The Analysis of Causality Relationship Between Export and Economic Growth in Indonesia Year 1986:1 – 2003:4 Using ARDL Approach

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A BACHELOR DEGREE THESIS

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STATEMENT OF FREE PLAGIARISM

Herein I declare the originality of this thesis; there is no other work which has ever presented to obtain any university degree, and in my concern there is neither one else's opinion nor published written work, except acknowledged quotation relevant to the topic of this thesis which have been stated or listed on the thesis bibliography.

If in the future this statement is not proven as it supposed to be, I am willing to accept any sanction complying with the determined regulation for its consequence.

Yogyakarta, December 27, 2006

Eko Budi Prihatin Putro

This Thesis I dedicate to;

Mom & Dad with their never ending love
And the people who loved me with their heart

No Pain, No Gain

Don't loose with faith, we create our own faith

Don't Assess the Result, but Assess the Path of the Struggle

Successfulness will become dignity to us,
when we can grateful to Allah & share it with humanity

Success is not a target but it's a life journey, hence spring up you everyday &
discontinues what too old you conduct to grow & expand

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The writer realizes this thesis is far from perfect, because the eternity always belong Allah. Because of it, I really accept all suggestion & critics for make this thesis perfect. I hope this thesis able to giving advantages for all parties.

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The Writer

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Abstract

Indonesia as less developed country (LDC) still needs much investment to encourage the production especially in export goods. By encouraging the export, it will stimulate the economic growth. Especially in recent condition, Indonesia directly affected by the globalization. Where there are many foreign goods enter the Indonesia's market and compete with domestic goods. In this case, the domestic products lose from the foreign product. It indicates that Indonesia not ready competes in global market and the product itself still lack of product-based export quality.

The objective of this research is to know what the relationship between the export and economic growth in Indonesia. Is there bidirectional causality or unidirectional causality between export and economic growth? To answer this question, the researcher was applying the *Granger Causality Test* combined with *Error Correction Model based ARDL approach by Pesaran and Shin*. The data used in this research were export and economic growth taken from Indonesia Statistic Center Bureau (BPS), Indonesia Export-Import Bureau (BEXI), and Bank Indonesia for the period 1986:1-2003:4.

The result was that there was bidirectional causality from export to economic growth and inversely economic growth to export. From the result can be concluded that the presence of export positively influence to economic growth. Even the export stronger affects economic growth than economic growth affect export.

Abstrak

Indonesia sebagai negara sedang berkembang (LDC) masih memerlukan banyak investasi untuk mendorong produksi terutama dalam produksi barang-barang ekspor. Dengan memperkuat ekspor, akan merangsang pertumbuhan ekonomi. Pada kondisi sat ini, Indonesia secara langsung dapat dipengaruhi oleh efek globalisasi. Yaitu, banyak barang-barang produksi asing masuk pasar Indonesia dan bersaing dengan barang-barang domestik. Dalam hal ini, produk dalam negeri kalah bersaing dengan produk luar negeri. Ini adalah salah satu tanda Indoensia belum siap bersaing dalam pasar global dan produk dalam negeri berbasis ekspor Indonesia masih kalah kualitas.

Sasaran riset ini adalah untuk mengetahui apa hubungan antara ekspor dan pertumbuhan ekonomi di Indonesia. Apakah ada hubungan sebab akibat dua arah atau hubungan sebab akibat searah antara ekspor dan pertumbuhan ekonomi? Untuk menjawab pertanyaan ini, peneliti menerapkan Granger Test hubungan sebab akibat dengan Model Koreksi Kesalahan berdasarkan pendekatan ARDL oleh Pesaran dan Shin. Riset ini menggunakan data ekspor dan pertumbuhan ekonomi diambil dari Kantor Pusat Statistik Indonesia (BPS), Badan Export-Import Indonesia (Bexi), dan Bank Indonesia untuk periode 1986:1-2003:4.

Hasil dari penelitian ini adalah terdapat hubunagan sebab akibat dua arah antara ekspor dan pertumbuhan ekonomi dan sebaliknya pertumbuhan ekonomi mempengaruhi ekspor. Dari hasil tersebut dapat disimpulkan bahwa ekspor secara positif mempengaruhi pertumbuhan ekonomi dan ekspor lebih kuat pengaruhnya dalam pertumbuhan ekonomi.

CHAPTER I

INTRODUCTION

1.1 Introduction

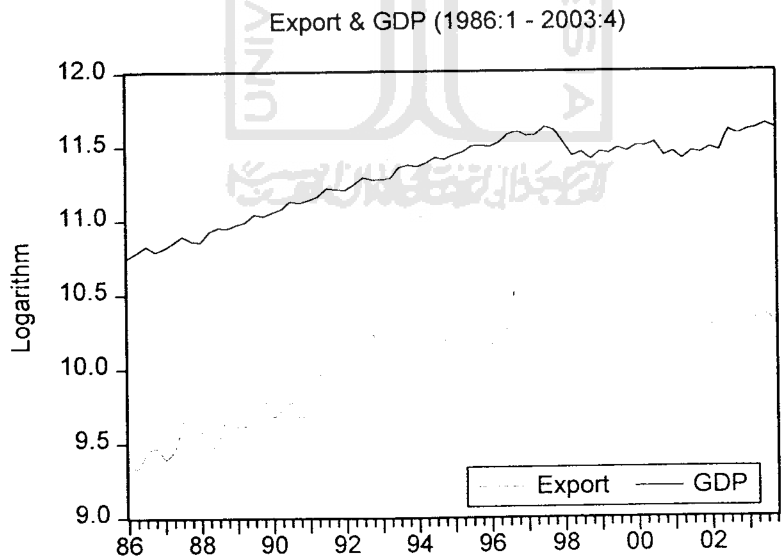
This chapter contains the study background of the research about the causality relationship between export and economic growth in Indonesia and the reason to analyze the problem of causality relationship in a specific period.

1.2 Study Background

One of the indicators of the success of the development is the high economic growth. The high economic growth is needed to fasten the national economy structure toward the dynamic and well-balanced economy, owning strong industrial characteristic, tough agriculture, and also having bases of balanced sector growth. A high economic growth is needed to strengthen the development of other areas, at the same time as special strength of development in order to improve earnings of society and overcome economic social problem which its process earn happened to reduce poorness number and improve of applying of labor (Financial and RAPBN notes, 1997/1998, pg 3).

Indonesia is one of the developing countries that follow an open economy system, the price of the export commodity depend on the world price. It means that an international economy has an important role in developing the national economy. The target of economic development of Indonesia is to develop the national society as a whole with the surplus condition in international trading. The use of advanced technology can help to increase the production on goods and services for trading. In international trade theory a country has a comparative advantage in production of good in case that the quality of the goods is lower in that country, and in other countries. Hence, trade between two countries can benefit both countries, if each country exports having appropriate for a comparative advantage theory.

Figure1. Export & GDP



The figures showed that the GDP and export fluctuated together. Both GDP and export move to the same direction. They even seem to have the same trend. Therefore, they likely have positive correlation. However, GDP leads export or the opposite remains to be seen.

Some previous studies show mixed results. **Harjito (2003)** - The result of his research is export & economic growth are integrated in Indonesia & Singapore, there's a long term relationship. There are two way causality relationship exports to economic growth in Indonesia & Philippines. While, in Singapore unidirectional causality export to economic growth. No causality between export & economic growth in Malaysia & Thailand. **Maulidyah & Dwi Murtiningsih (2003)** – they analyzed the causality of non oil export & economic growth using final prediction error. The data used quantity time series. The result is only unidirectional causality relation economic growth to non oil export. And many others correlated research.

However, those studies do not address the issues of non stationarity when applying granger causality. In this research the researcher only focuses on the relationship between export and economic growth. The question of whether export leads GDP or the opposite is investigated using cointegration based on autoregressive distributive lags framework that overcomes the issue of non-stationarity.

Based on the study background above, the researcher is interested to do a research in some cases to the causality relationship between export and economic growth. In this research the researcher will analyze the causality relationship between exports to economic growth in Indonesia during period 1986:1 – 2003:4.

1.3 Problem Identification

The focus of this research is analyzing the causality relationship between export and economic growth.

1.4 Problem Formulation

1. Whether these variables are correlated export and GDP
2. Whether the export variable affects the GDP or inversely GDP affects export.

1.5 Limitation of Research Area

The limitation of this research based on the data of export, and GDP Indonesia in recent years.

1.6 Research Objectives

Based on study background above, this research observes the behavior of the export variable and economic growth (GDP) variable. The objectives are:

1. To find out whether the export variable affects the economic growth or vice versa.
2. To find those effects using error correction model and long term relationship between export and economic growth (GDP) based on ARDL (autoregressive distributive lags) approach.

1.7 Research Contribution

1. To give other researcher temporary data and argument about the causality of export and economic growth
2. To show the causality relation export with economic growth
3. To find out the coefficient stability of the model
4. To give an additional information to the other researcher.
5. As additional information the export commodity can increase the government balance of trade.

1.8 Definition of Term

Basically, the economic growth defined as a growth process of per capita output in long term (Boediono, 1993). The economic growth involves an increase in economy's real economic growth, and export is one of the economic activities that resulted to the economic growth that involves all economic aspect.

This indicates that in long term the performance of wealth appears on the rise of output per capita and also giving many alternatives in consuming goods and services, and followed by high demand buyer.

By looking at the economic condition by the increasing export, the government observed to the economic growth in the way to of point the macro economic obligation. Based on that background problem, we would like to make an" ***analysis of causality between export and economic growth by using ARDL approach, year 1986:1 – 2003:4."***

1.8 Hypothesis Formulation

There is a feedback or bilateral causality between export and economic growth. It means that export causes economic growth and export causes economic growth or vice versa.

1.9 Thesis Organization

Chapter I Introduction

This chapter explains about study background, problem identification, problem formulation, limitation of research, research objectives, research contributions, and hypothesis and guide book organization.

Chapter II Literature Research Review

This chapter describes some empirical findings from the previous research about the export and economic growth and the previous research used the same method that is causality analysis.

Chapter III Theoretical Background

This chapter gives some understanding about the basis concept of economic growth, economic growth theories, kinds of theoretical trade, the benefits of trade, and the policy and trade barriers.

Chapter IV Economic Description

This chapter contains some information about the recent economic conditions in Indonesia related to the economic growth and the export and the supported economic data appropriate with real condition and situation.

Chapter V Research Method

This chapter explains about the technical method and the steps of data regression.

Chapter VI Analysis Data

This chapter explains about the data regression and the analysis of the regression result, so it can be used to describe the relation between economic growth and export.

Chapter VII Conclusions and Recommendation

This chapter withdraws some conclusion resulted from the data analysis and also several recommendation.

CHAPTER II

REVIEW OF RELATED LITERATURE

2.1. Introduction

This chapter presents some empirical findings from the previous researches about the causality of export and economic growth which used the same method, i.e., causality analysis.

2.2. Literature Research Review

Several recent empirical studies that use Granger-type causality tests have not shown a supportively positive causal relation running from export to the economic growth, such a research conducted by Jung and Marshall (1985) did the research on data for 37 developing countries in the period of 1951 -1981. They found evidence of unidirectional causality of export and the economic growth in four countries. Exports lead to influence the growth causality in one of the industrialized economic countries, bi-directional causality, and no causal relation for the intended countries (Chow,1987). Furthermore, Hsiao (1987) shown that granger causality test confirmed no causal relation between exports and GDP for four Asian industrializing economies, except Hong Kong, where unidirectional causality runs from GDP to exports.

1). D. Agus Harjito (2003)

Harjito has analyzed the causality between exports and economic growth in the ASEAN countries over the period 1966 – 2000. The data used in this research were log export and log GDP. The role of the export variable in the investigation of economic growth was emphasized. Using the Johansen co integration procedure test, the results indicated that there was co integration relationship between exports and economic growth in Indonesia and Singapore, while the Granger causality test showed that there was feedback or bidirectional causality between exports and economic growth, only in Indonesia and Philippines.

The formulations of a Granger – type test of causality are:

$$\mathrm{LnY}_t = \alpha_t + \sum_{i=1}^{m} \alpha_t \ln Y_{t-i} + \sum_{i=1}^{m} b_i \ln X_{t-i} + \text{å}_t \qquad (1)$$

$$\mathrm{LnX}_t = \tilde{a}_o + \sum_{i=1}^{m} \hat{a}_t \ln X_{t-i} + \sum_{t=1}^{m} d_t \ln Y_{t-i} + \grave{\imath}_t \qquad (2)$$

Y is the growth rate of real GDP measured as ln (GDP_t/GDP_{t-1}) and X is growth rate of real export of goods and services measured as ln ($export_t/export_{t-1}$) ε_t and μ_t is zero mean, serially uncorrelated random error terms.

The result of the test for cointegration growth indicates that; (1) exports and economic growth are integrated in Indonesia and Singapore. This conclusion implies that there is a long term relationship between exports and economic growth. While in other countries there is a short term relationship between exports and economic growth. (2) There are two way causality relationships between exports and economic growth in Indonesia and Philippines. While, in Singapore there is only unidirectional causality running from exports to economic growth. However, there is no causality between exports and economic growth in Malaysia and Thailand.

2). Maulidyah and Dwi Murtiningsih (2003)

Maulidyah and Dwi Murtiningsih analyzed the causality of non petrol export with economic growth using final prediction error methods. The goals of this research are (1) To know that non petrol export variable affects economic growth variable and economic growth variable affects non petrol export variable. (2) To know the final prediction error with existence of long term equilibrium between non petrol export with economic growth. The hypothesis proposed is non petrol export having positive effect to economic growth and economic growth having positive effect to non petrol export. Final prediction error with existence of relation between long term equilibrium and non petrol export and economic growth has positive effect, and the final prediction error with existence of relation between long term equilibrium with economic growth and non petrol has positive effect also.

The formulation of final prediction error:

$$FPE_{y(m)} = \frac{N+m+1}{N-m-1} \cdot \frac{SSE}{N}$$

$$\text{FPE}_{y(m,n)} = \frac{N+(m,0)+n+1}{N-(m,0)-n-1} \cdot \frac{SSE}{N}$$

The result of the research is that there was only one way of causality relation between economic growth and non petrol export. From the facts above, it can be concluded that economic growth will bring creation process and expand a strong domestic market because export is not a starting point or initial destination of economic growth but export is only an economic growth process.

The researcher also includes other abroad empirical studies to support the research about relationship between export and economic growth. It is represented in table: 1 summary of a set of 10 empirical studies conducted between 1967 – 1998, which includes time period, methodology, variables, econometric techniques, and conclusions made by the researcher. Although a substantial part of the earlier studies found evidence of a correlation between exports and growth which was used to support the export lead growth, the table tends to hold only for cross section studies. In fact, the recent evidence on time series, which makes extensive use of cointegration techniques, doubts the positive effects of exports on growth in the long run.

As shown in Table 1, some studies use real GDP and export, while others use real GDP growth and export, to examine the relationship between export and economic growth. In addition, those studies make use of various empirical methods

3). Jin (1995)

Jin use time series data from 1976(2) -1993(2), the subject is four little tigers of Asia. The variable real GDP and real exports, other variables are real exchange rate, foreign price shock, and output shock. The methods are F test, ADF test, impulse response function, VAR, EG two step procedures. The results of Jin's research are that: (i) bidirectional causality was found in the short run but no cointegration was detected; therefore, (ii) no long run relationship was proved.

4). Afxentiou & Serletis (1991)

Afxentiou & Serletis use time series data from 1950 – 1985, the subject is developed industrial countries. The variables are real GDP growth and real export growth. The methods are Philips Perron unit root test, EG procedure, and granger causality test. The results are that there: (i) was no systematic relationship between exports; (ii) GDP is verified; (iii) Two countries from 16 countries were 16 were a bidirectional causality manifested (US & Norway).

