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The Role of Distance in Determining International Transport Costs: Evidence from Philippine Import Data

Hiroshi Kuwamori*

May 2006

Abstract

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Results indicate that while distance is important in determining transport costs, using distance alone as the proxy of international transport costs is insufficient, and such use underestimates the impact of distance on international transport costs. Results also indicate that the impact of distance varies across commodity groups, but it is difficult to precisely determine the direction and the magnitude of this impact.

Keywords: transport costs, distance, trade
JEL classification: F14, L91

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The Role of Distance in Determining International Transport Costs
Evidence from Philippine Import Data

(Very Preliminary)

Hiroshi Kuwamori*

May 2006

Abstract

In the empirical literature on international trade, it is a common exercise to use the distance between countries as a proxy for transport costs. This is due to the limited availability of the direct data related to transport costs. However, there is only a small amount of evidence available to determine whether or not this assumption is really appropriate.

This paper presents an empirical investigation of the appropriateness of distance as a determinant of international transport costs by using Philippine import data. This study addresses three specific questions. First, does distance really matter in the determination of transport costs? Second, if distance is a significant factor, what is the magnitude of its impact? Third, does the impact of distance on transport costs vary by commodity?

Results indicate that while distance is important in determining transport costs, using distance alone as the proxy of international transport costs is insufficient, and such use underestimates the impact of distance on international transport costs. Results also indicate that the impact of distance varies across commodity groups, but it is difficult to precisely determine the direction and the magnitude of this impact.

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1. Introduction

In recent years, international transport costs have attracted the increasing attention from international economists and policy makers. For example, the World Trade Organization (WTO) considered air transport and its development as a main topic in the *World Trade Report 2005*.

Transport costs are regarded as important because they affect economic growth through changing trade patterns. Radelet and Sachs (1998) listed three channels through which transport costs affect economic growth: First, higher transport costs reduce manufactured exports that are crucial for earning foreign exchange that is needed to purchase capital goods necessary for growth. Second, higher transport costs reduce the rents from natural resources for exporters of primary products, and this lowers savings for investment. Third, countries with higher transport costs reduce trade and are less attractive to foreign direct investment (FDI). Trade and FDI are major sources of technology transfer, and reducing these leaves the country behind in the world technology frontier. To support these claims, Radelet and Sachs (1998) estimated a growth equation that includes shipping costs as an independent variable. Their results indicate that there exists a strong relationship between shipping costs and economic growth. Results further imply that doubling shipping costs are associated with slower annual growth rates by slightly more than one-half of one percent.

Transport costs have also attracted attention due to recent progress in economic integration resulting from free trade agreements (FTA) between countries. With the consequent decline of artificial trade barrier, mainly because of lowering import tariffs, the importance of transport costs as a major barrier of international trade has increased. According to the World Bank (2001), transport costs outweigh tariff barriers in 168 out of 216 countries that are U.S. trading partners.

Despite the increased recognition of the importance of transport costs in international trade, most empirical studies in international trade that commonly use gravity equations, replace transport costs with geographic distance. This is due to lack

of availability of direct transport cost data and only a limited amount of evidence has been provided to show the appropriateness of using distance as a proxy for transport costs. Thus, it is important to explore the relationship between distance and transport costs in order to develop accurate analyses of international trade patterns.

Using import data from the Philippines, this paper examines whether or not geographic distance is an appropriate proxy for transport costs. Three specific questions are addressed: First, does distance really explain variation in transport costs? Second, if distance is important in determining transport costs, how large is the impact? Third, does the impact of distance on transport costs vary by commodity?

Section 2 includes a discussion of the concepts of transport costs and their determinants. In section 3, formulation in transportation technology of estimation is developed. Section 4 describes the data used for estimation, and Section 5 includes the results of the estimation. Conclusions are presented in Section 6.

2. Determinants of international transport costs

Interpretation of the term "transport cost" varies relative to the particular literature being reviewed. Sometimes its meaning not only freight costs but other costs incurred in transactions (tariffs, information costs, contract costs, etc…).[1] In this paper, transport costs are defined as shipping costs paid to international forwarding agents. In the case of international shipping trade, this definition covers freight and insurance from the exporting ports to the importing ports.

Given the above definition, what factors determine the transport costs? As mentioned, geographic distance is the most popular proxy used in empirical studies. The rationale for using distance is that for a given mode of transportation, the greater the distance, the more energy and time are consumed. However, there is some doubt as to whether or not distance alone is appropriate as a proxy for transport costs.

[1] For example, see Anderson and Wincoop (2004), pp.691-692.

Several studies have approached this problem from different perspectives. Geraci and Prewo (1977) estimated the transport cost equation for OECD countries and found that using only distance as a proxy for transport costs may result in underestimating the sensitivity of bilateral trade flows to transport costs. Hummels (1999) and Hummels (2001) estimated transport cost elasticity with respect to distance by transportation mode using U.S. import data. His results show that the distance coefficient of sea transport is higher than that of ocean transport. Limao and Venables (2001), Micco and Perez (2002) and Martinez-Zarzoso and Suarez-Burguet (2003) emphasized the role of the quality of transport infrastructure. Limao and Venables (2001) found that using distance alone explains only 10 percent of the variation of transport costs; this is much lower than the approximately 50 percent explained when infrastructure variables are included.[2] The general consensus of the past studies is that distance plays a certain role in determining transport costs, but it does not sufficiently explain transport costs.

A primary goal of this paper is to confirm the relationship between distance and transport costs using import data from the Philippines. Compared with past literature, a major characteristic of this study is that transport cost elasticity with respect to distance by commodity group is measured. Previous studies have limited analyses of aggregate imports, and the question of whether or not transport cost elasticity with respect to distance varies across commodities has not been explored. However, it is natural to think that the magnitude of the impact of determinants differs across goods because transportation modes and shipping methods such as containerization vary relative to different commodities. Hopefully, this study will lead to more accurate analyses of trade patterns. This study provides evidence of the transport cost structure for Asian countries. Existing studies have conducted analyses using data for Europe, the U.S., and Latin American countries. So far, no study has focused on Asian countries.[3] This study may

[2] Bougheas *et al* (1999) also focused on the role of the transport infrastructure. They added an infrastructure index to the gravity equation as a transport cost variable.

