Philippine Export Efficiency and Potential: An Application of Stochastic Frontier Gravity Model

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PHILIPPINE EXPORT EFFICIENCY AND POTENTIAL: AN APPLICATION OF STOCHASTIC FRONTIER GRAVITY MODEL

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ABSTRACT

This study was conducted to investigate the issue of what Philippine merchandise trade flows would be if countries operated at the frontier using gravity model. The study sought to estimate the coefficients of the gravity equation. The estimated coefficients were used to estimate merchandise export potentials and technical efficiency of each country in the sample and these were also aggregated to measure impact of country groups.

Result of the estimated coefficients of the gravity equation shows that merchandise export flows of the Philippines to trading partners is significantly positively affected by income and market size of the importing partner. The income elasticity of merchandise exports is 0.69%. A 1% increase in market size increases export flow by 0.24%. Distance was estimated to reduce export flow by 1.22% in every 1% increase in distance.

The technical efficiency for all sample countries is not so high; it ranged from 38 to 42% with standard deviation of 30. The most efficient countries in the sample which recorded more than 80% efficiency were Singapore (100%), New Zealand (97%), HongKong (97%), USA (96%), Australia (96%), Canada (96%), UK (93%), Denmark (93%), Japan (87%), Malaysia (85%) and S. Korea (81%). Countries with larger markets emerge as high export potentials such as USA, China and Japan with potential ranging from 10 to 30 Trillion US dollars.

These potential has been changing within the period. Result of technical inefficiency model reveals that these potential is increased by membership of the Philippines to ASEAN, APEC and WTO. Reduction of corruption and freer labor market in the importing country enhances export potential of Philippine merchandise exports. Commonality of language also enhances these potential.

Keywords: Merchandise exports, Gravity, Stochastic frontier, Philippine export potential

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INTRODUCTION

Trade is the exchange of goods and services across regions and national borders was considered important in improving welfare of people even before the birth of economics as organized science in 1776. The mercantilist philosophy maintained that the way for a nation to be rich and powerful was to export more than to import. The Philippines is one of the world's oldest open economies, which traded goods even prior to its discovery by the western world. For more than a century however, it experienced widening gap between exports and imports which causes trade deficit. This means that the country is not trading at its potential, which may be due to its institutional and infrastructures rigidities or the rigidities of its trading partner which will be explored in this study.

Transactions of the Philippines with the rest of the world are recorded in the Balance of Payment (BOP) which shows country's external economic position. The BOP is composed of current, capital and financial account. Figure 1 shows a positive BOP position of the Philippines since 2004 which reflects a positve extenal position. This means that financial inflow to the Philippines is greater than outflow to the rest of the world. Current account as one of the components of the BOP shows the flows of goods and services, income and current transfers. It was observed that the Philippines have been operating a current account surplus since 2003 (pushing the BOP), despite a large trade deficit as reflected in Figure 2. Current account surplus stimulates domestic production and income while the deficit dampens domestic production and income. This surplus in the current account is accounted to current transfers and strong remittances inflows of Overseas Filipino Workers (OFW) which are represented as income. Moreover, trade of goods and services pulls current account surplus. This pulling of current account due to trade of goods and services is called trade deficit.

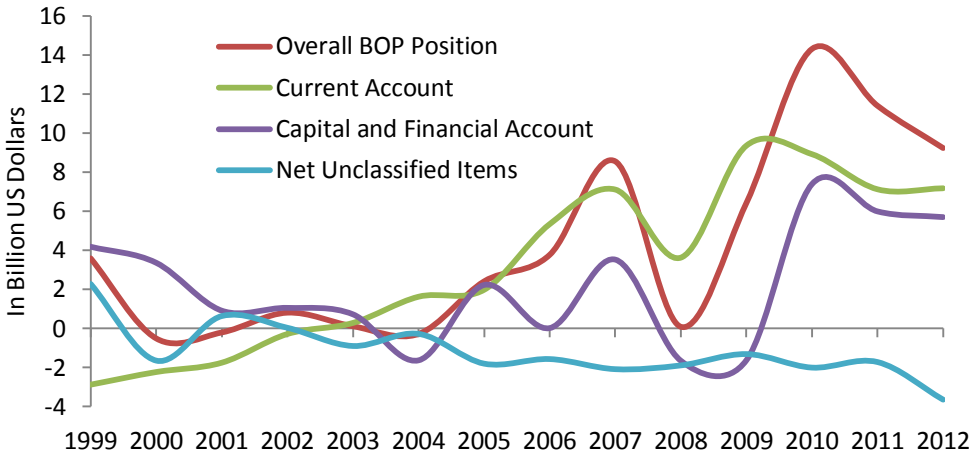

Figure 1. Balance of payment (BOP), Philippines, 1999-2012.
Source of Data: Philippine Institute of Development Studies
http://econdb.pids.gov.ph/tablelists/table/153

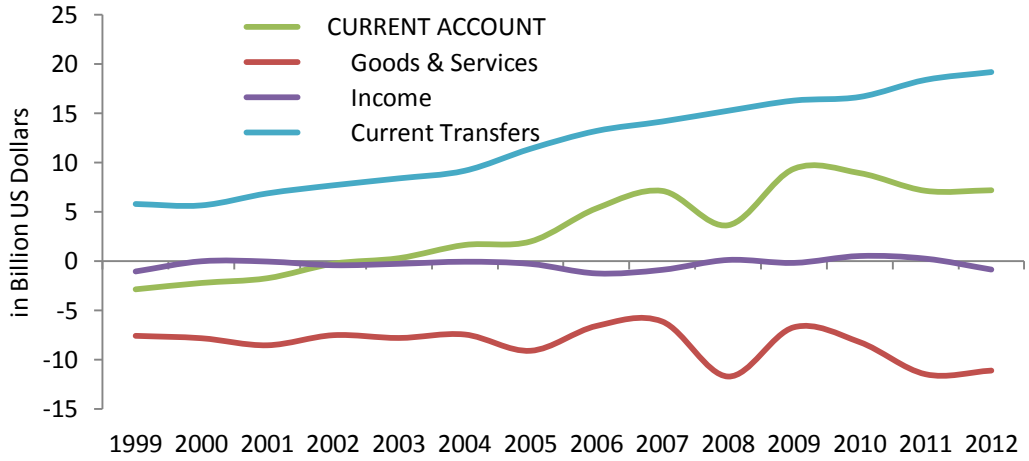

Figure 2.Current account balance, Philippines, 1999-2012.
Source of Data: Philippine Institute of Development Studies
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Trade deficit is an economic measure of a negative balance of trade in which a country's import exceeds its export (Figure 3) which was observed in the Philippines for decades. Figure 4 show that huge trade deficit was accounted to large deficit on traded goods. A trade deficit represents an outflow of domestic currency to foreign markets. Furthermore, it causes the strengthening of foreign currency against the home currency which results in expensive importation of goods and services as compared to

exportation home-produced goods and services.These are the impacts of devalued home currency (peso) and if significantly large can cause BOP deficit.

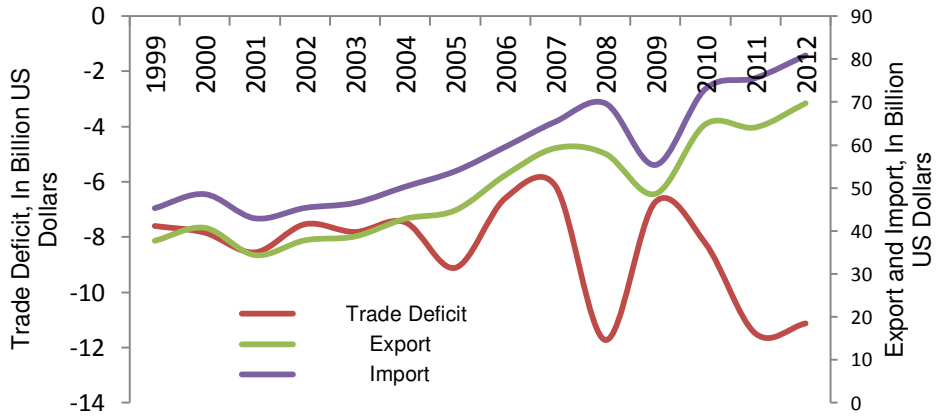

Figure 3.Trade Deficit (export - import), 1999-2012.
Source of Data: Philippine Institute of Development Studies
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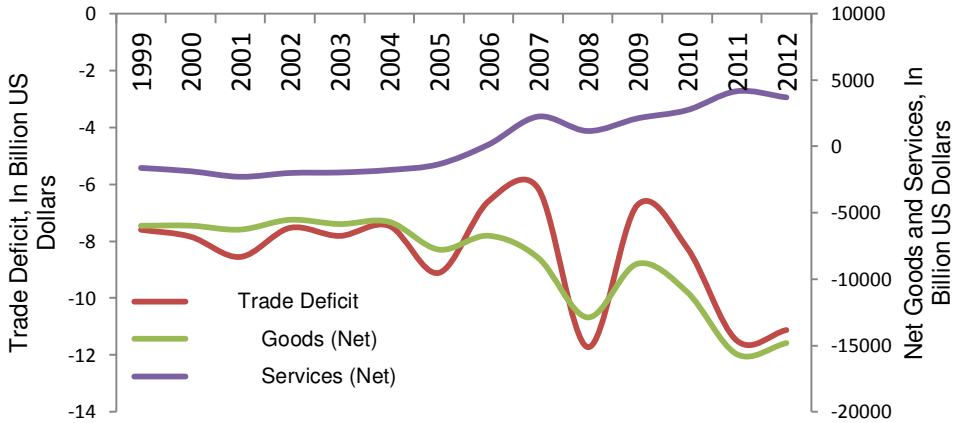

