

**A SEMIPARAMETRIC ASSESSMENT OF  
EXPORT-LED GROWTH  
IN THE PHILIPPINES**

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## ABSTRACT

This study contributes to the literature on the export-led growth (ELG) hypothesis by adopting a semiparametric approach under two levels of temporal aggregation to investigate the ELG hypothesis in the Philippines. To assess the impact of model specification on the ELG hypothesis, parametric and semiparametric ECMs are estimated using Philippine annual and quarterly data on GDP, exports, exchange rates and gross fixed-capital formation, focusing on the role of exchange rates.

The causal relationship between exports and economic growth is examined using the Granger-causality procedure. It can be concluded that for the Philippines, the ELG hypothesis is *(a)* sensitive to model specification, *(b)* affected by different levels of temporal aggregation, and *(c)* by the inclusion or exclusion of exchange rates.

Under short-run and total causality tests, parametric and semiparametric analyses using annual data support export-led growth and bidirectional causality, respectively, and no causal relation between exports and output in the long run. Quarterly data analysis revealed that, in the long run, parametric and semiparametric procedures support bidirectional causality and growth-led exports, respectively, and that there is bidirectional causality between exports and economic growth for short-run and total causality tests.

Using annual data, total causality tests support export-led growth and no causality, with the inclusion and exclusion of exchange rates, respectively. No change in results is evident for short-run and long-run causality tests. Using quarterly data, no change in results is shown in all Granger causality tests.

The general results on bidirectional causality between exports and economic growth suggest that the Philippines could enjoy economic prosperity by strengthening their trade and investment policy and gearing it towards opening up the economy.

Previous studies have argued that differences in outcomes of the ELG hypothesis tests may be due to different levels of temporal aggregation, methodologies, model misspecification, and omitted variables. This analysis introduces empirical evidence on these issues.

## **CHAPTER 1**

### **INTRODUCTION**

The empirical testing of the hypothesis that export promotion strategies accelerate the pace of economic growth (export-led growth) has been the subject of much research interest. Some of the early works on the export-led growth (ELG) hypothesis generally affirmed its validity because exports and output appeared to be significantly correlated.

Advocates of the ELG hypothesis highlight several beneficial aspects of promoting exports on overall economic activity. The export sector uses more advanced technologies, which result in higher productivity and better allocation of resources. Furthermore, gains are realized through higher capacity utilization and greater economies of scale due to large markets. In addition, they contend that the accumulation of foreign exchange earnings from exports allows the import of high-quality inputs, mainly capital goods, for domestic production and exports, thus expanding the production possibilities of the overall economy.

However, the degree to which exports bring about growth in an economy has been debated in the literature. Some empirical studies have reported a significant and positive relationship between exports and growth, others documented growth-led exports, and still others have given an account of no significant relationship between exports and economic growth. In some works, a bi-directional causality between economic growth and openness is reported.

In recent years, GDP growth in the Philippines has co-moved with the growth of exports. Real export of goods and services has followed an upward trend since 1981, with an average of 997.02 billion Philippine pesos (PhP) per year. The highest exports of goods and services was recorded in 2004, when the country exported a total of PhP 2,024.00 billion in

real terms. The lowest level of exports was in 1982 when, in real terms, they exported only PhP 387.30 billion.

Like the investigation of the ELG hypothesis for other countries, empirical evidence for the Philippines is mixed. For instance, the findings of the study by Ahmad *et al.* (1999) using annual data on GDP, exports, and imports for selected ASEAN countries (including the Philippines), support contrary hypotheses: that economic growth is due to exports and vice versa. Islam (1998), among others, employing multivariate error-correction models, concluded that in the case of Philippines, there was no evidence of causality between the export variable and the economic growth variable. Mohsin *et al.* (1999) using variables such as exports and economic growth in their study for the ELG hypothesis for the ASEAN countries and employing improved cointegration and error-correction models, reported that there was evidence of a long-run relationship between exports and income. The same conclusion was reached by Anoruo *et al.* (2001), who used error-correction models in determining the interrelationships among GDP growth rate, export growth rate, real money supply, and exchange rates. Finally, studies such as those conducted by Ram (1987) reported an insignificant effect of exports upon the Philippine economy.

Though empirical results on the studies of export-led growth in the Philippines are mixed, some research states that exports have been the major engine of economic growth in the Philippines. That is, among some other countries in Asia, the Philippines is often cited as an example of the success of export-promotion strategies.

Al-Yousif (1999) argued that previous studies on the ELG hypothesis are biased due to omitted variables. His study accounted for other variables such as exchange rates, labor, and capital and noted that, of these three additional variables, exchange rates played an

important role in determining both exports and real output in Malaysia. For the period 1981-2004, the real effective exchange rate of the Philippine peso followed a downward trend with a corresponding upward trend for the GDP. In addition, the year-to-year fluctuations of exchange rates followed a downward trend and were coupled with increasing annual growth rates of exports of goods and services. Studies have shown that exchange rate volatility impacts exports (see Koray and Lastrapes (1989), Maskus (1986), and McKenzie (1999)).

Ekanayake (1999) further argued that, in general, the varying and ambiguous results of empirical studies may be attributed to different time periods, different sample intervals, different methodologies, use of an incomplete error-correction specification and unverified stationarity conditions. For example, using the Philippine economic data, an analysis by Riezman *et al.* (1996), showed that with 5-variable conditional linear feedback, there is no evidence of causality between the export and economic growth variable, but the same study reported evidence of growth-led exports using the bivariate Granger method.

This study will examine the effect of exchange rates on the ELG non-causality tests and the sensitivity of non-causality findings to model specification for the Philippines. Parametric and semiparametric models are used to assess the impact of model specification on the ELG hypothesis. The use of a semiparametric approach might be advantageous since it addresses misspecification issues surrounding non-linearity and omitted variables. When one has good information about the regression functional form, one should use a parametric model. However, economic theories rarely provide a specific functional form for econometric estimation. Annual and quarterly data are used to determine the effect of different levels of temporal aggregation on the ELG hypothesis. This study attempts to explain the growth of the Philippine GDP in terms of exchange rates, export growth, and

gross fixed-capital formation, focusing on the role of exchange rates. Gross fixed-capital formation is used as a proxy variable to investment, which determines long-term growth.

### **1.1. Problem Statement**

The government of the Philippines has recently placed emphasis on export promotion by enacting the Export Development Act of 1994. The economic reasoning for this policy agenda is founded on the export-led growth (ELG) hypothesis, which suggests that exports contribute to economic growth, and therefore, can be an effective mechanism to expand output, employment, and income and foreign exchange earnings. Nevertheless, the ELG hypothesis is still a much-debated proposition. Authors have employed a variety of econometric techniques in testing the ELG hypothesis. The majority of empirical tests of the ELG hypothesis have been formulated as a two-variable relationship between economic growth (GDP) and exports.

The exchange rate of the Philippine peso against the U.S. dollar and other foreign currencies has fluctuated considerably over the past few decades. Percentage changes in currencies from year to year ranging from 30% to 50% are not uncommon. Such volatility has attracted interest in explaining its impact on exports from the Philippines. Empirical findings on this issue are ambiguous; however, there is support for the argument that exchange rates significantly impact exports. Given that exchange rates can impact exports, exchange rates affect the relationship between economic growth (GDP) and exports. An alternative formulation to test the ELG hypothesis, therefore, is a model specification where the exchange rate is considered.

This study contributes to ELG research on the Philippines by developing parametric and semiparametric models that specify exchange rates as an explanatory variable. The

econometric evaluations address two important questions: 1) how exchange rates affect the ELG non-causality tests and the sensitivity of non-causality findings in the context of parametric and semiparametric models, and 2) how different levels of temporal aggregation affect non-causality tests.

## **1.2. Justification**

The Philippine government enacted Republic Act No. 7844, otherwise known as “Export Development Act of 1994,” as a policy measure to increase employment and income. The aim is to institutionalize the concept among Filipino people that exporting is not just a sectoral concern, but the key to national survival and the means through which the economic goals of increased employment and income can be most expeditiously achieved. For the period 1981-2004, real exports contributed an annual average of 31.94% to the Philippine GDP and even comprised 55.40% in 2000. Export promotion policies, however, are not without risk. For example, exchange rate fluctuations can have a negative impact on export expansion if exporters become more risk averse as exchange rates increase.

Ekanayake (1999) noted that different methodologies may be one of the reasons of varying and inconsistent outcomes of previous studies on the ELG hypothesis. The early studies examined the simple correlation between exports and economic growth and others estimated output growth regression equations based on the neoclassical growth accounting techniques of production function analysis, including exports or export growth as an explanatory variable. Other studies emphasized causality between export growth and economic growth, employing Granger or Sims causality tests. The relatively new studies involve the application of cointegration and error-correction modeling. A problem with

parametric approaches, however, is that they require the model to be correctly specified. Otherwise, the estimates are likely to be inconsistent and biased.

The relationship between exports and GDP might also be complicated by the presence of non-linear relationships between exports and exchange rates as suggested by the study of Baum *et al.* (2002) and by the non-linear behavior of exchange rates with output (Akram *et al.* 2005). The semiparametric procedure can address misspecification issues surrounding non-linearity and omitted variables. This procedure does not require specifying a parametric form for the nonlinearity part. Various parametric methodologies have been employed in testing the export-led growth hypothesis, but to the knowledge of this researcher, no study to date has employed a semiparametric methodology.

Additionally, previous researchers inferred that using more disaggregated data may help find evidence to support the ELG hypothesis. Since no work has been cited in the literature that assesses the effects of different levels of temporal aggregation<sup>1</sup> on the ELG hypothesis tests, this study also contributes to this end.

Given the ambiguity of results from previous studies, this research is justified based on its adoption of a semiparametric procedure under different levels of temporal aggregation. It also considers the impact of exchange rates on the ELG hypothesis tests. The use of these alternative methodologies may help identify sources of ambiguity in previous works. Finally, the result of this study is of major relevance to other low-income economies heavily dependent on international trade, including the Philippines.

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<sup>1</sup> The work of Granger and Siklos (1995) determined whether systematically sampled data performed differently in cointegration tests relative to temporally aggregated data. The existence of seasonal unit roots, say, in monthly data can lead to missing seasonal unit roots at the quarterly frequency. Even a unit root finding in annual data may be due to seasonal unit root properties in higher frequency data. This is a problem that stems from systematic sampling, while temporal aggregation produces no such results.



### **1.3. Objectives of the Study**

The overall objective of this study is to empirically test the Export-Led Growth Hypothesis for the Philippines using parametric and semiparametric methods for the period 1981-2004. The following are the specific objectives:

1. To estimate dynamic econometric models on the relationship between exports and economic growth of the Philippines;
2. To determine the effect of exchange rates on the ELG non-causality tests and the sensitivity of the non-causality findings to parametric and semiparametric model estimation;
3. To assess the effect of temporal aggregation on the ELG non-causality tests.

### **1.4. Procedures**

#### **1.4.1. Source of Data**

Philippine annual (1981-2004) and quarterly (1981:1-2004:4) data of exports, gross fixed capital formation, gross domestic product (GDP), and real effective exchange rates are used in this study. Please refer to Appendix 2 for the definition of each variables. These are obtained from the website of International Financial Statistics published by the International Monetary Fund<sup>2</sup>. The starting point is dictated by data availability. Exports, gross fixed capital formation, and GDP are total unadjusted series and measured in billions of Philippine pesos. These are converted to real terms using a consumer price index, 2000 = 100. The real effective exchange rate is the nominal effective exchange rate divided by a price deflator or index of costs. The nominal effective exchange rates index of the Philippine peso are based on a methodology that takes into account the country's trade in both manufactured goods and

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<sup>2</sup> <http://ifs.apdi.net/imf/logon.aspx>. Accessed on November 2005.

primary products with its trading partner countries. This is the weighted average exchange rate of the Philippine peso vis-à-vis a basket of foreign currencies including the U.S. dollar, the Japanese yen, the European Monetary Unit (EMU), the euro, and the British pound.

#### **1.4.2. Data Analysis**

##### **Objective 1**

In estimating dynamic econometric models of the relationship between exports and economic growth in the Philippines, both parametric and semiparametric procedures are employed. To attain objective 1, parametric dynamic econometric time series models are specified. Prior to determining the relationship between exports and economic growth, the time series properties of each underlying series are examined by conducting unit root tests. This study makes use of the Philips-Perron (PP) test for unit roots. Cointegration may exist if the economic variables contain unit roots. The two-step OLS approach of Engle and Granger is used in testing for cointegration. An error-correction model (ECM) is built if cointegration is found. If there is no cointegration, the model is estimated in differences. The optimal lag length of the changes in each variable in the VAR model is determined using the Schwartz Bayesian Criterion (SBC).

A regression is also estimated that excludes the exchange rate variable in the model. Granger causality tests are also conducted and results are compared with the regression that includes this variable in the model. In this way, the effect of exchange rates in the ELG hypothesis test can be determined, thus addressing the omitted variable problem.

The export-led growth hypothesis is also tested using the same Philippine economic data by estimating a semiparametric model. In this study, the effects of exchange rates to GDP are modeled nonparametrically, whereas the effects of other variables (EXP, GFCF,

error correction term) are modeled parametrically. The optimal lag length of the nonparametric variable in the semiparametric ECM is determined using the generalized cross-validation of Craven and Wahba (1979). The model is estimated following Robinson (1988).

### **Objective 2**

The causal relationship between exports and economic growth with the influence of exchange rates is examined using the Granger-causality procedure. Two major hypotheses are tested, namely: 1) export-led growth and 2) growth-led exports. Granger causality involves the use of an F-test to determine whether lagged information on a dependent variable provides statistically significant information about an independent variable in the presence of the lags of this particular independent variable. Thus, in order to test an export-led growth hypothesis, the significance of the export coefficients (lagged) on the GDP growth equation is tested. This means that past values of exports help to predict GDP. In the same manner, to test for the growth-led exports hypothesis, the significance of the lagged GDP coefficients on the export equation is determined. To compare the performance between the parametric and semiparametric procedures, the Granger causality tests are estimated on both models.

### **Objective 3**

To assess the effect of different levels of temporal aggregation on the ELG hypothesis test, the estimation of parametric and semiparametric models is also carried out using quarterly data (1981:01 – 2004:04). The time series properties of the quarterly data are also identified. Cointegration tests are conducted using the Engle-Granger two-step procedure. Again, if there is cointegration, an ECM is estimated using the lagged of the first difference

of the residuals of the estimated regression in levels and the lagged changes of all other variables in the ECM specification. If there is no cointegration, the model is estimated in differences. Granger causality tests are estimated to determine the causal relation between exports and GDP. The results of the quarterly data analysis are compared with the results of the annual data analysis. This is done in both parametric and semiparametric procedures.

### **1.5. Outline of the Thesis**

This thesis is organized as follows. Chapter 1 concentrates on the development of the problem statement, the justification and objectives of the study, and the procedures that are followed in conducting this research. Chapter 2 provides a condensed review of various literature that provides background to this work. Chapter 3 introduces the theories, economic and econometric models and the methodologies that are used in this study. Results, analysis and interpretation of the study are discussed in Chapter 4. Chapter 5 summarizes, concludes, and recommends issues for further study.

## **CHAPTER 2**

### **REVIEW OF LITERATURE**

#### **2.1. Previous Research**

Empirical evidence on export-led growth hypothesis for the Philippines is mixed, that is, some authors reported results supporting export-led growth, others reported growth-led exports, and still others reported no significant relationship between exports and economic growth. According to Ram (2003), the empirical literature on the ELG hypothesis has been based on either cross-country studies or individual-country analysis. This vast literature with emphasis on the Philippines is reviewed here.

##### **2.1.1. Various Statistical Approaches**

###### **2.1.1.1. Correlation Coefficients**

Earlier studies on this issue examined the simple correlation coefficient between export growth and economic growth. These studies generally concluded that there was strong evidence in favor of an export-led growth hypothesis based on the fact that export growth and economic growth are highly correlated. The main weakness of this group of studies is that a strong positive correlation between these variables was taken as evidence supporting the export-led growth hypothesis. But correlation alone does not imply causation, therefore, more general “causal” models based on regression techniques are often used.

###### **2.1.1.2. Regression Applications**

The second group of studies examined whether or not exports are driving output by estimating output growth regression equations based on the neoclassical growth accounting techniques of production function analysis, including exports or export growth as an

explanatory variable. These studies found a significant positive relationship between exports and economic growth lending support to the export-led growth hypothesis. This group of models is subject to criticism based on a methodological issue. Even though these techniques clearly showed that there was a correlation between exports and economic growth, they were not able to examine the direction of the causal relation between the two variables.

An instance of a cross-country study employing OLS regression was conducted by Ram (1987) using data from 88 developing countries to test the ELG hypothesis. The Philippines was one of the countries studied by Ram who considered variables such as population growth, real investment as a share of output, and a dummy variable to take into account the effects of the 1973 oil crisis and found out that the ELG hypothesis is valid for 39 out of 88 developing countries examined.

#### **2.1.1.3. Causality Tests**

Because the second group of studies is criticized for not determining the direction of causality between the exports and output variable, a third group of relatively recent studies put their emphasis on causality between export growth and economic growth. This approach has been taken in a number of recent studies designed to assess whether or not individual countries exhibit evidence supporting export-led growth hypothesis using Granger or Sims causality tests. The major shortcoming of these causality test results is that the Granger or Sims tests used in these studies are only valid if the original time series are cointegrated. Therefore, one must check for cointegrating properties of original export and output series before using Granger or Sims tests.

It was in 1985 when there was a shift in the approach to investigating the relationship between exports and economic growth (Anoruo and Ahmad, 1999). Instead of using typical

production function models, researchers performed causality tests to determine the causality between exports and economic growth. Jung and Marshall (1985) first used the Granger causality test developed by Granger (1969). Their study used a bivariate Granger causality test under the VAR framework to determine the relationship between exports and GDP for 37 developing countries between 1950 and 1981. The causality tests go beyond mere correlation and address the issue of the direction of causation. Their findings were supportive of the ELG hypothesis when they explored the causality between exports and income in only 4 out of 37 cases they examined, suggesting that the empirical evidence supporting the ELG hypothesis on this study is weaker than what the previous studies have reported. Nevertheless, the authors did not conduct stationarity and cointegration tests.

#### **2.1.1.4. Cointegration Techniques and Error-Correction Models**

A relatively recent group of studies applied the techniques of cointegration and error-correction models (ECM). Among others, studies conducted by Afxentiou and Serletis (1991), Oxley (1993), Bahmani-Oskooee and Alse (1993), Dutt and Ghosh (1994, 1996), Ghatak, Milner and Utkulu (1997), Rahman and Mustafa (1998), Islam (1998) and Balaguer *et al.* (2001), employed the cointegration techniques. According to Ekanayake (1999), the cointegration techniques and error-correction models do not suffer from the shortcomings found in methodologies of previous studies (i.e., use of a correlation coefficient between exports and GDP as evidence of ELG, failure to consider the direction of causality and failure to check for cointegrating properties before applying Granger or Sims tests).

#### **2.1.2. ELG Studies for High Income Countries**

Work by Afxentiou and Serletis (1991) investigated the export-led growth hypothesis for 16 industrial countries. The empirical evidence obtained indicated that there was a

bidirectional causality between exports and output growth using economic data from the United States. There was evidence of causality from GNP to exports in Norway with optimal lag length of one year as well as Canada and Japan with 10 years as the optimal lag length. Discarding the cases of Canada and Japan as meaningless in terms of economic policy due to excessive length of their optimal lag, the established statistical support for causality is restricted to the United States and Norway, i.e., to two out of 16 countries examined. The authors generally concluded that export policies are not instrumental in spurring GNP growth.

The method used by Afxentiou and Serletis (1991) to test the ELG hypothesis involved Granger-causality tests for exports and GNP. The unit-root test was done using the Phillips-Perron tests (1988) using annual data from 1950-1985. A cointegrating regression was estimated since the variables contained a unit root.

Jin and Yu (1996), using quarterly data from 1959:1 to 1992:3, examined the hypothesis of export-led growth for the U.S. economy, by constructing a six-variable vector autoregressive (VAR) model to balance various possible offsetting impacts on exports and output. The dynamic effects of one variable on another are examined by computing variance decompositions (VDCs) and impulse response functions (IRFs) for which standard errors are calculated using a Monte Carlo simulation procedure. The model variables include: real exports of goods and services; real gross domestic product; real gross fixed capital formation, which is the chosen measure of capital; non-agricultural employment, which is used as a proxy for labor; the industrial production index for all industrial countries, which is used as a proxy for foreign output shocks, and the real exchange rate, which is measured using consumer price indexes. Based on the VAR techniques, no significant causal impacts are



found between exports and output. This suggests that export expansion is neutral with respect to the growth of the US economy. On the other hand, the work of Shan and Sun (1999) that employed the Granger no-causality procedure developed by Toda and Yamamoto (1995), indicated a two-way Granger causality between output and exports, a result that stands against the earlier findings of export-growth studies in the U.S. economy. Their study also specified a six-variable VAR model to test the ELG hypothesis using quarterly data from the U.S. economy. The study of Jin and Yu (1996) eliminated the imports variable in the VAR model used by Shan and Sun (1999).

Moosa (1999) examined the relationship between exports and output using Australian annual data over the period 1900–1993. The author determined the order of integration by applying the Phillips–Ouliaris (1990) unit root tests to levels and first differences of the variables. The tests cannot reject the null hypothesis of no cointegration. Thus, exports and output do not form a cointegrating vector, i.e., they are not driven by a common stochastic trend. The author argued that perhaps the finding of no cointegration between exports and output is due to omitted variables such as imports. The inclusion of imports in the cointegrating regression may be useful to take into account the possibility that export externality effects are due to the role of exports in relieving a foreign borrowing constraint (Serletis, 1992). The author determined the order of integration of imports and estimated a cointegrating regression but still the null hypothesis of no cointegration cannot be rejected. The study proceeded by specifying a bivariate model to test the causality from exports to output. The results showed that the null of no causality cannot be rejected for any value of  $k$ , and so a short-run causal relationship between exports and output does not exist. According to the author, the problem with causality testing is that it is based on the observed

time series, and while differencing removes the trend component, a significant irregular (random) component remains which could contaminate the cyclical export–output relationship. This was the basis for reexamining the exports–output relationship using structural time series analysis.

