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The Impact of ICT on Trade in Persian Gulf Countries

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Abstract

Information and Communications Technologies(ICT) are transforming our world on a daily basis. In a fast-moving global economy, international trade, by adopting electronic technologies, could save billions of dollars every year. ICT development which has lead to faster, cheaper and more efficient modes of trade by reducing transactions costs. Due to the network characteristic of ICT, trade enhances when both trading partners have advanced ICT developments. The study analyzes empirically this theoretical argument. A gravity model is applied to assess the impact of ICT development on trade in Persian Gulf countries. In this study, it was tried to investigate the impact of ICT on business in the neighboring countries to the Persian Gulf. The obtained results from the gravity model assessment using panel data method for the countries of Iran, Bahrain, Iraq, Saudi Arabia, Oman, Kuwait, Qatar, and UAE from 2001 to 2009 showed that the better ICT development infrastructures the countries have, the more their business exchanges increase. In fact, for country business partners to increase business exchanges, it is imperative to have proper ICT development.

Keywords: ICT, Trade, Panel Data.

1- Introduction

In recent years, ICT services have played a larger role in international trade agreements, both at the multilateral and regional level. During the same time, Information and Telecommunication Technologies (ICT) have developed rapidly facilitating the global exchange of information. This is

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particularly true when broadband technologies were implemented around the world.

On the other hand, integration among countries that have common economic as well as political benefits, such as Persian Gulf Countries, may result in resource reallocation, an increase in products, trade and then economic welfare for members. These countries have some common borders and therefore, spatial dependence among them affects their trade flows. The growth of diffusion of ICT has increase trade flows between them.

These current growth trends discover a relationship between ICT and international trade. Theoretically, ICT should enhance trade as it reduces information costs across international borders. Economic literature commonly shows that ICT markets are strongly influenced by positive network effects (Wendt and von Westarp 2000). Those effects constitute of two aspects: the requirement of compatible products to exchange data or information (direct network effects) and the requirement of complementary products and services (indirect network effects) (Wendt and von Westarp 2000, Katz and Shapiro 1985). Thus, due to the network characteristics, economic theory would suggest that ICT enhances trade when both trading partners have a good level of ICT development. Most of papers consider the impact of ICT on productivity and economic growth. Cronin et al(1997) estimated a I-O model and found the a significant positive effect of telecommunication investment in industries such as finance, wholesale and rail trade and other services. Correa(2005) carried out the impact of telecommunication diffusion on UK productivity growth and found the sectors such as finance, transport, construction ,wholesale and retail trade have benefited more from advanced telecommunication technology. Farahani T (2010) found the investment in telecommunication infrastructure significantly have enhanced the sectors such as manufacturing, insurance & banking, trade and electricity. There are a few papers regarding the impact of ICT on trade in developed countries, but no empirical research in Asian countries. Above findings are further motivations for an empirical analysis of the impact of ICT on trade. In this paper, we assess the impact of ICT on trade in Persian Gulf countries because this area is an important business center.

An attempt is made to establish a positive link between ICT and trade by applying the gravity model in Persian Gulf countries. The gravity model is an econometric model commonly applied in order to analyze trade related issues such as determining the trade potential of a country or evaluating the effect of certain policy variables on trade. Such policy variables may be the membership in a free trade agreement (FTA) or the quality of transportation infrastructure.

We are using 8 countries of Persian Gulf during 9 years for estimating two regression equations by panel data method. The estimation results indicate that ICT development has a significant positive impact on trade.

The paper organized as follows: section 2 quantifies the model and definition data, section 3 presents the estimation method, section 4 reports and discuss the results and finally section 5 summarized and bring the paper to its conclusion and suggestions.

2- Economies of the Persian Gulf:

All of the Arab states of the Persian Gulf have significant revenues from oil and gas and, with the exception of Saudi Arabia, have small local populations. This has raised their per capita incomes to higher than those of their neighbors. The following table show the value of export between persian Gulf countries.