[3] The only exception is Limao and Venables (2001). They estimated the transport cost equation using CIF/FOB measures calculated from the IMF's *Direction of Trade Statistics* (DOT) for the year 1990. Their sample consisted of 103 countries, including Asian countries.

also have value in reinforcing the findings of past studies by developing a case study for a specific Asian country, and it may also serve to clarify characteristics of the determinants of transport costs in Asia.

3. Modeling transportation technology

In addition to distance, past studies have proposed factors such as the quality of infrastructure and the value of commodities as determinants of international transport costs. Thus, transport costs for a given importing country i can be expressed as a function of various factors:

$$(1) \quad C_{ijkt} = f\left(x_{jt}, X_{ij}, X_{ijkt}, v_k\right)$$

C_{ijkt} denotes the transport cost for country i's imports from exporting country j of commodity k at time t. x_{jt} represents the trading partner's characteristics, and X_{ij} and X_{ijkt} are the characteristics associated with travel between countries i and j. Since the primary purpose of this paper is to explore the role of distance in determining transport costs, transport technology as a function is formulated as a function of distance that is controlled by other variables and is augmented by the trend terms: [4]

$$(2) \quad \ln C_{ijkt} = \alpha_k + \beta_{1k} T_t + \beta_{2k} T_t^2 + \gamma_k \ln W_{ijkt} + \delta_k \ln I_{jt} + \theta_k \ln D_{ij} + \zeta_{1k} T_t \ln D_{ij} + \zeta_{2k} T_t^2 \ln D_{ij} + \varepsilon_{ijkt}$$

T_t denotes time trend, and D_{ij} denotes the measure of distance from importing country i to exporting country j. W_{ijkt} represents an index of the unit value of commodities, and this variable is added because commodity value is considered

[4] This specification is based on Hummels (1999) and Brun *et al* (2002).

important in determining transport costs. I_{jt} is a measure of the infrastructure quality of the exporting country. $T_t \ln D_{ij}$ and $T_t^2 \ln D_{ij}$ are added in order to take into consideration price changes during the observed period; no direct price deflator of transport costs is available. In the pooled regression, commodity dummy variables will be added to the equation. ε_{ijkt} is a disturbance term that is assumed to be normally distributed with zero mean.

4. Data

The source of data for transport costs and unit value is *Foreign Trade Statistics of the Philippines* for the period from 1991 to 1996. There are two advantages in using this data. First, detailed values of freight and insurance on Philippine imports at the SITC seven digit level are reported. Second, the data is consistent. Studies that employ the difference between FOB and CIF import values as transport cost measures generally use the IMF's *Direction of Trade Statistics* (DOT).[5] However, DOT data is collected from various sources, and Hummels and Lugovskyy (2003) found that using it to calculate transport costs creates severe distortions and does not provide useful information. Using a single data source eliminates this problem.

Data of approximately 6,000 were aggregated at the seven to two digit level yielding 64 commodity groups. Transport cost rates (C_{ijkt}), which are commonly called CIF/FOB factors, were calculated for each commodity group by dividing the sum of freight and insurance by FOB import values. Transport cost index was then calculated as follows:

$$(3) \quad C_{ijkt} = \frac{CIF_{ijkt} - FOB_{ijkt}}{FOB_{ijkt}} = \frac{CIF_{ijkt}}{FOB_{ijkt}} - 1$$

[5] For example, refer to Limao and Venables (2001). Geraci and Prewo (1979) also used the IMF rule-of-thumb (which is the main cause of distortions in DOT data) to estimate transport cost rates for several countries in their samples.

Table 1 shows the average freight and insurance rates for the aggregated SITC 1 digit level commodity groups (for more detailed SITC 2 digit level data, see Appendix 1). As observed in other countries, transport cost rates of primary commodities, such as agricultural products and minerals, tend to be higher than those of manufactured commodities. On average, the rate of freight and insurance on overall Philippine imports is from six to seven percent.

Using the same source, the index of the value of a commodity is obtained as a weight to value ratio (W_{ijkt}). This can be calculated by dividing the gross weight of the commodity (KG) by the value of FOB imports (US dollars):

$$(4) \quad W_{ijkt} = \frac{KG_{ijkt}}{FOB_{ijkt}}$$

No direct data covering all target countries and the observation period is available to determine quality of infrastructure of the exporting countries. Therefore, a proxy that seem to reflect levels of infrastructure of the country may be used. The per capita Gross Domestic Product (GDP) of each exporting country was employed as a proxy for an infrastructure quality measure. This assumes that a better quality infrastructure is provided in countries where citizen income is higher. Per capita GDP data are taken from the *Penn World Table*.

Shipping route distance is used for the distance variable and is calculated based from *Distance Tables for World Shipping*. Published by the Japan Shipping Exchange, Inc., this source reports distances between major ports. This assumes, of course, that Philippine imported commodities are transported by ocean. According to Hummels (1999), ocean transport was used for 45.5 percent of U.S. imports in 1998. Martinez-Zarzoso and Suarez-Burguet (2003) reports that maritime transport accounts for 50 to 70 percent of Latin American imports in 1998. Though the Philippine authority does not report data for imports by transportation mode, the Philippines is an island

country and it is probable that a significant amount of imports are transported by ocean, even Philippine imports.

5. Results

5.1 Pooled Regression

To understand the overall characteristics of transport costs on Philippine imports, a pooled regression for all commodities was first performed. Results are reported in Table 2.