Figure 4.Trade Deficit (goods + services), 1999-2012.
Source of Data: Philippine Institute of Development Studies
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The characteristics of exports and global trade are radically changing as the world recovers from the recent global financial crisis and the natural disasters in Japan. Moreover, the unfolding political events in the Middle East and North Africa (MENA) will contributed to volatile market conditions. The key features are the speedy growth of emerging economies with large consumer populations and the sluggish single-digit growth of developed markets. This will result in the re-balancing of consumption, export

market size and supply chain configurations in relation to pre-crises periods (PEDP, 2011-2013).

These changes in global export environment pose opportunities for the Philippines to grow exports of merchandise and services. This leads the Philippines to target a forty percent (+40%) increase in export by 2013 and to exceed Philippine exports by one hundred twenty billion U.S dollars (US$ 120B) by 2016 as targeted in the Philippine Export Development Plan (PEDP). The 2016 target is more than twice compared to the 2012 Philippine export value of US$ 57.5B (BSP Database). Achievement of this target requires understanding of the factors that prevent the Philippines to reach its export potential. These factors could be explored to achieve the target of PEDP.

Conventional trade study uses Gravity Model to explain trade flows between two countries as directly proportional to the product of each country's 'economic mass' that can be measured by their Gross Domestic Product (GDP) and inversely proportional to the distance between the countries (Anderson, 1979). This model was derived from different theories but was criticized because of weak theoretical foundations. This is rectified the recent work to the point where Frankel, Stein and Wei (1997) claimed that the gravity model has "gone from an embarrassing poverty of theoretical foundation to an embarrassment of riches" as cited by Armstrong (1997). This model was very successful in analyzing trade flows. However, this cannot provide estimates of trade potential if estimated using the Ordinary Least Square (OLS) regression analysis as the commonly used method in estimating conventional gravity models.

Earlier studies have estimated the difference between observed values and the estimated predicted values by using the gravity equation through OLS estimates as potential trade (Baldwin, 1994 and Nilsson, 2000) between a pair of countries. The OLS estimation procedure produces estimates that represent the centered values of the data set. However, potential trade refers to free trade with no restrictions to trade. Thus, for policy purposes, it is rational to define potential trade as a maximum possible trade that can occur between any two countries, which has liberalized trade restrictions the most, given the determinants of trade. This means that the estimation of the potential trade requires a procedure that represents the upper limits of the data and not the centered

values of the data (Kalirajan, 2007). To address this, the concept of stochastic production frontier analysis which deals with the upper bound of the data set to measure the maximum possible output is utilized (Drysdale et al., 2000).

This thesis is an attempt to investigate the trade patterns and constraints of the merchandise exports of the Philippines using the gravity stochastic frontier model. It seeks to analyze factors affecting trade of merchandise export. It also aims to come up with technical efficiency estimates for each of the trading partner. Further, the study attempt to assess if multilateral agreements of the Philippines increase the volume of Philippine trade.The factors considered in this study are “beyond the border” constraints and natural constraints to trade. This will also estimate export potential and compare it with actual export performance to see whether there are still some opportunities to ensure the surplus of the current account of the balance of payments by increasing the volume of exported goods. Estimation of the model will follow the proposed method of Drysdale et al., (2003) and Kalirajan and Finley (2005). The study includes comprehensive measures of “beyond the border” constraints which are product of recently established country specific indices which are not included in the studies in the literatures.

Knowing the trade potential and factors affecting it could narrow down trade deficit especially in merchandise export. Narrowing the trade deficit is an advantage of the country as it will be reflected in a trade surplus of current account balance. The surplus of the current account of BOP is a full factor for the Philippines to achieve an investment grade sovereign rating which boost capital inflows and positive factor for the Philippines Economic fundamentals like appreciation of Philippines peso against US dollars.

Understanding the rigidities that affect export flows could help policy maker’s efforts to minimize or at least mitigate the effects of existing restrictive measures of trade growth, i.e., engaging in bilateral and multilateral agreements and processes. Therefore the objective of every country is to try to achieve its full trade potential through the engagement process or even through unilateral reforms. It is of significant importance that each country may know its full potential with other countries or other

regions in order to get the engagement process started. Enhancement of this trade flows will enhance welfare of people.

OBJECTIVES OF THE STUDY

This study aims to analyze the export flows between the Philippines from 2009 to 2012 based on 69 trading partners of merchandise exports. Specifically, the study aims:

1. to estimate the potential trade between the Philippines and its trading partners;
2. to estimate the technical efficiency of Philippine merchandise exports to each trading partners; and,
3. to determine the constraints to Philippine trade.

THE GRAVITY MODEL

The Gravity Model is based on the law of universal gravitation in physics developed by Isaac Newton in 1687 which described the gravitational force between two masses in relation to the distance that lies between them (Newton, 1687), that is

$$F_{ij} = G\frac{M_i M_j}{d_{ij}^2} \qquad (1)$$

The gravitational force F_{ij} is proportional to the product of the two masses M_i and M_j and inversely proportional to the square of the distance d_{ij} that keeps the two masses apart from each other. The gravitational constant G is an empirical determined value. This relationship is applicable to any context where the modeling of flows or movements is demanded (Starck, 2012).

The gravity equation was first applied to international trade flows by Timbergen in 1962. He assumed the relationship as in equation 1.

$$X_{ij} = A\frac{Y_i^{\alpha} Y_j^{\beta}}{D_{ij}^{\gamma}} \qquad (2)$$

There is a direct proportionality between the explanatory variables and the variable to be explained is not necessary implied. The exponents α, β and γ can therefore take values different from 1. These are elasticity of the exporting country's GDP (α), the

elasticity of the importing country's GDP (β) and the elasticity of distance (γ). Where, α=β=1 and γ=2, in equation 2, will correspond to the universal gravitation equation of Isaac Newton. By taking the natural logarithm of equation 2 and by adding the error term ε_{ij} a linear relationship is obtained. This is traditionally estimated using the Ordinary Least Squares (OLS) regression analysis; the coefficients can be interpreted as elasticities.

$$\log(X_{ij}) = \log A + \alpha \log(Y_i) + \beta \log(Y_j) - \gamma \log(D_{ij}) + \varepsilon_{ij} \quad (3)$$

Anderson (1979) was one of the first economists who developed a sound theoretical foundation of the gravity model that brought gravity model into mainstream economics. The development of the Anderson's theoretical foundation of gravity model was gradual. His work became the basic theoretical framework for a gravity model of trade flows with the basic assumptions of homothetic preferences for trade goods across countries and using the constant elasticity of substitution (CES) preferences.

Anderson yielded the specification of aggregated trade flows as final gravity equation

$$X_{ij} = \frac{Y_i \Phi_i}{\sum_j Y_j \Phi_j \frac{1}{f(d_{ij})}} \cdot \frac{\Phi_j Y_j}{f(d_{ij})} = \frac{Y_i \Phi_i \Phi_j Y_j}{f(d_{ij})} \left[\sum_j Y_j \Phi_j \frac{1}{f(d_{ij})} \right]^{-1} \quad (4)$$

Adding the error term ε_{ij}, equation 4 can be rewritten as

$$X_{ij} = \frac{Y_i \Phi_i \Phi_j Y_j}{\sum_j Y_j \Phi_j} \frac{1}{f(d_{ij})} \left[\sum_j \frac{Y_j \Phi_j}{\sum_j \Phi_j Y_j} \frac{1}{f(d_{ij})} \right]^{-1} \varepsilon_{ij} \quad (5)$$

where,

X_{ij} = Exports of country i to country j

Y_i= Income in country i

d_{ij}= Distance between country$i$and country$j$

Φ_i= The share of expenditure on all traded goods and services in total expenditure of country $\Phi_i = F(Y_i N_i)$, where N_i is the population in country i

Inherent Bias of the Gravity Model

According to Anderson (1979), the log linear of equation 5 resembles the standard gravity equation in equation 3, with an important difference. This difference is the bracket term in equation 5 which is:

$$\left[\sum_j \frac{Y_j \Phi_j}{\sum_j \Phi_j Y_j} \frac{1}{f(d_{ij})}\right]^{-1}$$

This is missing in the generally used empirical specification of the gravity model presented in equation 4. Anderson (1979) described this term as "the flow from i to j depends on economic distance from i to j relative to a trade weighted average of economic distance from i to j to all points in the system. Measuring the correct specification of the relative economic distance term is difficult because researchers do not know all the factors affecting this term. The economic distance can be affected by many factors, including institutional, regulatory, cultural and political, which are difficult to measure completely. These factors are referred to as 'behind the border' constraints of the importing countries or constraints to export.

