

**Does Trade Openness Promote Long-run Growth in Egypt? ARDL Bounds Testing Approach  
for Co-integration and Impulse Response (GIRF) Analysis for Causality**

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**Major Paper presented to the  
Department of Economics of the University of Ottawa  
In partial fulfillment of the requirements of the M.A. Degree  
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**Eco6999**

**Ottawa, Ontario  
December 2013**

## **ACKNOWLEDGMENTS**

First of all I wish to thank my family for their love and support. I would like to express my deepest gratitude for my supervisor Professor Nasser Ary Tanimoune for continuous cooperation, support and the valuable advice.

## **Abstract**

This paper aims to investigate the empirical relationship between trade openness and economic growth in Egypt for the time period of 1970-2012. Trade openness is a multi-dimensional concept and hence three measures imports, exports and trade volumes (exports + imports) have been used as proxies for openness. We use the augmented production function following the framework of Mankiw et al. (1992) by including indicators of trade openness in our models as endogenous variables. We apply the ARDL bounds as well as Johansen Maximum Likelihood approaches to test for a long run relationship between trade openness and economic growth. We use the VECM Granger causality and the Generalized Impulse Responses Function (GIRF) to test the direction of the causality between trade openness and economic growth. The results suggest the co-integration between the series and the empirical evidence in support of a bi-directional causal relationship between imports as well as trade and GDP growth for Egypt, but a unidirectional causality for exports.

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## List of Abbreviations

### (a) Terms

ADF.....	Augmented Dickey Fuller test
ARDL.....	Autoregressive Distributed Lag Model
ECM.....	Error Correction Model
ECT.....	Error Correction Term
ELG.....	Exports Led-Growth
GDP.....	Gross Domestic Product
GIRF.....	Generalized Impulse Responses Function
GLE.....	Growth-Led Export
GLI.....	Growth-Led Import
GLTR.....	Growth-Led Trade
ILG.....	Import-led Growth
KPSS.....	Kwiatkowski, Phillips, Schmidt and Shin test
LCB.....	Lower Critical Bound
SIC.....	Schwartz Information Criterion
TRLG.....	Trade-led Growth
UECM.....	dynamic Unrestricted Error Correction Model
UCB.....	Upper Critical Bound
VECM.....	Vector Error Correction Model

### (b) Variables (at time t )

$E_t$ .....	Real Exports
$G_t$ .....	Real GDP growth
$I_t$ .....	Real imports
$K_t$ .....	Capital
$L_t$ .....	Labour
$TR_t$ .....	Real Trade

# Chapter 1

## Introduction

This paper seeks to investigate the empirical relationship between trade openness (liberalization) and economic growth in the case of Egypt from 1970-2012. Empirical research concerning Egyptian economy is strikingly scarce. The study in this paper attempts to fill this gap in the literature on the relationship between trade openness and growth. To the best of our knowledge, only three studies have been published on this issue. These three studies used exports as a measure (a proxy) for trade openness. However, trade liberalization is a multi-dimensional concept and hence, in this study we utilize three indicators imports, exports and trade volumes (exports + imports) as proxies for openness. We use the augmented production function the framework of Mankiw et al. (1992) by including the indicators of trade openness in our models as endogenous variables. We apply the Autoregressive Distributed Lag Model (ARDL) bounds as well as Johansen Maximum Likelihood approaches to test for co-integration as well as Vector Error Correction Model (VECM) Granger causality and Generalized Impulse Responses Function (GIRF) to test the direction of the causality between trade liberalization and economic growth.

The rest of this chapter provides the research objectives, shows what sort of questions the study tries to answer and highlights the importance as well as the contributions of the current study. Lastly, it maps out the structure of the entire study.

The aim of the current study is to examine the impact of trade openness (free trade) on economic growth in the case of Egypt for the time period 1970-2012, by satisfying the following objectives: firstly, we seek to provide empirical evidence on the long run relationship between free trade and economic growth as well as the direction of causality between trade openness and economic growth. Secondly, we intend to re-examine the Export-Led Growth, import-led, and Trade-Led Growth hypotheses (or vice versa), so we give further attention to the often empirically neglected import-led hypothesis. On the basis of our endogenous growth model with labour and capital, thirdly, we explore the effect of skilled labour (proxied by secondary school enrolment) and capital stock (proxied by fixed capital formation) on Egyptian economic growth.

The introduction of the economic reforms (in 1974 and 1991) and the recent open door policies have made Egypt a very captivating case study, we propose to expose the impact of those policies on economic growth.

The present study intends to examine the relationship between free trade and economic growth in the case of Egypt. There were numerous questions asked in the literature related to our topic. The basic research questions for those studies which are similar to this study are the following: Is there a long-run relationship between trade openness and growth? Is there any trend in the long run between the variables? If a long-run relationship exists what is the direction of the trend? These types of questions will be answered by conducting a co-integration analysis. In this study we apply the Johansen Maximum Likelihood approach and the Autoregressive Distributed Lag Model (ARDL). Other questions asked in the earlier studies for Egypt include, does trade openness (proxied by exports) affect economic growth? That is, they investigated whether export-Led-Growth (ELG) hypothesis (or vice versa). In the current study we re-examine the validity of Export-Led Growth as well as Trade-Led Growth and Import-Led Growth hypotheses. We will answer these questions by performing the Grange' Causality test using Vector Error Correction Model (VECM) and Generalized Impulse Responses Function (GIRF). Since the present study applies free trade in our models as endogenous variables into the production function, other questions can be asked such as the following: What is the effect of skilled labour (human capital) and capital stock on economic growth? What is the direction of the connection between those variables?

The importance of this study emerges from the following facts: first, our study relates to international trade which is an essential issue; as countries export and import from each other that may lead to gain or loss from trade. Next, free trade encourages globalization, which may have a positive or a negative effect on developing countries including Egypt. Then, the eminence of this study is highlighted by the fact that, there are conflicts of interest between developed and developing countries including Egypt on what to export or import from each other. Focusing on the individual country interests persuades the developed countries to follow the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO) rules and regulations to the extent suitable to the products in which they have merits in producing and exporting. This also imposes the protection to the products in which developing countries including Egypt have an advantage. Those ideologies may lead free trade to become partial and

periodic, instead of global issue. Also, those practices may discourage the production in the developing countries, limiting exporting as well as importing from the developed countries markets. So, the developing countries including Egypt may end up exporting their raw materials. Consequently, this study raises the question of whether trade openness adopted in Egypt as one of the developing countries, has any impact on the country's economic growth? Furthermore, our study gives further attention to the often empirically neglected, import-led hypothesis. Investigating the imports is very essential for Egypt, because for many years the level of import is elevated especially at war times. We intend to find whether Egyptian domestic industrial production is highly dependent on imported inputs or the imports are mainly military equipments, which led to increase in Egypt's military expenditures and hence its debt during 1974-1979.

The contributions of this research as follows: the study investigates long run relationship among the series using both the Johansen Maximum Likelihood and Autoregressive Distributed Lag Model (ARDL) approaches of co-integration. The bound test approach (ARDL) has overriding advantages (see section 3.2) over the other traditional approaches. This setting is different from the previous studies for Egypt's settings and it may lead to a robust findings. The current study applies the causality analysis for the growth-led-export, growth-led-import and growth-led-trade hypotheses under both VECM and GIRF frameworks. This specification may confirm the fact that the composite effect of trade (exports + imports) is different from the individual effect of either exports or imports. Also, using VECM framework helps not only to investigate the long run causality between the trade openness and economic growth but also the short run and even the joint long and short ones between the series. The contribution of this research not only examines the effectiveness of Egypt's export, imports or trade driven strategy but also evaluates the effectiveness of various economic policies adapted from 1970-2012, aiming at the promotion of imports, exports or trade of goods and services. The findings will help policymakers to evaluate various economic policies, including their impact on foreign exchange, the reform of the public sector, and other policies and regulations that directly affect the performance of the trade sector and economic development. Nonetheless, we hope to make a contribution both to a better understanding of the links between trade openness and growth and to the explanation of the role which trade played in Egypt.

We believe that our results provide a more comprehensive picture of the relationship between openness and growth as compared to empirical studies that used a subset of openness measures. We find co-integration among the series. The causality analysis confirms growth-led-import, growth-led-trade (or vice versa) and the export-led-growth hypotheses in the case of Egypt.

The structure of the rest of this study is organized into three chapters as follows: next, chapter 2 consists of the theory and empirical literature on the relationship between trade openness and growth, which contains the following sections: the first section provides a theoretical discussion of the theory and the importance of trade openness, its definition and the bi-directional openness-growth debate. In the second section, we review the empirical literature. This is followed by chapter 3, trade openness and growth: an empirical analysis, which includes an overview of economy and Egypt's trade policy section. In the penultimate section the theoretical framework and methodological issues are discussed. In the last section we discuss the empirical results. In chapter 4, we present the summary and conclusions, policy implications and the proposed direction for future research.

## **Chapter 2**

### **Trade Openness and Growth: Theory and Empirical Literature**

This chapter reviews the theoretical and empirical literature on the relationship between trade openness and growth and is divided into the following sections: a theoretical discussion of the theory and the importance of trade openness, its definition and the bi-directional openness-growth debate; a review of the empirical evidence.

#### **2.1. Theoretical Consideration**

The following section focuses on the discussion of the theory and the importance of trade openness, its definition problem and the bi-directional openness-growth debate.

##### **2.1.1. Trade Openness and Growth: Neoclassical and Endogenous Theories**

New interest in the determinants of economic development has reignited the debate on trade openness and growth. Various theories have been advanced to provide a theoretical foundation for the empirical analysis of economic growth. The neoclassical theory and endogenous growth models (often called new growth theories) have received the most attention in the literature.

The neoclassical approach to economic growth usually starts with an examination of Solow (1956, 1957) and Swan (1956), to such an extent that the model is often referred to as the Solow-Swan growth model. From 1956 to the mid 1980s, a huge volume of literature developed, representing various adaptations to the basic neoclassical framework (Edwards 1989; Rogers 2003 and Temple 1999). In neoclassical growth models developed by Solow (1957) and others, technological change is exogenous- unaffected by a country's openness to world trade.

The endogenous approach linked permanent changes in certain policy variables to permanent changes in economic growth rates. Endogenous growth models may be classified into two groups. The first or early sets of models, generally referred to in the literature as AK-models, were based on the writings of (Lucas 1988; Rebelo 1991 and Romer (1986; 1987)). The second strand of endogenous growth models, which focused more explicitly on endogenous technological change for examples (Aghion and Howitt 1992; Grossman and Helpman (1990; 1991) and Romer 1990). Endogenous growth theories, on the other hand, provide an explanation of sustained productivity and output growth, and most importantly of the openness-growth

nexus. These theories provide theoretical support for the positive relationship between trade openness and economic growth as discussed by Edwards (1998). These theories cease to consider technological progress as exogenous, and consider trade openness as an engine for the needed technological progress. That is, in essence (unlike the neoclassical model), endogenous growth theory treated technical change as endogenous, not as exogenous.

Trade openness is understood as one of the engines that foster needed technological progress, highlighted in neoclassical and endogenous growth theories. Openness makes it possible for poor countries to access intermediate inputs and technology transfers from more advanced countries which promotes exports by reducing anti-export bias, and generates positive spillovers through exploiting scale economies, encouraging competitiveness and efficiency in both domestic and international markets (Balassa 1978; Feder 1982; Grossman and Helpman, 1991 and Rodrik 1999). Also, openness adds to the meaning of economic cooperation on a larger scale where careful and well-handled trade liberalization can be crucial to achieving sustainable economic growth in the long run Shahbaz (2012).

Furthermore, Srinivasan (2001) argued free trade can potentially enhance the growth prospects of a country by influencing any of the three sources of growth factor accumulation, increasing in productivity and innovation as follows: First, trade openness improves the allocation of resources, thus leading to an increase in production. Trade liberalization may also enhance productivity growth through the diffusion of technology, but it may affect productivity through a positive effect on the efficiency in production (Trefler 2001; Dollar and Collier 2001). Second, free trade affects economic growth by implementing advanced technology from technologically advanced countries which boosts the total factor productivity Romer (1990) and Chuang (2000). Third, openness gives domestic producers access to new markets thus increasing the return to innovation which may motivate further technological advancement.

For a developing country such as Egypt, greater openness to trade may bring about the upgrading of skills through the importation of superior technology and innovation Negem (2008). These ideas stimulated the unprecedented wave for unilateral trade reforms in the 1980s for many developing countries Greenaway et al. (2002) because greater openness plays a vital role in shaping the economic and social performance and prosperity of countries UNCTAD (2005). The new growth theories or the endogenous openness to trade provides access to

imported inputs which embody new technology and increase the effective size of the market facing producers, which raises the return to innovation and affects a country's specialization in research-intensive production Grossman and Helpman (1992). However, endogenous growth theories do not predict that trade will unambiguously raise economic growth Harrison (1991). Hence, the relationship between openness and economic growth, including the direction of causality between the two variables, has long been the subject of extensive debate and research. Since theoretical literature does not provide a clear cut answer, more empirical work is needed to resolve the debate over the causality between economic growth and openness.

### **2.1.2. Trade openness: Definition Dilemma**

Despite, of the importance of trade openness, a number of the greatest challenges for researchers in this field to resolve: first, is to give a clear definition of “trade openness” or "trade liberalization". Second challenge is the problems in the trade openness measures. Edwards (1993) confirmed the lack of clarity in defining trade openness and the means by which trade openness is measured in each country. Third, the issue that debated a lot in the literature, the causality between trade liberalization and economic growth. The first and the third problems will be discussed in this section, but the second one will be considered in the next section.

Throughout time, the definition of openness has evolved considerably. For example, openness may be defined in narrow terms to include only export, import and export taxes or subsidies. It could also be defined to include explicit non-tariff distortions of trade. Alternatively, it could be defined broadly to capture issues such as exchange-rate policies, domestic taxes and subsidies, competition and other regulatory policies, education policies, the nature of the legal system, the form of government, and the general nature of institutions and culture. Liu et al. (1997) defined openness as the ratio of external trade (exports, imports or exports plus imports) to GDP. While, Shahbaz (2012) described trade openness as a new way to define the ease of the exchange of goods and services, capital, labor, information, and ideas across borders in order to join economies and societies globally. Recently, it can refer to a free trade system without any restrictions. Therefore, it is crucial to understand this definition problem because various openness measures have different theoretical implications for growth and different linkages with growth Edwards (1993). So, the various definitions could lead to different hypotheses to be tested for.

Even today, the definition of "openness" remains uncertain. On the one direction, Krueger (1978) discussed how trade liberalization can be achieved by employing policies that lower the biases against the export sector. Based on her definition, one country can have an open economy by employing a favorable exchange rate policy towards its export sector and at the same time can use trade barriers to protect its importing sector. This is best described in Krueger (1978, p. 89) that "(a) regime could be fully liberalized and yet employ exceedingly high tariffs in order to encourage import substitution". As discussed in Edwards (1993), Krueger's definition guided early literature to place too much emphasis on exports.

Rodrik (1999) argued that, early research with an emphasis on exports only, from the standpoint of international trade theory, is hard to defend because, according to the theory of comparative advantage, international trade leads to a more efficient use of a country's resources through the import of goods and services. Those are otherwise too costly to produce within the country. Thus, it is probably safe to conclude that imports are as important as exports for economic performance. As a matter of fact, these two should be considered complementary to each other rather than alternatives.