The first column shows the estimation result of equation (2) with commodity dummies. Here, the signs of parameter estimates are as expected and are consistent with previous studies. That is, transport costs rise as distance increases, and they fall as the value of commodity and the quality of infrastructure rise. The parameter estimate of the distance variable indicates that if a trading partner of the Philippines is as much as twice the distance as another exporting country, the rate of transport costs of the distant trading partner is about 29 percent higher than its closer counterpart.

In order to identify the major determinants of transport costs and to check the robustness of parameter estimates, other specifications are also estimated. The second column reports results of the model in which the commodity dummies are dropped. Though the impact of distance and the weight to value ratio of the commodities drop slightly, no significant changes occur. Other columns show estimation results of regressions using different combinations of variables. The third and fourth columns report results where the weight to value ratio has been dropped from the regression. The fifth and sixth columns report results in which the exporter infrastructure variable is excluded. Finally, the seventh and the eighth columns present results where the effect of distance is isolated.

In all specifications, the signs of parameter estimates do not change. However, several important changes may be observed between specifications. First, as the number

of variables decreases, the value of the distance coefficient becomes smaller. The distance coefficient is greater in the first column than in other columns, and the coefficient becomes smaller as the number of variables in the model decreases. When comparing the distance coefficient of the first column (which includes all variables) with that of the seventh column (in which only distance is included), the magnitude of the coefficient drops by about 34 percent. This implies that the impact of distance on transport costs will be significantly underestimated when necessary variables are omitted. Second, results in the fourth and the eighth columns, in which both weight to value ratio and commodity dummies are excluded from the regressions, have extremely low explanatory power. This result may imply that the weight to value ratio and the characteristics associated with commodities are important in explaining variations in transport costs.

In addition, the fifth column shows that magnitudes of the parameter estimates are close to those of Hummels (1999) where U.S. import data was used. This may mean that for a given specification, the impact of distance and the weight to value ratio on overall transport costs of imported goods is almost the same across countries. Other parameters, as well as trend and interaction terms, show consistent results with Hummels (1999), but they are statistically insignificant.

5.2 Regressions by Commodity Group

The results of pooled regression indicate the importance of commodity level analysis. A second exercise was to conduct regressions for each commodity group to determine if the role of distance varies significantly across goods. A transport cost equation specified in (2) was estimated. Estimation results for each SITC 2 digit commodity group may be seen in Appendix 2 and are summarized in Table 3.

Table 3 shows that most parameter estimates are statistically insignificant; signs are mixed except for the weight to value ratio. Parameter estimates of the weight to value ratio yield relatively robust results; 59 out of 64 estimates are statistically significant

with values ranging from -0.246 to 0.757. The average is 0.318. Commodity groups that have negative signs are "33 Petroleum and its products", "34 Gas, natural and manufactured" and "53 Dye, tanning, color material". Sectors 34 and 53 are statistically insignificant.

Estimates of distance parameters produce conflicting results. The ranges of parameter estimate clusters lie between -0.303 and 1.099. The average is 0.268, and this is close to the result of the pooled regression. However, statistically significant estimates were found for only 17 commodity groups. Though they are all insignificant, negative signs are reported for 11 commodity groups. Similar results were also obtained in Hummels (2001).[6]

Poor results with commodity group level regressions were probably due to the small samples. Since the sample available for each commodity group is small compared with full samples, variances of parameter estimates tend to be much larger when compared with the pooled regression where 11,562 observations are available. Therefore, most estimates are statistically insignificant.

Though it is difficult to make inferences regarding the direction and magnitude of the impact of distance on transport costs, these poor results do not mean that the impact of distance is the same across commodities. The question of whether or not parameter estimates are the same across commodity groups was tested based on specification (2) by calculating an *F* statistic using residuals obtained from pooled and commodity group regressions. As reported in Table 1, the value of the *F* statistic is 45.320. Thus, the null hypothesis that parameters are same across commodity groups was rejected.[7]

[6] Hummels (2001) estimated gravity-type import demand equations using import data (by two digit SITC commodity group) for the US, New Zealand and Latin American countries. He found that distance parameters are significant for 35 out of 62 goods. Further, he obtained positive effects of distance on import demand for 10 of the sectors; this indicates that greater distance tends to lower transport costs.

[7] This test was conducted not only with the distance coefficient (θ_k), but all other parameters as well. However, the result provides strong support for the inference that distance elasticity differs across commodity groups.

6. Concluding Remarks

This paper presented an analysis of the relationship between distance and transport costs. Three questions were addressed. Philippine import data was used in this analysis, and questions/answers were as follows: The first question concerned whether or not distance was important in determining transport costs. Results of regression analysis indicate that distance is important, but not decisive at the commodity level. Further, though distance matters, results imply that distance is insufficient as a proxy for transport costs. The impact of distance on transport costs may be underestimated if other necessary variables are omitted. The second and the third questions related to the magnitude of the impact of distance. Results indicate that the rate of transport costs on overall imports of the Philippines increases at about 29 percent as distance from the Philippines doubles. Yet for each commodity group, no useful information on the direction and the magnitude of impact were derived. It should be noted, however, that it may be possible to infer that the impact of distance differs across commodities.

To sum up, this study confirmed the relationship between distance and transport costs that were revealed in the previous studies. That is, analysis here indicates that using distance as the only proxy for transport costs is insufficient and underestimates the impact of distance on transport costs. Commodity level exercises in this paper did not identify the role of distance except that its impact varies across commodities.

One qualification of the analysis presented here related to the quality of data. Analyses were conducted using detailed import data of the Philippines. In this data, import values as well as freight and insurance costs are available by country and by commodity group. However, various goods and transportation methods (transport modes and shipping methods) are often mixed in the same commodity group. Thus, results obtained from such data may contain much noise and provide limited information. Therefore, further refinement of data will be critical to grasp a more accurate picture of transportation technology in international trade.