Omission of this term in the empirical work of gravity model leads to the biasness of the estimation. This is because the term in the square brackets (economic distance term) of equation 18 affects the log-normal distribution of the error term. Therefore, the expected value of the error term is no longer zero (E(Uij) ≠ 0) and the normality assumption of OLS is violated. This omission leads to heteroskedastic error terms and the log-linearization of the empirical model in the presence of heteroskedasticity leads to inconsistent estimates because the expected value of the logarithm of a random variable depends on higher-order moments of its distribution (Silva and Tenreyro, 2003 as cited in Miankhel et al., 2009). Therefore, the OLS estimation on such gravity equations will be biased.

Aside from the violation of the OLS normality assumption, the estimation of these conventional gravity models through OLS provides the values at the mean of the observation or sample countries. This is problematic in determining trade potential which requires identifying the upper bound. To address these problems, the concept of

stochastic production frontier analysis was incorporated to the gravity model. In this case, export potential is conceptually similar to a firm producing at the *frontier*.

STOCHASTIC FRONTIER GRAVITY MODEL

The Gravity Stochastic Frontier Model is the Integration of Gravity Model and Stochastic Frontier Production Function Model which was formally introduced by Kalirajan (2000) to address the inherent bias of the conventional gravity model of trade and to estimate potential trade flows.

With a stochastic frontier approach, the gravity equation can be written as:

$$lnX_{ijt} = lnf(Y_{ijt}; \beta)exp^{(v_{ijt}-u_{ijt})} \qquad (6)$$

where the term X_{ijt} represents the actual exports from country i to country j. The term $f(Y_{ijt}; \beta)$ is a function of the determinants of potential trade (Y_{ijt}) and β is a vector of unknown parameters. The single sided error term, u_{ijt} ***is the economic distance bias referred by Anderson (1979), which is due to the influence of the "behind the border measures" of the importing country.*** This bias creates the difference between actual and potential trade between two countries. u_{ijt} takes value between 0 and 1 and it is usually assumed to follow a truncated (at 0) normal distribution, $N(\mu, \sigma_u^2)$. When u_{ijt} takes the value 0, this indicates that the bias or country-specific "behind the border constraints" are not important and the actual exports and potential exports are the same, assuming there are no statistical errors. When u_{ijt} take the value other than 0 (but less than or equal to 1), this indicates that the bias or country-specific "behind the border" constraints are important and they constrain the actual exports from reaching potential exports. The double-sided error term v_{ijt}, which is usually assumed to be $N(0, \sigma_v^2)$, captures the influence on trade flows of other left out variables, including measurement error that are randomly distributed across observations in the sample.

Export potential is conceptually similar to a firm producing at the frontier. When a firm is producing at the frontier, it has achieved economic efficiency which is composed of technical and allocative efficiency (Kalirajan and Shand, 1999). It is then argued that

when a country achieves its trade potential or is trading at the frontier, the country is trading in the most efficient manner. Export potentialis defined as the export achieved when there is least resistance (least inefficiencies) to trade given the current trade, transport and institutional practices (Drysdale et. al., 2000; Kalirajan, 2000; Armstrong, 2007). In other words, export potential is explained as the maximum possible value of exports that could hypothetically be attained using the most open (most efficient) trade policies observed.Following from this argument, we can define export performance (the achieved export efficiency of the economy) as the ratio of actual to potential exports as shown in equation 7.

$$TEX_{ijt} = \frac{f(Y_{ijt};\beta)\exp(v_{ijt} - u_{ijt})}{f(T;\beta)\exp(v_{ijt})} = \exp(-u_{ijt}) \qquad (7)$$

The advantages of the suggested method of estimation of the gravity model are as follows: Firstly, it does not suffer from loss of estimation efficiency. Secondly, it corrects for the economic distance bias term, which is creating heteroskedasticity and non-normality, isolating it from the statistical error term. This isolation property will enable us to examine how effective are the importing countries “behind the border constraints” as major trade constraints. Thirdly, the suggested approach provides potential trade estimates that are closer to frictionless trade estimates. This is because the approach represents the upper limits of the data, which come from, those economies that have liberalized their trade restrictions the most (Miankhel, et al., 2009). Finally, the suggested method bears strong theoretical and trade policy implications towards finding ways of minimizing unilateral impacts to volume of trade.

CONCEPTUAL FRAMEWORK OF THE STUDY

The flow of the study and variables are presented in Figure 8. The study will utilize secondary data from various sources to estimate the stochastic frontier gravity model and determine the export potential of the Philippines to trading partners. The model will utilize GDP, population and bilateral distance between country i to j. Since the study will employ the stochastic frontier gravity model which is similar to estimation of firm level technical efficiency and production potential. Various beyond the border

variables like trade agreements between Philippines and partner country; commonality of language, landlocked, and partner country specific measures was explored.

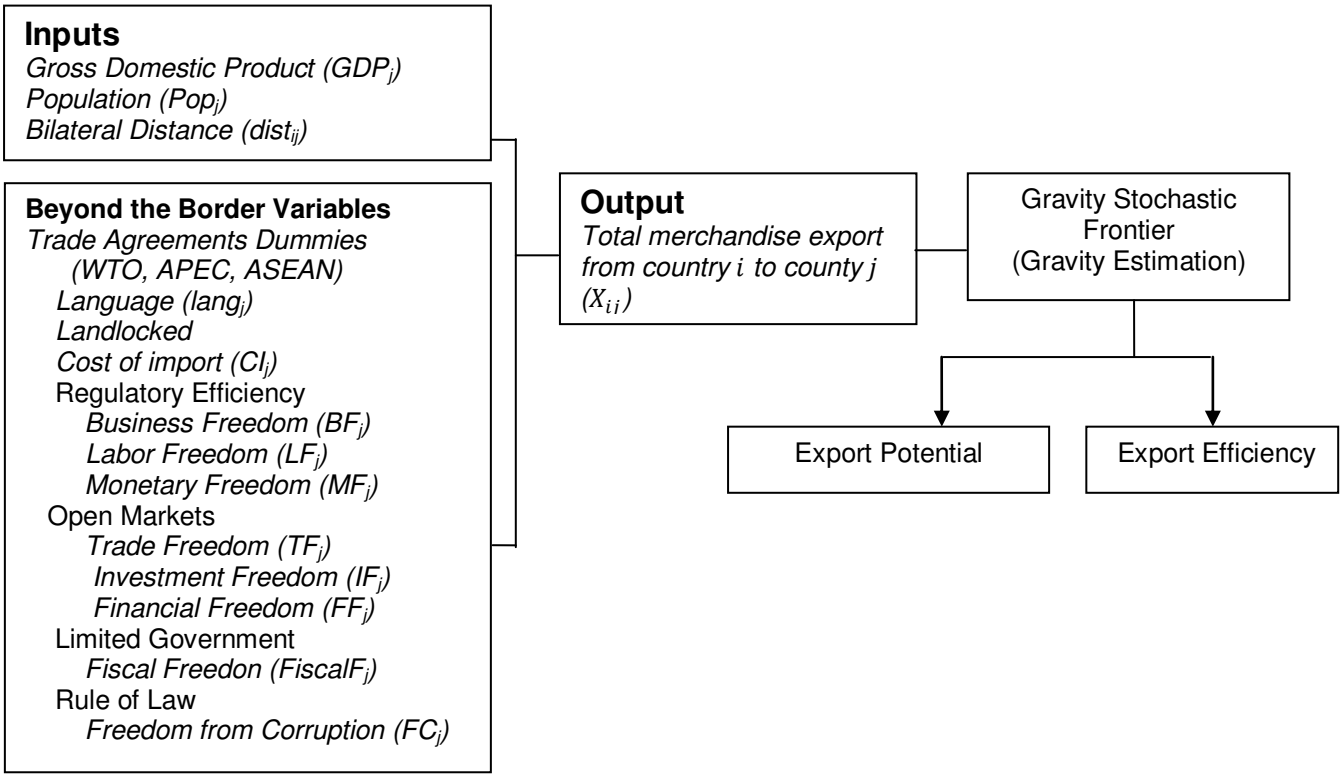


Figure 5. Estimation framework of stochastic frontier gravity model.