Table 1.Summary of Literature Review of Previous Study Economic Growth & Export

Study	Sample	Period of study	Methodology					Conclusions
			Data set	Economic growth	exports	Econometric techniques	Other variables	
Balassa (1985)	43	1973-1979 Semi industrialized countries	Cross-section	Real GNP growth	Real export growth	OLS, production function	Savings, labour GDP per capita, share of exports (manufactured products)	Supports the hypothesis and suggests that outward trade orientation is beneficial.
Jung & Marshall (1985)	37	1950-1981 LDCs	Time series	Real GNP or GDP	Lagged real export growth	OLS, Granger causality test	Lagged GNP and GDP growth	Only in 4 cases out of 37 was there evidence that supported the export-led hypothesis (Indonesia, Egypt, Costa Rica and Ecuador).
Lee & Cole (1994)	73	1960-1970 1970-1977	Cross section two sub-periods	Real GNP growth	Real export growth	2SLS, production function, Hausman's test	Labour growth, GDI/GDP	Supports the existence of a bidirectional causality between exports and growth.
Afxentiou & Serletis (1991)	16	1950-1985 Industrial countries	Time series	Real GNP growth	Real export growth	Phillips-Perron unit roots, EG procedure, Granger causality tests	None	No systematic relationship between exports and GDP is verified. Only in 2 cases out of 16 was a bidirectional causality manifested (US and Norway).

Study	Sample	Period of study	Methodology					Conclusions
			Data set	Economic growth	exports	Econometric techniques	Other variables	
Jin (1995)	4	1976(2)-1993(2) Four little tigers of Asia	Time series	Real GDP	Real exports	F-tests, ADF, impulse response function,VARs, EG two-step procedure	Real exchange rate, foreign price shock, output shock	Bidirectional causality was found in the short run but no cointegration was detected; therefore, no long-run relationship is proved.
Al-Yousif (1997)	4	1973-1993 Arab Gulf countries	Time series	Real GDP growth	Real growth of exports and export change/ output	ADF unit roots tests, White test, production function	Labour force and GDI/GDP	Evidence that supports the hypothesis in the short run; however, it fails to find any long-run relationship, i.e. does not find cointegration.
Islam (1998)	15	1967-1991 NICs of Asia	Time series	Real GDP growth	Export growth and Export change/output	ADF unit root tests, Granger causality test, error correction mode	Imports, government nondefence expenditures, trade orientation, investment, instability in exports earnings.	Evidence that supports the hypothesis in the short-run but only in 5 cases was a long-run relation (no cointegration) found.
Shan & Sun (1998)	1	1978(5)-1996(5) China	Time series monthly	Real industrial output	Export growth	Ad hoc production function, VAR	Labour force, investment and energy consumption	Indicates a bidirectional causality between export and real output. Therefore, the export-led hypothesis defined as a unidirectional causal ordering from exports to growth is rejected

CHAPTER III

THEORETICAL BACKGROUND

3.1 Introduction

This chapter explains some theoretical concepts that underlie the relationship between economic growth and export. Before doing so, however the theory of how economic growth and export are determined is highlighted in this chapter.

3.2 Theoretical Background

International commerce in economics that is relied on barter process is voluntary will, from each party. Foreign trade represents activity of transfer of service and goods among countries which have the same advantages. This commerce is conducted because it gives certain benefits. Mercantilism clans have argument that, to become rich, a country should export rather than import.

a. Export Concept Theory

Export is one factor that develops the economic growth and labor absorption. The growth rate exports as a whole can guarantee the supply of foreign exchange. Export's income also imposes the various production of export in an economy to produce goods using domestic resource. It means that the production will be created by opportunity of activity.

If the costs of natural resources are cheap, exports will increase the government's income. The economist Adam Smith firstly showed possibilities that can be obtained from the following advantages intrinsically, he has a notion that:

1. By the existence of international trade, a country is able to raise the goods of production which could not be sold in domestic market, but it is able to be sold in foreign market.
2. By the existence of international trade a country able to expand the markets. The expanding market will support productive sectors to held higher level production technique (Sadono, 1981:128).

b. International Trade Advantage Theory:

1). Adam Smith Theory

Adam Smith, in his book '*The Wealth of Nation*', compares trade to household, because each household is able to produce part of its needs to buy goods using the goods it produces (Appleyard, 1998:25).

Smith also perceives that a nation's wealth was reflected in its productive capacity (i.e. its ability to produce final goods and services), not in its holdings precious metals. Smith believes that the growth in productive capacity is fostered well in an environment where people are free to gain their own interests. Self interest will lead individuals to specialize and to exchange the goods and services based on their own special abilities. Smith observes that there is a small role of the government to intervene the economy. He stresses that a government policy of laissez faire will provide the environment for increasing a nation's wealth.

The proper role of government is to see that the market is free to function in an unconstrained problem by removing the barriers to effective operation of the "invisible hands" of the market.

Smith applies his ideas on the economy activity within a country to specialize and barter among countries. He concludes that countries should specialize in such export commodities which have an absolute advantage and should import the commodities from the trading partners which have an absolute advantage. Each country should export those commodities with absolute advantage; it produces more efficiently because the absolute labor require per unit is less than that of the trading partner candidates.

2). David Ricardo Theory

Ricardo has showed that the advantage of trade still exists for both parties, even of the country which does not have absolute advantage. If there are differences in price comparison without trade, the wanted goods can be produced at low relative price level. Ricardo suggests using the comparative advantage law, in which every country has a good and gets an advantage if the good can be traded to gain another good to consume (Appleyard, 1998).

The essence of Ricardo's argument is that the international trade does not require different absolute advantages but it is possible to trade when comparative advantages exist. A comparative advantage exists whenever the relative labor requirements are different between the two commodities. It means that when the relative labor requirements are different, the internal opportunity cost of the two commodities is different in two countries; i.e., the internal price ratios are different between two countries to trade. For example; country A has a comparative advantage in the production of cloth, and country B has a comparative advantage in the production of radio. Country A's comparative advantage clearly lies in cloth, as much as the relative labor cost (1/2) is less than that in radio (3/4). The basis for trade has evidence that price ratios in each country are different.

3). Stopler – Samuelson Theory

This theory shows that open trade and the rise of relative price from export goods definitely brings an advantage to the production factors which can be used intensively in perfect competition market. Based on this theory, the assumption starts that trade can increase the result of the factors used intensively in industry with low price and not depend on price (Kindleberger.1993:23).

3.2.1 The Benefits of International Trade

- Trade is an important stimulator of economic growth. It enlarges a country's consumption capacities, increases world output, and provides access to scarce resources and worldwide markets for products.
- Trade tends to promote greater international and domestic equality by equalizing factor prices, raising real incomes of trading countries, and making efficiency of the use of each nation's and the world's resource endowments (e.g., raising relative wages in labor abundant countries and lowering them in labor scarce countries).
- Trade helps countries achieve development by promoting and rewarding the sectors of the economy where each country has a comparative advantage, in terms of labor efficiency.

- In a world of free trade, international prices and costs of production determine how much a country should follow the principle of comparative advantage and not try to interfere with the free workings in the market.
- To promote growth and development, an outward looking international policy is required. In all cases, self reliance based on partial or complete isolation is asserted to be economically inferior to participate in a world of unlimited free trade.

3.3 Basic Concept of Economic Growth

Before discussing the concept of economic growth, the researcher interprets the definition of GDP as activator of economic growth. The gross domestic product (GDP) is the primary indicator used to measure the health of a country's economy. It represents the total dollar value of all goods and services produced over a specific time period. Usually, GDP is expressed as a comparison to the previous quarter or year with present quarter or year. For example, if the year-to-year GDP rises by 3%, it means that the economy has grown by 3% over the last year.

Measuring GDP is complicated; the calculation can be done in one of two ways: either calculates the people earned in a year, or calculate the people spent in a year. Logically, both measures should arrive at the same total.

A significant change in GDP, whether up or down, usually has a significant effect on the stock market. It's not hard to understand why a bad economy usually lowers the profits for companies; it means that the stock prices lower. Investors worry about negative GDP growth, which is one of the factors determining economic factors, if an economy is in recession condition.

The concepts of economic growth and economic development are very close, although they are quite different. Economic growth involves an increase in an economy's real growth domestic product (GDP) and income over time. Economic development involves economic growth itself in addition to the process of broad structural changes and transformation of the economy.

In its closest association to the concepts of economic development, economic growth is defined in terms of increasing per capita real output or per capita income. Economic development is the process which the economy raises per capita output and income by improving and increasing the productivity, and how these factors may increase income per capita.

Economic development involves growth and structural changes. To develop the economy there must be positive economic growth accompanied by structural transformation in the economy. Achievement and maintenance of structural transformation is the sufficient condition for economic development. Todaro (1998), states that the indicators of economic development are showed by: (1) the development of people ability to fulfill their basic needs, (2) increase of the self – esteem, (3) and the increase the freedom from servitude which part of human right.

3.3.1 The Measurement of Economic Growth

1. Internal Measurement of Growth

Economic growth reflects the increases in capacity of productivity (expansion of GDP) and changes in the rate of utilization of this capacity (percentage increases). GDP measures the total output of final goods and services produced by the region of the country over a given period of one year. The GDP (y) defined in terms of annual gross national expenditure of economy. The economy's total gross national expenditure is made up of its total domestic expenditure and its net foreign trade transaction. The total domestic sector expenditure comprises of the individual and household private sector expenditure (consumption, c), the total business sector – sector expenditure (Investment, I) and the total public sector expand (government expenditure, G), the net foreign trade transaction, i.e., is total volume of exports (x) minus total volume imports (M). The GDP expressed as:

$$Y = C + I + G + X - M \qquad (3.1)$$

2. External Measurement of Growth

For the purposes of international comparison of economic performance, a growth index takes into account of a nation ability to expand, its output relative to (or, rather, at a faster than) the growth of its population. In the connection, levels and rates of the growth of real per capita GDP are normally used to measure the populations of overall country's economy. This term indicates the nominal or monetary value minus the rate of inflation. This index suggests how much real goods and services should be available to the nation's average income. By using this index, it is easy to carry out a straight forward comparison of economy well being or welfare across nations, as a parameter that gives quantitative measure of standard of living.

3.4 The Relationship of International Trade and Economic Growth

Although the theoretical links between export and economic growth have been discussed for over two centuries, the controversy of this term still exists regarding their real effects. The initial wave of favorable arguments with respect to international trade can be traced to the classical school of economic thought that was started by Adam Smith and this argument was subsequently enriched by the work of Ricardo, Torrens, James Mill and John Stuart Mill in the first part of the nineteenth century. Since then, the justification for free trade and the benefits of international specialization brings to the productivity of nations have been widely discussed and documented in the economic literature (Bhagwati, 1978; Krueger, 1978).

Being a component of GDP, exports directly contribute to national income growth. Indirect growth can stimulate the promoting effects due to scale of economies, increased capacity utilization, productivity, and greater product variety. Furthermore, greater exposure to the world market may induce the competitive pressures that lead to improving the technology, production efficiency as well as in management procedures, etc (Krueger,1980).

Economic development is one of the main objectives of every society in the world and economic growth is fundamental to economic development. Neoclassical school of economists suggests that exports give major contributions to economic growth. There are four reasons mentioned for the support of this hypothesis: a) specialization gives benefit from the comparative advantages; b) utilizing the full capacity of the market size, where domestic demand is less than the full capacity production; c) getting benefits of the greater economies of scale due to large market, and d) increasing the rate of investment and technological change (Krueger, 1978, Kavoussi, 1984, and Ram, 1987).

In addition the competition in the world market may also help producer to reduce inefficiencies. There are also some term concerning about trade, especially between the primary and industrial goods exporting countries where the terms of trade are deteriorated against the poorer countries. The income elasticity of demand for primary products is low. Technical innovations and synthetic substitutes for natural resources decrease the demand for primary products and the real prices for them have fallen overtime (Mozhgan Alei Far).

The theory of export related with economic growth is supported by the research of some economist. They generally agree that export benefits economic growth, the researchers found contrasting evidence that export is Granger caused economic growth, while others demonstrated that there exists a bi-directional relationship between these variables. But, Dorado (1993) found that export growth has had negative rather than positive effect on economic growth. Those effects negative or positive depend on the performance of such country's economic.

CHAPTER IV

ECONOMIC DESCRIPTION

4.1 Introduction

In this chapter the researcher describe about the condition of export and economic growth, pre and post the economic crisis. The researcher shows the process of growth both export and economic growth and the trade barriers and the solutions.

4.2 Economic Growth

Before the economy crisis in the middle of 1997, economic growth in Indonesia showed a good performance. In the period of 1990 until 1996 the economic growth in Indonesia always was above 5%, even in the year of 1995 the economic growth reached 8.22%. It means that the economy condition before the crisis was sustainable. However, the crisis makes Indonesian economic condition be suffered until now. In 1997, the economic growth decreased to 4.91 % and got worse in 1998, decreasing to -13.1 %.

Several economic actions and policies were applied during the crisis by the government to recover the economic condition; the results are the economic progression. The economic growth in the year 1999 became positive even it only still reaches 1 %. This increase caused by the increasing of household or private consumption results from the increase in real income. Moreover, it is supported by the trust of consumer with the market because of the political and safety condition. As a consequence, the contribution of private consumption to the GDP increases from 66 % to 74 %. On the other hand, the contribution of government consumption increases from 5.43 % to 6.58 %. There is also a negative growth of export. As the consequences, the contribution of export to GDP decreases from 50.51 % in 1998 to 35.04 % in 1999.

Table 1 Growth of GDP at constant market price 1993

By expenditure (%)

Expenditure	1996	1997	1998	1999	2000
Private Consumption	9.27	7.82	-3.2	1.48	3.63
Growth & fixed Capital formation	2.69	0.06	-15.37	0.69	6.49
Exports	14.51	8.57	-35.54	-20.78	17.91
Imports	7.56	7.80	11.18	-32.06	16.06
GDP	7.82	4.70	-13.20	0.23	4.77

Source: Deprin.go.id (annual report)

The table shows that the economic recovery becomes better even it is still in weak condition. Even, when the economic growth can reach 4.8 %, it is beyond the government's targets that predicts around 3 – 4 %. This growth is supported by the investment spending that increases 17.9 % and export demand increases 16.1 %. From the demand side, at the beginning, the economic growth is mostly supported by private consumption, and then supported by export and investment. In the second quarter of the year 2000, the contribution of export, investment and private consumption to the GDP are 5.67 %, 4.05 %, and 2.01 %.

Generally, economic condition from 1999 to 2003 experiences positive growth. The economic condition is showed that in the macro condition such as stable foreign exchange rate, interest rate decreases, export increases, inflation rate is controlled; budget deficit decreases, and capital outflow decreases.

On the other hands, the micro condition also showes the economic recovery such as banking recovery, and the better intermediation function of the bank to allocate credit to middle micro business scales.

Meanwhile, the economic activity based on sectors, during the first semester of year 2003, is supported by positive growth that occurred in all sectors that formed GDP. The greater contribution was from manufacture sector and transportation sector (Table 2).

The economic growth rate of Indonesia in the year 2003 is better compared to the year of 2002. Based on the GDP estimation (constant price 1993), the economic growth in the year of 2002 was 5.66 % and GDP value year 2001 is 411.1 trillion and without non oil estimation the GDP is 393.7 trillion (BPS 2002).

Table 2 Percentage of Roles of Industrial Sub-Sector Process to GDP

(Based on constant price 1993 for 1993 – 1999

And constant price 2000 for 2000-2004)

Year 2003

No.	Industrial Sub-Sector Process	Value (Milyar Rp.)	Role to GDP (%)
A. Oil Industry		**52.609,2**	**3,33%**
1.	Refinery oil	22.374,1	1,42%
2.	Nature Gas	30.235,1	1,91%
B. Non Oil Industry		**389.145,5**	**24,64%**
1.	Food, Drink, and Tobacco	116.528,6	7,38%
2.	Textile, Husk goods, and Sandals	51.483,6	3,26%
3.	Woods and other Forest Goods	20.754,3	1,31%
4.	Paper and Printed Goods	21.731,1	1,38%
5.	Manure, Chemical, and Rubber	50.008,7	3,17%
6.	Cement and Mining non metal goods	13.735,8	0,87%
7.	Base Metal, Iron and Steel	8.222,9	0,52%
8.	Appliance Transport, Machine	103.414,7	6,55%
9.	Others	3.265,8	0,21%

Source: BEXI (Indonesia Export-Import Bureau) 2003

4.3 Export

Export is one of the economic activities which sells domestic product to the foreign market to fulfill the market demand. Export directly affects the economic growth. If the export is positive, the economic growth also shows a good performance. The income factor of the other country influences the export volume of Indonesia, because the number of export demands is determined by the production capacity of such country. In accordance with the increase of the world income, the export volume in such country will increase if the other factors are constant (ceteris paribus). The export volume is affected by relative price among the countries. The Indonesian relative price is low compared to foreign price that makes the export volume of Indonesia become high. Then the taste and trade policy will influence the related country's export volume (Suparmoko & Maria 2000).

