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

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## Abstract

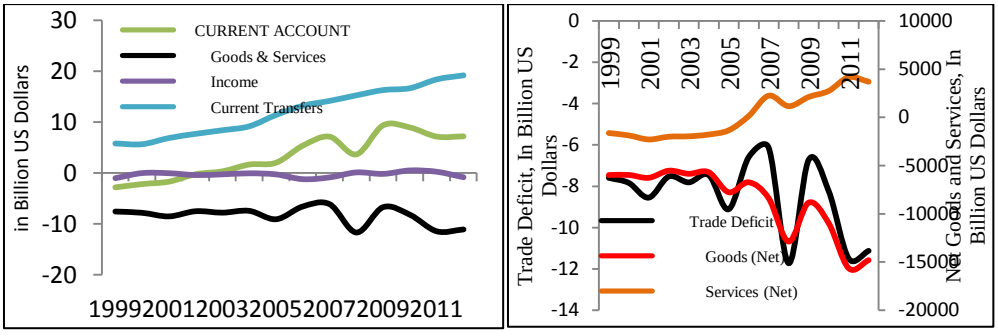
Trade across regions and borders are considered important in improving welfare of people. The Philippines is one of the oldest economies in the world, however, for more than a century it experienced severe trade deficit. This could be due to domestic rigidities and rigidities of its trading partners. This study is focused on examining export efficiency and potential based on trading partner's characteristics using new approach of measuring export potential. The study employed the Stochastic Frontier Gravity Model that measures potential from the frontier unlike the usual measure of gravity model using OLS that measure potential from the mean.

Results show that merchandise export flows of the Philippines is significantly affected by income, market size of the importing partner and the distance between them. The technical efficiency for all countries ranged from 38 to 42%. Countries with larger markets emerged as high export potentials such as USA, China and Japan with potentials ranging from 10 to 30 Trillion US dollars. These potentials have been variable. Results of technical inefficiency model reveal that these potentials are increased by membership of the Philippines to ASEAN, APEC and WTO. Reduction of corruption and freer labor market in the importing country enhanced export potential of Philippine merchandise exports. Commonality of language also enhanced this potential.

**Keywords:** Merchandise exports, Gravity model, Stochastic Frontier, Philippine export potential
***JEL Classification***: F13, F14, F15

## 1. INTRODUCTION

The Philippines is one of the world's oldest open economies, which traded goods even prior to its discovery by the western world. Since 2004, the country has a positive Balance of Payment (BOP) position which is attributed to the current account surplus. This surplus was accounted to influx of current transfers and strong remittances of Oveseas Filipino Workers (income). Large trade deficit however, continuesly pulling this surplus (Figure 1.a) for more than a decades. The trade deficit in the country are attributed to large deficit in the traded goods (Figure 1.b).




(a) (b)

Figure 1. (a) Current account balance; (b) Trade Deficit (goods + services), Philippines, 1999- 2012
Source of data: Philippine Institute of Development Studies (http://econdb.pids.gov.ph/tablelists/table/153)

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In the aim of reducing huge gap between export and imports, the Philippine government passed Republic Act No. 7844, known as the *"Export Development Act of 1994"* to evolve export development into a national effort. This mandated the creation of Philippine Export Development Plan (PEDP) as export development strategy. The PEDP shall define the country's annual and medium-term export thrusts, strategies, programs and projects and shall be jointly implemented by the government, export and other concerned sectors. Figure 2 shows the PEDP targets versus the actual exports. In 2010, the PEDP export target for merchandise exports was 51 Billion USD, however, it only achieved 71% of the target. 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. The 2016 target is more than twice compared to the 2012 Philippine export value of US$ 57.5B (PEDP 2011-2013). In the actual target of PEDP for 2016 however, it only targeted 92 Billion USD lower compared to the planned target for 2016 mentioned in PEDP 2011- 2013. PEDP 2011-2013 only reached 65% of the target. This was achieved by building on the current business for the period 2011-2013 and developing Key Export Sectors that have high potential for growth. In the subsequent three years (2014-2016), growth will be attained by implementing an agro-industrial resource-base export development program. This target is in line with the changing characteristics of exports and global trade as the world recovers from the recent financial crisis and natural disasters in Japan, among others. The key features of these changes 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. Achievement of this target requires understanding of the factors that prevent the Philippines to reach its export potential which both the institutional and infrastructures rigidities (*behind the border*) of the country or the rigidities of its trading partners (*beyond the border*). Several researches and efforts was conducted to understand and identify behind the border constraints on exports, however, it is surprising that there are very few, if any, in the literatures that focus on behind the border constraints (factors) of Philippine export. Understanding and reducing these rigidities may shrink trade deficits that will enhance and sustain positive current account position.

