

**ECONOMIC GROWTH , PORT EFFICIENCY, AND TARIFF COST AS A  
DETERMINANTS OF PHILIPPINE TOTAL DOMESTIC AND FOREIGN CARGO  
THROUGHPUT; AN ANALYSIS**

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**ABSTRACT**

A high transportation cost deters the free flow of goods and services within and outside the country. The Philippines has been undertaking macroeconomic reforms particularly in trade policy with the aim of liberalizing and neutralizing the policies to achieve accelerating growth industries, employment generation, improve efficiency of investment, sustaining growth performance of export and the benefits of industrialization. (Songco, 2004)

This research paper seeks to provide answers to specific problem that a higher percentage change in port dues tariff rates, and percentage change turn around time decreases the Philippine Foreign Cargo Throughput. Meanwhile, this paper validated that an percentage change in dockage tariff charge and percentage change in real gross domestic will result to an increase percentage change in Philippine Foreign Cargo Throughput.

Furthermore, this paper will validated that an increase in percentage change wharfage resulted to a decrease in the percentage change in Philippine Domestic Cargo. Meanwhile, an increase in percentage change in gross domestic product and increase percentage change in port turn around time will increase the Philippine Domestic Cargo Throughput.

The research design of this study is descriptive approach in the sense that it pertains to the narrative on Philippine total domestic and foreign maritime cargo throughput and other macroeconomic variables such as real gross domestic product and transport cost measured through average total domestic and foreign tariff rate per commodity. Accordingly, the multiple regression model was used to link the set of macroeconomic variables to total domestic and foreign maritime cargo throughput, and was measured thru the use of statistical models on empirical data that were gathered.

**Keywords: Turn Around Time, Port Dues, Dockage, Cargo Throughput**

## **Introduction**

Seaports play a vital role in linking in many supply chains and distribution channels, particularly in smooth flow of international trade transaction. The costs of transportation, economic condition and the capital investment of the country have an effect in the condition of the trade of a country. A high transportation cost deters the free flow of goods and services within and outside the country. The Philippines has been undertaking macroeconomic reforms particularly in trade policy with the aim of liberalizing and neutralizing the policies to achieve accelerating growth industries, employment generation, improve efficiency of investment, sustaining growth performance of export and the benefits of industrialization. (Songco 2004)

## **Statement of the Research Question**

This research paper seeks to provide answers to specific problem that percentage change in port dues tariff rates, and percentage change in turn around time decreases the Philippine Foreign Cargo Throughput. Meanwhile, this paper validated that an percentage increase in dockage tariff charge and percentage change in gross domestic product will result to an increase in percentage change in Philippine Foreign Cargo Throughput.

Furthermore, this paper validated that percentage change in wharfage, or charges on cargoes, resulted to a percentage decrease in Philippine Domestic Cargo. Meanwhile, a percentage increase in economic growth and percentage change increase in port turn around time will percentage change increase in the Philippine Domestic Cargo Throughput.

## **Significance of Research Question**

Being archipelago, the maritime industry is considered major means by which islands are linked and through movements of goods and people is achieved. Maritime transport

remains to be a cheaper alternative to air transport sector in moving goods and people around the country. The availability of a continued and reliable maritime transport service is a necessary condition for the growth and development of the countryside and for addressing rural poverty (Basilio, 2007).

The Philippines is likewise primarily linked to the international trade system via maritime transport. Almost 98 percent of materials and products imported and exported by the country are facilitated through maritime exchanges (Llanto et. al 2005).

Trends on the frequency of shipcalls at Philippine ports and the volume of cargo handled at these ports suggest on overall positive impact on trade. The upward trends on the frequency of ship calls by domestically registered vessels at Philippine ports steadily increased from 1995 to 2010 from 197,000 to 320,000, while the number of foreign vessels remained almost constant (LLanto and Navarro, 2012).

The purpose of this paper is to determine the impact of the various factors such as tariff rates being charge by the Philippine Government, Port Turn Around Time, and Gross Domestic Product to the Philippine Domestic and Foreign Cargo Throughput. Also, this paper aims to revisit the current port pricing issues throw away by the shipping industry and business sectors to the Philippine Government which resulted to a high cost of seaport transportation

### **Scope and Limitations**

This research employed time series data covering a period of sixteen (16) years from 1999 to 2014. The relevant data for this study are Foreign and Domestic cargo throughput (in million metric tons), average port dues tariff cost per commodity (in million pesos), average wharfage tariff cost (in million pesos), turn around time (in hours) and real gross domestic products (in million pesos).

This paper focused on the theory that a low transportation cost measured in terms of percentage change in port dues and percentage change in wharfage increases the volume of total domestic and foreign cargo throughput, respectively (Martinez-Zarzoso and Celestino,

2002). Also, this paper validated that an increase in turn around time will lead to a decrease in Foreign Cargo Throughput and an increase in domestic cargo throughput. Meanwhile, the paper presented that economic growth has positive effect in Domestic and Foreign Cargo Throughput.

## **Methodology**

The research design of this study is descriptive approach in the sense that it pertains to the narrative on Philippine total domestic and foreign maritime cargo throughput, transport tariff cost measured through percentage change in port dues and wharfage, turn around time measured through waiting time in the ports, and economic growth measured through gross domestic product. Accordingly, the multiple regression model was used to link the set of macroeconomic variables to total cargo throughput, and was measured thru the use of statistical models on empirical data that were gathered.