DATA SOURCES

This study utilized panel data consisting of 69 bilateral trading partners of the Philippines on merchandise exports from 2009 to 2012. The list of countries included in this study is shown in Table 1 which was chosen based on their relative importance to Philippine merchandise exports. The aggregate data on merchandise export was taken from the Department of Trade and Industry (DTI). Data on Gross Domestic product as proxy to income and population as proxy for market size was taken from the World Bank. Data on bilateral distance measured in kilometers, landlocked, language and land area was secured from the *Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)* which was developed by Mayer and Zignago (2005).

Table 1. Trade partners (69) of Philippine merchandise exports to be included in the study.

AFRICA (6)	UAE	Sweden
Algeria	Viet Nam	Switzerland
Egypt	Yemen	UK
Kenya	**EUROPE (25)**	Ukraine
Madagascar	Austria	**NORTH AMERICA (7)**
South Africa	Belgium	Canada
Tunisia	Croatia	Costa Rica
ASIA (20)	Cyprus	Dominican Republic
Bangladesh	Denmark	Guatemala
Cambodia	Finland	Mexico
China	France	Panama
Hongkong	Germany	USA
India	Greece	**SOUTH AMERICA (7)**
Indonesia	Hungary	Argentina
Japan	Italy	Brazil
Jordan	Lithuania	Chile
S. Korea	Luxembourg	Colombia
Lebanon	Netherlands	Ecuador
Macau	Norway	Peru
Malaysia	Poland	Uruguay
Nepal	Portugal	**OCEANIA (4)**
Saudi Arabia	Russia	Australia
Singapore	Slovak Republic	Micronesia
Sri Lanka	Slovenia	Papua New Guinea
Thailand	Spain	New Zealand

Note: Classification is based from http://www.worldatlas.com/cntycont.htm#.Ugv73aCHMag

"Beyond the Border" variables including freedom from corruption (FC), fiscal freedom (FiscalF), business freedom (BF), labor freedom (LF), monetary freedom (MF), trade freedom (TF) investment freedom (IF) and financial freedom (FF) was taken from the Heritage Foundation. List of APEC member countries was taken from apec.org while ASEAN member countries were taken from asean.org. World Trade Organization list of members was taken from wto.org.

EMPIRICAL APPLICATION

Adopting the methodology proposed by Drysdale et.al. (2000) and Kalirajan and Finley (2005), the stochastic frontier approach of the gravity model in equation 6, imposing the variables proposed in this study can be rewritten as:

$$\ln X_{ijt} = \beta_0 + \beta_1 lnGDP_{jt} + \beta_2 lnPop_{jt} + \beta_3 lndist_{ijt} - u_{ijt} + v_{ijt} \qquad (8)$$

where:

X_{ijt}- is the total value of exports from Philippines (i) to partner country (j) at time t.

GDP_j- Gross Domestic Product of country j at time t as proxy for income.

Pop_j- population of country j as proxy for market size.

$dist_{ij}$- is the geographical distance between the capital cities of country i and j measured in kilometers.

u_{ijt} - Single sided error for the combined effects of inherent economic distance bias or 'behind the border' constraints, which is specific to the exporting country with respect to the particular importing country, creating the difference between actual and potential bilateral trade. u_{ijt} is assumed to have an iid nonnegative half normal distribution that is $u_{ijt} \sim iid\ N(0, \sigma_u^2)$

v_{ijt} – Double sided error term that captures the impact of inadvertently omitted variables and measurement errors that are randomly distributed across observations in the sample. v_{ijt} is assumed to follow an iid normal distribution with mean zero and constant variance that is $v_{ijt} \sim iid\ N(0, \sigma_v^2)$.

The disturbance term can be specified as: $\varepsilon_{ijt} = v_{ijt} - u_{ijt}$

The inefficiency effect model,are specified in equation 9 captures significant factors that contribute to Philippine merchandise export inefficiency.

$$u_{ijt} = \delta_0 + \delta_1 APEC + \delta_2 ASEAN + \delta_3 WTO + \delta_4 Lang_j + \delta_5 Landlocked + \delta_6 CI_j + \delta_7 TF_j + \delta_8 BF_j + \delta_9 IF_j + \delta_{10} FC_j + \delta_{11} FiscalF_j + \delta_{12} LF_j + \delta_{13} MC_j + \delta_{14} FF_j + w_{ijt} \qquad (9)$$

where:

$APEC$- is a dummy variable that takes the value of 1 if country j is a member of Asia Pacific Economic Cooperation and 0, otherwise.

$ASEAN$ - is a dummy variable that takes the value of 1 if country j is a member of Association of Southeast Nation and 0, otherwise.

WTO-is a dummy variable that takes the value of 1 if country j is a member of World Trade Organization and 0, otherwise.

$Lang_j$- is a dummy variable, 1 if country js' language is English and 0 otherwise.

$Landlocked$- is a dummy variable, 1 if the country j is landlocked and 0 otherwise.

CI_j- cost of importing , this measures the fees levied on a 20-foot container on to import goods in U.S. dollars..

TF_j- Trade Freedom index of country j, which is a composite measure of the absence of tariff and non tariff barriers in partner country j which includes quantity, price, regulatory, investment, customs restrictions and direct government intervention. The TF score of each partner country j is a number between 0 and 100.The higher the score implies lesser barriers of trade.

BF_j- is Business Freedom index developed by The Heritage Foundation, is an overall indicator of the efficiency of government regulations of business. The BF score of each partner country j is a number between 0 and 100 with 100 as the freest business environment.

IF_j- Investment Freedom Index of partner country j determines how free the flow of investment capital is. The higher the score, the freer is the investment into and out of specific activities, both internally and across the country's border. The IF score of each partner country j is a number between 0 and 100with 100 as the freest in terms of investment.

FC_j-Freedom from corruption index of country j developed by Transparency International's Corruption Perception Index (CPI). The FC score of each partner country j is a number between 0 and 100, the higher the score indicates little corruption.

$FiscalF_j$- is Fiscal Freedom index of country j, is a measure of the tax burden imposed by the government, it includes direct taxes on individuals and corporate incomes. The index lies between 0 to 100, the higher the index means the higher tax burden.

LF_j- Labor Freedom index of country j, measures various aspect labor market's legal and regulatory framework including minimum wages, laws inhibiting layoffs, severance of requirements and measurable regulatory restraints on hiring and hours worked. The index lies between 0 to 100, the higher the index means freer labor.

MF_j- Monetary Freedom index of country j,combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market. The index lies between 0 to 100, the higher the index means country j has a stable currency and market determined prices.

FF_j –Financial Freedom index of country j, is a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector. The index lies between 0 to 100, the higher the index means higher financial freedom.

ESTIMATION

The estimation of equations 23 and 24 was done simultaneously using Frontier 4.1 software of Tim Coelli (2004). Frontier follows the Kumbhakar and McGuckin (1991) and Reifschneider and Stevenson (1991) idea to estimates all of the parameters in one step procedure to be consistent on the assumption that inefficiencies are independently and identically distributed (iid).

RESULTS

Philippine Merchandise Exports

Figure 6 presents trend of merchandise exports from 1948 to 2012 in the Philippines. The general trend of merchandise exports within the period is rising, however, at generally fluctuating growth rates.

The Philippines trade policies from 1950's to the late 1960's focused on imports and were generally protectionist in nature. In 1950's, the country adopted import-substitution policies mainly to conserve scarce foreign currency assets in the central bank rather than as a long-term development framework (Power and Sicat, 1970). This regime of protectionism resulted to "profit incentive which evoked a strong entrepreneurial response; and what began as an emergency tactic became the principal policy instrument for promoting industrialization in the 1950's (Power and Sicat, 1970).

In the 1960's, the government begun to decontrol import and foreign exchange markets. A tariff structure was set in place in 1962 under the Macapagal Administration (Sicat, 2002) that preserved the same industrial structure that had been protected by the earlier import/exchange control structure. The highest tariff rates were set on consumer goods, while imported capital equipment enjoyed the lowest rates. This

structure would remain essentially unchanged until the early 1970's (Power and Sicat 1970).

Trade policy changes were introduced in 1970's targeted export oriented industries and created the Board of Investments (BOI), and the 1970 Export Incentives Act (RA 6135), which specified the qualifications of a domestic industry to receive tax exemptions and subsidies on imports, and expanded the list of qualified industries and businesses. It was also at this stage that economic diplomacy entered into the picture through the creation of Association of Southeast Asian Nations (ASEAN) in 1967. This has lead to high growth rates of merchandise exports from 1970 to 1974. It reached a peak of 71% in 1973. This can also be attributed to a world price commodity boom in the same period and the devaluations of the Philippine currency (Bautista, et al., 1979). The Organization of Petroleum Exporting Countries (OPEC) oil crises during this period, however, wiped out most of these gains in manufacturing, including the 1973 trade surplus. This caused severe downturn on export growth rates until 1975, which recovered minimally in 1976 to 1979. The brewing political and economic crisis in the late 1970's and early 1980's as the impact of martial law hampered the growth of the export sectors. The sector was able to recover after the political transition in 1986.

