, not all trade deficits nor all debtor countries face eventual default or severe economic adjustment. Indeed for some countries a net debtor position with current account deficits may be an ideal economic situation. To distinguish the good cases from the bad requires us to think about situations in which debt is good or bad.

A current account deficit means that a country is able to spend more on goods and services than it produces during the year. The additional spending can result in either increase in consumption, investment and/or government spending. The country accomplishes this as a net debtor country by borrowing from the rest of the world (incurring debt), or by selling some of its productive assets (equities). A net international debt position means that the sum total of domestic resident liabilities to foreigners, in the form of debt and equities, exceeds the sum total of foreign assets held by domestic residents. A debt position arises by running net current account deficits (greater deficits than surpluses) over a country's history.

The problem of trade deficits run by a net debtor country is more worrisome if:

- The larger is the net debt position
- The larger is the net debt (rather than equity) position
- The larger is the CA deficit (> 5% of GDP is large according to Summers, 2008)
- The more net debt is government obligations or government-backed
- The larger is the government deficit
- A high % of debt is denominated in foreign currency and if the exchange rate has or will depreciate substantially
- Rising net debt precedes slower GDP growth
- Rising net debt correlates with falling investment
- Deficits correspond to "excessive" increase in (C + G) per capita
- Especially if G is not capital investment
- Interest rate on external debt is variable
- A large recession is imminent

The situation is benign or beneficial if the reverse occurs.

Case 2) Net Debtor Nation Running a Current Account Surplus

This case generally corresponds to a country in the process of repaying past debt. Alternatively, foreigners may be divesting themselves of domestic equity assets. In either case, the trade surplus will reduce the country's net debtor position and will require that domestic spending is less than national income. This case is especially problematic if it arises because currency depreciation has forced a sudden change in the country's required repayments on international debt. This is the outcome when a series of trade deficits proves to be unsustainable. What un sustainability means is that the deficits can no longer be continued. Once external financing is no longer available, the

country would not have the option to rollover past obligations. In this case, in the absence of default, the country's net repayment on current debt would rise and push the capital account into deficit and hence the trade account into surplus.

The situation of a net debtor nation running current account surpluses is more worrisome if:

- Surpluses follow default
- The GDP growth rate is low or negative
- Investment rate is low or falling
- Real C + G per capita is falling
- Surplus corresponds to rising net debt and larger equity sales

The situation is benign or beneficial if the reverse occurs.

Case 3) Net Creditor Nation Running a Current Account Surplus

A net creditor country with trade surpluses is channeling savings to the rest of the world either through lending or through the purchase of foreign productive assets. The situation is generally viewed as prudent but may have some unpleasant consequences. Recall that a country with a trade surplus is spending less on consumption, investment and government combined than their national income. The excess is being saved abroad. Net creditor status means that the country has more total savings abroad than foreigners have in their country.

The situation of a net creditor nation running current account surpluses is worrisome if:

- Net credit position is very large
- The current account surplus is very large
- The GDP growth rate is low
- Investment rate is low or falling
- The Consumption plus the Government expenditure per capita is low or falling
- The domestic currency has appreciated substantially

The situation is benign or beneficial if the reverse occurs.

Case 4) Net Creditor Nation Running a Current Account Deficit

In general, a deficit run by a country that is a net creditor is least likely to be problematic. In essence, this describes a country that is drawing down previously

accumulated savings. The deficit also implies that the country is spending more than its income. This situation is especially good if it allows the country to maintain living standards during a recession. This case would also be good if a country with a rapidly aging population is drawing down previous savings to maintain average living standards.

The situation of a net creditor nation running current account deficits is worrisome if:

- The smaller is the net creditor status and the larger is the deficit (although this is generally less worrisome than if the country were a net debtor)
- The investment is falling, although a temporary drop in I is likely in a recession
- The Consumption plus the Government expenditure per capita is rising rapidly

The situation is benign or beneficial if the reverse occurs.