According to Martinez-Zarzoso and Suarez-Burguet (2002), the volume of imports (exports) between pairs of countries depends on their income (GDPs) and transportation cost. This paper developed a maritime cargo throughput model derived from the previous existing model of Martinez-Zarzoso and Suarez-Burguet (2002). This paper used the same variables such as total domestic and foreign maritime volume of cargo throughput and real gross national product with slight modification on the transportation cost variable which substituted by average tariff rate per commodity due to unavailability of some data used in the prior study. The latter model was applied in Spain, while this model was used in the Philippine setting.

To determine the impact of the predictor variables on the dependent variable, a multiple regression analysis was utilized. This research study formulated two separate model for Domestic Cargo Throughput and Foreign Cargo Throughput.

The study used time series data from 1999 to 2014 obtained from the following different government agencies such as Philippine Statistical Authority, National Economic Development Authority (NEDA), National Statistics Office (NSO), and Philippine Ports Authority (PPA). The aforementioned government agencies provided data such as total domestic and foreign cargo throughput (in million metric tons), port dues (peso per metric tons), dockage fee (peso per metric tons), wharfage fee (peso per metric tons), turn around

time (waiting time in hours), and gross domestic product (in million pesos, constant 2000 prices)

## **Related Literature and Studies**

The seaport trade industry and the management and development of various ports in the world have changes due to transport liberalization and increase in competition among shipping lines. Since the maritime industry plays a vital role in the trade globalization, there are substantial economic reforms in the maritime industry to promote competition and improve the overall competitiveness in the Philippine maritime services.

The Average turnaround time has a negative effect not only in the traffic size, but as well as the average age of the vessels and the betweenness centrality of ports. The increase in the Average turn around time should be conform with joint effect of functional indicators and operational indicators (Ducruet, Itoh and Merk, 2014).

Table 1 presented the costs of exports and imports in terms of border compliance South East Asia for the year 2015. Samoa posted the highest cost to export in terms of border compliance amounting to US\$ 1,400.00. It was then followed by Vanuatu with US\$709.00 cost of export. The Philippines ranked 8<sup>th</sup> among 29 South East Asian Countries in terms of highest Cost of Export amounting to US\$ 456.00. South East Asian Countries which posted the lowest cost to export in term of border compliance are as follows: 1. Mongolia (US\$41); 2. Lao PDR (US\$73.00); 3. Micronesia, Fed Sts. (US\$168.00) 4. Tonga (US\$ 201.00); and Marshall Islands (US\$220.00).

Also, Samoa posted the highest cost to import in terms of border compliance amounting to US\$900.00.followed by Papua New Guinea, with US\$810.00. The Philippine was ranked 10<sup>th</sup> among 29 South East Asian Countries in term of highest cost to import goods amounting to US\$580.00. South East Asian Countries which posted the lowest cost to import in term of border compliance are as follows: 1. Mongolia (US\$60); 2. Lao PDR (US\$153.00); 3. Micronesia, Fed Sts. (US\$168.00) 4. Marshall Islands (US\$220.00) and Singapore (US\$220.00).

Trade barriers, such as tariff and non-tariff, continue to be a constraint in the free flow of trade between South Asia and Southeast Asia. Expanding the Free Trade Agreement may

reduce barriers in trade and can promote greater trade connectivity ( Asian Development Bank Institute 2013).

Non-Tariff Barriers (NTBs) has brought a problem in the trade system, but government uses this measure in time of economic downturns to discriminate foreign commercial interest ( Asian Development Bank Institute 2013).

Table 2 presented the time to export and import in terms of border compliance in South East Asia for the year 2015. Top 10 among 29 countries South East Asian which posted the shortest time to exports goods and services are as follows: 1. Lao (3 hrs) 2. Samoa (6hrs); 3. Singapore (12hrs); 4. Taiwan, China (17 hours) 5. Hong Kong SAR, China (19 hours) ; 6.Malaysia (20 hours); 7. China-Shanghai (23 hours); 8. China (26 hours); 9. China- Beijing (29 hours); and 10.Indonesia (Jakarta). The Philippines managed to ranked 15 out of 29 South East Asian Countries in term of fastest time to export goods and services posting 42 hours. Myanmar posted the longest period to export goods with 144 transaction hours. It was then followed by Solomon Islands and Palau with 110 hours and 102 hours time to export goods and services.

**Table 1**  
**2015 Cost to Export and Import in South East Asian**  
**(in US Dollars)**

Rank	Country	Cost to export:	Rank	Country	Cost to import
1	Samoa	1,400.00	1	Samoa	900
2	Vanuatu	709	2	Papua New Guinea	810

3	Papua New Guinea	675	3	China - Shanghai	790
4	Solomon Islands	630	4	China	777
5	China - Shanghai	602	5	China - Beijing	760
6	China	522	6	Solomon Islands	740
7	Palau	505	7	Kiribati	685
8	Philippines	456	8	Vanuatu	681
9	Myanmar	432	9	Palau	605
10	China - Beijing	425	10	Philippines	580
11	Kiribati	420	11	Timor-Leste	410
12	Cambodia	375	12	Brunei Darussalam	395
13	Timor-Leste	350	13	Taiwan, China	389
14	Brunei Darussalam	340	14	Indonesia - Jakarta	384
15	Singapore	335	15	Indonesia	383
16	Taiwan, China	335	16	Indonesia - Surabaya	376
17	Malaysia	321	17	Myanmar	367
18	Fiji	317	18	Tonga	330
19	Vietnam	309	19	Malaysia	321
20	Hong Kong SAR, China	282	20	Fiji	320
21	Indonesia - Surabaya	267	21	Vietnam	268
22	Indonesia	254	22	Hong Kong SAR, China	266
23	Indonesia - Jakarta	250	23	Cambodia	240
24	Thailand	223	24	Thailand	233