The Indonesian economic crisis in the middle of 1997 is showed by the decline of export related to depreciation of currency. The people expect that the depreciation of large currency will be followed by a strong export growth. This argument is suitable with the standard international trade theory and the fact that Indonesia's past experience in trade showed a close link between devaluation and export performance (Radelet, 1996 and Tambunan, 1996).

The Indonesian export value from 1986 was dominated by oil export, but since year 1987, non oil export has been increasing. The increase of non oil export value happened after the government conducted a policy and deregulation in export. In the year 1987 total non oil export was more than 50 % compared to total oil export. The growth rate export average was 12.1 % per year.

Table 3 Trend Value of Exports (Million US$)

Year	Export (Total US$)
1980	23 950.4

1981	25164.5
1982	22328.3
1983	21145.9
1984	21887.8
1985	18586.7
1986	14805
1987	17135.6
1988	19218.5
1989	22158.9
1990	25675.3
1991	29142.4
1992	33967
1993	36823
1994	40053.4
1995	45418
1996	49814
1997	53443.6
1998	48847.6
1999	48665.4
2000	62124
2001	56320.9
2002	57158.8
2003	61058.2

Source: BPS Trade & Finance year 2003

From the growth of export trend value on table 3 above, the prospect of export of Indonesia relatively continues in good conditions.

The growth focuses on the increase of export values especially in non oil sector. In the year 2001, the exporting results of industry continue to increase in the year of 2003.

However, from the exporting contribution compared to some countries in the world, the position of Indonesian exports relatively remains in downhill position. From 30 world exporter countries, Indonesia is in the position of 26 with contributions only 0,84 % in the world exports in the year of 2003. Meanwhile, in 2001, Indonesia only contributes 0,92% of the world exports. Even, the role of Indonesia exports before the economic crisis show a better condition compared to that of the year of 2003 (Table 4).

Table 4.The Role of World Exporter Countries (%)

Countries	1996	1998	2001	2003
German	9,80	9,97	9,32	10,05
US	11,68	12,51	11,92	9,72
Japan	7,68	7,12	6,58	6,34
China	2,82	3,37	4,34	5,88
France	5,38	5,61	4,85	4,91
England	4,90	4,99	4,36	4,09
Canada	3,77	3,93	4,24	3,66
Netherlands	3,69	3,69	3,53	3,47
Belgium	3,28	3,29	3,11	3,43
Hong Kong	3,38	3,19	3,10	3,01
South Korea	2,42	2,43	2,45	2,60
Mexico	1,79	2,15	2,59	2,22
Spain	1,91	2,00	1,88	2,10
Singapore	2,34	2,02	1,99	1,95
Russia	1,69	1,37	1,68	1,80
Sweden	1,59	1,56	1,25	1,36
Malaysia	1,46	1,34	1,44	1,33
Swiss	1,42	1,38	1,27	1,30
Ireland	0,91	1,18	1,35	1,24
Austria	1,08	1,15	1,09	1,18
Thailand	1,04	1,00	1,06	1,08

Brazil	0,89	0,94	0,95	0,98
Australia	1,13	1,03	1,03	0,96
Norwegia	0,93	0,74	0,97	0,91
Denmark	0,96	0,90	0,83	0,89
Indonesia	**0,93**	**0,90**	**0,92**	**0,84**
India	0,62	0,61	0,71	0,75
Finland	0,72	0,79	0,70	0,70
Turkey	0,43	0,49	0 51	0,63
Hungary	0,29	0,42	0,50	0,57
Others	19,08	17,91	19,48	20,03
World total (billion US$)	5.351,47	5.450,62	6.128,92	7.445,69

Source: Indonesia Trade Department 2003(without service sectors)

Because the exporting value amount of Indonesia has not shown the growth compared to the world exporting. However, Indonesia is unable to get the opportunity to penetrate the world exports market. However, China is able to continue its market penetration to the world export market.

The regional economic development is very slow, especially in East Asia. This is one of the factors that cause low demands in Indonesia's exports. Because of the great depreciation, the import cost becomes very expensive. It makes most export producers avoid the high costs. One factor that is believed to have strong relations to the poor performance of non-oil exports and high exchange rate depreciation is dealt with the social and political instability in the year of 1998 and in 1999, particularly the crisis of May 1998 which caused many international buyers to shift their orders to other countries.

On the micro level study (firms level), in most Indonesia's rattan furniture industry, export volume increased during the crisis period while there was a pressure from an unofficial foreign buyer association to lower the price of rattan furniture due to the large depreciation since the member of association realized that most rattan furniture firms have low access to broader market (Abdurohman and Nasution, 1999). The fact describes that fall of Indonesian non-oil export performance caused by the depreciation of Rupiah value.

This is also strongly supported by the fact that the world market prices for Indonesia's export commodities are slowing down as shown by the following table consisting the data collected from Global Commodity Market (World Bank, various issues).

Table 5. World Market Prices for Indonesia's Export Commodities

Commodities	1997 Export value ($M)	Unit	Jan-Jul 1997	Jul-Dec 1997	Jan-Jun 1998	Jul-Dec 1998	Jan-Jun 1999	% change Jan-Jun 97 to Jan-Jun 99
Agriculture								
Shrimps, Fresh & Frozen	1,008	$/kg	9.35	10.47	7.63	5.97	7.3	-22
Coffee	504	cent/sheet	177	170	188	177	161	-9
Fish	381	$/kg	1.14	1.11	1.19	1	0.94	-17
Industry								
Plywood	3,411	cent/sheet	500	474	384	372	423	-15
Textiles	3,658	$/kg	2.9	2.63	2.81	1.85	1.74	-40
Processed Rubber	1,988	cent/kg	116	85.8	73.2	68.7	62.7	-46
Palm oil	1,446	$/mt	559	530	663	681	511	-9
Paper & Paper Products	939	$/mt	573	461	482	510	469	-18
Mineral								
Cooper	1,485	$/mt	2,463	2,090	1,716	1,592	1,438	-42
Coal	1,497	$/mt	37.7	32.7	29.3	26.8	24	-36

Source: Global Commodity Market (World Bank.co.id, various issues 2002)

Based on the table above, it seems that most Indonesia's export commodity price has fallen around 25% since the devaluation. The percentage of change from January – July 1997 to January – June 1999 are negative, especially the primary product, such as copper, coal, plywood, rubber. Therefore, in this case, it is very important to observe the price movement as well as the quantity movement in analyzing the export performance.

4.3.1 Trade Barriers and Solutions

To increase exports, it needs to improve the infrastructure of domestic markets. The good domestic market will effectively support exports. The government has been trying to improve the infrastructure since the period of crisis. Infrastructure Summit (First IS) which was held last January and also the second IS which was held in November 2005 represent one of the evidences in resolving the problems of exports.

The strategies to expand the exports are also resulted from the infrastructure summit. The export strategies are:

1. <u>Reducing the high economic cost</u>. This matter can be reached by improving the policy transparency including licensing of commercial sector, conducting the deregulation of commerce regulation either in central region or in the region, making moderate licensing procedure in commercial sector (like SIUP, exporting document & import).

2. Making a good current flow by improving the distribution of efficiency. E.g., reduction or abolition of unequal distribution (like Perda and area retribution), increasing the availability of transportation and also integrating the security of domestic market.
3. Increasing the export competitiveness. E.g., having competitive export commodities, improving the traditional market export (ACE, Singapore and Japan) and non traditional export; improving the access market with exploiting of FTA (Free Trade Area) both bilateral or regional.
4. Eliminating the tariff resistance and non tariff. It is applied in the exporting countries and controlling the commodity price stability; completing commerce facility through import cost tariff stability, restituting tax and licensing procedure; and improving the role of support institution of commerce like financing trade for exporting.
5. Improving the coordination to support the development of investment. It is expected to develop sectors of commodity of exporting forestry, industry, and mining. This matter is reached by balancing the regulation of commerce and the regulation in export especially the development of export itself; eliminating the treatment of discrimination between foreign investor and domestic investor.

CHAPTER V

RESEARCH METHOD

5.1 Introduction

This chapter presents the empirical methods employed in this research. Before proceeding to Granger Causality and bounds testing cointegration based on ARDL, the researcher conduct unit root test on the variables used the Augmented Dickey Fuller (ADF) Method.

5.2 Research Method

Referring to the research conducted by the previous researchers about the causality test, the researcher used the same hypothesis but different variables and methods. For example; D. Agus Harjito (2003) analyzes the causality relationship among export & economic growth in the ASEAN countries using the Johansen co integration procedure test. The purpose is to find out that economic growth affect export or inversely. The error correction model used is to find out the existence of long run equilibrium between export and economic growth and the relationship between export and economic growth. This method is to find the short run and long run relationship among both variables in order to avoid spurious regression.

In this research, the researcher analyzed the causality relationship between export and economic growth in Indonesia, during period 1986:1 –

2003:4. The researcher used unit root test to know whether the data are stationer or not and used Engle Granger Causality test to find out that export variable affect the economic growth variable or vice versa and used error correction model to avoid the error term in the data interpretation.

5.3 Research Subject

The researcher used export and economic growth as the subject of research. The data ranges were from 1986:1 – 2003:4 collected from Industrial and Trade Department and statistical year book of Indonesia and also BEXI (Export-Import of Indonesia Bureau).

5.4 Research Variables

The researcher used two variables i.e., the export (Xt) as the dependent variable and economic growth that is GDP (Yt) as independent variable. These data are in log form and taken from 1986:1 to 2003:4.

The researcher used Engle Granger causality test to find out the causality relationship between export variable and economic growth variable. The researcher used integration testing to find out whether the data are stationer or not before doing the unit root test. The researcher also used error correction model method to get the optimum time lags.

5.5 Technique of Data Analysis

This research used Engle Granger causality test, Integrate test, Unit Root test, cointegration test and error correction model based on ARDL approach.

The researcher used quantity time series data, in time series data usually showed spurious correlation, because the data were not stationer and not co integrate, to avoid that problem. The test followed the following requirements:

5.5.1. Integration Testing (Unit Root Test) or Stationery Test

This test is to find out whether the data is stationer or not. If the data are not stationer, it needs to differentiate many times to get the stationer data. The data are stationer if they following this term:

Average : $E(Y_t) = \mu$ (constant average)

Variance : $Var(Y_t) = E(Y_t - \mu)^2 = \alpha^2$ (constant variance)

Covariance: $k = [(Y_t - \mu)(Y_t + k + \mu)]$

(Covariance between two periods depends on time length, between two Periods, does not depend on the count of the covariance).

Analyzing the time series data which are stationer has moved to average range, means the progress of variables point caused random factor. This test method and root square are developed by Dickey and

Fuller (Df test) and augmented Dickey Fuller (ADF test). The data are tested by these following three models:

$$\Delta Y_t = \delta y_{t-1} + U_t \qquad (1)$$

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + U_t \qquad (2)$$

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + U_t \qquad (3)$$

ADF test with maximum velocity as much as K = N. the model is:

$$\Delta Y_t = \delta y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + U_t \qquad (4)$$

$$\Delta Y_t = \beta_1 + \delta y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + U_t \qquad (5)$$

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + U_t \qquad (6)$$

Tested hypothesis are:

Ho = δ = 0 (is a unit root or data is not stationer)

Ha = δ = 0 (stationer data)

(Kuncoro, 2001:146).

5.5.2. Granger Causality Test

This method is popular because it is able to give relevant information to predict export variables that affect the economic growth or to predict that the economic growth variables affect export variable. Granger causality test is used to find out the short term relationship among variables. The formulas are:

$$Xt = \sum_{i=1}^{m} \alpha_i X_{t-1} + \sum_{j=1}^{n} b_j Y_{t-1} + Ut$$

$$Y_t = \sum_{i=1}^{m} c_i Yt\text{-}j + Ut + \sum_{j=1}^{n} d_j X_{t-j} + U_t$$

Where: X_t = export

Y_t = economic growth

n,m = lags

U_t, V_t = disturbance variables

The regression result of Granger causality test for both models will result four possibilities about the coefficient point for each regression.

a. If $\sum_{j=1}^{n} b_j \neq 0$ and $\sum_{j=1}^{n} d_j = 0$ so it shows one direct causality of economic growth to export.

b. If $\sum_{j=1}^{n} b_j = 0$ and $\sum_{j=1}^{n} d_j \neq 0$, so it shows one direct causality of export to economic growth.

c. If $\sum_{j=1}^{n} b_j = 0$ and $\sum_{j=1}^{n} d_j = 0$, so it shows no causality of export variables to economic growth variables or both.

d. If $\sum_{j=1}^{n} b_j \neq 0$ and $\sum_{j=1}^{n} d_j \neq 0$, so it show two direct causalities among variables.

5.5.3. ARDL (Autoregressive Distributive Lags) Approach

ARDL method is to test the existence of a level relationship between a dependent variable and a set of regressor, when it is known with certainty whether the underlying regressor is trend or first difference stationary. The proposed test is based on standard F and t-statistic used to the significance of the lagged levels of the variables in a univariate equilibrium correction mechanism. The asymptotic distribution of this statistic is non standard under the null hypothesis that exists no level relationship irrespective of whether the regressors are I (0) or I (1).

Two sets of asymptotic critical values are provided: one when all regressor are pure I (1) and the other if they are pure I (0). These two sets of critical values provide a band covering all possible classifications of the regressor into pure I (0), pure I (1) or mutually cointegrated.

Accordingly, various bounds testing procedures are proposed. It is shown that the proposed test is consistent, and their asymptotic distribution under the null and suitable defined local alternatives is derived.(Pesaran & Shin, 2001).

1. Error correction model based ARDL approach.

In order to test the absence of a level in data that affects in the conditional ECM more crucially to the absence of level relationship between Yt and Xt, it differentiates among five cases of interest delineated according to how the deterministic components are specified, and these five cases are presented in tables of bound test (see appendix) by Pesaran to detect the cointegration. The cases are:

a. Cases I (no intercepts, no trends) co = 0 and c1 = 0. That is $\mu = 0$ and $\gamma = 0$. the ECM is:

$$\Delta\gamma_t = \pi\ yy\ y_t - 1 + \pi\ yx.x\ X_{t-1} + \sum_{i=1}^{p-1} \psi i\ \Delta z_{t-1} + \dot{\varpi}\ \Delta x_t + \mu_t$$

b. Case II (restricted intercepts, no trend) co = -(π yy, π yx.x) μ $c_1 = 0, \gamma = 0$

$$\Delta\gamma_t = \pi\ yy\ (\gamma_{t-1} - \mu_y) + \pi\ yx\ (x_{t-1} - \mu_x) + \sum_{i=1}^{p-1} \psi i\ \Delta z_{t-1} + \dot{\varpi}\ \Delta x_t + \mu_t$$

c. Case III (Unrestricted intercepts, no trends) co $\neq 0$, c1 = 0. Again $\gamma = 0$. the intercept restriction co = -(π yy, π yx.x) is ignored and the ecm is

$$\Delta\gamma_t = co + \pi \text{ yy } y_{t-1} + \pi \text{ yx.x } x_{t-1} + \sum_{i=1}^{p-1} \psi i \ \Delta z_{t-1} + \varpi' \Delta x_t + \mu_t$$

d. Case IV (unrestricted intercepts, restricted trends) co $\neq 0$ and c_l = -(π yy, π yx.x) γ

$$\Delta\gamma_t = co + \pi \text{ yy } (y_{t-1} - \gamma_y t)\ \pi_{yx.x}\ (x_{t-1} - \gamma_x t) + \sum_{i=1}^{p-1} \psi i \ \Delta z_{t-1} + \varpi' \Delta x_t + \mu_t$$

e. Case V (unrestricted intercepts, unrestricted trends) co $\neq 0$ and $c_l \neq 0$, the deterministic trends restriction c_l = -(π yy, π yx.x) γ is ignored and the ecm is;

$$\Delta\gamma_t = co + c_l t + \pi \text{ yy } \gamma_{t-1} + \pi_{yx.x}\ x_{t-1} + \sum_{i=1}^{p-1} \psi i \ \Delta z_{t-1} + \varpi' \Delta x_t + \mu_t$$

The five cases above are to determine the F stat of bound test cointegration among variables in given lags. If the computed F stat larger than the critical value of bound test of level relationship table, it is cointegrated I (1), inverse if the computed F stat is less than critical value, it is not cointegrated.

