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A TALE OF TWO SILICON VALLEYS – U.S. VERSUS CHINA: WHAT LESSONS CAN BE LEARNT FROM U.S. SILICON VALLEY?

Weihang Lu, California State University, Los Angeles
Kern K. Kwong, California State University, Los Angeles
Wing Fok, Loyola University New Orleans
fok@loyno.edu

ABSTRACT

This paper focuses on the growth mechanism of hi-tech enterprises, using Penrose's theory of the growth of the firm and the authors' research into the development of Silicon Valley. The paper examines Silicon Valley as a special ecosystem composed of eight types of resources: universities and research institutes, venture capital, human resources, entrepreneurs and entrepreneurship, support service system, Government Policy and Legal Systems, network, and NASDAQ. These resources function together, supporting Silicon Valley's high-tech industry by forming a special enhancing mechanisms. These enhancing mechanism include: knowledge-oriented mechanism, a market pricing mechanism, an open network mechanism, a united entrepreneurs mechanism, and a risk-minimizing mechanism. They in turn contribute to the fast growth of the high-tech enterprises. This paper also compares the growth and development process between firms in the Silicon Valley and the firms along Highway 128 in the city of Boston, Massachusetts. It is suggested in the paper that although both regions are very close to very well endowed, and high quality education institutions, the comparison stops there. Firms in the Silicon Valley grow more rapidly than those along Highway 128 due to the availability of the other elements in the ecosystems. Using this comparison as the basis for illustration, the authors provide prescriptive suggestions to the development of a "Silicon Valley" type high-tech region in China.

KEY WORD: Firm growth, Resource, Silicon Valley, Hi-tech enterprise, Growth mechanism

OUTSOURCING PAST AND FUTURE: IMPLICATIONS AND GLOBAL TRENDS

Balasundram Maniam, Sam Houston State University
maniam@shsu.edu
Leah Peterson, Sam Houston State University
gba_bxm@shsu.edu
Hadley Leavell, Sam Houston State University
fin_whl@shsu.edu

ABSTRACT

For the past two decades, U.S. companies as well as those in other developed regions have looked to outsourcing as a way to focus on their own core competencies and relieve the monotony of managing everyday operations. Recently, the word outsourcing has new implications. The increasingly global economy has encouraged companies to begin off-shoring practices. Taking advantage of benefits provided by operating overseas, however, has risky implications. Companies are now exposed to a bevy of additional risks including government intervention and restrictions, trade barriers, and uncertainty. We will explore the history of outsourcing and how it has evolved, and what implications it has for businesses.

DOES THE PRESENCE OR LACK OF INTELLECTUAL PROPERTY RIGHT PROTECTION AFFECT INTERNATIONAL TRADE FLOWS IN EMERGING MARKET ECONOMIES? AN EXPLORATORY STUDY

Christopher Ngassam, Virginia State University
cngassam@vsu.edu

ABSTRACT

This study provides new evidence regarding the effects of patent protection on international trade in developing countries also known as "emerging market economies". It employs a gravity model of bilateral trade flows and estimates the effects of increased protection on a cross-section of 69x68 countries. It improves on previous studies in two respects. First, we estimate the gravity model for two different kinds of aggregates: total non-fuel trade and high technology trade. Second, it addresses the problem of zero trade flows between countries by adopting a bivariate distributed probit regression model. Third, to measure the strength of Intellectual Property Rights (IPRs) regimes, we make use of a fine tuned index on national IPRs systems developed by Park and Ginarte (1996). Our results confirm previous findings suggesting a positive link between IPRs protection and trade flows for the non-fuel trade aggregate. However, IPRs are not found to be significant for high technology trade flows.

I. INTRODUCTION

Intellectual property rights (IPRs) affect international trade flows when knowledge intensive goods move across national boundaries. The importance of IPRs for trade has gained more significance as the share of knowledge-intensive or high technology products in world trade has doubled between 1990 and 2003 from 12% to 24% (UN Comtrade Data Base). At the international level, IPRs have traditionally been governed by several conventions – most prominently the Paris Convention for patents and trademarks and the Berne Convention for copyright –, which are administered by the World Intellectual Property Organization (WIPO). In the 1980s, mounting disputes over IPRs lead to the inclusion of trade-related IPRs on the agenda of the GATT/WTO Uruguay round and the resulting "Trade Related Intellectual Property Rights Agreement, including Trade in Counterfeit Goods" (TRIPs) of 1994 represents the most far-reaching multilateral agreement towards global harmonization of IPRs.

Several studies have attempted to estimate the extent to which IPRs are trade-related. Maskus and Penubarti (1995) use an augmented version of the Helpman-Krugman model of monopolistic competition to estimate the effects of patent protection on international trade flows. Their results indicate that higher levels of protection have a positive impact on bilateral manufacturing imports into both small and large developing economies. These results are confirmed by Primo Braga and

Fink (1997) where we estimated a similar model and found the same positive link between patent protection and trade flows.