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. This paper is focus on measuring efficiency and potential of the Philippines exports to its sixty-nine (69) trading partners. The measured efficiency and potential could be used as benchmark in expanding exports of the country through trade negotiations to potential markets.

Earlier studies have estimated the difference between observed values and the estimated predicted values by using an augmented gravity equation through Ordinary Least Squares (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

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the maximum possible output is utilized (Drysdale et al., 2000). This approach is known as the Stochastic Frontier Gravity Model.

This study analyzed factors affecting trade of merchandise export. Merchandise exports was used as it accounts to 70% to 80% of the total exports of the country. It also aims to come up with technical efficiency estimates for each of the trading partner. Furthermore, the study assessed effectiveness of multilateral agreements of the Philippines on enhancing the volume of Philippine export. 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 data to give an overview of export enhancing opportunities base on the frontier. Estimation of the model will follow the proposed method of 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.

## 2. 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 in equation 2.

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

There is a direct proportionality between the explanatory variables and the variable to be explained is not necessary implied. The exponents $\alpha$, $\beta$ and $\gamma$ can therefore take values different from 1. These are elasticity of the exporting country's GDP ($\alpha$), the elasticity of the importing country's GDP ($\beta$) and the elasticity of distance ($\gamma$). By taking the natural logarithm of equation 2 and by adding the error term $\varepsilon_{ij}$ a linear relationship is obtained (equation 3). 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[1]. Anderson yielded the specification of aggregated trade flows as final gravity equation

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

[1]see Starck, S. C. 2012. "The theoretical foundation of the Gravity Modelling: What are the developments that have brought gravity modelling into mainstream economics?" for complete derivation.

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where, $X_{ij}$ = Exports of country $i$ to country $j$, $Y$= Income in country i and $j$, $d_{ij}$= Distance between country $i$ and country $j$, $\Phi_i$= 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 $i$.

### *2.1 Inherent Bias of the Gravity Model*

According to Anderson (1979), the log linear of equation 4 resembles the standard gravity equation in equation 3, with an important difference. This difference is the bracket term in equation 4 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 4 affects the log-normal distribution of the error term. Therefore, the expected value of the error term is no longer zero ($E(\varepsilon_{ij}) \neq 0$) 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 (Santos Silva and Tenreyro, 2003). 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*.

## 3. 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:

$$lnX_{ijt} = lnf(Y_{ijt}; \beta) exp^{(v_{ijt} - u_{ijt})} \qquad (5)$$

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 $\beta$ 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 "beyond 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 "beyond 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. In this approach, it is assumed that the

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Philippines as an exporting country is very efficient (no significant behind the border constraints).

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, 2008). 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 technical efficiency*(TEX)* of the economy) as the ratio of actual to potential exports as shown in equation 6.

$$TEX_{ijt} = \frac{f(Y_{ijt};\beta)\exp(v_{ijt} - u_{ijt})}{f(T;\beta)\exp(v_{ijt})} = \exp(-u_{ijt}) \qquad (6)$$

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.

## 4. DATA AND EMPIRICAL APPLICATION

### *4.1. Data Sources*

This study utilized panel data consisting of 69 bilateral trading partners of the Philippines on merchandise exports from 2009 to 2012. The countries included in this study are 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 (in kilometers), landlocked, language and land area was secured from the *Centre d'EtudesProspectivesetd'InformationsInternationales (CEPII)* which was developed by Mayer and Zignago (2005). "Behind the Border" variables of the importing partners 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) were taken from the Heritage Foundation. The 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.