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Table 1: Average Freight and Insurance Rates on Philippine Imports

SITC	Description	1991	1992	1993	1994	1995	1996	Changes
0	Food and live animals	0.1345	0.1259	0.1197	0.1273	0.1391	0.1280	-0.0065
1	Beverages and tobacco	0.0372	0.0295	0.0280	0.0432	0.0581	0.1859	0.1487
2	Crude materials, except fuels	0.1155	0.1099	0.1675	0.1337	0.1343	0.1435	0.0279
3	Mineral fuels, lubricants, etc	0.0766	0.0533	0.0721	0.0590	0.0656	0.0556	-0.0210
4	Animal and vegetable oil, fat	0.1009	0.0925	0.0915	0.0782	0.0863	0.1128	0.0119
5	Chemicals, related product nes	0.0845	0.0845	0.0871	0.0870	0.0873	0.0823	-0.0023
6	Manufactured goods by material	0.0708	0.0891	0.0823	0.0861	0.1083	0.1066	0.0358
7	Machinery, transport equipment	0.0439	0.0445	0.0426	0.0410	0.0553	0.0569	0.0129
8	Miscellaneous manufactured articles	0.0531	0.0515	0.0500	0.0511	0.0967	0.0677	0.0146
9	Goods not classified by kind	0.0439	0.0458	0.0424	0.0323	0.0381	0.0407	-0.0031
Total		**0.0668**	**0.0651**	**0.0659**	**0.0612**	**0.0735**	**0.0703**	**0.0035**

Source: Calculated based on *Foreign Trade Statistics of the Philippines* , National Statistics Office, Republic of the Philippines.

Table 2: Results of Pooled Regression

Variable	Estimated Coefficients							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-4.431 ***	-4.352 ***	-5.216 ***	-3.525 ***	-4.678 ***	-4.542 ***	-5.862 ***	-4.061 ***
	(-13.312)	(-13.171)	(-14.405)	(-9.016)	(-14.290)	(-14.004)	(-16.436)	(-10.557)
Trend	0.233	0.240	0.344	0.397	0.213	0.224	0.295	0.353
	(1.177)	(1.142)	(1.591)	(1.595)	(1.074)	(1.067)	(1.363)	(1.417)
Trend ^{2}	-0.020	-0.022	-0.035	-0.043	-0.019	-0.020	-0.031	-0.039
	(-0.739)	(-0.745)	(-1.182)	(-1.246)	(-0.675)	(-0.699)	(-1.045)	(-1.139)
Weight-Value Ratio (KG/US$)	0.298 ***	0.298 ***			0.301 ***	0.299 ***		
	(46.350)	(68.170)			(47.230)	(68.607)		
Exporter's Infrastructure	-0.036 ***	-0.028 ***	-0.090 ***	-0.079 ***				
	(-4.031)	(-2.979)	(-9.255)	(-7.181)				
Distance	0.289 ***	0.276 ***	0.232 ***	0.211 ***	0.279 ***	0.269 ***	0.207 ***	0.189 ***
	(7.907)	(7.141)	(5.835)	(4.618)	(7.659)	(6.963)	(5.190)	(4.143)
*Trend * Distance*	-0.026	-0.026	-0.042	-0.048	-0.024	-0.025	-0.037	-0.043
	(-1.107)	(-1.063)	(-1.633)	(-1.620)	(-1.009)	(-0.992)	(-1.419)	(-1.452)
Trend ^{2} ** Distance*	0.003	0.003	0.004	0.005	0.002	0.003	0.004	0.005
	(0.770)	(0.775)	(1.233)	(1.285)	(0.708)	(0.731)	(1.100)	(1.181)
Commodity Dummies	Included	Excluded	Included	Excluded	Included	Excluded	Included	Excluded
R^2	0.378	0.298	0.261	0.015	0.377	0.297	0.256	0.011
No. of Observations	11,562	11,562	11,562	11,562	11,562	11,562	11,562	11,562
F-statistic	-	45.320	-	75.934	-	40.489	-	70.378

1. Figures in parentheses are t statistics.
2. ***,**, and * indicate that the estimates are significant at the confidence levels of 99%, 95% and 90% respectively.

Table 3: Summary of Regression Results by Commodity Group

	Constant	Trend	Trend^2	W-V Ratio	Exporter's Infrastructure	Distance	Trend * Distance	Trend^2 * Distance
Max. value	3.945	4.277	0.534	0.757	0.555	1.099	0.418	0.068
Min. value	-8.805	-3.388	-0.586	-0.246	-0.681	-0.303	-0.528	-0.065
# of positive sign parameters	1	34	34	61	30	53	30	32
# of negative sign parameters	63	30	30	3	34	11	34	32
# of parameters statistically significant	37	4	3	59	23	17	6	4
Average	-4.319	0.186	-0.014	0.318	-0.024	0.268	-0.019	0.002