Export growth was stable from 1986 to 1999, when the economy recovered from the extreme political instability. Philippine exports was surprisingly unaffected by the 1997 Asian financial crisis which secured a growth rate of 21% and continued to rise until 1999. This growth rate was not maintained and dipped to an all time low of -18% in 2001, the ousting of President J. E. Estrada.

The earlier part of 21st century recorded low export growth rates. In response, the government under Executive Order No. 554 of 2006, eliminated fees and charges on export clearances, inspections, permits, certificates and other documentation requirements, except those imposed by specific laws or arrangements in order to improve export competitiveness. This resulted in

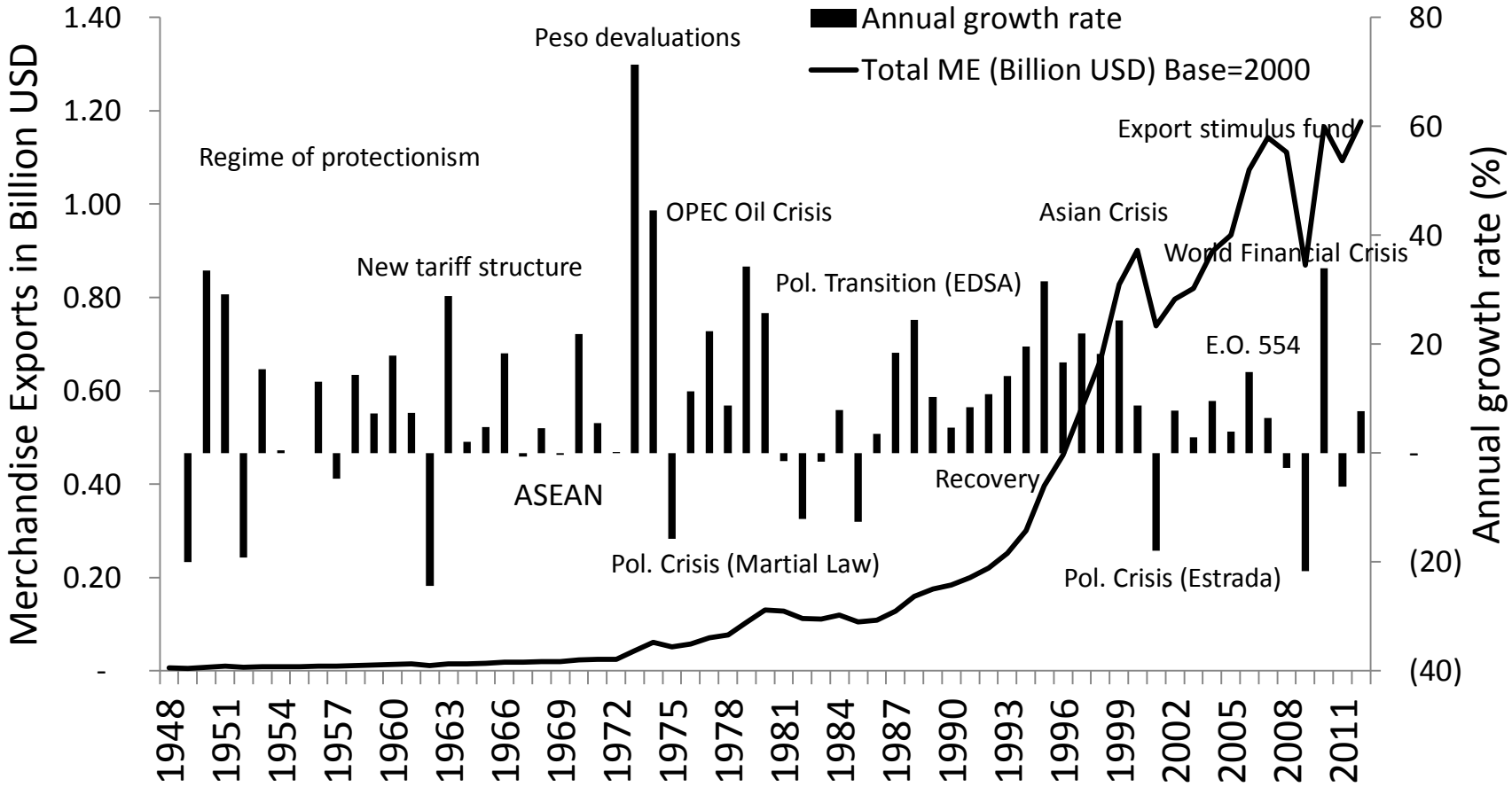


Figure 6. Philippine merchandise exports (ME), 1948-2012.
Source of data: World Bank Database

growth rate surge to 15% in 2006. This was not maintained, when the country's export sector was strongly hit by the world financial crisis in 2007. In response, the government allotted an economic stimulus fund to provide financial assistance to exporters which was lifted when the sector recovered in 2010. The export sector recovered and peaked at 33%. This was not maintained, growth rate was fluctuating until 2012. The average growth rate from 1948 to 2012 was 10%.

Figure 7 shows that manufactures dominated merchandise export in the Philippines. This is followed by machinery and transport equipment, office and telecom equipment, and integrated circuits and electronic components.

Figure 8 shows the global markets of Philippine merchandise exports from 2007 to 2012. Japan is the most important market which imports around 11% to 20% from 2007 to 2012. This is higher compared to the total exports of the Philippines to major regional trading blocs such as ASEAN, European Union (EU) and North America Free Trade Agreement (NAFTA). This is followed by China, Hong Kong, South Korea and Taiwan with 12%, 9%, 6% and 4% respectively in 2012.

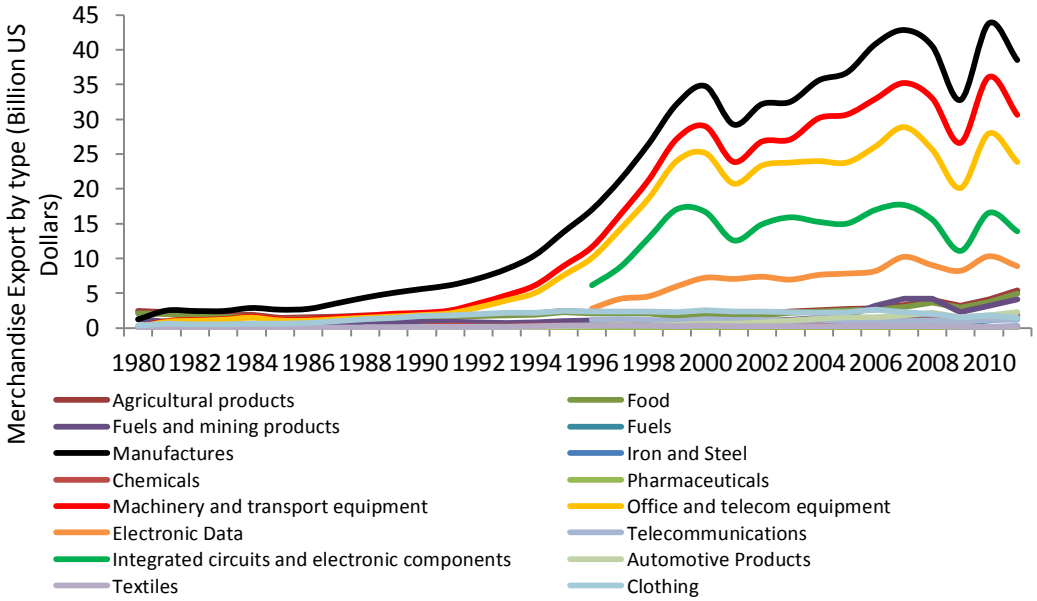


Figure 7. Philippines merchandise exports, by type, 1980-2012.
Source of data: World Bank Database

This very strong and consistent demand of the Philippine merchandise in domestic Japanese markets can be explained by complementarity and similarity indices between the two countries. The complementarity index measures the difference in factor endowments, while similarity index measures differences in export structure whether the two countries have similar main export products (Deardorff ,1984). These measures however, were not included in this study. A study conducted by Hapsari, et al.,(1996) measured these. The results revealed that Philippines and Japan have a relatively dissimilar export structure and relatively complementary factor endowments which indicate more favorable prospects for a successful trade arrangement between countries. This was intensified with the economic partnership of the two countries in December 2008 in the form of the Philippine-Japan Free Trade Area (FTA).