The purpose of this study is to provides additional evidence regarding the effects of patent protection on the international trade patterns of developing economies. It employs a gravity model of bilateral trade flows and estimates the effects of increased protection on a cross-section of 69x68 countries. The next section presents the methodology. Section III describes the empirical results obtained while Section IV concludes the paper.

2. METHODOLOGY

To empirically estimate the effects of increased patent protection on bilateral trade flows we use a conventional gravity model. Gravity model has been applied successfully to explain different types of international flows, such as migration, commuting, recreational traffic, and trade. Typically, they specify that a flow from country *i* to country *j* can be explained by supply conditions in country *i*, by demand conditions in country *j*, and by forces either assisting or resisting the flow's movement. Gravity models were developed based on intuitive reasoning rather than economic modeling. Due to their empirical success, there have been numerous attempts to shed some light on the economic underpinnings of the gravity equation. Linneman (1966) showed how standard gravity equation can be derived from a quasi-Walrasian general equilibrium model of export supply and import demand. Bergstrand (1989) used a general equilibrium world trade model assuming utility-and profit-maximizing agent behavior and showed that the gravity model "fits in the Heckscher-Ohlin model of inter-industry trade and the Helpman-Krugman-Markusen of intra-industry trade.

Our dependent variables are bilateral trade flows for 69x68 countries which were extracted from the United Nations Comtrade database. The data refer to 2003 total non-fuel and high technology trade. The rationale for using high technology trade flows besides total non-fuel trade is based on the a priori expectation that the effects of IPRs protection are stronger for knowledge-intensive trade.

Following earlier specifications of gravity models, our explanatory variables are GDP and population of both countries *i* and *j*, geographical distance between the two countries, a dummy variable which is one of the two countries share a common border and zero otherwise, and a dummy variable which is one of the two countries share the same language and zero otherwise. See, for example, Tinbergen (1962), Linneman (1966), Aitken (1973), Pelzman (1977), and Primo Braga, Safadi and Yeats (1994). The coefficients on GDP are expected to be positive and around unity (Anderson 1979); the coefficients on population are expected to be small and negative, representing economies of scales (Linneman 1966). Positive geographic and cultural distance are expected to have a negative influence on bilateral trade flows, that is the coefficient on geographical distance is expected to be negative, the coefficients on common border and language are expected to be positive.

Finally to capture the effect of intellectual property rights on bilateral trade flows we use the IPRs index developed by Park and Ginarte (1996). This index grades national IPRs regimes of 110 countries on a scale from zero to five. To compute a country's ranking, Park and Ginarte (1996) create five different categories – extent of coverage, membership in international patent agreements, provisions for loss of protection, enforcement mechanisms and duration of protection. For each category, they use several benchmark criteria (e.g. patentability of pharmaceuticals for extent of coverage) and compute the share of "fulfilled" criteria. A country's score is the unweighted sum of these shares over all categories. The United States receives the highest score with 4.52; several nations without patent laws (e.g., Angola, Burma, Ethiopia, Papua New Guinea) receive a score of 0.

A common problem regarding the estimation of bilateral trade flows are reported as zero because countries do not trade with each other. For example, in our data set on average about 26% of the total non-fuel trade flows and 53% high technology trade flows are zero. A standard log-linear model with a log-normally distributed error term can not , by definition, explain these zero trade flows. Simple exclusion of zero trade flows would lead to potential sample selection bias. There are several ways how to address this problem. We follow Bikker and de Vos (1992), who propose a bivariate normally distributed probit regression. The model consists of an equation for the probability of zero observations and an equation for the magnitude of a positive action:

$$I_{ij} = \begin{cases} 0 & \text{if } z_{ij}\gamma + v_{ij} = 0 \\ y_{ij} & \text{if } z_{ij}\gamma + v_{ij} = 0 \end{cases} \qquad (1)$$

$$\gamma_{ij} = x_{ij}\,\beta + u_{ij} \qquad (2)$$

I_{ij} is the observed phenomenon which is 0 if the bilateral trade flow between country *i* and *j* zero and y_{ij} - the log of bilateral trade – if the trade flow is positive; z_{ij} is the log of the variables explaining the probability of a positive observation (the gravity variables without the preferential trading dummies and the Park and Ginarte index), and γ the corresponding vector of coefficients for these variables. v_{ij} is a normally distributed error term with mean zero; the variance of v_{ij} is normalized to one as all parameters γ are determined apart from a constant. x_{ij} is the logarithm of the explanatory variables for positive trade flows (the gravity variables and the Park and Ginarte index), β the corresponding vector of coefficients to be estimated, and u_{ij} a normally distributed error term with mean zero and variance σ^2. The error terms v_{ij} and u_{ij} are correlated with each other and drawn from a bivariate normal distribution with a correlation coefficient equal to ρ. Equations (1) and (2) are estimated by maximum likelihood technique.