### *4.2. 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:

$$\ln X_{ijt} = \beta_0 + \beta_1 lnGDP_{jt} + \beta_2 lnPop_{jt} + \beta_3 lndist_{ijt} - u_{ijt} + v_{ijt} \qquad (7)$$

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 $u_{ijt} \sim iid\ N(0, \sigma_u^2)$and $v_{ijt}$ – Double sided error term that captures the impact of inadvertently omitted variables

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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.

$$u_{ijt} = \delta_0 + \delta_1 APEC + \delta_2 ASEAN + \delta_3 WTO + \delta_4 Lang_j + \delta_5 Landlocked + \delta_6 CI_j + \delta_7 TF_j + \delta_8 BF_j + \delta_9 IF_j + \delta_{10} FC_j + \delta_{11} FiscalF_j + \delta_{12} LF_j + \delta_{13} MC_j + \delta_{14} FF_j + w_{ijt} \quad (8)$$

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; and $FF_j$ –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. The estimation of equations 7 and 8 was done simultaneously using Frontier 4.1 software of Tim Coelli (2004).

## 5. RESULTS AND DISCUSSIONS

Philippine merchandise exports are dominated by manufactures. This is followed by machinery and transport equipment, office and telecom equipment, and integrated circuits and electronic components. 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.

The merchandise export pattern of the Philippines relative to the distance of its trading partners is shown in Figure 4. This reflects different size of bubbles. The bigger the bubble represents higher value of export flow from the Philippines. It reveals that the markets (destination) of Philippine merchandise exports are concentrated in the countries within the 5 thousand kilometres linear distance from the Philippines. This accounts for around

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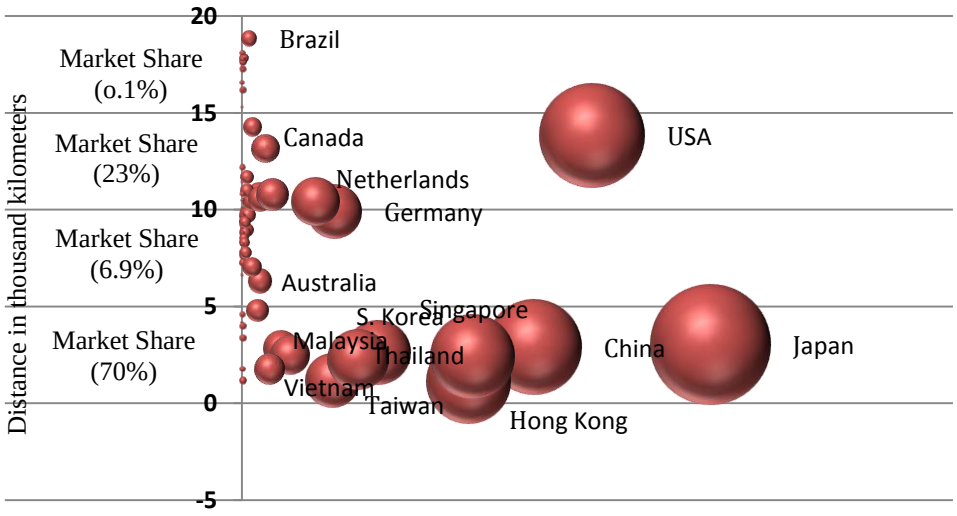
70% of the total merchandise exports of the country. The next distance range (5 to 10 thousand kilometres) accounted for 7%, while the 10 to 15 kilometres range with 23% market share. This relatively high share is attributed to export facilitation in the USA through bilateral agreements on trade. The 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 kilometres) 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 4. Relationship of distance and value of Philippine merchandise exports, 2012.
Sources of Data: CEPII and DTI

### *5.1 Stochastic Frontier Estimates of the Gravity Model*

Results of the simultaneous estimation of equations 8 and 9 were presented in Table 1 and 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%. 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%.

Table 1. Maximum likelihood estimates of the coefficients stochastic frontier gravity model for Philippine export 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

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,

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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?".