25	Marshall Islands	220	25	Singapore	220
26	Tonga	201	26	Marshall Islands	220
27	Micronesia, Fed. Sts.	168	27	Micronesia, Fed. Sts.	168
28	Lao PDR	73	28	Lao PDR	153
29	Mongolia	41	29	Mongolia	60

**Table 2**  
**2015 Time to Export and Import in South East Asian**  
**(In Hours)**

Rank	Country	Time to export	Rank	Country	Time to import:
1	Lao PDR	3	1	Cambodia	4
2	Samoa	6	2	Lao PDR	5
3	Singapore	12	3	Samoa	12
4	Taiwan, China	17	4	Hong Kong SAR, China	19
5	Hong Kong SAR, China	19	5	Mongolia	22
6	Malaysia	20	6	Malaysia	24
7	China – Shanghai	23	7	Tonga	26
8	China	26	8	Singapore	35
9	China – Beijing	29	9	Micronesia, Fed. Sts.	36
10	Indonesia – Jakarta	36	10	Fiji	42
11	Micronesia, Fed. Sts.	36	11	Taiwan, China	47
12	Mongolia	37	12	Brunei Darussalam	48



13	Vanuatu	38	13	Thailand	50
14	Indonesia	39	14	Vietnam	64
15	Philippines	42	15	China - Shanghai	72
16	Cambodia	45	16	Papua New Guinea	72
17	Indonesia – Surabaya	48	17	Philippines	72
18	Thailand	51	18	Indonesia - Jakarta	80
19	Tonga	52	19	Marshall Islands	84
20	Fiji	56	20	Palau	84
21	Vietnam	57	21	China	92
22	Marshall Islands	60	22	Kiribati	96
23	Brunei Darussalam	72	23	Timor-Leste	96
24	Kiribati	72	24	Indonesia	99
25	Papua New Guinea	72	25	Solomon Islands	108
26	Timor-Leste	96	26	China - Beijing	117
27	Palau	102	27	Myanmar	120
28	Solomon Islands	110	28	Indonesia - Surabaya	168
29	Myanmar	144	29	Vanuatu	198

Cambodia posted the shortest time to import goods and services among 29 South East Asian Countries with 4 hours. It was then followed by Lao PDR, Samoa, and Hongkong posting 5 hours, 12 hours and 19 hours time to import goods and services, respectively. The Philippines in terms of time to import ranked 17<sup>th</sup> among 29 South East Asian Countries recording 72 hours. Meanwhile, Vanuatu posted the longest time to import goods and services among 29 South East Asian Countries recording 198 hours. Next to it was **Indonesia** –

**Surabaya (168 hours) , Myanmar (120 hours) and China- Beijing posting (117 hours)**

### **Empirical Issues**

According to Martinez-Zarzoso and Suarez-Burguet (2002), the volume of imports (exports) between pairs of countries depends on their income (GDPs) and transportation cost:

$$\ln X_{ijk} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln TC_{ijk} + \mu_{ij} \quad (2.1)$$

where:  $\ln X_{ijk}$  = volume of trade

$\ln Y_i$  = natural logarithm of Gross Domestic Product of Exporter

$\ln Y_j$  = natural logarithm of Gross Domestic Product of Importer

$\ln TC_{jk}$  = transportation cost

where  $i$  is the exporting country and  $j$  is the importing countries.

Results of the paper indicated that all the variables included in the estimated transport cost equation are significant. The result also indicated the importance of connectivity in maritime networks for Spanish Trade.

### **THEORETICAL FRAMEWORK**

This portion of this research study contains the hypothesis of this research paper, different theoretical framework and the sources of data.

#### **Statement of Hypotheses**

The results of this study will either validate or reject the following null hypotheses:

1. There are no significant relationships between the independent variables such as Tariff Cost, Turn Around time and economic growth to the Philippine Domestic and Foreign Cargo Throughput

2. The predictor variables such as Tariff Cost, Turn Around time and economic growth individually and collectively, have no significant effect on Philippine Total Domestic and Foreign Cargo Throughput.

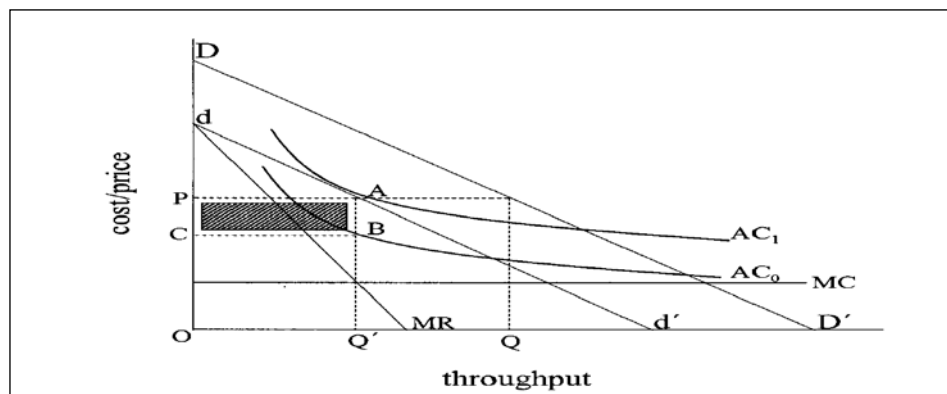
## Theoretical Model

There are several aspects of economic theory that explains the behaviour of total trade in the Philippines. This paper uses the following theories as a foundation of the paper

The paper uses the Cost recovery and limit pricing model (Haralambides) to explain the impact of tariff to Philippine Total Cargo Throughput as shown in Figure 2.5. The figure shows that there is an inverse relationship between the demand for cargo throughput and cost/ or pricing. Port A of country X has a dominant market position. As such, the port is able to meet a substantial part of the trade of the country Y through transshipment. Port A is strong proponent of cost recovery policies in port development in general but, at the same time it is allowed to consider “bygones as bygones” and thus its prices, current and future do not have include the recovery of its past investments.