Besides addressing the problem of sample selectivity, the bivariate probit regression model is attractive because it also estimates the effects of explanatory variables (such as IPRs) on the probability that two countries trade with each other. To evaluate the robustness of the results, we estimate these two model specifications for both exports – bilateral trade flows from country *i* to country *j* as reported by country *i* – and imports – bilateral trade flows from country *j* to country *i* as reported by country *i.* Since we are primarily interested in the role of IPRs in attracting trade flows and not in creating trade flows, we only use the Park and Ginarte index of the destination country of the trade flow as explanatory variable (that is country *j* in the case of exports and the country *i* in the case of imports).

3. EMPIRICAL RESULTS

Our estimation results are presented in Tables 1 through 3. The overall performance of the model is quite good. Most gravity variables have the expected signs and are statistically significant. Exceptions are for total non-fuel trade (Tables 1 and 2) the coefficient on the border dummy are, however, not significant. For the high technology aggregate (Tables 3 and 4), the exceptions are similar: the coefficients on the border dummy is not statistically significant. Likelihood ratio tests indicate that for all alternative specifications estimated the explanatory variables are jointly significantly different from zero.

The estimated correlation coefficients between the probit and gravity equations ρ are always close to zero and not statistically based on a likelihood ratio test for both total non-fuel and high technology trade. For both total non-fuel imports and exports, the Park and Ginarte index has only a small effect on the probability of positive trade flows between countries, although the effect is positive and statistically significant at the 5% level for total non-fuel exports. Turning to the gravity equation, IPRs have significantly positive impact on bilateral trade flows for both total non-fuel imports and exports. Comparisons of models (I) and (II) in Tables 1 and 2 suggests that inclusion of IPRs leads to relatively small changes in the coefficients of most gravity variables. The biggest changes occur in the coefficients on GDP and population of the destination country of the trade flow. These changes can be explained by the strong correlation strength of IPRs protection and the level of economic development as measured by per capita GDP. To what extent we pick up development related effects related to bilateral trade with the Park and Ginarte index remains open to discussion.

For high technology trade in Tables 3 and 4 the evolving pattern is different. For both exports and imports, the Park and Ginarte index has a significantly negative impact on the probability that countries trade with each other. The impact of IPRs on positive trade flows, in turn is slightly negative but not statistically significant. This result is somewhat surprising. If IPRs influence trade flows, we would expect this influence to be most visible for trade in knowledge-intensive goods. Several explanations can be brought forward. First, strong market power effects in the case of high technology goods may offset positive market expansion effects caused by stronger IPRs regimes. Second, stronger IPRs regimes may cause high technology firms to serve foreign markets by FDI, in-part substituting for trade flows. Third, it may be that the Park and Ginarte index does not correctly capture the IPRs effect or that development related effects interplay with stronger IPRs protection.

4. SUMMARY AND CONCLUSION

With an increasing share of knowledge-intensive products in international trade and the inclusion of trade-related IPRs on the agenda of the GATT/WTO, IPRs have become an important trade issue.

Economic analysis suggests that the effects of IPRs protection on bilateral trade flows are theoretically ambiguous. Because of the complex static and dynamic considerations related to a policy of tighter protection, it is difficult to generate normative recommendations. When estimating the effects of IPRs protection in a gravity model of bilateral trade flows, our empirical results suggest that, on average, higher levels of protection have significantly positive impact on non-fuel trade. However, this result is not confirmed when confining the estimation to high technology goods where we found IPRs to have no statistically significant impact.

More empirical research is needed to gain more insight regarding the IPRs-trade link, especially at industry and firm level. The challenge of such research will be to find 'natural experiments' to overcome the colineraty and endogeneity problems of the cross-country type of analyses like the present study. One alternative, for instance, would be to consider a country which at some point in the past significantly changed its system of IPRs and to test for structural change. A further important field of research is to examine the impact of tighter IPRs on FDI and their interplay with trade flows.