Appendix 1: Average Freight and Insurance Rates on Philippine Imports

SITC (2 digit)	1991	1992	1993	1994	1995	1996	Changes 1991-96
00	0.1435	0.1266	0.1594	0.1034	0.1132	0.1023	-0.0413
01	0.1383	0.1395	0.1151	0.1532	0.1535	0.1321	-0.0062
02	0.0614	0.0564	0.0477	0.0517	0.0757	0.0487	-0.0127
03	0.1407	0.1246	0.1290	0.1374	0.2498	0.2056	0.0648
04	0.1925	0.1646	0.1360	0.1727	0.1586	0.1227	-0.0698
05	0.1436	0.1548	0.1377	0.1899	0.2735	0.2972	0.1536
06	0.1625	0.1419	0.1133	0.1144	0.1054	0.1457	-0.0168
07	0.0661	0.0808	0.0813	0.0751	0.0674	0.0798	0.0138
08	0.1648	0.1639	0.1787	0.1664	0.1914	0.1677	0.0029
09	0.0719	0.0738	0.0694	0.0610	0.0781	0.1337	0.0618
11	0.0412	0.0472	0.0450	0.0960	0.1228	0.1253	0.0841
12	0.0361	0.0249	0.0217	0.0285	0.0356	0.0308	-0.0053
21	0.0678	0.0704	0.1061	0.1627	0.2504	0.2181	0.1503
22	0.1093	0.1237	0.1070	0.1036	0.3183	0.1232	0.0139
23	0.0562	0.0612	0.0567	0.0522	0.0981	0.0582	0.0019
24	0.2814	0.2577	0.2346	0.2635	0.2716	0.1986	-0.0828
25	0.3208	0.3682	0.4325	0.2682	0.2194	0.3053	-0.0155
26	0.0446	0.0509	0.0706	0.0603	0.0524	0.0874	0.0427
27	0.3064	0.2315	0.3980	0.4392	0.3126	0.4308	0.1243
28	0.0469	0.0247	0.0750	0.0648	0.0450	0.0479	0.0010
29	0.0545	0.0566	0.4281	0.0807	0.1258	0.0865	0.0320
32	0.3440	0.2133	0.8527	0.3504	0.3544	0.3425	-0.0015
33	0.0582	0.0403	0.0413	0.0380	0.0496	0.0421	-0.0161
34	0.2813	0.2724	0.3608	0.2673	0.1599	0.1231	-0.1582
41	0.1720	0.1472	0.1597	0.1611	0.1326	0.1299	-0.0421
42	0.0866	0.0821	0.0736	0.0631	0.0668	0.1254	0.0388
43	0.1003	0.0827	0.0825	0.0766	0.0820	0.0758	-0.0246
51	0.0708	0.0709	0.0725	0.0756	0.0663	0.0536	-0.0172
52	0.1433	0.1440	0.1652	0.1490	0.2661	0.1801	0.0368
53	0.0462	0.0470	0.0942	0.0413	0.0535	0.0451	-0.0011
54	0.0382	0.0341	0.0421	0.0292	0.0361	0.0612	0.0230
55	0.0615	0.0571	0.0611	0.0512	0.0742	0.0839	0.0224
56	0.1489	0.1779	0.1803	0.1778	0.1715	0.1716	0.0227
57	0.0883	0.0863	0.0817	0.0956	0.0596	0.0743	-0.0140
58	0.0503	0.0475	0.0465	0.0456	0.0915	0.0477	-0.0025
59	0.0697	0.0689	0.0750	0.1112	0.0700	0.0752	0.0055
61	0.0212	0.0235	0.0240	0.0285	0.0233	0.0265	0.0053
62	0.0579	0.0567	0.0531	0.0584	0.0547	0.0573	-0.0007
63	0.1344	0.1644	0.1479	0.1745	0.1634	0.1243	-0.0101
64	0.1353	0.1507	0.1484	0.1400	0.1303	0.1529	0.0176
65	0.0328	0.0409	0.0477	0.0532	0.0824	0.0751	0.0423
66	0.1609	0.1981	0.1661	0.1559	0.2753	0.2383	0.0775
67	0.0991	0.1189	0.1176	0.1154	0.1207	0.1169	0.0177

SITC (2 digit)	1991	1992	1993	1994	1995	1996	Changes 1991-96
68	0.0391	0.0419	0.0464	0.0388	0.0727	0.0404	0.0013
69	0.0620	0.1090	0.0504	0.0755	0.0839	0.1023	0.0403
71	0.0514	0.0579	0.0436	0.0481	0.0585	0.0694	0.0180
72	0.0525	0.0605	0.0532	0.0567	0.0641	0.0833	0.0307
73	0.0711	0.0497	0.0460	0.0507	0.0766	0.0523	-0.0188
74	0.0480	0.0511	0.0482	0.0514	0.0678	0.0580	0.0100
75	0.0386	0.0237	0.0245	0.0262	0.0315	0.0393	0.0007
76	0.0287	0.0292	0.0317	0.0277	0.0499	0.0465	0.0179
77	0.0268	0.0266	0.0289	0.0290	0.0426	0.0567	0.0298
78	0.0878	0.0904	0.0907	0.0733	0.0848	0.0687	-0.0191
79	0.0168	0.0136	0.0141	0.0124	0.0183	0.0169	0.0001
81	0.0953	0.0861	0.0621	0.0565	0.1156	0.0691	-0.0262
82	0.1747	0.1520	0.1200	0.1327	0.1123	0.0988	-0.0758
83	0.0403	0.0517	0.0475	0.0601	0.0677	0.0401	-0.0002
84	0.0481	0.0566	0.0457	0.0502	0.3247	0.1805	0.1325
85	0.0333	0.0375	0.0313	0.0453	0.0410	0.1359	0.1026
87	0.0378	0.0384	0.0307	0.0359	0.0421	0.0325	-0.0053
88	0.0370	0.0307	0.0317	0.0248	0.0354	0.0325	-0.0044
89	0.0675	0.0631	0.0685	0.0666	0.1248	0.0813	0.0138
93	0.0440	0.0458	0.0424	0.0323	0.0381	0.0407	-0.0032
96	0.0183	-	-	0.0073	0.9312	0.0354	0.0171
97	0.0164	0.0116	0.0116	0.0118	0.0239	0.0193	0.0029
TL	**0.0668**	**0.0651**	**0.0659**	**0.0612**	**0.0735**	**0.0703**	**0.0035**

Source: Calculated based on *Foreign Trade Statistics of the Philippines* , National Statistics Office, Republic of the Philippines.