Table 1: Export Persian Gulf in 2009 (Million Dollar)

IRAQ	IRAN	KUWAIT	SAUDI ARABIA	QATAR	OMAN	U.A.E	Export from….. to……
4200	7614	1186	2524	2677	1408	-	U.A.E
179	640	49	562	336	-	3469	OMAN
8	10	143	359	-	160	2635	QATAR
-	-	1393	-	1361	629	3316	SAUDI ARABIA
131	93	-	4417	147	115	1772	KUWAIT
146	-	3120	704	115	757	8447	IRAN
-	-	0.003	0.2	0.06	0.0001	777	IRAQ

Source: UN comtrade

According above table it can be said of the value of intra-trade flows is not significant. While, there is probably the commercial potential of the countries studied. The best reason is neighboring between them which make in addition to reduce the cost of transportation the economic overflow impact have been for the region. Primarily when capital accumulation takes place at a national level, the technology gets better but this technology and investment will overflow from the boundaries and the level of technology and return on investment also affects other countries. The overflow is provided from the assumption indirect effects due to that capital accumulation. When a country increases factors of production and technology advances its neighboring countries will benefit from it and their efficiency goes up, even if new investment is not occurring. It is clear the less geographical distance makes more the economic benefit of overflows.

3- The Gravity Model:

The gravity model estimates the pattern of international trade. While the model's basic form consists of factors that have more to do with geography and spatiality, the gravity model has been used to test hypotheses rooted in purer economic theories of trade as well. One such theory predicts that trade will be based on relative factor abundances.

The standard gravity equation is usually specified in the following log-linear form and looks as follows (time subscripts omitted):

$$\ln E_{ij} = a_0 + a_1 \ln(GDP_i) + a_2 \ln(GDP_j) + a_3 \ln(DIST_{ij}) + a_4 \ln(F_{ij}) + e_{ij} \quad (1)$$

where $\ln(E_{ij})$ represents the log of real exports from country *i* to country *j*, $\ln(GDP_i)$ and $\ln(GDP_j)$ correspond to the logs of the real GDP of country *i* and country *j*, $\ln(DIST_{ij})$ refers to the log of distance between countries *i* and *j*, F_{ij} stands for a set of dummy variables such as landlocked, common border or membership of a FTA, and, finally, e_{ij} is the error term.

This study uses equation (1) as the basis for the various specifications estimated, as will be explained in subsequent sections.

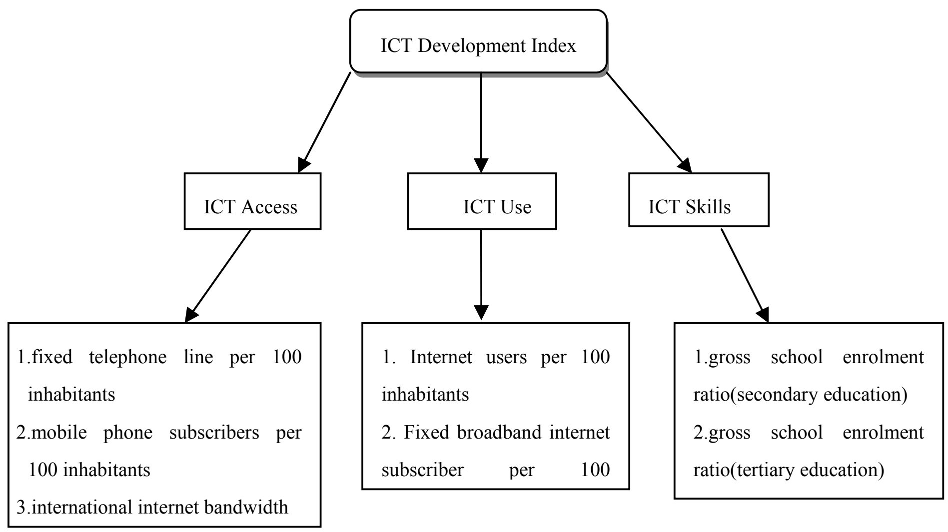
3-1- Data

The following estimations are based on a 9 year time period ranging from 2001 to 2009.The choice of the time period is grounded on data availability. In total, the analysis covers trade flows of 8 countries over a period of 9 years which leads to an unbalanced panel of 504 observations1.

