LINDER'S HYPOTHESIS REVISITED: A STUDY ON CHINA AND 13 OTHER COUNTRIES IN THREE DIFFERENT INCOME LEVEL GROUPS FROM 1981 TO 2004

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by

YEHENG GUO

has been approved for

the Center for International Studies by

Jie-Li Li

Assoc Professor of Sociology and Anthropology

Drew McDaniel

Interim Dean, Center for International Studies

Abstract

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LINDER'S HYPOTHESIS REVISITED: A STUDY ON CHINA AND 13 OTHER COUNTRIES IN THREE DIFFERENT INCOME LEVEL GROUPS FROM 1981 TO 2004 (32 pp.)

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This research paper conducted Linder's hypothesis on China and 13 other developed and developing countries for period from 1981 to 2004. The 13 countries are divided into three different groups according to their income level. The tests were conducted for each group for both entire period and three sub-periods (1981-1992, 1993-2000 and 2001-2004). From the test we found Linder's effect for both high and lower middle income group. However there is no clear evidence showing low income group has Linder's effect.

Approved:

Jie-Li Li

Assoc Professor of Sociology and Anthropology

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1. Introduction

In 1961, Steffan Linder presented his work on *An Essay on Trade and Transformation*. Different from traditional international trade theories which focused on the supply side in explaining the international trade direction, Linder (1961) in his paper provided an alternative view which argued that similar demand preferences led to more trade on manufactured commodities between countries with similar income levels. However, Linder didn't present any formal model in his paper to test this hypothesis. Since then, many empirical tests have been made to test Linder's hypothesis. It is noted that in Linder's essay he emphasized that this theory only applied to developed countries stating that "In these countries, many domestic entrepreneurs have never raised their trade horizon very much above the local village market. Between such countries there could be hardly any foreign trade, no matter how similar the demand structures may be."(Linder, 1961, p.108) This may be true in Linder's time; however the layout of international trade has changed greatly in the more than 50 years since then. Today more and more developing countries use international trade not just for meeting domestic demands but also as a means to develop their industries, which means huge export of manufactured products from developing countries. Naturally, the study on Linder's theory is not restricted to developed countries any more. Many (Arnon, 1998; McPherson, 2001; Tang, 2003) recent researches are in fact using trade data from developing countries to test the Linder's hypothesis as well.

In this paper, we will utilize data from China and several other countries (both developed and developing countries) from different regions of the world to test Linder's hypothesis for the period 1981-2004. The selection of countries is based

primarily on different average income levels. Contrary to other studies on the Linder's hypothesis, we choose China as our primary focus of the study. Subsequently other countries are selected based on both their income levels and their trade relationships with China.

There are two reasons why we have chosen China as our primary study object. First, after adopting Open Door policies for nearly three decades, China has become a leading trade partner in the world. According to the WTO report (World Trade Organization [WTO], 2005) China is ranked third among leading traders in the world, while U.S. and Germany are ranked first and second respectively. China's strong emergence in the world trade arena has brought both opportunities and challenges to other countries. Thus choosing China as our primary study object will give us a better understanding of today's world trade dynamics especially relative to China.

Second, the rapid growth of both China's foreign trade and its average income level make it an excellent example for researchers to study the dynamics between average income levels and foreign trade which is exactly what Linder's hypothesis is about. China has come a long way to reach today's economic achievement. According to an IMF report (IMF, 2004), in 2004, the total of China's imports and exports was about $1,298.25 billion, which was about 7.07% of the world total. However, in 1981, China's total of imports and exports was about $41.14 billion (International Monetary Fund, [IMF], 1987, 2004) which was about only 1% of the world total. Therefore, there has been an annual growth rate in trade of about 16.2% over the last two decades. Besides its growth in international trade, China also has excellent scores on increasing its average per capita income level. According to World Bank,

(World Bank, 2006) "Economies are divided according to 2004 GNI per capita… low income, $825 or less; lower middle income, $826 - $3,255; upper middle income, $3,256 - $10,065; and high income, $10,066 or more." According to World Development Indicator online database (World Bank, n.d.), from 1981 to 2004, China's GNI per capita has risen from $220 in 1981 to $1,290 in 2004, implying an annual growth rate in income per capita of 7.64% thus successfully emerging from the low income group to the lower middle income group. With high growth rates in both international trade and income level, China is an ideal candidate for researches on the relationship between trade intensity and income level.