Appendix 2: Results of Regressions by Commodity Group

SITC	Constant	Trend	Trend^2	Weight-Value	Infrastructure	Distance	Trend * Distance	Trend^2 * Distance	R^2	N
00	-0.4927	-1.5227	0.1669	0.3237 ***	0.0061	-0.0768	0.2002	-0.0213	0.2069	98
	(-0.120)	(-0.595)	(0.481)	(3.937)	(0.038)	(-0.153)	(0.657)	(-0.514)		
01	-7.7721 ***	3.0771 **	-0.4266 **	0.4725 ***	0.1916 **	0.5161 *	-0.3831 **	0.0530 **	0.2078	136
	(-3.143)	(2.036)	(-2.070)	(4.746)	(2.298)	(1.835)	(-2.143)	(2.169)		
02	-5.9023 **	2.1882	-0.2494	0.4100 ***	0.0657	0.3466	-0.2729	0.0320	0.1381	172
	(-2.401)	(1.391)	(-1.132)	(3.577)	(0.808)	(1.224)	(-1.467)	(1.233)		
03	-3.9908	-1.3933	0.1663	0.2363 ***	0.3547 ***	-0.1851	0.1792	-0.0197	0.2603	171
	(-1.422)	(-0.796)	(0.687)	(4.759)	(4.013)	(-0.564)	(0.856)	(-0.682)		
04	-4.1467	-0.3527	0.0617	0.2484 ***	0.2304 ***	0.0004	0.0360	-0.0061	0.1310	155
	(-1.466)	(-0.196)	(0.249)	(2.966)	(2.970)	(0.001)	(0.165)	(-0.202)		
05	-4.3288 **	-0.5944	0.1328	0.3639 ***	0.1064 **	0.1189	0.0774	-0.0151	0.2395	213
	(-2.573)	(-0.549)	(0.877)	(6.623)	(2.342)	(0.606)	(0.602)	(-0.838)		
06	-3.9366 *	0.1730	-0.0380	0.2412 ***	0.0090	0.2533	-0.0493	0.0079	0.1553	159
	(-1.779)	(0.124)	(-0.196)	(3.491)	(0.117)	(0.960)	(-0.292)	(0.339)		
07	-6.9373 ***	1.8604	-0.3100 **	0.2802 ***	0.0812 *	0.4829 **	-0.2344 *	0.0391 **	0.1943	197
	(-3.827)	(1.647)	(-1.989)	(4.411)	(1.769)	(2.281)	(-1.729)	(2.094)		
08	-3.5008 *	-0.9099	0.1313	0.5423 ***	0.0377	0.0615	0.1208	-0.0172	0.4031	192
	(-1.907)	(-0.771)	(0.790)	(10.341)	(0.618)	(0.291)	(0.867)	(-0.878)		
09	-4.3696 **	-0.0841	0.0058	0.6506 ***	0.0793	0.1608	0.0081	0.000003	0.3107	174
	(-2.236)	(-0.070)	(0.034)	(8.251)	(1.268)	(0.718)	(0.056)	(0.000)		
11	-4.1818 **	0.7864	-0.2013	0.5790 ***	0.1898 ***	0.0274	-0.0987	0.0249	0.3300	181
	(-2.028)	(0.612)	(-1.137)	(8.128)	(2.759)	(0.117)	(-0.652)	(1.195)		
12	-2.5514	-3.3877 *	0.5344 **	0.3918 ***	0.0227	-0.0769	0.4177 *	-0.0650 **	0.2831	135
	(-0.895)	(-1.851)	(2.069)	(4.842)	(0.259)	(-0.235)	(1.921)	(-2.118)		
21	3.9448	1.3708	-0.2993	0.4845 ***	-0.6809 ***	-0.0029	-0.1387	0.0341	0.4485	67
	(1.032)	(0.603)	(-0.957)	(5.002)	(-3.716)	(-0.007)	(-0.506)	(0.902)		
22	-7.2483 **	1.3460	-0.1585	0.3856 ***	0.0150	0.5526	-0.1508	0.0190	0.2900	91
	(-2.373)	(0.695)	(-0.593)	(3.824)	(0.215)	(1.472)	(-0.622)	(0.566)		
23	-3.5689 *	-0.8237	0.1065	0.6333 ***	0.0337	0.0487	0.1227	-0.0158	0.2470	134
	(-1.692)	(-0.636)	(0.595)	(4.917)	(0.455)	(0.197)	(0.780)	(-0.728)		
24	-1.0912	-0.5075	0.0219	0.3676 ***	-0.1119 *	-0.0248	0.0761	-0.0041	0.4722	139
	(-0.564)	(-0.435)	(0.138)	(7.103)	(-1.926)	(-0.102)	(0.527)	(-0.209)		
25	-3.8688 ***	-1.1549	0.1723	0.7573 ***	0.0568	0.1004	0.1399	-0.0208	0.7597	151