3. The Results

3.1 Summary of the Structure of the Export Trade of Ethiopia

Coffee is the dominant item of export of Ethiopia. As per the 2005 estimates, coffee production engages almost 25% of the working population and contributes 10% to the national production (CSA, 2006). Apart from coffee, livestock is another major export sector for Ethiopia. In terms of world livestock production, Ethiopia holds the tenth position. A major portion of the livestock production is exported to neighboring countries. Other main items of export are gold, leather products, *chat* and oil seeds. The country is exporting raw leather as well as luxury leather-made products. Floriculture is also expected to rise in the near future due to massive investment in the sector. If the growth in floriculture sustains, Ethiopia can become one of the largest exporter of flowers and plants in the world.

For more general information, the Ethiopian foreign trade of export is only dependent on the export of agricultural products and skin and leather across the continents Europe (which includes countries like Italy, France, Britain, German, Belgium, Norway, Sweden, Spain Turkey, the Netherlands, Greece, Denmark and the Czech Republic), Asia (which includes countries like UAE, Saudi Arabia, Yemen, China, India, Japan, and Korea), Africa (which includes countries like Djibouti, Sudan, Kenya, Somalia and Egypt) and North America (USA and Canada).

The total revenue which collected from export trade of Ethiopia is insignificantly affected by the export of each of the items to the continent of South America not clear. This might be an indication that the Ethiopia foreign trade of export is affected by the geographical location of the country. The export of Metals and Minerals and Animal and animal products do not have a significant contribution to the export trade of Ethiopia across all those continents. Moreover, the Table 3.1.1 will give us information about the structure of the export trade of Ethiopia across the continents from 1997 to 2010.

Table 3.1.1: The Ethiopia's value of Revenue from the export of items across continents

Year	Africa		Asia		Europe		N. America		S. America	
	Revenue in Million $	Share out of 100 %	Revenue in Million $	Share out of 100 %	Revenue in Million $	Share out of 100 %	Revenue in Million $	Share out of 100 %	Revenue in Million $	Share out of 100 %
1997	40.017	44.41	11.07	12.28	38.22	42.42	0.8	0.89	0	0
1998	13.37	27.54	9.68	19.93	24.99	51.46	0.52	1.07	0	0
1999	11.89	28.24	10.63	25.24	19.16	45.52	0.42	1	0	0
2000	22.82	51.25	5.11	11.48	16.36	36.75	0.23	0.52		0
2001	78.76	11.64	196.07	28.97	391.9	57.91	7.21	1.07	2.84	0.42
2002	58.33	2.92	1736.18	86.91	185.01	9.26	14.83	0.74	3.24	0.16
2003	490.75	17.41	253.62	9	164.46	5.83	1892.85	67.15	17.14	*0.61*
2004	128.39	12.22	502.7	47.84	206.53	19.65	196.19	18.67	16.98	1.62
2005	53.05	7.05	588.22	78.2	57.4	7.63	48.2	6.41	5.3	0.7
2006	45.95	17.62	119.27	45.74	69.68	26.72	24.01	9.21	1.84	0.71
2007	48.89	5.93	94.38	11.44	661.17	80.15	12.22	1.48	8.3	1.01
2008	26.42	3	430.68	48.95	407.63	46.33	12.16	1.38	2.93	0.33
2009	38.53	3.65	409.51	38.77	160.25	15.18	440.37	41.71	7.12	0.67
2010	542.72	28.38	490.57	25.65	829.83	43.39	38.88	2.03	10.301	0.54

3.2 The Trend of the Revenue Obtained from the Export Trade of Ethiopia

In this section we try to investigate the trend of the revenue, which is obtained, from the export trade of Ethiopia. The following table will help us to compare the best fit that can forecast the revenue from export with respect of time.

Table 3.1.2: Model Summary and Parameter Estimates
Dependent Variable: Revenue from export

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig	Constant	b1	b2	b3
Linear	661	72.018	1	37	000	-1111.847	161.592		
Quadratic	962	455.223	2	36	000	1854.577	-272.519	10.853	
Cubic	984	716.489	3	35	000	829.896	16.736	-6.999	.298
Power	368	21.575	1	37	000	212.397	665		
Growth	680	78.512	1	37	000	5.795	069		
Exponential	680	78.512	1	37	000	328.801	069		

The interpretations of Table 3.1.2

- From the table we observe that the regression models linear, quadratic, cubic, power, growth and exponential are all significant. But, the revenue of export trade of Ethiopia is best forecasted by the cubic trend which can control about 98.4% of the variations with respect of time.

- From the table we see that the revenue obtained from export trade of Ethiopia significantly growing with time.