There are two objectives to this paper. The first is to test Linder's hypothesis for different income level groups. As mentioned above, there are already some studies on Linder's hypothesis using developing countries as test samples. For example, McPherson (2001) tested 6 African countries (Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda) for the period around 1980's to 1992. Tang (2003) tested APEC (Asian-Pacific Economic Cooperation) countries for periods from 1985 to 1999. However, there is no evidence based on the most recent trade data. Since the world trade layout is undergoing significant changes during recent years, it is very necessary to test Linder's hypothesis using the most recent data. Thus, in this study, we use the period from 1981 to 2004 employing the latest trade data from sample countries from different regions of the world for conducting the test. The second objective is to introduce China as a primary study subject and examine trade dynamics between China and several countries of varying income levels. In other words, the trade data for China will be used as a control factor in the test. That is, we will compare test result for different income groups with and without China. We will also divide the whole period into three sub-periods (1981-1992, 1993-2000, and

2001-2004) in order to examine whether there is consistent evidence of the Linder's hypothesis over time. There are several reasons why we divide the whole period into three sub-periods. First, 25 years is a long period and many countries would have experienced a huge growth during that period. Breaking the entire period into smaller sub-periods could, therefore, give us a chance to study the countries at different stages of development. Second, the focus of our study is on China, and it seems a natural choice to break the whole period into three sub-periods according to so we broke the whole period into three sub-periods according to China's different stages of opening to the world. Year 1981 marked the beginning of China's adopting Open Door policies; year 1993 China's central government greatly expanded its Open Door policies after Deng Xiaoping's address during his tour to the South; year 2001 is the year when China became a member of World Trade Organization which greatly improved China's trade with the rest of the world.

2. A brief literature review of empirical tests of Linder Hypothesis

Since Linder did not present a formal model in his paper to test his hypothesis, many others have tried different approaches to test it. In the earliest days, there were attempts made by researchers to test the Linder's hypothesis (Sailors, 1973, Greytak & McHugh, 1977). Although they found evidence in favor of Linder theory, much of the work was greatly criticized for not using regression techniques in their analysis. Since then, many people (Hoftyzer, 1984; Qureshi, 1980; Kennedy & McHugh, 1980, 1983; Linnnemann & van Beers, 1988; Hanink 1990) have used regression analysis to test the hypothesis. These tests introduced distance as a control variable in order to analyze the trade intensity between countries, and generally found no support for the Linder model.

More recent research which uses more advanced regression techniques have generally generated favorable results for Linder's hypothesis. Thursby and Thursby (1987) used fixed panel data (1974-1982) for 17 industrialized countries and found evidence supporting Linder's hypothesis. Greytak and Tuchinda (1990) found strong support for Linder's hypothesis by testing U.S. interstate trade flow data. Bergstrand (1990) used the gravity model to test Linder's hypothesis on for 14 major industrialized countries, and also found favorable results supporting Linder's hypothesis. McPherson (2000) test Liner's hypothesis using a fixed effect Tobin model on OECD countries and found evidence supporting Linder's hypothesis.

Much of the research supporting Linder's hypothesis is limited to industrial countries. The reason is that during Linder's era, most manufactured goods were produced in industrial countries, which made Linder believe that his theory may only apply to industrial countries. However, today more and more developing countries are utilizing foreign trade as a tool to develop local economies. EOI (export oriented industries) have been widely established in many developing countries. They produce a great percentage of manufactured goods in the world market. According to Weinblatt and Schrager (1985), during the 1970's, total exports from least developed countries to least developed countries had a much higher growth rate than their total export to developed countries. So the point that developing countries could only export primary goods is already outdated. In the 1990's, increasingly more research was done on Linder's hypothesis introducing developing countries into the test, and many of them (Arnon, 1998; McPherson, 2001; Choi, 2002) found that Linder's theory applied to both developed and developing countries. Chow (1999) tested the income similarity effect on promoting

trade among East Asian countries from 1965 to 1990 and found evidence supporting Linder's theory. Tang (2003) tested the income similarity effect on APEC countries from1985 to 1999 and also found income similarity effect among both developed and developing countries. However, Tang's paper stated that income similarity effects among developed countries are stronger.

In this paper, we will test Linder's hypothesis with data from both developed and developing countries with a focus on China. However, in order to compare the income similarity effect in different income level groups, we only conduct the test within each income level group. Section 3 discusses the methodology that we use to test the Linder's hypothesis. Section 4 presents the estimation results and section 5 concludes.