	(-2.721)	(-1.316)	(1.426)	(18.226)	(1.282)	(0.618)	(1.348)	(-1.447)		
26	-5.3660 ***	0.4833	-0.0623	0.6346 ***	-0.0036	0.3333 *	-0.0454	0.0056	0.2923	230
	(-3.209)	(0.456)	(-0.425)	(7.821)	(-0.102)	(1.715)	(-0.363)	(0.327)		
27	-1.9897	-0.4190	0.0626	0.2645 ***	0.0632	-0.0770	0.0682	-0.0089	0.2211	229
	(-0.908)	(-0.302)	(0.323)	(7.246)	(1.134)	(-0.305)	(0.417)	(-0.389)		
28	-2.5665	-1.1977	0.1879	0.6845 ***	0.0613	-0.1523	0.1749	-0.0267	0.3925	132
	(-0.961)	(-0.710)	(0.797)	(8.677)	(0.752)	(-0.483)	(0.853)	(-0.929)		
29	-3.0073	1.4517	-0.1991	0.2504 ***	-0.1334	0.2132	-0.1572	0.0224	0.1281	185
	(-0.905)	(0.700)	(-0.692)	(3.627)	(-1.356)	(0.546)	(-0.631)	(0.651)		
32	-3.4003	-0.9710	0.2532	0.1859 ***	-0.0665	0.3202	0.1196	-0.0327	0.2000	71
	(-0.981)	(-0.435)	(0.810)	(2.817)	(-0.662)	(0.694)	(0.414)	(-0.813)		
33	-2.6497	0.2819	-0.0648	-0.2458 ***	0.0816	-0.0718	-0.0292	0.0075	0.1065	161
	(-0.890)	(0.151)	(-0.252)	(-3.163)	(0.962)	(-0.202)	(-0.130)	(0.243)		
34	-5.8325	4.2768	-0.5865	-0.1030	-0.0345	0.6680	-0.5280	0.0678	0.2383	52
	(-0.997)	(1.225)	(-1.287)	(-1.210)	(-0.205)	(0.883)	(-1.181)	(1.168)		
41	-0.8657	-2.4275 *	0.3078	0.2128 ***	0.1302	-0.3031	0.2867 *	-0.0359	0.2119	103
	(-0.373)	(-1.764)	(1.598)	(3.384)	(1.220)	(-1.193)	(1.733)	(-1.555)		
42	-5.1371 *	-0.0370	0.0299	0.2692 ***	0.0102	0.3086	0.0163	-0.0054	0.1778	111
	(-1.783)	(-0.021)	(0.120)	(3.021)	(0.094)	(0.899)	(0.074)	(-0.178)		
43	-6.5055 ***	0.4386	-0.0261	0.1018	0.1784 **	0.3227	-0.0512	0.0013	0.1652	122
	(-2.962)	(0.316)	(-0.135)	(1.169)	(2.335)	(1.245)	(-0.303)	(0.057)		
51	-4.8501 **	0.5032	-0.0437	0.2954 ***	-0.0996 *	0.3939 *	-0.0582	0.0038	0.3186	237
	(-2.590)	(0.409)	(-0.254)	(9.706)	(-1.679)	(1.795)	(-0.404)	(0.186)		
52	-1.4810	-1.5909	0.2756	0.2040 ***	0.0428	-0.1783	0.2167	-0.0356	0.0915	235
	(-0.646)	(-1.107)	(1.373)	(3.436)	(0.738)	(-0.685)	(1.290)	(-1.516)		
53	-2.7345	-0.8895	0.1216	-0.0234	-0.2568 ***	0.2761	0.1083	-0.0148	0.2464	204
	(-1.194)	(-0.610)	(0.598)	(-0.336)	(-4.211)	(1.033)	(0.629)	(-0.619)		
54	-4.6712 **	0.5644	-0.0967	0.2429 ***	-0.2773 ***	0.5755 **	-0.0698	0.0124	0.2913	258
	(-2.269)	(0.429)	(-0.529)	(6.807)	(-4.933)	(2.403)	(-0.455)	(0.581)		
55	-5.3404 **	-0.3605	0.0074	0.6306 ***	0.0538	0.3252	0.0605	-0.0023	0.3982	207
	(-1.988)	(-0.207)	(0.030)	(11.072)	(0.680)	(1.032)	(0.293)	(-0.079)		
56	-2.9682	-0.7380	0.1420	0.2523 ***	0.0413	0.0636	0.0696	-0.0143	0.1091	161
	(-1.258)	(-0.518)	(0.721)	(4.098)	(0.619)	(0.240)	(0.410)	(-0.612)		
57	-6.8516 ***	0.9781	-0.0866	0.1898 ***	-0.0165	0.5532 ***	-0.1154	0.0094	0.3093	222
	(-4.957)	(1.103)	(-0.698)	(3.622)	(-0.412)	(3.492)	(-1.115)	(0.651)		
58	-6.8783 ***	0.3021	-0.0390	0.3760 ***	0.0762	0.4685 *	-0.0358	0.0044	0.3268	178