To detect the long run relationship between export and economic growth, the researcher employed autoregressive distributed lag cointegration procedure by Pesaran et. al. (1996), the researcher also applied different model selection criteria to test the consistency of the variables. To begin with, the researcher tested the null of no cointegration against the existence of a long run relationship. Unlike other cointegration techniques (e.q., Johansen procedure) which require certain pre testing for unit roots and that the underlying variables to be integrated are of order one, the ARDL models provide an alternative test for examining a long run relationship whether the underlying variables to be integrated I (0), I (1), or fractionally integrated. The error correction representation of ARDL model for the equation is:

$$dlnYt = \alpha_o + \sum_{j=1}^{k1} b_j\, dlnYt_{t-j} + \sum_{j=0}^{k2} c_j\, dlnXt_{t-j} + n_1\, Yt_{t-1} + n_2\, Xt_{t-1}$$

$$dlnXt = \alpha_o + \sum_{j=1}^{k1} b_j\, dlnXt_{t-j} + \sum_{j=0}^{k2} c_j\, dlnYt_{t-j} + n_1\, Yt_{t-1} + n_2\, Xt_{t-1}$$

Where:

Yt: GDP (log)

Xt: Export (log)

α_o: Constanta / intercept

j: number of lags

k: number of regressor

b, c: regression coefficient

d: difference

Accordingly, the null hypothesis of no cointegration (as defined by Ho = $n_1 = n_2 = 0$) is tested against the alternative by means F test. The asymptotic distributions of F stat are non-standard irrespective of whether the variables are I (0) or I (1). Pesaran provides two sets of asymptotic critical values. One set assumes that all variables are I (0) and the others are I (1). If the computed F stat falls above the upper bound critical value, then the null of no cointegration is rejected. If it falls below the lower bound, then the null cannot be rejected. Finally, if it is fall inside the critical value band, the result would be inconclusive. Once cointegration is confirmed, the researcher moved to the second stage and estimated the long run coefficient of economic growth (GDP) function and the associated ARDL error correction model.

5.5.4. Diagnostic Test

1. Heterocedasticity

Heterocedasticity is a condition where the disturbance of variable does not have the same variance. To detect the heterocedasticity, the researcher used the white test. The steps of white test are as follows:

a. Regress the model and get the residual value (μ_t).

$DYt_t = \beta_1 + \beta_2\ DXt_{2t} + \beta_3\ DXt_{3t} + \beta_4\ ECT$

b. Regress the auxiliary and get the R^2 value

$U_t = \alpha_1 + \alpha_2\ DXt_{2t} + \alpha_3\ DXt_{3t} + \alpha_4\ ECT + \alpha_5\ DXt_t^2 + \alpha_6\ BXt_t^2 + \alpha_7\ ECT^2$

c. Count the X^2 with the formula $n.R^2$

d. If X^2 computed value > X^2 critical value (α, df) so there is a heterocedasticity in model (Ho: Homoscedasticity). df value is an independent variable in auxiliary regression.

2. Autocorrelation

Autocorrelation happens if there is a disturbance error in a correlated period with previous disturbance error period. One important assumption in a linier model is if there is no autocorrelation or successive condition among the disturbances in the regression function.

Breusch-Godfrey in his research tracks the existence of autocorrelation. The steps of Breusch-Godfrey test are as follows:

a. Regress the model

$DYt = \beta_1 + \beta_2\ DDXt_{2t} + \beta_3\ DXt_{3t} + \beta_1 ECT_1$

b. Regress the μ_t in all independent variables in the model and get the new independent variables. $\mu_{t-1}, \mu_{t-2,\ldots} \mu_{t-p}$ are lag value from estimate residual, and then get the R^2 value.

$DYt_t = \beta_1 + \beta_2 DXt_{2t} + \beta_3 BXt_{3t} + \beta_{4\mu t-1} + \beta_{5\mu t-2} + \beta_{6\ \mu t-3} + \ldots + \beta_{7\mu t}$

c. Count the χ^2 statistic by the formula: $\chi^2 = (n.p)R^2$

Where; n = total observation in a complete regression model, p = max time lags.

d. If the χ^2 computed value > χ^2 table = χ^2 (α, p), it shows autocorrelation (reject Ho). And if the χ^2 computed value < χ^2 table = χ^2 (α, p), it shows no autocorrelation.

5.5.5. Coefficient Stability Test CUSUM and CUSUM Square

The CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of *n* observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5% significance level represented by a pair of straight lines drawn at the 5% level of significance whose equations are given in Brown, Durbin, and Evans (1975), the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. If either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5% level of significance. A similar procedure is used to carry out the CUSUMSQ test, which is based on the squared recursive residuals. If the entire coefficient is relative stable after the test, it shows that the coefficient of variables relationship quite significant in term of causation relationship.

CHAPTER VI

DATA ANALYSIS

6.1 Introduction

This chapter explains about the data regression and the analysis of the regression result, so it can be used to describe the relation between economic growth and export.

6.2 Data Analysis

The researcher were used the quarterly data 1986:1 – 2003:4 period (table a). The data of GDP (Gross Domestic Product) and export collected from Bexi (Indonesia export-import bureau 2003) the data are in level. Before regress the data, the researcher changes the data into log. The log transformation can reduce the problem such a heterocedasticity, it compresses the scale in which the variables are measured, thereby reducing a tenfold difference among two values to a twofold difference (Gujarati 1995). The researcher used a computer program Eviews and Microfit to interpret the data. The result interpretation began with stationery data test by using Dickey and Fuller as condition to apply the ECM model. Before applying the ECM test, the researcher provided a Johansen cointegration test with stationery data to avoid spurious result. The researcher included the granger causality test to find the relationship between two variables.

In this research, the researcher also developed a new approach to the problems that is testing the existence of a level relationship between a dependent variable and set of regressor. The proposed tests were based on F statistics and they were used to test the significance of lagged levels of the variables in a univariate equilibrium correction mechanism. Once cointegration was confirmed, the test moves to the second stage and estimated the long-run coefficients of export function and the associated ARDL error correction models.

Finally, the researcher examined the stability of the long-run coefficients together with the short-run dynamic. The researcher follows Pesaran and Pesaran (1997) and applies the CUSUM and CUSUMSQ to check the coefficient stability [Brown, Durbin, and Evans (1975)].

Table A. The Export and GDP Data (in level)

Year	logXt(Export)	logYt(GDP)
1986Q1	9.34877	10.74864
1986Q2	9.32459	10.78607
1986Q3	9.44680	10.82661
1986Q4	9.46897	10.78865
1987Q1	9.38638	10.81250
1987Q2	9.44294	10.85090
1987Q3	9.65803	10.89354
1987Q4	9.70528	10.86159
1988Q1	9.57802	10.85495
1988Q2	9.44798	10.92716
1988Q3	9.53289	10.95329
1988Q4	9.72580	10.94768
1989Q1	9.61051	10.97223
1989Q2	9.61695	10.98934
1989Q3	9.73493	11.04220
1989Q4	9.78738	11.02846
1990Q1	9.67058	11.05377
1990Q2	9.72806	11.07557
1990Q3	9.78017	11.12914
1990Q4	9.65496	11.11807
1991Q1	9.74071	11.13618
1991Q2	9.96001	11.15964

1991Q3	9.96302	11.21526
1991Q4	9.96315	11.20727
1992Q1	9.90907	11.20072
1992Q2	9.99990	11.23872
1992Q3	10.04612	11.28671
1992Q4	10.23791	11.27109
1993Q1	9.98443	11.27123
1993Q2	9.95294	11.28201
1993Q3	10.01261	11.35340
1993Q4	10.05298	11.36919
1994Q1	9.938522	11.35750
1994Q2	10.09044	11.38382
1994Q3	10.14081	11.42019
1994Q4	10.19692	11.40762
1995Q1	10.05872	11.43565
1995Q2	10.12469	11.45466
1995Q3	10.25861	11.49574
1995Q4	10.22754	11.49878
1996Q1	10.15734	11.49144
1996Q2	10.24210	11.51925
1996Q3	10.26918	11.57648
1996Q4	10.29963	11.59659
1997Q1	10.12535	11.56420
1997Q2	10.27336	11.56994
1997Q3	10.36494	11.62815
1997Q4	10.47760	11.60737

Year	Log Xt (Export)	Log Yt (GDP)
1998Q1	10.58003	11.51827
1998Q2	10.47075	11.42673
1998Q3	10.56938	11.45379
1998Q4	9.96047	11.40578
1999Q1	10.00492	11.45499
1999Q2	10.00147	11.44452
1999Q3	10.08116	11.48185
1999Q4	10.07664	11.45798
2000Q1	10.14729	11.49521
2000Q2	10.28004	11.49468
2000Q3	10.31110	11.51827
2000Q4	10.35655	11.42674
2001Q1	10.32135	11.45379
2001Q2	10.34993	11.40578
2001Q3	10.29705	11.45499
2001Q4	10.25155	11.44452
2002Q1	10.28282	11.48185
2002Q2	10.29556	11.45798
2002Q3	10.32511	11.60408
2002Q4	10.29567	11.57218
2003Q1	10.31141	11.60191
2003Q2	10.33517	11.61306
2003Q3	10.35234	11.64299
2003Q4	10.29567	11.61480

Source: Bexi (Indonesia Export-Import Bureau) 2003

6.2.1 Unit Root Test ADF & PP

Dickey-Fuller (DF) and Phillips-Perron (PP) unit root tests were employed to test the stationary of the two macroeconomic series at level and then they were employed at the first difference of each series. The results of the DF and PP tests at level are reported in Table 1, by taking into consideration the trend variable and no trend variable in the regression. Based on Table 1 (a), the t-statistics for all series from both DF and PP tests were statistically insignificant to reject the null hypothesis of non-stationary at 5% significance level. It indicates that these series are non-stationary at their level form. Therefore, these variables contained a unit root or they share a common stochastic movement.

When the DF test was conducted on the first difference of each variable, the null hypothesis of non-stationary was easily rejected at 5% significance level as shown in Table 2 (b). It was in line with some previous studies showing that most macroeconomics and financial series contain unit root and were integrated in order one, I (1). A similar conclusion was resulted from PP test. Therefore, it can be concluded that the series were integrated of order one, and a higher order of differencing was not required.

Table 1. Unit Root Test for GDP and Export

a. Level (lag length = 1)

Variable	ADF		PP	
	constant No trend	Constant Trend	Constant no trend	constant Trend
GDP	-1.872758*	-1.433872*	-1.962466*	-1.607700*
Export	-2.198779*	-3.177959*	-2.147670*	-3.372210*

Notes: * the ADF & PP value are less than the critical values at all significance level

b. First Difference (lag length = 1)

Variable	ADF		PP	
	constant No trend	Constant Trend	Constant no trend	Constant Trend
GDP	-5.938332*	-6.061412*	-9.937086*	-10.09589*
Export	-7.267715*	-7.292343*	-9.664658*	-9.682531*

Notes: * the ADF & PP value are larger than the critical values at all significance level

6.2.2 Cointegration Test

Since the variables were integrated in order one (table 1b), then the researcher could proceed to conduct the Johansen cointegration test. The purpose was to examine whether the two variables are cointegrated or not. Instead, an error correction model that contains both short term adjustment and long term differences in the series is not necessary. The result in table 2 found that the cointegration test indicated one cointegration equations at 5% significance level (lag interval = 1 2). The researcher also used lag interval 1 4, it did not change the result. The result indicated that the two variables cointegrated to each other.

The current issue now is the direction of causation. However, this test does not tell the direction of causation. The researcher will examine the direction of the effect by using Granger Causality test, and ECM based on ARDL

Table 2. Johansen Cointegration Test

Lag Interval	Eigenvalue	Likelihood Ratio	5% critical value	1% critical value	Hypothesis No of CE
1 1	0.350870	32.92345*	15.41	20.04	None
	0.037491	2.674849	3.76	6.65	At most 1
1 2	0.292277	27.17234*	15.41	20.04	None
	0.046961	3.318885	3.76	6.65	At most 1
1 3	0.287038	28.28494*	15.41	20.04	None
	0.074691	5.278696	3.76	6.65	At most 1
1 4	0.262935	25.56192*	15.41	20.04	None
	0.073594	5.121639	3.76	6.65	At most 1

Note: * t stat is significant at 5%, there is cointegration between exports & economic growth

6.2.2 Granger Causality Test

It was found that the variables of export and GDP were cointegrated, the following analysis was Granger causality test to predict the direction of causation between export and GDP. The estimated regression of Granger causality test is reported in table 3. From the analysis of granger causality test, it was found that the variables of export and GDP had two direction relationships. That is, there are two directions between variables.

It is clearly showed in table 3 that in first lag, computed F stat of Yt (25.7691) > F table (4.00) and computed F stat of Xt (3.60852) < F table (4.00). Lags 2 the computed F stat of Yt (13.0738) > F table (4.00) and computed F stat of Xt (4.04161) > F table (4.00). Lags 3 the computed F stat of Yt (8.29351) > F table (4.00) and computed F stat of Xt (8.29351) <

F table (4.00). Lags 4 the computed F stat of Yt (5.36060) > F table (4.00) and computed F stat of Xt (3.25759) < Ftable (4.00). So, there was only unidirectional causality relationship GDP to export. That is shows GDP affects ex port not vice versa. But only in lags 2 there was bidirectional causality relationship export to GDP and inversely GDP to export.

Table 3. Granger Causality Test

Lags	Hypothesis	F stat	Prob
1	Yt does granger cause xt	25.7691*	3.2E-06
	Xt does not granger cause yt	3.60852	0.06173
2	Yt does granger cause xt	13.0738*	1.7E-05
	Xt does granger cause yt	4.04161	0.02216
3	Yt does granger cause xt	8.29351*	0.00010
	Xt does not granger cause yt	3.93754	0.01229
4	Yt does granger cause xt	5.36060*	0.00095
	Xt does not granger cause yt	3.25759	0.01759

Note: *significant at the 5% level

6.3 ARDL – Based Error Correction Model Analysis

The next analysis is dynamic error correction model test using ARDL method. Regress the variables into the cointegration test through ordinary least square then regress the variables into the long run estimation and ECM from cointegration test result through ARDL approach. This approach is to testing the existence of a relationship between variables in levels which is applicable irrespective of whether the underlying regresses are purely I(0), purely I(1) or mutually cointegrated. The statistic underlying in this procedure is the familiar F-statistic. In general, Dickey Fuller type regression used to test of lagged levels of the variables under consideration in a conditional unrestricted equilibrium error correction model (ECM) (Pesaran and Shin, 1994).

6.3.1 ARDL Based Cointegration Test

a. Bounds Testing Approach to Cointegration

This stage involves testing for the existence of a long-run equilibrium relationship between export and GDP (see table 7) within a univariate framework. In order to test for the existence of any long-run relation among the variables, the researcher employed the bounds testing approach to cointegration. One of the benefits of the bounds testing approach to cointegration is that there is a single long-run relationship that can identify which variable is the dependent variable. And this approach can be applied to the data which are stationery or non stationery.

The ARDL method of cointegration analysis is unbiased and efficient. This is because the method is used in small samples of data, such as in this research. ARDL method can estimate the long run and short run components of the model simultaneously, removing problems associated with omitted variables and autocorrelation. Finally, the ARDL method can distinguish dependent and explanatory variables. The bounds testing approach suggests that Xt and Yt be cointegrated when Xt is the dependent variable. The results of the cointegration tests are reported in Table 4.

As explained in the previous chapter, these hypotheses can be examined using the standard *F* statistic. However, this study has relatively small sample sizes, which are 72 observations. With small sample sizes, the relevant critical values potentially deviate substantially from the critical values (Pesaran *et al.* (2001).

Table 4. Bounds F Statistic for Cointegration Relation

1). Bounds F Statistic for Cointegration Relation (Xt is a regressor)

Order Of Lags	F statistic
1	6.6721
2	6.3729
3	10.2271
4	2.4172

Notes: The relevant critical value bounds are given in Table C1.iii (with an unrestricted intercept and no trend; number of regressors = 1), Shin and Smith (1999). They are 4.94 – 5.73 at the 95% significance level and 4.04 – 4.78 at the 90% significance level.