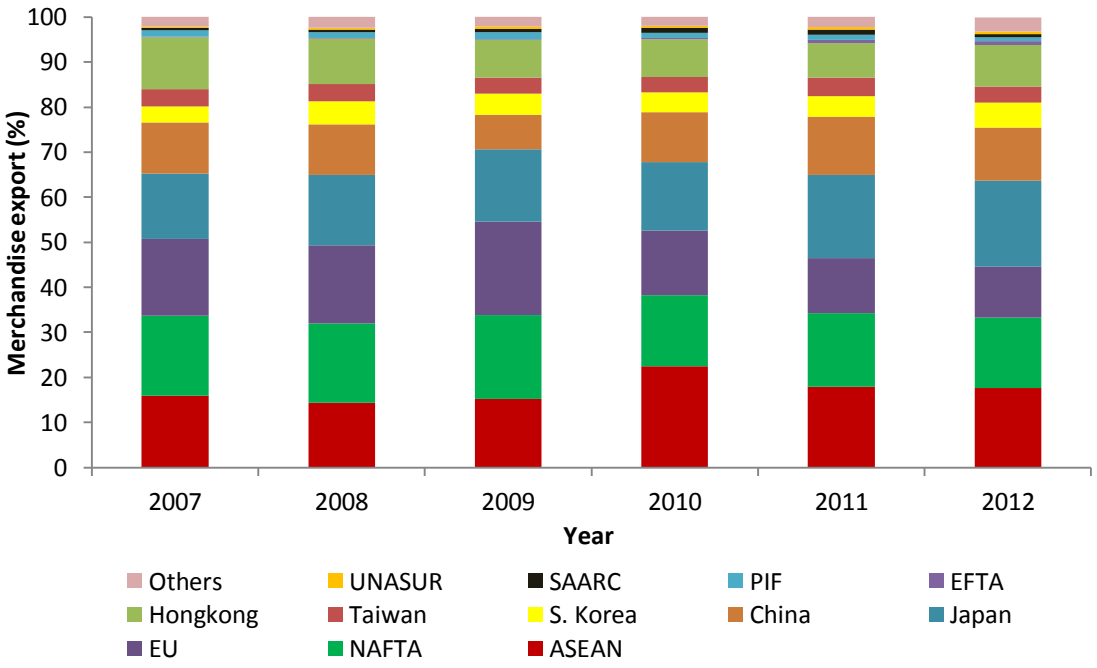


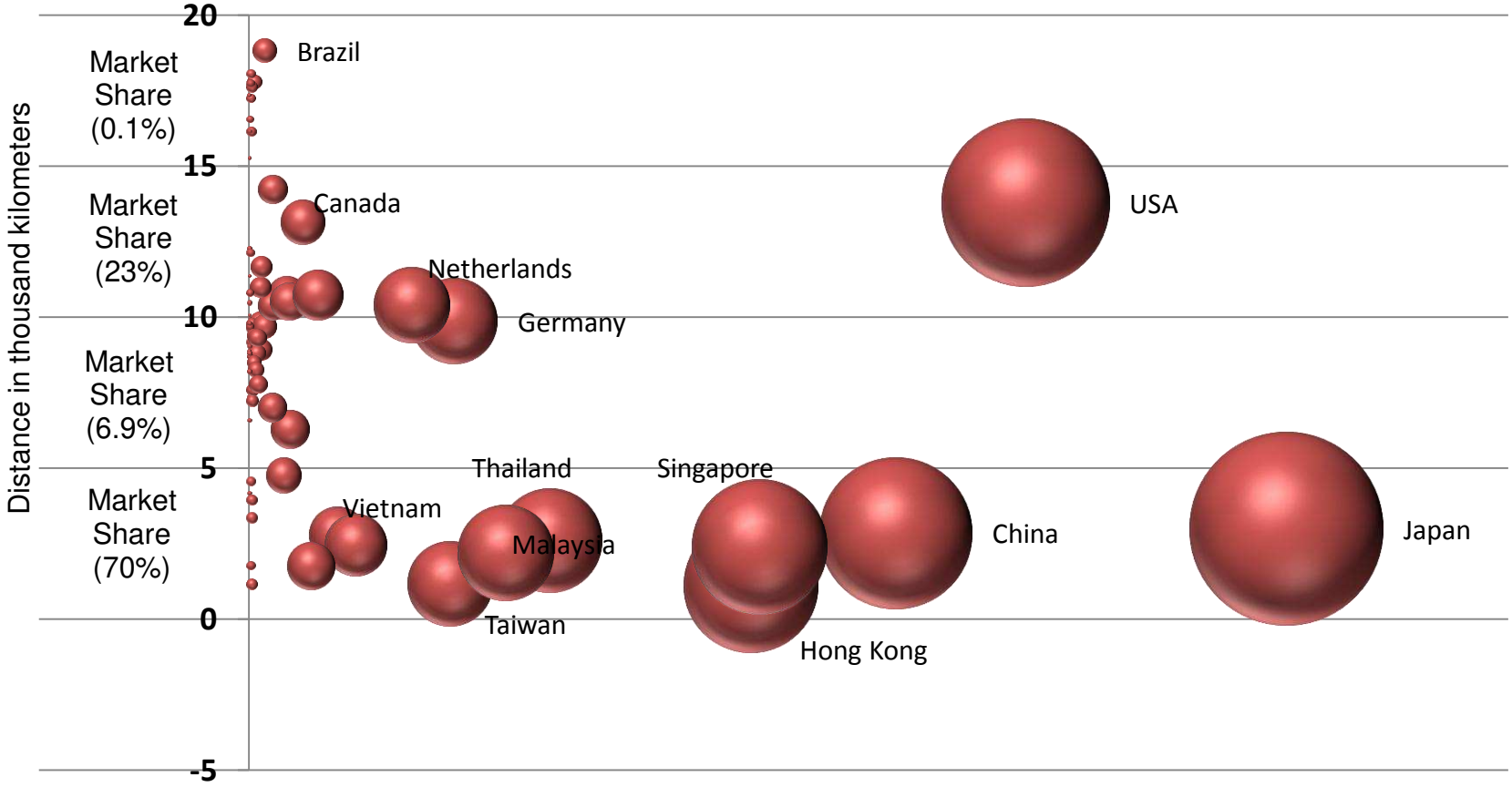
Figure 8. Philippine merchandise export destinations, by country and RTAs, 2007-2012.
Source of data: Department of Trade and Industry

The major trading bloc (regional) of the country is the ASEAN, with member states signing of the ASEAN Free Trade Agreement (AFTA). This

regionalism is sometimes called “natural trade bloc” which composed of neighboring countries and presumably with low transport cost or trade intensively with one another. Foroutan (1998), however, noted that ASEAN seems to be so far a rather ineffective grouping compared to other Preferential Trade Agreement (PTAs) in the world. To farther expand trade facilitation in the region the ASEAN facilitated the trade agreements with Australia, New Zealand, China, India, Japan and South Korea.

The merchandise export pattern of the Philippines relative to the distance of its trading partners is shown in Figure 9. This reflects different size of bubbles. The bigger the bubble represents higher value of export flow from the Philippines. It shows that the markets (destination) of Philippine merchandise exports are concentrated in the countries within the 5 thousand kilometers linear distance from the Philippines. This range account for to around 70% of the total merchandise exports of the country. The next distance range (5 to 10 thousand kilometers) accounted for 7%, while the 10 to 15 kilometers range with 23% market share. This relatively high share is attributed to export facilitation in the USA through bilateral agreements on trade. The United States and the Philippines have had a very close trade relationship for more than a hundred years (ustr.gov. accessed Jan. 2014). Both countries signed the Philippines-USA FTA in 1989. The market share of the last range (15 to 20 kilometers) accounted 0.1%.

This market shares of distance ranges diminishes as distance increases. This confirms the existence of the gravitational force on Philippine merchandise exports to trading partners which is reduced by the distance between them. The empirical analysis on determinants of this gravitational relationship on export flows are discussed in the next section.



*USA and Canada market share is 15.3%

Figure 9. Relationship of distance and value of Philippine merchandise exports, 2012.
Sources of Data: CEPII and DTI.

Stochastic Frontier Estimates of the Gravity Model

The trade gravity model in equation 8 and the trade inefficiency model in equation 9 were estimated simultaneously (one step approach) following the usual concept of stochastic frontier production function using Frontier 4.1. This estimation provided the inputs for the computation of TE and potential export flows based from the frontier which are the objectives of this study. This is a deviation from the usual application of the gravity model in the literatures which employs OLS which is problematic in the calculation of trade potential based on the mean.

Results of the estimation are presented in Table 2. It shows that merchandise export flows from the Philippines to its trading partners are significantly affected by Income and population of the importing country, and the distance between them. These results are consistent with the literatures previously cited (Felipe *et al*., 2011; Naser *et al*., 2007; Amin, *et al*., 2009). Income of the importing country positively and significantly affects merchandise export flows of the Philippines at the 5% level of significance. The effect, however, is only minimal with income elasticity of 0.70%.