The applied data stem from different sources. Trade data are collected from International Merchandise Trade Statistics (IMTS). GDP data at 2000 constant prices are taken from the World Development Indicators. Distance data as well as data for the dummies of common border and common language stem from CEPII. As mentioned above, the data for the ICT indicator stem from World Development Indicators. Another data-related issue regards the choice between using import and export data. The decision differs among studies. Import data have traditionally been preferred by trade economists due to the fact that countries are more concerned to measure imports in order to avoid tariff fraud. As the present study focuses on Persian Gulf countries and economics of these countries is more governmental, export data seem the best choice for modeling trade. Furthermore, it is important to note that trade data is not averaged in the study.

In order to measure the impact of ICT on trade, an ICT indicator is constructed. The ICT indicator applied in the present study is constructed in accordance with the ICT Development INDEX (IDI) which is published by the International Telecommunication Union. The IDI is constructed from a three-stage model (ITU 2009), which has usually been applied for measuring the information society. The three stages are ICT readiness, ICT intensity, and ICT impact. Due to a lack of data for the third stage, only indicators from the first two stages are included in the overall IDI indicator.

The first stage, ICT readiness, refers to infrastructure and access while the second stage, ICT intensity, refers to use and intensity of use. The evolution towards an information society and the reaching of the final state (ICT impact) depends on a third component, ICT capability or skills. All three components access, use, and skills are closely linked.



3-2- Estimation Approach for the Gravity Model:

The gravity model has traditionally been estimated using cross-sectional data. However, this has been shown to generate biased results since heterogeneity among the countries is typically not controlled in an appropriate way.

To mitigate this problem, researchers have turned towards panel data, which have the advantage that they permit more general types of heterogeneity. For example, consider estimating the impact of currency unions on trade while controlling for country-pair propensity to trade. For a single cross-section, these controls can only depend on observed country-pair attributes such as common language, and estimates can thus be biased if there is additionally an unobserved component to the country-pair propensity to trade. With panel data, such heterogeneity can be readily controlled for by means of a country-pair fixed effect.

One drawback of the fixed-effects estimation approach is that it is no longer possible to estimate the time-invariant effects on trade included in the basic gravity model (1) such as the distance between countries. The fixed effect estimator uses the within-group variation (over time) to form the estimator. Since ICT plays a in overcoming geographic distance, we estimate model by fixed effects estimator.

3-3- Regression Specifications:

As mentioned, ICT is not modelled via dummy a variable in this section due to the application of the fixed effects estimator. The application of the fixed effects estimator leads to further considerations regarding model specification in this section. As the fixed effects estimator controls for all time-invariant effects, the impacts of distance and of the time-invariant dummy variables language and border cannot be estimated separately any more. On the other hand, the GDP variables from our basic gravity model (1) in section 2 may now be included in the regression. Thus, the following two regression equations are estimated in this section:

$$lnE_{ij} = a_0 + a_1 ln(ICT_i) + a_2 ln(ICT_j) + a_3 (ln(ICT_i) * ln(ICT_j)) + \alpha_{ij} + \theta + (\theta * \delta)_i + (\mu * \theta)_j + e_{ij} \quad (2)$$

$$lnE_{ij} = a_0 + a_1 ln(GDP_i) + a_2 ln(GDP_j) + a_3 ln(ICT_i) + a_4 ln(ICT_j) + a_5 (ln(ICT_i) * ln(ICT_j)) + \alpha_{ij} + \theta + (\theta * \delta)_i + (\mu * \theta)_j + e_{ij} \quad (3)$$

α_{ij} refers to country pair fixed effects, $ln(ICT_i)$ and $ln(ICT_j)$ are the logs of ICT developments of country *i* and country *j*,respectively. ln(ICTi)*ln(ICTj) is an interaction term between $ln(ICT_i)$ and $ln(ICT_j)$ which accounts for a possible interaction effect of both variables.

4- Empirical Result:

We are using 8 countries of Persian Gulf during 9 years for estimating equations.

Table 1 contains the simple OLS results for the fully restricted model-no local or target country effects, and no time effects.