On the basis of data used in the analysis and the method employed, the author concluded that the export-led growth hypothesis is not valid for Australia, which is predominantly an exporter of commodities and raw materials and an importer of capital goods. Empirical testing failed to detect the existence of a long-run or short-run relationship between Australian exports and output. The author argued that these results are explained by restoring the structural time series modelling approach which shows that while the output series exhibits cyclical variation, the exports series does not have this property.

The work of Balaguer *et al.* (2001) for Spain in the last century using two variables (exports and domestic income) using Granger causality tests, revealed that real income growth has caused real export growth in Spain during the 1901-1999 period. However, when the causality analysis has been carried out a bit further by differentiating the Spanish economy into two different periods – the first half of the century, in which protectionism was practiced, the great depression of the 1930's and World and civil wars have made Spain a country that tried to be self-sufficient (1901-1958); and the period where Spain opens up as a result of trade liberalization (1959-1999), mixed results were obtained. The export-led growth hypothesis is supported during the economic liberalization period whereas for the protectionist and autarkic period, neither a long-run nor a short-run relationship between these two variables not found.

Panas *et al.* (2002) aimed to test the validity of ELG hypothesis by using the empirical framework of structural vector autoregressive (VAR) models and applying a sensitivity analysis to explore the robustness of the results. By modelling short- and long-run dynamics, the study provided estimates of the causal links between exports and output in the framework of multivariate systems for Greece, using annual data from the Greek economy. The authors reported that the ELG hypothesis is not valid for Greece and that long-run causality runs from output to exports. Their study used variables such as real GNP, real exports, nominal effective exchange rates and price levels for years 1948-1997.

Awokuse (2003) re-examined the export-led growth hypothesis for Canada by testing for Granger causality from exports to national output growth using vector error-correction models (VECM) and the augmented VAR methodology. Application of recent developments in time series modelling and the inclusion of relevant variables omitted in previous studies helped to clarify the contradictory results from prior studies on the Canadian economy. The empirical results suggested that a long-run steady state exists among the model's six variables and that Granger causal flow is unidirectional from real exports to real GDP.

Balaguer *et al.* (2001) started the analysis of the annual data by investigating the stationarity of the series using the unit-root tests developed by Dickey and Fuller (1979, 1981) and Phillips and Perron (1988). The cointegration between real domestic income and real exports was tested using the Johansen's (1988) methodology. The lag length of the level vector autoregression system has been determined by minimizing the Akaike (1969) Information Criterion. Finally, the authors applied Granger causality tests to examine the causal relationship between domestic income and real exports.

### **2.1.3. ELG Studies for Upper Middle Income Countries**

Howard (2002), using annual data from 1968 to 1997, investigated the interrelationships among variables such as exports, imports and income (in terms of GDP) for Trinidad and Tobago. The author employed the methodology of Granger-causality and error-correction modeling. The study examined the properties of the univariate time series using ADF and PP tests, tested for cointegration using Johansen trace tests and tested if exports Granger-causes GDP or vice versa. Results of his study supported the idea that income in Trinidad and Tobago was Granger caused by the growth of exports and ECM tests showed a bidirectional causality between exports and imports but there was a stronger causal relationship running from exports to imports, and in the long run, there was a bidirectional causality between imports and income. The author noted that the result should be interpreted with caution because of the possibility of omitted variables.

Keong *et al.* (2003) examined the relationship between exports and growth in Malaysia using a two-stage least square technique and found that the hypothesis of export led-growth is valid in the Malaysian economy when variables such as imports of consumable goods, capital formation and labor force are included in the model. The authors also took into account the influence of exchange rates in determining the relationship between exports and GDP. The stationarity of the variables was checked using Augmented Dickey-Fuller tests (1979) and Phillips-Perron (1988) test. A cointegration test was performed utilizing the Johansen's and Juselius' (1990) multivariate cointegration test. Two likelihood ratio test-statistics were used, namely: 1) the trace test, and 2) the maximum Eigenvalue test. The causal relationship between real exports and GDP was determined using the Granger causality tests. Akaike's minimum Final Prediction (FPE) criterion was used to determine

lag structure while the Wald test was used in examining the causality between predetermined and dependent variables.

#### **2.1.4. ELG Studies for Lower Middle Income Countries**

Abu-Qarn and Abubader (2004) investigated the export-led growth hypothesis for nine Middle East and North African (MENA<sup>3</sup>) countries using annual data. The period of analysis of each country varies depending on data availability. The authors employed a three-variable vector-autoregressive and error correction models. Before conducting causality tests, the author conducted unit root tests using a Phillips–Perron (PP) test. If the series were non-stationary, the authors proceeded to the next step which was testing for cointegration using Johansen’s (1988) approach. Granger causality was evaluated using the standard F-test.

The authors found out that when total exports are considered, the causality tests uncovered little support for the ELG hypothesis. There were only two countries out of the nine for which they found a bidirectional causality between export growth and economic growth. Nevertheless, upon testing for the impact of manufactured exports, they reported a positive causality from manufactured exports to economic growth for countries with a relatively high share of manufactured exports in total merchandise exports.

Abual-Foul (2004) also tested export-led growth hypothesis over the period 1976-1997 for Jordan. The author used three bivariate models namely: 1) vector autoregressive in levels; 2) vector autoregressive in first differences, and 3) error-correction models. The empirical results from these three models indicated a unidirectional causation from exports to output and thus lent support to the export-oriented growth of the country. The author

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<sup>3</sup> Include Algeria, Egypt, Iran, Israel, Jordan, Morocco, Sudan, Tunisia and Turkey (But Sri Lanka and Maldives are classified as Upper Middle Income Countries)

transformed the series to logarithms to eliminate the problem of heteroscedasticity. The vector autoregressive models in levels assume that both variables are integrated of order of zero. The vector autoregressive in first differences assumes that the variables are integrated of order one and that they are not cointegrated. The error-correction model assumes that variables are integrated of order one and that they are cointegrated. Unit roots cointegration tests were conducted and Hsiao's (1981) version of the Granger causality test was used in determining the causal relation between exports and output as measured by GDP. Annual data from 1976-1997 was used.

#### **2.1.5. ELG Studies for Low-Income Countries**

The work of Love *et al.* (2005) in investigating the ELG hypothesis for South Asia,<sup>4</sup> employed cointegration and error-correction models using annual data whose period varies on each country. Mixed results were obtained and the authors found no conclusive evidence to support the ELG hypothesis. Countries such as India, Maldives and Nepal exhibit export-led growth while Bangladesh and Bhutan exhibit the opposite result of growth-led exports. In the case of Pakistan and Sri Lanka no causality in either direction was found. The authors also took a common period of analysis and confirmed the mixed results.

Zuniga<sup>5</sup> (2004) in studying ELG hypothesis for Honduras and the Central American region, reported that there was no evidence supporting this hypothesis in the Honduran model as well as its agricultural based model but it is valid in its non-agricultural model. The author estimated a dynamic econometric time series model for studying the ELG hypothesis

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<sup>4</sup> India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan and Maldives. But Maldives is classified as Upper-Middle Income Country.

<sup>5</sup> Countries examined were Honduras, Guatemala, El Salvador, Nicaragua and Costa Rica. Except for Costa Rica, these countries are classified as low-income countries.

involving a VAR model. Tests for unit roots in the series were done using Augmented Dickey Fuller (ADF) test and the Phillips-Perron test. A cointegration test was performed using Johansen and Juselius procedure. If cointegration existed, an error correction model was built, and if otherwise, a model in first differences was estimated. Granger causality was used to test for export-led growth and/or growth-led exports.

It can be noticed that there is no unanimity concerning the empirical causal relationship between exports and economic growth. The mixed results can be found in countries having the same income classification and those having different income classification. This maybe due to various methodologies used in the investigation and diverse sample countries being used in the study (Mohsin and Anam (1999)). The mixed results may also be due to omitted variables. Some authors of the ELG works have reported an evidence of a third factor that can influence the export-output growth relationship. Hence, recent studies have accounted for several other factors (exchange rates, money supply, investment, government spending and so on) in testing the export-led growth hypothesis.

The varying and inconsistent outcomes may also be attributed to different time periods, that is, researchers used different periods of analysis, and it is believed that ELG changes with time. It is also possible that model specification has caused the inconsistent outcomes. That is, whether there are linear or non-linear relationship between the dependent and independent variables. The non-stationarity of the data series may also have contributed the mixed results. Some studies examined the relationship between exports and GDP without evaluating the stationarity of the data. Another reason is the data frequency. Some researchers used annual data and others used quarterly data. Different econometric methods may also contribute to inconsistent outcomes.

### **2.1.6. ELG Works for the Philippines**

In the case of the Philippines, empirical results on the studies of the export-led growth hypothesis are also mixed, but some literature cited that exports have been the major engine of economic growth in the Philippines. An outline of 32 various empirical works testing ELG hypothesis, which included among other countries, the Philippines, is shown in Appendix 1. These empirical works covered a wide spectrum of approaches ranging from ordinary regression analyses to Granger causality tests.

Of the foregoing studies conducted, 9 employed ordinary least squares estimation (OLS) and/or generalized least square estimation allowing for first order serial correlation and included both bivariate and multivariate analyses with one study using both OLS and VAR framework. Multivariate analyses accounted for other economic variables believed to contribute to economic development such as: population growth, real investment as share of output; gross fixed capital formation as % of GDP; real industrial production growth, employment, real investment (capital), share of investment in output; growth of workforce, labor force, real investment, ratio of gross domestic investment to GDP, real investment to output share; and population growth. Two studies include a dummy variable to account for trade regimes in the 1973 oil crisis. Annual data were employed by all of these studies beginning as early as 1950s. Five studies reported a significant positive export economic growth relationship and the remaining reported no significant results. Common characteristics of these estimates were regressions in terms of growth rates or first differences of exports and GDP/GNP variables. These were likely to be stationary representations of the time series and therefore were not estimating long-run relationships. This approach is



criticized for having an “accounting identity” problem, endogeneity issues and misspecification errors (Giles *et al.* 1999).

The remaining studies employed a VAR framework. Results of the VAR research included cases of export-led growth, growth-led export, bi-directional causality and non-causality. For multivariate analyses, in addition to variables accounted for in the OLS above, other variables were included, namely: total private investment expenditure, business fixed investment, real world output, terms of trade, real import growth, total investment per output, primary school enrollment as % of school age children, total investment over output, share of non-defense expenditures in GDP, imports as share of GDP, money supply and imports.

With the exception of two studies, that used quarterly data, Lee *et al.* (2002), who reported no causal relationship between export and growth, and Bahmani-Oskooee *et al.* (1991), who found out bi-directional causality between these variables, these twenty-four case examinations used annual data. Dutt and Ghosh in 1994 and 1996, conducted bivariate analysis using the same time period (1951-1991). In their first study, results were based on cointegration with the concept that cointegration implies causality. The authors found cointegration for the Philippines. In their second study using a bivariate Granger method in examining annual data for a large sample of 26 low, middle and high income countries including 4 newly industrialized countries, the Engle-Granger two stage cointegration tests failed to establish long-run relationship for half of the sample countries though it reported evidence to support export-led growth hypothesis in the Philippine case.

Bivariate studies dominated the Philippine test for ELG hypothesis (14 studies) with only 3 trivariate and 7 multivariate studies. Different methods seemed to have different effects on the tests of the ELG hypothesis. For instance, the study of Riezman *et al.* (1996)

that selected variables such GDP, export growth, real import growth, primary school enrollment (as % of primary school age children) and the ratio of total investment over output for 126 countries for the period 1965 to 1999, revealed that for the 5-variable conditional linear feedback, the Philippines had evidence of non-causality between the export variable and the economic growth variable. The same study reported evidence of growth-led export for the Philippines using a bivariate Granger method. Pomponio (1996) reported non-causality for bivariate analysis but found evidence of growth-led exports for a trivariate case when accounting the role of investment in the determination of the relationship between exports and economic growth.

Ekanayake (1999) and Anoruo (1999) used the same time period (1960-1997), with bivariate and multivariate analysis, respectively. The former author used cointegration and error-correction models in testing an export-led growth hypothesis in eight Asian developing countries<sup>6</sup> while the latter, who used the same method, tested this hypothesis in selected ASEAN countries<sup>7</sup>. Anorou's (1999) analysis further accounted for imports. But even given this differences, both reported bidirectional causality for the Philippines.

Bahmani-Oskooee and Alse (1993) used annual data (1951-87) in testing ELG hypothesis in 20 Least Developed Countries (LDCs); a study similar to the one using quarterly data (1973:1-88:4) that they conducted in 1991. Annual and quarterly data reported non-causality and bidirectional causality respectively, between exports and output though both studies employed bivariate Granger causality. Ahmad *et al.* (1997) examined the cointegration and causality between exports and economic growth of the five members of the ASEAN (which includes the Philippines) from 1987-1993. The two-stage cointegration

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<sup>6</sup> Included India, Indonesia, Korea, Pakistan, Philippines, Sri Lanka & Thailand.

<sup>7</sup> Included Indonesia, Malaysia, Philippines, Singapore & Thailand.

procedure could not reveal any long-run relationship. The study reported that there is evidence of causality running from output to economic growth in the case of the Philippines.

In addition to those mentioned earlier, trivariate or higher order systems of analysis have the following results: Analysis of Sharma and Dhakal (1994) and Anoruo *et al.* (1999) both reported bi-directional causality between exports and economic growth, though they accounted for different variables that may influence in the determination of the relationship between exports and output. Imports were accounted by Anoruo *et al.* (1999) while Sharma and Dhakal (1994) accounted for more and different variables, namely: population, world output, exchange rate and gross fixed capital formation. Both studies employed multivariate Granger causality test. Sharma and Dhakal (1994) used the unit root test developed by Phillips and Perron (1988) while Anoruo *et al.* (1999) employed an Augmented Dickey-Fuller test.

In addition, Islam (1998) reported that there was non-causality between the export variable and the economic growth variable for the Philippines in the study of 15 East Asian countries using annual data on proportion of export earnings to GDP, change in share of non-export component in GDP and real GDP from 1967 to 1991 when using multivariate extension of the bivariate causal structure (Granger, 1969). The novelty of this work is the development of an error-correction technique that allows for testing of Granger causality in the presence of a stochastic trend common to all variables in question. The technique identifies an additional source of causation, stemming from the common trend in the underlying series. The author argued that the Granger test, as used in earlier studies, is therefore found to be inadequate, because it ignores this additional channel of causation, i.e., from output growth to exports growth.

It can be noted that ELG studies that included the Philippines in the investigation also reported mixed results, that is, cases of export-led growth, growth-led export, bi-directional causality and non-causality were reported by these studies. However, the Philippines is often cited as an instance of a success of export-promotion strategies by some literature. Both annual and quarterly data were used in the analyses. This study differs from previous literature in that the effect of different levels of temporal aggregation on tests of the ELG hypothesis in the Philippines is examined. In addition, no other study has employed semiparametric procedures to test for export-led growth.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1. Economic Model**

The principle of comparative advantage still remains at the core of arguments for trade liberalization. Trade allows each country to specialize in the most efficient production of goods and services that could give her a comparative advantage in a global market. Trade barriers result in production of fewer goods that can be efficiently produced by a country, and more of goods that could be produced efficiently elsewhere. By lowering barriers so that countries may exploit their own specializations, world output will increase and each country can raise its overall consumption and welfare. Theoretically, trade liberalization offers promising gains to a country but alarming distributional issues may pose valid concerns.

Applying the principle of comparative advantage raises productivity and subsequently leads to overall economic growth. This can be done by either reallocating resources to their most productive uses or enhancing the processes or technologies through competition and innovation. A country's access to foreign markets may improve from reduced production costs. Open markets that enforce greater competition encourage innovation, drive the least competitive firms out of markets, and eventually reduce prices of commodities. Trade, like investment, is also an important mechanism by which countries can have access to new technologies. Moreover, the pace of structural change is likely to be faster in open economies compared to closed economies. The former lead to expanding industries as compared to the latter that is inefficient, with out-of-date production methods and, therefore, less developed economy.

The theory of comparative advantage gave rise to the so-called export-led growth hypothesis. Countries advocating export-promotion strategies consider export activity as a way to achieve economic development. This growth is the primary rationale, and efficient alternative, to import substitution industrialization and inward-orientation strategies of development. Outward orientation is said to lead to elevated total-factor productivity leading to economic prosperity.

Nevertheless, for a poor less-developed country, export-promotion strategy may not be beneficial since the effectiveness of export promotion policies may depend on both the level of development and the structure of exports. A country must have domestic industries that are efficient and competitive for it to face globalization and participate in economic integration. Economic integration presupposes that participating economies have already attained a high level of competitiveness and maturity of their production structures to be able to face regional and global competition (Onguglo and Cernat 2000). Hence, export promotion strategies may result in economic growth only if resources for exports production are allocated according to a country's comparative advantage. This is because when products are produced and exported based on comparative advantage, industries are better prepared to face global competition. Export promotion strategies may provide a country with the opportunity to penetrate larger markets, thus, expanding output in a manner consistent with economies of scale.

As a benchmark to this study, the macroeconomic variables considered important in the works of Keong *et al.* (2003)<sup>8</sup> and Al-Yousif (1999)<sup>9</sup> on the ELG hypothesis for Malaysia are used to model the ELG hypothesis in the Philippines (Equation 1). Malaysia has also a

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<sup>8</sup> Other variables accounted in their study included exchange rates, GFCF, labor and imports.

<sup>9</sup> Other variables accounted in his study included labor, capital and exchange rates.

small open economy that embraces export-promotion as a means to increase employment and income. The static model below conjectures that economic growth is a function of exports of goods and services, gross fixed capital formation and real effective exchange rates is used in this study. It is given by:

$$GDP_t = f(\overset{+}{EXP}_t, \overset{+}{GFCF}_t, \overset{+}{RER}_t), \quad (\text{Eq. 1})$$

where GDP is the real GDP growth, EXP represents real exports growth of goods and services, GFCF for real gross fixed capital formation and RER for real effective exchange rates index. The expected relationship between each of the explanatory variable with the dependent variable is indicated by the signs above the variables

The early tests on ELG hypothesis were focused on a two-variable model of GDP growth in terms of exports. Recently, studies accounted for exports along with other explanatory variables considered important in explaining GDP. These variables include labor, exchange rates, money supply, gross fixed capital formation and investment.

Henriques and Sadorsky (1996), in testing ELG hypothesis for Canada, accounted for exchange rates to reflect price competitiveness in the international markets while Al-Yousif (1999) included this variable to reflect its indirect influence on economic performance via export channel. The author noted that of the three additional variables considered (exchange rate, labor and capital), exchange rate variable played an important role in determining both exports and real output in Malaysia. Cuaresma *et al.* (2005), covering 45 countries including the Philippines, also included exchange rates. Among other previous studies, Lee *et al.* (2002), Sharma and Dhakal (1994), and Jin and Yu (1996), included gross fixed capital formation in testing the export-led growth hypothesis.

Though it is hypothesized that export growth can contribute to economic growth, an equally plausible hypothesis states that economic growth can lead to export growth. The theoretical argument for this hypothesis is in the positive correlation between economic growth and export growth embedded in the theory regarding international trade and development. Jung and Marshal (1985) pointed out that export growth represents an increase in the demand for a country's output and thus serve to an increase in real GNP. In addition, increase in exports may loosen a binding foreign exchange constraint and allow purchase of productive intermediate imports and hence serves as an engine to economic growth. Chow (1987) suggests that in small open economies, export growth can expand their limited domestic markets, and contribute to the economies of scale necessary for industrial developments.

It is also important to note that causality may run from economic growth to export growth, in contrast to export-led growth hypothesis. According to Lee *et al.* (2002), when an economy is growing, some industries are experiencing rapid learning and technical changes related to the accumulation of human capital, manufacturing experiences, and technology transfer from abroad through direct licensing or real capital accumulation arising from direct investment. These changes may have very little to do with the export promotion policies of the government and that output will continue to grow even without such policies. The result is an unbalanced growth, that is, the growth of domestic demand will lag behind the output growth of these booming industries, triggering producers to export their products. Hence, economic growth contributes to the growth of exports.

The absence of a consistent causal pattern in ELG studies can be attributed to the omission of other important variables, namely, imports, investment, government spending,



exchange rates and so on, that can influence the export-growth relationship (Islam, 1998). Knowing this importance, the influence of other important variables such as gross fixed capital formation (proxy for investment) and exchange rates will be dealt with in this study. In the output model, labor and capital are included as the most likely variables to explain growth aside from exports (Sharma, *et al.* 1994). Perturbations of these factors will register an appreciable effect in total output predicted by the neoclassical growth theory. Investment is a key factor to long-term growth. The higher the level of investments, the possibility of long-term sustained growth increases. As Islam (1998) pointed out, an increase in exports allows an increase in imported capital goods, which eventually raises the growth rate of capital formation and thus stimulates growth. Edwards (1993) reiterates that export industries are more susceptible to productivity improvements leading to increase investment, higher profits and more rapid economic growth.

Concurrent macroeconomic stability, achieved through prudent fiscal and monetary policies, i.e., avoidance of an appreciated exchange rates, in promoting economic growth is the cornerstone in the success of high-performing Asian economies (HPAEs). Exchange rates can indirectly cause output growth through the demand of exported goods. As viewed by the “new growth theory”, exports in developing countries depend on world demand for exported goods. In the same note, world demand is dependent on the price of goods and the income of buyers. Hence, exchange rate is significant in the determination of the relationship between exports and economic growth. Wildly fluctuating exchange rates may do a great damage to export industries and creates an atmosphere of uncertainty that is not conducive to investment. There are two general theoretical schools of thought that attempt to explain the effect of exchange rate volatility on international trade. The traditional school holds that

higher volatility increases risk, and therefore, depresses trade flows, while the risk-portfolio school maintains that higher risk presents greater opportunity for profit and should increase trade (Pickard 2003). From the viewpoint of the classical model, the devaluation of the real exchange rate has expansionary effects on output if the Marshall-Lerner condition<sup>10</sup> is satisfied. Hence, it is expected that this variable is positively related with output. Specifically, Philippine peso depreciation will raise the competitiveness of the domestic commodities and as a consequence, exports will be encouraged.