### Figure 1

### Cost Recovery and Limit Pricing Model



Source: Haralambides (2002)

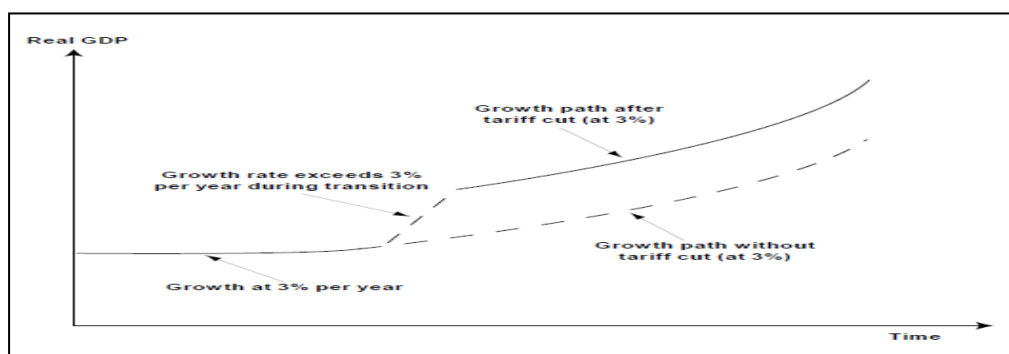
The growth rate of gross domestic product (GDP) is higher in growth path after tariff cut compared to growth path without tariff cut, as shown in Figure 2.7. As a result of the tariff cut, export will rise from 10 to 30 percent of gross domestic product. If the GDP is growing at

3 percent per year, the 6 percent benefit from the tariff reduction is bigger which rises to 300 percent of the prior year's GDP (Harberger, 2006)

The cost recovery and limit pricing model were adopted as the theoretical foundation of this research paper. Both of the model cited that the gross Domestic Product and Tariff Rate of the country affects the trade of a country. Adopting the two model, the research has come up with the following trade model for Foreign and Domestic Cargo Throughput:

**Figure 2**

### **Gross Domestic Product and Tariff Cut.**



Source : Arnold C Harberger (2005)

### **Mathematical Model**

#### **Model 1:**

$$\text{LNFC} = \beta_0 - \beta_1(\text{LNPD}) + \beta_2(\text{LNDOCK}) - \beta_3(\text{LNWHARF}) + \beta_4\text{LNTAT} + \beta_5 \text{LNGDP} + u$$

where:

$\beta$ 's = Parameter estimates

LNFC = Natural Logarithm of Foreign Cargo Throughput

LNPD = Natural Logarithm of Tariff Port Dues

LNDOCK = Natural Logarithm of Tariff Dockage Fee

LNTAT = Natural Logarithm of Turn Around Time

LNGDP = Natural Logarithm of Real Gross Domestic Product

u = Error term

$$\text{LNDCT} = \beta_0 + \beta_2(\text{LNWHARF}) + \beta_3 \text{LNTAT} + \beta_4 \text{LNGDP} + u$$

where:

$\beta$ 's = Parameter estimates

LNDCT = Natural Logarithm of Domestic Cargo Throughput

LNWHARF = Natural Logarithm of Wharfage Tariff Fees

LNTAT = Natural Logarithm of Turn Around Time

LNGDP = Natural Logarithm of Real Gross Domestic Product

u = Error term

## **Data Sources**

This paper obtained the nominal gross national product data from Philippine Statistical Authority (PSA) and National Statistics Office (NSO). Meanwhile, cargo throughput, average tariff per cargo and capital investment to port infrastructure were culled from Philippine Ports Authority.

## **Analysis of the Results**

The paper employed time series data covering a period of sixteen years (16) years from 1999 to 2014. The relevant data for this study are Total foreign and domestic cargo throughput (in million metric tons), Port Dues (pesos per tons), Dockage Fee (Pesos per tons), Wharfage Fee (Pesos Per tons), turn around time (waiting time in the ports, in hours) and gross domestic product (in million pesos

## **The Philippine Total Domestic and Foreign Trade Cargo Throughput**

Table 3 showed the Philippine total domestic and foreign cargo throughput from 1999 to

2014. Over the period of 16 years from 1999 to 2014, the Philippine manage to posted an average of domestic cargo throughput of 76.14 million metric tons with an average cumulative growth rate of 0.01 percent. Meanwhile, the country recorded an average foreign cargo throughput of 85.81 million metric tons with an average cumulative growth rate of 5.36 percent.