SITC	Constant	Trend	Trend^2	Weight-Value	Infrastructure	Distance	Trend * Distance	Trend^2 * Distance	R^2	N
	(-3.412)	(0.237)	(-0.221)	(5.680)	(1.179)	(1.967)	(-0.235)	(0.210)		
59	-3.6476 *	0.5177	-0.0718	0.3870 ***	-0.1028 *	0.2636	-0.0561	0.0076	0.2058	218
	(-1.728)	(0.388)	(-0.388)	(6.921)	(-1.751)	(1.091)	(-0.358)	(0.351)		
61	-4.4225 *	0.6130	-0.1233	0.2523 ***	-0.0200	0.2315	-0.0639	0.0137	0.1812	176
	(-1.662)	(0.363)	(-0.520)	(4.486)	(-0.276)	(0.740)	(-0.316)	(0.484)		
62	-2.6591	-0.5533	0.0710	0.0088	-0.0843	0.0894	0.0687	-0.0090	0.0591	206
	(-1.281)	(-0.415)	(0.382)	(0.153)	(-1.303)	(0.372)	(0.436)	(-0.410)		
63	-2.4926 *	0.4554	-0.1107	0.4962 ***	-0.1370 ***	0.1745	-0.0428	0.0119	0.5696	175
	(-1.676)	(0.484)	(-0.849)	(13.199)	(-2.928)	(0.969)	(-0.378)	(0.763)		
64	-3.7963 **	0.1232	0.0249	0.1576 ***	-0.0815	0.2749	-0.0027	-0.0046	0.1427	197
	(-2.178)	(0.112)	(0.164)	(2.676)	(-1.576)	(1.351)	(-0.021)	(-0.259)		
65	-7.1350 ***	0.1431	0.1064	0.2684 ***	-0.0444	0.6272 **	-0.0216	-0.0117	0.1759	247
	(-2.909)	(0.092)	(0.495)	(3.962)	(-0.674)	(2.204)	(-0.119)	(-0.462)		
66	-0.8354	-0.8799	0.1462	0.2937 ***	-0.2069 ***	0.0728	0.1124	-0.0183	0.3137	238
	(-0.466)	(-0.762)	(0.907)	(8.855)	(-4.224)	(0.347)	(0.827)	(-0.965)		
67	-4.9863 ***	-0.0660	0.0128	0.2595 ***	0.0859 **	0.1920	0.0150	-0.0022	0.2699	246
	(-3.380)	(-0.070)	(0.098)	(7.814)	(2.111)	(1.139)	(0.136)	(-0.145)		
68	-5.5517 ***	0.4043	-0.0508	0.6657 ***	0.0282	0.2840 *	-0.0359	0.0050	0.3957	220
	(-3.739)	(0.431)	(-0.387)	(10.042)	(0.734)	(1.681)	(-0.326)	(0.326)		
69	-3.1433	-0.5601	0.0941	0.1861 ***	-0.0215	0.0978	0.0770	-1.27E-02	0.1209	250
	(-1.607)	(-0.451)	(0.545)	(5.346)	(-0.412)	(0.436)	(0.529)	(-0.627)		
71	-3.3172	-0.4680	0.0290	0.3185 ***	-0.0725	0.1573	0.0810	-0.0064	0.2157	189
	(-1.328)	(-0.299)	(0.132)	(5.768)	(-0.855)	(0.552)	(0.438)	(-0.246)		
72	-4.0323	0.6919	0.0003	0.1978 ***	-0.2716 ***	0.5245 *	-0.1072	0.0042	0.1733	242
	(-1.644)	(0.447)	(0.001)	(4.693)	(-3.708)	(1.847)	(-0.593)	(0.166)		
73	-3.6188	-0.4815	0.1502	0.2170 ***	-0.1674 **	0.3333	0.0548	-0.0183	0.2393	179
	(-1.589)	(-0.341)	(0.773)	(4.547)	(-2.308)	(1.262)	(0.327)	(-0.793)		
74	-3.8126 *	-0.1526	0.0431	0.2894 ***	-0.1804 ***	0.3532	0.0389	-0.0077	0.2326	243
	(-1.763)	(-0.111)	(0.225)	(6.107)	(-3.098)	(1.422)	(0.241)	(-0.342)		
75	-8.3454 ***	1.3498	-0.1688	0.3278 ***	-0.0054	0.7453 ***	-0.1683	0.0218	0.3649	199
	(-3.573)	(0.914)	(-0.829)	(7.851)	(-0.077)	(2.745)	(-0.963)	(0.904)		
76	-8.8046 ***	3.1576 *	-0.3497	0.2924 ***	-0.0914	0.8702 ***	-0.3816 **	0.0432	0.2145	204
	(-3.516)	(1.965)	(-1.567)	(6.508)	(-1.237)	(2.943)	(-2.006)	(1.636)		
77	-6.4565 **	0.3176	0.0773	0.3674 ***	-0.0303	0.5776 *	-0.0715	-0.0036	0.3722	286
	(-2.515)	(0.193)	(0.339)	(12.121)	(-0.510)	(1.936)	(-0.372)	(-0.134)		
78	-4.5670 **	0.4761	-0.0815	0.3102 ***	-0.0024	0.2742	-0.0402	0.0074	0.2131	240
	(-2.034)	(0.328)	(-0.402)	(7.466)	(-0.045)	(1.036)	(-0.235)	(0.313)		
79	-2.5589	-0.3474	0.0960	0.1982 ***	-0.1594	0.1157	0.0675	-0.0149	0.1111	163
	(-0.595)	(-0.133)	(0.269)	(3.965)	(-1.204)	(0.232)	(0.217)	(-0.351)		
81	-3.7602	0.0002	-0.0319	0.2216 ***	-0.0492	0.2855	-0.0228	0.0069	0.2311	154
	(-1.609)	(0.000)	(-0.155)	(4.539)	(-0.655)	(1.017)	(-0.127)	(0.279)		
82	-3.4849 *	0.8690	-0.1640	0.5633 ***	-0.0854	0.3476	-0.1272	0.0230	0.3300	157
	(-1.665)	(0.668)	(-0.920)	(6.871)	(-1.306)	(1.404)	(-0.812)	(1.073)		
83	-2.1910	-1.1744	0.1204	0.4534 ***	0.0353	0.0073	0.1704	-0.0187	0.3439	121
	(-0.764)	(-0.666)	(0.497)	(7.451)	(0.397)	(0.021)	(0.782)	(-0.627)		
84	-7.2937 **	0.9434	-0.0153	0.2765 ***	-0.0261	0.6917 *	-0.1447	0.0078	0.1447	164
	(-2.184)	(0.433)	(-0.051)	(3.973)	(-0.265)	(1.699)	(-0.549)	(0.213)		
85	-6.7438 **	1.3123	-0.1849	0.3600 ***	0.0430	0.5208	-0.1558	0.0224	0.2545	128
	(-2.362)	(0.746)	(-0.767)	(4.787)	(0.454)	(1.523)	(-0.720)	(0.758)		
87	-6.0908 ***	2.1769	-0.3044	0.1184 **	-0.2651 ***	0.7444 ***	-0.3051 *	0.0431 *	0.2064	224
	(-2.629)	(1.463)	(-1.482)	(2.611)	(-4.031)	(2.730)	(-1.744)	(1.788)		
88	-1.8961	-1.2105	0.1678	0.2531 ***	-0.2679 ***	0.2597	0.1309	-0.0183	0.2568	178
	(-0.649)	(-0.651)	(0.647)	(4.427)	(-2.845)	(0.764)	(0.593)	(-0.596)		
89	-6.5393 ***	2.3308	-0.2713	0.2761 ***	-0.1834 ***	0.7334 **	-0.2793	0.0330	0.1493	265
	(-2.632)	(1.462)	(-1.225)	(5.609)	(-2.861)	(2.516)	(-1.494)	(1.275)		
93	-8.6583 ***	2.6726	-0.2393	0.3840 ***	-0.2862 ***	1.0988 ***	-0.3181	0.0296	0.3990	342
	(-2.726)	(1.319)	(-0.853)	(13.562)	(-4.037)	(2.982)	(-1.348)	(0.908)		
97	-8.5323	-1.4465	0.1036	0.1733	0.5555	-0.1167	0.2346	-0.0180	0.2305	39
	(-0.973)	(-0.261)	(0.131)	(1.264)	(1.396)	(-0.113)	(0.331)	(-0.177)		

Notes: 1. Figures in parentheses are t statistics.

2. ***,**,* indicate that the estimates are significant at the confidence levels of 99%, 95%, and 90% respectively.