### 3.2. Econometric Methods

#### 3.2.1. Parametric Method

##### 3.2.1.1. Stationarity and Order of Integration

Prior to the estimation of any relationships between real GDP and its explanatory variables, the stationarity of each data series should be evaluated. A stationary series fluctuates around a mean value with a tendency to converge to the mean but the non-stationary series wanders widely without the tendency to converge. The nonstationarity of the data is tested using the Philips-Perron (1988) test. The tests are conducted by computing the following regression:

$$\Delta Y_t = a + cY_{t-1} + d_1\Delta Y_{t-1} + d_2\Delta Y_{t-2} + \dots + d_{p-1}\Delta Y_{t-p+1} + \mu_t \quad (\text{Eq. 3})$$

where  $\Delta Y$  are the first differences of the variables of interest ( $GDP_t$ ,  $EXG_t$ ,  $GFCF_t$ , and  $RER_t$ );  $a$ ,  $c$ ,  $d_1$ ,  $d_2$ ; . . . ;  $dp_{-1}$  are parameters;  $t$  stands for time; and  $\mu_t$  is a white noise

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<sup>10</sup> The condition that sum of the elasticities of demand for exports and imports exceed one (in absolute value); that is,  $\eta_X + \eta_M > 1$ , where  $\eta_X$ ,  $\eta_M$  are the demand elasticities for a country's exports and imports respectively, both defined to be positive for downward sloping demands. Under certain assumptions, this is the condition for a depreciation to improve the trade balance, for the exchange market to be stable, and for international barter exchange to be stable.

disturbance term. The null and alternative hypotheses are  $H_0: c = 0$ ;  $H_1: c < 0$ . An important step is to specify the number of lagged first difference terms in equation 3. The Phillips-Perron (PP) unit root test makes a nonparametric correction to the  $t$ -statistic of the  $c$  coefficient in order to control for the serial correlation in  $\mu_t$ . The Newey-West (1987) correction is used to adjust for heteroscedasticity and serial correlation. For the PP unit root test the truncation lag  $p$  for the Newey-West correction is specified using the Akaike Information Criterion (AIC). The lag length which minimizes the AIC is considered the appropriate lag of the series under study. For the PP  $t$ -statistics MacKinnon tables (1991) are used. If the coefficient  $c$  is not significant, we fail to reject the null hypothesis of non-stationarity and can conclude that the series is  $I(1)$  process.

#### **3.2.1.2. Lag Order**

The distribution of a test statistic is sensitive to the order of lags used. If the lag order used is less than the true lag, the regression estimates will be biased and the residuals will be serially correlated. If the order of lags used exceeds the true order, the power of the test is likely to be reduced. This problem is overcome by employing the Schwartz Bayesian Criterion (SBC). The optimal lag length corresponds to the minimum SBC for selected lag length values. This procedure removes arbitrariness in choosing the lag length in statistical tests of causality.

#### **3.2.1.3. Cointegration Test**

If economic variables contain a unit-root, then there is the possibility of cointegration (Engle and Granger, 1987). Cointegration is the process of getting equilibrium or long-run relationship among non-stationary variables. Although individual time series that contain

stochastic trends are non-stationary in their levels, it is possible that stochastic trends are common across series, rendering stationary combinations of the levels.

The Granger Representation Theorem is an important finding in the cointegration analysis (Kikuchi, 2004). This theorem states that if a set of variables is cointegrated of the same order, there exists a valid error-correction representation of the data. Engle and Granger (1987) provided a principal feature of the cointegrated variables in that their time paths are influenced by the deviation from the long-run relationship, given that cointegration implies error-correction representation. That is, a cointegrated system can always be represented by an error correction model (ECM).

Cointegration can be tested using several procedures. A common method used in empirical research is the two-step OLS approach of Engle and Granger (EG2 hereafter). This approach, which attains objective 1, is simple and can be summarized as follows:

1. Determine the order of integration of each variable;
2. Estimate the long-run equilibrium relationship using a regression in levels for each variable in the VAR system and save the residuals.
3. Test for cointegration using the Durbin-Watson and R-square statistics in Engle and Granger.
4. If cointegration is found, build an ECM using the residuals in step 2 and lagged changes of all the other variables in the ECM specification. If no cointegration is found, the model is estimated in differences. In this case, the error correction terms are eliminated from equation (4) and (5).

An example of an ECM with one lag for each variable is given in the next equations.

$$\Delta \text{GDP}_t = \alpha + \alpha_1 \Delta \text{GDP}_{t-1} + \alpha_2 \Delta \text{EXP}_{t-1} + \alpha_3 \Delta \text{RER}_{t-1} + \alpha_4 \Delta \text{GFCF}_{t-1} - \rho_1 \varepsilon_{t-1} + \mu_{1t}, \quad (\text{Eq.4})$$

$$\Delta EXP_t = \beta + \beta_1 \Delta GDP_{t-1} + \beta_2 \Delta EXP_{t-1} + \beta_3 \Delta RER_{t-1} + \beta_4 \Delta GFCF_{t-1} - \rho_2 \varepsilon_{t-1} + \mu_{2t}, \quad (\text{Eq.5})$$

where  $\varepsilon_{t-1}$  is called the lagged error term obtained from the long-run cointegrating regression (step 2 of EG2) and  $\rho_1$  or  $\rho_2 \neq 0$ . There are two possible sources of causation in the ECMs above. For instance, if  $EXP_t$  causes  $GDP_t$ , then this can be tested by either through  $\varepsilon_{t-1}$  (which is a function of  $EXP_{t-1}$ ) if  $\rho_1 \neq 0$  or through lagged  $EXP_t$  if  $\alpha_2 \neq 0$ .

In the formulation of an ECM, the lag length of the changes in each variable must be identified. This is done by using the Schwartz Bayesian Criterion (SBC) in a similar fashion as done for the unit root tests.

#### 3.2.1.4. Granger-Causality

The causal relationship between economic growth and exports is examined using the Granger-causality procedure based on ECM. This test has been employed in the ELG work done by Zapata and Gil (1998). Equations (4) and (5) can be respectively expressed below, which include the error-correction term ( $\varepsilon_{t-1}$ ):

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^p \alpha_{1i} \Delta GDP_{t-i} + \sum_{i=1}^p \alpha_{2i} \Delta EXP_{t-i} + \sum_{i=1}^p \alpha_{3i} \Delta GFCF_{t-i} + \sum_{i=1}^p \alpha_{4i} \Delta RER_{t-i} - \rho_1 \varepsilon_{t-1} + \mu_t, \quad (\text{Eq.6})$$

$$\Delta EXP_t = \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta GDP_{t-i} + \sum_{i=1}^p \beta_{2i} \Delta EXP_{t-i} + \sum_{i=1}^p \beta_{3i} \Delta GFCF_{t-i} + \sum_{i=1}^p \beta_{4i} \Delta RER_{t-i} - \rho_2 \varepsilon_{t-1} + \mu_t, \quad (\text{Eq.7})$$

The error-correction term,  $\varepsilon_{t-1}$ , is the lagged residual series obtained from the cointegrating relation estimated in step 2 above. The estimated coefficients of  $\varepsilon_{t-1}$  ( $\rho_1, \rho_2$ ) are expected to respectively capture the adjustments of  $\Delta GDP_t$  and  $\Delta EXP_t$  towards long-run equilibrium. That is, these coefficients determine whether there is an inherent mechanism that correct deviations in economic growth and export growth back to equilibrium very quickly. The parameters ( $\beta_1, \beta_2, \dots, \beta_4$ , and  $\alpha_1, \alpha_2, \dots, \alpha_4$ ) are expected to capture the short-run dynamics of

the model, that is, the coefficients determine whether GDP, EXP, GFCF and RER have a temporary or short-run relationship. The structure lag is determined by using Schwartz Bayesian criterion (SBC). Wald test is used to examine the causality between predetermined and dependent variables.

Six non-causality hypotheses are tested in this study, namely: 1) exports do not cause economic growth, 2) economic growth does not cause exports, 3) exports do not long-run cause economic growth, 4) economic growth does not long-run cause exports, 5) exports do not short-run cause economic growth, and 6) economic growth does not short-run cause exports. Detailed discussion is done in the sections that follow (objective 2).

- **Exports Do Not Cause Economic Growth**

This hypothesis means a test on the coefficients of exports in Equation (6).

$$H_0: \alpha_{21} = \alpha_{22} \dots = \alpha_{2p} = \rho_1 = 0.$$

- **Economic Growth Does Not Cause Exports**

This hypothesis means a test on the coefficients of GDP in Equation (7). Economic growth is assumed to cause export growth if the joint test in the corresponding coefficients is significant.

$$H_0: \beta_{11} = \beta_{12} \dots = \beta_{1p} = \rho_2 = 0.$$

- **Exports Do Not Long-run Cause Economic Growth**

The cointegration between two or more variables is already sufficient to indicate the presence of causality at least in one direction (Granger 1988). Hence, long-run non-causality shall be tested if cointegration is present. This hypothesis means that there is no significant cointegrating relation in Equation (6).

$$H_0: \rho_1 = 0.$$

- **Economic Growth does not Cause Long-run Exports**

This hypothesis means that  $\rho_2$  in Equation (7) does not have significant cointegrating relation, as follows:

$$H_0 \rho_2 = 0.$$

- **Exports Do Not Short-run Cause Economic Growth**

This hypothesis means that coefficients of exports in Equation (6) do not have a significant effect on GDP:

$$H_0: \alpha_{21} = \alpha_{22} \dots = \alpha_{2p} = 0.$$

- **Economic Growth Does Not Short-run Cause Exports**

This hypothesis means that the coefficients of GDP ( $\beta_{1i}$ ) in Equation (7) do not have a significant effect on exports (EXP):

$$H_0: \beta_{11} = \beta_{12} \dots = \beta_{1p} = 0.$$

### **3.2.2. Semiparametric Method**

In this paper, the export-led growth hypothesis is investigated using the same Philippine economic data by estimating a semiparametric ECM. This estimation procedure combines the benefits of parametric and nonparametric approaches. Parametric test procedures are those that involve estimation of parameters and require a set of assumptions about the underlying functional forms. Nonparametric test procedures, on the other hand, are more flexible and not concerned with the estimation of parameters. Nonparametric approaches have the following major distinct advantages over the parametric approach: 1) for small sample sizes they are easy to apply; 2) they make fewer and less stringent assumptions than their parametric counterparts; and 3) depending on the particular procedure, they may be almost as powerful as the corresponding parametric procedure when the assumptions of the

latter are met, and when this is not the case, they are generally more powerful. However, there are also primary disadvantages to nonparametric estimation. Because the procedures are nonparametric, there are no parameters to describe and it becomes more difficult to make quantitative statements about the actual difference between populations. Furthermore, if the assumptions of the parametric methods can be met, it is generally more efficient to use them. Nonparametric estimators also require large sample sizes to be accurate when the number of explanatory variables is large. But data manipulations for large sample sizes tend to become more laborious.

In semiparametric specification, efficiency is improved by specifying a parametric portion of the model for those characteristics whose effects on the dependent variable are expected to be linear, and a nonparametric portion for those expected to be nonlinear. The strength of this method lies in the fact that one does not need to specify a parametric form for the nonlinearity part. Thus, this method allows for the estimation of a regression function with flexible functional form, and is computationally much easier than most of nonlinear regression models (Bachmeier and Li, 2002).

Studies have shown that there is a nonlinear relationship between exports and exchange rates and that the behavior of real exchange rates is non-linear. In this study, the effects of exchange rates on GDP are modeled nonparametrically whereas the effects of other variables (EXP, GFCF, error correction term) are modeled parametrically.

The same time series properties (stationarity, lag length, etc.) previously determined for all parametric variables are used. For the nonparametric variable, however, the generalized cross-validation (Craven and Wahba, 1979) is used to determine the number of lags to be included in the estimation of the semiparametric ECM. Results of the ELG



hypothesis tests following a semiparametric approach is compared with results of the ELG hypothesis using the parametric model (Objective 2).

Based on the model described by Robinson (1988), the parametric error-correction models written as equations (4)<sup>11</sup> and (5)<sup>12</sup> can be respectively expressed as semiparametric error correction models as follows:

$$\Delta GDP_t = \alpha + \alpha_1 \Delta GDP_{t-1} + \alpha_2 \Delta EXP_{t-1} + \alpha_4 \Delta GFCF_{t-1} - \rho_1 \varepsilon_{t-1} + f_1(RER) + \mu_{1t} \quad (\text{Eq. 8})$$

$$\Delta EXP_t = \beta + \beta_1 \Delta GDP_{t-1} + \beta_2 \Delta EXP_{t-1} + \beta_4 \Delta GFCF_{t-1} - \rho_2 \varepsilon_{t-1} + f_2(RER) + \mu_{2t} \quad (\text{Eq.9})$$

Taking the conditional expectations for both sides of equation (8) will result to equation (10) below:

$$E(\Delta GDP_t | RER_t) = \alpha_1 E(\Delta GDP_{t-1} | RER_t) + \alpha_2 E(\Delta EXP_{t-1} | RER_t) + \alpha_4 E(\Delta GFCF_{t-1} | RER_t) - \rho_1 E(\varepsilon_{t-1} | RER_t) + f(RER_t) \quad (\text{Eq.10})$$

Subtracting equation (10) from equation (8) results to equation (11) as follows:

$$\Delta GDP_t - E(\Delta GDP_t | RER_t) = \alpha_1 (\Delta GDP_{t-1} - E(\Delta GDP_{t-1} | RER_t)) + \alpha_2 (\Delta EXP_{t-1} - E(\Delta EXP_{t-1} | RER_t)) + \alpha_4 (\Delta GFCF_{t-1} - E(\Delta GFCF_{t-1} | RER_t)) - \rho_1 (\varepsilon_{t-1} - E(\varepsilon_{t-1} | RER_t)). \quad (\text{Eq.11})$$

Following Robinson (1988), the steps below are carried out in estimating  $\alpha_1, \alpha_2, \alpha_3, \rho_1$  and  $f(RER_t)$ .

1. The unknown conditional means,  $E(\Delta GDP_t | RER_t)$ ,  $E(\Delta EXP_{t-1} | RER_t)$  and  $E(\Delta GFCF_{t-1} | RER_t)$ , in equation (10) are estimated using a nonparametric estimation technique.
2. These estimates are substituted in place of the unknown functions in equation (10) and the coefficients  $\alpha_1, \alpha_2, \alpha_3$ , and  $\rho_1$  are estimated using OLS.

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<sup>11</sup>  $\Delta GDP_t = \alpha + \alpha_1 \Delta GDP_{t-1} + \alpha_2 \Delta EXP_{t-1} + \alpha_3 \Delta RER_{t-1} + \alpha_4 \Delta GFCF_{t-1} - \rho_1 \varepsilon_{t-1} + \mu_{1t} \quad (\text{Eq. 4}).$

<sup>12</sup>  $\Delta EXP_t = \beta + \beta_1 \Delta GDP_{t-1} + \beta_2 \Delta EXP_{t-1} + \beta_3 \Delta (RER_{t-1}) + \beta_4 \Delta GFCF_{t-1} - \rho_2 \varepsilon_{t-1} + \mu_{2t} \quad (\text{Eq. 5}).$

3. Substitute the estimated  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$ , and  $\rho_1$  to equation (8) and estimate  $f(RER_t)$  using nonparametric regression.

The semiparametric ECM is applied to the export equation (Eq. 9) as well. Granger-causality tests to determine the causal relation between exports (EXP) and GDP in the semiparametric ECMs is also carried out. This test involves using an  $F$ -test to test whether lagged information on a dependent variable (GDP) provides any statistically significant information about an independent variable (EXP) in the presence of lagged  $EXP$ . If not, then "GDP does not Granger-cause EXP."

To accomplish objective 3, the parametric and semiparametric methods previously outlined in the methodology sections are followed using quarterly data. Quarterly data on real effective exchange rate index are the averages during the quarter while exports of goods and services, gross fixed capital formation and GDP are the total values at the end of the quarter.

## CHAPTER 4

### RESULTS AND DISCUSSION

This study used time series data on real GDP, real exports of good and services, real effective exchange rate index and gross-fixed capital formation to test the export-led growth hypothesis in the Philippines. Real effective exchange rate is the nominal effective exchange rate<sup>13</sup> divided by a price deflator or index of costs. The sample period chosen for this study was from 1981-2004 and 1981:1-2004:4 for annual and quarterly analysis, respectively. The logs of the variables are taken so that the differences can be easily interpreted as growth rates.

Data were obtained online from the website of the international monetary fund – international financial statistics. Data on real effective exchange rates are expressed as an index and represent the averages during the period (i.e., quarterly or annual average). Exports of goods and services, GDP and gross fixed capital formation are measured in terms of billions of Philippine pesos. Real values were calculated using consumer price index, 2000=100.

#### 4.1. Descriptive Analysis

Table 1 shows the descriptive statistics of macroeconomic variables analyze in this study for both annual and quarterly data, while Figure 1 graph them over time.

##### 4.1.1. Annual Data

##### 4.1.1.1. Real Effective Exchange Rate Index (REER)

Annual real effective exchange rate index from 1981-2004 has an average of 109.50 with the highest recorded at 154.08 in 1982 and the lowest at 79.56 in 2004. This variable

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<sup>13</sup>Against the U.S. dollar, the Japanese yen, the euro, and the British pound.

followed a downward trend during the period of analysis as depicted in Figure 1, graph (a). As of end-of December 2003, the Philippine peso (which closed at PhP 55.50/U.S.\$) had weakened by 4.7% year-on-year and by more than 110% vis-à-vis the U.S. dollar since mid-1997, reflecting uncertainties over export and balance of payments, resurgent peace and order worries, and political uncertainties in the run-up to the May 2004 election<sup>14</sup>. Figure 2 shows the monthly Philippine peso per US dollar rate from January 1997 to July 2005 while Appendix 3 shows the monthly average exchange rate from January 2003 to July 2005.

Table 1. Descriptive Statistics for Philippine GDP, Exports, GFCF and REER, Annual and Quarterly Data.

<b>Annual (1981-2004)</b>							
Descriptive Statistics	GFCF (PhP)	Exports		Gross Domestic Product (GDP)		Real Effective Exchange Rate (REER)	
		Real (PhP)	Growth Rates (%)	Real (PhP)	Growth Rates (%)	Index	Growth Rates (%)
Mean	539.98	997.02	6.64	2588.58	3.29	19.23	-2.71
Std. Dev.	118.01	559.78	9.39	629.49	4.68	109.53	9.61
Min.	297.03	387.30	-12.58	1805.41	-12.22	79.56	-24.83
Max.	713.09	2024.00	24.60	3929.64	10.04	154.08	10.11
<b>Quarterly (1981:1-2004:4)</b>							
Mean	129.89	242.99	1.69	646.57	0.78	109.54	-0.63
Std. Dev.	30.80	138.93	9.47	147.54	10.09	19.41	4.99
Min.	51.31	78.85	-24.90	429.91	-18.49	77.7	-15.81
Max.	184.58	532.88	24.18	1071.69	18.34	158.09	12.83

Note: Real GFCF, Exports and GDP are measured in terms of Philippine pesos (PhP) in billions with 2000=100

<sup>14</sup> Background Note: Philippines. [www.state.gov/r/pa/ei/bgn/2794.htm](http://www.state.gov/r/pa/ei/bgn/2794.htm). Bureau of Public Affairs. U.S. Department of State.



Figure 1. Philippine Annual Exchange Rates, Exports, GDP and GFCF, 1981-2004.

#### 4.1.1.2. Exports of Goods and Services

The real export of goods and services also followed an upward trend (graph (b), Figure 1) since 1981 with an average of PhP 997.02 billion per year. The highest export of goods and services was recorded in 2004 when the country exported a total of PhP 2,024.00 billion in real terms. The lowest observation for export was in 1982 when in real terms the country only exported PhP 387.30 billion.



Figure 2. Monthly Philippine Peso per US\$ Dollar Rate<sup>15</sup> (January 1997-July 2005).

#### 4.1.1.2.1. Traditional Exports Led in 2004

Figure 3 shows the growth of Philippine merchandise exports for the year 2004 while Table 2 reflects the share of each product category to total Philippine exports in 2004. Industrial manufactures, which accounted for three-fourths of total exports, inched up by 12.53% (see Figure 3). Electronics contributed 67.35% of the country's exports product amounting US\$ 26,727 million. Machinery and transport equipment reached US \$2,409 million.

In 2004, consumer manufactures which is the second largest contributor to Philippine exports (8.64%) decreased by 2.65% from 2003. It hit US \$ 3,438 million with the garment producers leading the group.

The local food producers shipped some US\$ 1,574 million worth of goods for a 0.51% growth from 2003 to 2004. Exports of processed food led the group in 2004. Resource-based products which include traditional exports like coconut, minerals, forest

<sup>15</sup> Source: National Statistic Coordination Board, <http://www.nscb.gov.ph/stats/pesodollar.asp>.

products, posted the highest growth rate from 2003-2004 (14.01%) making this group the export leader in 2004. Coconut producers shipped some US\$584 million worth of coconut products. Petroleum and mineral products contributed 1.02% and 0.91%, respectively to the Philippine exports in 2004.