On the other direction, the definition of trade openness by Harrison (1996 p. 420) stated that "The concept of openness, applied to trade policy, could be synonymous with the idea of neutrality. Neutrality means that incentives are neutral between saving a unit of foreign exchange through import substitution and earning a unit of foreign exchange through exports. Clearly, a highly export oriented economy may not be neutral in this sense, particularly if it shifts incentives in favor of export production through instruments such as export subsidies. It is also possible for a regime to be neutral on average, and yet intervene in specific sectors". However, empirical studies are rarely clear on this issue.

### **2.1.3. Trade Openness and Growth: Causality Debate**

Based on Kruger's definition and the focus on exports, researchers began to test export Led-growth (ELG) hypothesis. In a while, the vast majority of this literature focuses on the causal effect of export on economic growth. There are five possible thoughts with regarding the relationship between exports and economic growth can be categorized as follows: Export-Led Growth, growth-led export, the bidirectional causal relationship, negative correlation and no causality (feedback) between the two variables.

There are a number of reasons within trade theory to support the first vision, the Export Led-Growth (ELG) proposition. First, export growth may represent an increase in demand for the country's output and thus serves to increase real output. Second, an expansion in exports may promote specialization in the production of export products, which in turn may boost the productivity level and may cause the general level of skills to rise in the export sector. Third, an increase in exports may loosen a foreign exchange constraint (e.g. Chenery and Strout 1966), that allows for increasing levels of the import of intermediate goods that in turn raises capital formation and thus fuels output growth. Also, the export development of certain goods based upon a country's comparative advantage may allow for the exploitation of economies of scale, which may lead to increased growth Balassa (1978) and Esfahani (1991).

Alternatively, there are many additional reasons for other researcher to support the second thought, the hypothesis that causality runs from economic growth (productivity) to exports or Growth-Led Export Hypothesis (GLE). Economic theories also suggest that economic growth influences, or causes, export expansion. This can happen when domestic markets become well developed, for example due to an increase in capital formation and technological change, which then enhances international competitiveness of tradable goods and in turn improves export performance Ghartey (1993). Also, Bhagwati (1988) noted that an increase in GDP generally results in a corresponding expansion of trade. While, Jung and Marshall (1985) argued that economic growth may have little to do with government policy to promote exports, rather than being related to the accumulation of human capital, cumulative production experience, technology transfer from abroad or physical capital accumulation.

The third thought is the recognition of the potential for bidirectional (feedback) causality between economic growth and exports indicating that they may be interrelated in a cumulative process, Sharma and Dhakal (1994). According to Bhagwati (1988) argued that an increased trade produces more income which facilitates more trade, thus creating a virtuous circle. Also, Thirlwall (2003) supported this model if output growth, which mainly results from export growth, induces productivity growth; this makes goods more competitive and therefore accelerates export growth.

The fourth thought is that negative correlation exists between exports and economic growth. Exports and economic growth are both the result of the process of development. Jung and Marshall (1985) suggested that increased exports arising from some types of inward foreign

direct investment might lower the domestic output due to various distortions. According to Dodaro (1993) exported growth might lead to a decline in output growth when exports are promoted at the expense of domestic consumption and efficiency.

In addition to the contradicting thought is potential for no causal relationship between exports and economic growth such that the growth paths of the two variables are determined by other unrelated variables in the economic system Giles and Williams (2000). Alternatively, Yaghmaian (1994) argued that both exports and economic growth may be caused by the process of development and structural change whereby exports and economic development are both the result of the same forces. Thus, no causal relationship may exist between them.

Thus, the hypothesis of a causal relationship between exports and economic growth does not imply that exports are the only determinant of economic growth or vice versa. While most of the early literature focused on relationship between exports and economic growth, few investigations had been made of the causality between economic growth and trade (exports plus imports) or imports and growth. This could be due to the macroeconomic dispute that imports represent a leak from the circular flow of income and will lead to domestic unemployment rather than economic growth Liu et al. (1997). In addition, this could be due to the argument that imports has no short or long runs effect on growth, which may attributed to the need to conserve scarce foreign exchange for the essential needs Krueger (1978). Also, some of the earlier studies showed a negative effect of imports on growth.

For instant, Rodrik's definition concluded that imports are as important as exports for economic performance. As a result, the definition of trade openness has changed over-time, where import became a proxy of trade openness. There are a number of theoretical reasons to believe that an economy could experience Import-Led Growth (ILG), rather than Export-Led Growth (ELG). It can be argued, however, that imports are a very important determinant of economic growth if they are used as a means to ensure the supply of key raw materials. Nonetheless, imports are traditionally treated as functions of national income Afxentiou et al. (1992). Also, imports are essential to stimulating overall economic performance. Import growth is always connected to export growth since imports offer much needed factors of production employed in the export sector. Imports are always considered as a medium of technology transfer by acquiring embodied technology through the import of capital goods and may play a more

significant role on economic growth than export Awokuse (2008). In particular, this emphasizes the process of modernization and transfer of advanced technology through acquisition of sophisticated capital and materials which boosts domestic production and leads to economic growth Marwah and Tavakoli (2004). Moreover, cumulative causation effects between imports and economic growth from the unbundling of new technologies would also be expected, whereby higher output will increase the incentive for producers to take advantage of foreign technology by increasing imports into the domestic economy Thangavelu and Rajaguru (2004). Import can also affect productivity growth through its effect on local innovation through import competition. Imports are important to productivity growth because increased imports of competing products advocate innovation as domestic producers respond to the technological competitive pressure from foreign competition Lawrence and Weinstein (1999). As a result, there can be a bi-directional causality between imports and economic growth Liu et al. (1997).

Since the emergence of those definitions, for example the definition by Harrison (1996), trade openness as an engine of economic growth is now well established in literature. The research produced two hypotheses better to understand the bi-directional relationship between trade openness and growth: Trade-Led Growth and Growth-Led Trade hypotheses (Liu et al. 1997; Bahmani et al. 1999; Yanikkaya 2003; Wang et al. 2004 and Tsen 2006).

Since theoretical considerations indicate that causation between openness and economic growth can be in either direction, the nature of this causality is essentially an empirical question Arnade and Vasavada (1995). The current study seeks to generate empirical evidence for Egypt on the co-integration and causality between trade openness and growth. An overview of the literature is provided in the following section.

## **2.2. Empirical Evidence**

Several studies have been conducted regarding the relationship between trade openness and growth and various results have been obtained. They can be broadly classified into two groups: cross-country studies and country-specific case studies. The cross-country literature is vast and the important papers are well-documented in Edwards (1993), Baldwin (2003) and Winters (2003). Examples of earlier researchers who have used mostly cross-sectional data and supported the Export-Led Growth hypothesis are (Michaely 1977; Balassa 1978; Tyler 1981; Feder 1982 and Esfahani 1991). However, after the literature of trade openness well established, researcher

investigated Trade-Led Growth hypothesis. For examples (Greenaway and Sapsford 1994; Sengupta and Espana 1994; McCarville and Nnadozie 1995; Bodman 1996 and Thornton 1996) confirm the Trade-Led Growth hypothesis for some countries; on the contrary, Boltho (1996) and some others reject it. But controversies still surround the direction of causality. Logically, to exhaustively survey this huge body of literature in any single undertaking is virtually impossible. In fact, such an exercise is far beyond the scope of our study.

Differing specifications have been used to test the relationship between trade openness and economic growth. As the focus of this study more on the problems of trade openness measures. So, we do not wish to become embroiled in dispute over what the correct specification should be. Generally a variety of time-series and cross-sectional techniques have been employed to test the relationship between exports and economic growth. Earlier studies investigating the relationship by applying rank correlation to developing countries (Michaely 1977; Balassa 1978; Tyler 1981 and Kavoussi 1984). Later, the aggregate production function was examined in cross-sectional studies, which considered exports as an additional input to capital and labour (Dodaro 1991; Esfahani 1991; Greenaway and Sapsford 1994 and Burney 1996). Recently, some researchers examine relationship between trade openness and growth using Trade-Led Growth. Most of these cross-sectional studies found a significant and positive relationship between export performance and national output growth. However, it is recognized that they do not address the issue of causality, while the cross-country regressions provide little insight into the way the various explanatory variables affect growth and the dynamic behaviours within countries Giles and Williams (2000). However, several country specific studies examined free trade growth relationship in aggregate production specification. For instance, (Herzer et al. 2006; Sarkar 2004; Sarkar and Bhattacharyya 2005; Sarkar 2005; Monojitet et al. 2013; Shahbaz; 2012 and Awokuse 2008). These studies will be discussed on our country-specific case subsection. So, the current study seeks to generate empirical evidence for Egypt on the co-integration and causality between trade openness and growth in aggregate production function specification and using a dynamic time series setting.

The rest of this section is as following, next subsection shows some examples of the studies on trade openness measures evolution overtime. After that, given the scope of our study, we do not enter into a detailed discussion of the shortcomings of many cross-country studies and instead choose to focus more on the country-specific case studies.

### **2.2.1. Trade Openness Measures Evolution Overtime.**

On this sub-section the evolution in measuring openness will be discussed. Starting from the 1980s up to now numerous openness measure were developed, here are the following majors ones:

One of the major openness measures is the World Bank (1978) index. In the study a group of 41 developing countries classified into four groups in term of their trade orientation. The strongly- outward oriented countries, the moderately outward oriented countries, moderately inward oriented and the strongly inward oriented. The shortcoming of that study the classification of Korea as a strongly outward oriented country in 1963-1985 created a controversy, because its regime was the most restrictive that time Edwards (1993). Second, Leamer's (1988) openness index computed, based on the government intervention and factor endowments, using nine indicators of trade openness. The model does not predict the trade patterns under free trade. The results shows that more open economics tend to grow faster. But the model was criticized by Rodrik (1993) for the inadequacy of the methods used to construct the indices, which may lead to biased results. Another measure of openness is Dollar's (1992) distortion index. Dollar examined the relationship between free trade and growth. The main contribution of the paper in the construction of two indices, which he demonstrated that are each negatively correlated with growth. In measure by Pritchett (1996) found that collected tariff rates (CTR) underestimated true protection. They found that the relation between tariffs rates and CTR is not linear. The measure of trade openness by Sachs and Warner (1995) openness index used a series of trade-related indicators...Tariffs, quotas coverage, black market premia, social organization and the existence of export marketing boards... to construct a composite openness index. The Economic Heritage Foundation Index, which developed in 1995. According to O'Driscoll et al. (1999) the index includes institutional factors such as corruption, trade distortion and the fiscal burden and black market activities. This index ranks from one to five the measure of distortions. The countries divided into five groups: free, mostly free, repressed and un-free.

Several authors (Harrison 1996; Edwards1998; Rodriquez and Rodrik 2001; Greenaway et al 2002 and Yanikkaya 2003) have tested the explanatory power of a number of these measures to find which might be "best".

Edwards (1998) used 9 measures to test the relationship between openness and total factor productivity (TFP) growth as a proxy for economic growth. The study was that, given the difficulties of creating satisfactory summary indexes, it would be worthwhile to examine whether econometric results were robust to the use of alternative measures. His finding, that TFP growth is faster in more open economies, was robust to the choice of openness indicators, providing ammunition for the argument that a positive relationship between openness and productivity growth does exist. He argued that even the measure openness is improvement over the past it provide a binary classification, either the country is closed or opened. As a result, countries with varied degree of trade intervention are equivalently categorized as open.

Rodriguez and Rodrik (2001) surveyed four measures and three other studies, argued that, owing to methodological problems with the empirical strategies used indicated the relationship between trade policy (as reflected by openness) and economic growth is not well established. Their distrust was driven by two concerns: first, the measures used were either poor measures of trade policy or were highly correlated with other factors affecting economic performance; and second, the mechanisms linking trade policy and economic growth had not been well established. In their study they found little evidence that lower trade barriers were associated with economic growth. They criticized many cross-country studies on the ground of flawed trade openness measures and “weak” econometrics. Such as Dollar (1992), Sachs and Warner (1995), Edwards (1998) and Frankel and Romer (1999) even these studies concluded that trade openness affects growth positively.

Yanikkaya (2003) divided the trade indicators into five categories and disputed that the need for indices of trade orientation (such as Leamer’s, 1988 openness index, Dollar’s, 1992 price distortion and variability index, and Sachs and Warner’s, 1995 index) that are constructed to test the effects of trade openness on growth, partly due to the fact that most trade openness measures are uncorrelated or weakly correlated with each other and no single measure of openness is superior to the others. He concluded that a good measure of trade openness should capture the differences between neutral, inward-oriented and export promoting regimes, which is trade.

Also, Harrison (1996) argued that, regardless of the many openness measures that exist in the literature, the simplest ones are those based on actual trade flows, such as the sum of exports and imports (% of GDP). Most of the earlier measures show a positive correlation with GDP growth,

even after controlling for other variables such as capital and labour. In the latest study by Monojit et al. (2013) trade barriers and trade volumes were used as proxies for openness. They concluded that trade barriers as index shows no evidence of openness growth connection and its bias measure.

The present paper recognises these estimation problems and agrees with earlier researchers that openness measures are not free from methodological and measurements problems. This is important because different openness measures capture different aspects of openness. The current study seeks to avoid the demerits of the other measures of openness and achieve a robust finding, so exports/GDP, import/GDP and (exports + imports)/GDP will use as a proxies of trade openness, similar to the measures used by Sarkar and Bhattacharyya (2005); Sarkar (2005; 2008) and Deme (2002).

### **2.2.2. Trade Openness and Growth Country -Specific Studies**

This study in a time series framework, because many researchers including; Moschos (1989), Bahmani-Oskooee and Alse (1993), Sprout and Weaver (1993) suggested that the effect of trade openness on economic growth vary based on the economic characteristic of individual countries. Also, the issue of causality is dynamic in nature and is best examined using a dynamic time series modelling framework Greenaways et al. (2002). Furthermore, the implicit assumption of the same production function across different types of economies may be unrealistic as the level of technology may vary across countries Awokuse (2008).

Despite these authors' suggestions, Greenaways et al. (2002) postulated that both misspecification and the diversity of the openness measures contribute to the inconclusiveness of the debate. They addressed the misspecification issue by using a dynamic framework and found that liberalization impacts economic growth with all of the three measures of openness but, their findings were relatively modest. Their results suggest that many factors may work in explaining why the literature on trade openness and growth is so inconsistent even for country-specific case studies. First, there is a large variation in sample size and composition, as well as the methodological approaches. Second, different analysis used different measures; some are ex ante indicators of trade openness, some are ex post and other are clearly indicators of trade openness. Third, it is clear that many models which have been estimated are poorly specified, so the results of two empirical studies for one country during the same time periods using different indicators

of trade openness, methodological approaches and sample size could completely agree or not. We survey some of the inconsistency in research findings next.

Due to the lack of literature involving this subject related to Egypt, we examine the results of literature in other countries from the developing world as well as Egypt. The current study reviews examples of the inconsistencies in findings on the relationship between trade openness and growth, including the long run relationship and the direction of causality on the country-specific case studies. The studies will be separated based on the measure/s of the trade used whether, exports, imports and exports, trade, the three together imports, exports and trade or the other measures of trade openness.

#### **2.2.2.1. Studies Using Exports as Measure of Openness**

As stated earlier, Edwards (1993) discussed that Krueger's definition guided early literature to place too much emphasis on exports. In the case of Egypt, to the best of our knowledge, only three studies have been published on causality between trade openness (proxied by exports) and growth. Even the studies used the same measure of openness, but they achieved inconsistent findings.