The ***technical inefficiency*** effect model estimates are presented in Table 2. 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 turn 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 (negative sign of the coefficient indicates reduction of technical inefficiency) 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.

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. 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.

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

| Variables | Est. Coefficient | Std. error | p-value | Variables | Est. Coefficient | Std. error | p-value |
|---|---|---|---|---|---|---|---|
| Constant | 4.6793* | 1.3306 | 0.0010 | Business Freedom | -0.0121 $^{ns}$ | 0.0079 | 0.1250 |
| APEC | -0.5978* | 0.2325 | 0.0110 | Labor Freedom | -0.0238* | 0.0055 | 0.0000 |
| ASEAN | -0.7824* | 0.3839 | 0.0430 | Monetary Freedom | 0.0151 $^{ns}$ | 0.0136 | 0.2690 |
| Language | -0.7762* | 0.2005 | 0.0000 | Trade Freedom | -0.0178 $^{ns}$ | 0.0129 | 0.1690 |
| Landlocked | 0.3435 $^{ns}$ | 0.2790 | 0.2190 | Investment Freedom | -0.0070 $^{ns}$ | 0.0061 | 0.2520 |
| Freedom from Corrupt. | -0.0197* | 0.0085 | 0.0210 | Financial Freedom | 0.0029 $^{ns}$ | 0.0060 | 0.6290 |
| Fiscal Freedom | 0.0045 $^{ns}$ | 0.0087 | 0.6070 | Cost to import | 0.0003 $^{ns}$ | 0.0002 | 0.1300 |
| Sigma-squared ($\sigma^2$) | 1.068* | 0.0740 | 0.0000 | log likelihood function | | -397.31 | |
| gamma ($\gamma$) | 0.058$^{ns}$ | 0.3490 | 0.8690 | LR test of one sided error | | 102.7 | |

* significant at the 5% level of significance, $^{ns}$ not significant at the 5% level of significance

The estimated $\sigma^2$ 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. The

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hypothesis however, that there is no technical inefficiency in the model was accepted as implied by large value of log likelihood function and insignificant gamma ($\gamma$). This means that this variation is not due to technical inefficiency in the model. Thus, further modification and inclusion of variables both beyond and behind the border is necessary to understand this variation.

### *5.2 Export Performance*

It covers Technical Efficiency (TE) of Philippine merchandise export flows to 69 markets in the world. TEs in four years period are changing minimally. The mean TEs for all sample ranged from 42 to 48% 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.

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.

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. The relative export performance of the Philippines to countries with common agreements/cooperation and integration reveal 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. 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.

### *5.3 Export Potential*

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 among countries in the sample ranged from 600 million to 30 trillion US dollars.

## 6. RECOMMENDATIONS

Given the result of the study, several insights/recommendations are suggested: *(1)* Philippine export sector is highly viable in increasing foreign reserve of the country. This is reflected in the very substantial export gap between estimated potential and observed actual outflow. To expand this outflow the country should intensify its engagement on bilateral and unilateral trade talks/agreements on countries within the region and target high-growth emerging markets. *(2)* Export inefficiency effect model reveals that Philippine membership to ASEAN is significant factor in reducing export inefficiency. This could lead to expansion of export flows within this “natural

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trade blocs" which has emerging demands and lower transportation cost. Technical efficiency estimates, however, of Philippine export outflow to ASEAN member states were not that high compared to technical efficiency of other trading blocs. This implies that the Philippines is not maximizing the benefits of this regionalization. The country must seek to comprehensively identify goods with comparative advantage relative to other members of the ASEAN. This will help the country maximize benefits of the 2015 ASEAN Integration. Furthermore, the country should increase efficiency of exportation by improving domestic infrastructure and strengthening the export sectors. *(3)* There should be unification, and strategic direction among players in the domestic export industries that will be supported by the government in terms of information monitoring and other support services. *(4)* In the international level, RTAs should move to stimulate/improve logistical services competition to increase transportation efficiency and decrease cost of transportation and other cost. *(5)* Further study is needed, specifically, the inclusion of complementarity index, similarity index and other behind the border (domestic) factors in the gravity model.

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