**Table 3**  
**Philippine Total Domestic and Foreign Cargo Throughput**  
**(million metric tons)**

Year	Domestic	Growth Rate	Foreign	Growth Rate	Total Cargo	Growth Rate
1999	77.41	-	65.51	-	142.92	-
2000	77.66	0.32	72.18	10.18	149.84	4.84
2001	75.83	-2.36	72.00	-0.25	147.83	-1.34
2002	79.88	5.34	69.58	-3.36	149.46	1.10
2003	79.76	-0.15	61.94	-10.98	141.70	-5.19
2004	82.94	3.99	74.43	20.16	157.37	11.06
2005	79.40	-4.27	75.83	1.88	155.23	-1.36
2006	72.84	-8.26	81.50	7.48	154.34	-0.57
2007	74.59	2.40	82.85	1.66	157.44	2.01
2008	72.00	-3.47	73.90	-10.80	145.90	-7.33
2009	71.94	-0.08	77.96	5.49	149.90	2.74
2010	66.86	-7.06	97.45	25.00	164.31	9.61

2011	74.86	11.97	102.48	5.16	177.34	7.93
2012	78.27	4.56	106.75	4.17	185.02	4.33
2013	77.96	-0.40	124.10	16.25	202.06	9.21
<b>2014</b>	76.06	-2.44	134.49	8.37	210.55	4.20
<b>AVERAGE</b>	76.14	0.01	85.81	5.36	161.95	2.75

Source: Philippine Ports Authority

The average Philippine Total Cargo Throughput from the year 1999 to 2014 is 161.95 million metric tons. This was comprised by domestic cargo which shared 47 percent of the total cargo throughput and foreign cargo with 53 percent share.

Table 4 presented the total cargo throughput of various ports in South East Asia for the year 2013. The terminal at Manila showed an improvement in its Cargo Throughput World Rank posting a ranked of 89 with 45.068 million metric tons in 2013, a slight improvement compared in 2012 with the ranked of 92. The cargo throughput handled by Manila Port is far behind other Southeast Asian Countries, in fact, Singapore managed to be in 2<sup>nd</sup> ranked in the world which posted highest cargo throughput.

**Table 4**  
**2012 and 2013 Total Cargo World Rank of**  
**Southeast East Asian Countries**

2012 World Rank	2013 World Rank	Port	Country	2013 Total Cargo (In 000 mt)
2	2	Singapore	Singapore	560,888
17	17	Port Kelang	Malaysia	198,928
32	30	Tanjung Pelepas	Malaysia	120,047
54	42	Saigon New Port	Vietnam	93,560
56	59	Laem Chabang	Thailand	67,067

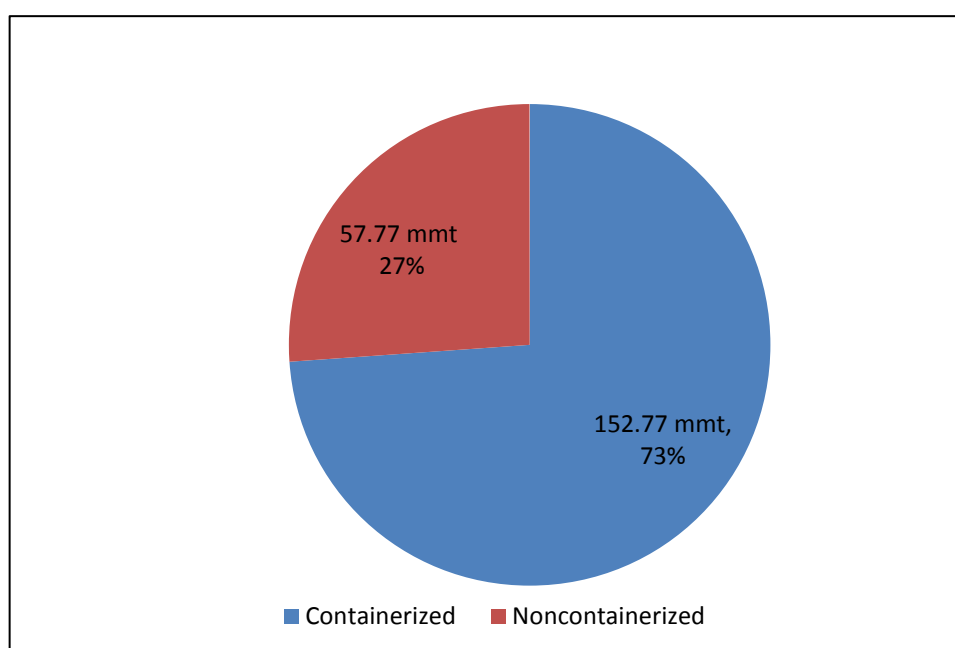
N.A.	69	Tanjung Priok	Indonesia	58,429
96	89	Manila	Philippines	45,068
N.A	133	Penang	Malaysia	29,329
N.A.	199	Bangkok	Thailand	19,557

Source: American Association of Port Authorities

The 2014 Philippine total throughput was comprised by 27 percent Containerized cargoes or 57.77 million metric tons and 73 percent or 152.77 million metric tons. (Figure 3)

Figure 3

#### Composition of Philippine Cargo Throughput



The domestic shipping industry plays an important role in the country's international trade by carrying, between ports in the country, cargoes intended for exports and cargoes arriving as imports, or what are referred to as transit cargoes (Austria 2003).

The average total quantity of domestic trade transactions from 1996 to 2013 is 22.02 million tons. The commodities were traded mostly through water, comprising an average of 99.79 percent of the total domestic trade or an average of 21,975.29 thousand metric tons. Meanwhile, commodities traded in air and rail comprises an average of 0.20 percent (44.69



thousand metric tons) and 0.01 percent (2.03 thousand metric tons) of the total domestic trade, respectively. In the year 2007, where RORO Port System in the Philippine has been established resulted to diversion of cargo carried by rail transportation to water transportation (Table 5).

## Results of Statistical Test

### Augmented Dickey Fuller (ADF) Test

The Dickey Fuller (ADF) test was used to test how stationary is each variable. As summarized in Table 6, Natural Logarithm of domestic cargo was stationary at First Difference since the computed ADF test statistics of -4.35 was more negative than the Mc Kinnon critical value of 4.00 at 1 percent level of significance.