- From the table we see that there are two time phases on the export trade of Ethiopia by considering the cubic trend is a good fit. The first time phase is from 1970 up to 1990 in which the revenue from exports was stagnant. The second phase is 1990 to those recent times in which the Ethiopian foreign trade of exports showing rapid and considerable growth.

We have enough statistical information that the revenue from export is following a cubic trend; therefore, our next step is to get the estimates of the best regression equation, which can possibly forecast the revenue from export with respect of time. According to this, Table 1.2 will provide the estimates of the model parameters, which is free from both the data and statistical problems.

Table 3.1.3: The estimated model parameters for the revenue from the Export Trade of Ethiopia

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	899.336	96.501		9.319	.000
Tsquare	-6.061	.616	-1.257	-9.841	000
Tcube	283	016	2.210	17.295	000

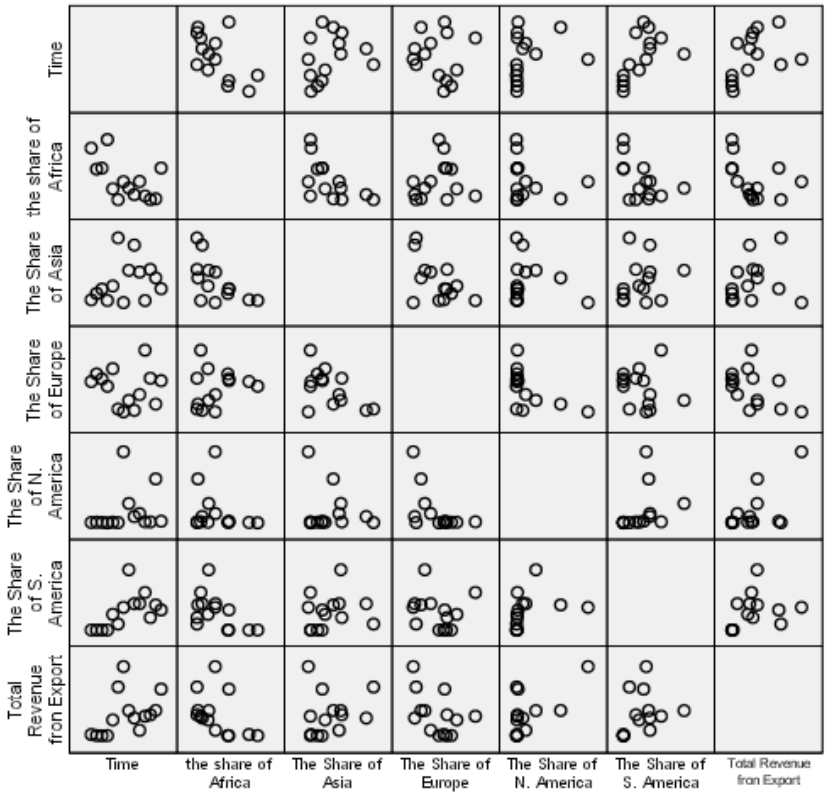
a. Dependent Variable: RE in Ethiopian Birr

From Table 1.2 the regression equation of the trend of the revenue from the export trade of Ethiopia is given as:

$\hat{RE} = 899.336 - 6.061(t-1969)^2 + 0.283(t-1969)^3$ in millions of Ethiopian birr and *t* is the time in Gregorian Calendar (GC).

The explanation behind the negative sign of the coefficient of the squared time in our regression equation is that; the export trade of Ethiopia showed to collapse in the years from 1987-1991. Therefore, if we fit the revenue from the export trade of Ethiopia from the year 1970-1991, then the negative quadratic trend is a good fit. By considering the annual continental shares and annual revenue from the export trade from 1997 to 2010, we can characterize the growth of the export of country. This is summarized by showing the matrix scatter plot in following figure.

Figure 3.1: Important correlations about the structure of the export trade of Ethiopia



From the plot we see that:

- Any of the continental shares are not correlated (neither positive nor negative) with time on the on the export trade of Ethiopia.
- The continental share of Europe is negatively correlated with the continental shares of share of Asia and N. America.
- An indicator of increment of the overall revenue from the export of items by Ethiopia is recorded when the continental share of N. America is high.