3. Methodology and Data description

We employ a modified gravity model for the test, and estimate the model using trade-related data for China and 13 other selected developed and developing countries.

We collected relevant data for China and the other additional countries or regions from 1981 to 2004. These countries or regions were not randomly selected. They were chosen from the top 50 trade partners with China according to the trade data in year 2004 (IMF,2004), and then separated into three distinct groups according to their different income levels which are low income, lower middle income and high income groups. Finally, the top 4 or 5 countries from each group were selected for testing. Although some other countries ranked higher than some

selected countries in the group, due to the data availability issue, they were not selected. For example, Russia ranked much higher in lower middle income group than Thailand. However, Russia's trade data for many years in our study period are missing, so we chose Thailand rather than Russia for the test. The selected countries are Germany, Hong Kong, Indonesia, Japan, Korea, Nigeria, Pakistan, Philippines, Sudan, Thailand, Turkey, United States and Vietnam. The modified gravity model is first estimated for the entire 24 year period and then for three sub-periods.

During the first sub-period, 1981-1992, China greatly increased its trade with foreign trade partners while its income was approximately at the same level as the countries in the low income group. In the second sub-period, from 1993 to 2000, China continued its robust growth in foreign trade and also greatly increased its per capita income level leaving other low income countries far behind. During the final time period, from 2001 to 2004, China, after becoming a member of the WTO, emerged as a new economic power in the world and its role in world trade changed dramatically. For comparison purposes, we will estimate the modified gravity model first for the entire period for each income level group with and without China (except lower middle income group which will not be tested without trade data for China), and then for three sub-periods for each income level group with and without China (except lower middle income group which will not be tested without trade data for China).

The Modified Gravity Model and Variables

The gravity model was first introduced into economics studies on international trade flow by Jan Tinbergen (1962). Since then gravity models have been widely

applied to studies on bilateral trade flows. In its original form, the gravity model was specified as follow:

$$trade_{ij} = A \cdot \frac{GDP_i \times GDP_j}{dist_{ij}}$$

where $trade_{ij}$ is the bilateral trade flow value between country *i* and country *j*, GDP_i and GDP_j are country *i* and *j*'s respective national incomes, and $distance_{ij}$ is the physical distance between country *i* and *j*. *A* is a constant of proportionality. After taking logarithms of both sides of the equation, the gravity model is transformed to the following equation:

$$\log(trade_{ij}) = A + b_1 \log(GDP_i \cdot GDP_j) + b_2 \log(dist_{ij}) + \varepsilon_{ij}$$

In this equation, *A* is the constant, and b_1 and b_2 are coefficients to be estimated, and ε_{ij} is a random error term. This equation explained that the amount of bilateral trade is positively related to the two countries' GDP values and inversely related to the physical distance between them. While there is still no consensus on the theoretical justification for the gravity equation, it was widely used and generated accurate results in empirical tests. Besides the original core variables of income and distance, more variables were later introduced into the gravity model to control for differences in language, trade policy, exchange rate risk, population and some other factors. (Aitken, 1973; Bergstrand, 1985; Thursby & Thursby, 1987, Frankel & Rose, 2002).

In this study a modified gravity model specified by Tang (2003) will be used for the test. The modified gravity model includes the trade variable as the dependant variable and a host of explanatory variables including the economic weight (GDP) variable, the geographic distance variable, the income similarity variable, and dummy variables which will account for individual country effects, which are

differences in bilateral trade for each exporting country with its selected trading partners. The main focus of these studies is the income similarity variable. Under Linder's hypothesis, it is expected that the less income difference between two countries, the more that they will trade with each other and we will formally examine whether empirical data in fact supports this hypothesis. Accordingly, the modified gravity model that we estimate is presented as follows:

$$\log(Trade_{ij,t}) = b_0(\log GDP_{it}) + b_1(\log GDP_{jt}) - b_2(\log Dist_{ij}) - b_3(\log GDPC_{it} - \log GDPC_{jt})^2 + b_4 d_1 + b_5 d_2 + ..b_n d_m + \varepsilon_{ij,t}$$

In this equation, $Trade_{ij,t}$ stands for the export value from country *i* to country *j* during time period *t*. $GDP_{i,t}$ and $GDP_{j,t}$ stand for the economic scales of country *i* and country *j* (as measured by their GDP value) during that same period; $dist_{ij}$ stands for the geographic distance between countries *i* and *j*; $(\log GDPC_{it} - \log GDPC_{jt})^2$ measures the income level difference between countries *i* and *j*, and GDPC stands for GDP per capita. Furthermore d_m stands for the dummy variables which will specify the exporting countries in the pooled cross section sample. The number of dummy variables *m* in each income group will depend on how many countries are in fact included in each group. The equation is estimated by the least squares method that accounts for heteroskedasticity using the White cross section covariance. Compared to the ordinary least squares (OLS) test, the White correction generates more efficient test results.