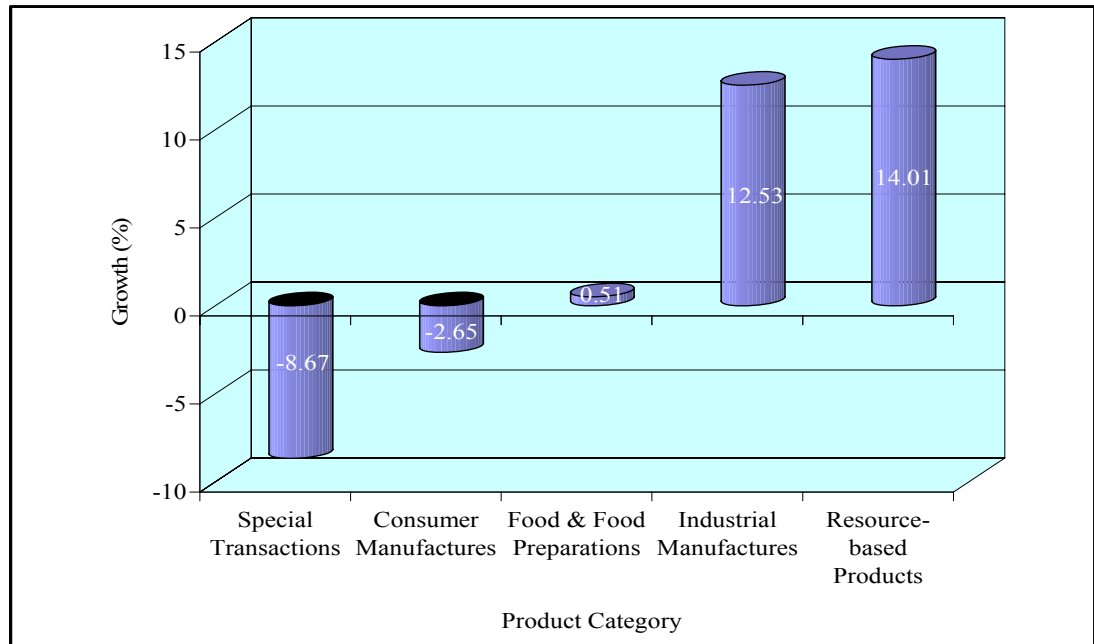


Figure 3. Growth of Philippine Exports, 2003-2004 (%).

#### 4.1.1.3. Gross Domestic Product (GDP)

The annual average real GDP for the Philippines from 1981-2004 is PhP 2,588.58. It followed a general upward trend (graph (c), Figure 1), reaching highest in 2004 (PhP3,929.64 billion) and lowest in 1985 (PhP 1,805.41 billion). Philippine GDP grew by 6.11% in 2004, up from 4 ¾% in 2003 exceeding growth expectations. Important determinants of the growth include beneficial international economic relation, favorable weather and growth in all regions. Although remittances by overseas workers rose by 11.8% to \$8.5 billion, gross

national product (GNP) grew by the same amount as GDP. This was due to increasing external debt service payments, which lowered net factor income growth to 4.9% in 2004 from 17.9% the previous year. Growth in personal consumption expenditure, accounting for about two thirds of aggregate demand, accelerated to 5.9% from 5.3% - higher farm output, stronger remittances from overseas workers, and booming demand for telecommunications services were the largest contributors.

Table 2. Philippine Merchandise Exports, 2004.

<b>Product Category</b>	<b>FOB (US \$)</b>	<b>Share (%)</b>
<b>Consumer Manufactures</b>	<b>3,428,158,320</b>	<b>8.64</b>
Garments	2,084,518,948	5.25
Housewares	170,235,678	0.43
Others <sup>16</sup>	1,173,403,694	2.96
<b>Food and Food Preparations</b>	<b>1,574,267,773</b>	<b>3.97</b>
Processed Foods	731,677,740	1.84
Fresh Food	431,159,663	1.09
Marine Products	411,430,370	1.04
<b>Resource-based Products</b>	<b>2,509,295,737</b>	<b>6.32</b>
Coconut Products	584,258,320	1.47
Mineral Products	359,707,890	0.91
Petroleum Products	406,007,959	1.02
Others <sup>17</sup>	522,249,344	2.83
<b>Industrial Manufactures</b>	<b>30,448,761,122</b>	<b>76.73</b>
Electronics	26,726,077,443	67.35
Machineries/Transport Equipment/Apparatus & Parts	2,409,389,575	6.07
Others <sup>18</sup>	1,313,294,104	3.32
<b>Special Transactions</b>	<b>1,720,037,528</b>	<b>4.33</b>

<sup>16</sup> Include holiday decorations, toys and dolls, fashion accessories, furniture, footwear, builders' woodwork, woodproducts, giftware and other consumer products.

<sup>17</sup> Include tobacco, seaweed, carageenan, cutflowers/ornamental plants, marble products, textile yarns, non-metallic minerals and other resource-based products.

<sup>18</sup> Include metal manufactures, construction materials, chemicals and packaging products.



Government consumption expenditure declined by 0.8 % in 2004 while growth of fixed capital formation accelerated to 5.1% from 2.9% due to stronger private investment. A 6.2% expansion was reached in 2004 for investment in construction from the 2.9% decline in 2003. Table 3 presents the per capita GDP, GNP and personal expenditure for the 3<sup>rd</sup> quarter of 2004 and 2005.

Table 3. Per Capita: Philippine GNP, GDP and Personal Consumption Expenditure, 3<sup>rd</sup> Qtr 2005 and 2004.

Type of Expenditure	3 <sup>rd</sup> Qtr 2005	3 <sup>rd</sup> Qtr 2004	Growth Rates
<b>A. Estimates in current pesos</b>			
GDP	15,468	14,298	8.2
GNP	16,863	15,260	10.5
Personal Consumption Expenditure	10,965	9,951	10.2
<b>B. Estimates in Constant (1985) pesos</b>			
GDP	3,403	3,336	2.0
GNP	3,737	3,582	4.3
Personal Consumption Expenditure	2,719	2,649	2.6

Source: National Statistical Coordination Board, Philippines website: <http://www.nscb.gov.ph>

#### 4.1.1.4. Gross Fixed Capital Formation (GFCF)

Annual GFCF with 2000=100, from 1981-2004 has an average of PhP 539.98 billion with a maximum value of PhP 713.09 billion recorded in 1997 and lowest in 1985 with a value of PhP 297.029 billion. This variable followed a fluctuating trend during the period of analysis as shown in graph (d), Figure 1.

For the third quarter of 2005, investments in fixed capital formation fell by 3.8 percent from a marginal growth of 3.6 growth in the previous year as investments in all its subsectors declined during the period.

#### **4.1.2. Quarterly Data**

Figure 4 shows the quarterly real GDP, real exports, real effective exchange rates and quarterly real GFCF with 2000=100 for the period of analysis (1981:1-2004:4). It can be noticed that exports and GDP are trending upward as real effective exchange rates index are trending downwards. Quarterly REER had a mean of 105.54 attaining highest in 1982 (158.09) and registering lowest exchange rates in the first quarter of 2004 (77.70). The country exported a quarterly average of PhP 997.02 billion during the period of analysis. Gross domestic product and GFCF had a quarterly average of PhP 2588.58 and PhP 539.98 billion, respectively.

The standard deviation of the REER which is also a measure of the volatility of exchange rates is 19.41. Covariance matrix for quarterly data (Appendix 4) shows that the covariance between REER and GDP is -1731.86 and -1643.37 between REER and exports. These negative relationships are further confirmed by their correlation coefficients which are respectively, -0.60, -0.61 (Table 4). These are significant at 5% level of significance as suggested by their p-values lesser than 5%. These economic variables when correlated with time have coefficients ranging from 0.70-0.94 and all significant at 5% level.

#### **4.2. Correlation Coefficients**

The correlation coefficients for the four macroeconomic indicators of the Philippines are given in Table 4 with their respective p-values in parentheses. The correlation coefficient between the Philippine real exchange rate and the annual GDP is -0.65, which follows that as

exchange rate increases (devalues), the GDP decreases with a significant p-value of 0.0005. The REER is also negatively correlated with GFCF and exports. It has significant correlation with exports at 5% level but not with GFCF.

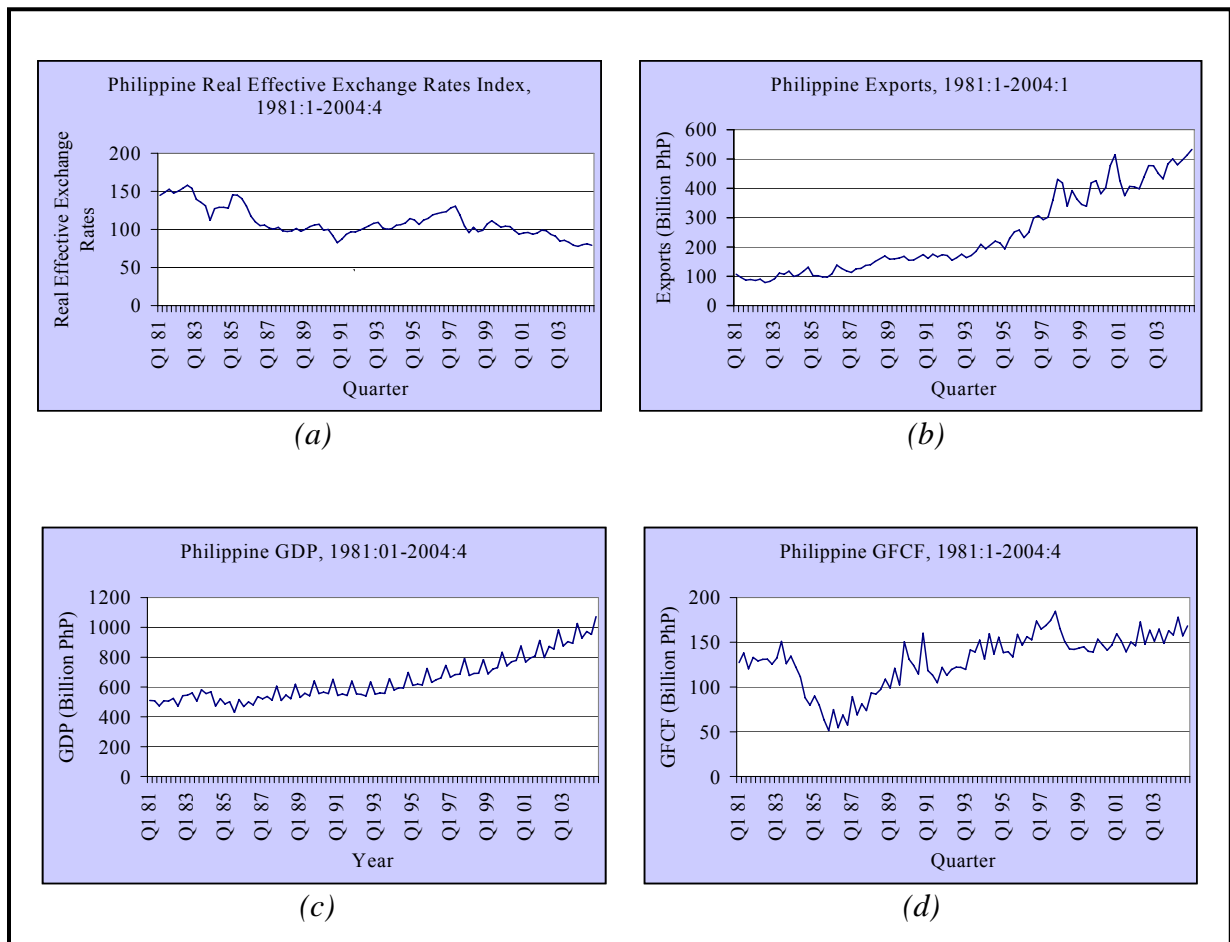


Figure 4. Philippine Quarterly Exchange Rates, Exports, GDP and GFCF, 1981:1-2004:4.

There is a positive correlation coefficient between GFCF and GDP (0.73); GFCF and exports (0.72) and GDP and exports (0.98). There are significant relationships between these variables at 5% level as revealed by p-values that are less than 0.0001 for all coefficients. In addition, these variables also increase with time as exhibited by a positive correlation

coefficient between GFCF and time (0.67); exports and time (0.99) and GDP and time (0.95), all significant at 5% level as revealed by p-values of less than 0.0001.

Table 4. Correlation Coefficients of Four Philippine Macroeconomic Variables, 1981-2004.

<b>Annual (1981-2004)</b>					
	GFCF	Exports	GDP	REER	Time
GFCF	1.000	.720 (<.0001)	0.730 (<.0001)	-0.216 (.309)	0.670 (.0003)
Exports	.720 (<.0001)	1.000	0.980 (<.0001)	0-.590 (0.002)	0.990 (<.0001)
GDP	.730 (<.0001)	0.990 (<.0001)	1.000	-0.650 (0.0005)	0.950 (<.0001)
REER	-0.216 (.309)	0-.590 (0.0020)	-0.650 (0.0005)	1.000	0.720 (<.0001)
Time	.670 (.0003)	0.940 (<.0001)	0.950 (<.0001)	0.720 (<.0001)	1.000
<b>Quarterly (1981:1-2004:4)</b>					
	GFCF	Exports	GDP	REER	Time
GFCF	1.000	0.670 (<.0001)	0.691 (<.0001)	-0.228 (.0251)	0.659 (<.0001)
Exports	0.670 (<.0001)	1.000	0.940 (<.0001)	0.610 (<.0001)	0.940 (<.0001)
GDP	0.691 (<.0001)	0.940 (<.0001)	1.000	-0.600 (<.0001)	0.890 (<.0001)
REER	-0.229 (.0251)	0.610 (<.0001)	-0.600 (<.0001)	1.000	-0.700 (<.0001)
Time	0.659 (<.0001)	0.940 (<.0001)	0.890 (<.0001)	-0.700 (<.0001)	1.000

Note: Figures in parentheses are the p-values.

There is a positive correlation coefficient between GFCF and GDP (0.73); GFCF and exports (0.72) and GDP and exports (0.98). There are significant relationships between these variables at 5% level as revealed by p-values that are less than 0.0001 for all coefficients. In addition, these variables also increase with time as exhibited by a positive correlation coefficient between GFCF and time (0.67); exports and time (0.99); and GDP and time (0.95), all significant at 5% level as revealed by p-values of less than 0.0001.

It is obvious that the same conclusion is reached when using quarterly data except for the correlation coefficient between exchange rates and gross fixed capital formation which is significant using quarterly data but otherwise using annual data.

### 4.3. Growth Rates

#### 4.3.1. Annual

##### 4.3.1.1. Real Effective Exchange Rates and Exports

Annual growth rates of real effective exchange rates and exports are graphed in Figure 5. As exchange rate decreases, exports in real terms increase. But the relationship is not significant at 5% level (i.e., negative correlation coefficient of -0.26 with p-value=0.223). The growth rates of these variables (REER and Exports) have significant and positive correlation with time (p-value = <0.0001).

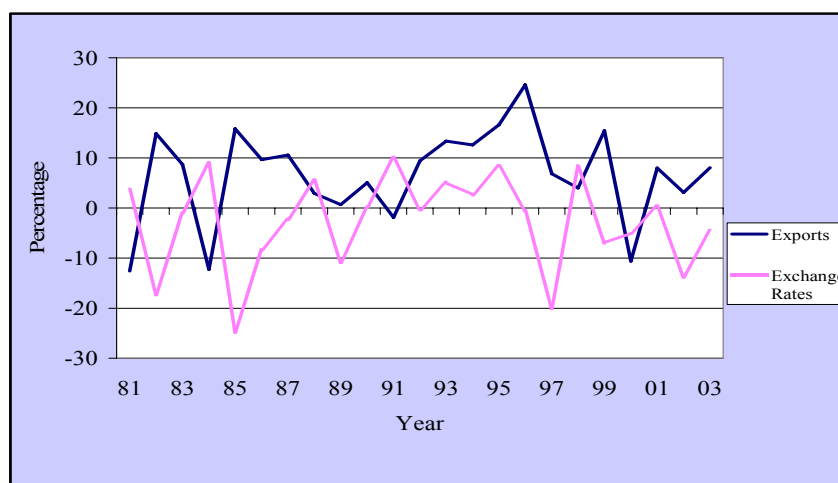


Figure 5. Philippine Annual Growth Rates of REER and Real Exports, 1981-2004.

##### 4.3.1.2. Real GDP and Exports

Figure 6 reflects the annual growth rates (in percent) of real GDP and exports. Average annual exports and GDP growth for the period covered was 6.64% and 3.29%,

respectively. Highest GDP growth was in 1983 when it grew by 10.04% from the previous year. In 1985, it recorded its lowest growth when GDP declined by 12.22% from the earlier year. In 1998, a year after the Asian crisis, GDP increased only by a small percentage from the previous year (0.51%). During the years after large devaluations, 1984 and 1985, GDP declined. The growth in export of goods and services hit the highest during the period reported (1981-2004) when exports increased from PhP 1,117.88 billion in 1996 to PhP 1,429.66 billion in 1997, an improvement by 24.60 percent while it declined lowest in percentage (-12.58) in 1985.

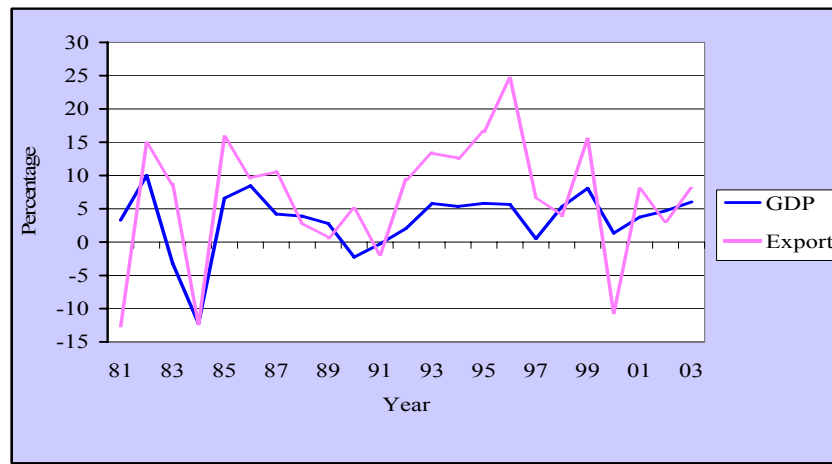


Figure 6. Philippine Annual Growth Rates of Real GDP and Exports, 1981-2004.

The correlation coefficient between time and exports and GDP are 0.16 and 0.23, respectively. At 5% level of significance, correlation between time and exports are not significant and between time and GDP (p-values = 0.462 and 0.3008, respectively). Furthermore, annual growth rates of GDP and REER are correlated in a negative and insignificant manner at 5% level of significance (i.e. coefficient = -0.35, p-value = 0.099).

### 4.3.2. Quarterly Data

#### 4.3.2.1. Real Effective Exchange Rates and Exports

Figure 7 is the quarterly growth rates of REER and exports plotted against time. It can be observed that these variables tend to move in opposite direction during a given quarter. Such observation can be confirmed by a negative correlation coefficient between them (-0.51). It also has a significant correlation at 5% level of significance since p-values < 0.0001. However, quarterly growth rates of the real effective exchange rates have a positive and significant correlation with time (0.959) as p-values = 0.005. The same is true with the growth rates of exports.

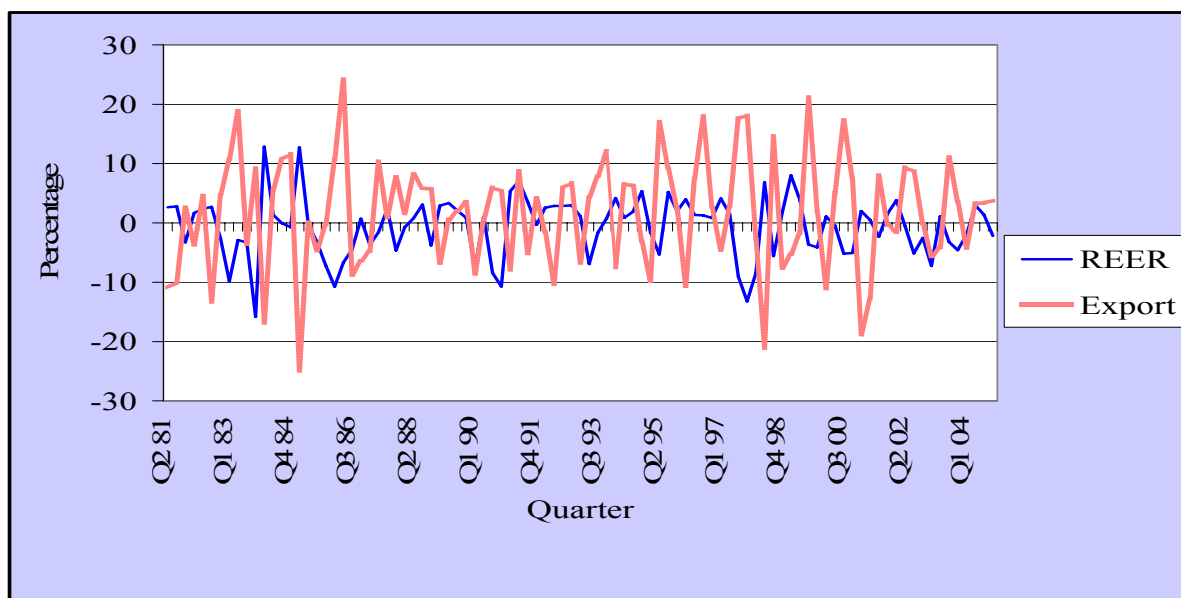


Figure 7. Philippine Quarterly Growth Rates of Real Exports and REER, 1981:1-2004:4.

The standard deviation of the growth rates of exchange rates can be compared to determine the exchange rate volatility. It can be noted that the quarterly REER is more volatile than the annual REER as suggested by a lower standard deviation of quarterly REER (4.99) than annual REER (9.61).

### 4.3.2.2. Real GDP and Exports

The growth of quarterly real exports and real GDP is graphed in Figure 8. Exports increased at a maximum from the previous quarter by 24.18% during the 2<sup>nd</sup> quarter of 1986. It declined lowest from the previous by a more or less half of the same percentage of the maximum growth in exports (-12.58%) during the first quarter of 1985. Correlation coefficient between the growth rates of exports and GDP is 0.39 with a p-value <0.0001, hence significant at 5% level. At 5% level of significance, correlations between exports and time (0.007) and between GDP and time (0.06) are not significant as suggested by p-values of 0.94, 0.58, respectively.