**Table 5**  
**Quantity of Domestic Trade by Mode of Transport**  
**(In thousand tons)**

Year	Water Transport		Air Transport		Rail Transport		Total
	Quantity	Percentage to Total	Quantity	Percentage to Total	Quantity	Percentage to Total	
1996	5,380.08	99.70%	73.72	0.29%	1.54	0.01%	25,455.34
1997	26,473.84	99.74%	66.07	0.25%	3.61	0.01%	26,543.52
1998	22,089.04	99.78%	46.34	0.21%	3.20	0.01%	22,138.58
1999	1,509.45	99.75%	50.33	0.23%	2.76	0.01%	21,562.54
2000	6,625.00	99.66%	54.03	0.32%	2.01	0.01%	16,681.04
2001	19,555.74	99.73%	51.74	0.26%	1.90	0.01%	19,609.38
2002	27,581.00	99.82%	48.00	0.17%	2.14	0.01%	27,631.14
2003	27,028.00	99.85%	39.00	0.14%	2.07	0.01%	27,069.07

2004	24,566.00	99.81%	44.62	0.18%	1.75	0.01%	24,612.37
2005	21,407.00	99.83%	36.83	0.17%	0.67	0.00%	21,444.50
2006	20,441.00	99.86%	28.00	0.14%	0.65	0.00%	20,469.65
2007	22,799.00	99.81%	42.99	0.19%	-	0.00%	22,841.99
2008	18,350.00	99.82%	32.51	0.18%	-	0.00%	18,382.51
2009	9,355.00	99.79%	41.69	0.21%	-	0.00%	19,396.69
2010	20,237.00	99.78%	44.00	0.22%	-	0.00%	20,281.00
2011	18,962.29	99.82%	34.85	0.18%	-	0.00%	18,997.14
2012	21,532.69	99.84%	35.08	0.16%	-	0.00%	21,567.77
2013	21,663.01	99.84%	34.59	0.16%	-	0.00%	21,697.60
Average	21,975.29	99.79%	44.69	0.20%	2.03	0.01%	22,021.21

Source: National Statistics Office

Likewise, the natural logarithm of port dues, natural logarithm of dockage, natural logarithm of wharfage, and natural logarithm of turn around time were stationary at first Difference since the computed ADF Test statistics is more negative than the Mc Kinnon critical value at 1 percent level of significance. Meanwhile, the Gross Domestic Product was stationary at 5 percent level of significance as indicated in more negative ADF statistics of 3.77 compared to Mc Kinon critical value of 3.10.

**Table 6**  
**Results of ADF Test for Stationarity**

Variables	T- ADF Statistics	Critical values
D(LNDC)	(4.35)	1% (4.000)
D(LNPD)	(4.61)	1% (4.000)

D(LNDOCK)	(4.03)	1%	(4.000)
D(LNWHARF)	(4.47)	1%	(4.000)
D(LNTAT)	(4.85)	1%	(4.000)
D(LNGDP)	(3.77)	1%	(4.000)
		5%	(3.10)

### Analysis of the Regression Results

The results of the regression made on the data between percentage change in foreign and each of the explanatory variables are summarized in the following regression equation:

$$\text{LNFC} = -1.80 - 0.90(\text{LNPD}) + 0.89(\text{LNDOCK}) - 0.30 \text{LNWHARF} \\ - 0.04 \text{LNTAT} + .50 \text{LNGDP} + u$$

$$t\text{-values} \quad (.73) \quad (2.49) \quad (4.92) \quad (0.94) \\ (1.40) \quad (2.77)$$

$$R^2 = 0.97 \quad \text{Adj. } R^2 = 0.94 \quad F_{(4,17)} = 38.08 \quad \text{D.W.} = 1.52$$

### Critical Values:

$$F_{(5,11)} = 2.45$$

$$t\text{-ratio}_{(0.05)} = 2.13 \quad t\text{-ratio}_{(0.01)} = 2.94 \quad t\text{-ratio}_{(0.10)} = 1.75$$

$$\text{D.W.}_{(0.01)} = d_L (0.43) \quad d_U (1.90)$$

The regression results showed that the percentage change in port dues had a significant negative effect on the percentage change in foreign cargo throughput trade since the calculated t-value of 2.49 is greater than critical t value of 2.13 at  $\alpha = 0.05$  and d.f.= 15. A one percentage increase in port dues, the Philippine foreign cargo throughput will decrease by 90 percent. **Thus, the null hypothesis that percentage change in port has no significant**

**relationship effect in Philippine cargo throughput is rejected.**

Likewise, the regression results also showed that percentage change in dockage fee has significant effect in percentage change in foreign cargo throughput at 1 percent level of significance. Thus, a one percent increase in Dockage fee will result to an increase in foreign cargo throughput by 89 percent. **Thus the null hypothesis was also rejected in the case of percent change in dockage having no effect on to foreign cargo throughput.**

Meanwhile, the percentage change in wharfage fee has no significant **effect on foreign cargo throughput. Thus, the null hypothesis that there is no significant relationship between percent change in wharfage and percent change in foreign cargo throughput was accepted**

Further, the regression results showed that there is significant relationship between turn around time and foreign cargo throughput. **Thus, a one percent increase in turn around time will result to decrease in foreign cargo throughput by 4 percent.**

Moreover, the Gross Domestic Product had significant relationship to foreign cargo throughput at 5 percent level of significance. Thus, a 1 percent increase in Gross domestic product will result to an increase in foreign cargo throughput by 50 percent.