Based on the table above, the computed F statistic in order of lags 1 – 3, is larger than the critical value that is 4.78. This means in those lags the variables are cointegrated. But, at lags 4 the variables are not cointegrated because the computed F statistic is 2.4172 < the critical value 4.78. The researcher conclude that in bound F statistic test using Xt as a regressor, the all variables are not cointegrated when 4 lags are included.

2). Bounds F Statistic for Cointegration Relation (Yt is regressor)

Order Of Lags	F Statistic
1	17.5060
2	15.9071
3	13.6302
4	14.1745

Notes: The relevant critical value bounds are given in Table C1.iii (with an unrestricted intercept and no trend; number of regressors = 1), Shin and Smith (1999). They are 4.94 – 5.73 at the 95% significance level and 4.04 – 4.78 at the 90% significance level.

In this section the researcher used lnXt (log of export) as dependent variable, in this test is clearly explain on the table 4(2) that there is a cointegration amongst the variables. Because the computed F value in all given lags (lags 1 – 4) is larger than the critical value.

Compared those two tables above, it found that the cointegration is much stronger when GDP becomes the regressor. Therefore, the researcher found the evidence that the direction of causation is from GDP to Export is stronger than Export to GDP and vice versa. This result seems to support the result from Granger causality test.

6.3.2 The Long Run Cointegration Relation

a. Long run approach to Cointegration

The researcher tested for the presence of long-run relationships. The researcher use quarterly data and the maximum number of lags in the ARDL was set equal to 4. This test is to find the relationship between variables. The calculated coefficients are reported in Table 5.

Table 5. Estimated Long Run Coefficients using the ARDL Approach

1). Long Run Based Model Selection Criterion (LogXt as dependent variable)

Regressor	AIC*	SBC*	HQC*	Max lags 4
LogYt	1.0872 (11.7407)	1.0872 (11.7407)	1.0736 (11.7407)	1.0736 (12.0773)
C	-2.2610 (-2.1509)	-2.2610 (-2.1509)	-2.0985 (-2.1509)	-2.0985 (-2.0061)

Note: *coefficient based on model selection criteria

Figure in the bracket is t stat.

2). Long Run Coefficients Based Max Lags 4 (LogXt as dependent variable)

Regressor	Coefficient
LogYt	1.0773 (20.4227)
C	-2.1347 (-3.5412)

The long run equation is LogXt = -2.2610 + 1.0872 LogYt (based AIC). The model selection criterion AIC, SBC, and HQC give the same results; it means that there is a long run relationship between variables. But, if the maximum number of lags is 4 the result is LogXt = -2.1347 + 1.0773 LogYt, which is quite close to those using. AIC, SBC, and HQC model selection criteria. All regressor are highly significant.

6.3.3 Error Correction Model

The error correction estimation presented by the equation of specified coefficients from the regressor, it's to find out the relationship between the variables and avoiding spurious result. In here, LogXt as dependent variable, the test used model selection criteria; the result was very similar and the values were highly significance, the result is reported in table 6.

Table 6. Error Correction Model

1). ECM based on AIC, SBC, & HQC (dLogXt as dependent variable)

Regressor	AIC*	SBC*	HQC*
dLogYt	0.60654 (5.2641)	0.60654 (5.2641)	0.60654 (5.2641)
C	-1.2614 (-2.0010)	-1.2614 (-2.0010)	-1.2614 (-2.0010)
Ecm (-1)	-0.55789 (-5.9858)	-0.55789 (-5.9858)	-0.55789 (-5.9858)
R^2	0.35915	0.35915	0.35915
F stat	17.9336	17.9336	17.9336
DW stat	1.9111	1.9111	1.9111

Note: *coefficient based on model selection criteria

2). ECM based on selected Max Lags 4 (dLogXt as dependent variable)

Regressor	Coefficient
dLogXt1	0.39467

	(2.1464)
dLogXt2	0.24156 (1.5844)
dLogXt3	0.086804 (0.66688)
dLogYt	0.20164 (0.42331)
dLogYt1	-0.99637 (-1.7978)
dLogYt2	-0.71494 (-1.3462)
dLogYt3	-0.49476 (-0.95545)
C	-2.1913 (-3.0439)
Ecm	-1.0265 (-4.3800)
F Stat	5.1505
R^2	0.41535
DW Stat	2.0171

Based on the table above, the equation is DLogXt = -1.2614 + 0.60654 DLogYt - 0.55789 ecm, means that the constanta is negative which indicates the export will decrease as 1.2614 while others are constant (ceteris paribus). The coefficient of ECM is -0.55789 which is show that any deviation from the long run equilibrium is only temporary (short run) and it takes around 2 quarters for the system to return to the equilibrium. This means the decreasing of GDP every by 1% will decrease of export by 1% as well.

From the table of error correction model estimation, the ECM show high significant value -0.55789 or -55.789%. This means a deviation from the long run equilibrium takes at least 2 quarters for the system to restore the equilibrium.

The equation for ECM based max lags 4 is dLogXt = -2.1913 + 0.39467 dLogXt(-1) + 0.24156 dLogXt(-2) + 0.086804 dLogXt(-3) - 0.99637 dLogYt(-1) - 0.71494 dLogYt(-2) - 0.49476 dLogXt(-3) - 1.0265 ECM. The coefficient of ECM is -1.0265 which shows that any deviation from the equilibrium is only temporary (short run) and it take around 1 quarters to the system to return to the equilibrium. This means the decreasing of GDP by 1% decreases export by 1%.

It can be concluded that the error correction model estimation based on model selection criterion and max lags 4 have the high significant value -0.55789 and -1.0265. This means that both model giving same result that GDP affect export.

6.3.4 Diagnostic Test

1). Diagnostic Test

The term of serial correlation is defined as correlation between residual of one observation in time series data or space in cross sectional data. The tool of analysis used to detect serial correlation is LM test

(Lagrange Multiple Test). LM test used the level of degree (X^2), Ho expresses that there is no serial correlation (if X^2 statistic < value of X^2 table) and there is a serial correlation (if X^2 statistic > value of X^2 table), hence Ho is denied, and also contrary. Besides that, to get the fittest lag is by estimating the smallest number of Akaike Info Criterion (AIC).

To detect there is any heterocedasticity problem or not, the researcher used diagnostic test. If X^2 statistic less than the value of X^2 table there is no heterocedasticity problem and if X^2 stat > the value of X^2 table there is a heterocedasticity problem.

Table 6. Diagnostic Test (AIC)

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(4)= 2.0369[0.729]	F(4, 60)= 0.47033[0.757]
B:Functional Form	CHSQ(1)= 0.75280[0.386]	F(1, 63)= 0.71590[0.401]
C:Normality	CHSQ(2)= 20.0927[0.000]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 0.63910[0.424]	F(1, 65)= 0.62599[0.432]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

In this ARDL test estimation (based on akaike criterion), the classical assumption through the diagnostic test resulted that the serial correlation test with LM stat is 2.0369 < LM table 9.4877 at 5%

significance level, so it's accept Hi and reject Ho insignificant. There is no autocorrelation in the model (pass the test).

The Heterocedasticity test with LM statistic is 0.63910 < LM table 3.8415 at 5% significance level, means there is no heterocedasticity in the model (pass the test). In the model selection criteria SBC, HQC, and using maximum lags 4 have similar value, the model are pass the test (see on appendixes). And there is no autocorrelation and heterocedasticity problem.

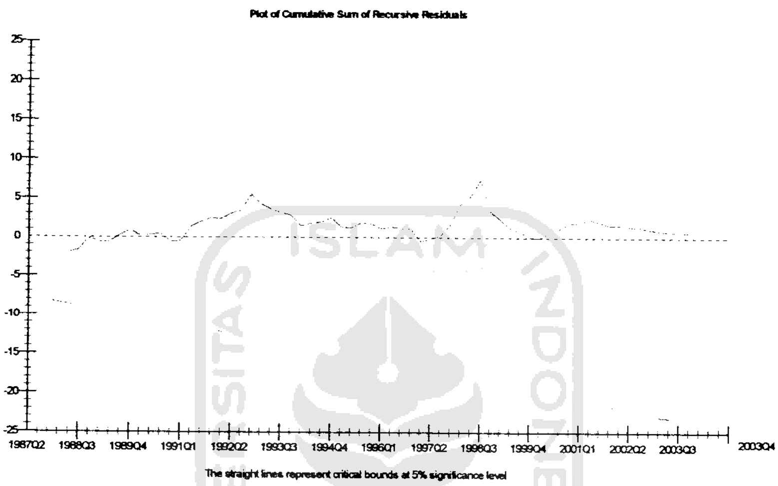
There is no functional form problem because LM stat (0.75280) < LM table (3.8415), but there is a normality problem because LM stat (20.0927) > LM table (5.9915).

But, if the diagnostic test based max lags 4, the result there is a serial correlation and normality problem so the model not passes the test (see appendix).

6.3.5. Coefficient Stability Using CUSUM and CUSUM Square

Figure 1.CUSUM test of ARDL based on AIC

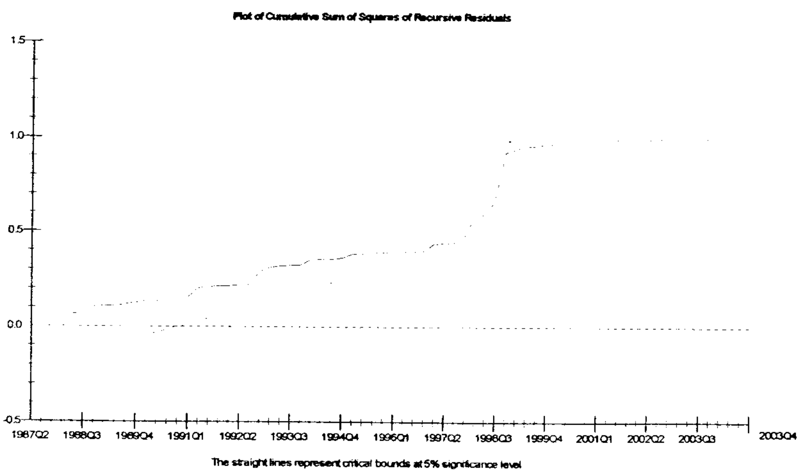
Plot of cumulative sum recursive of residual



Represent critical bounds at 5% significance level

Figure 2.CUSUM Square test of ARDL based on AIC

Plot of cumulative sum recursive of residual



Represent critical bounds at 5% significance level

Specifically, the CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of *n* observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5% significance level [represented by a pair of straight lines drawn at the 5% level of significance whose equations are given in Brown, Durbin, and Evans (1975)], the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. If either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5% level of significance. A similar procedure is used to carry out the CUSUMSQ test, which is based on the squared recursive residuals.

The graphs explain the coefficient is stable or not. On the graph 1 and 2, the blue line still in the boundaries. Stretch from point (0), means the coefficients is dynamic or consistent (stable) using in this model; the straight lines represent critical bounds at 5% significance level. Whether the coefficient stability test using CUSUM based on SBC, HQC and using maximum lags 4, the result are the coefficient still stable (see the appendixes).

From the result above, we can conclude that:

- The results of Unit Root Test of integration using ADF and PP hypothesis of GDP and export in first difference (lags 1) the variables are integrate of order one I (1) or non stationery.

- The result of Johansen cointegration test indicates one cointegration at 5% significance level (lags 1-4), means the variables are cointegrated. And cointegration using ARDL approach has the same result there is cointegration among the variables.
- The result of granger causality test is there is a causality relationship between variables. There was only unidirectional (lags 1, 3 & 4) causality relationship GDP to export, but in lags 2 there was bidirectional causality relationship GDP to export and inversely.
- The cointegration test based on ARDL (bound test) found that export and economic growth (GDP) are cointegrated and the direction of causation is from GDP to export.
- The coefficient on the ECM term is significant in affecting export when economic growth (GDP) serves as the regressor and when Xt as dependent variable. This means the economic growth (GDP) affects export.
- The series data free from serial correlation and heterocedasticity problem based on model selection criterion. CUSUM & CUSUMQ test resulted that the coefficients are stable both in the model selection criterion and the using of max lags 4.

Chapter VII

CONCLUSION AND IMPLICATIONS

7.1. Introduction

This chapter withdraws some conclusion resulted from the data analysis and also the implications.

7.2. Conclusions

Based on the research about the causality relationship of export to the economic growth (GDP) of Indonesia in 1986:1 – 2003:4, this research can be concluded that:

1. The result of examination (F test) on economic growth (GDP) and export in Indonesia indicates that there is a cointegration between economic growth (GDP) and export. And economic growth (GDP) has significant and positive influence on the export.
2. The result of examination (F stat) on export and economic growth in Indonesia indicates that there is a causality relationship both in short and long run, the computed F stat is significant at 5% level, the computed F stat is larger than F table. It means that there was unidirectional causality relationship GDP to export.
3. The data show that the independent variable influences the dependent variable. According to the bound test, when export as

dependent variable of the estimation result is significant, means the economic growth (GDP) influence the export.

4. The coefficient on the ECM term is significant in affecting export when economic growth (GDP) serves as the regressor and when Xt as dependent variable. This means the economic growth (GDP) affects export.

5. The result of examination of coefficient by CUSUM & CUSUMSQ shows that the coefficients using in this research are stable.

7.3. Implications

From the conclusion above, the implications policy related to the results of this research are as follows:

1. The export production still needs stimulation from the change of GDP in Indonesia.
2. The economic growth (GDP) in Indonesia still has a significant role in affecting the change of export.
3. The government should encourage the local producers to promote their products in overseas markets.
4. The government should employ both fiscal policy and monetary policy to stimulate the growth of GDP.

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APPENDICES 1

Data of Export & GDP

The Observation Data (level)

Obs	GDP (Yt)	Export (Xt)
1986Q1	46566.8	11484.66681
1986Q2	48342.7	11210.29339
1986Q3	50342.3	12667.5521
1986Q4	48467.6	12951.75419
1987Q1	49637.2	11924.7989
1987Q2	51580.4	12618.81652
1987Q3	53827.6	15646.95187
1987Q4	52134.8	16404.03442
1988Q1	51790.1	14443.77548
1988Q2	55668	12682.51375
1988Q3	57141.8	13806.47487
1988Q4	56822.2	16744.12184
1989Q1	58234	14920.71842
1989Q2	59239.4	15017.19426
1989Q3	62455	16897.58684
1989Q4	61602.7	17807.62264
1990Q1	63181.9	15844.4797
1990Q2	64574.2	16781.89728
1990Q3	68127.8	17679.59693
1990Q4	67378	15598.9535
1991Q1	68608.9	16995.65594
1991Q2	70237.3	21163.09807
1991Q3	74254.8	21226.71325
1991Q4	73664.3	21229.63532
1992Q1	73183.2	20112.01128
1992Q2	76017.4	22024.27842
1992Q3	79754.9	23066.23776
1992Q4	78518.7	27941.47754
1993Q1	78529.7	21686.1
1993Q2	79380.5	21014
1993Q3	85255	22305.9
1993Q4	86611.5	23224.9
1994Q1	85604.9	20713.1
1994Q2	87888.1	24111.5
1994Q3	91143	25357
1994Q4	90004.8	26820.5
1995Q1	92563.1	23358.6
1995Q2	94340.3	24951.5
1995Q3	98293.7	28527.1
1995Q4	98595.1	27654.5
1996Q1	97874.8	25779.6
1996Q2	100634.8	28060.1
1996Q3	106562	28830.1
1996Q4	108726.3	29721.6
1997Q1	105261.1	24967.9
1997Q2	105867.1	28951.1

Obs	GDP (Yt)	Export (Xt)
1997Q3	112212.7	31727.6
1997Q4	109905	35511.3
1998Q1	100535.7	39341.2
1998Q2	91741.9	35268.7
1998Q3	94258.1	38924.5
1998Q4	89839.2	21172.8
1999Q1	94371.1	22135.1
1999Q2	93387.9	22058.9
1999Q3	96939.9	23888.6
1999Q4	94653.6	23781
2000Q1	98244.47078	25521.8
2000Q2	98191.93221	29144.9
2000Q3	100862.9408	30064.6
2000Q4	100717.5096	31462.3
2001Q1	102226.66	30374.2
2001Q2	102456.1983	31254.8
2001Q3	104684.6738	29644.9
2001Q4	102385.9517	28326.3
2002Q1	104651.7747	29226.2
2002Q2	106642.6082	29601
2002Q3	109543.9939	30488.6
2002Q4	106104.5595	29604.2
2003Q1	109306.3857	30073.7
2003Q2	110532.4033	30797
2003Q3	113889.9716	31330.5
2003Q4	110724.7131	31522.8