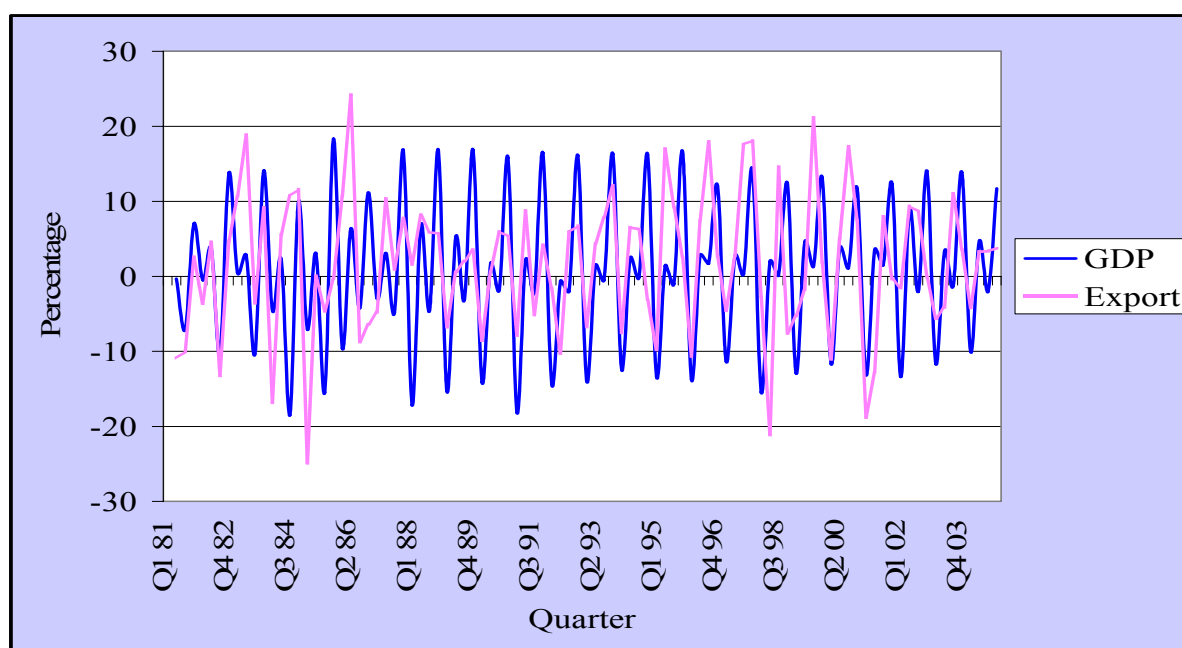


Figure 8. Philippine Quarterly Growth Rates of Real GDP and Exports, 1981:1-2004:4.

### 4.4. Contribution of Exports to GDP

The contribution of exports to GDP is graphed in Figure 9 as a percentage to GDP with an annual mean of 31.91% from 1981-2004. It contributed most in the year 2000,



55.40%, and the least in 1982, with only 20.33%. The contribution generally followed an upward trend.

#### 4.5. Analysis of Time Series Properties

##### 4.5.1. Unit Root Tests

Real GDP and exports of goods and services, gross fixed capital formation and real effective exchange rates are the time series variables considered in this study. These variables must be stationary or cointegrated in order to avoid a spurious regression<sup>19</sup> situation. Hence, the unit roots tests are first conducted on these time-series to investigate whether they are stationary or not.

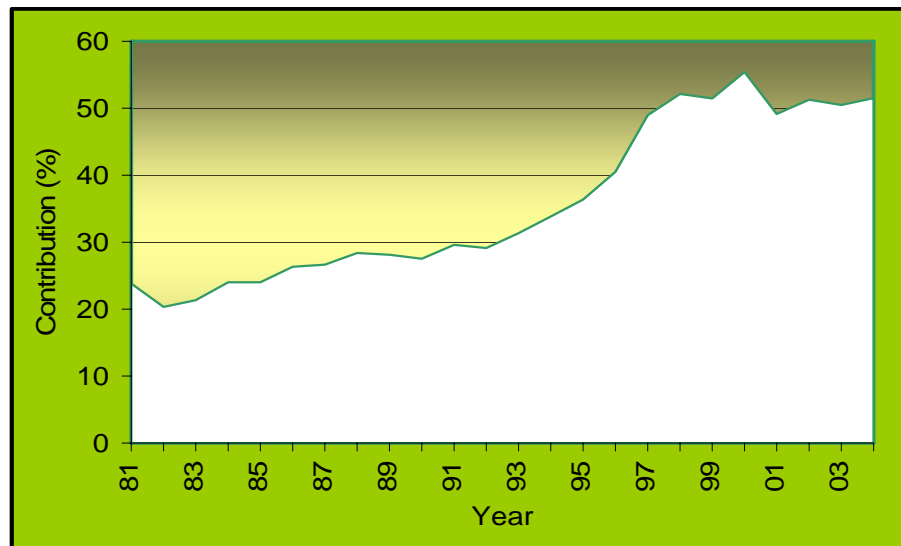


Figure 9. Contribution of Philippine Exports to GDP, 1981-2004 (%).

The unit root test used in this study is the Philips-Perron (PP) test. The regression equations are:

$$\Delta Y_t = \delta_0 + \delta_1 Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-1} + \mu_t, \quad (\text{Eq. 13})$$

<sup>19</sup>Spurious regression has a high  $R^2$ , t-statistics that appear to be significant, but the results are without economic meaning (Enders, 1995).

$$\Delta Y_t = \delta_0 + \delta_1 Y_{t-1} + \delta_2 t + \alpha_i \sum_{i=1}^m \Delta Y_{t-1} + \mu_t, \quad (\text{Eq. 14})$$

where  $\mu_t$  is the white noise. The additional lagged terms,  $m$ , are included to ensure that the errors are uncorrelated. Equation (13) is a model with constant and no trend and (14) is one with-constant and a trend.

#### 4.5.1.1. Annual Data

Table 5 is the result of the unit root test for the Philippine annual data (1981-2004) collected from the IMF-IFS webpage<sup>20</sup>. Column 1 indicates the regression equations used in testing the null hypothesis in column 2. The null hypotheses are as follows: 1) null hypothesis of a unit root ( $\delta_1 = 0$ ) and 2) null hypothesis that the trend term is equal to zero given the presence of a unit root ( $\delta_1 = \delta_2 = 0$ ). Column 3 is the critical value at 10% level of significance. The last major column is the variable under investigation. The test-statistic sub-column is the computed statistics and it is compared with the critical value column to arrive to a conclusion that is indicated in the conclusion sub-column.

Phillips-Perron (PP) unit root test was employed to test for the stationarity of the macroeconomic time series. The results of PP unit root test for the variables in levels are reported in Table 5. It shows that the t-test statistics for all series from PP tests are statistically not significant to reject the null hypothesis of non-stationary at 0.10 significance level. This indicates that these series are non-stationary at their level forms. Therefore, these variables contain a unit root process or they share a common stochastic movement. The

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<sup>20</sup> Accessed on November 2005 (<http://ifs.apdi.net/imf/logon.aspx>).

discussion for unit root test for each variable under investigation is done in the succeeding sections.

Table 5 . Results of the PP Unit Root Tests for the Variables in the ELG Hypothesis Test for the Philippines, Annual Data.

Equation	Null Hypothesis $H_0$	Critical Value at 10% level	Variable							
			GDP		Exports		GFCF		Exchange rate	
			Test-Stat	Conclusion	Test-Stat	Conclusion	Test-Stat	Conclusion	Test-Stat	Conclusion
(14)	$\delta_1 = 0$	-3.13	-1.978	I(1)	-2.579	I(1)	-2.430	I(1)	-2.018	I(1)
(14)	$\delta_1 = \delta_2 = 0$	5.34	2.524	I(0)	3.676	I(0)	3.111	I(0)	2.021	I(0)
(13)	$\delta_1 = 0$	-2.57	0.501	I(1)	0.285	I(1)	-1.572	I(1)	-1.425	I(1)

#### 4.5.1.1.1. GDP

The power of the test maybe reduced due to the presence of unnecessary time trend and/or constant term. Therefore, the presence of the significance of the time trend is tested given the presence of a unit root. This is done by testing the null hypothesis that  $\delta_1 = \delta_2 = 0$ . The t-test statistic is lesser than the critical value at 10% level suggesting that the null hypothesis can be rejected. Thus, time trend is significant. From Equation 14, the t-test statistic for the null hypothesis  $\delta_1=0$  is -1.978. Critical value at 10% level of significance in the given number of observations is -3.13. Hence, it is not possible to reject the null of  $\delta_1=0$  and conclude that the series is nonstationary. Therefore, the variable is integrated of order 1. The model is estimated with a trend (i.e., in the form of equation 13). The t-test statistic is greater than the critical value at 10% level (.501 > -2.57). Hence, the null hypothesis of  $\delta_1=0$  can not be rejected and conclude that the series is integrated of order 1.

#### **4.5.1.1.2. Exports of Goods and Services**

Using equation 14, the null hypothesis of a unit root  $\delta_1=0$ , cannot be rejected at 10% level of significance since t-test statistic = -2.579 > critical value = -3.13. The exports series, thus contain a unit root and is an I (1) process.

The test for the significance of time trend  $\delta_2=0$  is tested to determine if too many regressors were included in equation 14. Given that  $\delta_1=0$ , this can be done by testing the null hypothesis  $\delta_1= \delta_2=0 = 0$ . The null hypothesis that the trend term is equal to zero given the presence of a unit root, can be rejected at 10% level of significance as evidenced by a smaller test statistics than the critical value ( $3.676 < 5.34$ ). It can therefore be concluded that the time trend is significant in equation 14. When equation 13 is estimated, the null hypothesis of nonstationarity cannot be rejected and therefore conclude that the exports series is integrated of order one.

#### **4.5.1.1.3. Gross Fixed Capital Formation (GFCF)**

From Equation 14, the t-test statistic for the null hypothesis  $\delta_1=0$  is -2.430. Critical value at 10% level of significance is -3.13. Therefore, it is not possible to reject the null of  $\delta_1=0$  and conclude that the series is nonstationary or integrated of order 1. The power of the test maybe reduced due to the presence of unnecessary time trend and/or constant term. The presence of the significance of the time trend is tested given the presence of a unit root. This is done by testing the null hypothesis of  $\delta_1= \delta_2= 0$ . The t-test statistic is lesser than the critical value at 10% level suggesting that the null hypothesis can be rejected. The time trend is therefore significant.

Equation 13 is estimated and tested for the presence of unit roots. The null hypothesis of  $\delta_1=0$ , cannot be rejected at 10% level of significance ( i.e. t-statistic  $-1.572 > -2.57$  critical value). Hence, the series is integrated of order one.

#### **4.5.1.1.4. Real Effective Exchange Rates**

Using equation 14, the null hypothesis of a unit root  $\delta_1=0$  cannot be rejected at 10% level of significance since t-test statistic =  $-2.018 >$  critical value =  $-3.13$ . Based on this result, it can be concluded that the exchange rates series contain a unit root and is an I(1) process.

The null hypothesis of  $\delta_1= \delta_2= 0$  is tested to test the significance of the trend term given the presence of a unit root. At 10% level of significance, the null hypothesis can be rejected (test stat =  $2.021 <$  critical value =  $5.34$ ). Hence, the trend term is significant. Equation 13 is estimated (a constant, without a trend). The null of  $\delta_1=0$  cannot be rejected at 10% level of significance and therefore the series is nonstationary.

#### **4.5.1.2. Quarterly Data**

Table 6 presents the result of the unit root tests for quarterly data. It shows that the GDP and exports series are stationary in their level forms but the GFCF and exchange rates are not. Detailed discussion is done below.

##### **4.5.1.1.1. GDP**

In the test of the null hypothesis  $\delta_1=0$  of the model with constant and a time trend (equation 14), it is possible to reject the null hypothesis of nonstationarity of the quarterly logGDP series. This is suggested by a t-test statistic of  $-6.382$  which is smaller than the critical value of  $-3.13$ . But when estimating equation 13, the null hypothesis of no unit root can not rejected, hence, the GDP series is non-stationary.

#### 4.5.1.1.2. Exports of Goods and Services

Using equation 14, the null of unit root is rejected at 10% level of significance. But it is integrated of order 1 when estimating equation 13. Thus, the quarterly data on exports of goods and services does not contain a unit root or stationary.

#### 4.5.1.1.3. Gross Fixed Capital Formation (GFCF)

The null of unit root cannot be rejected in PP unit root test using equation 14 as suggested by a t-test statistic = -2.858 > critical value = -3.13 and conclude that the GFCF series is integrated of order 1. The same conclusion can be reached when equation 13 is estimated. However, the null hypothesis that  $\delta_2 = 0$  given the presence of a unit root, can be rejected, hence, the trend term is significant.

Table 6. Results of PP Unit Root Tests for the Variables in the ELG Hypothesis Test for the Philippines, Quarterly Data.

Equation	Null Hypothesis $H_0$	Critical Value at 10% level	Variable							
			GDP		Exports		GFCF		Exchange rates	
			Test-Stat	Conclusion	Test-Stat	Conclusion	Test-Stat	Conclusion	Test-Stat	Conclusion
(14)	$\delta_1 = 0$	-3.13	-6.382	I(0)	-4.676	I(0)	-2.858	I(1)	-2.181	I(1)
(14)	$\delta_1 = \delta_2 = 0$	5.34	20.539	I(1)	11.126	I(1)	4.106	I(0)	2.389	I(0)
(13)	$\delta_1 = 0$	-2.57	0.731	I(1)	-0.328	I(1)	-1.738	I(1)	-1.523	I(1)

#### 4.5.1.1.4. Real Effective Exchange Rates

Using equation 14, the null hypothesis of a unit root,  $\delta_1=0$ , cannot be rejected at 10% level of significance since t-test statistic = -2.181 > critical value = - 3.13. The same is true

when using equation 13. Thus, the exchange rates series contain a unit root and is I(1) process. The trend term is significant.

#### 4.5.2. Stationarity Test in First Differences

When the DF test is conducted at first difference of each variable using annual and quarterly data, the null hypothesis of non-stationarity is rejected at 0.10 significance level as shown in Table 7 for all the variables examined. This is consistent with some previous studies that demonstrated that most of the macroeconomics and financial series expected to contain unit root and thus are integrated of order one, I(1). Therefore, it can be concluded that the series are integrated of order 1, and a higher order of differencing is not required.

Table 7. Results of the Unit Root Tests on the First Differences of the Variables for Philippine ELG Hypothesis Test.

Variable	Annual		Quarterly	
	Tau Statistics	Pr < Tau	Tau Statistics	Pr < Tau
GDP	-1.78	0.07	-2.90	0.00
Exports	-3.19	0.00	-4.48	<.00
Exchange Rates	-3.65	0.00	-4.53	<.00
GFCF	-4.28	0.00	-3.72	0.00

Note:  $H_0$ : The series is nonstationary in first differences

#### 4.5.3. Correcting for Seasonal Unit Roots

The seasonality of the nonstationary series is treated by estimating a regression equation with quarterly seasonal dummy variables (quarters 1, 2 and 3). Results of stationarity tests indicate that the linear combination is stationary in first differences when

seasonal dummy variables are included in the model. Hence, quarterly data are analyzed with seasonal dummies<sup>21</sup>.

#### **4.6. Lag Order Selection**

Among the various statistical model selection criteria available in the literature, the Schwartz Bayesian Criteria (SBC) is used in this study. The optimal number of lags ( $p$ ) is when the SBC is minimum. The determination of the optimum  $p$  is done by running various ECMs using different lag levels.

Due to small sample size of annual data, no SBC values were provided by SAS output when using lags of 4 to 6 for there is an associated loss of degrees of freedom. For annual data, the SBC is minimum (-19.82) when the model uses 2 lags while it is minimum (-21.16) when the model uses 4 lags for quarterly data. Hence, the SBC identifies a vector autoregressive model of order 2 and 4 for annual and quarterly data, respectively.

#### **4.7. Cointegration Test**

Having confirmed the existence of unit roots for almost all the data series, the next step involves applying Engle-Granger two-step cointegration procedure<sup>22</sup>. The cointegration test was conducted without a deterministic trend in the data since none of the series exhibit apparent trend. Since all four variables in the model are presumed to be jointly determined, the long-run equilibrium regression can be estimated using GDP, exports, exchange rates or GFCF as the “left-hand-side” variable or regressand. The essence of the test is to determine whether the residuals from estimating the long-run equilibrium relationship are stationary. In

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<sup>21</sup> A formal test of the unit roots at various frequencies using the test proposed by Hylleberg, Engle, Granger, and Yoo (HEGY) (1990) were conducted. Results revealed that seasonal dummy variables capture seasonality well.

<sup>22</sup> Johansen and Juselius procedure reported 2 cointegrating vectors. The test was conducted assuming that there is no deterministic trend in the data and that the constant lies within the cointegrating equation.



performing the test, there is no presumption that any one of the residual is preferable than any of the others. Using each of the residual of the four series to estimate an equation in the form of equation (15) below, the estimated values of the lagged of the residuals of the series ( $\alpha_1$ ) and the estimated values of  $\alpha_1$  are given in Table 8.

$$\Delta \hat{\epsilon}_t = \alpha_1 \hat{\epsilon}_{t-1} + \epsilon_t, \quad (\text{Eq. 15})$$

where  $\{\hat{\epsilon}\}$  sequence is a residual from a regression equation.

Using any one of the four equilibrium relations, it can be concluded that at 10% level of significance, the variables are cointegrated of order (1,1) for both annual and quarterly data as shown in Table 8. Based on this test, the economic growth and its macroeconomic determinants exhibit a long-run relationship. This means that real GDP, exports of goods and services, gross fixed capital formation and real effective exchange rates tend to move together over the entire period of analysis (annual and quarterly data).

Table 8. Results of the Cointegration Tests for four Philippine Macroeconomic Variables, 1981-2004.

Regressand	Annual		Quarterly	
	$\alpha_1$	p-value	$\alpha_1$	p-value
GDP	0.329	.075	0.197	0.003
Exports	0.385	.053	0.158	0.008
Exchange Rates	0.508	.011	0.114	0.017
GFCF	0.499	.013	0.069	0.000

#### 4.8. Adequacy of the Selected Econometric Model

##### 4.8.1. Portmanteau Test

According to Lutkepohl *et al.* (1993), the selection of the lag order may be interpreted as a method for determining a filter that transforms data into a white noise series. The

sequence of residuals is a white noise process if each value in the sequence has a mean of zero, a constant variance, and is serially uncorrelated. As long as the residuals of a given model are close enough to white noise, that model can be regarded as appropriately specified (Judge, *et. al*, 1987). The result of the Portmanteau test for residual autocorrelation is reported in Table 9.

Table 9. Portmanteau Test for Residual Autocorrelation of the Selected Model for ELG Hypothesis Test of the Philippines, 1981-2004.

<b>Annual</b>		
To Lag	Chi-Square	P-value
3	45.12	0.0001
4	64.94	0.0005
<b>Quarterly</b>		
6	205.99	<0.0001
12	264.51	<0.0001
18	266.51	<0.0001

Note:  $H_0$ : There is no remaining residual autocorrelation at lags 1 to specified lag length.

The presence of correlation in estimated model usually means that the lag lengths are too short. The portmanteau test checks the null hypothesis that there is no remaining residual autocorrelation at lags 1 to specified lag length against the alternative that at least one of the autocorrelations is nonzero. It can be noticed that the null hypothesis of no residual autocorrelation is rejected both at lags 1 to 3 and at lags 1 to 4 for annual data. For quarterly data, the null hypothesis that there is no remaining residual autocorrelation at lags 1 to 6, 1 to 12 and 1 to 18 can be rejected.

#### 4.8.2. Normality

The hypothesis tests and interval estimates for the coefficients are based on the assumption that the errors, and hence the dependent variable, are normally distributed. The normality of the errors for the model selected is tested using Jarque-Bera test. The rejection of normality may indicate that there are some outlying observations or that the error process is not homoskedastic. Based on the results presented in Table 10, it can be observed that the residuals are normality distributed at 10% level of significance, i.e., p-values > 0.10.

Table 10. Normality Tests for the Residuals of the Selected Model for ELG Hypothesis Test of the Philippines, 1981-2004.

<b>Annual</b>		
Variable	Jarque-Bera Chi-Square	P-value
GDP	2.74	0.2544
Export	1.12	0.5723
Exchange Rates	0.22	0.8958
GFCF	1.23	0.5405
<b>Quarterly</b>		
GDP	3.67	0.1588
Export	2.60	0.2729
Exchange Rates	2.77	0.2506
GFCF	5.64	0.0596

#### 4.9. Parametric Analysis

##### 4.9.1. Long-Run Equilibrium Relationship Estimation

For annual data analysis, equations 16 present parameter estimates (cointegrating vector) that represent long-run elasticities, together with their respective p-values in parentheses. This is presented as equation 17 for quarterly data.

$$\text{GDP} = 5.68 + 0.33\text{Exp} + 0.15\text{GFCF} - 0.21 \text{RER}, \quad (\text{Eq.16})$$

(0.00)    (0.00)    (0.01)    (0.01)    (p-value)

$$\text{GDP} = 4.80 + 0.29 \text{Exp} + 0.12 \text{GFCF} - 0.08 \text{RER} - 0.10\text{D}_1 - 0.08\text{D}_2 - 0.12\text{D}_3, \quad (\text{Eq.17})$$

(0.00)    (0.00)    (0.00)    (0.15)    (0.00)    (0.00)    (0.00)    (p-value)

The equations above indicate that the variables such as exports and gross fixed capital formation are positively correlated with economic growth. These results are as expected from economic theory, i.e., as exports increase, GDP increases. Investment, (proxied by GFCF), can determine long-term growth, so the higher the level of investments, the higher the prospect of economic growth.

