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The Impact of ICT Infrastructure on Malaysian Trade

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ABSTRACT

This paper examines the impact of ICT infrastructure on trade in the case of Malaysia by using a gravity model and a number of indicators for the ICT infrastructure. The analyses are based on data from a panel of countries, 36 trading partner countries over time from 1980 to 2008. It is found that mobile and fixed-line telephone subscribers, personal computers and internet users are significant and positively related to the value of bilateral trade between Malaysia and its trading partners. The results support that infrastructure development serves as the facilitating role in reaching higher levels of exporting.
Keywords: Malaysia, ICT infrastructure, trade

INTRODUCTION

Asia's trade expansion has been facilitated and encouraged by the development of supporting infrastructure (Brooks, 2008). Even though the use of the word infrastructure is relatively new, infrastructure has long played an important role in integrating markets across nations. Infrastructure can be distinguished into hard and soft infrastructure. Transport (e.g., roads, railways, and ports), energy (e.g., electricity, gas and oil pipelines), telecommunications (e.g., telephone and internet) and basic utilities (e.g., water supply, hospitals and clinics) are the examples of hard infrastructure which refer to physical structures or facilities that support the society and economy. There is also non-physical infrastructure which covers the aspects of laws, regulations, regulatory program, government bureaus, civil society groups and stakeholder dialogues (Lee, 2008).

The enhancement in infrastructure that appeared as a consequence from the recent revolution in information technology (IT), consisting the internet and cellular mobile technology, has bring about impressive transformation in the economic environment. Access to information technology has extended greatly within Malaysia together with the development of the fixed network. While the number of internet users was negligible in the early 1990s, the beginning of 2000, the number of subscribers increases from 1.7 million to more than 13.7 million in 2010 (The Ninth Malaysia Plan). To attract domestic and foreign investors to ICT industry, the Government invested heavily to develop Multimedia Super Corridor (MSC) in 1996. Supported by a high-speed link that connects Malaysia to Japan, the ASEAN countries, USA and Europe, the MSC had assists as the backbone in the country for the ICT infrastructure.

With the advance of Information Technology (IT), the trade potential for both export and import countries will be surged. IT reduces entry costs in potential market and provides firms with greater freedom of entry and exit and on the other hand, importers can reduce search costs in the market (Park and W. Koo, 1995). Thus, by upgrading information flow, it will drive markets to become more competitive and efficient through the lower of transaction costs. While the past studies have been acknowledge in exploring the relationship between trade costs and trade flows which involve a number of countries in the region, studies of trade costs through the aspect of ICT infrastructure and trade have been lacking, especially in a case of a single country. A cursory scan of the literature notifies that studies in a context of one-country are still insufficient.

This study, therefore seek to examine the impact of ICT Infrastructure on trade in Malaysian by employing gravity model of bilateral trade flows from 1980 to 2008. This paper is organized as follows. In section 2 the review of literature is discussed and the methodology and data is presented in Section 3. Results are show in Section 4 while conclusions offered in Section 5.

LITERATURE REVIEW

Any business today can hardly operate without telecommunications because effective telecommunications provide a low-cost channel for searching, gathering and exchanging information. Recent study has acknowledged the importance of modern information and communications technologies as determinants for international trade costs. The costs of entering into and monitoring contracts with suppliers are correlated with the quality of communication infrastructure services. Thus, with the improved of this infrastructure makes markets more competitive and efficient by reducing transaction costs and can reduce search costs in the market. Park and W. Koo (1995) found that telecommunication investments in both exporting and importing countries are significant and positively related to the value of bilateral trade between them. Nordas and Piermartini (2004) also find that telecommunications has a significant positive effect on trade flows. They argue that 'the cost of not being able to place a telephone call or access the internet may be just as important as the cost of making the call'.

The telephone is the primary point of selling for many industries and for marketing and sales for some industries the internet has become an increasingly important channel. Fink et al. (2002) includes the cost of a telephone call in a gravity model and found that the cost has a significant negative effect on bilateral trade flows. In other study, Limao and Venables (2001) includes the number of mainlines as the proxy for infrastructure quality while Francois and Machim (2007) consider a mobile telephone usage as a determinant for infrastructure development. In line with the view that communications costs are an important part of trade costs, these studies conclude that improvement in these infrastructure have a positive effect on bilateral trade.

Therefore, for such information flows and for internet access, telecommunications networks provided the supporting infrastructure. Information technology (IT), on the other hand, lowers entry costs in market and firms will be provides with greater freedom of entry and exit. Apart of that, search costs in the market can be reduced by importers. Thus, markets will be more competitive and efficient with the improved of information flow by reducing transaction costs. By using a gravity equation of trade among 56 countries, Freund and Weinhold (2004) indicate that 10 percent increase in the relative number of web hosts in one country would have led to about 1 percent greater trade.