APPENDICES 2

Regression Result of Granger Causality, Unit Root Test, & Cointegration Test

The Regression Result
Unit Root Test ADF (logXt)

ADF Test Statistic	-2.198779	1% Critical Value*	-3.5253
		5% Critical Value	-2.9029
		10% Critical Value	-2.5886

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XT)
Method: Least Squares
Date: 09/13/06 Time: 10:17
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XT(-1)	-0.099309	0.045165	-2.198779	0.0314
D(XT(-1))	-0.124500	0.117692	-1.057848	0.2939
C	1.011053	0.452706	2.233357	0.0289

R-squared	0.090394	Mean dependent var	0.013873
Adjusted R-squared	0.063242	S.D. dependent var	0.120490
S.E. of regression	0.116618	Akaike info criterion	-1.417916
Sum squared resid	0.911182	Schwarz criterion	-1.321552
Log likelihood	52.62708	F-statistic	3.329152
Durbin-Watson stat	2.025911	Prob(F-statistic)	0.041839

ADF Test Statistic	-3.177959	1% Critical Value*	-4.0928
		5% Critical Value	-3.4739
		10% Critical Value	-3.1640

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XT)
Method: Least Squares
Date: 09/13/06 Time: 10:19
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XT(-1)	-0.299497	0.094242	-3.177959	0.0023
D(XT(-1))	-0.017580	0.122170	-0.143899	0.8860
C	2.889838	0.897709	3.219126	0.0020
@TREND(1986:1)	0.003458	0.001443	2.396730	0.0194

R-squared	0.163223	Mean dependent var	0.013873
Adjusted R-squared	0.125188	S.D. dependent var	0.120490
S.E. of regression	0.112696	Akaike info criterion	-1.472799
Sum squared resid	0.838227	Schwarz criterion	-1.344313
Log likelihood	55.54796	F-statistic	4.291366
Durbin-Watson stat	1.986488	Prob(F-statistic)	0.007921

1st difference of ADF

ADF Test Statistic	-7.267715	1%	Critical Value*	-3.5267
		5%	Critical Value	-2.9035
		10%	Critical Value	-2.5889

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:20
Sample(adjusted): 1986:4 2003:4
Included observations: 69 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(XT(-1))	-1.339050	0.184246	-7.267715	0.0000
D(XT(-1),2)	0.160177	0.121046	1.323273	0.1903
C	0.017257	0.014627	1.179807	0.2423

R-squared	0.589428	Mean dependent var	-0.002592
Adjusted R-squared	0.576986	S.D. dependent var	0.183621
S.E. of regression	0.119426	Akaike info criterion	-1.369733
Sum squared resid	0.941331	Schwarz criterion	-1.272598
Log likelihood	50.25579	F-statistic	47.37559
Durbin-Watson stat	2.066054	Prob(F-statistic)	0.000000

ADF Test Statistic	-7.292343	1%	Critical Value*	-4.0948
		5%	Critical Value	-3.4749
		10%	Critical Value	-3.1645

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(XT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:21
Sample(adjusted): 1986:4 2003:4
Included observations: 69 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(XT(-1))	-1.356189	0.185974	-7.292343	0.0000
D(XT(-1),2)	0.168425	0.121808	1.382710	0.1715
C	0.039149	0.030966	1.264273	0.2106
@TREND(1986:1)	-0.000585	0.000729	-0.802736	0.4251

R-squared	0.593458	Mean dependent var	-0.002592
Adjusted R-squared	0.574694	S.D. dependent var	0.183621
S.E. of regression	0.119749	Akaike info criterion	-1.350612
Sum squared resid	0.932091	Schwarz criterion	-1.221099
Log likelihood	50.59613	F-statistic	31.62835
Durbin-Watson stat	2.072172	Prob(F-statistic)	0.000000

PP test of Xt

PP Test Statistic	-2.147670	1% Critical Value*	-3.5239
		5% Critical Value	-2.9023
		10% Critical Value	-2.5882

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 1	(Newey-West suggests: 3)
Residual variance with no correction	0.013203
Residual variance with correction	0.011512

Phillips-Perron Test Equation
Dependent Variable: D(XT)
Method: Least Squares
Date: 09/13/06 Time: 10:23
Sample(adjusted): 1986:2 2003:4
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XT(-1)	-0.095380	0.043359	-2.199765	0.0312
C	0.968448	0.434408	2.229351	0.0290

R-squared	0.065534	Mean dependent var	0.013337
Adjusted R-squared	0.051991	S.D. dependent var	0.119712
S.E. of regression	0.116558	Akaike info criterion	-1.433089
Sum squared resid	0.937420	Schwarz criterion	-1.369352
Log likelihood	52.87466	F-statistic	4.838968
Durbin-Watson stat	2.243730	Prob(F-statistic)	0.031176

PP Test Statistic	-3.372210	1% Critical Value*	-4.0909
		5% Critical Value	-3.4730
		10% Critical Value	-3.1635

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 1	(Newey-West suggests: 3)
Residual variance with no correction	0.011991
Residual variance with correction	0.011684

Phillips-Perron Test Equation
Dependent Variable: D(XT)
Method: Least Squares
Date: 09/13/06 Time: 10:26
Sample(adjusted): 1986:2 2003:4
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
XT(-1)	-0.291576	0.085634	-3.404895	0.0011
C	2.807293	0.816023	3.440214	0.0010
@TREND(1986:1)	0.003495	0.001333	2.621617	0.0108

R-squared	0.151312	Mean dependent var	0.013337
Adjusted R-squared	0.126351	S.D. dependent var	0.119712
S.E. of regression	0.111893	Akaike info criterion	-1.501204
Sum squared resid	0.851370	Schwarz criterion	-1.405598
Log likelihood	56.29274	F-statistic	6.061855
Durbin-Watson stat	2.026877	Prob(F-statistic)	0.003779

1st difference of PP test

PP Test Statistic	-9.664658	1% Critical Value*	-3.5253
		5% Critical Value	-2.9029
		10% Critical Value	-2.5886

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: (Newey-West suggests: 3)
1

Residual variance with no correction	0.013956
Residual variance with correction	0.013659

Phillips-Perron Test Equation
Dependent Variable: D(XT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:37
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(XT(-1))	-1.157628	0.119970	-9.649344	0.0000
C	0.016132	0.014429	1.118056	0.2675

R-squared	0.577928	Mean dependent var	-0.000464
Adjusted R-squared	0.571721	S.D. dependent var	0.183153
S.E. of regression	0.119861	Akaike info criterion	-1.376814
Sum squared resid	0.976932	Schwarz criterion	-1.312571
Log likelihood	50.18848	F-statistic	93.10984
Durbin-Watson stat	2.026815	Prob(F-statistic)	0.000000

PP Test Statistic	-9.682531	1% Critical Value*	-4.0928
		5% Critical Value	-3.4739
		10% Critical Value	-3.1640

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: (Newey-West suggests: 3)
1

Residual variance with no correction	0.013807
Residual variance with correction	0.013489

Phillips-Perron Test Equation

Dependent Variable: D(XT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:38
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(XT(-1))	-1.164660	0.120498	-9.665382	0.0000
C	0.038345	0.029848	1.284669	0.2033
@TREND(1986:1)	-0.000606	0.000712	-0.850642	0.3980

R-squared	0.582437	Mean dependent var	-0.000464
Adjusted R-squared	0.569973	S.D. dependent var	0.183153
S.E. of regression	0.120105	Akaike info criterion	-1.358984
Sum squared resid	0.966494	Schwarz criterion	-1.262620
Log likelihood	50.56445	F-statistic	46.72748
Durbin-Watson stat	2.036828	Prob(F-statistic)	0.000000

ADF test of Yt

ADF Test Statistic	-1.872758	1% Critical Value*	-3.5253
		5% Critical Value	-2.9029
		10% Critical Value	-2.5886

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(YT)
Method: Least Squares
Date: 09/13/06 Time: 10:40
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YT(-1)	-0.034075	0.018195	-1.872758	0.0655
D(YT(-1))	-0.201440	0.117686	-1.711671	0.0916
C	0.399566	0.205799	1.941533	0.0564

R-squared	0.083523	Mean dependent var	0.011839
Adjusted R-squared	0.056165	S.D. dependent var	0.039374
S.E. of regression	0.038253	Akaike info criterion	-3.647300
Sum squared resid	0.098038	Schwarz criterion	-3.550935
Log likelihood	130.6555	F-statistic	3.053006
Durbin-Watson stat	1.975883	Prob(F-statistic)	0.053837

ADF Test Statistic	-1.433872	1% Critical Value*	-4.0928
		5% Critical Value	-3.4739
		10% Critical Value	-3.1640

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(YT)

Method: Least Squares
Date: 09/13/06 Time: 10:41
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YT(-1)	-0.061899	0.043169	-1.433872	0.1563
D(YT(-1))	-0.185555	0.120215	-1.543523	0.1275
C	0.699805	0.469920	1.489201	0.1412
@TREND(1986:1)	0.000385	0.000541	0.711321	0.4794

R-squared	0.090495	Mean dependent var	0.011839
Adjusted R-squared	0.049154	S.D. dependent var	0.039374
S.E. of regression	0.038394	Akaike info criterion	-3.626365
Sum squared resid	0.097293	Schwarz criterion	-3.497880
Log likelihood	130.9228	F-statistic	2.188989
Durbin-Watson stat	1.968740	Prob(F-statistic)	0.097585

1st difference ADF Test

ADF Test Statistic	-5.938332	1% Critical Value*	-3.5267
		5% Critical Value	-2.9035
		10% Critical Value	-2.5889

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(YT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:42
Sample(adjusted): 1986:4 2003:4
Included observations: 69 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YT(-1))	-1.122906	0.189094	-5.938332	0.0000
D(YT(-1),2)	-0.062888	0.122807	-0.512086	0.6103
C	0.012943	0.005280	2.451177	0.0169

R-squared	0.598407	Mean dependent var	-0.000996
Adjusted R-squared	0.586238	S.D. dependent var	0.061005
S.E. of regression	0.039241	Akaike info criterion	-3.595687
Sum squared resid	0.101630	Schwarz criterion	-3.498552
Log likelihood	127.0512	F-statistic	49.17283
Durbin-Watson stat	1.908865	Prob(F-statistic)	0.000000

ADF Test Statistic	-6.061412	1% Critical Value*	-4.0948
		5% Critical Value	-3.4749
		10% Critical Value	-3.1645

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(YT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:43

Sample(adjusted): 1986:4 2003:4
Included observations: 69 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YT(-1))	-1.167537	0.192618	-6.061412	0.0000
D(YT(-1),2)	-0.038977	0.124277	-0.313632	0.7548
C	0.023752	0.010799	2.199581	0.0314
@TREND(1986:1)	-0.000277	0.000242	-1.146728	0.2557

R-squared	0.606371	Mean dependent var	-0.000996
Adjusted R-squared	0.588203	S.D. dependent var	0.061005
S.E. of regression	0.039148	Akaike info criterion	-3.586730
Sum squared resid	0.099615	Schwarz criterion	-3.457217
Log likelihood	127.7422	F-statistic	33.37667
Durbin-Watson stat	1.917993	Prob(F-statistic)	0.000000

PP test of Yt

PP Test Statistic	-1.962466	1% Critical Value*	-3.5239
		5% Critical Value	-2.9023
		10% Critical Value	-2.5882

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: (Newey-West suggests: 3)
1

Residual variance with no correction	0.001442
Residual variance with correction	0.001154

Phillips-Perron Test Equation
Dependent Variable: D(YT)
Method: Least Squares
Date: 09/13/06 Time: 10:45
Sample(adjusted): 1986:2 2003:4
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YT(-1)	-0.033260	0.017700	-1.879153	0.0644
C	0.387886	0.199975	1.939666	0.0565

R-squared	0.048685	Mean dependent var	0.012199
Adjusted R-squared	0.034898	S.D. dependent var	0.039210
S.E. of regression	0.038520	Akaike info criterion	-3.647535
Sum squared resid	0.102379	Schwarz criterion	-3.583798
Log likelihood	131.4875	F-statistic	3.531215
Durbin-Watson stat	2.391460	Prob(F-statistic)	0.064448

PP Test Statistic	-1.607700	1% Critical Value*	-4.0909
		5% Critical Value	-3.4730
		10% Critical Value	-3.1635

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 1	(Newey-West suggests: 3)
Residual variance with no correction	0.001420
Residual variance with correction	0.001174

Phillips-Perron Test Equation
Dependent Variable: D(YT)
Method: Least Squares
Date: 09/13/06 Time: 10:46
Sample(adjusted): 1986:2 2003:4
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
YT(-1)	-0.072497	0.042246	-1.716065	0.0907
C	0.811477	0.459874	1.764566	0.0821
@TREND(1986:1)	0.000545	0.000532	1.022797	0.3100

R-squared	0.063099	Mean dependent var	0.012199
Adjusted R-squared	0.035543	S.D. dependent var	0.039210
S.E. of regression	0.038507	Akaike info criterion	-3.634633
Sum squared resid	0.100828	Schwarz criterion	-3.539027
Log likelihood	132.0295	F-statistic	2.289845
Durbin-Watson stat	2.334549	Prob(F-statistic)	0.109041

1st difference of PP test

PP Test Statistic	-9.937086	1% Critical Value*	-3.5253
		5% Critical Value	-2.9029
		10% Critical Value	-2.5886

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 1	(Newey-West suggests: 3)
Residual variance with no correction	0.001474
Residual variance with correction	0.001479

Phillips-Perron Test Equation
Dependent Variable: D(YT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:46
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YT(-1))	-1.189438	0.119659	-9.940270	0.0000
C	0.014259	0.004900	2.909966	0.0049

R-squared	0.592348	Mean dependent var	-0.000937
Adjusted R-squared	0.586353	S.D. dependent var	0.060563
S.E. of regression	0.038951	Akaike info criterion	-3.624848
Sum squared resid	0.103170	Schwarz criterion	-3.560606

Log likelihood	128.8697	F-statistic	98.80898
Durbin-Watson stat	1.968475	Prob(F-statistic)	0.000000

PP Test Statistic	-10.09589	1% Critical Value*	-4.0928
		5% Critical Value	-3.4739
		10% Critical Value	-3.1640

*MacKinnon critical values for rejection of hypothesis of a unit root.