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Table 1: Maximum Likelihood Estimates for Total Non-Fuel Imports[a]

Model	(I)		(II)	
Equation	Probit	Gravity	Probit	Gravity
Intercept	-7.000	-10.228	-6.960	-10.956
	(-27.40)	(-29.02)	(26.28)	(-30.58)
GDP_i	0.541	1.109	0.545	.949
	(31.47)	(51.73)	(29.90)	(34.98)
GDP_j	0.567	1.341	0.566	1.339
	(32.36)	(61.89)	(32.33)	(62.12)
$Population_i$	-.0194	-0.233	-0.198	-0.082
	(-9.80)	(-8.53)	(-9.17)	(-2.64)
$Population_j$	-0.058	-0.333	-0.058	-0.336
	(-3.03)	(-12.76)	(-3.03)	(-12.97)
Distance	-0.435	-1.109	-0.437	-1.060
	(-12.17)	(-23.87)	(-12.15)	(-23.20)
Border	-0.376	0.179	-0.378	0.239
	(-2.32)	(0.91)	(-2.33)	(1.27)
Language	0.592	0.861	0.591	0.867
	(8.67)	(9.50)	(8.66)	(9.62)
IPRs[b]			-0.014	0.369
			(-0.53)	(9.59)
ρ		2.100		2.083
Obs.	7304	5492	7304	5492
ρ	-0.034		-0.043	
$-2\ln\lambda\ (\rho = 0)$[c]	0.853		1.346	
$-2\ln\lambda\ (\{\gamma,\beta\}= 0)$[c]	8874.433		8965.677	

[a] t-statistics in parentheses

[b] Park and Ginarte index of the destination country of the trade flow, that is country *j* in the case of exports and country *i* in the case of imports.

Table 2: Maximum Likelihood Estimates for Total Non-Fuel Exports[a]

Model	(I)		(II)	
Equation	Probit	Gravity	Probit	Gravity
Intercept	-6.631	-10.791	-6.766	-11.170
	(-27.77)	(-29.31)	(-27.10)	(-29.55)
GDP_i	0.556	1.374	0.556	1.374
	(33.86)	(60.26)	(33.85)	(60.38)
GDP_j	0.458	1.017	0.443	0.945
	(29.84)	(46.85)	(25.93)	(35.11)
$Population_i$	-0.052	-0.320	-0.052	-0.3320
	(-2.84)	(-12.18)	(-2.83)	(-12.20)
$Population_j$	-0.153	-0.137	-0.137	-0.070
	(-8.15)	(-4.90)	(-6.57)	(-2.17)
Distance	-0.473	-1.114	-0.467	-1.100
	(-13.55)	(-23.69)	(-13.34)	(-23.41)
Border	-0.393`	0.301	-0.381	0.328
	(-2.54)	(1.52)	(-2.47)	(1.65)
Language	0.588	0.826	0.588	0.826
	(8.96)	(8.95)	(8.97)	(8.98)
IPRs[b]			0.047	0.176
			(1.92)	(4.46)
ρ		2.113		2.109
obs.	7309	5294	7309	5294
ρ	0.005		0.002	
$-2\ln\lambda\ \ (\rho = 0)$[c]	0.016		0.003	
$-2\ln\lambda\ (\{\gamma,\beta\}= 0)$[c]	8520.968		8544.524	

[a] t-statistics in parentheses

[b] Park and Ginarte index of the destination country of the trade flow, that is country *j* in the case of exports and country *i* in the case of imports.

Table 3: Maximum Likelihood Estimates for High Technology Imports[a]

Model	(I)		(II)	
Equation	Probit	Gravity	Probit	Gravity
Intercept	-5.494	-14.487	-4.794	-14.313
	(-27.17)	(-26.21)	(-22.87)	(-26.95)
GDP_i	0.568	0.911	0.717	0.960
	(40.12)	(22.68)	(39.04)	(16.69)
GDP_j	0.495	1.898	0.512	1.897
	(36.36)	(52.12)	(36.45)	(52.38)
$Population_i$	-.0324	-0.086	-0.474	-0.132
	(-18.71)	(-2.06)	(-22.59)	(-2.38)
$Population_j$	-0.170	-0.733	-0.175	-0.731
	(-10.31)	(-20.70)	(-10.43)	(-20.70)
Distance	-0.421	-1.115	-0.466	-1.124
	(-13.56)	(-19.11)	(-14.62)	(-19.00)
Border	0.011	0.157	-0.110	0.141
	(0.08)	(0.64)	(-0.78)	(0.61)
Language	0.480	1.154	0.488	1.146
	(8.54)	(9.53)	(8.43)	(9.49)
IPRs[b]			-0.340	-0.093
			(-14.09)	(-1.50)
ρ		2.229		2.228
Obs.	7304	3548	7304	3548
ρ	0.066		0.064	
$-2\ln\lambda\ (\rho = 0)$[c]	1.354		1.309	
$-2\ln\lambda\ (\{\gamma,\beta\}= 0)$[c]	7606.860		7812.274	

[a] t-statistics in parentheses

[b] Park and Ginarte index of the destination country of the trade flow, that is country *j* in the case of exports and country *i* in the case of imports.

NOTE: Table 4 has been omitted due to Space limitations. It can be obtained from the contact author, Dr. Chris Ngassam.

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