Furthermore, Tanzi (2005) argue that by reducing transport and telecommunication costs, it enlarges the markets for labours and for goods and services. Cross-border trade in services (GATS Mode 1) largely depends on telecommunications as the channel for transactions but, however, anecdotal evidence suggest that new technology can sometimes also create barriers between those connected and those not connected in low-income countries (World Trade Report, 2004).

EMPIRICAL METHODOLOGY AND DATA

To attain the objective of the study, the gravity equations for the Malaysian bilateral trade partners cover 36 countries for the period of 1980 to 2008. The gravity model is used to evaluate the impact of infrastructure on trade since it is the approach that is widely used in the empirical literature of international trade flows because the model can explain the main link between trade barriers and trade flows. The equation is estimated using the pooled OLS, Random Effects Model (REM) and Fixed Effects Model (FEM).

The selected numbers of variables in infrastructures is regress separately in order to avoid endogeneity problem. Each of these indicators is added one point at time in the regression instead of made up an index of it. This will also specify which variables of the infrastructure that play more significant role for trade in Malaysia. The effect of these infrastructure coefficients is expected to be positive since a high level of infrastructure should reduce transport cost which facilitates trade. Thus, the model is therefore specified as follow;

$$Ln\ X_{ijt} = \beta_0 + \beta_1 Ln\ Y_{it}Y_{jt} + \beta_2\ ln\ ENDW_{ijt} + \beta_3 Ln\ DIST_{ij} + \beta_4\ BORDER + \beta_5\ LOCKED_{ij} + \beta_6\ Ln\ IFRS_{it} + U_{ijt}$$

(Equation 1)

Where X_{ijt} denotes the value of country i exports to country j; $Y_{it}Y_{jt}$ is the multiplied GDP from both countries as a proxy for market size; $ENDW_{ijt}$ is act as a proxy for relative endowment; $DIST_{ij}$ indicate the distance between country i and country j to capture trade costs; *BORDER* is a dummy variable that assumes value of one when the countries have a common border and $LOCKED_{ij}$ will take a value of one if the country is a landlocked. Lastly, $IFRS_{it}$ is proxy for ICT infrastructure such as (1) mobile and fixed-line

telephone subscribers per 100 people, (2) personal computers per 100 people and (3) internet user per per 100 people.

THE RESULTS

The results of the estimation for Malaysian bilateral exports based on three estimation OLS, RE and FE are reported in Table 1. Based on pooled OLS estimations, all variables are mostly statistically significant. Since the results from the OLS are known for its biased results which due to the ignorance of heterogeneity problem, the Hausman test is running to choose either REM or FEM which is a better model to use. After testing the Hausman test, the FEM is preferred since the null hypothesis that REM is consistent and efficient is rejected. Hence, the time effect which includes country-pair individual effects is employ in the FEM in the next column. However, when FEM is employed the time-invariant variables such as distance, border and landlocked dummies are dropped.

Based on the standard gravity model, as expected, the bilateral export increases with GDP (summation of GDP with the partner) which implied the larger of economic space , the larger trade potential between two partners. The coefficient of relative endowment (absolute difference in GDP per capita between trading partners) has a negative sign and it shows that the smaller the gap of endowment, the higher trade between two partners. It is contradicted with the gravity result where country tends to trade with the country which has the similar endowments. However, this can be explained according to the Ricardian theory where the county tend to trade with other country which is less similar endowments where the preference is different. Real exchange rate is negative because the depreciation of the currency means that the domestic goods become cheaper rather than foreign goods, hence making export more competitive. The distance exerts negative relationship with trade because the shorter the distance, the lower trade cost between two countries, and thus trade expect to be larger.

All the three infrastructure indicators are positive and statistically significant. The mobile and fixed-line telephone subscribers (*teli*) is the most significant, which result 10 percent increases in the mobile and fixed-line telephone subscribers will generate export by 6.3 percent. This is followed by personal computers (*com*) and internet users (*int*). The result is supported by the study made by Freund and Weinhold (2004) where they found that the internet has reduced the fixed costs of market entry, like gaining information on product requirements or preferences, but did not reduced the variable costs of international trade implied by distance. These results provide evidence that the improvement in ICT infrastructure such as easy access to mobile, personal computers and internet in one country can enhance trade.