Lag truncation for Bartlett kernel: 1	(Newey-West suggests: 3)
Residual variance with no correction	0.001433
Residual variance with correction	0.001440

Phillips-Perron Test Equation
Dependent Variable: D(YT,2)
Method: Least Squares
Date: 09/13/06 Time: 10:47
Sample(adjusted): 1986:3 2003:4
Included observations: 70 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YT(-1))	-1.210668	0.119866	-10.10017	0.0000
C	0.026148	0.009901	2.640934	0.0103
@TREND(1986:1)	-0.000318	0.000231	-1.378907	0.1725

R-squared	0.603598	Mean dependent var	-0.000937
Adjusted R-squared	0.591765	S.D. dependent var	0.060563
S.E. of regression	0.038696	Akaike info criterion	-3.624261
Sum squared resid	0.100323	Schwarz criterion	-3.527897
Log likelihood	129.8491	F-statistic	51.01007
Durbin-Watson stat	1.979190	Prob(F-statistic)	0.000000

Cointegration Test

Date: 09/13/06 Time: 10:54
Sample: 1986:1 2003:4
Included observations: 70
Test assumption: Linear deterministic trend in the data
Series: YT XT
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.350870	32.92345	15.41	20.04	None **
0.037491	2.674849	3.76	6.65	At most 1

*(**) 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:

YT	XT
-1.275161	1.213286
0.754773	-0.255627

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

YT	XT	C
1.000000	-0.951476	-1.766291
	(0.05897)	
Log likelihood	198.1892	

Date: 09/13/06 Time: 10:56
Sample: 1986:1 2003:4
Included observations: 69
Test assumption: Linear deterministic trend in the data
Series: YT XT
Lags interval: 1 to 2

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.292277	27.17234	15.41	20.04	None **
0.046961	3.318885	3.76	6.65	At most 1

*(**) 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:

YT	XT
-1.650320	1.530149
0.665851	-0.157505

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

YT	XT	C
1.000000	-0.927183	-2.007895
	(0.05220)	
Log likelihood	197.0397	

Date: 09/13/06 Time: 10:58
Sample: 1986:1 2003:4
Included observations: 68
Test assumption: Linear deterministic trend in the data
Series: YT XT
Lags interval: 1 to 3

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.287038	28.28494	15.41	20.04	None **

0.074691	5.278696	3.76	6.65	At most 1 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

YT	XT
-1.826292	1.771291
1.033075	-0.487227

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

YT	XT	C
1.000000	-0.969884	-1.578213
	(0.05387)	

Log likelihood 196.9140

Date: 09/13/06 Time: 10:59
Sample: 1986:1 2003:4
Included observations: 67
Test assumption: Linear deterministic trend in the data
Series: YT XT
Lags interval: 1 to 4

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.262935	25.56192	15.41	20.04	None **
0.073594	5.121639	3.76	6.65	At most 1 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

YT	XT
-2.416471	2.157026
0.298553	0.220283

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

YT	XT	C
1.000000	-0.892635	-2.354214
	(0.04120)	

Log likelihood 210.1254

Granger Causality Test

Pairwise Granger Causality Tests
Date: 09/13/06 Time: 11:01
Sample: 1986:1 2003:4
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
YT does Granger Cause XT	71	25.7691	3.2E-06
XT does not Granger Cause YT		3.60852	0.06173

Pairwise Granger Causality Tests
Date: 09/13/06 Time: 11:01
Sample: 1986:1 2003:4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
YT does t Granger Cause XT	70	13.0738	1.7E-05
XT does not Granger Cause YT		4.04161	0.02216

Pairwise Granger Causality Tests
Date: 09/13/06 Time: 11:02
Sample: 1986:1 2003:4
Lags: 3

Null Hypothesis:	Obs	F-Statistic	Probability
YT does Granger Cause XT	69	8.29351	0.00010
XT does not Granger Cause YT		3.93754	0.01229

Pairwise Granger Causality Tests
Date: 09/13/06 Time: 11:03
Sample: 1986:1 2003:4
Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
YT does Granger Cause XT	68	5.36060	0.00095
XT does not Granger Cause YT		3.25759	0.01759

APPENDICES 3
ARDL Approach

Variable Addition Test (OLS)

Xt as dependent variable

Lags 4

****

Dependent variable is DLXT
List of the variables added to the regression:
LOGXT(-1) LOGYT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-2.6818	0.72021	-3.7236[.000]
DLXT(-1)	0 .64113	0.21629	2.9642[.004]
DLXT(-2)	0.42186	0.17630	2.3929[.020]
DLXT(-3)	0.23685	0 .14369	1.6484[.105]
DLXT(-4)	0.35513	0.12056	2.9456[.005]
DLYT(-1)	-1.4998	0.57317	-2.6167[.011]
DLYT(-2)	-0.82427	0.52624	-1.5663[.123]
DLYT(-3)	-0.61777	0.49761	-1.2415[.220]
DLYT(-4)	-0.25804	0.48221	-.53511[.595]
LOGXT(-1)	-1.3209	0.24949	-5.2942[.000]
LOGYT(-1)	1.4104	0 .26579	5.3065[.000]

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 22.5182[.000]
Likelihood Ratio Statistic CHSQ(2)= 27.4440[.000]
F Statistic F(2, 56)= 14.1745[.000]

Lags 3

Dependent variable is DLXT
List of the variables added to the regression:
LOGXT(-1) LOGYT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-1.9943	.71692	-2.7817[.007]
DLXT(-1)	0.43993	0.17898	2.4580[.017]
DLXT(-2)	0.26193	0.14996	1.7467[.086]
DLXT(-3)	0.084068	0.12738	0.65996[.512]
DLYT(-1)	-1.2669	0.52936	-2.3933[.020]
DLYT(-2)	-0.80703	0.49960	-1.6153[.112]
DLYT(-3)	-0.57721	0.47933	-1.2042[.233]
LOGXT(-1)	-1.1003	0.21106	-5.2132[.000]
LOGYT(-1)	1.1547	0.23012	5.0176[.000]

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 21.4220[.000]
Likelihood Ratio Statistic CHSQ(2)= 25.8129[.000]
F Statistic F(2, 58)= 13.6302[.000]

****

Lags2

****

Dependent variable is DLXT
List of the variables added to the regression:
LOGXT(-1) LOGYT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-1.7753	0.66610	-2.6652[.010]
DLXT(-1)	0.32103	0.14629	2.1944[.032]
DLXT(-2)	0.17055	0.12495	1.3650[.177]
DLYT(-1)	-1.0449	0.49142	-2.1262[.038]
DLYT(-2)	-0.59895	0.46556	-1.2865[.203]
LOGXT(-1)	-0.95900	0.17023	-5.6336[.000]
LOGYT(-1)	1.0093	0.18844	5.3563[.000]

****

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 23.2159[.000]
Likelihood Ratio Statistic CHSQ(2)= 28.5033[.000]
F Statistic F(2, 60)= 15.9071[.000]

****

Lags1

****

Dependent variable is DLXT
List of the variables added to the regression:
LOGXT(-1) LOGYT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	-1.4768	.63755	-2.3164[.024]
DLXT(-1)	0.20243	0.12415	1.6305[.108]
DLYT(-1)	-0.85388	0.46933	-1.8193[.074]
LOGXT(-1)	-0.80125	0.13569	-5.9052[.000]
LOGYT(-1)	0.84266	0.15425	5.4629[.000]

****

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 24.1805[.000]
Likelihood Ratio Statistic CHSQ(2)= 29.9959[.000]
F Statistic F(2, 62)= 17.5060[.000]

****

Yt as dependent variable

Lags 4

Variable Addition Test (OLS case)

****

*** Dependent variable is DLYT
List of the variables added to the regression:
LOGYT(-1) LOGXT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	0.16653	0.17821	0.93446[0.354]
DLYT(-1)	-0.085542	0.14183	-0.60313[0.549]
DLYT(-2)	-0.028812	0.13022	-0.22126[0.826]
DLYT(-3)	-0.10418	0.12313	-0.84611[0.401]
DLYT(-4)	0.56597	0.11932	4.7432[.000]
DLXT(-1)	-0.054642	0.053521	-1.0209[0.312]
DLXT(-2)	-0.077450	0.043625	-1.7754[0.081]
DLXT(-3)	-0.034228	0.035555	-0.96267[0.340]
DLXT(-4)	-0.0073722	0.029833	-0.24712[0.806]
LOGYT(-1)	0.042485	0.065770	0.64597[0.521]
LOGXT(-1)	-0.063487	0.061737	-1.0284[0.308]

****

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 5.3245[0.070]
Likelihood Ratio Statistic CHSQ(2)= 5.5480[0.062]
F Statistic F(2, 56)= 2.4172[0.098]

****

Lags 3

Variable Addition Test (OLS case)

****

Dependent variable is DLYT
List of the variables added to the regression:
LOGYT(-1) LOGXT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	.086130	.20073	.42908[.669]
DLYT(-1)	-0.40347	0.14822	-2.7222[0.009]
DLYT(-2)	-0.32640	0.13988	-2.3333[0.023]
DLYT(-3)	-0.36550	0.13421	-2.7234[0.009]
DLXT(-1)	0.071653	0.050113	1.4298[0.158]
DLXT(-2)	0.019866	0.041988	0.47312[0.638]
DLXT(-3)	0.026127	0.035667	0.73252[0.467]
LOGYT(-1)	0.17644	0.064432	2.7383[0.008]
LOGXT(-1)	-0.20521	0.059095	-3.4725[0.001]

****

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 17.4679[.000]
Likelihood Ratio Statistic CHSQ(2)= 20.2388[.000]
F Statistic F(2, 58)= 10.2271[.000]

****

Lags 2

Variable Addition Test (OLS case)

****

Dependent variable is DLYT
List of the variables added to the regression:
LOGYT(-1) LOGXT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]

C	0.17729	0.19629	0.90319[0.370]
DLYT(-1)	-0.25355	0.14481	-1.7508[0.085]
DLYT(-2)	-0.18938	0.13719	-1.3804[0.173]
DLXT(-1)	0.0047260	0.043110	0.10963[0.913]
DLXT(-2)	-0.028951	0.036821	-0.78627[0.435]
LOGYT(-1)	0.099024	0.055531	1.7832[0.080]
LOGXT(-1)	-0.12756	0.050163	-2.5430[0.014]

****

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 11.7391[0.003]
Likelihood Ratio Statistic CHSQ(2)= 12.9060[0.002]
F Statistic F(2, 60)= 6.3729[0.003]

****

Lags 1

Variable Addition Test (OLS case)

****

Dependent variable is DLYT
List of the variables added to the regression:
LOGYT(-1) LOGXT(-1)
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
C	.16510	.19156	.86186[.392]
DLYT(-1)	-0.19153	0.14102	-1.3582[0.179]
DLXT(-1)	-0.0064704	0.037303	-0.17345[0.863]
LOGYT(-1)	0.088655	0.046346	1.9129[0.060]
LOGXT(-1)	-0.11498	0.040768	-2.8203[0.006]

** Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2)= 11.8664[0.003]
Likelihood Ratio Statistic CHSQ(2)= 13.0605[0.001]
F Statistic F(2, 62)= 6.6721[0.002]

****

ARDL (based on AKAIKE criterion)

Autoregressive Distributed Lag Estimates
ARDL(1,0) selected based on Akaike Information Criterion

****

Dependent variable is LOGXT
67 observations used for estimation from 1987Q2 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LOGXT(-1)	0.44211	0.093203	4.7435[.000]
LOGYT	0.60654	0.11522	5.2641[.000]
C	-1.2614	0.63038	-2.0010[.050]

****

R-Squared	0.88068	R-Bar-Squared	0.87695
S.E. of Regression	0.098840	F-stat. F(2, 64)	236.1776[.000]
Mean of Dependent Variable	10.0651	S.D. of Dependent Variable	0.28177
Residual Sum of Squares	0.62524	Equation Log-likelihood	61.5205

Akaike Info. Criterion	58.5205	Schwarz Bayesian Criterion	55.2135
DW-statistic	1.9111	Durbin's h-statistic	0.56246[0.574]

Diagnostic Tests

* Test Statistics *	LM Version *	F Version *
* A:Serial Correlation*	CHSQ(4)= 2.0369[.729]*	F(4, 60)= 0.47033[.757]*
* B:Functional Form	* CHSQ(1)= 0.75280[0.386]*	F(1, 63)= 0.71590[.401]*
* C:Normality	* CHSQ(2)= 20.0927[.000]*	Not applicable *
* D:Heteroscedasticity*	CHSQ(1)= 0.63910[.424]*	F(1, 65)= 0.62599[.432]*

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Long-run equation (cointegration equation) based on AKAIKE criterion

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0) selected based on Akaike Information Criterion

Dependent variable is LOGXT
67 observations used for estimation from 1987Q2 to 2003Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LOGYT	1.0872	0.092600	11.7407[.000]
C	-2.2610	1.0512	-2.1509[.035]

ECM (based on AKAIKE criterion)

Error Correction Representation for the Selected ARDL Model
ARDL(1,0) selected based on Akaike Information Criterion

Dependent variable is dLOGXT
67 observations used for estimation from 1987Q2 to 2003Q4

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLOGYT	0.60654	0.11522	5.2641[.000]
dC	-1.2614	0.63038	-2.0010[.050]
ecm(-1)	-0.55789	0.093203	-5.9858[.000]

List of additional temporary variables created:
dLOGXT = LOGXT-LOGXT(-1)
dLOGYT = LOGYT-LOGYT(-1)
dC = C-C(-1)
ecm = LOGXT -1.0872*LOGYT + 2.2610*C

```
*************************************************************
R-Squared                 0.35915   R-Bar-Squared            0.33912
S.E. of Regression        0.098840  F-stat.   F( 2, 64)  17.9336[.000]
Mean of Dependent Variable  0.014509
S.D. of Dependent Variable   0.12158
Residual Sum of Squares     0.62524
Equation Log-likelihood     61.5205
Akaike Info. Criterion     58.5205
Schwarz Bayesian Criterion   55.2135
DW-statistic              1.9111
*************************************************************
```

R-Squared and R-Bar-Squared measures refer to the dependent variable dLOGXT and in cases where the error correction model is highly restricted, these measures could become negative.

ARDL based on SBC

```
              Autoregressive Distributed Lag Estimates
        ARDL(1,0) selected based on Schwarz Bayesian Criterion
*************************************************************
Dependent variable is LOGXT
67 observations used for estimation from 1987Q2 to 2003Q4
*************************************************************
Regressor          Coefficient     Standard Error      T-Ratio[Prob]
LOGXT(-1)              0.44211         0.093203        4.7435[.000]
LOGYT                  0.60654         0.11522         5.2641[.000]
C                    -1.2614         0.63038         -2.0010[.050]
*************************************************************
R-Squared                0.88068          R-Bar-Squared            0.87695
S.E. of Regression        0.098840          F-stat.  F( 2, 64) 236.1776[.000]
Mean of Dependent Var  10.0651    S.D. of Dependent Variable     0.28177
Residual Sum of Squares  0.62524    Equation Log-likelihood       61.5205
Akaike Info. Criterion    58.5205   Schwarz Bayesian Criterion    55.2135
DW-statistic          1.9111          Durbin's h-statistic    0.56246[0.574]
*************************************************************
```

```
                         Diagnostic Tests
*************************************************************
*   Test Statistics  *        LM Version        *        F Version        *
*************************************************************
* A:Serial Correlation* CHSQ(  4)= 2.0369[0.729]*  F(  4,  60)= 0.47033[0.757]*
* B:Functional Form   * CHSQ(  1)= 0.75280[0.386]* F(  1,  63)= 0.71590[0.401]*
* C:Normality        *  CHSQ(  2)= 20.0927[.000]*       Not applicable       *
D:Heteroscedasticity*  CHSQ(  1)= 0.63910[0.424]* F(  1,  65)=  0.62599[0.432]*
*************************************************************
```

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residual
D:Based on the regression of squared residuals on squared fitted values

Long-run equation based on SBC

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0) selected based on Schwarz Bayesian Criterion
****
Dependent variable is LOGXT
67 observations used for estimation from 1987Q2 to 2003Q4
****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LOGYT	1.0872	0.092600	11.7407[.000]
C	-2.2610	1.0512	-2.1509[0.035]

****

ECM based on SBC

Error Correction Representation for the Selected ARDL Model
ARDL(1,0) selected based on Schwarz Bayesian Criterion
****
Dependent variable is dLOGXT
67 observations used for estimation from 1987Q2 to 2003Q4
****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLOGYT	0.60654	0.11522	5.2641[.000]
dC	-1.2614	0.63038	-2.0010[0.050]
ecm(-1)	-0.55789	0.093203	-5.9858[.000]

****
List of additional temporary variables created:
dLOGXT = LOGXT-LOGXT(-1)
dLOGYT = LOGYT-LOGYT(-1)
dC = C-C(-1)
ecm = LOGXT -1.0872*LOGYT + 2.2610*C
****

R-Squared	0.35915	R-Bar-Squared	0.33912
S.E. of Regression	0.098840	F-stat. F(2, 64)	17.9336[.000]
Mean of Dependent Var	0.014509	S.D. of Dependent Variable	0.12158
Residual Sum of Squares	0.62524	Equation Log-likelihood	61.5205
Akaike Info. Criterion	58.5205	Schwarz Bayesian Criterion	55.2135
DW-statistic	1.9111		

****
R-Squared and R-Bar-Squared measures refer to the dependent variable dLOGXT and in cases where the error correction model is highly restricted, these measures could become negative.