The sample countries (not including China) will be divided into three groups based on the World Bank categorization of GNI per capita: the low income group that includes Nigeria, Pakistan, Sudan and Vietnam; the lower middle income group that includes Indonesia, Philippines, Thailand, and Turkey; and the high income group that includes Germany, Hong Kong, Japan, Korea and the United States. As

discussed earlier, the reason we choose the three income level groups is that we not only want to test the Linder's Hypothesis for different income levels, but we also want to use China as a control factor and compare results with and without China for different income level groups. The high and low income groups are chosen as the two extremes, since high income group countries have much higher per capita income level compared with China while low income group countries have much lower per capita income level compared with China.

In his essay, Linder concluded that income similarity effect should only take place between industrial countries, because he believed only developed countries with strong demands for manufactured goods could develop similar demands between each other and thus generate trade on manufactured goods between each other. Based on Linder's theory, it is expected that the high income group countries should show a stronger Linder effect while lower middle and low income group should show a weaker or no Linder effect. It is also expected that when including China in the test with high income group countries, it would reduce the income similarity effect since there is a notable difference between the average income level of China and high income group countries. In the lower middle income group test, since all the countries in this group including China generally are on the same income level, income similarity effect is expected. However it may not be as strong as the income similarity effect expected in the high income group countries test. For low income countries, according to Linder's hypothesis, we should not observe an income similarity effect.

In the modified gravity model, $Trade_{ij.t}$ is the dependant variable which measures the export from country *i* to country *j* (IMF, 2004, 2000, 1994, 1987)

during period *t*. To adjust for the inflation effect on each year's data, the actual numbers are adjusted by year 2000 U.S. dollar deflator to convert them into constant year 2000 U.S. dollar values. In the Linder's Hypothesis test, the most idealistic case measures only manufactured good export from country *i* to country *j*. However, due to the lack of data, the total export from country *i* to country *j* is used. Though it is a common practice in the Linder's Hypothesis test, it unavoidably generates some bias in the test results.

GDP_{it} and GDP_{jt} are the GDP value from exporting country *i* and importing country *j* during period *t*. The GDP value is a direct measure of a country's economy. To be consistent with the $trade_{ij,t}$ value, both the GDP_{it} and the GDP_{jt} values used are also constant year 2000 U.S. dollar values (World Bank, n.d.). According to Linder's theory, GDP_{it} reflects the supply of the exporting country while GDP_{jt} reflects the demand of the importing country. Thus the bigger the GDP_{it} and the GDP_{jt} are, the bigger $trade_{ij}$ would be and we would, therefore, expect positive coefficient estimates for these two variables. Another reason we used GDP as the measurement for the economy scale of a country is because the total of the export and the import of a country are mainly decided by its GDP in U.S. dollar value (Gros, 1996). Therefore the GDP figure in U.S. dollar value will better reflect the international trade power of a country. $Dist_{ij}$ is the distance variable measuring the physical distance between the two trading countries. For large countries with huge territory and separated by very long borders, it is difficult to tell how far the two countries are from each other. In this study, the distance was measured by the physical distance between the capital cities of the exporting country and importing country (Byers, 1997). Longer distance means higher transportation costs thus

decreasing the potential for bilateral trade flows. As a result, $Dist_{ij}$ is expected to have a negative effect on $trade_{ij,t}$.

The $(logGDPC_{it}-logGDPC_{jt})^2$ is the most important independent variable in this equation. It measures the difference of income levels between the two trading partners (WDI online). According to Linder's theory, countries with similar income levels would trade more with each other. Therefore when two countries' GDP per capita are close to each other, this income similarity variable would tend to be smaller and the dependant variable $trade_{ij}$ would tend to be bigger. The coefficient of this variable therefore should bear a negative sign.

