Domestic demand and regional market segmentation in China *

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Key Words: China's domestic markets, Chinese provinces, regional trade, market integration, border effects

JEL Classification: F10, F14, F15, O18, O50, O53

* We thank Huiran Pan, seminar participants at Fudan University and WEA International's 85th Annual Conference and the anonymous referee for helpful comments and suggestions. Xu acknowledges the financial support of a summer research grant in 2009 by the College of Business at GCSU. Fan thanks the National Social Science Foundation of China for research support (No.11 & ZD003). The usual disclaimers apply.

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Abstract

Recent global economic crisis led China to move from its export-led growth to promoting domestic demand. The new growth strategy, if successful, will signify China's move onto the path of long-run sustainable growth; but its success depends on integrations of China's internal markets. In this paper, we use the methodology proposed by Anderson and Wincoop (2003) to examine China's domestic market integrations. We find evidence of border effects in China's regional markets at both national and regional levels and significant regional differences. Among the factors affecting China's regional trade, better business environment has the largest positive impacts on lifting China's domestic trade between regions, suggesting that improving business environment should be the priority of governments at all levels in China.

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1. Introduction

With an average annual growth rate of nearly 10% for the last three decades, China had become the second largest economy in the world, next only to the US. Yet for a country as large as China, growth mainly through exports cannot be sustainable in the long-run. In response to the global economic crisis, the Chinese government launched a bailout plan with 4 trillion yuan (approximately US$586 billion) in November 2008 and expressed its desire to promote domestic demand and expand internal markets. In its recent world economic outlook, the IMF also urges China to reduce its dependency on exports and boost domestic demand.[1]

Household consumption is the most important component of GDP in the west. For instance, it accounts for more than 70% of the GDP in the US. But it is currently very low in China and accounts for only about 40% of China's GDP, despite China's population is more than four times larger than the US population whereas its GDP is about a half of the US GDP. Therefore, if successful, the new strategy will signify China's move onto the path of long-run sustainable growth; but its success depends on integrations of China's internal markets.

Market integrations can be examined by border effects, which can result from (1) the degree of substitution among similar products and (2) local government's protections and other regional trade barriers. The border effect measures the extent that domestic companies trade more with each other than with foreign companies of similar size and distance. Therefore, in the presence of border effects, higher volumes of intra-regional trade than inter-regional trade will be observed. For developed countries, domestic markets are fairly

[1] See IMF's World economic outlook (October 2010).

integrated and thus border effects are small. For example, Wolf (2000) found that the border effect for the US in 1993 was about 3 – 5 times, suggesting that US companies are only 3 – 5 times more likely to engaging in intrastate trade than interstate trade. Head and Mayer (2000) found that the border effect in Europe was 21 times at the end of 1970s but reduced to 11.3 times by 1995.

China's central planning past implies internal market segmentations.[2] Some contend that there have been increasing trade barriers in China's regional markets even after the economic reform. For instance, Young (2000) argued that China's high ratio of foreign trade to GDP was a sign of intra-national trade barriers rather than international economic openness. Although China's foreign trade has increased drastically in the last three decades, the intensity of provincial trade in China actually declined between 1987 and 1997. Poncet (2005) found increasing trade barriers in China's inter-provincial trade, equivalent to a tariff of 48% in 1992 and 53% in 1997, higher than 45% tariff found for the European Union and the Canada–US border at the beginning of the 1990s.[3]

But some other researchers have found evidence of increased domestic market integrations in China after the economic reform. For example, Xu (2002) used an error-component model to analyze the pattern of provincial economic integration in China between 1991 and 1998. He found evidence of market integrations of the Chinese provinces. In another study, Fan and Wei (2006) adopted the method of panel unit root tests and nonlinear mean reversion to investigate price convergence in China. They found evidence of price

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[2] For a discussion of provincial trade barriers in the literature, see Naughton (2000).

[3] Gui et al (2006) used provincial price indices for the period between 1985 and 2001 to study the trend of commodity markets integration in China and found strong supporting evidence of provincial markets integration. They suggested that Poncet's results could arise from the absence of some critical control variables (p. 3).

convergence to the law of one price in China for an overwhelming majority of goods and services. In a more recent study, Li and Hou (2008) found evidence of relative price convergence at industry level across various regions in China.