3.3 Summary of the Structure of the Import Trade of Ethiopia

The import trade of Ethiopia is dependent on the goods, which are the products of industries and oil and fuel. Ethiopia trade imports include food, animals, machinery, transport equipments, fuel, cereals, vehicles and textiles. Ethiopia's import volume

grossed is increasing on these recent times. Moreover, China is the largest import partner for Ethiopia in these recent times. Saudi Arabia, India, Italy and Japan also have significant share in Ethiopia imports.

For more general information, the Ethiopian foreign trade of import is dependent on the import of Consumer and Capital goods, Industrial suppliers, Transport Equipment and accessories and Fuel and Lubricants from the continents Europe (which includes countries like Italy, France, Britain, German, Belgium, Russia, Norway, Sweden, Spain and Turkey, the Netherlands and the other European countries have least significance in determining the import trade of Ethiopia) and Asia (which includes countries like UAE, Saudi Arabia, Yemen, China, India, Japan, Korea, Malaysia, Indonesia the other Asian countries have least significance in determining the import trade of Ethiopia). Moreover, the Table 3.2.1 will give us information about the structure of the import trade of Ethiopia across the continents from 1997 to 2010.

Table 3.2.1: The Ethiopia's value of Expenditure to import goods across continents

Continents	Africa		Asia		Europe		N. America		S. America	
Year	Expenditure in Million $	Share out of 100 %	Expenditure in Million $	Share out of 100 %	Expenditure in Million $	Share out of 100 %	Expenditure in Million $	Share out of 100 %	Expenditure in Million $	Share out of 100 %
1997	14.58	2.5	315.37	54.06	218.11	37.39	30.01	5.14	5.25	0.9
1998	8.32	0.42	1744.01	88.01	181.65	9.17	42.34	2.14	5.16	0.26
1999	14.26	0.45	2950.71	93.08	167.37	5.28	32.78	1.03	5	0.15
2000	9.25	0.56	632.08	37.98	999.53	60.06	20.66	1.24	2.55	0.15
2001	10.85	0.28	3311.01	84.68	558.31	14.28	26.23	0.67	3.56	0.09
2002	28.06	2.47	788.02	69.21	293.91	25.81	21.44	1.88	7.16	0.62
2003	21.24	0.25	2818.18	32.87	5707.14	66.56	21.64	0.25	5.85	0.07
2004	60.13	0.44	2830.85	20.58	10837.24	78.78	21.33	0.15	6.68	0.05
2005	19.64	1.13	534.63	30.86	1152.03	66.45	14.17	0.82	12	0.69
2006	24.55	0.38	333.18	5.16	6073.68	94.09	10.6	0.16	12.83	0.2
2007	10.78	0.34	247.1	7.73	2066.27	64.62	10.52	0.33	862.91	26.99
2008	20.42	0.69	14023	47.45	1316.42	44.53	11.88	0.4	204.75	6.93
2009	11.89	0.93	183.67	14.42	761.37	59.76	9.22	0.72	307.84	24.16
2010	18.18	0.9	118.84	5.87	1810.04	89.34	9.38	0.46	69.47	3.43

3.2 The Trend of the Expenditure to the Import Trade of Ethiopia

In this section, we try to investigate the trend of the Expenditure of the import trade of Ethiopia. Table 3.2.2 will help us to compare the best fit that can forecast the revenue from export with respect of time.

Table 3.2.2: Model Summary and Parameter Estimates
Dependent Variable: Expenditure to import goods in USD

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	632	63.535	1	37	000	-77.563	66.399	3.910	
Quadratic	854	104.961	2	36	000	991.207	-90.007	-11.734	261
Cubic	949	218.935	3	35	000	93.225	163.483		
Power	560	47.048	1	37	000	255.275	.509		
Growth	.831	181.442	1	37	000	5.986	047		
Exponential	831	181.442	1	37	000	397.777	.047		

The independent variable is 1:

The interpretations of Table 3.2.2

- From the above table we observe that, the regression models linear, quadratic, cubic, power, growth and exponential are all significant. However, the expenditure of import trade of Ethiopia is best forecasted by then the cubic trend, which can control about 94.9% of the variations with respect of time.
- From the table we see that the expenditure of import trade of Ethiopia significantly growing with time.
- From the table we see that like that of the export trade of Ethiopia, there are two time phases on the import trade of Ethiopia. The first time phase is from 1970 up to 1990 in which the expenditure to import goods was stagnant. The second phase is 1990 to those recent times in which the import trade of Ethiopia showing rapid and considerable growth.