To determine the proportion of the total variation in Y “explained” by the multiple regression equation of dependent variable Y on Xs, the coefficient of multiple determination was employed. The estimated regression equation’s showed a “goodness of fit” since the adjusted  $R^2$  was 0.94. This means that 94.00 percent of the variation in the percentage change in foreign cargo throughput was explained by the variation in explanatory variables.

The computed F-ratio of 27.32 exceeds the critical F-ratio of 38.08 at 1 percent level of significance. Thus, the null hypothesis No. 2, which states that **the aggregate impact of predictor variables on the percentage change in foreign cargo throughput is not significant is REJECTED.** Furthermore, it also implied that the model was significant and the selected independent variables have an aggregate impact on percentage change in foreign cargo throughput.

## Regression Results for Domestic Cargo Throughput Model

The results of the regression made on the data between percentage change in domestic cargo throughput and each of the explanatory variables are summarized in the following regression equation:

$$\text{LNDCT} = 3.11 - 0.10 (\text{LNWHARF}) + 0.11 (\text{LNTAT}) + 1.70 (\text{LNGDP}) + u$$

$$t\text{-values} \quad (12.48) \quad (2.25) \quad (6.61) \quad (3.64)$$

$$R^2 = 0.87 \quad \text{Adj. } R^2 = 0.78 \quad F_{(3,17)} = 9.81 \quad \text{D.W.} = 2.41$$

### Critical Values:

$$F_{(5,11)} = 2.43$$

$$t\text{-ratio}_{(0.05)} = 2.13 \quad t\text{-ratio}_{(0.01)} = 2.94 \quad t\text{-ratio}_{(0.10)} = 1.75$$

$$\text{D.W.}_{(0.01)} = d_L (0.59) \quad d_U (1.47)$$

The regression results showed that the percentage change in wharfage had a significant negative effect on the percentage change in domestic cargo throughput trade since the calculated t-value of 2.25 is greater than critical t value of 2.13 at  $\alpha = 0.05$  and d.f.= 15. A one percentage increase in wharfage, the Philippine domestic cargo throughput will decrease by 10 percent. **Thus, the null hypothesis that percentage change in wharfage has no significant relationship effect in Philippine domestic cargo throughput is rejected.**

Further, the regression results showed that there is significant relationship between turn around time and domestic cargo throughput. Thus, a one percent increase in turn around time will result to an increase in domestic cargo throughput by 11 percent.

Moreover, the Gross Domestic Product had significant relationship to foreign cargo throughput at 1 percent level of significance. Thus, a 1 percent increase in Gross domestic product will result to an increase in foreign cargo throughput by 170 percent.

The estimated regression equation's showed a "goodness of fit" since the adjusted  $R^2$  was 0.78. This means that 78.00 percent of the variation in the percentage change in domestic cargo throughput was explained by the variation in explanatory variables.

The computed F-ratio of 9.81 exceeds the critical F-ratio of 2.43 at 1 percent level of

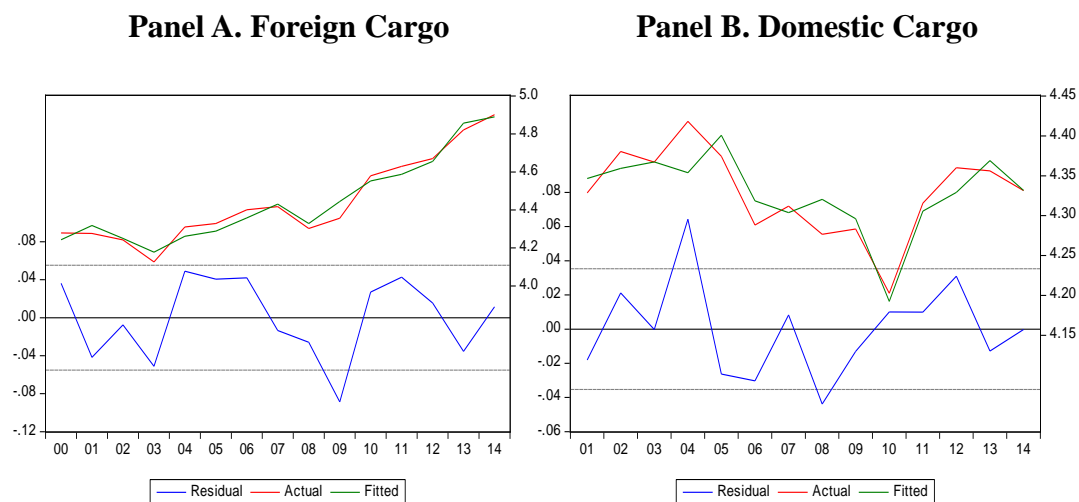
significance. Thus, the null hypothesis No. 2, which states that **the aggregate impact of predictor variables on the percentage change in domestic cargo throughput is not significant** is **REJECTED**. Furthermore, it also implied that the model was significant and the selected independent variables have an aggregate impact on percentage change in domestic cargo throughput.

### Results of Other Tests Employed

Figure 4 showed how well the Foreign and Domestic Cargo Throughput Model in tracking actual data. Over the period of sixteen years, the regression estimates generated by the Philippine Foreign Cargo Throughput (Panel A) and Philippine Foreign Domestic Cargo throughput visualized that actual data is somehow close to fitted. This can be supported by regression residuals pattern which are more or less concentrated around zero. This is an evidence that the residuals are stationary.