As indicated earlier, we add dummy variables to the model to control for each exporting country in the pooled cross section bilateral trade data sample. Recall that most cases we do the test among countries with similar income levels except when we add China into high and low income group tests. However, the differences in income levels and bilateral trade volumes among countries in the same income group make it necessary to add dummy variables in the test to separate one exporting country from the other. We conduct likelihood ratio test on the dummy variables to confirm the need to add the dummy variables in the test. Accordingly, the number of dummy variables depends on how many countries we have in each test. For example, if we have 6 countries in the test (Note that if we include a constant term in our estimations we will need only five dummy variables to avoid perfect multicollinearity), we would have 6 dummies, d_1, d_2, d_3, d_4, d_5, and d_6. When country 1 is the exporting country (i.e. *country*$_i$ in our model) in the test we set $d_1=1$. For other exporting countries $d_1=0$. If $country_2$ is the exporting country in the test, then

d_2=1. For all other exporting countries, d_2=0. We construct the remaining dummy variables in a similar manner.

4. Estimation results

The estimation results for high income, lower middle income, and low income groups are summarized in Table 1 through Table 5. The values in parentheses are the P-values.

High income group

Table.1.High Income group without China

	Log GDPi	Log GDPj	Log Distij	$(logGDPC_i-logGDPC_j)^2$	D_1	D_2	D_3	D_4	D_5	R^2	Observation
1981-2004	1.0305	0.4802	-0.0679	-1.0699	-18.9425	-16.7076	-18.4299	-17.318	-19.2947	0.7857	480
	(0.0000)	(0.0000)	(0.0000)	(0.4111)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
1981-1992	1.5526	0.5137	-0.0504	1.6583	-34.7835	-31.0469	-34.5618	-31.9481	-35.7367	0.8222	240
	(0.0000)	(0.0000)	(0.0000)	(0.0874)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
1993-2000	0.2625	0.4288	-0.0810	-15.1112	4.4578	4.7864	5.5958	4.9324	5.2333	0.7336	160
	(0.2970)	(0.0000)	(0.0000)	(0.0000)	(0.5290)	(0.4573)	(0.4438)	(0.4637)	(0.4843)		
2001-2004	1.8128	0.4534	-0.1642	-10.9962	-39.2893	-35.3939	-39.8577	-37.1322	-41.3030	0.6933	80
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0007)	(0.0009)	(0.0009)	(0.0009)	(0.0009)		

Table.2.High Income group with China

	Log GDPi	Log GDPj	Log Distij	$(logGDPC_i-logGDPC_j)^2$	D_1	D_2	D_3	D_4	D_5	D_6	R^2	Observation
1981-2004	1.1882	0.3961	-0.2211	0.0431	-18.2538	-19.6901	-16.6774	-19.5311	-17.9268	-20.4009	0.5883	702
	(0.0000)	(0.0000)	(0.0000)	(0.8140)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
1981-1992	1.1545	0.4059	-0.2476	-0.3899	-17.2792	-18.9249	-15.9588	-18.5708	-16.9711	-19.3796	0.5485	342
	(0.0000)	(0.0000)	(0.0000)	(0.0140)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
1993-2000	0.9488	0.3524	-0.1363	0.8164	-11.3321	-12.3716	-9.8637	-12.0625	-11.0532	-12.8409	0.4677	240
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0259)	(0.0179)	(0.0375)	(0.0250)	(0.0257)	(0.0199)		
2001-2004	2.8436	0.3788	-0.2288	3.8885	-64.3948	-65.8258	-59.1101	-67.5415	-62.4827	-69.7427	0.5513	120
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		

Lower middle income group

Table.3.Lower middle income group with China

	Log GDPi	Log GDPj	Log Distij	$(logGDPC_i\text{-}logGDPC_j)^2$	D_1	D_2	D_3	D_4	D_5	R^2	Observation
1981-2004	1.6799	0.9283	-2.4708	-0.9961	-27.8258	-28.1816	-26.7684	-26.8426	-27.4292	0.8484	470
	(0.0000)	(0.0000)	(0.0000)	(0.5998)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
1981-1992	0.9450	1.2828	-2.9344	-5.7397	-13.6973	-13.3245	-13.4918	-13.9412	-14.5819	0.7829	233
	(0.0000)	(0.0000)	(0.0000)	(0.0059)	(0.0078)	(0.012)	(0.0074)	(0.0059)	(0.0038)		
1993-2000	1.4845	0.7232	-1.9732	-5.6994	-21.8195	-21.8357	-20.3212	-20.4869	-21.1874	0.8587	157
	(0.0004)	(0.0000)	(0.0000)	(0.0455)	(0.0688)	(0.0842)	(0.09)	(0.0856)	(0.0698)		
2001-2004	3.3850	0.8287	-2.1373	-4.0750	-72.5699	-76.1683	-70.9180	-70.2752	-70.0983	0.9439	80
	(0.0000)	(0.0000)	(0.0000)	(0.0417)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		