ARDL based on HQC

Autoregressive Distributed Lag Estimates
ARDL(1,0) selected based on Hannan-Quinn Criterion
****
Dependent variable is LOGXT
68 observations used for estimation from 1987Q1 to 2003Q4
****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LOGXT(-1)	0.44129	0.093110	4.7395[.000]
LOGYT	0.62036	0.11416	5.4341[.000]
C	-1.4115	0.60905	-2.3175[.024]

****

R-Squared	0.88869	R-Bar-Squared	0.88526
S.E. of Regression	0.098745	F-stat. F(2, 65)	259.4656[.000]
Mean of Dependent Var	10.0551	S.D. of Dependent Variable	0.29151
Residual Sum of Squares	063379	Equation Log-likelihood	62.4806
Akaike Info. Criterion	59.4806	Schwarz Bayesian Criterion	56.1514
DW-statistic	1.8888	Durbin's h-statistic	0.71566[.474]

****

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(4)= 2.5893[0.629]	F(4, 61)= 0.60368[0.661]
B:Functional Form	CHSQ(1)= 0.27989[0.597]	F(1, 64)= 0.26452[0.609]
C:Normality	CHSQ(2)= 19.1456[.000]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 0.58222[0.445]	F(1, 66)= 0.56998[0.453]

A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

Long Run based on HQC

Estimated Long Run Coefficients using the ARDL Approach
ARDL(1,0) selected based on Hannan-Quinn Criterion

****

Dependent variable is LOGXT
68 observations used for estimation from 1987Q1 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
LOGYT	1.1104	0.088967	12.4805[.000]
C	-2.5263	1.0091	-2.5035[0.015]

****

ECM based on HQC

Error Correction Representation for the Selected ARDL Model
ARDL(1,0) selected based on Hannan-Quinn Criterion

****

Dependent variable is dLOGXT
68 observations used for estimation from 1987Q1 to 2003Q4

****

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dLOGYT	0.62036	0.11416	5.4341[.000]
dC	-1.4115	0.60905	-2.3175[.024]

```
ecm(-1)              -0.55871        0.093110        -6.0005[.000]
*******************************************************************
List of additional temporary variables created:
dLOGXT = LOGXT-LOGXT(-1)
dLOGYT = LOGYT-LOGYT(-1)
dC = C-C(-1)
ecm = LOGXT  -1.1104*LOGYT +  2.5263*C
*******************************************************************
R-Squared   0.35651                 R-Bar-Squared          0.33671
S.E. of Regression   0.098745       F-stat.   F( 2, 65)  18.0060[.000]
Mean of Dependent Var  0.013081  S.D. of Dependent Variable  0.12125
Residual Sum of Squares  0.63379  Equation Log-likelihood   62.4806
Akaike Info. Criterion     59.4806  Schwarz Bayesian Criterion   56.1514
DW-statistic              1.8888
*******************************************************************
R-Squared and R-Bar-Squared measures refer to the dependent variable
dLOGXT and in cases where the error correction model is highly
restricted, these measures could become negative.
```

ARDL Based On Max Lags 4

```
                    Autoregressive Distributed Lag Estimates
                              ARDL(4,4) selected
*******************************************************************
Dependent variable is LOGXT
68 observations used for estimation from 1987Q1 to 2003Q4
*******************************************************************
Regressor           Coefficient      Standard Error      T-Ratio[Prob]
LOGXT(-1)              0.36816           0.14491          2.5405[0.014]
LOGXT(-2)             -0.15311           0.15106         -1.0136[0.315]
LOGXT(-3)             -0.15476           0.14803         -1.0455[0.300]
LOGXT(-4)             -0.086804          0.13016         -0.66688[0.507]
LOGYT                  0.20164           0.47634         .42331[0.674]
LOGYT(-1)             -0.092177          0.57626         -0.15996[0.873]
LOGYT(-2)              0.28143           0.56740          0.49601[0.622]
LOGYT(-3)              0.22017           0.56888          0.38703[0.700]
LOGYT(-4)              0.49476           0.51783          0.95545[0.343]
C                     -2.1913            .71989          -3.0439[.004]
*******************************************************************
R-Squared      0.89886               R-Bar-Squared               0.88317
S.E. of Regression    0.099641       F-stat.   F( 9, 58)  57.2758[.000]
Mean of Dependent Var  10.0551  S.D. of Dependent Variable     0.29151
Residual Sum of Squares  0.57584  Equation Log-likelihood        65.7408
Akaike Info. Criterion     55.7408  Schwarz Bayesian Criterion    44.6433
DW-statistic              2.0171
*******************************************************************

                              Diagnostic Tests
*******************************************************************
Test Statistics  *              LM Version        *        F Version        *
*******************************************************************
* A:Serial Correlation  CHSQ(  4)= 12.8680[0.012]* F(  4, 54)=  3.1509[0.021]*
* B:Functional Form   CHSQ(  1)= 0.063386[0.801]* F(  1, 57)= 0.053182[0.818]*
```

```
* C:Normality           CHSQ(  2)= 11.9951[0.002]*          Not applicable      *
* D:Heteroscedasticity* CHSQ(  1)= 0.10583[0.745]* F(  1,  66)= 0.10288[0.749]*
*******************************************************************************
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values
```

Long Run Estimation Based on Max Lags 4

```
Estimated Long Run Coefficients using the ARDL Approach
ARDL(4,4) selected
*****************************************************************************
Dependent variable is LOGXT
68 observations used for estimation from 1987Q1 to 2003Q4
*****************************************************************************
Regressor           Coefficient     Standard Error       T-Ratio[Prob]
LOGYT                   1.0773          0.052749           20.4227[.000]
C                      -2.1347          0.60282            -3.5412[.001]
*****************************************************************************
```

ECM Based on Max Lags 4

```
Error Correction Representation for the Selected ARDL Model
ARDL(4,4) selected
*****************************************************************************
Dependent variable is dLOGXT
68 observations used for estimation from 1987Q1 to 2003Q4
*****************************************************************************
Regressor           Coefficient     Standard Error       T-Ratio[Prob]
dLOGXT1                0.39467          0.18387           2.1464[0.036]
dLOGXT2                0.24156          0.15247           1.5844[0.118]
dLOGXT3               0.086804          0.13016          0.66688[0.507]
dLOGYT                 0.20164          0.47634          0.42331[0.674]
dLOGYT1               -0.99637          0.55421          -1.7978[0.077]
dLOGYT2               -0.71494          0.53109          -1.3462[0.183]
dLOGYT3               -0.49476          0.51783          -.95545[0.343]
dC                     -2.1913          0.71989          -3.0439[0.003]
ecm(-1)                -1.0265          0.23437          -4.3800[.000]
*****************************************************************************
List of additional temporary variables created:
dLOGXT = LOGXT-LOGXT(-1)
dLOGXT1 = LOGXT(-1)-LOGXT(-2)
dLOGXT2 = LOGXT(-2)-LOGXT(-3)
dLOGXT3 = LOGXT(-3)-LOGXT(-4)
dLOGYT = LOGYT-LOGYT(-1)
dLOGYT1 = LOGYT(-1)-LOGYT(-2)
dLOGYT2 = LOGYT(-2)-LOGYT(-3)
dLOGYT3 = LOGYT(-3)-LOGYT(-4)
dC = C-C(-1)
```

ecm = LOGXT -1.0773*LOGYT + 2.1347*C

****

R-Squared 0.41535 R-Bar-Squared 0.32463
S.E. of Regression 0.099641 F-stat. F(8, 59) 5.1505[.000]
Mean of Dependent Var 0.013081 S.D. of Dependent Variable 0.12125
Residual Sum of Squares 0.57584 Equation Log-likelihood 65.7408
Akaike Info. Criterion 55.7408 Schwarz Bayesian Criterion 44.6433
DW-statistic 2.0171

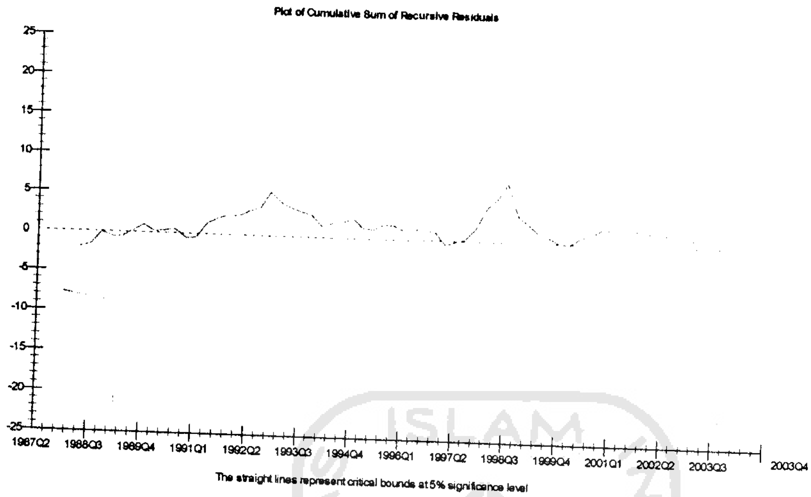
****

R-Squared and R-Bar-Squared measures refer to the dependent variable dLOGXT and in cases where the error correction model is highly restricted, these measures could become negative.

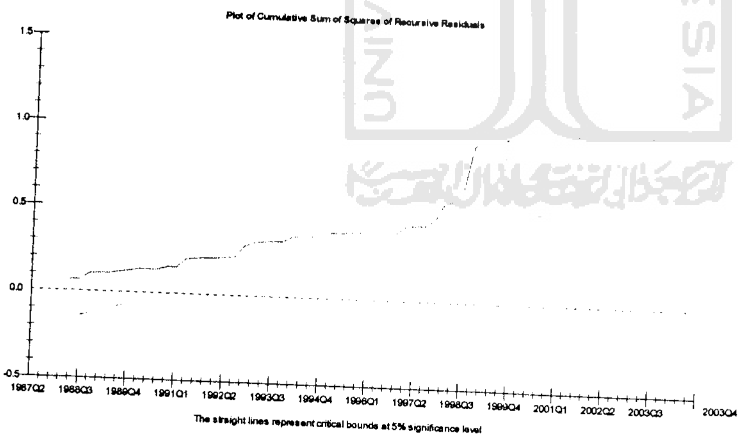
APPENDICES 4
CUSUM & CUSUMSQ
Coefficient Stability Test

CUSUM & CUSUMSQ Test

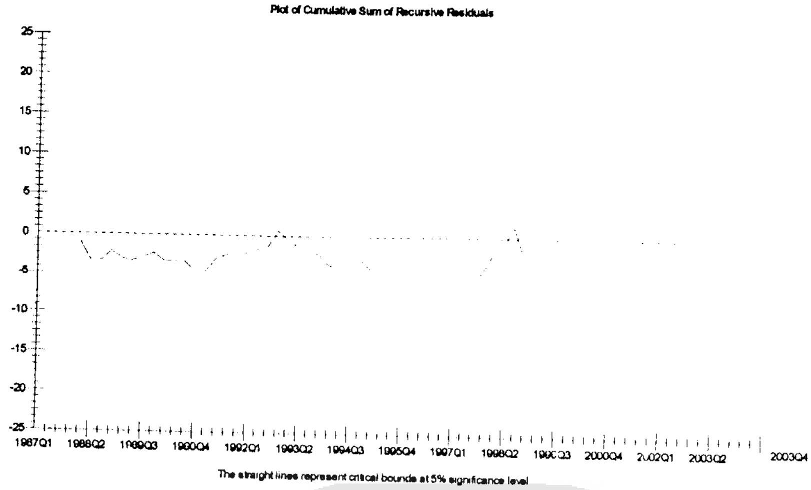
1. CUSUM based AIC



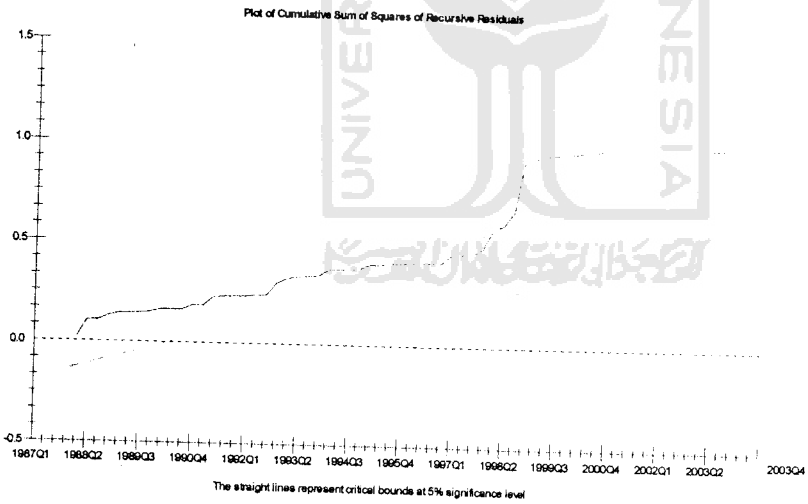
CUSUMSQ based AIC



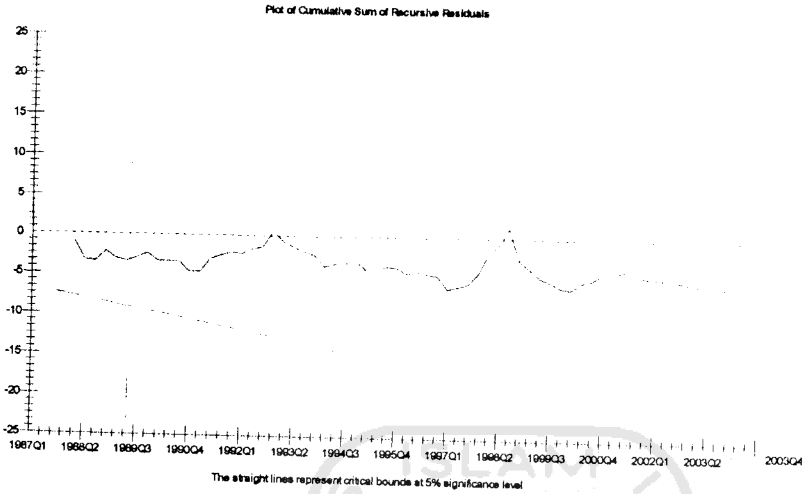
2. CUSUM based SBC



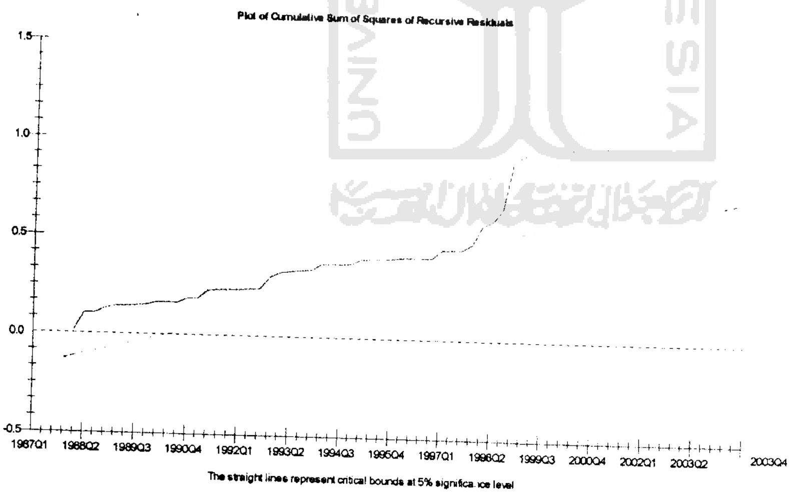
CUSUMSQ based SBC



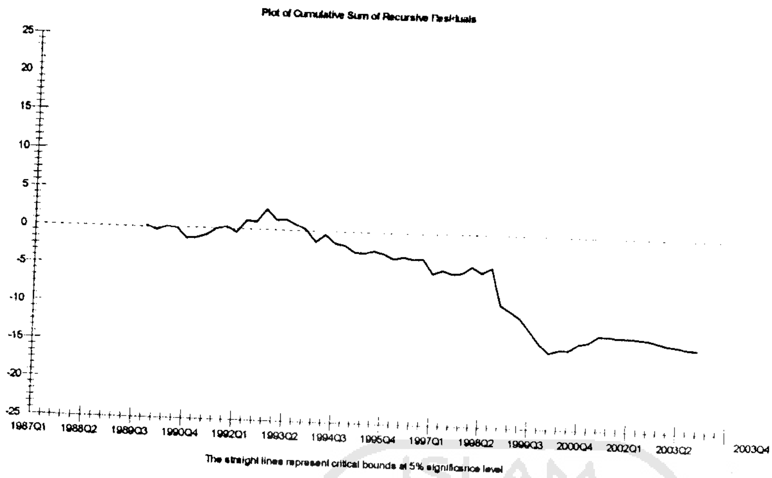
3. CUSUM based HQC



CUSUMSQ based HQC



4. CUSUM based Max Lags4



CUSUMSQ based Max Lags 4