TABLE 1

Variables	**OLS**			**REM**			**FEM**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Const	-3.727 (0.625)***	-5.083 (0.961)***	-3.332 (1.247)***	-0.731 (2.709)	-12.326 (3.487)***	-22.14 (3.495)***	-2.005 (2.511)	-21.916 (5.151)***	-28.25 (5.969)***
LnY_iY_j	1.315 (0.027)***	1.345 (0.0417)***	1.329 (0.043)***	1.26 (0.085)***	1.778 (0.121)***	2.272 (0.109)***	0.824 (0.100)***	1.576 (0.196)***	1.818 (0.222)***
$LnEn_{ij}$	0.148 (0.023)***	0.163 (0.03)***	0.1267 (0.034)***	-0.231 (0.035)***	0.039 (0.0365)	0.018 (0.048)	-0.228 (0.035)***	-0.046 (0.037)	-0.026 (0.048)
$LnDIS_{ij}$	-1.605 (0.052)***	-1.415 (0.07)***	-1.539 (0.083)***	-1.433 (0.256)***	-1.696 (0.29)***	-2.141 (0.307)***	-	-	-
EX_{ij}	-0.009 (0.052)***	-0.019 (0.01)*	0.067 (0.031)**	-0.003 (0.001)***	-0.008 (0.002)***	0.071 (0.032)**	-0.004 (0.001)***	-0.007 (0.002)***	-0.011 (0.036)
$Border_{ij}$	0.076 (0.096)	0.395 (0.129)***	0.256 (0.15)**	-0.172 (0.97)	-0.04 (1.085)	0.268 (1.158)	-	-	-
$locked_j$	-2.12 (0.184)***	-2.089 (0.2586)***	-2.068 (0.313)***	-1.978 (0.622)***	-1.659 (0.698)**	-1.282 (0.741)*	-	-	-
$LnTeli_i$	0.423 (0.026)***	-	-	0.509 (0.029)***	-	-	0.63 (0.041)***	-	-
$LnCom_i$	-	0.165 (0.047)***	-	-	0.107 (0.03)***	-	-	0.251 (0.055)***	-
$LnInt_i$	-	-	0.1353 (0.045)***	-	-	0.033 (0.018)*	-	-	0.108 (0.031)***
Obs	1026	539	429	1026	539	429	1026	539	429

R^2	0.81	0.77	0.77	0.75	0.74	0.73	0.42	0.36	0.35
Country Effects	-	-	-	-	-	-	F(35, 959) = 100.00	F(35, 486) = 136.69	F(35, 379) = 158.36

***, ** and * denote 1, 5 and 10% level significance, respectively. The number in parentheses is the standard error

CONCLUSION

By employing an augmented gravity model, this paper has enabled to identified the impact of ICT infrastructure on Malaysia trade. The Hausman test is conducted to choose between REM and FEM due to the biased result of pooled OLS, and FEM is preferred. The gravity variables have predicted signs and as expected, all the infrastructure variables are statistically significant and have a positive impact on Malaysian trade. In order to catch up with the government aim toward higher income country that has been highlight in the Tenth Malaysian Plan, we have to increase the quality of infrastructure to avoid problem in linking toward the global economy and export products at competitive prices. As in the result above, the internet users have a lower impact to trade within the infrastructure indicators. So, this aspect of infrastructure should be giving more attention in terms of its penetration rate so that the quality of this infrastructure could be increase and also improve the result for the future research.

APPENDIX

Data Source

Variable	Descriptions
Bilateral trade flows (exports)	Dependent variable where the choice of countries is based upon the importance of trading partnership with Malaysia and availability of required data. The data collected is expressed in constant US dollars and all observations are annual. Source: Department of Statistic Malaysia DOS
Real gross domestic product	Proxy for market size (constant US$ 2000). GDP between Malaysia and the partner countries are sum together and taken at constant US$. Source: World Bank, World Development Indicators
Endowment	Proxy for relative endowment: absolute different of GDP per capita between exporters and importers. Source: World Bank, World Development Indicators
Distance	Distance is calculated based on the great circle formula. Source: Centre D'etudes Prospectives Et D'informations International (CEPII)
Exchange Rate	Official exchange rate (LCU per US$), Malaysia official rate is divided with partners official rate to linearize them. Source: World Bank, World Development Indicators
Border	Dummy variable An alternative proxy for distance costs
Locked	Landlocked dummy: To reflect that transport costs increase with distance, they are higher for landlocked countries.
Infrastructure	Three had been choose as the proxy for infrastructures that are mobile and fixed-line telephone subscribers, personal computers and internet users per 100 people. Source: World Bank, World Development Indicators

Sample countries

	Importers	
Australia	Bangladesh	Brazil
Brunei	Canada	China
Denmark	Finland	France
Germany	Hong Kong	India
Indonesia	Iran	Italy
Japan	Korea	Mexico
Nepal	Netherlands	New Zealand
Norway	Pakistan	Philippines
Portugal	Romania	Singapore
Spain	Sri Lanka	Sweden
Switzerland	Thailand	Turkey
United Arab Emirates	United Kingdom	United States

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