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The Role 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 panel data 36 trading partner countries 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 ICT infrastructure development serves as the key facilitating role in achieving higher levels of exports in Malaysia.

Keywords: Malaysia, ICT infrastructure, trade

INTRODUCTION

Asia's trade expansion has been facilitated and encouraged by the rapid development of supporting infrastructure (Brooks, 2008). Although the use of the word infrastructure is relatively new, it has long played an important role in integrating markets across nations. Generally, infrastructure can be distinguished into two types; 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 soft infrastructure involves the non-physical infrastructure which covers the aspects of laws, regulations, regulatory program, government bureaus, civil society groups and stakeholder dialogues (Lee, 2008).

The enhancement of infrastructure appears as a result of the recent revolution in information technology (IT), comprising the internet and cellular mobile technology which brought impressive transformation in the economic environment. With the extensive development of fixed network in this country, the information technology

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has become more accessible. Access to information technology has extended greatly within Malaysia together with the development of the fixed network. Looking back in the early 1990s, the number of internet users was negligible but in the beginning of 2000, from 1.7 million subscribers, the number has increased tremendously to 13.7 million in 2010 (The Ninth Malaysia Plan). 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. This sharp increase in the number of internet users is attributed to the government commitment in developing ICT infrastructure. In 1996, the government invested heavily in developing Multimedia Super Corridor not only to develop greater accessibility to attract domestic investment but also foreign investment in the ICT industry. Consequently, the MSC serves as the country's ICT backbone, which enables a high-speed IT link connecting Malaysia to Japan, ASEAN countries, USA and Europe to promote greater trade 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 rapid advancement of IT, trade potential for both exporting and importing countries would flourish. In addition, the availability of an efficient IT infrastructure can help importers and exporters to reduce their search cost in the market (Park and Koo, 1995). Thus, a lower transaction cost would upgrade information flow and drive markets to become more competitive and efficient. Previous studies have explored the relationship between trade costs and trade flows involving a series of countries in the region. However, a brief scan through the literature indicates that there is a lack of study on trade costs from the perspective of ICT infrastructure and trade, especially in the case of a single country.

Therefore, this study seeks to examine the impact of ICT Infrastructure on trade in Malaysia by employing gravity model of bilateral trade flows from 1980 to 2008. This paper is organized as follows. In section 2 the literature is reviewed whilst, the methodology and data is presented in Section 3. A discussion of the results is given in Section 4, followed by the conclusion in Section 5.

LITERATURE REVIEW

The effective functioning of the ICT infrastructure relies heavily on the support of a good telecommunication system. Today, it is almost impossible for any business to operate smoothly without a reliable telecommunication system in place because effective telecommunication is an important support in providing a low cost channel for searching, gathering and exchanging information. Recent study has acknowledged the importance of modern information and communications technologies in reducing the international trade costs. The costs of entering into a contract and monitoring the contracted suppliers are correlated with the

quality of communication services provided. Park and 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. Similarly, Nordas and Piermartini (2004) also found 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'.

As a result, the telephone becomes a primary point of selling for many industries, a channel of marketing and sales for some industries. Parallel to this, the internet too has become an increasingly important complementary channel which serves the same purpose like the telephone. 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 another study, Limao and Venables (2001) incorporates the number of mainlines available as the proxy for infrastructure quality while Francois and Machim (2007) consider the use of mobile telephone as a determinant of infrastructure development. In line with the view that communication costs are an important part of trade costs, these studies conclude that improvement of the related infrastructures have a positive effect on bilateral trade.

Therefore, to facilitate smooth flow of information, internet accessibility and telecommunications networks should provide the needed supporting infrastructure. By using a gravity equation of trade among 56 countries, Freund and Weinhold (2004) indicate that 10% increase in the relative number of web hosts in one country would have led to about 1% greater trade. Furthermore, Tanzi (2005) argues that by reducing transport and telecommunication costs, it enlarges the labour markets for labours as well as the goods and services market. Cross-border trade in services (GATS Mode 1) largely depends on telecommunications as the channel for transactions, but anecdotal evidence suggests that new technology can sometimes create barriers between those connected and those not connected in low-income countries (World Trade Report, 2004).

EMPIRICAL METHODOLOGY AND DATA

To achieve the objective of the study, the gravity equations for the Malaysian bilateral trade partners cover 36 countries for the period from 1980 to 2008. The gravity model is used to evaluate the impact of infrastructure on trade since this approach 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 regressed separately in order to avoid endogeneity problem. Each of these indicators is added one point at a time in the regression instead of making an index out of it. This will also specify which variables of the infrastructure 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 transportation cost which facilitates trade. Thus, the model is specified as follow;

$$Ln\ X_{ijt} = \beta_0 + \beta_1 Ln\ Y_{it}Y_{jt} + \beta_2 ln\ ENDW_{ijt} + \beta_3 Ln\ DIST_{ij} + \beta_4 BORDER + \beta_5\ LOCKED_{ij} + \beta_6\ Ln\ IFRS_{it} + U_{ijt} \quad \text{(Equation 1)}$$

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; $ENDW_{ijt}$ 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, most variables are statistically significant. Since the results from the OLS are known for its biasness due to ignorance of heterogeneity problem, the Hausman test is run to choose whichever is a better model; either REM or FEM. After applying the Hausman test, the FEM is preferred since the null hypothesis stating that REM is consistent and efficient is rejected. Hence, the time effect which includes country-pair individual effects is employed 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 it is expected that the bilateral export increases with GDP (summation of GDP with the partner) implying; the larger the economic space, the larger the trade potential between two partners. The coefficient of relative endowment measured by the absolute difference in GDP per capita between trading partners has a negative sign which shows that the smaller the gap of endowment, the higher the trade between two partners. This finding contradicts with the gravity result where country tends to trade with other countries with similar endowments. However, this trend is consistent with Ricardian theory which stipulates that a country is inclined to trade with others with lesser endowments and different preference. Real exchange rate is negative because the depreciation of the currency means that the domestic goods become relatively cheaper than foreign goods, hence, making export more competitive. The distance between the two trading countries exerts negative relationship with trade because the shorter the distance, the lower the trade cost between the two countries, and thus trade is expected to be larger.

Table 1 The impact of ICT infrastructure on Malaysian trade

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

All the three infrastructure indicators are positive and statistically significant. The mobile and fixed-line telephone subscribers (*teli*) is the most significant, where 10% increase in the number of mobile and fixed-line telephone subscribers will generate export by 6.3%. Similarly, the trend follows for personal computers (*com*) and internet users (*int*). The result is congruent to the study conducted by Freund and Weinhold (2004) who found that the internet has reduced the fixed costs of market entry, such as acquiring information on product specification or preference but did not reduce the variable costs of international trade which is distance. These results provide evidence that with improvement in ICT infrastructure such as easy access to mobile, personal computers and internet in a country can enhance trade to greater heights.

CONCLUSION

By employing an augmented gravity model, this paper is able to identify the impact of ICT infrastructure on Malaysia's trade. When the Hausman test is conducted to choose between REM and FEM due to the biased result of pooled OLS, the 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. Parallel to the government's aim to be a high income country as highlighted in the Tenth Malaysian Plan, it is crucial to increase the quality of infrastructure to avoid problem in networking with the global economy and penetrating export products in global market at competitive prices. As demonstrated in the result above, the internet users have a lower impact to trade within the infrastructure indicators (*teli, com, int)*, hence this aspect should be given more attention in terms of its penetration rate which will enhance the quality of the infrastructure and also improve the result of future research in this area.

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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 the 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 variables had been chosen as the proxy for infrastructures which 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