Table 2. Maximum likelihood estimates of the coefficients stochastic frontier gravity model for Philippine trade among trading partners, 2009-2012.

Variable	Est. Coefficient	Std. err	p-value
Constant	7.6039*	1.2498	0.0000
GDP	0.6971*	0.0489	0.0000
Population	0.2464*	0.0845	0.0039
Bilateral Distance	-1.2193*	0.1121	0.0000

[ns] not significant at 5% level, * significant at 5% level

Population a proxy to market size, revealed a positive relationship between Philippine exports and market size. On the average, 1% increase in the population or market size of the importing country, increases value of export from the Philippines by 0.25%.

On the other hand, bilateral distance was seen to have negative effect to export flows thereby reducing trade between them. This variable is a proxy to transport costs and other cost of trade like communication cost, and transaction cost, among others. Thus, greater distance the higher the cost. That is, a percent increase in bilateral distance, decreases export flows by 1.21%. This estimate is relatively close to the estimated coefficients of distance by Kumar et al. (2010) which is -1.56% and Herera et al. (2011) which is -1.24%, among others. This implies that even with modern transport technology, distance/cost of trade in many forms still significantly affects trade flows

among countries. For example, distance can reflect logistical difficulties. The study conducted by Djankov et al. (2006) revealed that each additional day taken to move the goods from warehouse to the ships reduces trade by at least 1%. This is equivalent to increasing the distance of a country from its trade partners by 70kms.

These results suggest that to increase export flows of the country, it should focus on strengthening trade linkages/partnership in form of bilateral or multilateral agreement in nearby countries with fast growing population/ expanding markets and with higher income. This leads us to a very important question on "which nearby countries posed potentials for market expansion of Philippine export?". This will be answered by the second objective of the study.

The ***technical inefficiency*** effect model estimates are presented in Table 3. The model includes international commitment, RTA and Multilateral Trading Agreements (MTA) participation of the Philippines, and importing country's specific variables that might explain trade flow variations. Trade agreements included in the analysis were APEC, ASEAN and WTO to capture the impact of international engagement/commitment entered into by the Philippine government. However, WTO was removed in the actual estimation to avoid double counting. If APEC and ASEAN turns out significant, will also imply that WTO is a significant variable. This is because WTO is the convergence of the members of ASEAN and APEC.

Results revealed that the Philippines membership to APEC, ASEAN and WTO increases technical efficiency of the Philippine export flows to trading partners in almost the same degree. This implies the positive impact of Philippines active involvement to international trade negotiations in narrowing trade gap between trading partners.

Table 3. Maximum likelihood estimates of coefficients of the inefficiency effect model for Philippine trade among trading partners, 2009-2012.

Variables	Est. Coefficient	Std. err	p-value
Constant	4.6793*	1.3306	0.001
APEC	-0.5978*	0.2325	0.011
ASEAN	-0.7824*	0.3839	0.043
Language	-0.7762*	0.2005	0.000
Landlocked	0.3435 ns	0.2790	0.219
Freedom from Corrupt.	-0.0197*	0.0085	0.021
Fiscal Freedom	0.0045 ns	0.0087	0.607
Business Freedom	-0.0121 ns	0.0079	0.125
Labor Freedom	-0.0238*	0.0055	0.000
Monetary Freedom	0.0151 ns	0.0136	0.269
Trade Freedom	-0.0178 ns	0.0129	0.169
Investment Freedom	-0.0070 ns	0.0061	0.252
Financial Freedom	0.0029 ns	0.0060	0.629

Cost to import	0.0003 [ns]	0.0002	0.130
Sigma-squared (s2)	1.068*	0.074	0.000
gamma (g)	0.058[ns]	0.349	0.869
log likelihood function	-397.31		
LR test of one sided error	102.70		

[ns] not significant at 5% level, * significant 5% level

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The study also included trading partner's "natural" specific characteristics such as language, and if the country is landlocked. Landlocked turns out insignificant at 5% level of significance, while common language significantly increases technical efficiency of export flows. This increases technical efficiency by 0.77%.

This study used the disaggregated components of economic freedom to capture the impact of country specific indicators covering macroeconomic stability, the role of the government and corporate sector in business, price stability, legal system and policies regarding investment and international trade. Result of the estimation shows that among these indices only freedom from corruption and labor freedom significantly affects trade efficiency. This implies that less corruption in importing means freer flow, thus increasing technical efficiency of this flow. Corruption is a cost to trade. Freer labor which means less intervention of government in the labor market of importing country will also increase technical efficiency. This will result to freer determination of wages and lead to a well functioning labor market.

The estimated σ^2 is highly significant. This is a measure of the mean total variation over the four (4) year time periods. This implies that the exports flows of the Philippines during this period have been changing (not remained constant). This variation can be attributed to the Philippine specific variables (home country) and partner countries specific variables (beyond the border) such as variables included in the inefficiency effect model. However, the estimated gamma (γ) turns out insignificant. This could mean that the variations shown in σ^2 are not due to beyond the border variables identified in this study. Furthermore, this implies that behind the border (home country) specific determinants should be carefully analyze and model specifications in terms variables included in the study should be improve to further explain the variations of export flows.

Export Performance

The estimated technical efficiency as measure of export performance is presented in Table 4. It covers Technical efficiency of Philippine merchandise export flows to its 69 markets in the world. This shows that TEs is changing minimally during the four years period. The mean TEs for all sample ranged from 48 to 42% during

these periods. Mean technical efficiency among the country groups in 2012 are relatively high, which is above the mean TE. Export flows is more efficient in NAFTA with TE of 73%, East Asia with TE of 72%, followed Members of APEC, ASEAN, EFTA and lastly EU with 69%, 62%, 50% and , 43% respectively.

Table 4. Technical efficiency (in percent) of Philippine merchandise exports, by country, by trading blocs, 2009-2012

Trading Partner/Blocs	2009	2010	2011	2012
ASEAN	***58.98***	***61.12***	***58.94***	***61.56***
Cambodia	8.67	11.39	10.67	12.64
Indonesia	29.04	31.00	33.53	31.90
Malaysia	86.67	85.24	86.94	84.98
Singapore	100.00	100.00	100.00	100.00
Thailand	77.00	79.31	78.68	77.90
Viet Nam	52.49	59.80	43.80	61.95
EAST ASIA	***59.30***	***71.05***	***70.24***	***72.02***
China	23.21	16.40	19.17	23.12
Hongkong	54.70	96.77	96.59	96.82
Japan	86.14	87.81	87.87	86.99
S. Korea	73.16	83.24	77.33	81.16
EU	***42.16***	***44.39***	***41.99***	***42.73***
Austria	54.39	59.66	54.50	60.91
Belgium	72.31	68.04	70.17	72.24
Croatia	11.34	14.79	13.59	11.79
Cyprus	27.50	38.40	40.44	32.80
Denmark	94.09	94.51	93.52	93.34
Finland	55.01	63.40	59.92	70.58
France	39.11	31.67	28.06	29.76
Germany	47.47	49.30	45.65	50.05
Greece	20.24	21.09	15.54	13.79
Hungary	30.43	29.22	29.51	25.22
Italy	27.59	29.59	18.06	21.04
Lithuania	21.54	29.31	26.11	27.44
Luxembourg	23.94	25.06	25.25	24.48
Netherlands	79.69	80.06	74.99	75.79
Poland	17.04	21.27	23.66	26.11
Portugal	24.42	23.17	19.73	20.36
Slovak Republic	19.47	18.11	15.18	16.20
Slovenia	24.49	30.72	29.70	22.54
Spain	27.66	28.92	27.77	32.53
Sweden	74.37	82.45	77.26	76.88
UK	93.26	93.41	93.11	93.46
NAFTA	***71.57***	***75.36***	***74.75***	***72.96***
Canada	95.68	96.13	95.88	95.92