From the viewpoint of the classical model, the coefficient of the exchange rates is not consistent with the *a priori* assumption. Classical model suggests that the devaluation of the real exchange rate has expansionary effects on output if the Marshall-Lerner<sup>23</sup> condition is satisfied. This result suggested that the depreciation of the Philippine peso slows down the growth of GDP. The Philippine government has devaluated its currency in order to improve competitiveness of exported goods in the international markets. Such policy may have not work after the 1997 Asian financial crisis as most of currencies in East Asia has already devaluated its currency in which case the depreciation of one country in the region of East Asia may induce contagion effects to other countries as they will also depreciates their currencies to improve international competitiveness (Keong *et al.* 2003). This will not make the country better off.

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<sup>23</sup>The condition that sum of the elasticities of demand for exports and imports exceed one (in absolute value); that is,  $\eta_X + \eta_M > 1$ , where  $\eta_X$ ,  $\eta_M$  are the demand elasticities for a country's exports and imports respectively, both defined to be positive for downward sloping demands. Under certain assumptions, this is the condition for a depreciation to improve the trade balance, for the exchange market to be stable, and for international barter exchange to be stable.

Additionally, the negative effect of the depreciation of exchange rates to GDP validates the contention of Austria (2002) that one major shortcoming of the trade reform was the lack of adjustment of the exchange rates in the face of trade liberalization. Reductions in tariff protection and import restrictions have not been complemented by a consistent exchange rate policy that favors (or is neutral to) exports. The real effective exchange rate depreciated by an average of 46.40 percent during the period 1981-2004; and this helped enhance the competitiveness of the export sector during the early phase of the reforms. However, from 1988 to 1996, the real effective exchange rate continuously appreciated because of the increase in foreign investment. The overvaluation of the currency was inconsistent with the adjustment called for by trade liberalization. It penalized exports and encouraged the growth of imports. Although the East Asian economies all experienced an appreciation of their currency, the Philippines appreciated the most in the 1990s resulting in the loss of its competitiveness vis-à-vis its major competitors in the region (Intal, 1997). The major depreciation experienced by the East Asian economies in 1997 and 1998 was a long overdue correction of the appreciation of the Philippine peso.

It can also be noticed that the effects of exchange rates on GDP using quarterly data is not significant at the 10% percent level of significance as opposed to the significant effect of exchange rates to the annual GDP. The initial changes of the exchange rates may not be felt by the economy during a given quarter since there might be orders that took place in the past and still sold with the previous exchange rates.

#### **4.9.2. The Effect of Excluding the Exchange-Rate Variable**

This study also determines the effect of exchange rates on the ELG hypothesis tests since exchange rates seems to have an impact on economic growth. This might address the

omitted-variables problem cited in previous ELG works. This is done by estimating a regression where the exchange rates variable is not considered as opposed to what have been done in the previous section and testing the ELG hypothesis using this regression. In order to be comparable with previous ELG studies, the determination of the effects of the exchange rates on the relationship between exports and GDP in this study is only done using the parametric approach. The long-run equilibrium relationships are reported as equation 18 and 19 for annual and quarterly analysis, respectively, with the p-values reported in parentheses below coefficient estimates.

$$\text{GDP} = 4.687 + 0.384 \text{ EXP} + 0.0875 \text{ GFCF}, \quad (\text{Eq.18})$$

(0.000)    (0.000)            (0.114)            (p-values)

$$\text{GDP} = 4.393 + 0.309 \text{ EXP} + 0.0988 \text{ GFCF} - 0.0977\text{D}_1 - 0.07618\text{D}_2 - 0.122 \text{ D}_3, \quad (\text{Eq.19})$$

(0.000)    (0.000)            (0.0018)            (0.000)    (0.000)            (0.000)    (p-values)

The signs of the coefficient of exports and gross fixed capital formation are consistent with economic theory which are also true when estimating a regression with the exchange rates variables. In terms of the significance of each coefficient, they are significant at 10% level just like the estimated regression with the exchange rates variable except for the coefficient estimates of annual GFCF which is not significant here as shown in equation 18. While the exchange rates variable appears to have an important effect on annual GDP (Eq. 16), there is little effect on the size of the exports coefficients, (Eq.16 and Eq.17), and the significance is unaffected, by the exclusion of the exchange rates variable (Eq. 18 and Eq. 19).

#### **4.9.3. Error-Correction Model (ECM) Estimation**

Since the four variables are non-stationary, integrated of order one and cointegrated, an ECM can be estimated to account for the long-run relationship. The empirical results of

the estimated ECMs for annual and quarterly analysis are given in Appendix 5. Since the theme of thesis is the ELG hypothesis, the results are not discussed in detail here.

#### **4.9.4. Granger - Causality**

The direction of the causality between exports and GDP can be investigated using Granger causality test. Since cointegration exists, a once-lagged error correction term ( $\rho_1\varepsilon_{t-1}$ ,  $\rho_2\varepsilon_{t-1}$ ) is included in the model to represent long-run causality from independent variables to dependent variables. The short-run causality, on the other hand, is represented by the lagged coefficients of the independent variables. Equations 20 and 21 are used to perform Granger-causality tests for export-led growth and growth-led exports hypotheses, respectively.

$$\Delta\text{GDP}_t = \alpha + \alpha_1\Delta\text{GDP}_{t-1} + \alpha_2\Delta\text{EXP}_{t-1} + \alpha_3\Delta\text{RER}_{t-1} + \alpha_4\Delta\text{GFCF}_{t-1} - \rho_1\varepsilon_{t-1} + \mu_{1t} \quad (\text{Eq.20})$$

$$\Delta\text{EXP}_t = \beta + \beta_1\Delta\text{GDP}_{t-1} + \beta_2\Delta\text{EXP}_{t-1} + \beta_3\Delta\text{RER}_{t-1} + \alpha_4\Delta\text{GFCF}_{t-1} - \rho_2\varepsilon_{t-1} + \mu_{2t} \quad (\text{Eq.21})$$

The Likelihood Ratio (LR) test was used in testing the above Granger-causality hypotheses. Restrictions on short-run, long-run and both were imposed in testing the linkage between exports and economic growth.

##### **4.9.4.1. Exports-Led Growth**

Table 11 presents the result of LR tests for export-led growth hypothesis for the three restrictions under the null hypothesis that exports do not Granger-cause economic growth.

For annual data, the null hypothesis that exports do not cause economic growth can be rejected at 10 percent level of significance for short-run and total causality tests with a p-value of 0.0517 and 0.0371, respectively. However, the null hypothesis that exports do not cause economic growth in the long-run can not be rejected at 10% level of significance as suggested by a p-value of 0.4151. It follows that in the Philippines, exports contribute to

economic growth in the short-run and in totality but not in the long-run using annual data from 1981 to 2004.

Table 11. Parametric Granger-Causality Results for ELG Hypothesis Test for the Philippines, 1981-2004.

Restriction	Annual		Quarterly	
	Chi-Squared	P-value	Chi-Squared	P-value
Short-run	5.9238	0.0517	63.1160	0.0000
Long-run	0.6640	0.4151	65.1901	0.0000
Total	8.4785	0.0371	62.1404	0.0000

Null hypothesis: Exports do not cause economic growth.

Using quarterly data (1981:1 to 2004:4), however, there is evidence of long-run, short-run and total causality from exports to GDP.

#### 4.9.4.2. Growth-Led Exports

The results of LR tests under the null hypothesis that economic growth does not cause exports in the short-run, long-run and both is given in Table 12.

The results of the tests demonstrate that the growth-led export hypothesis is not supported by annual data (1981-2004) in the short-run and long-run with p-values of 0.1835 and 0.2963, respectively. Moreover, in totality, economic growth does not Granger cause export growth. In contrast, quarterly data analysis revealed different results, that is, economic growth causes exports in the short-run, long run and in totality.



Table 12. Parametric Granger-Causality Results for Growth-Led Export (GLE) Hypothesis Test for the Philippines, 1981-2004.

Restriction	Annual		Quarterly	
	Chi-Squared	P-value	Chi-Squared	P-value
Short-run	3.3909	0.1835	72.9413	0.0000
Long-run	1.0908	0.2963	62.2821	0.0000
Total	4.9079	0.1787	73.3764	0.0000

Null hypothesis: Economic growth does not cause exports.

#### 4.9.4.3. Granger-Causality Tests on the Effect of Excluding the Exchange-Rate Variable

To determine how exchange rates affect the ELG hypothesis tests, Granger causality tests were also conducted on the regression without the exchange rates variable. A comparison of the results between the two regressions is presented in Table 13.

Table 13. The Effect of Exchange Rates on ELG Hypothesis Test in the Philippines Using Parametric Procedure, 1981-2004.

Restriction	Annual		Quarterly	
	A	B	A	B
Short-run	Export-led growth	Export-led growth	Bidirectional	Bidirectional
Long-run	No causality	No causality	Bidirectional	Bidirectional
Total	Export-led growth	No causality	Bidirectional	Bidirectional

Note: A represents the regression with the exchange rates variable. The direction of causality is determined using the results presented in Tables 11 and 12. B represents the regression without the exchange rates variable. The separate ELG and GLE hypothesis tests are presented in Appendix 6 and 7.

Based on the results presented in Table 13, the exchange rates variable affect the result of the ELG hypothesis tests only when testing for total Granger causality. That is, total Granger causality following an estimation of a regression with exchange rates variables reported evidence of export-led growth while estimation without the exchange rates variable reported no causal relation between exports and economic growth. But all other causality tests reported the same results for both regressions either using annual and quarterly data.

#### **4.10. Semiparametric Analysis**

The export-led growth hypothesis in the Philippines is also investigated using a semiparametric ECM. The effects of the exchange rates variable to GDP are modeled nonparametrically while the effects of other variables are modeled parametrically. In other words, in the semiparametric ECM, the exchange rates variable enters the model in nonparametric form while exports, gross fixed capital formation and the error correction term enter the model as the independent parametric variables. The decision to model the effects of exchange rates nonparametrically is based on studies that reported a nonlinear relationship between exports and exchange rates. The same relationship might be expected between exchange rates and GDP.

The same time series properties on stationarity, lag length and cointegration previously determined for all parametric variables are used. For the exchange rate variable, however, the generalized cross-validation (Craven and Wahba, 1979) is used to determine the number of lags to be included in the estimation of the semiparametric ECM. In order to establish the causal relationship between exports and economic growth, Granger causality tests were conducted on the semiparametric ECM. The results are reported in Table 14 and 15.

#### 4.10.1. Granger-Causality Tests

##### 4.10.1.1. Exports-Led Growth

As shown in Table 14, annual data analysis revealed that there is evidence of causality running from exports to economic growth in the short-run at 10% level of significance as well as total causality with a p-value of 0.0762 and 0.0764, respectively. However, the null hypothesis that exports do not cause economic growth in the long-run can not be rejected at 10% level of significance as suggested by a p-value of 0.7902. It follows that in the Philippines, exports contribute to economic growth in the short-run and in totality but not in the long-run using annual data from 1981 to 2004.

Table 14. Semiparametric Granger-Causality Results for ELG Hypothesis Tests in the Philippines, 1981-2004.

Restriction	Annual		Quarterly	
	F -Test	P-value	F- Test	P-value
Short-run	5.1482	0.0762	8.8093	0.0660
Long-run	0.4708	0.7902	0.4987	0.9736
Total	5.1446	0.0764	8.7200	0.0685

Null hypothesis: Exports do not cause economic growth.

Using quarterly data, findings of the Granger-causality test for export-led growth hypothesis are consistent with the result of the annual data analysis, that is, at a 10% level of significance; there is evidence of short-run and total causality but no evidence of long-run causality from exports to economic growth.

#### 4.10.1.2. Growth-Led Exports

As reported in Table 15, the result of the tests show that the growth-led export hypothesis is supported by annual data (1981-2004) in the short-run and total causality analyses and with p-values of 0.0042 and 0.0016, respectively. However, the growth-led exports hypothesis is not supported in the long-run using annual data but this hypothesis is supported by the quarterly data analysis in all cases, i.e. short-run, long-run and total analysis.

Table 15. Semiparametric Granger-Causality Results for GLE Hypothesis Tests in the Philippines, 1981-2004.

Restriction	Annual		Quarterly	
	F -Test	P-value	F- Test	P-value
Short-run	11.0344	0.0040	32.3226	.0000
Long-run	1.1904	0.5515	16.7166	0.0022
Total	12.8397	0.0016	32.9625	0.0000

Null Hypothesis: Economic growth does not cause exports.

#### 4.11. Comparative Analysis

Based on the results presented on Tables 14 and 15, the Granger causality tests between exports and economic growth for the Philippines is summarized in Table 16.

##### 4.11.1. Parametric Analysis of Annual and Quarterly Data

Results of parametric procedure show that the tests on the export-led hypothesis vary depending on the frequency of the data, that is, different levels of temporal aggregation have different effects on the ELG hypothesis test. Based on the result of this study, the annual data analysis supports the export-led growth theory in the Philippines but only in the short-

run. It can be noticed that though there is total causality running from export growth to economic growth, there is no evidence of long-run causality. Hence, over the longer-run horizon, this positive impact of exports on economic growth tends to die down.

Table 16. Results of the Granger Causality Tests Between Exports and Economic Growth for the Philippines, 1981-2004.

Restriction	Annual		Quarterly	
	Parametric	Semiparametric	Parametric	Semiparametric
Short-run	Export-led growth	Bidirectional	Bidirectional	Bidirectional
Long-run	No causality	No causality	Bidirectional	Growth-led Exports
Total	Export-led growth	Bidirectional	Bidirectional	Bidirectional

On the other hand, quarterly data analysis reveals that there is a feedback relationship, i.e., that output growth causes export growth and vice versa. This analysis suggests that using quarterly data, the Philippines followed the path of export-led growth, while at the same time suggesting that domestic market conditions had a significant impact on the growth process, with exports playing a reactive role.

#### **4.11.2. Semiparametric Analysis of Annual and Quarterly Data**

Findings of the preceding annual data analysis provide evidence of bidirectional causality between exports and economic growth in the short-run and total granger causality tests in Philippine context. However, in the longer-run, no causal relationship can be found.

It is interesting to note that quarterly data analysis also shows evidence to support bidirectional causality between exports and economic growth in the Philippines in the short-

run and total granger causality tests. While annual data analysis reported no causal relationship between exports and economic growth, quarterly data analysis revealed that in the long-run, economic growth causes growth in exports.

### **4.11.3. Parametric Versus Semiparametric**

#### **4.11.3.1. Annual Data**

It is shown that in testing the export-led growth hypothesis, results of parametric analysis vary from the semiparametric one in annual data. That is, in this study, parametric procedure supported the export-led growth hypothesis in the short-run and in total causality tests but semiparametric reported bidirectional causality for the same restrictions. In the long-run causality tests, however, parametric and semiparametric procedure, reported the same result, that is, there no causality between exports and output.

#### **4.11.3.2. Quarterly Data**

The parametric procedure of the study provides evidence of bidirectional causality between exports and economic growth when quarterly data were used. The semiparametric procedure also reported a bidirectional causality except in the long-run where there is evidence running from economic growth to exports growth.

It is interesting to note that though differences are evident between the results of parametric and semiparametric procedures and in different levels of temporal aggregation, the conclusions are generally not contradictory. For instance, annual analysis following a parametric procedure supports ELG hypothesis in the short-run and total causality tests while semiparametric model provides evidence to support bidirectional causality between exports and economic growth in both restrictions. Hence, aside from causality running from GDP to exports, there is also causality running from exports to GDP in this case which is supportive

of the conclusion of the parametric procedure. Both procedures support bidirectional causality using the same restrictions in the quarterly data analysis. In the long-run analysis, there is no causality based on the result of both procedures using annual data. Quarterly data analysis, however, reports bidirectional causality and GLE for parametric and semiparametric procedures, respectively. Hence, result of semiparametric procedure in this case support the parametric procedure that reports causality running from exports to GDP and vice versa though in just one direction.

#### **4.12. The Philippine Trade and Investment Policy<sup>24</sup>**

Industrialization has always been a major development goal for the Philippines since its independence. This goal was carried out through trade and investment policies. The country has in fact undergone several trade and investment policy regimes in its pursuit of industrialization. In the 1950s up to the 1970s, trade and investment policies have been highly restrictive and protectionist in support of the country's inward-looking, import-substitution industrialization strategy. High tariffs and import controls were the main policy instruments to protect domestic industries from foreign competition. At the same time, the exchange rate was highly overvalued. Investment incentives, on the other hand, came in the form of tax exemptions, tax credits and tax deductions. The pattern of protection was highly uneven with high protection for finishing/assembly operation and low protection for raw materials, intermediate goods and capital goods production. This adversely affected the efficient allocation of resources by creating bias in favor of import-competing manufacturing industries over exports and agriculture, and consumer goods over capital and intermediate goods. The end result was an imperfectly competitive industry structure characterized by

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<sup>24</sup> This section relies on the paper of Dr. Myrna S. Austria (November 2002).

unrealized scale economies and poor economic performance. Unable to keep pace with the fast growing economies in the region, there were mounting pressures, both from internal and external sources, for the country to undergo industrial restructuring. This prompted the government to undertake major reforms beginning in the 1980s, signaling a major paradigm shift toward greater openness and outward-oriented industrialization strategy. Trade and investment policies have since been made gradually liberal and open. This was carried out in various stages involving unilateral, regional and multilateral liberalization.

Unilateral liberalization has three important components, namely: 1) trade liberalization; 2) investment liberalization; and 3) exchange rate policy.

Since 1981, the country has been implementing a progressive reduction in tariffs through the Tariff Reform Program (TRP) to reduce the overall level of protection and the dispersion of tariff protection within and across sectors and industries. The reform was aimed at improving the efficiency in the allocation of resources, attaining global competitiveness and sustaining economic growth. By ridding the market distortions, trade liberalization would espouse greater reliance on the market, foster competition, and provide an even playing field which would encourage the development of industries with real comparative advantage (Medalla, 2002).

Investment liberalization opens up the Philippines to foreign investors. This is embodied in Republic (RA) Act 7042, otherwise known as the Foreign Investment Act of 1991 that allowed foreign equity participation up to 100 percent in all areas, except the Foreign Investment Negative List (FINL); by 1996, the FINL was shortened taking into consideration the constitutional limitations and specific legislation (Negative List A) and those related to defense, risk of health and morals, and small and medium enterprises



(Negative List B). In addition, an incentive system was put in place, such as those defined in the two Omnibus Investment Code: the first in 1983, covering the period of 1983 to 1986; and the second in 1987 covering the period from 1987 to present.

The exchange rate policy aimed to use foreign exchange to boost exports or at least make it neutral in order to enhance the global competitiveness of the export sector, by lifting restrictions to foreign exchange. Under this component foreign exchange was deregulated and is now freely sold or purchased even outside the banking system.

By unilaterally liberalizing the Philippine foreign trade regimes in response to competitive pressures of globalization, the country has succeeded in attracting greater foreign direct investment, particularly outward-oriented foreign direct investment that contributes not only to more robust export performance but also to higher technology, and improved labor and management skills, in the domestic economy.

Regional and multilateral trade liberalizations extend and supplement the unilateral liberalization program, the aim of which is to promote transparency, predictability and stability in trading arrangements. The unilateral liberalization efforts that started in the 1980s made it possible for the country to enter this phase of its international trade policy. That is, by fostering domestic efficiency where resources are allocated according to the country's comparative advantage, the unilateral liberalization policies enable the industries to prepare for global competition. In the Philippines, regional liberalization is felt in the country's commitments to AFTA-CEPT<sup>25</sup> and APEC<sup>26</sup>. Multilateral liberalization is realized in the country's accession to World Trade Organization (WTO). AFTA-CEPT came into being in

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<sup>25</sup> ASEAN Free Trade Area (AFTA)-Comprehensive Effective Preferential Tariff (CEPT).

<sup>26</sup> Asia Pacific Economic Community (APEC).

1992<sup>27</sup> - three years before the Philippines acceded to WTO, and 12 years since the Philippines undertook a unilateral liberalization program. The country's move towards regional and multilateral liberalization came as a response to the growing integration of economies around the world.

#### **4.13. The Empirical Evidence of Export-Led Growth in the Philippines**

The evidence of export-led growth using parametric procedure for annual data analysis is consistent with the report of the Asian Development Bank (ADB) that the important determinants of the growth of Philippine GDP includes beneficial international economic relation together with favorable weather and growth in all regions.<sup>28</sup> In addition, the Institute for Management Development (IMD) World Development Competitiveness Yearbook 2003 identifies exports among the key positive factors of the country's competitiveness. The Philippines has become one of the more competitive exporters of electronics components and other technology products. The country's ratio of exports to GDP, ratio of trade to GDP and terms of trade (or ratio of export prices to import prices) ranked high compared to those of other large industrial emerging countries.

In 2003, the Philippines had a 2.65% market share in the world electronics market and ranked 20<sup>th</sup> out of 99 exporting countries of electronics. Information technology and consumer electronics ranked 26<sup>th</sup> out of 107 exporting countries of this export sector. This has a 1.11% of the world's market share. See Appendix 8 for the ranking of the rest of export sectors.

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<sup>27</sup> This was formally launched in January 1, 1993.

<sup>28</sup> Asian Development Outlook 2005: II. Economic Trends and Prospects in Developing Asia: Southeast Asia. [www.adb.org](http://www.adb.org), 2005.

Figure 10 shows the Philippines' top trading partner<sup>29</sup> for the first semester of 2004 (January-June). It can be seen that Japan was the Philippines's top trading partner accounting for 18.86% share of the total Philippine exports and 18.82% of the total imports. Top imports from Japan included electronic products and industrial machinery and equipment. Philippines' top exports to this country are electric products.