Low income group

Table.4.Low income group without China

	Log GDPi	Log GDPj	Log Distij	$(logGDPC_i\text{-}logGDPC_j)^2$	D_1	D_2	D_3	D_4	R^2	Observation
1981-2004	0.5306	0.9194	0.2742	-72.8292	-23.0487	-21.0488	-23.0835	-22.1978	0.4784	129
	(0.1843)	(0.0000)	(0.2099)	(0.0198)	(0.0280)	(0.0466)	(0.0227)	(0.0332)		
1981-1992	0.2858	0.0933	-0.6156	-123.2967	10.745	11.8828	11.0988	11.5898	0.2766	47
	(0.7224)	(0.8878)	(0.8063)	(0.2326)	(0.6396)	(0.6061)	(0.5974)	(0.5957)		
1993-2000	-0.3039	0.9276	0.5609	-24.4128	-5.694	-3.1271	-7.0297	-4.9961	0.7376	47
	(0.7978)	(0.0001)	(0.1394)	(0.5872)	(0.8370)	(0.9118)	(0.7879)	(0.8540)		
2001-2004	4.4111	1.9155	1.1273	-136.029	-149.1826	-148.9471	-145.7838	-148.1721	0.7372	35
	(0.1134)	(0.0025)	(0.1093)	(0.5901)	(0.0110)	(0.0121)	(0.0075)	(0.0095)		

Table.5.Low income group with China

	Log GDPi	Log GDPj	Log Distij	$(logGDPC_i\text{-}logGDPC_j)^2$	D_1	D_2	D_3	D_4	D_5	R^2	Observation
1981-2004	0.8350	1.0174	-0.0964	52.7373	-27.4435	-30.6273	-28.5192	-29.1650	-28.9832	0.7413	301
	(0.0042)	(0.0000)	(0.5343)	(0.0000)	(0.0013)	(0.0001)	(0.0003)	(0.0001)	(0.0002)		
1981-1992	-0.9048	0.9463	-0.2948	22.3298	22.1643	15.0307	17.5686	14.4730	13.8183	0.6212	125
	(0.0220)	(0.0000)	(0.3738)	(0.5709)	(0.0099)	(0.0525)	(0.0269)	(0.0497)	(0.0587)		
1993-2000	0.8209	0.9287	-0.5658	74.553	-21.1373	-23.9950	-22.2730	-23.4353	-22.1603	0.8614	109
	(0.0083)	(0.0000)	(0.0001)	(0.0001)	(0.0194)	(0.0039)	(0.0075)	(0.0027)	(0.0067)		
2001-2004	3.7392	1.0745	-0.0403	67.5756	-110.5204	-104.1544	-103.0322	-99.1026	-101.0567	0.8372	67
	(0.0022)	(0.0000)	(0.7467)	(0.0000)	(0.0014)	(0.0007)	(0.0010)	(0.0008)	(0.0009)		

High income group

Of the three sample groups, the high income group is mostly like to have income similarity effect thus we expected negative sign for the income similarity variables. Table1 documents that the coefficient estimates for the income similarity variable for the high income group ranges from -15.1112 to 1.6583. All the test results in Table 1 are statistically significant except the result for the period from 1981-2004 periods. Note that the p-value for the coefficient of income similarity variable for that period is 0.4111 which exceeds the usually accepted 5% or 10% significance levels. All signs of the coefficients of the income similarity effect are negative as expected except for the period from 1981 to 1992. A possible explanation can be given based on the fact that we selected countries based on their GDP per capita figure in year 2004. Although all of these high income group countries are on a similar per capita income level in 2004, it is not so especially in the earlier period. Usually in such a case, a sensitivity test would be conducted. However due to the fact that the countries in the test should be the same in both year 1981 and year 2004 for comparison purpose, the sensitivity test is not conducted. Thus it is unavoidable for us to see income level gap among the same income level group, especially in the early period. For example, in 1982 the GDP per capita of these 5 economies are (in 2000 U.S. Dollar) Germany $15,721.19, Hong Kong $12,210.58, Japan $24,416.92, Korea $3,368.85 and the United States $22,911.46 (WDI, n.d.). In 1992, the figures were changed to Germany $20,601.58, Hong Kong, $20,614.53, Japan, $34,506.59, Korea $7,916.10, and United States $28,747.42. From these figures we could see that in 1982, there are relatively wider gaps between these high income group countries. The 1982-1992 is a transition period for Germany, Korea and Hong Kong. Their economies and income levels took huge progress and therefore