We have enough statistical information that the expenditure to import goods is following a cubic trend; therefore, our next step is to get the estimates of the best regression equation which can possibly forecast the expenditure to import goods with respect of time. According to this, the following table will provide the estimates of the model parameters.

Table 3.2.3: The Estimated model parameters for the Expenditure of the Import Trade of Ethiopia

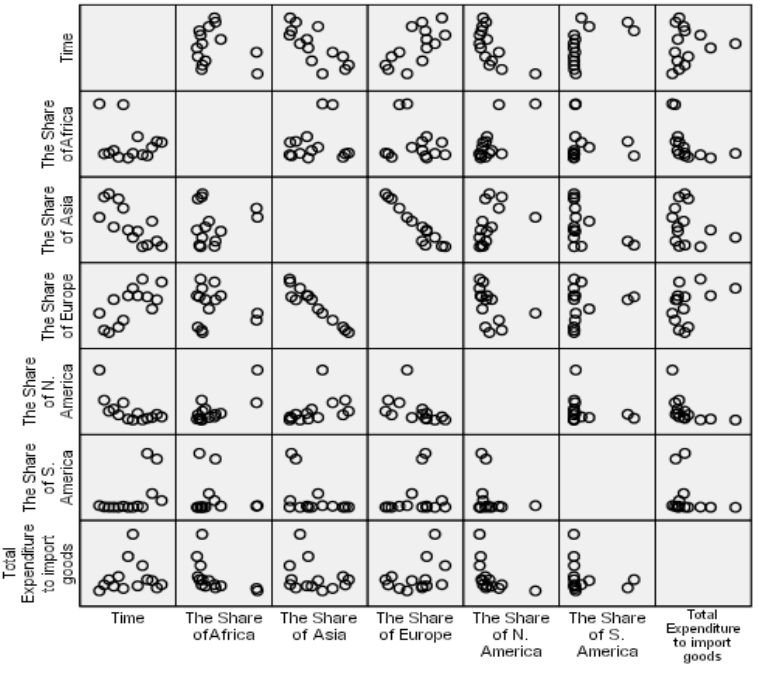
Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
2	tsquare	886 [a]	11.608	.000	.886	1.000
	tcube	933 [a]	15.824	.000	933	1.000
	t	795 [a]	7.971	.000	795	1.000

From Table 3.2.3 the regression equation of the trend of the expenditure to import goods on the import trade of Ethiopia, which is free from both data and statistical problem, is given as:

$\hat{E}I = 0.795\,(t-1969\,) + 0.886\,(t-1969\,)^2 + 0.933\,(t-1969\,)^3$ in millions of US dollar and t is the time in Gregorian Calendar (GC).

By considering the annual continental shares and annual expenditure to import trade from 1997 to 2010, we can characterize the how to decline the import of country. This is summarized by showing the matrix scatter plot in following figure.

Figure 3.2: Important correlations about the structure of the import trade of Ethiopia



From the plot we see that:

- The continental share of Europe is showing a positive correlation with time while the continental share of Asia and N. America are showing negative correlation with time on the on the import trade of Ethiopia.
- An indicator of decline of the overall expenditure to import goods by Ethiopia is recorded when the continental share of Africa, N. America or S. America are high.

3.3 The Trend of the Net Payment of the Foreign Trade of Ethiopia

In sections 5.1 and 5.2, we investigated that the cubic polynomial regression equations are both the best fit for the trends of the revenue from export and the expenditure to import goods on the foreign trade of Ethiopia. In this section, we try to investigate the best fit for the trend of the Net payment of the foreign trade of Ethiopia. Moreover, we can estimate the contribution of the foreign trade of Ethiopia for its GDP.

Now the following table will provide us information about which regression equation is the best fit for the trend of the Net payment of the foreign trade of Ethiopia.