The first study by Morley and Perdakis (2000) investigated the combined effects of government expenditure, exports, investment and labour supply on economic growth from 1955-1996. The study applied co-integration and error correction methods. The findings indicate a long run relation between the variables, but no evidence in the short run. After they added the dummy variables for the 1974 and 1991 policy reforms, the results become significantly positive for the connection between government expenditure and growth, but there is negative relationship between exports and economic growth.

Alternatively, Abou-Stait (2005) examined exports as engine of growth for the period 1977 to 2003. The study employed co-integration analysis, Granger causality tests, coupled with vector auto regression (VAR) and impulse response function (IRF) analyses. Abou-Stait used tested three hypotheses the ELG paradigm for Egypt, (i) whether GDP, exports and imports are co-integrated, (ii) whether exports Granger cause growth, (iii) whether exports Granger cause investment. The findings fail to reject the first two hypotheses, while failing to accept that exports Granger cause investment. In addition to the analysis of the 1977-2003 periods, the paper

looks briefly at the impact of the economic reforms undertaken in 1991, and whether the ELG hypothesis still holds during the 1991-2003 sub-period.

In addition, Negem (2008) examined the relationship between trade liberalisation and economic growth during the period of 1970-2006, by addressing some challenges remaining in theoretical and empirical literature on free trade and economic growth. Two models were constructed: the first one attempted to deal with the causality problem by re-examining the causality between exports and economic growth based on the Vector Error Correction Model (VECM). The second model, a Simultaneous Equation Model (SEM), was developed to deal with the endogeneity problem and investigate the impact of selected openness indicators on economic growth in Egypt. The most important finding is the strong positive and bi-directional relationship between Egyptian exports and economic growth. The role of human capital in growth and exports was also shown to be significant. Similar findings were obtained for countries at different stages of development (low- and middle-income). It is concluded that, like Egypt, all groups will benefit from trade openness, regardless of the degree of development.

Khan and Qayyum (2007) and Shahbaz et al. (2011) used exports as indicator of openness and reported positive impact of trade on economic growth for Pakistan. Khan and Qayyum (2007) investigated the impact of trade and financial liberalisation on economic growth using annual observations over the period 1961-2005. Their empirical findings suggest that both trade and financial policies play an important role in enhancing economic growth in the long-run. However, the short-run responses of the real deposit rate and trade policy variables are very low, suggesting further acceleration of the reform process. The feedback coefficient suggests a very slow rate of adjustment towards long-run equilibrium.

While, Shahbaz et al. (2011) scrutinized the effect of financial development, imports and foreign direct investment (FDI) on output over the period of 1990-2008 using quarterly data sets to examine the long run relationship and the direction of causality by using VECM framework. Their findings indicate the long run relationship between openness and growth. Further, results show the existence of the Export-Led Growth hypothesis and that exchange rate changes decrease domestic output while capital stock improves the volume of domestic output and hence economic growth.

Ljungwall (2006) and Kwan and Kwok (1995) both show a positive relationship between growth and openness for China. Ljungwall (2006) reviewed relationship between growing exports and economic growth or whether growth in exports drives growth in GDP, at the provincial level. A vector auto-regressive (VAR) model is employed for both multivariate co-integration analysis and Granger-causality testing. The Johansen and Juselius (1990) procedure were used to test for a long-run relationship between the variables. The ELG hypothesis is validated in 13 of the 27 provinces in the sample.

Kwan and Kwok (1995) examined the endogeneity assumptions of the export growth variable in an output growth equation. They used the standard Granger test for the 1952 to 1985 period. They concluded that the export variable is exogenous in the output growth equation and found instead a one-way causality from exports to economic growth.

Chuang (2000) and Biswal and Dhawan (1998) concluded a positive connection between exports and growth for Taiwan. Chuang tested the causal relationship among human capital accumulation, exports, and economic growth using data pertaining to Taiwan's real GDP, real exports and higher education attainment over the period 1952–95. Co-integration and error-correction representation methodology were used. The main findings of the paper are that human capital accumulation fosters growth and stimulates exports, while exports promote long-run growth by accelerating the process of human capital accumulation.

Biswal and Dhawan examined the causality between growth and exports from 1960-1990 using Engle and Granger's co-integration and error correction model approaches. The results indicate long run relationship between total exports and GDP. The empirical evidence supports the bi-directional causality between the variables. Also, long run relationship between manufactured goods exports and GDP, with a stronger causality from GDP to manufactured goods exports and weak causality in the reverse direction. Granger's causality tests were applied.

#### **2.2.2.2. Studies Using Both Import and Exports as Measures of Openness**

The empirical evidence for India is quite mixed. Some studies used exports and imports as the proxy for openness find positive associations between trade openness and growth whereas some find a negative relationship. Sarkar (2008) employed time series analysis and finds that trade openness has negative impact on India's growth. On the contrary, Dash and Sharma (2008) used the Engle and Granger two-step co-integration analysis. They find that trade had a positive

impact on economic growth during the time period of 1950-2007. Marelli and Signorelli (2011) used the 2SLS methodology. Their result is that openness had a positive impact on economic growth from 1980-2007.

Awokuse (2008) explored the contribution of both exports and imports as share of GDP as an indicator of trade openness to economic growth in selected Latin American countries: Argentina, Colombia and Peru. Time series data in a neoclassical growth modelling framework and multivariate co-integrated VAR methods and impulse response function were used. The analysis revealed that the Export Led-Growth (ELG) hypothesis could not be supported in any of the three countries. In contrast, the study found empirical evidence in support of a bi-directional causal relationship between imports and GDP growth for Argentina and Colombia, but evidence in support of only the ILG hypothesis for Peru.

#### **2.2.2.3. Studies Using Trade (Exports plus Imports) as Measure of Openness**

Liu et al. (1997) examined the causal relationship between openness and economic growth using quarterly data for China from 1983 to 1995. The integration and co-integration properties of the data are analysed and three different models of Granger causality, Sims, Geweke and Hsiao were used to investigate the relationship between economic growth and trade (exports plus imports). They find a feedback causal relationship between economic growth and trade. Sakyi (2011) scrutinized the relationship between trade and growth by incorporating foreign aid as an additional variable in the case of Ghana in post-liberalization regime. His paper employs the ARDL bounds testing approach to co-integration and finds that trade and foreign aid inflows contribute to economic growth both in long and short runs.

#### **2.2.2.4. Studies Using Exports, Imports and Trade as Measures of Openness**

Deme (2002) tested the Trade-Led Growth, the Export-Led and the Import-Led Growth hypotheses using 1970: I - 1997: 1 quarterly data for Nigeria. He applied Johansen's co-integration techniques to examine the long-run relationships among the variables, and tested their causal links in a vector autoregressive (VAR) framework. Then, he used response functions to analyze the short-run dynamics between each measure of trade openness and economic growth. The tests failed to establish a long-run link between trade openness and economic growth. The results indicate a bi-directional causality between some measures of trade openness and

economic growth. The impulse response function suggests that a one- time positive shock in trade openness has an optimal impact on economic growth during the third quarter.

(Sarkar 2004; Sarkar and Bhattacharyya 2005 and Sarkar 2005) applied the same measure of openness and the same methodology which is an Autoregressive Distributive Lag Method (ARDL) for India. Sarkar and Bhattacharyya (2005) scrutinized the relationships between growth and trade liberalisation in the context of the Indian and Korean economies. They find evidence of an “unfavourable” impact of trade liberalisation on real growth rates of India. Similarly, Sarkar (2005) used the same trade openness indicator for India only. The research finds no positive long-term relationship between openness and growth from 1956-1999.

Also, Sarkar (2004) examined trends in Indian macroeconomic series since 1970 and changes during the regime of ‘liberalisation’ since 1991 using the same methodology and proxies of trade openness. The results indicate no evidence of change in the period of liberalization from 1991 to 2002 in India’s macroeconomic performance observed over the preceding period, 1970-1990/91. real GDP did not experience an accelerated growth.

Shahbaz (2012) re-examined the impact of trade openness on economic growth in the long run for Pakistan. He applied the ARDL bounds testing approach to test for a long run relationship and the augmented production function by incorporating financial development as an additional determinant of economic growth using the framework of Mankiw et al. (1992) and applying the three indicators of free trade exports, imports and trade plus term of trade. They examined causality association between trade openness and economic growth by using VECM framework and the innovative accounting approach (IAA). Their findings confirm co-integration among the series. In the long run, trade openness promotes economic growth. Their findings regarding the causality are mixed where exports and trade positively linked to economic growth but, imports negatively tied to it.

#### **2.2.2.5. Studies Using Other Measures of Openness**

Hye (2011) tested the long term effect of trade openness on economic growth for Pakistan from 1971 to 2009. Using an index of trade openness, a composite trade openness index is developed by using principal component analysis (PCA) and is employed in the JJ co-integration, autoregressive distributed lag (ARDL) approach to co-integration, dynamic OLS and variance decomposition. The results indicate a negative effect of trade openness on economic

growth but a combined effect of human capital and trade openness accelerate economic growth, suggesting that the performance of human capital must be improved through education and technical training to attain fruits of trade openness on economic growth. Monojit et al. (2013) investigated the empirical relationship between trade openness and economic growth in India for the time period of 1970-2010. Trade barriers and trade volumes were used as proxies for openness. The findings are that an increase in import penetration ratio and total trade share leads to an increase in GDP growth rate of India, but they find no evidence of any empirical relationship between trade barriers and growth.

The empirical results have generally indicated a positive relationship between trade openness and economic growth. However, the strength of the link has greatly depended on whether the specification uses time series, cross section or panel data techniques, on problems of data and the measurements of openness (Sachs and Warner 1995; Harrison 1996; Kaplan and Aslan 2006). These mixed results suggest that the researchers must focus more and more on the trade liberalization. Thus, there is ambiguous empirical evidence for the connection between trade openness and economic growth even in the country-specific case studies. (Sharma and Panagiolidis 2004; Monojit et al. 2013 and Greenaways et al. 2002) suggested that ambiguity or inconsistency in findings can be attributed to two main reasons for such methodological shortcomings and inappropriate choice of trade openness indices. So, this study uses three proxies of trade openness. Second, applies two approaches to test the long run relationship between trade openness and growth. Third, uses two frameworks to test the causality between the variables. That will be presented in the following chapter in which we conduct an empirical analysis.

## Chapter 3

### Trade openness and growth: An Empirical Analysis

This chapter is an empirical analysis of the relationship between trade openness and growth in Egypt for the period 1970-2012. In the present chapter, the first section shows an overview for the economy and Egypt's trade policy. It gives a summary of the economy and a brief history of Egypt's trade policy. In addition, a descriptive statistic of Egypt's trade policy is provided. The second section introduces the theoretical framework and methodologies to perform the empirical analysis. The last section is empirical results and discussions.

#### 3.1. Overview of Economy and Egypt's Trade Policy

From 1974-1980 the rapid increase in the flows of external resources, partly linked to mega-projects and the petroleum sector, was a key factor behind that rapid GDP growth averaging 9% per year in Egypt. As the sectoral breakdown of growth shows, Petroleum: 25.5%, Suez Canal: 42.8%, Trade: 17.0%, Government Services: 9.9%, Agriculture: 2.5% and Industry: 6.2% of the GDP Handoussa (1991). Major investment projects emerged due to contributions from the World Bank and the Western countries Weinbaum (1985).

In 21th Century the Egyptian economy is dominated by the service sectors the basic two are Tourism Sector and Suez Canal. The other important sectors are the Agriculture 16.5% of GDP, Industry 19.7% of GDP and Petroleum 8% of GDP about 40% of that exported, so Egypt's trade share of GDP in 2003 is 29% Negem (2008).The table that follows shows the major Egyptian economy indicators for selected years.

**Table 1**

#### Economic Indicators for Egypt from 1970-2012 (selected years)

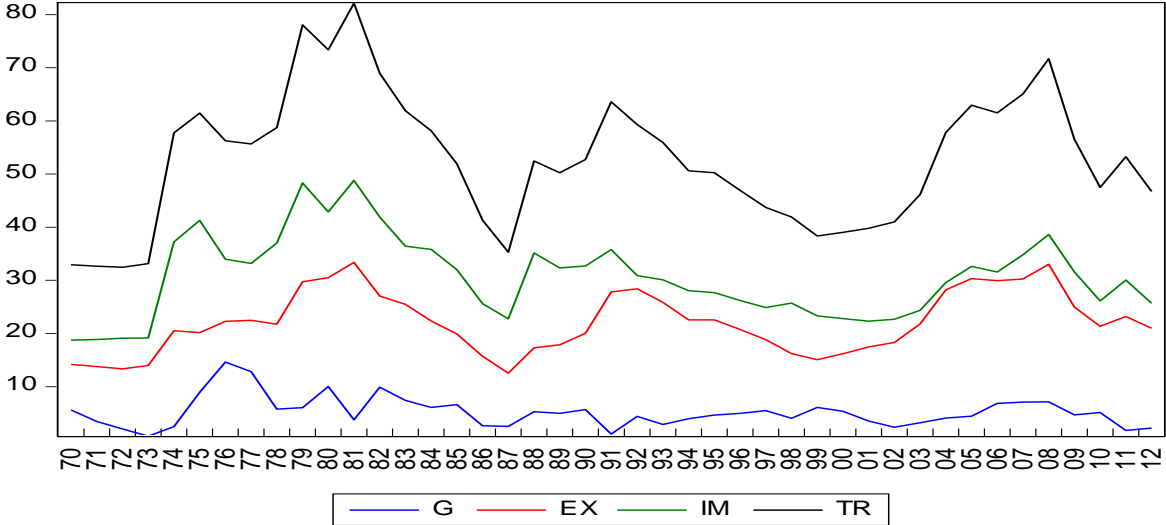
	1970	1975	1980	1985	1990	1995	2000	2005	2007	2008	2009	2010	2011	2012
population (M)	36.4	40.4	45	50.3	56.3	61.2	66.1	71.8	74.2	75.5	76.8	78.1	79.4	80.7
GDP (US \$)	7.68	11.4	22.9	34.7	43.1	60.2	99.8	89.7	130.5	163	189	218.8	236	257.3
GDP growth (%)	5.6	8.9	10	6.6	5.7	4.6	5.4	4.8	7.1	7.2	4.7	5.1	1.8	2.2
EXPORTS/GDP	14.2	20.2	30.5	19.9	20.1	22.5	16.2	30.4	30.2	33.1	25	21.4	23.2	21
IMPORTS/GDP	18.8	41.3	42.9	32.1	32.7	27.7	22.8	32.6	34.8	38.6	31.6	26.1	30.1	25.7
TRADE/GDP	32.9	61.5	73.4	52	52.8	50.2	39	53	65	71.7	56.6	47.5	53.3	46.7

Source: World Development Indicator annual data updated on line up to 2012.

For Egypt in 2012, the total trade (sum of exports and imports) (% of GDP) makes up 46% of the country's gross domestic product. The imports are huge making this nation a suitable sample

to test the Export, Import and Trade-Led Growth hypotheses. Figure 1 shows that during most of the 1970-2012 periods, trade openness variables and gross domestic products were closely fluctuating in the same direction. For example, we see that the exports, imports, trade (sum of exports and imports) and gross domestic product fluctuated in the same direction and furthermore both the highest peaks and the lowest troughs of imports, exports, trade and GDP mirrored each other. Even though the figure suggests a correlation between each of the trade openness variables and economic growth, the statistical significance of the co-movements needs to be examined econometrically. There's also a gap in the literature of Egypt, no other study that investigated the case of Egypt used the exports, imports and trade as proxies of trade openness.