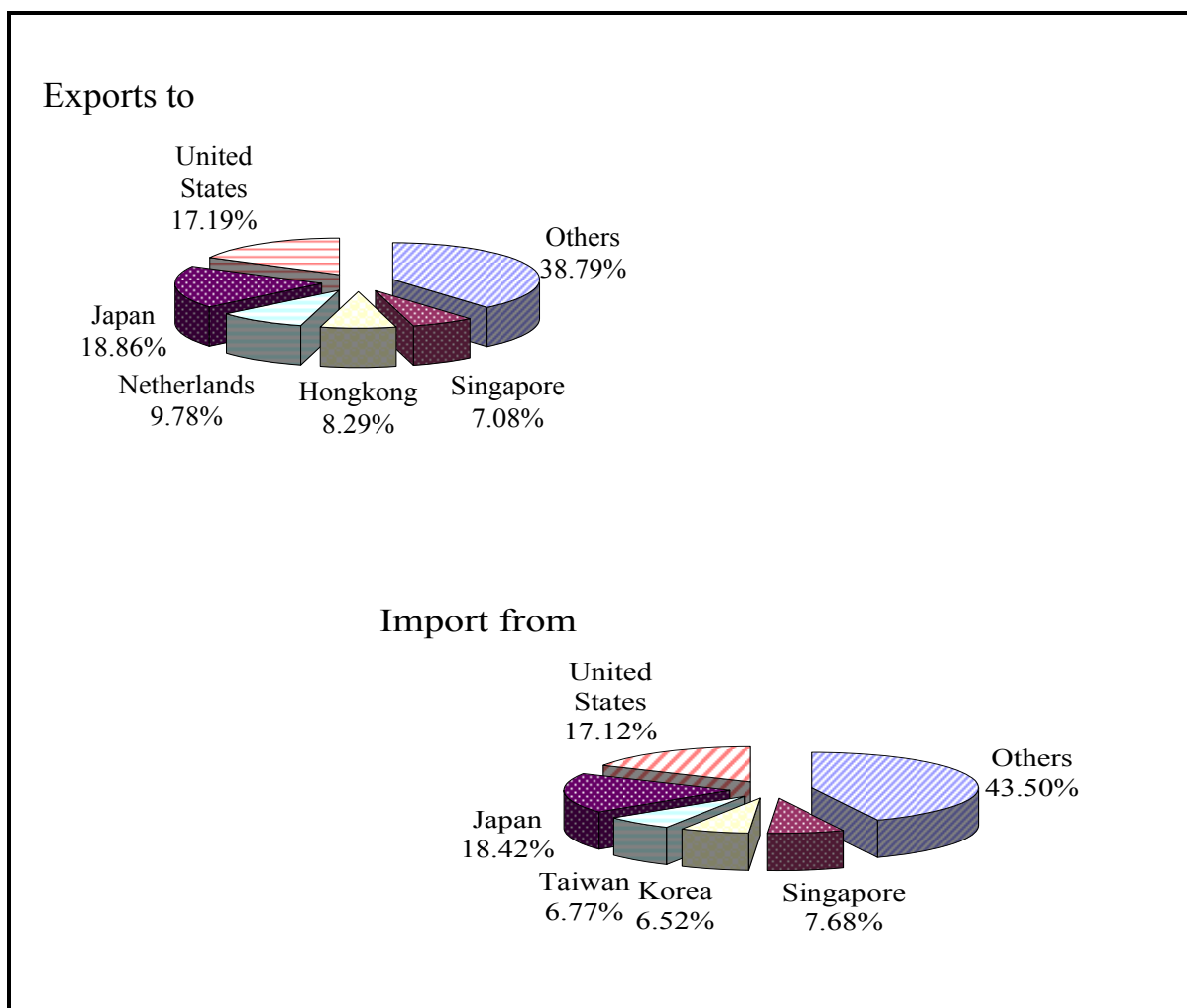


Figure 10. Major Trading Partners of the Philippines, First Semester 2004.

The Philippines' second biggest trading partner was the United States (US) accounting for 17.19% and 17.12% of the total exports and imports, respectively. Key exports

<sup>29</sup> Source: Philippine Bureau of Census at <http://www.census.gov.ph> accessed on March 2006

to the U.S. in the first semester of 2004 included electronic products and apparel and clothing accessories. The bulk of imported goods bought from the US consisted of electronic products and industrial machinery and equipment.

Exports to the European Union (EU) comprised 18.00%, with the Netherlands as the top Philippine trading partner among EU member-countries. It accounted 9.78% of the total Philippine exports.

Two-way trade with Singapore consisted of 7.08% and 7.68% of the total Philippine exports and imports, respectively. Top exports to Singapore consisted mainly of electronic products and coconut oil. Main imports from Singapore consisted of electronic products mineral fuels, lubricants and related materials.

Except for evidence of no long-run causality using both procedures of analyzing annual data, and evidence of growth-led exports using semiparametric analysis of quarterly data, the fact that, generally, there are evidence of causal relations running from exports to economic growth (Tables 12 and 13) of the Philippine economic data suggests that the government efforts to implement substantial trade and investment policy reforms for almost three decades may seem helpful to attain faster economic growth

Furthermore, the general evidence of bidirectional causality (Table 16) suggests that the Philippines followed the path of export-led growth, while at the same time suggesting that domestic market conditions had a significant impact on the growth process, with exports playing a reactive role. Thus, the growth of Philippine exports is simultaneous with the growth of its GDP. It can therefore be inferred that the unilateral liberalization pursued by the Philippines in order to foster efficiency and competitiveness is warranted and supported by the empirical results of this study. By pursuing unilateral liberalization, the inefficiency

arising from past protectionist regime is eliminated making the country competitive and be able to participate in regional and multilateral integration and face global competition.

The MTPDP also cited that the key to achieving GDP expansion of 7-8% by the end of the decade is to attain growth rates of the capital stock of at least 10% (in net terms), substantially higher than the current rate (around 3%), as the experience of other Asian economies during their high-growth periods suggests. This requires an extended investment push to create a virtuous cycle of higher rates of productivity, wages, and employment. However, according to Edwards (1993), exports industries are more susceptible to productivity improvements and these lead to more investment, higher profits and more rapid economic growth. As such, the unilateral investment liberalization must be strengthened since it is equally important as unilateral trade liberalization.

#### **4.14. Comparative Evaluation of Major Findings**

Table 17 summarizes the results of this study vis-à-vis other works. However, these previous works only share some procedural aspects of this study. That is, though they tested for the stationarity of the data and cointegration, accounted for the effects of other variables in the ELG hypothesis tests, and the conclusions were based on Granger-causality procedure, no other study has explained the growth of Philippine GDP using exactly the same macroeconomic variables used in this study. The results of semiparametric analysis are also compared with previous works though this approach has never been employed before.

For quarterly data analysis, results of total granger causality tests of the parametric and semiparametric procedures of this study (i.e. bidirectional causality) is somewhat similar

to the findings of Bahmani-Oskooee and Alse<sup>30</sup>(1993), Ekanayake<sup>31</sup>(1999), Sharma and Dhakal<sup>32</sup>(1994), Mohsin *et al.*(1999) and Anoruo *et al.*(1999) that use a similar methodology. This feedback relationship is an indication of simultaneous relationship between exports and GDP.

Table 17. Comparative Evaluation of Major Findings of the ELG Hypothesis Test Using the Philippine Economic Data.

Authors	Data	Parametric Conclusion
Amrinto <sup>33</sup> (this study)	Annual 1981:04 Quarterly, 1981(1):04(4)	ELG (short-run/total); NC (long-run) BDC
Jung & Marshall (1985)	Annual, periods within 1950:81	NC
Bahmani-Oskooee et al. (1991)	Annual, periods within 1951:87	NC
Ahmad and Harnhirun (1992)	Annual, 1967:88	GLE
Bahmani-Oskooee & Alse (1993)	Quarterly, 1973(1):88(4)	BDC
Dodaro (1993)	Annual, 1967:86	NC
Sharma & Dhakal (1994)	Annual, periods within 1960:88	BDC
Dutt & Ghosh (1996)	Annual, 1953:91	ELG
Pomponio (1996)	Annual, periods within 1965:85	NC(bivariate), ELG (trivariate)
Riezman et al. (1996)	Annual, 1950:90	NC GLE (Bivariate)
Xu (1996)	Annual, periods within 1951:90	ELG
Anwer <i>et al</i> (1997)	Annual data, 1960-1992	NC
Ahmad et al. (1997)	Annual, 1966:93	GLE
Rahman (1997)	Annual	BDC (short-run) ELG (long-run)
Islam (1998)	Annual, 1967:91	NC
Ekanayake (1999)	Annual, 1960-1997	BDC
Mohsin <i>et al</i> (1999)	Annual, 1960-61 to 1995-96	BDC
Anoruo <i>et al</i> (1999)	Annual, 1960-1997	BDC
Afxentiou <i>et al</i> (2000)	Annual, 1970-1993	NC
Lee, <i>et al</i> (2002)	Quarterly, 1981(1):00(1)	NC

Notes: BDC denotes bidirectional causality; ELG denotes export-led growth hypothesis; GLE denotes growth-led exports; and NC denotes no causality.

<sup>30</sup> Bivariate Granger (quarterly data).

<sup>31</sup> Bivariate Granger (annual data).

<sup>32</sup> Other variables considered – population, real world output, exchange rates, gross fixed capital formation.

<sup>33</sup> The reported results for comparison purposes are based on the regression where the exchange rates variable is included.

For annual data analysis, findings of total causality test (i.e., export-led growth) of the parametric procedure of this study is to some extent consistent with the findings of Dutt & Ghosh (1996), Pomponio (1996) and Xu (1996). However, total Granger causality test for the semiparametric procedure using annual data reported bidirectional causality, a result similar to the semiparametric procedure using quarterly data.

The findings of this study validate the supposition of previous works that the differences in outcomes of the ELG hypothesis tests could be due to a number of reasons including different levels of temporal aggregation, different methodologies, and model misspecification. Additionally, the contention that previous works might be biased due to omitted variable is also supported in this study based on the parametric analysis of annual data when testing for total Granger causality tests.

## CHAPTER 5

### SUMMARY, CONCLUSION AND FUTURE RESEARCH

#### 5.1. Summary

The theory of comparative advantage gave rise to the so-called export-led growth (ELG) hypothesis. Countries around the world advocating export-promotion strategies consider export activity as a means through which economic development can be achieved. However, the relationship between economic openness and economic growth has been a topic of sustained interest and controversy in the economic development literature for the past few decades. Although it is often assumed that exports growth contributes positively to economic growth, recent empirical studies generate mixed results. Given such ambiguity of results, this research contributes to the literature by studying the ELG hypothesis via parametric and semiparametric models and at two levels of temporal aggregation. The use of the semiparametric approach might be advantageous since it addresses misspecification issues surrounding non-linearity and omitted variables. When one has good information about the regression functional form, one should use a parametric model. However, economic theories rarely tell us specific functional forms in regression modeling analysis. Annual and quarterly data are used to determine the effect of different levels of temporal aggregation on ELG hypothesis tests. The use of these alternative methodologies may help clarify mixed results reported in previous works.

More specifically, the objective of this study is to empirically test the export-led growth hypothesis for the Philippines using annual and quarterly data over the period 1981-2004. It utilizes parametric and semiparametric procedures, and compares the results of these methods on tests of the ELG hypothesis. This study aims to examine the relationship



between exports and economic growth in the Philippine context using error-correction models in which real effective exchange rates and gross fixed capital formation are allowed to exert their potential influence on exports and economic growth, using a flexible semiparametric ECM.

Chapter 2 provided a condensed review of the literature that gave a background to this work. Empirical evidence on this issue in the Philippines is mixed, that is, some authors reported results supporting export-led growth, others reported growth-led exports, and still others reported no significant relationship between exports and economic growth. According to Ram (2003), the empirical literature for the ELG hypothesis has basically taken two forms over the past years, namely: 1) cross-country studies; and 2) individual-country analysis. Within these two general forms, ELG studies have been conducted using various statistical approaches.

Chapter 3 introduced the economic model and the hypotheses tested in the study. The econometric models, as well the methodologies that are followed, are outlined in this chapter. Specifically, the steps in estimating the parametric and semiparametric models are discussed in this chapter.

Chapter 4 introduced the data used in the ELG hypothesis for the Philippines. The empirical analysis in this study employed cointegration techniques and estimation of parametric and semiparametric error-correction models. Results, analysis and interpretation of the study are also presented in this chapter.

The Phillips-Perron tests were used to test for stationarity. All variables in the model were found to be integrated of order 1 for annual data. For quarterly data, the GFCF and exchange rate variable are integrated of order 1 while the GDP and export series do not

contain a unit when estimating an equation with a constant and trend but it is integrated of order 1 when estimating an equation with a constant and no trend. Cointegration was studied using Engle-Granger's two-step procedure. Using any one of the four equilibrium relations, empirical evidence shows that at the 10 percent level of significance, the variables are cointegrated of order (1,1) for both annual and quarterly data. This implies that most previous studies in the Philippine context that ignore cointegration between exports and real output are misspecified, for they ignore that these variables tend to move together and that deviations from such co-movement tend to be short-lived.

Estimates of the long-run equilibrium relationship showed that variables such as exports and gross fixed capital formation are positively correlated with economic growth. These results are as expected from economic theory, i.e., as exports increase, GDP increases. Investment can determine long-term growth, so the higher the level of investments, the higher the prospect of economic growth. The coefficients of the exchange rates, however, are not consistent with the *a priori* assumption from the viewpoint of the classical model. Results suggested that the depreciation of the Philippine peso will slow down the growth of GDP.

The causal relationship between exports and economic growth was examined using Granger-causality tests. Two major hypotheses were tested, namely: 1) exports do not cause economic growth, and 2) economic growth does not cause exports. When testing Granger-causality, restrictions were imposed in the long-run, short-run and on totality. That is, the Granger-causality tests are estimated for the short, long, and, short and long (total) causality.

Following the parametric procedure with annual data, an important result is that real exports tend to exert a unidirectional impact on real output in the short run, but this influence

tends to die out over the long run as results revealed no Granger-causality from exports to GDP. Total Granger-causality tests also support the export-led growth hypothesis. On the other hand, using Philippine quarterly data, Granger-causality tests revealed that there is evidence of bidirectional causality between exports and economic growth in all cases, i.e., in the short run, long run and in total. This means that increases in exports directly affect economic development and that economic growth also influences exports activities either in the short run, long run, or both. In other words, the analysis suggests that the Philippines followed the path of export-led growth, while at the same time suggesting that domestic market conditions had a significant impact on the growth process, with exports playing a reactive role.

To determine whether exchange rates affect ELG non-causality tests, a model was also estimated which excludes this variable and results were compared with the model that considers this variable. Results showed that the real effective exchange rate variable appears to have an effect on annual GDP but the size of export coefficients is not affected much, and no effect on its significance was shown. Using annual data, short-run and long-run Granger-causality tests showed no change in results but total Granger-causality tests change. When exchange rates are excluded, there is no causality between exports and economic growth but there is evidence of export-led growth when this variable is included. Using quarterly data, however, Granger-causality tests in the short run, long run, and total showed no change in results.

The export-led growth hypothesis in the Philippines is also investigated by estimating a semiparametric ECM. The work of Akram *et al.* (2005), reported that the real exchange-rates variable has a non-linear behavior which may be attributed to its volatility. The study

also found evidence of asymmetric effects of the monetary policy variables on output. Hence, in this study, the exchange-rates variable enters the model nonparametrically, while exports, gross-fixed capital formation and the error-correction term enter the model parametrically. The same time series properties on stationarity, lag length and cointegration previously determined for the parametric variables are used. However, for the nonparametric exchange rate variable, the generalized cross-validation (Craven and Wahba, 1979) is utilized to determine the number of lags to be included in the estimation of the semiparametric ECM.

Granger-causality tests based on the semiparametric procedure revealed that annual and quarterly data analysis support bidirectional causality between exports and GDP in the short run and for total causality. Nevertheless, while annual data analysis reported no causal relationship between exports and economic growth, quarterly data analysis revealed that in the long run, economic growth causes growth in exports.

It can be emphasized that different levels of temporal aggregation affect the tests on ELG hypothesis in both procedures, as shown in the above mentioned results.

It is interesting to note that though differences are evident between the results of parametric and semiparametric procedures, and in different levels of temporal aggregation, the conclusions are generally not contradictory. For instance, in the short-run and total-causality tests, parametric analysis using annual data supports the ELG hypothesis, while the semiparametric model provides evidence to support bidirectional causality between exports and economic growth. Hence, aside from causality running from GDP to exports, there is also causality running from exports to GDP in this case, which is supportive of the conclusion of the parametric analysis. Both procedures support bidirectional causality using the same restrictions in the quarterly data analysis. In the long-run analysis, there is no

causality based on the result of both procedures using annual data. Quarterly data, however, reports bidirectional causality and growth-led exports for parametric and semiparametric procedures, respectively. Hence, the result of the semiparametric procedure in this case supports the parametric procedure that reports causality running from exports to GDP and vice versa, though just in one direction.

Parametric analysis using annual data that the support export-led growth hypothesis in the short-run and total-causality tests are consistent with the report of the Asian Development Bank (ADB) that the important determinants of the growth of the Philippine GDP includes beneficial international economic relations together with favorable weather and growth in all regions. The findings also validate the report of the Institute for Management Development (IMD) World Development Competitiveness Yearbook 2003 that identifies exports among the key positive factors of the country's competitiveness.

Generally, results of this study showed that there are causal relations running from exports to economic growth. Hence, this study suggests that government efforts to implement substantial trade and investment policy reforms for almost three decades may seem helpful to attain faster economic growth.

Furthermore, the general evidence of bidirectional causality suggests that the Philippines followed the path of export-led growth, while at the same time suggesting that domestic market conditions had a significant impact on the growth process, with exports playing a reactive role. It can therefore be inferred that the unilateral liberalization pursued by the Philippines in order to foster efficiency and competitiveness is warranted and supported by the empirical results of this study. By pursuing unilateral liberalization, the inefficiency

arising from past protectionist regimes is eliminated, making the country competitive and able to participate in regional and multilateral integration while facing global competition.

## **5.2. Conclusions and Implications**

There is empirical evidence to support the argument that real exports tend to exert a unidirectional impact on real output (i.e. export-led growth) in the Philippines in the short run. However, this evidence is supported only by a parametric procedure that utilizes annual data, and not by the semiparametric procedure. The latter provided empirical evidence to support bidirectional causality between exports and economic growth. The same conclusion can be reached when testing for total Granger causality. Interestingly, both procedures reported no long-run causality between exports and economic growth. It follows that over the longer-run horizon, this positive impact of exports on economic growth tends to die down. The test on export-led growth hypothesis, therefore, is sensitive to parametric and semiparametric model estimation.

Upon considering the exchange variable in the model, the Granger causality tests reported that the results only change in total causality analysis if annual data was analyzed but other causality results using both data were maintained in both regressions. In general, the exchange rates policy of the government that was intended to complement the trade and investment policies may not have been very effective. This can be attributed to the fact that the ASEAN and other Asian countries, which accounted for 40.60% of the total Philippine exports in 2004, and at the same time, the Philippines' competitors in the region, also experienced a large devaluation during the 1997 Asian financial crisis. This may have hampered the level of international trade of the Philippines.

The different levels of temporal data aggregation can also affect the test results of the export-led growth hypothesis. Though both annual and quarterly data frequency used in the semiparametric procedure reported short-run and total bidirectional causality, long-run causality tests differ. There is no long-run causal relation between exports and output based on annual data analysis, but quarterly analysis shows evidence supporting a unidirectional causality running from output to exports. On the other hand, the parametric procedure using quarterly data reported bidirectional causality between exports and output in all cases. Annual data analysis revealed a unidirectional causality running from exports to output for short-run and total causality tests with results of no causal relation in the long run.

It can be implied that the general results of analysis using quarterly data (i.e., bidirectional causality) in both parametric and semiparametric procedures can be a better representation of the Philippine economy than the analysis using annual data. The justifications behind this implication are as follows: 1) the quarterly data can capture the seasonality of exports and the volatility of the exchange rates well; and 2) quarterly data provide more observations and will likely better capture the variations of the time series data. A semiparametric model may provide a more flexible way of modeling the data-generation process for the relationship between growth and exports.

The challenge facing the Philippine economy in global markets is how to improve its competitiveness so that it can deepen and expand its economic integration. From a policy perspective, the general results of this study on bidirectional causality, suggest that the Philippines could enjoy economic prosperity by strengthening their trade and investment policy geared towards opening up the economy. But it can be emphasized too that the results also suggested that the beneficial effects of trade liberalization could only be attained if much

of the trade is linked to domestic economic activity. Resources must be allocated according to the country's comparative advantage. When inefficient industries are eliminated through unilateral trade liberalization, the development of industries with a real comparative advantage is encouraged. In this way, the economy is prepared to face global competition. This is important, as economic integration presupposes that participating economies have already attained a high level of competitiveness and maturity in their production structure. Hence, proper timing/phasing of trade efforts must be done in order to maximize the gains and minimize the threats of globalization. While not diminishing the importance of global trade and investment or of trade liberalization, deregulation, and privatization in development, measures that will strengthen the capacity of the country to tackle domestic problems and global competition are also imperative.

Empirical evidence linking exports to economic growth has been mixed and inconclusive. Much work argued that the differences in outcomes may be due to different levels of temporal aggregation, methodologies, model misspecification, and omitted variables. This study puts forward empirical evidence on these issues. It can also be argued that the export-led growth hypothesis may be consistently supported on empirical works that define exports variable as the exports of goods and services produced based on the theory of comparative advantage and exported during the time that appropriate exchange rates policy is implemented to complement export-promotion policy. Based on the period of analysis of this study, the Philippines generally exported goods and services for which the country has a comparative advantage<sup>34</sup> but the government failed to implement outright complementary

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<sup>34</sup>See Appendix 9 for the ranking of the Philippine products with comparative advantage.



reform in exchange rates<sup>35</sup>. Hence, results of the study are generally bidirectional causality between exports and GDP rather than unidirectional causality from exports to GDP.