Table 3.3.1: Model Summary and Parameter Estimates
Dependent Variable: EX in USD

Equation	Model Summary					Parameter Estimates			
	R Square	F	Df1	Df2	Sig	Constant	b1	b2	b3
Linea	651	69100	1	37	000	282.739	-56.526		
Quadratic	829	87039	2	36	000	-519.015	60.804	-2.933	
Cubic	920	133930	3	35	000	215.885	-146.649	9.870	-.213

The independent variable is time

The interpretations of Table 3.3.1

From the above table we observe that, the regression models linear, quadratic and cubic are all significant. The regression models of exponential, growth and power are inadequate models since the net payment contain negative observations. And, according to this the net payment of foreign trade of Ethiopia is best forecasted by then the cubic trend which can control about 92% of the variations with respect of time.

From the table we see that the trend of Net payment of the foreign trade of Ethiopia is showing deficit with time.

From the table we see that there are two time phases that the net payment of the foreign trade of Ethiopia was changing at two time phases. The first time phase is from the year 1970- 2000, which shows neither growth nor decrement. In addition, the second time phase is from the year 2000 to these recent times, which shows the net payment is a negative balance.

Table will give us the estimates of the best regression of the trend of the net payment of the foreign trade of Ethiopia.

Table 3.3.2: Estimates of the model parameters of the Net payment of the foreign trade of Ethiopia

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(constant	215.885	166.630		1.296	.204
	tsquare	9.870	2.055	5.812	4.802	000
	tcube	-213[a]	.034	-4.732	-6.313	000
	t	-146.649	35.621	-2.094	-4.117	000

a. Dependent Variable: EX in USD

From **Table 3.3.2** the regression equation of the trend of the Net payment of the foreign trade of Ethiopia is given as:

$$\hat{E}X = 215.885 - 146.649\left(t-1969\right) + 9.87\left(t-1969\right)^2 - 0.213\left(t-1969\right)^3$$

in millions of US dollar and t is the time in Gregorian Calendar (GC).

4. Conclusion and Recommendation

4.1 Conclusion

The export trade of Ethiopia is dependent on the export of Agricultural products and Skin and leather, while its import trade is dependent on the imports Industrial suppliers, Capital Goods, Consumer Goods, Transport Equipments and fuel and lubricants.

The values of the trade of imports and exports are growing with time, but the Net payment of the trade is decreasing with time. The Net payment the foreign trade of Ethiopia has two time phases from the year 1970-2000 and 2000 to the recent times. In

the first time phase we observed that there was a zero balance and in the second time phase the balance is showing the decreasing cubic trend.

When we evaluate the Balance of the foreign trade of Ethiopia, the foreign trade is Net Debtor Nation Running a Current Account Deficit. This might be evidence that, as long as some changes on the structure of the foreign trade of Ethiopia, it will continue that the export trade is dominated by the import trade.

4.2 Recommendations

The structure of the foreign trade of Ethiopia has similar feature between the trade of imports and the trade of exports the difference is that the trade of imports cover many countries than the trade of export. The dominant imported items to the country are the products of small and large industry from the developed countries. The products that imported to the country from the small industries are many of the capital and consumer goods and from large industry are industrial Suppliers.

In order to rebalance the net payment of the foreign trade of Ethiopia, the country needs structural adjustments. Both the government and the private sectors must work together to improve the performance of the foreign trade of the country. As a study, we recommend the following points to improve the performance of the foreign trade of Ethiopia.

The domination of the volume of the import trade of Ethiopia is because of the demand from each the citizens. It means we are all responsible for the negative cubic trend of the net payment of the foreign trade. Therefore, the government needs creating awareness to its citizens about international trade and its impact on the GDP of the country. In parallel to this, the government plays an important rule on the controlling increment of population.

The import of Food and Beverages is insignificant to the overall performance of the foreign trade of imports when we consider its effect within continents. However, if we take its effect across continents, it is estimated that it covers about 5% of the total import value. Therefore, the country increases the potential of producing both the processed and unprocessed food products.

The expansion of electric generation is supportive to the country's growth of export and the subsidizations of the import of Fuel and Lubricants. In parallel to this, the country should use other forms of energy like the production of ethanol and biogas; to reduce the overall reduction of the imports of Fuel and Lubricants.

The country needs the implementations and the expansions of small industries like the industries of textile, cement, furniture's, shoe factories, pharmacy…etc. The implementations of such industries will reduce the total imports of Consumer and Capital goods which covers about 37.5% of the total import value.

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