caught up greatly with the U.S. and Japan in the early 1990's. This is a possible explanation why we do not observe Linder's effect in the earlier periods for these countries. For the rest of the sub-periods, we do observe very strong Linder's effect. The significant negative values for the coefficients of income similarity variables show that there is a very strong income similarity effect among high income group countries. In other words, the more similar the two countries' incomes are, the more they trade with each other.

When bringing China into the high income group, all the results are statistically significant except for the result for the whole period from 1981 to 2004. Only the coefficient of income similarity variable for the sub-period from 1981 to 1992 is negative as expected while the relevant coefficient for the other two sub-periods are both positive. There are two main findings in this test. First, there is no or weak Linder's effect when adding China into the high income group test. Second, although there is no apparent Linder's effect boosting the trade between China and other high income group countries, the trade volume between China and other high income group countries have increased very fast in most recent periods thus further weakening the Linder's effect among high income group countries. For example, for the period from 1993 to 2000, the coefficient of income similarity effect variable was changed from -15.1112 to 0.8164; and for the period from 2001 to 2004, it changed from -10.9962 to 3.8885. Among the three sub-periods, only in the first one, do we observe even a weak Linder's effect. However, in the following two sub-periods, the test shows no Linder's effect.

That is, when adding China to the test with other high income group countries, China either weakened or removed the Linder's effect between other countries, especially in the most recent periods. Data indicates (World Bank, n.d.) that the income gap between China and high income group countries is wider in the most recent period (the average GNI per capita of high income group countries from 1981 to 1992 is $18,740, which changed to $15,666, when including China; the gap therefore is $3,074; and in the second sub-period, the gap became $3,704, in the third sub-period it became $4,300). However a closer look at the data indicates the growth rate of trade between China and high income group countries greatly exceeded the growth rate of trade among high income group countries. Apparently, there is no income similarity effect which might boost the trade between these countries. But there are several other factors taking effect that appear to make up for the lack of an income similarity effect between China and high income group countries. First is a trade treaty effect. When China signed the free trade treaty with both the U.S. and E.U. in 2001 and finally became a member of WTO in that same year, both the import and export of China gained an immediate boost effect. Second, heavy foreign investment in China establish a very strong export capacity of China. In 2005, China surpassed the U.S. and became the biggest foreign investment taker. The foreign capital took advantage of China's cheap labor cost to make their products more competitive in the world market. Such foreign multinational corporations greatly increased China's trade with other countries, especially with those high income countries.

In summary, the test for the high income group shows strong support for Linder's hypothesis. When bringing China into the test, the test results show no income

similarity effect. This result proves that the Linder's hypothesis does hold for high income countries since Linder claimed that there was no income similarity effect between countries with different income levels. However, we observe that even with no income similarity effect other factors such as treaty effects and foreign direct investment could increase the trade between countries as well.

Lower middle income group

Unlike the high income and low income groups, the lower middle income countries have most similar average income levels with China. All the test results are statistically significant except for the test for the entire period. In addition, all the signs of the coefficient for income similarity effect are negative as we expected.

In comparison with high income group economies, lower middle income group countries have a much lower average income level. For example, from 1981 to 2004 the average income of the 5 high income group economies is $21,915.64, and that of the 5 lower middle income group countries is $1,260.19 (WDI, n.d.). However, these lower middle income group countries generally have a substantial percentage of their merchandise exports comprising of manufactured goods. For example, in 2003 the percentage of the manufactures export of total merchandise export for the five lower income level group countries are, China, 90.57%; Indonesia, 52.11%; Philippines, 90.11%; Thailand, 75.41%; and Turkey, 84.91% (WDI, n.d.). Thus we can reasonably expect to see Linder's effect among this group of countries as well. The test results for the lower middle income group confirmed this prediction. See Table 3 for results that include China among other lower middle income group countries. The coefficients of income

similarity effect ranged from -5.7397 to -4.0750 (result for period from 1981 to 2004 is not counted because it is not statistically significant). These results therefore confirm that there is income similarity effect among developing countries as well. It is worthwhile to note that, we do observe a significant result for the most recent period as well. One may have suspected that China's increased trade with high income group countries since 2001 after it joined the WTO may have replaced some of its trade with the lower middle income group countries. This, however, appears not to be the case.