Figure 1: GDP Growth Rate (G) compare to the Ratios of Exports (EX), Imports (IM) and Trade (TR) for Egyptian economy.



### 3.1.1. A Brief History of Egypt's Trade Policy

An examination of present trade liberalization in Egypt requires a brief historical review of Egypt’s protectionist past. During the 1950s and 1960s, the Nasser regime applied a Land Reform Law that led to enhanced productivity of the agriculture sector. Nevertheless, the construction of Aswan Dam, Nationalization of Suez Canal and the Suez War at 1965 led Nasser to impose Corporatism. The reform had some benefits in controlling the labour force and many industries were built Ates (2005). Generally from years 1950 to 1970, Egypt pursued a centralized economic policy which led to major macroeconomic imbalances and inhibited the country's ability to cope with its high population growth. Many problems facing industrial

development in Egypt, such as the limited capacity to import due to a foreign exchange shortage, poor labour capital productivity and poor infrastructure El Din (1986). The year 1974 manifested the starting point for major changes in the Egyptian economy. In that year, President Sadat initiated the 'Open Door Policy' ('Infitah'). After the Camp David Accords, the Suez Canal was reopened and the Sina oil fields were regained, and consequently Western institutions began to extend credit to Egypt. The Open Door Policy aimed to encourage foreign and domestic investment, especially in the private sector and reduce government control over the agricultural and industrial sectors; thus, it marked the beginning of the transition of the economy from a central and comprehensive planning approach to a market-oriented economy. This shift led the economy to a rapid growth of GDP, averaging 9% per year during the period of 1973-1981 Morley and Perdakis (2000).

Despite of the rapid growth rates during this period, the Egyptian economy suffered from many macroeconomic problems. For instance, following the 1973 war, Egypt's public sector fell into serious debt. Imports increased by about 350% from 1974-79, due to sharp increases in the imports of capital and intermediate goods while exports were not increasing at the same rate. Another reason for the increase in external debts was a result of a rapid increase in military expenditures during 1977-1981. In 1982, President Mubarak called for an economic conference which led to an increase in domestic and foreign savings, control of the import of luxury goods, and reduced government expenditures. Accordingly, the government agreed in its first five-year plan (1982-1987) to rely on domestic capital and to reduce external borrowing Amin (1998). However, this did not occur due to two twin macroeconomic imbalances, one between investment and domestic savings, and another between imports and exports.

In 1991, Egypt signed an economic reform and structural adjustment program with the International Monetary Fund (IMF) which was a turning point for Egyptian economy. In addition, Egypt became engaged in various trade agreements with the European Union (EU), the Arab Free Trade Area (AFTA), and the agreement to establish a Common Market for Eastern and Southern Africa (COMESA). The stabilization and economic reform program encompassed trade liberalization. The structural adjustment program aimed to restructure the economy, reduce inefficiency, re-arrange the foreign exchange system, the interest rate and enhance the role of the market. It also aimed to provide a more liberal arena for entrepreneurship Hopwood (1991). The economic reform of 1991 led to a 5.1% positive growth rate. The foreign debt fell from \$33

billion in 1995 to 26.1 billion in 2001. The reform program emphasized the importance of the trade sector through various measures aimed at liberalizing foreign trade, including the Egyptian government adjustment of exchange rates to reflect market forces.

In 2004, Egypt executed a Custom Reform to encourage the foreign direct investment. Nonetheless, the Reform led to an increase in the budget deficit up to 8% of GDP. Also, the new reform escorted the government to float the currency and increased the inflation Negem (2008).

### **3.1.2. A Descriptive Statistic of Egypt's Trade Policy**

In the years after the 1974 and 1991 Reforms, there was a positive impact on trade. From 1973-1981 GDP growth was averaging 9% per year Morley and Perdakis (2000), accordingly its share of total exports in GDP increased from 13% in 1973 to 33% in 1981, imports (% of GDP) also increased from 19% to 48% and total trade (% of GDP) from 33% to 82%<sup>1</sup>.

The economic reform of 1991 led to a 5.1% positive growth rate, the reform program emphasized the importance of the trade sector through various measures aimed at liberalizing foreign trade, including when the Egyptian government adjusted exchange rates to reflect market forces. Export controls were removed and import tariffs reduced, particularly on capital goods and inputs. In 1998, Egypt reached its lowest import tariff rate by 50% to 40%, but it was still considered high compared to the rest of the world. Imports grew in 2003-2004 by 427%. On another hand, the exports growth rate increased, but not continuously Abou-Stait (2005). Egyptian exports included agricultural products, petroleum, natural gas and building materials, which in 2004 rose to 55%. The exports of non-Petroleum products rose to 60% of total exports, but the petroleum exports fell by 8% in 2005. Most of Egypt's exports were to the European Union, which represent 41% of the total exports. Then, the exports to Asia rose by 18% and 10% to North America of the total exports, but the exports to Africa fell by 2%<sup>3</sup>.

In 2008 Egypt built a huge exports project, the Arab Gas Pipeline which currently connects Egypt to Syria and Jordan, in the future it will continue to Turkey Negem (2008). As a result of the various reforms, Egypt's exports in GDP increased from 20% in 1990 to 33% in 2008, while imports (% of GDP) rose from 32.7% to 38.6% and the total trade (% of GDP) rose from 52.7% to 71.6%<sup>2</sup>. Unfortunately, due to the Arab Spring and instability in the region, all of these figures have drastically decreased and in 2012, Egypt's exports (% of GDP) were 21%, imports (% of GDP) 25%, and the total trade 46%<sup>4</sup>.

The table 2 below shows the main descriptive statistic for Egyptian economy for the four decades under study. The table reports the mean, median, maximum and minimum of GDP growth, exports, imports and trade ratios. The mean and median of imports are greater than the exports ones. Also, the maximum of imports is greater than exports, which make the Egyptian economy the best case study to investigate ILG as well as ELG and TRLG hypotheses. In addition, a good example to examine whether the composite effect of trade on growth is different than the individual effect of either exports or imports.

**Table2**

**Descriptive Statistic for Egyptian economy from 1970-2012**

	GDP Growth	EXPORTS/GDP	IMPORTS/GDP	TRADE/GDP	CAPITAL	LABOUR
Mean	5.185272	22.06078	30.67618	52.73696	22.63146	59.51755
Median	4.972379	21.74579	30.91301	52.76088	20.85124	64.78453
Maximum	14.62725	33.37182	48.80485	82.17668	34.91937	84.86881
Minimum	0.705247	12.55871	18.75164	32.48178	12.33960	28.00068
Std. Dev.	2.873426	5.715912	7.552069	12.39500	5.978928	17.14213
Skewness	1.242162	0.240609	0.431634	0.233039	0.344115	-0.295700
Kurtosis	4.991654	2.110396	2.749625	2.587727	2.126485	1.997253
Jarque-Bera	18.16490	1.832814	1.447525	0.693727	2.215734	2.428166
Probability	0.000114	0.399953	0.484924	0.706902	0.330263	0.296982
Observations	43	43	43	43	43	43

Source: the author calculation for this study sample from 1970-2012 (using EViews software).

### 3.2. Theoretical Framework and Methodologies

This section illustrates the generation of the model needed to test the long-run and causality connecting trade openness and growth. Subsequently, we introduce our methodologies, which are the unit root test methods, the co-integration and the causality approaches. We apply the Johansen Maximum Likelihood and ARDL bound testing for co-integration as well as VECM and GIRF frameworks to test the causality.

#### 3.2.1. The Model

Numerous empirical works tested the similar hypotheses to the ones of the present study, which are: Export-Led Growth, Import-Led Growth and Trade-Led Growth assuming exports, imports or trade are key factors to enhance production (Balassa 1978; Awokuse 2008; Shahbaz; 2012 and Sarkar 2005). Endogenous growth theories, on the other hand, provide an explanation

of the sustained productivity and output growth, and most importantly of the openness-growth nexus. They provide "theoretical support for the positive relationship between trade openness and economic growth (Edwards 1998)". They depart from treating technological progress as exogenous and as a result trade openness is considered as one of the engines for the needed technological progress.

Following the steps of Mankiw et al. (1992), using a Cobb–Douglas production function in aggregate form and assuming marginal contribution of capital and labor in production, production function in period t is given below:

$$G(t) = A(t) K(t)^\beta L(t)^{1-\beta} \quad 0 < \beta < 1 \quad (1)$$

Where G is domestic output, A is a technological progress, K is capital stock, labor is L and  $\beta$  is output elasticity of capital. Expanding Cobb–Douglas production function by assuming technological progress can be achieved through opening to trade. The empirical formulation of this study incorporates the causal link between openness and GDP growth by including trade openness indicators (exports, imports or trade) in our model as endogenous variables into the aggregate production function (Balassa 1978; Awokuse 2008; Shahbaz (2012) as follows:

$$A(t) = \varphi TR(t)^\delta \quad (2)$$

Where  $\varphi$  is time-invariant constant, TR is an indicator of trade openness (whether exports, imports or trade...). Substituting Equation (2) into Equation (1):

$$G(t) = \varphi TR(t)^\delta K(t)^\beta L(t)^{1-\beta} \quad (3)$$

Taking logs, Equation (3) can be re-written as follows:

$$\ln G_t = \Phi_1 + \Phi_2 \ln TR_t + \Phi_3 \ln K_t + \Phi_4 \ln L_t + u_i \quad (4)$$

where  $\Phi_1 = \log \varphi$  is a constant term,  $\ln G_t$  is log of real GDP growth,  $\ln TR_t$  is log of trade openness,  $\ln K_t$  is log of real capital stock,  $\ln L_t$  is skilled labor and  $u_i$  is error term assumed to be constant.

### 3.2.2. Methodologies

We will use the following Methodologies: the unit root test methods, which are Augmented Dickey-Fuller (ADF) and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test.

The co-integration approaches the Johansen Maximum Likelihood and ARDL bound testing. VECM and GIRF frameworks will be used to test the causality.

### **3.2.2.1. Unit Root Test Methods**

In order, to test the stationary of the variables, two units root tests are used. First, we use the Augmented Dickey-Fuller (ADF hereafter) to test for the presence of unit root under the alternative hypothesis that the time series in question is stationary around a fixed time trend where the numbers of lags in the procedure are auto-determined by the level of significance of the lagged first-differenced term Dickey and Fuller (1979). Second, the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test is used to test for the null hypothesis of stationary which is proposed by Kwiatkowski et al. (1992). The combination of the two tests is very robust in determining the presence of unit roots Awokuse (2008). Table (1) reports the results of the ADF and KPSS tests applied not only to the level of all variables, but to their first differences as well.

### **3.2.2.2. Co-integration Test Approaches**

The co-integration approaches are the Johansen Maximum Likelihood and ARDL bound testing.

#### **A. Johansen Maximum Likelihood Approach**

The long-run equilibrium relationship between two variables could be detected by the co-integration method. We define  $d$  to be the number of times that a variable needs to be differenced in order to achieve stationarity. Such a variable is said to be integrated of order one denoted by  $I(d)$ . For example, the first differenced stationary variable is said to be an  $I(1)$  variable and a level stationary variable is said to be an  $I(0)$  variable.

The long-run causality relationship between trade openness and output growth requires appropriate methodology to detect the equilibrium. Hence, it is necessary to test co-integration before the granger causality analysis. In particular, in Johansen (1991) and Johansen and Juselius (1990) multivariate cointegration tests are applied. This methodology is extensively discussed in the literature and therefore has not been discussed here. Please see the above references for details. In order to implement the Johansen test, we first examine the time series properties of the variables of the study. The Augmented Dickey Fuller (ADF) tests are used to find out the order

of integration of the series. If the series is found to be of the same order of integration, we can apply the cointegration tests.

Johansen and Juselius (1990) modelled time series as reduced rank regression in which they computed the maximum likelihood estimates in the multivariate co-integration model with Gaussian errors. The model is based on the error correction representation given by:

$$\Delta Z_t = \mu + \sum_{i=1}^{\rho-1} \Gamma_i \Delta Z_{t-k} + \Pi Z_{t-1} + \varepsilon_t \quad (5)$$

Where  $Z_t$  is an  $(n \times 1)$  column vector of  $\rho$  variables,  $\mu$  is an  $(n \times 1)$  vector of constant term,  $\Delta$  is a difference operator,  $k$  denotes the lag length and  $\varepsilon_t \sim N(0, \Sigma)$ . The coefficient matrix  $\Pi$  is known as the impact matrix or co-integrating matrix which is an  $(N \times N)$  matrix, and it contains information about the long-run relationships including the number of co-integrating vectors ( $r$ ) between the variables in  $Z$ . In this setup,  $r$  is usually the rank of  $\Pi$ . Johansen and Juselius (1990) demonstrate the co-integrating vector; can be estimated as the eigenvector associated with the  $r$  largest and significant eigenvalues. Using the eigenvalues Johansen and Juselius prove that one can test the hypothesis that there are at most  $r$  co-integrating vectors by calculating the following two likelihood test statistics known as trace and  $\lambda$ -max tests respectively:

$$-2 \ln Q = -T \sum_{i=r+1}^n \ln(1 - \lambda_i) \quad (6)$$

and

$$-2 \ln Q = -T \ln(1 - \lambda_{r+1}) \quad (7)$$

Where,  $\lambda_{r+1} \dots \lambda_N$  are the estimates of  $N - r$  smallest eigenvalues. Johansen (1988) and Johansen and Juselius (1990) suggest a maximum likelihood estimation procedure to obtain an estimate of trace and  $\lambda$ -max. Table 4 reports the results of trace and  $\lambda$ -max, along with the critical values and the probabilities. The null hypothesis is rejected when the estimated likelihood ratio test statistic exceeds the critical values. Since each of the two tests have their strengths and limitations, it is preferable to make an inference using both tests Cheung and Lai (1993).

However, co-integration tests such as the Johansen maximum likelihood, among others, rely on strictly  $I(1)$  stationary variables. The reason being that, if all the variables are  $I(1)$  stationary, then there are special cases where a linear combination result in an  $I(0)$  stationary variable and hence co-integration Asterius and Hall (2007). However, the requirement of  $I(1)$  variables often makes estimates of these co-integration tests subject to biases. This is the case, as the order of

integration of a variable often depends on the type of unit root test, the choice of optimal lag length and whether a constant and/or trend is included in the underlying unit root test.