Table2: Simple OLS Results: αi=γj=λt =0 for all i,j,t

	Coefficient	Std. Error	t-Statistic	Prob.
LGDPI	0.332777	0.074625	4.459333	0.0000
LGDPJ	0.128310	0.076153	1.684884	0.0927
LICTI	1.070462	0.323250	3.311560	0.0010
LICTJ	-1.021096	0.313305	-3.259111	0.0012
LICTIJ	1.037215	0.230103	4.507617	0.0000
C	12.67587	0.909836	13.93204	0.0000
	Weighted Statistics			
R-squared	0.608097	Mean dependent var		33.02906
Adjusted R-squared	0.604057	S.D. dependent var		27.85064
S.E. of regression	2.250310	Sum squared resid		2455.988
F-statistic	150.5103	Durbin-Watson stat		0.398044
Prob(F-statistic)	0.000000			
	Unweighted Statistics			
R-squared	0.391556	Mean dependent var		18.07546

To compare between two OLS and (fixed or random effets) estimator, we test the null hypothesis H0:αi=γj=λt by F- distribution as following:

$$F=\frac{(RRss-URSS)/(N+(N-1)+T-3}{(URSS)/(N(N-1)T-N-(N-1)-K+3}\sim F_{N+(N-1)+T-3,\,N(N-1)T-N-(N-1)-K+3}$$

Where RRSS and URSS are the residual sum of squares from the restricted and unrestricted model respectively and K is the number of explanatory variables(excluding the dummies, but including the constant term). The calculated test- statistic of 69.33 clearly rejects the null hypothesis. This suggests that any inference based on OLS estimation would be incorrect. We are using Hausman test for choice between fixed and random effects. The following table shows the result.

Table3: Hausman Test

TesT Summary	Chi-Sq.statistic	Chi- Sq.df	Prob
Cross-section random	15/871859	5	0/0072

The best model is chosen fixed effects estimator based on Hausman test. Following table shows the results of equation 2 and 3.

Table 4: Results from Estimation Equations 2 and 3.

Random Effects		Fixed Effects				Variables
Prob	Coefficient	Prob	Coefficient	Prob	Coefficient	
0/0001	0.9	-	-	0.000	1.73	LGDPi
0.388	-0.2	-	-	0.000	1.06	LGDPj
0.255	0.45	0.0016	0.56	0.010	0.49	LicTi
0.2	0.48	0.0007	0.69	0.005	0.58	LicTj
0.23	0.3	0.09	0.21	0.68	-0.052	LicTij
0.001	10.26	0.00	16.4	0.000	-8.03	C
R^2= 0.19 Adj. R^2= 0.18 20/43=F-statistiC RSS=711.75		R^2=0.95			R^2=0.979 Adj. R^2= 0.955 RSS=510.79	

Table 4 indicates that the interaction term is significant in first model specification in 10% level. In second model specification the interaction term is insignificant that maybe because of these countries get most revenues from oil revenues. However, the results recover the ICT development in business partners or one country enhances trade between them. ICT development in exporter and importer countries almost has same effect on trade. Further note that Adj R-squared of 0.95 indicates a high explanatory fit of the model.

5- Conclusion

This paper has analyzed the impact of ICT on trade of Persian Gulf through the application of the gravity model, which is frequently applied in trade-related research and has proven to be a reliable model. A rather recent discussion about the correct estimation approach has led to new considerations regarding model specification and estimation method. The chosen estimation approaches for the present study are directly based on that discussion.

The estimation results indicate that ICT development has a significant positive impact on trade. In particular, the results suggest that ICT enhances trade when both trading partners have good ICT implementation. This finding is in line with economic theory which characterizes ICT as a network technology. The first estimation approach suggests that after adequately controlling for transportation infrastructure -two countries with good ICT development trade 21% more than a country pair where one country or both countries have poor ICT development. The second estimation approach supports the relevance of ICT development for trade of Persian Gulf area. The results suggest that ICT development in exporter and importer countries almost has same effect on trade. Countries should improve infrastructure investment in ICT sector.

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