### **5.3. Limitations and Future Research**

As a semiparametric assessment, this study provided no assumption about the functional form of the exchange-rate variable. The work of Akram *et al.* (2005) reported that the real exchange-rate variable has a non-linear relationship with output. Of particular interest to future research may be to test the ELG hypothesis in a model where the relationship between the exchange rates and GDP is known, such as in a Monte Carlo framework. By specifying the true data-generation process, the relative merits of various econometric methods, under temporal aggregation, can be more robustly assessed.

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<sup>35</sup>In the face of trade liberalization, there was lack of adjustment of exchange rates. Reductions in tariff protection and import restrictions have not been complemented by a consistent exchange rate policy that favors (or is neutral to) exports.

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## **APPENDICES**



**APPENDIX 1**  
**EMPIRICAL WORKS ON ELG HYPOTHESIS IN THE PHILIPPINES**

Authors	Data	Method	Other Variables	Result
Krueger (1978)	Annual, 1954:71	OLS (log real GNP on log real exports relative to average exports over the entire period)	Time trend; dummy variables for trade regimes	Significant export/economic growth relationship
Jung & Marshall (1985)	Annual, periods within 1950:81. Real GNP/GDP growth & export growth.	Bivariate Granger (F); DVAR & some D2VAR with constant. Lags Preset to 2; increased to 3 if residuals correlated.		Non-causality
Ram (1987)	Annual, various periods within 1960:82	OLS & AUTO (real GDP growth on real export growth or % share of changes in exports in GDP)	Population growth; real investment as share of output; dummy variable for 1973 oil crisis.	Insignificant
Bahmani-Oskooee et al. (1991)	Annual, periods within 1951:87.  Real GDP and export growth	Bivariate Granger (Akaike FPE); LVAR in growth variables, some DVAR, with constant.		Non-causality
Salvatore & Hatcher. (1991)	Annual, 1963:85. 7 split up as 1963:73 & 1973:85.	OLS & AUTO (real GDP growth on real export growth)	Gross fixed capital formation as % of GDP; real industrial production growth.	Insignificant

Ahmad & Harnhirun (1992)	Annual, 1967:88. Real per capita exports & GDP.	Bivariate Granger (LR); ECM for cointegrated countries, DVAR for noncointegrated, with constant. For unit root test, ADF (LM; with constant & trend) EG-ADF (not specified.; no constant). Noncointegration. Lags by FPE		Growth-led export
Bahmani-Oskooee & Alse (1993)	Quarterly, 1973(1):88(4). Logs; real GDP & exports.	Bivariate Granger (F); ECM for cointegrated countries with constant ADF (general to specific; with constant) for unit root test; CRDW; EG-ADF (general to specific; with constant). Cointegration for Philippines; Lag selection -Specific to general.		Bidirectional causality
Dodaro (1993)	Annual, 1967:86. Real GDP growth, growth of real exports of goods & nonfactor services.	OLS simple regression between growth variables. Bivariate Granger (F); LVAR in growth variables with constant. Lags preset to 2		Granger – Non-causality  OLS - Insignificant
Kugler & Dridi (1993)	Annual, 1960:89. Logs; real GDP & exports.	4-variable with conclusions based on cointegration results. Unit root test-ADF (preset to 1&2; with constant & trend; Cointegration test -JJML (AIC; Case 1).	Total private consumption expenditures; business-fixed investment.	Export-led growth

		Cointegration for Philippines; Lags by AIC		
Sengupta (1993)	Annual, periods within 1961:87. $\Delta$ real GDP & exports; GDP growth & % share of changes in exports in GDP	OLS - contemporaneous relationship in growth or change variables - aggregate production function	Real investment (capital); employment	Significant positive export/economic growth effect
Dutt & Ghosh (1994)	Annual, 1953:91. Logs; real GDP/GNP & exports.	Results based on cointegration outcomes. ADF (SC; with constant); PP & KPSS (ACF; with constant) for unit root test Cointegration test: PO (ACF; with constant & trend and combinations thereof).		Cointegration
Greenaway & Sapsford (1994a)	Annual, periods within 1957:85. Real GDP per capita growth & growth of exports. Repeated with (weighted) growth of non-export GDP. Also with export variable expressed as % share of changes in exports in GDP.	OLS simple regressions between variables. ADF(n.s.) for unit root test	Share of investment in output; growth of the workforce.	Insignificant

Sengupta & España (1994)	Annual, periods within 1960:87. $\Delta$ real GDP & $\Delta$ real exports).	OLS simple regressions between variables. Cointegration test: CRDW; EG-ADF for South Korea only. Cointegration.	$\Delta$ labor force; real investment & (real investment) <sup>2</sup> .	Significant positive export/economic growth
Sharma & Dhakal (1994)	Annual, periods within 1960:88. Logs; real GDP & exports.	4-variable Granger (F); DVAR & D <sup>2</sup> VAR with constant. Unit root test: PP (n.s.; with constant & trend) Lag selection: FPE	Population; real world output; real exchange rate; real gross fixed capital formation.	Bidirectional
Lee et al (1994)	Annual, 1960-70, 1970-77; growth rate of GNP, growth rate of exports	OLS; Hausman's test for exogeneity; 2SLS	Labor force, ratio of gross domestic investment to GDP	Exports cause growth
Ahmad & Harnhirun (1995)	Annual, 1966:90. Real per capita GDP & exports.	Bivariate Granger (LR) - only examined for Singapore as cointegrated; ECM with constant. Unit root test: ADF (n.s.; with constant & trend) Cointegration test: JJML (preset to 2; Case 1). Non-cointegration for Philippines; Lag selection: Preset to 2.		No support to ELG hypothesis
Amirkhalkhali & Dar (1995)	Annual, various periods within 1961:90.	OLS (real GDP growth on real export growth).	Real investment to output share; population growth.	Significant export/economic growth relationship
Arnade & Vasavada (1995)	Annual, 1961:87. Real agricultural	Trivariate Granger (F); ECM for cointegrated countries, DVAR for	Terms of trade (unit export value/unit	Export-led growth

	output & agricultural exports	noncointegrated, with no deterministic terms. Also tries both for all countries. Unit root test: ADF (preset to 3; no deterministic terms) Cointegration test: JJML (preset to 3; Case 1*). Cointegration except for Uruguay, Nicaragua, Guatemala, Ecuador, Thailand, Taiwan, Nepal, Canada. Lag selection: Preset to 3	import value)	
Dutt & Ghosh (1996)	Annual, 1953:91. Logs; real GDP/GNP & exports.	Bivariate Granger (F); ECM for cointegrated countries with no deterministic terms. Unit root test: DF, PP (SC; with constant); KPSS (ACFs; with constant) Cointegration test: EG-ADF (SC; with constant & trend); PO (with constant & trend & testing downwards). Cointegration; Lag selection: SC		Export-led growth
Pomponio (1996)	Annual, periods within 1965:85. Nominal manufactured output & exports.	Bivariate & trivariate Granger (F); DVAR for noncointegrated countries, ECM for cointegrated, with constant. Trivariate case tested as (investment+export) causes output (IELG) and (investment+output) causes exports (IGLE)).	Investment	Bivariate - Non-causality  Trivariate - IGLE:

		Unit root test: n.s. Cointegration test: n.s. Lag selection: Preset to 2, some higher if correlation detected.		
Riezman et al. (1996)	Annual, 1950:90. GDP & export growth in current international dollars.	Bivariate & trivariate Granger (F). FEVDs - 5 & 16 year horizons, with 2 orderings tried. Geweke (1984) CLFs. No deterministic terms. 5-variable CLFs Lag selection: not specified	Real import growth. For the 5-variable cases also: primary school enrolment as % of primary school age children(interpolated); total investment/output	5-variables conditional linear feedback – non-causality  Bivariate Granger – Growth-led export
Xu (1996)	Annual, periods within 1951:90. Logs; real GDP & exports.	Bivariate Granger (F). ECM for cointegrated cases, DVAR or D <sup>2</sup> VAR for noncointegrated, with constant. Unit root test: ADF (preset to 3; combinations of constant & trend tried). Some $\Delta^2$ used. Cointegration test: EG-ADF (preset to 3; no constant). Lag selection: FPE		Export-led growth
Anwer et al (1997)	Annual data, 1960-1992; GDP and exports of goods and non factor services	Bivariate Granger; Cointegration tests; ADF for unit root test		Insignificant
Ahmad et al. (1997)	Annual, 1966:93. Logs; real per capita GDP &	Bivariate Granger (LR); DVAR with constant. Unit root test: ADF (n.s.; with constant & trend)		Growth-led export

	exports.	Cointegration test: EG-ADF (n.s.; no constant). Noncointegration. Lag selection: FPE		
Rahman (1997)	Annual, export growth & GDP growth	Bivariate Granger (LR); Cointegration and error correction models; ADF for unit root test;		bidirectional causality in the short-run and long-run unidirectional causality from real export growth to real GDP growth.
Islam (1998)	Annual, 1967:91. Proportion of export earnings in GDP; change in share of non export component in GDP; real GDP.	Bivariate & 5-variable Granger (F). ECM for cointegrated, DVAR for noncointegrated, with constant. Unit root test: ADF (n.s.) Cointegration test: JJML (FPE; Case 1). Noncointegration for Philippines; Lag selection: FPE	Share of non-defense expenditures in GDP; imports as a share of GDP; total investment share of GDP.	Bivariate – non-causality  Multivariate - non-causality
Ekanayake (1999)	Annual, 1960-1997	Bivariate Granger (F); Cointegration and error correction model. ADF for unit root test		Bi-directional causality
Mohsin et al (1999)	Annual, 1960-61 to 1995-96. Exports vs economic growth	Bivariate Granger (LR); Cointegration and error correction models; ADF, PP & KPSS for unit root tests,		Bi-directional
Anoruo et al (1999)	annual,1960-1997	Multivariate Granger (LR); Cointegration and vector error-correction model; ADF for unit root test. Lags by FPE	imports	Bi-directional causality

Afxentiou et al(2000)	Annual, 1970-1993; GNP, merchandise exports	Multivariate Granger (F) Cointegration tests; Unit Root Tests: Weighted Symmetric, ADF & Phillips and Perron Test ; Lag preset to 2;	Imports	No causality
Anorou et al(2001)	Annual, 1949-1998	Multivariate Threshold Autoregressive model; ADF for unit root test; Lags by AIC	Exchange rates, money supply	Export-led growth
Lee, et al (2002)	Quarterly, 1981 : 1- 2000 : 1	VAR Model; Error Correction Model; ADF for unit root test; Lag selection by AIC;	Gross Fixed Capital Formation, Imports	No causal relationship between export and growth
Cuaresma et al(2005)	Annual, 1981-1997; exports of manufacturing and non-manufacturing sector	Random effect models;	Investment, Population, Imports, Exchange Rates	Support the hypothesis of qualitative differences between high and low tech exports with respect to output



Notes to Appendix 1:

- 2SLS – Two Stage Least Squares Estimation
- $\Delta$  – First Differencing Factor
- D<sup>2</sup>VAR – Second Differenced VAR model
- FPE – Akaike’s (1969) Final Prediction Error Criterion for Lag Selection
- AIC – Akaike’s (1973) Information Criterion for Lag Selection
- ADF – Augmented Dickey-Fuller unit root test
- CRDW – Cointegrating Regression Durbin-Watson cointegration test
- PP – Philips and Perron Test
- JJML – Johansen and Juselius maximum likelihood cointegration test
- KPSS – Kwiatkowski et al.’s unit root test
- CLF – Conditional Linear Feedback
- GDP – Gross Domestic Product
- GNP – Gross National Product
- LR – Likelihood Ratio general to specific
- F – F test of exclusion restrictions employed for non-causality test. F distribution used as finite sample approximation for the null distribution
- SC – Schwarz’s (1978) criterion for lag selection
- ACF – Autocorrelation Function
- GLE – Growth-led exports
- OLS – Ordinary Least Squares Estimation
- EG-ADF – Engle and Granger’s ADF Cointegration Test. The terms in the parenthesis are the method employed to select the augmentation lag and deterministic terms included in the integrating regression
- PO – Phillips and Ouliaris cointegration test. The expressions in the parenthesis give the technique adopted to select the truncation lag and the deterministic components included in the integrating regression

**APPENDIX 2**  
**DEFINITION OF FOUR PHILIPPINE MACROECONOMIC VARIABLES**  
**USED IN TESTING THE ELG HYPOTHESIS**

**1. Gross Domestic Product (GDP)**

GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources (WDI, 2004). Data are converted into constant 2000 Philippine peso.

**2. Gross Fixed Capita formation (GFCF)**

This consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 System of National Accounts, net acquisitions of valuables are also considered capital formation. Data are in current local currency.

Source:

World Bank national accounts data, and OECD National Accounts data files.

**3. Real Effective Exchange Rate Index (REER), (2000=100)**

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs (WDI, 2004).

**4. Exports of Goods and Services (X)**

Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income (formerly called factor services) as well as transfer payments (WDI, 2004). Data are converted into constant 2000 Philippine peso.

**APPENDIX 3**  
**MONTHLY AVERAGE EXCHANGE RATES,**  
**JANUARY 2003 – JULY 2005 (PHP/US\$)**

<b>Month</b>	<b>2005</b>	<b>2004</b>	<b>2003</b>
<b>Average</b>		<b>56.052</b>	<b>54.203</b>
December		56.183	55.445
November		56.322	55.372
October		56.341	54.952
September		56.213	55.024
August		55.834	54.991
July	56.006	55.953	53.714
June	55.179	55.985	53.399
May	54.341	55.845	52.507
April	54.492	55.904	52.807
March	54.44	56.303	54.591
February	54.813	56.07	54.07
January	55.766	55.526	53.564

**APPENDIX 4**  
**COVARIANCE MATRIX OF THE PHILIPPINE MACROECONOMIC VARIABLES**  
**FOR THE ELG HYPOHESIS TEST**

<b>Annual (1981-2004)</b>				
	GFCF	EXPORTS	GDP	REER
GFCF	13925.59	47593.50	54252.56	-491.36
EXPORTS	47593.50	313353.13	346015.32	-6365.29
GDP	54252.56	346015.32	396257.51	7905.57
REER	-491.36	6365.3	-7905.57	369.65
<b>Quarterly(1981:1-2004:4)</b>				
	GFCF	EXPORTS	GDP	REER
GFCF	949.07	2869.69	3140.72	-136.85
EXPORTS	2869.69	19302.71	19313.39	-1731.86
GDP	3140.72	19313.39	21767.95	-1643.37
REER	-6806.41	1643.37	-1731.86-	-377.84

**APPENDIX 5**  
**RESULTS OF THE ERROR CORRECTION MODEL ESTIMATION FOR**  
**THE PHILIPPINE ELG HYPOTHESIS TEST, ANNUAL AND QUARTERLY DATA**

Annual

$$\Delta GDP_t = 1.135 \Delta GDP_{t-1} - 0.079 \Delta GDP_{t-2} - 0.259 \Delta Ex_{t-1} + 0.224 \Delta Ex_{t-2} + 0.113 \Delta RER_{t-1} \\ + 0.118 \Delta RER_{t-2} - 0.131 \Delta GFCF_{t-1} - 0.188 \Delta GFCF_{t-2} - 0.386 \varepsilon_{t-1}$$

$$\Delta Ex_t = -1.942 \Delta GDP_{t-1} - 1.116 \Delta GDP_{t-2} + 0.033 \Delta Ex_{t-1} + 0.751 \Delta Ex_{t-2} + 0.389 \Delta RER_{t-1} \\ + 0.283 \Delta RER_{t-2} - 0.316 \Delta GFCF_{t-1} - 0.107 \Delta GFCF_{t-2} - 0.355 \varepsilon_{t-1}$$

Quarterly

$$\Delta GDP_t = -0.356 \Delta GDP_{t-1} - 0.248 \Delta GDP_{t-2} - 0.248 \Delta GDP_{t-3} + 0.739 \Delta GDP_{t-4} + 0.024 \Delta Ex_{t-1} \\ - 0.025 \Delta Ex_{t-2} - 0.034 \Delta Ex_{t-3} - 0.008 \Delta Ex_{t-4} + 0.099 \Delta RER_{t-1} - 0.121 \Delta RER_{t-2} \\ + 0.064 \Delta RER_{t-3} + 0.004 \Delta RER_{t-4} - 0.036 \Delta GFCF_{t-1} + 0.079 \Delta GFCF_{t-2} \\ - 0.016 \Delta GFCF_{t-3} + 0.022 \Delta GFCF_{t-4} + 0.022 D_1 - 0.004 D_2 \\ + 0.010 D_3 + 0.016 \varepsilon_{t-1}$$

$$\Delta Ex_t = .289 \Delta GDP_{t-1} + 0.268 \Delta GDP_{t-2} + 0.503 \Delta GDP_{t-3} + 0.684 \Delta GDP_{t-4} - 0.082 \Delta Ex_{t-1} \\ - 0.196 \Delta Ex_{t-2} - 0.268 \Delta Ex_{t-3} + 0.049 \Delta Ex_{t-4} + 0.053 \Delta RER_{t-1} + 0.060 \Delta RER_{t-2} \\ + 0.151 \Delta RER_{t-3} + 0.059 \Delta RER_{t-4} + 0.087 \Delta GFCF_{t-1} - 0.037 \Delta GFCF_{t-2} \\ - 0.114 \Delta GFCF_{t-3} - 0.008 \Delta GFCF_{t-4} - 0.012 D_1 - 0.043 D_2 \\ + 0.043 D_3 + 0.016 \varepsilon_{t-1}$$

**APPENDIX 6**  
**THE EFFECTS OF EXCHANGE RATES VARIABLE ON GRANGER CAUSALITY**  
**TESTS FOR ELG HYPOTHESIS, PHILIPPINES (1981-2004)**

Restriction	Annual				Quarterly			
	A		B		A		B	
	Chi-Squared	P-value	Chi-Squared	P-value	Chi-Squared	P-value	Chi-Squared	P-value
Short-run	5.9238	0.0517	5.9370	0.05138	63.1160	0.0000	52.0398	0.0000
Long-run	0.6640	0.4151	0.0022	0.9626	65.1901	0.0000	51.0937	0.0000
Total	8.4785	0.0371	4.2266	0.2380	62.1404	0.0000	51.8401	0.0000

Note: A is the regression with the exchange rates variable while B is without the exchange rates variable.

**APPENDIX 7**  
**THE EFFECTS OF EXCHANGE RATES VARIABLE ON**  
**GRANGER-CAUSALITY TESTS FOR GROWTH-LED**  
**EXPORTS HYPOTHESIS, PHILIPPINES, 1981-2004**

Restriction	Annual				Quarterly			
	A		B		A		B	
	Chi-Squared	P-value	Chi-Squared	P-value	Chi-Squared	P-value	Chi-Squared	P-value
Short-run	3.3909	0.1835	1.4571	0.4826	72.9413	0.0000	60.7810	0.0000
Long-run	1.0908	0.2963	1.2617	0.2613	62.2821	0.0000	50.6046	0.0000
Total	4.9079	0.1787	2.8073	0.4223	73.3764	0.0000	61.5404	0.0000

Note: A is the regression with the exchange rates variable while B is without the exchange rates variable.

**APPENDIX 8**  
**PHILIPPINE TRADE PERFORMANCE INDEX, 1999-2003**

Export Sector*	Share in National Exports (%)	Share in World Exports (%)	Current Position
Electronics ( 99)	48.00	2.65	20
IT & Consumer Electronics (77)	22.00	1.11	26
Clothing	6.00	0.93	34
Miscellaneous Manufacturing (124)	5.00	2.00	35
Transport Equipment (97)	4.00	0.15	48
Processed Food (146)	4.00	0.44	70
Fresh Food (173)	3.00	0.34	90
Mineral Foods (151)	0.28	0.11	46
Basic Manufactures (130)	2.00	0.13	76
Non-electronic Machinery(10)	0.08	0.08	56
Chemicals (127)	1.00	0.06	63
Wood Products (125)	1.00	0.13	83
Textiles (112)	1.00	0.15	74
Leather Products (84)	0.00	0.19	46

Source: International Trade Center at <http://www.intracen.org/menus/countries.htm>

\* Figures in parentheses are the ranking out of total number of exporting countries



**APPENDIX 9**  
**SPECIALIZATION INDEX OF THE PHILIPPINES**

<b>Exports Sector</b>	<b>Rank</b>	<b>Comparative Advantage</b>
Electronic components	4	5.17
IT & Consumer electronics	8	2.16
Clothing	53	1.81
Transport equipment	54	0.29
Miscellaneous manufacturing	65	0.55
Leather products	81	0.35
Non-electronic machinery	81	0.16
Textiles	95	0.29
Processed food	100	0.86
Basic manufactures	108	0.25
Wood products	111	0.25
Chemicals	115	0.11
Minerals	130	0.21
Fresh food	135	0.65

Source: International Trade Center, 2004

Note: The index measures the country's revealed comparative advantage in exports according to Balassa formula. It compares the share of a given sector in national exports with the share of this sector in the world exports. Values above 1 indicate that the country is specialized in the sector under review. The graph shows the ranking of the specialization indices across countries: Rank 1 indicates that the country has the highest specialization index in the world for the sector under review.

Calculations based on COMTRADE of UNSD

## **VITA**

LORNA ECONG AMRINTO was born on February 13, 1975, in Leyte, Philippines. She earned the bachelor's degree in agribusiness at the Visayas State College of Agriculture, now Leyte State University, at Baybay, Leyte, Philippines, in 1997 through an scholarship from the Philippine Agriculture Resources and Research Foundation Inc., and from the University as University Scholar. She was hired to work at the Iloilo State College of Fisheries (ISCOF), Iloilo, Philippines, in 1998. She served the College for 6 years. While employed at ISCOF, she pursued further studies and earned a master's degree in business administration at the University of San Agustin in Iloilo City, Philippines in 2002.

Recently, she is a candidate for the degree of Master of Science in agricultural economics at the Louisiana State University, U.S.A. which shall be conferred in May 2006. Her study is under the auspices of the Fulbright-Philippine Agriculture Scholarship Program.