## B. The ARDL Bounds Testing Approach

In order to have robust findings and overcome some of the demerits of the traditional co-integration approaches, we employ the Autoregressive Distributed Lag Model (ARDL) bounds test. This method allows the estimation of the long run level relationship between variables and its choice is motivated by the key benefits it has over the strictly I(1) stationary variables dependent co-integration test. Firstly, the method yields valid results irrespective of whether the underlying variables are I(0), I(1), or a combination of both. This is important when it becomes difficult to treat a variable as either I(0) or I(1) stationary, although it may not necessarily be I(2) stationary. Secondly, the method is asymptotically efficient in finite and small sample studies and applicable even in the case where the regressors are endogenous. This is appropriate for the present paper with only 43 observations. Thirdly, the method allows the introduction of optimal lags of both the dependent and independent variables. Thus, different variables are allowed to have their optimal speed of adjustment to equilibrium. Last but not least, OLS is easily employed to estimate the co-integration relationship. Also, a dynamic unrestricted error correction model (UECM) can be derived from the ARDL through a simple linear transformation (Narayan and Narayan 2005; Rao and Rao 2009 and Shahbaz 2012). The UECM integrates the short run dynamics with the long run equilibrium without losing any information for long run, taking each of the variables in turn as a dependent variable. Based on equation (4) as follows:

$$\begin{aligned} \Delta \ln G_t = & \alpha_1 + \alpha_T T + \alpha_G G_{t-1} + \alpha_{TR} TR_{t-1} + \alpha_K K_{t-1} + \alpha_L L_{t-1} + \sum_{i=1}^p \alpha_i \Delta \ln G_{t-i} \\ & + \sum_{j=0}^q \alpha_j \Delta \ln TR_{t-j} + \sum_{l=0}^s \alpha_L \Delta \ln K_{t-l} \sum_{m=0}^t \alpha_m \Delta \ln L_{t-m} + U_t \end{aligned} \quad (8)$$

$$\begin{aligned} \Delta \ln TR_t = & \alpha_1 + \alpha_T T + \alpha_G G_{t-1} + \alpha_{TR} TR_{t-1} + \alpha_K K_{t-1} + \alpha_L L_{t-1} + \sum_{i=1}^p \beta_i \Delta \ln TR_{t-i} \\ & + \sum_{j=0}^q \beta_j \Delta \ln G_{t-j} + \sum_{l=0}^s \beta_L \Delta \ln K_{t-l} \sum_{m=0}^t \beta_m \Delta \ln L_{t-m} + U_t \end{aligned} \quad (9)$$

$$\begin{aligned} \Delta \ln K_t = & \alpha_1 + \alpha_T T + \alpha_G G_{t-1} + \alpha_{TR} TR_{t-1} + \alpha_K K_{t-1} + \alpha_L L_{t-1} + \sum_{i=1}^p \delta_i \Delta \ln K_{t-i} \\ & + \sum_{j=0}^q \delta_j \Delta \ln G_{t-j} + \sum_{l=0}^s \delta_L \Delta \ln T_{t-l} \sum_{m=0}^t \delta_m \Delta \ln L_{t-m} + U_t \end{aligned} \quad (10)$$

$$\begin{aligned} \Delta \ln L_t = & \alpha_1 + \alpha_T T + \alpha_G G_{t-1} + \alpha_{TR} TR_{t-1} + \alpha_K K_{t-1} + \alpha_L L_{t-1} + \sum_{i=1}^p \rho_i \Delta \ln L_{t-i} \\ & + \sum_{j=0}^q \rho_j \Delta \ln G_{t-j} + \sum_{l=0}^s \rho_L \Delta \ln K_{t-l} \sum_{m=0}^t \rho_m \Delta \ln L_{t-m} + U_t \end{aligned} \quad (11)$$

We use F-test to examine the existence of a long run relationship between the variables of interest following the null hypothesis i.e.  $H_0: \alpha_G = \alpha_{TR} = \alpha_K = \alpha_L = 0$  against alternate hypothesis of co-integration Pesaran et al. (2001) for Eq. (4). The F-test has a nonstandard distribution which depends upon; (i) whether variables included in the ARDL model are  $I(0)$  or  $I(1)$ , (ii) the number of regressors and (iii) whether the ARDL model contains an intercept and/or a trend. The critical values (CVs) are reported in Pesaran et al. (2001). However, these CVs are generated for sample sizes of 20,000 and 40,000 observations. Narayan (2004) argues exiting CVs, because they are based on large sample sizes, cannot be used for small sample sizes. So, the F-statistic will be computed in our study to compare with critical bounds generated by Lower critical Bound (LCB) and Upper Critical Bound (UCB) developed by Narayan (2005), which was found appropriate for small samples than the table generated by Pesaran et al. (2001). There is co-integration if the computed F-statistic is more than Upper Critical Bound (UCB) and no co-integration if the value of the F-statistic below the Lower Critical Bound (LCB). However If the sample test statistic falls between these two bounds, the result is inconclusive. The stability tests are used to inspect the stability of ARDL bounds testing estimates, have been applied using both CUSUM and CUSUMSQ for a robust stability result Brown et al. (1975).

The ARDL bounds testing approach can be used to estimate the extent of the long run relationships between the variables. If there is co-integration in Eq. (4) where trade openness ( $TR_t$ ), capital stock ( $K_t$ ) and skilled labor ( $L_t$ ) are used as forcing variables, then there is an established long run relationship between the variables that can be molded in following equation given below.

$$\ln G_t = \theta_0 + \theta_1 \ln TR_t + \theta_2 \ln K_t + \theta_3 \ln L_t + \mu_t \quad (12)$$

Where  $\theta_0 = -\alpha_1/\alpha_G$ ,  $\theta_1 = -\alpha_{TR}/\alpha_1$ ,  $\theta_2 = -\alpha_K/\alpha_1$ ,  $\theta_3 = -\alpha_L/\alpha_1$  and  $\mu_t$  is the error term assumed to be normally distributed Shahbaz (2012).

These long run estimates are computed using ARDL bounds testing approach to co-integration when real GDP growth ( $G_t$ ) in logarithm form is used as a dependent variable. The results of the bounds testing to co-integration and the extent of the long run effect of trade openness on economic growth are displayed in tables (5) and (6) respectively.

### 3.2.2.3. Causality Frameworks

The VECM and GIRF frameworks will be used to test the causality.

#### A. The VECM Granger Causality Approach

Once Johansen's procedure and the ARDL bounds testing approach confirm the presence of co-integration for long run relationship between economic growth, trade openness, capital and labor, then we apply the Vector Error Correction Model (VECM) Granger Causality Approach to test the direction of casual relation between the series. VECM provides estimates on both short-run and long-run casual patterns. The exact direction of causality between the variables helps policy making authorities to sustain economic growth attaining fruitful impacts of trade openness. It is documented by Granger (1969) that the VECM Granger causality test is appropriate once variables are integrated at the same level of integration. To test the direction of causality between the variables following error correction representation:

$$(1 - L) \begin{bmatrix} \ln G_t \\ \ln TR_t \\ \ln K_t \\ \ln L_t \end{bmatrix} = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_4 \end{bmatrix} + \sum_{i=1}^p (1 - L) \begin{bmatrix} b_{11i} & b_{12i} & b_{13i} & b_{14i} \\ b_{21i} & b_{22i} & b_{23i} & b_{24i} \\ b_{31i} & b_{32i} & b_{33i} & b_{34i} \\ b_{41i} & b_{42i} & b_{43i} & b_{44i} \end{bmatrix} * \begin{bmatrix} \ln G_{t-1} \\ \ln TR_{t-1} \\ \ln K_{t-1} \\ \ln L_{t-1} \end{bmatrix} + \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad (13)$$

Where  $(1 - L)$  is the difference operator,  $ECT_{t-1}$  is a lagged residual term from the long run relationship and  $\varepsilon_{1t}$ ,  $\varepsilon_{2t}$ ,  $\varepsilon_{3t}$  and  $\varepsilon_{4t}$  are errors term assumed to be normally distributed with mean zero and finite covariance matrix.

The causality between variables in the long run is estimated by the significance of t-statistic connecting the coefficients of the errors term ( $ECT_{t-1}$ ) Shahbaz (2012). However, the short run causality are indicated by the significance of the chi-square in the first differences of the variables of equation 13. The chi-square<sup>5</sup> is calculated using WALD-test, the null hypothesis is whether the coefficients of lagged independent variables together equal zero, for any of the 12 equations in the system. WALD test for Granger is a non-causality test introduced by Toda and Phillips (1994).

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<sup>5</sup>This study uses EViews software to generate both F-stat and Chi-square using WALD -test to test for the causality relationship between the variables. However, only chi- square is reported, because Toda and Phillips (1994) argued the F- distribution is not a standard test to test the joint causality when the variables are integrated. Lags (1999) demonstrated three procedures to solve this problem as follows: firstly using WALD-test by Toda and Phillips (1994), secondly as Mosconi and Giannini (1992) suggested a Likelihood Ratio (LR) and thirdly Toda and Yamamoto (1995) proposed a MWALD test. Lags recommended a MWALD test using common software packages which can do a better job than Eviews e.g. RATS, SAS and SHAZAN.

In addition, the joint significance of both long and short runs causality are indicated by the joint significance of both  $ECT_{t-1}$  and the estimate of lagged independent variables. Rejection of the null implies a rejection of Granger non-causality. For example, when  $b_{12i} \neq 0$  and significant for any  $i$  that indicates economic growth, Granger-causes trade openness and the causality is running back from trade openness to economic growth if  $b_{21i} \neq 0$  and significant for any  $i$  Shahbaz (2012). The tables (7), (8) and (9) report the results of VECM analysis: using exports, import and trade are as an indicator of trade openness respectively.

### **B. The Generalized Impulse Response Function (GIRF)**

The causality by the VECM Granger approach test cannot capture the relative strength of causal relation between the variables beyond the selected time period. This weakens the reliability of causality results. So, the strength of the causal relationships could be checked by analysis of forecast error variance decompositions (FEVD) and/or IRF Riezman et al. (1996). The generalized impulse response functions (GIRF) be used in this study to identify the structure of the VECM innovations. The study examines the impulse response function derived from VECM model in equation 13 above, to investigate the response of economic-growth to a one time positive shock in a trade variable. The GIRF approach is preferred since it is invariant to the alternative orderings of the variables in the VAR system. Koop et al. (1996) showed that GIRFs are unique and explicitly reflect the historical patterns of the observed correlation among the different shocks. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. Thus, GIRFs could provide more insight into how shocks to exports, imports or trade affect economic growth (or vice versa). We report impulse response estimates only for the variables that appear to significant, Granger causes economic growth (based on the causality tests).

## **3.3. Empirical Results and Discussions**

### **3.3.1. Data**

The data on the variables of this study has been collected from World Development Indicators (WDI)<sup>6</sup>. The data set consists of observations for real GDP growth, real capital stock proxies by gross fixed capital formation (% GDP) and skilled labor proxies by secondary

enrollment (%GDP) as applied by Shahbaz (2012). Additional variables are, three of the many trade openness measures that exist in the literature are used: real exports, real imports as used by Awokuse (2008) and Shahbaz (2011) and actual trade flows as the sum of exports and imports (% of GDP) as applied by (Harrison 1996 and Sakyi 2011) or the three measures as used by (Sarkar and Bhattacharyya 2005; Sarkar 2005 and Shahbaz 2012). Secondary enrollment (%GDP), which represents skilled labour as a measure of educational attainment is the most significantly correlated with growth Barro and Lee (1994). Since, some of the educational attainment data are missing from WDI; data are updated mainly from the Central Agency for Public Mobilisation and Statistics (CAPMS)<sup>7</sup>. The present study covers the period of 1970–2012 annual data. All the empirical results in section 3 are generated using Eviews software.

### **3.3.2. Unit Root Test Results**

As mentioned earlier in this chapter, before testing the co-integration and causality, the first step is to test the stationarity of the variables. The data series must be stationary to avoid instantaneous causation; two unit root tests are employed. The Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt and Shin ( KPSS) unit roots test for the six variables are included in the causality test, which are log of real GDP growth ( $\ln G_t$ ), log of exports ( $\ln E_t$ ), log of imports ( $\ln I_t$ ), log of trade ( $\ln TR_t$ ), capital ( $\ln K_t$ ) and log of skilled labour ( $\ln L_t$ ). The ADF and the KPSS tests are based on containment of intercept (constant) as well as linear time trend, given the dynamic nature of the variables of the study and the series doesn't evolve around zero (as displayed in figure 1). The lag lengths of the models are auto-selected by Schwartz Information Criterion (SIC); the maximum lag length is set to nine. Table 3 summarizes the unit-root tests results for the variables of the study in their levels as well as their first differences.

By applying these tests we investigate the time series properties of the data. We reach the decision by comparing the ADF and KPSS statistics to their critical values. We find that the ADF statistics are less than the critical values in their first levels, but greater than their first differences (in absolute values). Hence, the ADF test reveals that real GDP growth, exports, trade, imports, capital and skilled labour in logarithm forms are all non-stationary at their levels but stationary at their first differences in real terms. We reject the null hypothesis for ADF test for the existence of the unit root. Thus, the variables are said to be integrated of order one,  $I(1)$ , together with real GDP growth.

The KPSS statistics are less than the critical values in their first differences, but greater than their first levels for trade, capital and skilled labour in logarithm forms only (in absolute values). We can't reject the null hypothesis of stationary for KPSS. So, KPSS test shows that all the variables are stationary at their first difference. However, Real GDP growth, exports and imports in logarithm forms seem to be stationary in KPSS test at level but, this is not justified by ADF test.

**TABLE 3**  
**Tests of unit root**

VARIABLES:	ADF	KPSS
<u>Levels:</u>		
ln $G_t$	-3.6600	0.0665
ln $E_t$	-3.9259	0.0614
ln $I_t$	-2.8153	0.0952
ln $TR_t$	-2.4518	0.1804 <sup>**</sup>
ln $K_t$	-2.6848	0.1327 <sup>***</sup>
ln $L_t$	-1.1863	0.1659 <sup>**</sup>
<u>1st Difference</u>		
ln $G_t$	-7.3742 <sup>*</sup>	0.1537
ln $E_t$	-5.0824 <sup>*</sup>	0.0542
ln $I_t$	-6.4278 <sup>*</sup>	0.0872
ln $TR_t$	-5.9059 <sup>*</sup>	0.0698
ln $K_t$	5.3888 <sup>*</sup>	0.1406
ln $L_t$	6.7775 <sup>*</sup>	0.0699

Notes \* , \*\* and \*\*\* denote rejection of null hypothesis for ADF and KPSS unit root tests at 1%, 5% and 10% significance levels respectively. Critical values at the 1%, 5% and 10% levels of significance for the ADF (constant+ linear trend) are: -4.1985, -4.1923 and -4.2191, respectively and for KPSS (constant+ linear trend) are: 0.2160, 0.1460 and 0.1190, respectively. The lags auto-selected using SIC.

As a result, findings all of the variables under consideration are stationary at their first difference long-run equilibrium relationship will be now investigated by using Johansen Maximum Likelihood and ARDL bounds testing approaches for co-integration on the next subsection.

### 3.3.3. Co-integration Analysis

Co-integration analysis is to assess the long-run relationship between the trade openness and economic growth. The test includes the entire variables in the series, which are real GDP growth ( $G_t$ ), exports ( $E_t$ ), imports ( $I_t$ ), trade ( $TR_t$ ), capital ( $K_t$ ) and skilled labour ( $L_t$ ) all used in logarithm form. Testing the co-integration for the non-stationary variables represents the first

step; the second step is to test the causality. The co-integration techniques we apply in this study are the Johansen Maximum Likelihood and ARDL bounds testing approaches.

### **3.3.3.1. The Johansen Co-integration Test Results**

The Johansen-Juselius (1990) maximum likelihood approach is employed to test for the presence of co-integration. The optimum lag lengths of the models are auto-selected by SIC, the maximum lag length is set for the model to nine and each model is specified with a constant and a trend variable, given the dynamic nature of the variables of the study and the series doesn't evolve around zero, so the model is random walk (as displayed by figure 1). Since, co-integration tests require that the variables be of the same order of integration the order of integration of each variable was tested first using the unit roots test above.