Mexico	22.88	33.38	31.94	26.72
USA	96.13	96.57	96.44	96.25
EFTA	**52.01**	**60.17**	**62.26**	**49.56**
Norway	50.15	50.30	50.49	28.30
Switzerland	53.86	70.04	74.04	70.82
APEC	***64.67***	***69.66***	***68.62***	***69.09***
Australia	96.48	96.79	96.37	96.15
Canada	95.68	96.13	95.88	95.92
Chile	83.72	85.44	81.52	78.79
China	23.21	16.40	19.17	23.12
Hongkong	54.70	96.77	96.59	96.82
Indonesia	29.04	31.00	33.53	31.90
Japan	86.14	87.81	87.87	86.99
S. Korea	73.16	83.24	77.33	81.16
Malaysia	86.67	85.24	86.94	84.98
Mexico	22.88	33.38	31.94	26.72
New Zealand	96.89	97.08	96.95	96.99
Papua New Guinea	62.14	65.36	61.71	60.47
Peru	18.26	35.48	40.91	37.13
Russia	9.42	8.13	9.58	10.31
Singapore	100.00	100.00	100.00	100.00
Thailand	77.00	79.31	78.68	77.90
USA	96.13	96.57	96.44	96.25
Viet Nam	52.49	59.80	43.80	61.95
OTHERS	***18.98***	***20.36***	***20.05***	***18.40***
Algeria	9.07	8.13	7.21	6.38
Argentina	8.88	9.22	9.05	7.66
Bangladesh	4.31	6.08	8.22	7.96
Brazil	11.50	7.64	8.28	8.13
Colombia	15.38	18.84	18.23	17.61
Costa Rica	26.86	24.34	29.26	24.54
Dominican Republic	10.49	13.29	10.89	10.75
Ecuador	4.32	4.55	5.46	5.53
Egypt	24.05	26.07	30.15	22.06
Guatemala	9.76	13.11	11.05	8.59
India	16.82	15.54	20.44	21.36
Jordan	45.54	57.80	51.42	49.31
Kenya	16.30	16.01	16.53	11.86
Lebanon	19.03	24.01	21.26	17.77
Macau	27.06	30.85	27.77	24.67
Madagascar	7.14	9.52	8.36	7.93
Micronesia	43.99	39.64	44.21	39.56
Nepal	2.74	2.46	2.15	2.02
Panama	12.01	13.10	12.56	10.30
Saudi Arabia	25.43	29.90	34.45	21.37
South Africa	35.31	37.04	33.26	26.53
Sri Lanka	19.32	15.95	15.67	17.10
Tunisia	11.56	13.42	14.25	17.24
Ukraine	6.27	6.42	5.31	4.82
United Arab Emirates	33.01	46.16	37.00	43.22
Uruguay	46.91	48.34	50.54	52.39
Yemen	19.37	12.28	8.51	10.16

Technical efficiency of merchandise exports to ASEAN member states is high, however relatively lower compared to TEs of NAFTA and countries in East Asia. This clearly implies that the Philippines is not taking full advantage of the benefits of regionalization through ASEAN. In this bloc, Singapore is the most efficient country which recorded 100% technical efficiency. This is followed by Malaysia (85%) and Thailand (78%). Cambodia and Indonesia recorded a very low technical efficiency. ASEAN as a natural bloc in Southeast Asian should further strengthen its trade facilitation among its member states given lower transport cost and existing agreements. On the other hand, the Philippines should explore the potential of its neighboring countries and take maximum advantage of this potential.

Trading partners in the East Asia (EA) recorded relatively high TEs. TE is high with Hong Kong, Japan and South Korea with 97%, 87%, and 81% in 2012 respectively. In this group, China recorded a very low TE of 23%. This implies that Philippines can further improve export to China and take advantage of its very large market for manufactured goods. This can be further facilitated through bilateral negotiations and further improve economic partnership.

European Union, one of the major trading blocs of the world, is an important trading partner of the Philippines. Among the members of EU, United Kingdom (93%), and Denmark (93%) recorded the highest TE. Countries like Belgium, Finland, Netherlands, and Sweden also posted high TEs. Currently, there is no existing trade agreement between the Philippines and EU or its member states except common involvement in WTO.

Among the trading blocs included in the study, NAFTA recorded the highest TE which is attributed to the high TEs of Canada and USA. Trading with this country deviates from the gravity concept, which then proved that trade can be improved through a very tight economic partnership.

Low technical efficiency of 18 to 20% was recorded for other countries in the sample. Among countries in this group, Uruguay, Jordan and United Arab Emirates posed the highest TEs of 52%, 49% and 43% respectively. United Arab Emirates, particularly Abu Dhabi is the second largest importer of Philippine merchandise export in the Middle East. It serves as a transit hub for the Philippine merchandise exports in the region. This is further exported to many other countries in the Middle East duty-free (uae-embassy.ae, 2012).

Table 5 shows the relative export performance of the Philippines to countries with common agreements/cooperation and integration. It revealed that TEs of export flows between the Philippines to WTO and non-WTO countries almost did not differ. On the hand, Philippine export performance is relatively high in APEC member countries than to Non-APEC countries.

Table 5. Mean technical efficiency (in percent) of Philippine merchandise exports, by trading groups, 2009-2012.

Item	No. of Countries	2009	2010	2011	2012
WTO	63	38.78	41.58	40.51	39.87
Non-WTO	6	39.00	42.13	40.97	40.17
APEC	18	39.64	42.53	41.45	40.82
Non-APEC	51	38.76	41.56	40.49	39.85
Overall Mean	69	38.76	41.56	40.49	39.85
Std. deviation	69	29.29	30.43	30.11	30.69

In general, the technical efficiency measure of export flow is quite low (38 to 42%), this suggests large deviations of actual observed export flows from the potential export flows estimated by the gravity equation. The standard deviation from the mean is 29-31% which means that the TEs are not that far from each other. The next section shows trade potential if countries in the sample operated at the frontier.

Export Potential

Export potential is defined as the trade that could have been achieved at optimum trade frontier with open and frictionless trade possible given the current level of trade, transport and institutional technologies or it is the maximum level of trade given current level of determinants of trade as well as the least level of restrictions within the economic system (Miankhel, et al., 2009). The potential export in this study was computed using the estimated coefficients of the gravity model and imposed the mean actual observed data of the four year periods. The results are shown in Table 6.

Table 6. Philippines export potential of merchandise exports, in Trillion USD, 2009-2012.

Country	Export potential	Export Gap
United States of America	29.5849	29.5777
China	13.0500	13.0449
Japan	11.2131	11.2051
Germany	6.8143	6.8121
France	5.2987	5.2984
UK	4.6732	4.6728
Brazil	4.2128	4.2127

Country	Export potential	Export Gap
Italy	4.1938	4.1936
India	3.3846	3.3843
Russia	3.2818	3.2818
Canada	3.2462	3.2459
Spain	2.8405	2.8404
Australia	2.4490	2.4486
Mexico	2.1225	2.1223
S. Korea	2.0402	2.0379
Netherlands	1.5952	1.5930
Indonesia	1.4666	1.4661
Switzerland	1.1750	1.1749
Saudi Arabia	0.9790	0.9789
Belgium	0.9730	0.9726
Sweden	0.9646	0.9646
Poland	0.9549	0.9548
Norway	0.8932	0.8932
Austria	0.7914	0.7913
Argentina	0.7903	0.7903
South Africa	0.7134	0.7133
Thailand	0.6448	0.6430
United Arab Emirates	0.6419	0.6417
Denmark	0.6382	0.6381
Colombia	0.6070	0.6070
Greece	0.5760	0.5760
Malaysia	0.5161	0.5149
Finland	0.4954	0.4953
Hongkong	0.4778	0.4738
Singapore	0.4635	0.4591
Portugal	0.4572	0.4572
Chile	0.4500	0.4499
Egypt	0.4496	0.4496
Algeria	0.3500	0.3500
Peru	0.3243	0.3243
Ukraine	0.2943	0.2942
New Zealand	0.2682	0.2681
Hungary	0.2606	0.2605
Viet Nam	0.2331	0.2325
Bangladesh	0.2086	0.2086
Slovak Republic	0.1816	0.1816
Ecuador	0.1458	0.1458
Croatia	0.1201	0.1201
Luxembourg	0.1096	0.1096
Dominican Republic	0.1065	0.1065
Sri Lanka	0.1045	0.1045
Slovenia	0.0962	0.0962
Tunisia	0.0904	0.0904
Guatemala	0.0882	0.0882
Uruguay	0.0812	0.0812
Lithuania	0.0792	0.0792
Lebanon	0.0775	0.0775
Costa Rica	0.0753	0.0753

Country	Export potential	Export Gap
Kenya	0.0670	0.0670
Macau	0.0630	0.0630
Yemen	0.0616	0.0616
Panama	0.0589	0.0589
Jordan	0.0551	0.0551
Cyprus	0.0475	0.0475
Nepal	0.0333	0.0333
Cambodia	0.0242	0.0242
Papua New Guinea	0.0221	0.0220
Madagascar	0.0187	0.0187
Micronesia	0.0006	0.0006

Note: Export potential was computed using equation 23. Trade gap was computed as the difference between actual and potential exports.

The estimated export potentials revealed large deviation of the actual export flows to potential outflows. Generally, all countries in the sample posed large merchandise export potential. However, highest potential emerges in countries with large markets like USA and China. This is followed by other developed and industrialized countries like Japan, Germany and France. Among the ASEAN countries Indonesia posed highest export potentials. The estimated export potential from all sample ranged from 600 million to 30 trillion US dollars.

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