Low income group

Tables 4 and 5 present results for the low income group. As documented, we do not observe significant test results when conducting the test without China except for the whole period from 1981 to 2004. Specifically, the coefficient of income similarity variable is -72.8292, which in theory appears to show a very strong income similarity effect. However in the same period, when tested with China, the result is entirely in the opposite direction. For example the coefficient of income similarity variable is now 52.7373, which shows no income similarity effect. Test results without China for all sub-periods yield negative coefficient estimates for the income similarity effect variables. However, none of these are significant at conventional (5% or 10%) significance levels. When conducting the test with China, only the test for the period from 1981 to 1992 is not statistically significant. Furthermore, we also observe positive income similarity effect variables in all cases when conducting the test with China.. The income similarity coefficients in the tests for the 1993 to 2000 and 2001 to 2004 sub-periods with China are 74.5530 and 67.5756, which also indicate no income similarity effect. There are several possible explanations for these mixed results. First, the test for the low income

group suffers from substantially incomplete data. Note that there is a significantly fewer number of observations for this test compared with the other two sample groups. Second, we selected our sample groups based on both the average income level of that country and its trade relation with China. The four countries we selected for the low income group, even though they have relatively big trade volumes with China, do not have much trade amongst themselves. For example, in the year 2000, the total exports from Sudan to Vietnam is only about $210,000 compared with total exports from Sudan to China of $655 million. Third, as we had mentioned in the methodology section of this paper, Linder's hypothesis applies mainly to manufactured goods and we use the total of merchandise exports instead thus generating a potential bias in the test. For high income and lower middle income groups, a bigger percentage of the merchandise exports are in fact manufactured goods. For example, in the year 2004, China's total export to the United States is 196,699 million U.S. dollar, 83.5% of which consists of manufactured goods, machinery and transport equipment (International Trade Administration, 2005). However, in the case of low income group countries, things are different. For example, to our knowledge a bigger portion of merchandise export from Sudan to China is crude oil which is clearly not a manufactured good. We do not however have detailed data for the composition of merchandise exports for other countries in the low income groups. All these factors added up, we get test results that are not consistent with the Linder's hypothesis for low income group.

Other independent variables

Although our test is focused on the relationship between trade and income similarity variables, the other three variables GDP_{it}, GDP_{jt} and $dist_{ij}$ all affect the

dependent variable $trade_{ij,t}$. Recall that, we use GDP as a measure of the size of an economy. Generally, the bigger the economies are, the more the two economies will trade with each other. Thus, we expect positive coefficients for both GDP_i and GDP_j. The results presented in Table1 through Table5 confirm this prediction. We get significant positive coefficients for GDP_i and GDP_j in all except a couple of cases in the low income group. In the case of distance variable, the bigger the distance between two countries, the higher the transportation costs would be. Thus less trade would take place between them. We would expect, therefore, a negative coefficient for the distance variable in our test. However as we mentioned earlier, it is very difficult to measure exactly how far two countries are from each other especially if they have a common border and big territories. In our test we use the distance between two countries' capital cities as a reference, which might generate a bias in our results. Results indicate that, for the most part, we do obtain significant negative coefficients as expected providing empirical evidence that a greater distance between trade partners relate to less trade between them.

5. Conclusion

In this paper, we tested Linder's hypothesis using trade data for China and 13 other developing and developed countries for the period from 1981 to 2004. We used a least square dummy variable approach that account for individual country effects. We also corrected for cross-section heteroskedasticity in all estimations. We separated the countries into three different groups, which are high income group, lower middle income group, and low income group. In the test for high income group, we found very

strong support for Linder's theory. In the test for lower middle income group, we observed strong Linder's effect for all sub-periods. However we do not get any significant result for the entire period. In the case of low income group, there is no significant evidence supporting an income similarity effect. We also found that, although the income similarity effect might boost trade among countries with similar income levels, there may be other factors that could be more important in promoting trade between countries even if they do not have the same levels of income. A good example would be the trade treaties that promoted trade between China and some high income group countries since China joined the WTO in 2001.

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