The Johansen technique applies two tests statistics to assess the number of co-integrating vectors (the co-integrating rank  $r$ ). As stated earlier, the first test is a trace test, which tests the null hypothesis that there are at most  $r$  co-integrating vectors. The second test is the maximal eigenvalue test ( $\lambda$ -max). The null is that there are  $r$  co-integrating vectors, against the alternative hypothesis of  $r+1$  co-integrating vectors. Table 4 shows the results of the Johansen co-integration tests. The trace statistic reveals that the null hypothesis of absence of co-integrating relation at ( $r = 0$ ), ( $r \leq 1$ ) and ( $r \leq 2$ ) can be rejected at 5% level of significance. That is, trace testing shows three co-integrating equations. But the maximum eigenvalue test statistics indicate that a co-integration rank of one is present for Egypt. This implies that there is a long-term stationary relationship between all the variables.

We reach these results by comparing the computed values of the test statistic, for both trace and maximal eigenvalue, with the corresponding critical values to indicate the rejection of null hypothesis of no co-integration. Thus, we can conclude that real GDP growth, exports, imports, trade, capital and skilled labour are co-integrated. Specifically, there is a long-run relationship between all the series for Egypt. These results are consistent with Zang et al. (2012) for Mexico, Negem (2008) and Abou-Stait (2005) for Egypt, but inconsistent with Liu et al. (1997) for China, Sarkar (2008) for India, Deme (2002) for Nigeria. As a result, there is a stable relationship between economic growth and any of the trade openness variables. According to economic theory, trade induces economic growth by enhancing capital formation efficiency and by increasing the supply of scarce resources. For Egypt, the results in this study show these links.

**Table 4****Johansen Co-integration Test Results**

<u>Cointegrating rank (r)(H<sub>0</sub>)</u>	<u>Trace statistics</u>	<u>Critical Value (5%)</u>	<u>Cointegrating rank (r) (H<sub>0</sub>)</u>	<u><math>\lambda</math>-max statistics</u>	<u>Critical Value (5%)</u>
$r = 0$	131.591**	95.7537	$r = 0$	44.0116**	40.0776
$r \leq 1$	87.5789**	69.8189	$r \leq 1$	30.9047	33.8769
$r \leq 2$	56.6743**	47.8561	$r \leq 2$	28.2199**	27.5843
$r \leq 3$	28.4544	29.7971	$r \leq 3$	14.7656	21.1316
$r \leq 4$	13.6887	15.4947	$r \leq 4$	10.4887	14.2646

Notes: \*\* Denotes rejection of the null hypothesis of co-integration rank  $r$  at the 5% significance level.  $r$  denotes the number of co-integrating vectors for co-integration test with constant and trend. We stop at the first  $r$  where we fail to reject the null hypothesis. The critical values (5%) for the tests are taken from Osterwald-Lenum. The optimum lags length auto-selected using SIC.

As previously mentioned, the Johansen maximum likelihood, among others, rely on strictly I(1) stationary variables. The reason being that, if all the variables are I(1) stationary, then there are special cases where a linear combination result in an I(0) stationary variable and hence co-integration Asterius and Hall (2007). However, the requirement of I(1) variables often makes estimates of these co-integration test subject to bias. In order to overcome some of the demerits of the Johansen maximum likelihood we employ the Autoregressive Distributed Lag Model (ARDL) bounds testing next subsection. Also, Pesaran et al. (2001) argued the Johansen approach requires the pre-testing of the variables included in the model for unit root but, ARDL approach to co-integration does not, it required only avoiding I(2) variables.

**3.3.3.2. ARDL Bounds Testing Approach Results**

The second approach that is employed to test the co-integration between trade openness and growth in this study is ARDL bound testing. The first step in the ARDL procedure is to test for unit roots to eliminate the possibility of I(2) variables. Because, in the presence of I(2) variables the computed F-statistics provided by Pesaran et al. (2001) and Narayan (2005), are no more valid since they are based on the assumption that the variables are I(0) or I(1). Consequently, the implementation of unit root tests in the ARDL procedure is necessary to ensure that none of the variables are integrated of order 2 or beyond.

The computation of the ARDL bounds testing is sensitive with lag length selection (Shahbaz, 2011; 2012). Hence, in the second step, the orders of the lags in the ARDL model are selected on each first differenced variable using the SIC. For this reason, we follow Bahmani-Oskooee and Gelan (2006) and impose a maximum of two lags on each first differenced variable and the SIC criteria is used to select the optimum lags. Narayan (2005) suggested that the SIC is the best for lag selection for the ARDL model with small sample. Also, the lag selection procedure is used in the diagnostic test of all the equations.

In the third step, we estimate four dynamic unrestricted error correction model (UECM<sub>s</sub>) taking each of the variables in turn as a dependent variable (equations 8, 9, 10 and 11 in section 2.2 above). That is, dependent variables are log of real GDP growth ( $\ln G_t$ ), log of trade openness indicator ( $\ln TR_t$ ), log of capital ( $\ln K_t$ ) or log of skilled labour ( $\ln L_t$ ). In this study we apply three indicators of trade openness to UECM<sub>s</sub> of Eq.4 (equations 8, 9, 10 and 11). So, we have three models which are exports, imports and trade models. As a result, we estimate 12 equations four for each of exports, imports and trade (imports +exports) models. Any of the 12 equations of the three models are selected and estimated by the ordinary least squares technique using constant and time trend, given the dynamic nature of our variables and the series doesn't evolve around zero (figure 1). The results of each equation are displayed in tables 5 and 6.

The transformations and the variables of each model are as follows: First, The transformations for the exports model are four equations as follows:  $FG[G](E, K, L)$ ,  $FE[E](G, K, L)$ ,  $FK[K](G, E, L)$  and  $FL[L](G, E, K)$  where, in square brackets log of real GDP growth ( $\ln G_t$ ), log of exports  $\ln E_t$ ), log of capital ( $\ln K_t$ ) or log of labour ( $\ln L_t$ ) are used as dependent variables for each of the equations in logarithm form respectively. Next, the transformations for the imports model are:  $FG[G](I, K, L)$ ,  $FI[I](G, K, L)$ ,  $FK[K](G, I, L)$  and  $FL[L](G, I, K)$  where, in square brackets log of real GDP growth ( $\ln G_t$ ), log of imports ( $\ln I_t$ ), log of capital ( $\ln K_t$ ) or log of labour ( $\ln L_t$ ) are dependent variables for each of the equations respectively. Then, the transformations for the trade model are:  $FG[G/TR](K, L)$ ,  $FTR[TR](G, K, L)$ ,  $FK[K](G, TR, L)$  and  $FL[L](G, TR, K)$  where, in square brackets log of real GDP growth ( $\ln G_t$ ), log of trade ( $\ln TR_t$ ), log of capital  $\ln K_t$ ) or log of labour ( $\ln L_t$ ) are used as dependent variables respectively. All the variables in parentheses are independent variables for all the equations in a logarithm form.

The fourth step is to verify whether the coefficients of first lag of independent variables of interest in the selected equation together are significant from zero. That is, we compute the F-statistic using WALD test. We perform the F-test at optimum lags selected above. F-test is computed to examine the existence of a long run relationship between the variables of interest following the null hypothesis i.e.  $H_0: \alpha_G = \alpha_{TR} = \alpha_K = \alpha_L = 0$  against alternate hypothesis of co-integration Pesaran et al. (2001) for UECM of Eq. (4). The variables of interest depend on the specific model, i.e. whether exports, imports or trade models.

We reach our decision regarding the presence of the long run relationship between the variables of the specific model with a simple comparison. i.e. the bounds approach compares the calculated F-statistics against the critical values generated by Lower critical Bound (LCB) and Upper Critical Bound (UCB) developed by Narayan (2005), which was found appropriate for a small sample than the original LCB and UCB table, which developed by Pesaran et al. (2001). As stated before, there is co-integration if the computed F-statistic is more than Upper Critical Bound (UCB) and no co-integration if the value of the F-statistic below the Lower critical Bound (LCB). However, if the sample test statistic falls between these two bounds, the result is inconclusive. The results of the bounds testing to co-integration are displayed in tables (5).

The results of the bounds testing to co-integration is reported in Table 5, show that the calculated F-statistic for FG[G](E, K, L), FK[K](G, E, L), FG[G](I, K, L), FG[G](TR, K, L) and FK[K](G, TR, L) are higher than the upper bound critical value of 6.200 at the 1% level (critical values are reported at the bottom of Table 5), but FK[K](G, I, L) at the 5% level. Thus, the null hypothesis of no co-integration cannot be accepted for the exports, imports and trade models when real GDP growth and capital are the dependent variables. As observed, that when the other variables [Exports, Imports, Trade and skilled Labour] are taken as dependent variables the calculated F-statistics are less than the lower bound critical value at the 10% level. This result indicates that there is an exceptional co-integration relationship among the variables. These findings are consistent with Narayan's (2005) findings. This leads us to conclude that the presence of co-integration validates the existence of long run relationship between economic growth, trade openness, labor and capital in the case of Egypt over the study period 1970–2012.

**Table 5****The ARDL bounds testing co-integration approach analysis.**

Bounds testing to co-integration		Diagnostic tests		
Estimated models	F-statistics	$\chi^2$ NORMAL	$\chi^2$ RESET	$\chi^2$ SERIAL
FG[G](E, K, L)	7.4574*	0.6848	[1]: 0.2893 [2]: 0.5152	[2]:3.7778 [1]:3.5878
FE[E](G, K, L)	2.6710	0.0210	[1]: 2.4100 [2]: 1.2570	[5]: 9.5416 [6]: 9.5712
FK[K](G, E, L)	9.1529*	3.6064	[1]: 0.6204 [2]: 0.3334	[3]: 6.730 [4]: 6.7679
FL[L](G, E, K)	2.0242	0.5530	[1]: 2.6624 [2]: 2.5324	[2]: 4.8975 [3]: 6.5094
FG[G](I, K, L)	6.6576*	0.6157	[1]: 0.9783 [2]: 1.3736	[2]: 1.5865 [1]: 1.0446
FI[I](G, K, L)	1.9924	0.2061	[4]: 2.8618 [5]: 2.7011	[2]:5.7689 [3]: 6.9030
FK[K](G, I, L)	5.8066**	2.9074	[1]: 0.2443 [2]: 0.1418	[2]:1.8439 [1]: 1.8413
FL[L](G, I, K)	0.8349	1.1473	[1]: 3.4660 [2]: 2.0149	[2]:1.0331 [1]: 0.9272
FG[G](TR,K,L)	7.0197*	0.7690	[1]: 0.7172 [2]: 0.3955	[2]:2.27189 [1]: 0.2036
FTR[TR](G,KL)	2.0692	0.0858	[4]: 2.5451 [6]: 2.6278	[2]: 5.5400 [1]: 3.5300
FK[K](G, TR,L)	7.2018*	4.3880	[1]: 0.0059 [2]: 0.0708	[2]: 3.6544 [1]: 3.5334
FL[L](G,TR, K)	2.6984	0.8714	[1]: 3.4054 [2]: 2.2391	[2]: 2.5095 [1]: 2.4670
Significant level	Critical values (T=43)			
	Lower bounds I(0)	Upper bounds I(1)		
1% level	4.763	6.200		
5% level	3.578	4.668		
10% level	2.985	3.918		

Note: \*, \*\*, \*\*\* represent significance at 1%, 5% and 10% levels respectively. Between the square brackets the optimal lags length is selected for each of the autocorrelation and RESET diagnostic tests. The appropriate lag is selected using SIC.

The next task in ARDL bound testing procedure is to investigate the extent (or the amount) of the long run effects of trade openness, capital and labor on economic growth in the case of Egypt. The results the extent of the long run effects of trade openness are displayed in Table 6. Firstly, the results show that exports, imports and trade are positively linked to economic growth and they are statistically significant at 1% level. The tests reject the null hypothesis of no co-integration on each of the models examined suggesting a long-run relationship between economic growth and the various measures of trade openness. Secondly, using the values of the coefficients of the exports, imports and trade models, we can calculate the extent of the long run effects (in percentage) for any of trade openness indicators on the country economic growth. The results demonstrate that keeping other things constant, a 0.0680% economic growth is induced by a 1% growth in exports in Egypt, a 0.0696% economic growth is stimulated by a 1% growth in Egypt's imports and a 0.0351% economic growth is made by a 1% growth in the country trade (imports +exports).

These results of the long-run relationship between economic growth and the various measures of trade openness are consistent with Hye (2011) for Pakistan and Biswal and Dhawan (1998) for Taiwan, but inconsistent with Sarkar et al. (2005) for India, Deme (2002) for Nigeria and Sarkar (2005) for India and Korea. However, for (Shahbaz, 2011; 2012) in the case of Pakistan their findings on the above issues are mixed, whereas exports and trade are positively linked to economic growth, imports negatively are tied to it.

Also, the present study applies trade openness to our models as endogenous variables into the Cobb–Douglas production function with capital and skilled labour. This specification of the production helps in picturing a conclusion on capital and skilled labour. So, 1% growth in skilled labour in Egypt is positively enhances the economic growth in the three models by a 0.0419%, 0.0429% and 0.0430% at 1% levels of significance respectively. The finding implies that skilled labor utilizes the technology to enhance domestic production and hence economic growth (Shahbaz, 2011; 2012) and Chuang (2000) for Taiwan.

**Table 6**

**The extent of Long run effect of trade openness on economic growth**

Dependent variable= $\ln G_t$						
Variables	<u>Exports Model</u>		<u>Imports Model</u>		<u>Trade openness Model</u>	
	Coefficients	t-stat.	coefficients	t-stat.	Coefficients	t-stat.
Constant	-3.0400*	-3.7218	-2.7773*	-3.4298	-2.9664*	-3.6553
@trend	-0.0472*	-2.9308	-0.0449*	-2.8013	-0.0467*	-2.9004
$\ln E_t$	0.0680*	3.2490	-	-	-	-
$\ln I_t$	-	-	0.0696*	3.2335	-	-
$\ln TR_t$	-	-	-	-	0.0351*	3.3017
$\ln K_t$	0.0232	1.2129	-0.0200	-0.7445	0.0011	0.0515
$\ln L_t$	0.0419*	3.6724	0.0429*	3.6084	0.0430*	3.6913
R <sup>2</sup>	0.8058		0.7905		0.7993	
Adjusted R <sup>2</sup>	0.6708		0.6448		0.6596	
F-statistic	5.9652*		5.4240*		5.7235*	
Durbin Watson	2.4093		2.1791		2.2992	
CUSUM	stable		stable		stable	
CUSUMQ	stable		stable		stable	

Note: The 1%, 5% and 10% levels of significance are indicated by \*, \*\* and \*\*\* respectively.

In order to test the reliability of the dynamic unrestricted error correction models (UECM<sub>s</sub>), a number of diagnostic tests, including tests of autocorrelation, normality, stability and heteroscedasticity in the error term, stability and accuracy of the model, were applied. As stated

above, the lag selection is used in the autocorrelation and RESET diagnostic tests of the equations of the model (see table 5), because the computation of the ARDL bounds testing is sensitive with lag length selection Shahbaz (2012). The optimal lags values, in square brackets, are selected for each of the tests (see tables 5 and 6).