The issue about China's domestic market segmentations is indeed important because it will be extremely difficult, if not impossible, for the central government in China to achieve its goal of promoting domestic demand when domestic markets are highly segmented. In this paper, we use the gravity model, an input-output data, and survey data from Li and Hou (2008) to investigate border effects in China's internal markets. In addition to income and distances, we have constructed a few regional indices, measuring transportation costs, business environment, and intra-industry trade. We find evidence of border effects in China's regional markets, ranging from 5.30 to 5.46 times at the national level. We also find significant regional differences. For instance, the North Municipalities (Beijing and Tianjin) show the highest border effect, ranging from 21 to 22 times. On the other hand, the Central Costal Region (Jiangsu, Zhejiang and Shanghai) displays the lowest border effect, approximately 2.3 times. The finding of such a drastic difference in border effects between the Central Costal Region and the North Municipalities is consistent with the observation that Jiangsu, Zhejiang and Shanghai are the most open area in China, while government regulations and controls are typically tighter in China's capital city of Beijing and its vicinity. Among all factors under investigations in this study, we find that better business environment has the largest positive effects on promoting China's regional trade. Therefore, to achieve the goal of promoting domestic demand, improving business environment further should be the priority of governments at all levels in China.

2. The Gravity Model

The empirical analysis in this study is based on the gravity model. Because of its robust explanatory power on bilateral trade, it is widely adopted by researchers to investigate various trade related issues. See, for example, McCallum 1995, Wei 1996, Helliwell 1997, Head and Mayer 2000, Wolf 2000, Evans 2003, Anderson and Wincoop 2003, and Chen 2004. It is even used by the Market Analysis Section (MAS) of International Trade Center (ITC) of the UNCTAD/WTO for calculating trade potentials for developing countries and the economies in transition.

2.1 The Basic Gravity Model

Following Anderson and Wincoop (2003), we assume each region is specialized in the production of only one good and the supply of each good is fixed. We also assume identical and homothetic preferences for the consumers in each region. Therefore, the representative consumer in region *j* is to maximize the following CES utility function

$$\left(\sum_i \beta_i^{(1-\sigma)/\sigma} c_{ij}^{(\sigma-1)/\sigma}\right)^{\sigma/(\sigma-1)} \tag{1}$$

Subject to the budge constraint

$$\sum_i p_{ij} c_{ij} = y_j \,, \tag{2}$$

where β_i is the positive distribution parameter, σ is the elasticity of substitution between all goods, c_{ij} is the consumption of region *j*'s consumers of goods from region *i*, y_j is the nominal income of region *j*'s residents, and p_{ij} is the price of region *i* goods for region *j*'s consumers. It is worth noting that prices are different between regions because of trade costs and are not directly observable.

Let p_i be region i's supply price, net of trade costs, and t_{ij} be the trade cost factor between region i and region j. It follows $p_{ij} = p_i t_{ij}$. Assuming a fraction of each good is lost in the process of transportation, the export costs from region i to region j is then equal to $t_{ij} - 1$ of region i's goods. We assume that the exporter in region i pay the cost and then pass the cost on to the importer in region j. Therefore, the nominal income of region i is

$$y_i = \sum_j x_{ij} , \tag{3}$$

where $x_{ij} = p_{ij} c_{ij}$ is the nominal value of exports from region i to region j, which includes the value of production at the origin, $p_i c_{ij}$, and the trade cost $(t_{ij} - 1) p_i c_{ij}$ that the importer eventually pays for.

Solving the maximization problem of (1) subject to (2), we obtain the nominal import demand of the representative consumer in region j for region i's goods

$$x_{ij} = \left(\frac{\beta_i p_i t_{ij}}{P_j} \right)^{(1-\sigma)} y_j , \tag{4}$$

where P_j is the consumer price index in region j,

$$P_j = \left[\sum_i (\beta_i p_i t_{ij}) \right]^{1/(1-\sigma)} . \tag{5}$$

The market clearing condition for the general-equilibrium model requires

$$\begin{aligned} y_i &= \sum_j x_{ij} \\ &= \sum_i (\beta_i t_{ij} p_i / P_j)^{(1-\sigma)} y_j \\ &= (\beta_i p_i)^{(1-\sigma)} \sum_j (t_{ij} / P_j)^{(1-\sigma)} y_j , \forall i \ . \end{aligned} \tag{6}$$