**Figure 4**

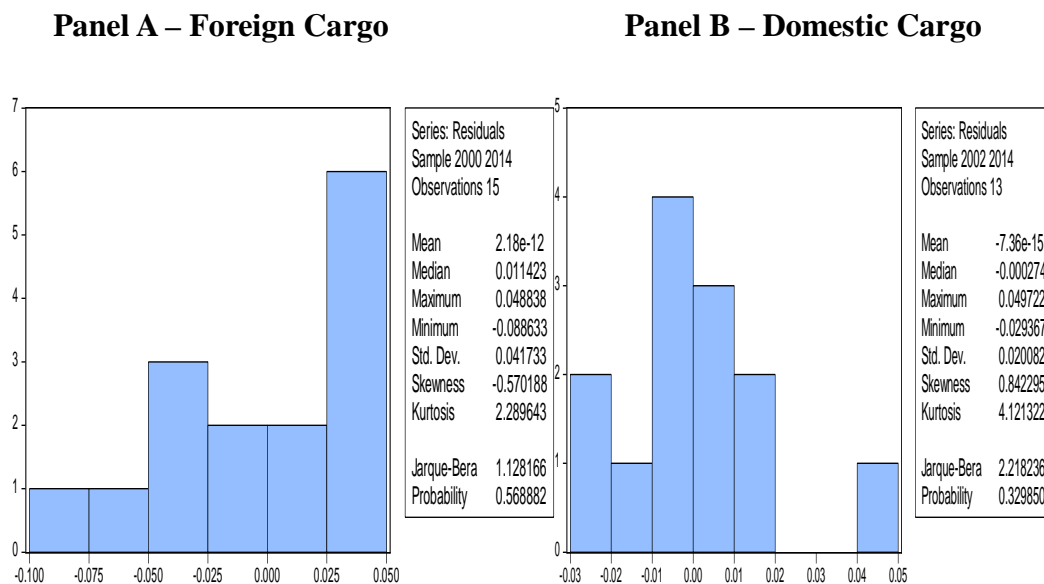
#### Plot of the Regression Estimates Versus Data



To test if the model is normally distributed, the Jarque Bera Normality Test was employed. The regression residual both for foreign (Panel A) and domestic cargo (Panel B) the regression residual was normally distributed since the computed p-values does not exceed to 5 percent level of significance.

Both Foreign and Domestic Cargo throughput model pass the Ramsey Reset test to indentify if the model is correctly specified, since the respective p-value does not exceed the 5 percent level of significance.

**Figure 5**  
**Jarque Bera Normality Test for Foreign and Domestic**



## Conclusions

Each of the predictor variables namely percentage change in port dues, percentage change in dockage, percentage change in turn around time, and percentage change in gross domestic product were significantly correlated with Philippine foreign Cargo throughput. Thus, a collinear relationship among the explanatory variables is ruled out, and the partial effect of each explanatory variable on dependent variable was given by their respective coefficients.

Explanatory variables such as percentage change in wharfage, percentage change in turn around time and first difference of gross domestic product have significant relationship with Philippine domestic cargo throughput.

All the explanatory variables individually and collectively exerted a significant effect on Philippine Foreign and Domestic Cargo Throughput. Thus, the model is considered satisfactory from the standpoint of statistical criteria.

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## APPENDIX

Dependent Variable: LNCARGO\_FOREIGN

Method: Least Squares

Date: 12/15/15 Time: 23:33

Sample (adjusted): 2000 2014

Included observations: 15 after adjustments

Convergence achieved after 14 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.807986	2.460938	-0.734673	0.4835
LNAVE_PD	-0.908194	0.363948	-2.495394	0.0372
LNAVE_DOCK	0.899051	0.182621	4.923053	0.0012
LNWAITINGTIMEDOM	-0.042048	0.029926	-1.405087	0.1976
LNAVE_WHARFAGE	-0.308978	0.328418	-0.940806	0.3743
LNGDP	0.505785	0.182056	2.778184	0.0240
AR(1)	0.236087	0.359352	0.656980	0.5296
R-squared	0.966172	Mean dependent var		4.442762
Adjusted R-squared	0.940801	S.D. dependent var		0.225828
S.E. of regression	0.054946	Akaike info criterion		-2.660205
Sum squared resid	0.024153	Schwarz criterion		-2.329781
Log likelihood	26.95154	Hannan-Quinn criter.		-2.663724

F-statistic                      38.08153    Durbin-Watson stat                      1.523879

Prob(F-statistic)                      0.000019

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Inverted AR Roots                      .24

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Dependent Variable: LNCARGO\_DOMESTIC

Method: Least Squares

Date: 12/14/15    Time: 22:01

Sample (adjusted): 2002 2014

Included observations: 13 after adjustments

Convergence achieved after 8 iterations

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
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C	3.116975	0.249494	12.49318	0.0000
LNAVE_WHARFAGE	-0.102390	0.045311	-2.259725	0.0584
LNWAITINGTIMEDOM	0.115968	0.017527	6.616565	0.0003
D(LNGDP)	1.707550	0.468857	3.641937	0.0083
AR(1)	1.160338	0.198380	5.849057	0.0006
AR(2)	-0.956523	0.225801	-4.236135	0.0039

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R-squared                      0.875184    Mean dependent var                      4.328196

Adjusted R-squared                      0.786029    S.D. dependent var                      0.056842

S.E. of regression                      0.026294    Akaike info criterion                      -4.134947

Sum squared resid                      0.004839    Schwarz criterion                      -3.874201

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Log likelihood	32.87715	Hannan-Quinn criter.	-4.188542
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F-statistic	9.816494	Durbin-Watson stat	2.415864
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Prob(F-statistic)	0.004575
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Inverted AR Roots	.58+.79i	.58-.79i
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