We found no evidence of autocorrelation in the disturbance of the error term. The model passes the Jarque-Bera normality test suggesting that the errors are normally distributed. The RESET test indicates that the model is correctly specified. Adjusted  $R^2$  of exports, imports and trade models, are 67.08%, 64.48% and 65.96% respectively, when GDP growth is a dependent variable. Adjusted  $R^2$  are greater than Durbin Watson statistics (see table 6), which means that the models are no spurious. Finally, F-statistics for the three models are significant at 1% level which indicates that the models explain all the variables very well. The estimated equations remain stable over the period of study as indicated by CUSUM and CUSUMQ stability tests (generated in graphical formats), which are both used for more robust results. Hence, it is reasonable to say that the models are well behaved.

As assured earlier, once Johansen's Methodology and the ARDL bounds testing approaches have confirmed the presence of co-integration between economic growth, trade openness, capital and labor, then Granger Causality approaches is applied to test the direction of casual relation between the series.

### **3.3.4. Granger's Causality Results**

The concept of Granger's Causality (1969) will be employed to examine the relationship between trade openness and economic growth. Our questions are, does trade openness (proxied by exports, imports or trade) Granger cause GDP growth or is the inverse true and is there a bidirectional relationship. Two frameworks are applied to answer those questions VECM and GIRF.

#### **3.3.4.1. Granger Causality Results under VECM Approach**

The vector Error Correction Model (VECM) will be employed to investigate the direction of the causality between the variables, as soon as the co-integration of the series is confirmed. Tables 7, 8 and 9 report the results of Granger causality tests based on the VECM Granger causality approach. The tables represent exports, imports and trade as indicators of trade openness respectively. In this study we apply three indicators of trade openness exports, imports

and trade so, we have three models. As a result, we estimate 12 equations, four for each of exports, imports and trade (imports +exports) models. The VECMs are estimated using symmetric lag of two, given the small sample size of our study. Then, each ECM will be estimated using the ordinary least squares (OLS) technique including constant and time trend, given the dynamic nature of our variables (as displayed in figure 1). The general theme of the equations of the ECM is provided above (equation 13 see section 2.2.). Using Eviews software the constant or linear trend term should not be included in the Exogenous Series edit box. The constant and trend specification for VECs should be specified in the Co-integration tab. We must choose from one of the five trend specifications in that tab. There is a linear trend in our data (see figure 1), so we choose intercept no trend in VAR. By default, EViews will compute the critical values for the test using the computer programme associated with MacKinnon, Haug and Michelis (1999) (MHM) and is appropriate for case 1 of Osterwald-Lenum (1992), which allow an intercept no trend in the VCEM which is capable of generating a trend regardless (Turner 2007). Also, we must specify the number of co-integrating relations in the appropriate edit field.

Each row of Tables 7, 8 and 9 represents ECM equations for each of the four variables in each the models. The variables in the exports model are: real GDP growth ( $G_t$ ), exports ( $I_t$ ), capital ( $K_t$ ) and skilled labour ( $L_t$ ). Then, the variables in imports model are: real GDP growth ( $G_t$ ), imports ( $I_t$ ), capital ( $K_t$ ) and skilled labour ( $L_t$ ). The variables in trade model are: real GDP growth ( $G_t$ ), trade ( $TR_t$ ), capital ( $K_t$ ) and skilled labour ( $L_t$ ). The first column in each table is the dependent variables for ECM equations, the rest of the columns are the independent ones. All the variables are used in a logarithm form.

The column in the middle of each table 7, 8 and 9 (labelled long run) contains the coefficients, t-statistics and probability in parentheses, for the lagged error-correction terms ( $ECT_{t-1}$ ). A significant lagged error correction term coefficient represents the speed of adjustment towards a long-run equilibrium, which implies that past equilibrium errors plays a role in determining current outcomes. So, the causality between the variables in the long run is estimated by the significance of t- statistic connecting the coefficients of lagged error-correction terms ( $ECT_{t-1}$ ).

As stated before, the short run causality are indicated by the significance of the chi-square in the first differences of the variables in equation 13. Chi-square is calculated using WARD-test to test the null hypothesis of whether the coefficients of lagged independent variables together

equal zero, for any of the 12 equations in the system. In addition, the joint significance of both long and short run causality are indicated by the joint significance of both  $ECT_{t-1}$  and the estimate of lagged independent variables. In other words, the Granger causality results are given as in each table 7, 8 or 9 as the chi-square (probability in parentheses) for the joint significance of the lagged independent variables in the ECM equations. Chi-square for the individual coefficients of the different terms capture the short-run dynamics along with lagged errors correction term for the joint short and long run causality.

The results of exports model are explained in Table 7. The long run causality evidence depends on the statistical significance of the coefficients of lagged error-correction terms ( $ECT_{t-1}$ ) using t- statistic. In table 7 the t- statistic of  $ECT_{t-1}$  is significantly negative at 5% level from all independent variables to GDP growth. Hence, table 7 suggests that the causality is running from all the independent variables in the model to GDP growth. As a result, the findings imply that the causality which runs from exports to GDP growth (economic growth) is significant so, export- led growth (ELG) hypothesis is supported by the data in long run. However, there is no reverse causality, the t- statistic of  $ECT_{t-1}$  from GDP growth as independent to the dependent variable exports is not significant, and so GLE hypothesis is not validated. The findings indicate there is unidirectional causality running from exports to the GDP growth, but neither short-run nor long-run causation from GDP growth to exports are established. The joint long-and-short run causality results verify the long run and short run causal analysis.

Our results are consistent with Abou-Stait (2005) for Egypt but, Negem (2008) for Egypt found a bidirectional causal relationship between GDP and exports. In economic literature, Balassa (1978), Tyler (1981), Esfahani (1991) and Deme (2002) for Nigeria agree with our findings. There are many possibilities for exports to promote GDP growth in Egypt as in 1970-2012 which witnessed a strong shift in economic policy towards a more export growth oriented stance. It covered the reforms of 1974 and 1991 as well as the establishment of the WTO in 1995 and Egypt's accession to it. The causality is not running back from GDP growth to export since, there are several difficulties facing the exports sector in Egypt. For example, non-tariff export barriers include banning more than 20 commodities from exporting; multiple exchange rates, poor infrastructures and an overvalued currency were additional problems facing Egyptian exports<sup>8</sup>.

Also, the present study applies free trade to our models as endogenous variables into the Cobb–Douglas production function with capital and skilled labour. The results suggest a bidirectional causal relationship between GDP growth, skilled labour and capital. The capital enhances growth therefore bidirectional causality in both long, short run and the joint short and long run causality are validated. The skilled labour (human capital) promotes growth in long run only. The results are consistent with Dutta and Ahmed (2004) for Pakistan and Chuang (2000) for Taiwan.

**Table.7**

**The VECM Granger causality analysis: exports as an indicator of trade openness**

Direction of Causality:									
	Short run: chi-square-stat (prob)				Long run: coeff., (t-stat)(prob)	Joint long-and-short run causality chi-square-stat(prob)			
<u>Dependant variables</u>	$\Delta \ln Gt-1$	$\Delta \ln Et-1$	$\Delta \ln Kt-1$	$\Delta \ln Lt-1$	$ECT_{t-1}$	$\Delta \ln Gt-1, CT_{t-1}$	$\Delta \ln Et-1, ECT_{t-1}$	$\Delta \ln Kt-1, ECT_{t-1}$	$\Delta \ln Lt-1, ECT_{t-1}$
$\Delta \ln Gt$		1.9377 (0.3795)	18.4407* (0.0001)	0.1484 (0.9285)	-0.2370 (- 0.9690*) (0.0582)		7.2161*** (0.0653)	19.5401* (0.0002)	4.83578 (0.1850)
$\Delta \ln Et$	2.9425 (0.2296)		0.7729 (0.6795)	2.8365 (0.2421)	-0.0407(-0.6033) (0.5508)	3.3786 (0.3369)		1.4959 (0.6832)	4.0529 (0.2558)
$\Delta \ln Kt$	3.8836 (0.1434)	0.3323 (0.8469)		1.5934 (0.4508)	-0.1648 (- 3.0508*) (0.0047)	11.7169* (0.0084)	9.8616*** (0.0198)		9.6055** (0.0222)
$\Delta \ln Lt$	0.4725 (0.7896)	0.4995 (0.7790)	1.6634 (0.4353)		-0.0617(-.9182***) (0.0647)	3.8477 (0.2784)	5.1364 (0.1621)	7.0216*** (0.0712)	

Note: \*, \*\* and \*\*\* show significance at 1%, 5% and 10% levels respectively.

According to the results of the imports model which are reported in Table 8, the t- statistic of  $ECT_{t-1}$  is significantly negative at 10% level from all independent variables to GDP growth and at 5% from GDP growth to imports. Hence, table 8 shows that long-run causality is found to run from imports to GDP growth and the reverse causality exists. The causality runs from economic growth to imports validating Growth-Led Import hypothesis and the causality runs back from imports to economic growth supporting Import-Led Growth hypothesis. The findings suggest the bidirectional causality between GDP growth, imports in long run and in the joint short and long run, but there is no causality between imports and economic growth in short run. The joint long-and-short run causality results confirm the long run and short run causal analysis.

In economic literature, our results are consistent with Awokuse (2008), and Liu et al. (1997) that support the Import-Led Growth hypothesis, but the empirical results obtained by Afxentiou et al. (2000) and Deme (2002) for Nigeria do not support it. The results for Egypt also suggest that GDP growth is relatively more important to imports than to exports. During parts of the eighties and seventies, Egyptian economy showed a rapid growth of GDP averaging 9% per year. The sectoral breakdown of growth has confirmed that the fast increase in the flow of external resources to a certain extent is linked to mega-projects, industrial and the petroleum sectors, the key elements to growth (see section 3.1).

As mentioned before, this study applies trade openness to our models as endogenous variables into the production function specification with capital and skilled labour. Interestingly, there is evidence supporting both bidirectional long and short-run Granger causality from capital to GDP growth but, only long run bidirectional causality in skilled labour. The results are consistent with Dutta and Ahmed (2004).

**Table.8**

**The VECM Granger causality analysis: imports as an indicator of trade openness**

Direction of Causality:									
	<u>Short run: chi-square-stat (prob)</u>				<u>Long run:</u> coeff., (t-stat)(prob)	<u>Joint long-and-short run causality</u> chi-square-stat(prob)			
<u>Dependan</u> <u>variables</u>	$\Delta \ln Gt-1$	$\Delta \ln It-1$	$\Delta \ln Kt-1$	$\Delta \ln Lt-1$	ECTt-1	$\Delta \ln Gt-1,$ CTt-1	$\Delta \ln It-1,$ ECTt-1	$\Delta \ln Kt-1,$ ECTt-1	$\Delta \ln Lt-1,$ ECTt-1
$\Delta \ln Gt$		0.8777 (0.6448)	6.2280*** (0.0444)	0.3832 (0.8256)	-0.1779(-0.16993***) (0.0996)		7.2161*** (0.0653)	19.5402* (0.0002)	4.8258 (0.1850)
$\Delta \ln It$	1.4247 (0.4905)		1.0766 (0.5837)	0.0434 (0.9786)	-0.2621 (- 2.3712**) (0.0243)	7.1915*** (0.0660)		7.0506*** (0.0703)	5.9433 (0.1144)
$\Delta \ln Kt$	3.7063 (0.1567)	0.1348 (0.9348)		1.6251 (0.4437)	-0.0381 (- 3.1601*) (0.0036)	13.1437* (0.0043)	11.6711* (0.0086)		10.5976** (0.0141)
$\Delta \ln Lt$	0.4267 (0.8079)	0.2605 (0.8779)	1.3955 (0.4977)		-0.0645 (- 1.6940***) (0.10006)	3.2170 (0.3594)	4.2540 (0.2354)	5.8461 (0.1193)	

Note: \*, \*\* and \*\*\* show significance at 1%, 5% and 10% levels respectively.

The results of trade (exports +imports) model are displayed in Table 9. The t- statistic of  $ECT_{t-1}$  is significantly negative at 10% level from all the independent variables to GDP growth and also, from GDP growth to trade (exports +imports). The Granger causality between trade

and economic growth suggests the presence of Growth-Led Trade and Trade- Led Growth hypotheses in the case of Egypt. These findings indicate bidirectional causality between GDP growth and trade. However, in the short-run, there is no Granger causality from trade to GDP growth or vice versa. The joint long-and-short run causality results don't confirm the long run and short run causal analysis for the trade model. These findings demonstrate bidirectional causality between GDP growth, capital and skilled labour. In the literature, our results agree with (Bodman 1996; Thornton 1996; Yanikkaya 2003 and Deme 2002) who confirm the Trade-Led Growth hypothesis for some countries; on the contrary, Boltho (1996) and some others reject it.

**Table.9**

**The VECM Granger causality analysis: Trade as an indicator of trade openness**

	Direction of Causality:								
	<u>Short run: chi-square-stat(prob)</u>				<u>Long run:</u> <u>coeff., (t-stat)(prob)</u>	<u>Joint long-and-short run causality</u> <u>chi-square-stat(prob)</u>			
<u>Dependant variables</u>	$\Delta \ln Gt-1$	$\Delta \ln Trt-1$	$\Delta \ln Kt-1$	$\Delta \ln Lt-1$	ECTt-1	$\Delta \ln Gt-1,$ CTt-1	$\Delta \ln Trt-1,$ ECTt-1	$\Delta \ln Kt-1,$ ECTt-1	$\Delta \ln Lt-1,$ ECTt-1
$\Delta \ln Gt$		1.5760 (0.4547)	10.6386* (0.0049)	0.2189 (0.8963)	-0.1905(-1.7730***) (0.0864)		6.0115 (0.1099)	11.4233* (0.0096)	3.9891 (0.2626)
$\Delta \ln Trt$	1.7605 (0.4147)		0.2407 (0.8866)	0.5434 (0.7621)	-0.1499 (- 1.7138***) (0.0969)	4.8844 (0.1805)		3.1449 (0.3698)	4.3292 (0.2280)
$\Delta \ln Kt$	3.6000 (0.1653)	0.2451 (0.8847)		1.6480 (0.4387)	-0.1007(-3.1526*) (0.0037)	3.9056** (0.0182)	11.0961** (0.0112)		10.3219** (0.0160)
$\Delta \ln Lt$	0.4036 (0.8173)	0.3679 (0.8320)	1.4863 (0.4756)		-0.0648 (1.8460***) (0.0748)	3.6622 (0.3003)	4.8836 (0.1805)	6.6288*** (0.10847)	

Note: \*, \*\* and \*\*\* show significance at 1%, 5% and 10% levels respectively.

A number of diagnostic tests for the ECM equations including tests of autocorrelation, stability, normality and heteroscedasticity in the error term, stability and accuracy of the model were applied. We found no evidence of autocorrelation in the disturbance of the error term. The model passes the Jarque-Bera normality test suggesting that the errors are normally distributed.

As stated before, the causality by the VECM Granger approach test cannot capture the relative strength of the causal relation between the variables beyond the selected time period. This weakens the reliability of causality results. So, the strength of the causal relationships could be checked by analysis of the Generalized Impulse Responses Function (GIRF).

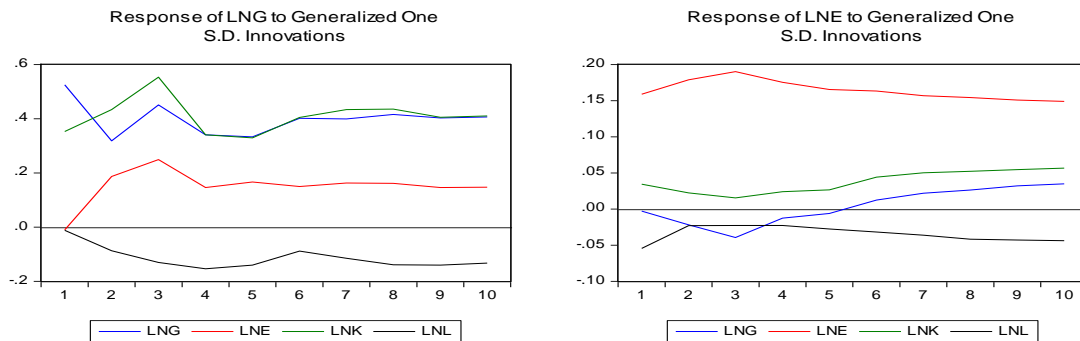
### 3.3.4.2. Granger Causality Results under Generalized Impulse Responses Function (GIRF)

Applying the estimated VECM system (see equation 13 section 2.2), the Generalized Impulse Responses Function (GIRFs) are provided for each of the variables in the system, but focusing on the trade openness (exports, imports or trade) and GDP growth. The results of the GIRF are displayed in Figures 2, 3 and 4 which are exports, imports and trade models respectively. The GIRFs maps out how a one-time shock to exports, imports or trade affects economic growth (or vice versa). The GIRF covers 10 periods in order to guarantee sufficient time for tracing the effect of the shocks to variables in the system.

First, the results of the exports model are displayed in figure 2, which include two panels. The variables in the exports model are: log of real GDP growth ( $\ln G_t$ ), log of exports ( $\ln E_t$ ), log of capital ( $\ln K_t$ ) or log of labour ( $\ln L_t$ ). The first panel of figure 2 contains the response of GDP growth to a positive one-time shock to exports. We find that GDP growth experiences a huge positive response up to the third period, then a small slow down to the fourth period. Then, the positive response from the GDP growth is continuously positive after four periods. The relatively larger and positive response of the GDP growth validates the Export-Led Growth hypothesis. However in the second panel of figure 2, the response of exports to Generalized One SD Innovations indicate no causality running back from GDP growth to exports; after the fifth period they approach a constant positive value. These findings support the unidirectional relationship between exports and GDP growth. These results are consistent with the findings from VECM Granger causality test above.

Figure 2

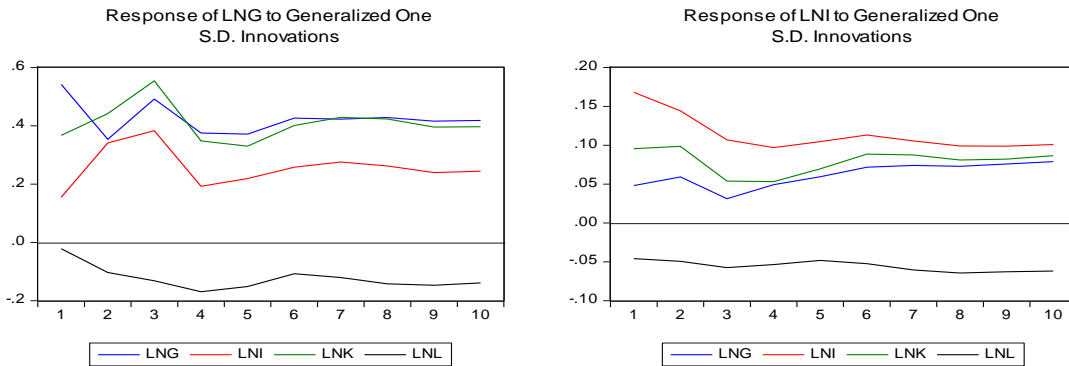
The General Impulse Response of One Time Shock to Exports:



Next, the results of the imports model in figure 3, which includes two panels. The variables of the imports model are: real GDP growth ( $G_t$ ), imports ( $I_t$ ), capital ( $K_t$ ) or skilled labour ( $L_t$ ) in a logarithm form. The first panel of figure 3 encompasses the response of the GDP growth to a positive one-time shock to imports. We find that the GDP growth experiences a massive positive response up to the third period, then a small slow down until the fourth period. Then, the positive response from the GDP growth is a persistent strong positive after four periods. So, the Import-Led Growth proposition is supported. Also, the second panel of figure 3 shows a positive movement of imports in Egypt to the same direction of GDP growth. The results signify a feedback causal effect from GDP growth to imports.

Figure 3:

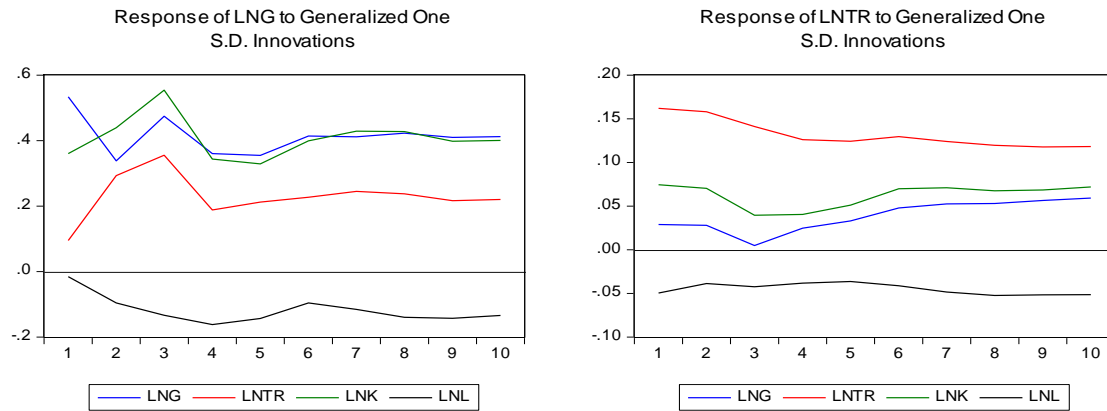
The General Impulse Response of One Time Shock to Imports:



The last figure 4 shows two panels to display the Granger causality between trade and GDP growth. Similar to the exports and imports model, the trade model has the following variables: log of real GDP growth ( $\ln G_t$ ), log of trade ( $\ln TR_t$ ), log of capital ( $\ln K_t$ ) or log of skilled labour ( $\ln L_t$ ). The first panel of figure 4 displays the response of GDP growth to a positive one-time shock to trade (exports + imports). We find that GDP growth experiences a very big positive response up to the third period, then a small slow down to the fourth period. Then, the positive response from GDP growth to trade follows a continuous movement after the fourth period. As a result, the Trade-Led Growth proposition is supported. Also, in the second panel of figure 4, the trade mirrors GDP growth. These results imply the reverse causality is running back from GDP growth to trade, which further validates the Growth-led Trade hypothesis. The findings ensure the bidirectional relationship connecting trade to economic growth.

Figure 4

The General Impulse Response of One Time Shock to Trade:



The results from GIRF analysis signify that there are bidirectional causal effects from imports or trade to GDP growth, but a unidirectional causality between exports and growth. Despite the Export-Led Growth hypothesis is authenticated in the long run, the effect of growth on both imports and trade appears to be much stronger than on exports. These results are consistent with the above findings from VECM Granger causality tests. In the literature, the findings are consistent with Awokuse (2008).

## Chapter 4

### Conclusions and Policy Implications

The present study examined whether trade openness promotes economic growth in the long run in the case of Egypt from 1970-2012. The current study consists of four chapters including this chapter. Each of the three chapters will be summarized and concluded separately to make it easy to discuss the policy implications and recommendations of this study.

#### 4.1. Summary and Key Findings

Chapter 1 presented an introduction to the entire research. It indicated the research objectives, showed what sort of questions the study asked and highlighted the importance as well as the contributions of the current study. At the end, chapter 1 outlined the structure of the entire study. The evidence provided in chapter 1 indicates the importance of the Egyptian economy, its

value as an object of study regarding the issue of trade openness and its impact on Egypt's economic growth.

Chapter 2 surveyed the theoretical and the empirical literature regarding the relationship between free trade and economic growth. At the beginning, the chapter provided a theoretical discussion of the theory and the importance of trade openness. Then, we tried to address some of the basic challenges facing the researcher when analysing the theoretical and the empirical literature in the field of trade openness. The first challenge is to find a clear definition of "trade openness". Throughout time, the definition of openness has evolved considerably from one extreme to another. The second challenge is the trade openness measures problem. This study reviewed the evolution of trade openness measures overtime. The third challenge is the issue that is debated a lot in the literature, the causality between trade liberalization and economic growth. There are five possible thoughts regarding the relationship between exports and economic growth which can be categorized as follows: Export-Led Growth, growth-led exports, the bidirectional causal relationship, negative correlation and no causality (feedback) between the two variables. Liu et al. (1997) argued that there could be a bi-directional causality between imports and economic growth. Soon, the research produced two hypotheses to better understand the bi-directional relationship between trade openness and growth: Trade (exports+ imports)-Led Growth or Growth-Led Trade hypotheses.

On the empirical evidence section, the literature review concentrated on two issues: the evolution of trade openness measures overtime and trade openness and growth on the country-specific studies. We discussed some of the researchers' contributions and criticisms to the various trade openness measures. Then we reviewed the inconsistencies in findings due to different measures of trade openness used on country-specific case studies. It was noted that most of the literature found a positive connection between trade liberalization and growth despite of differences in methodologies, measures of openness and sample size. However, some researchers concluded a negative effect of trade openness on growth even using the same methodology.

Several conclusions were made from the analysis of the theoretical and the empirical literature: first, we recognised these estimation problems and agree with earlier researchers that openness measures are not free from methodological problems. Second, we admitted that

controversy remains as to the nature of trade openness and growth. The uncertainty has been shown in numerous studies. In order to generate robust findings that help to resolve this controversy and ensure there is a relationship between trade liberalization and growth, our study applied various methodologies and trade openness measures to provide empirical evidence in the case of Egypt in attempt to support any of the views mentioned above.

Chapter 3 was an empirical analysis of the relationship between free trade and growth in Egypt for the period of 1970-2012. The first section showed an overview of the economy and Egypt's trade policy. On the second section we specified the theoretical framework and methodology to perform the empirical analysis. The last section was empirical results and discussions.

At the beginning, the time series data was used for Egypt. So, the time series properties of the data was verified using Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit roots tests for the six variables included in the causality test. The results indicated that using the ADF and the KPSS tests all of the variables under consideration are stationary at their first difference, therefore the co-integration of the variables and the long-run equilibrium relationship were investigated.

Then, two approaches were applied for co-integration Johansen Maximum Likelihood and ARDL bounds testing. The paper included three indicators of trade openness [exports, imports and trade] as endogenous variables in our model, which result in three different specifications. We found the long run relationship between trade openness, capital, labor and economic growth using the three specifications.

In addition, once Johansen's Methodology and ARDL bounds testing approaches confirmed the presence of co-integration between economic growth, trade openness, capital and labor, the Granger causality approaches was applied to test the direction of casual relation between the series. We used two frameworks to test the direction of the causality between trade openness and economic growth, Vector Error Correction Model (VECM) Granger Causality and Generalized Impulse Responses Function (GIRF). The study found empirical evidence in support of a bi-directional causal relationship between imports as well as trade and GDP growth for Egypt, but a unidirectional causal relationship between exports and GDP growth. However, GIRF showed that the strength of the effect of growth on imports and trade is relatively stronger than the effect

on exports. Our results show that the effects of trade openness on growth tend to be over the long-run with little evidence of a short-run relationship. However, the joint short and long runs connection confirmed the long run and short run findings except when trade was used as indicator of openness. The results suggest that exports, imports and trade have a positive impact on economic growth. These findings are consistent with Khan (2003) and Monojitet et al. (2013) for India, Hye (2011), but inconsistent with Sarkar et al. (2005) for India and Sarkar (2005) for India and Korea.

Also, the present study applied trade openness to our models as endogenous variables into the Cobb–Douglas production function with capital and labour. The results pointed out a bidirectional causal relationship between GDP growth, skilled labour and capital. The capital enhanced growth bidirectional causality in the long run, short run and joint short and long causality. The skilled labour (human capital) promotes growth in the long run only.

In conclusion, for chapter 3 there is a positive relationship between trade openness and economic growth for Egypt from 1970-2012. The study found empirical evidence in support of a bi-directional causal relationship between imports as well as trade and GDP growth for Egypt, but unidirectional causal relationship between exports and GDP growth. Furthermore, all methodological approaches applied in this study yielded equivalent results in testing the co-integration as well as the causality.

## **4.2. Policy Implications**

Exports, imports, trade, skilled labour and capital formation are very important sources of economic growth for the Egyptian economy. The various economic reforms policies and the shift towards a free market will help the economy to reallocate its resources to more productive uses.

Policy makers in Egypt have to reduce the imports tariff to liberate the trade even more, especially for imported inputs Egyptian domestic industrial production is highly dependent on. This study vindicates the imports led growth hypothesis in Egypt and the reverse, which implies that increasing imports does not have a negative impact on the economy. Developing economies with limited technological endowment could benefit from access to foreign technology and knowledge from developed countries via imports Grossman and Helpman (1991). As evident from the experiences of large developing countries that adopted the import substitution growth strategy, large scale import restrictions can be a constraint to growth Awokuse (2008).

For trade openness to have a meaningful effect on economic growth, Egypt should focus more on the exports. Egyptian economy needs better policies towards the promotion of export of non-traditional goods are important to stimulate exports, and it is equally important to ensure that the produced goods are able to compete internationally. Then, better trade policy reform to eliminate many restrictions the exporters face, lower tariff and moving towards more liberalization. Also, many facilities are needed to support exports by improving and updating the infrastructure and transportation system. In addition, Egyptians need to improve their institutions, marketing system with pricing free based on the world market, stable currency and one exchange rate. Furthermore, Egyptians should considerably revise their bilateral and regional trade agreement to benefit from them the most.

### **4.3. Proposed Direction for Future Research**

Based on this study's results, it is recommended that future empirical research focuses more on the following:

- 1) The impact of trade liberalization should explicitly account for the role of imports in stimulating economic growth. It may be useful to extend the analytical framework used in this study to other developing countries.
- 2) Future research can examine financial developments or foreign direct investment as endogenous variables in the analytical framework used in this study.
- 3) Also, future research can scrutinize the relationship between trade and growth by incorporating foreign aid as an additional variable in the case of Egypt, in the same framework used in this study.
- 4) Future research can investigate the impact of Egypt's regional trade agreements on the economic growth.
- 5) Future research with more advanced methodology and more measures of openness is recommended.

### **Endnotes**

<sup>1,2 &3</sup> the calculation of the change in exports, imports and trade from years 1973 to 1982, 1991 to 2008 and the values for 2012. All the calculations based on the annual data from World development indicators web site or the(CD ROM 2011)which is updated online too.

<sup>6</sup>Data on the variables of this study has been collected from world development indicators (WDI) (CD ROM 2011) which is updated online up to 2012. The same data is available directly from the WDI web-side.

<sup>7</sup> Some of the educational attainment data are missing from WDI; data are updated mainly from the Central Agency for Public Mobilisation and Statistics (CAPMS), which is available in the following web-sites: <http://www.censusinfo.capmas.gov.eg/DivInfo/> and

<http://www.indexmundi.com/facts/egypt/school-enrollment>

<sup>4, 8</sup>Data on commodities for exporting and problems facing Egyptian exports sector can found the World Fact Book (Egypt). Available at:

<https://www.cia.gov/library/publications/the-world-factbook/docs/profileguide.html>

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