Imposing the choice of units such that all supply prices p_i are equal to one, we can solve for the equilibrium scaled price ($\beta_i p_i$) from (6) (see Deardorff 1998). Substituting the solution to the import demand function in (4), we obtain the following gravity equation

$$x_{ij} = \frac{y_i y_j}{y^w}\left(\frac{t_{ij}}{\Pi_i P_j}\right)^{(1-\sigma)}, \tag{7}$$

where

$$\Pi_i = \left(\sum_j (t_{ij} / P_j)^{(1-\sigma)} \theta_j\right)^{1/(1-\sigma)}, \tag{8}$$

and $y^w \equiv \sum_j y_j$ is the world nominal income while $\theta_j \equiv y_j/y^w$ is the income share of region j. Substituting the solution to the consumer price index in (5), we have

$$P_j = \left(\sum_i (t_{ij} / \Pi_i)^{(1-\sigma)} \theta_i\right)^{1/(1-\sigma)}. \tag{9}$$

Assuming that the trade barriers are symmetric, i.e., $t_{ij} = t_{ji}$, then it can be verified that the solution to equations (8) and (9) is $\Pi_i = P_i$ with

$$P_j^{(1-\sigma)} = \sum_i P_i^{(\sigma-1)} \theta_i t_{ij}^{(1-\sigma)}, \forall j. \tag{10}$$

Substituting $\Pi_i = P_i$ to (7), we have

$$x_{ij} = \frac{y_i y_j}{y^w}\left(\frac{t_{ij}}{P_i P_j}\right)^{(1-\sigma)}, \tag{11}$$

which is the basis for our empirical gravity equation for estimations.

2.2 The Gravity Equation Used in Our Estimations

The popular gravity equation proposed by McCallum (1995) takes the following form

$$ln\, x_{ij} = \alpha + \beta_1 ln\, y_i + \beta_2 ln\, y_j + \beta_3 ln\, d_{ij} + \beta_4 \delta_{ij} + \varepsilon, \qquad (12)$$

where x_{ij} is region i's export to region j, y_i and y_j are the gross income in regions i and j, d_{ij} is the distance measure between regions i and j, δ_{ij} is a dummy variable to measure home bias, and ε is the iid error term. The major difference between the McCallum type gravity model in (12) and the gravity equation in (11) is the absence of the prices in (12). Anderson and Wincoop (2003) argue that the prices indices P_i and P_j measure "multilateral resistance" to trade; without such multilateral resistance variables, the estimation results from the gravity model are biased due to omitted variables.

The multilateral resistance terms, however, are not observables. Therefore, the gravity model derived from (11) may not be for estimations. Anderson and Wincoop (2003) shows that the vector of the prices can be solved as an implicit function of observables and parameters, i.e.,

$$P_j^{(1-\sigma)} = \sum_i P_i^{(\sigma-1)} \theta_i e^{a_1 ln\, d_{ij} + a_2(1-\sigma_{ij})}, \qquad (13)$$

where ln denotes the natural logarithm. After substituting the implicit function in (13), the gravity model in (11) becomes fully operational because it now includes only parameters and all observable variables.

Define $z_{ij} \equiv x_{ij}/y_i y_j$. Then, the gravity model we adopted in this study takes the following logarithm form:[4]

[4] Sanso, Cuairan, and Sanz (1993) show that there is little benefit to select a more complex general specification of the gravity equation than the simple log form.

$$ln(z_{ij,k}) = \alpha + \beta_1 ln(d_{ij}) + \beta_2 Home + \beta_3 ln(\theta_i) + \beta_4 ln(\theta_i) + \gamma_k H_{ij} + \varepsilon, \quad (14)$$

where i and j indicate the supply (exporting) and demand (importing) region, respectively, k indicates the industry, and α is a constant. Note that in (14), $x_{ij,k}$ is the supply of industry k's products from region i to region j. Thus our dependent variable $z_{ij,k}$ is the supply of industry k's products from region i to region j weighted by the product of income in regions i and j. The introduction of this new dependent variable in our empirical model allows us to avoid the endogeneity problem in (12) as both y_i and y_j can be endogenous. d_{ij} measures the remoteness between region i and region j. $y_{i,k}$ is the value of production in region i in industry k, while y_j is region j's income measured by the value-added in the region. H_{ij} is a vector of the relevant variables to be discussed below, while γ is a vector of the parameters. *ln* stands for natural logarithms, and ε is a Gaussian white noise error term.

A large number of studies show that bilateral trade flows are subject to the law of gravity. Two contradicting forces pull bilateral trade flows in opposite directions. While economic growth, improved economic environment, rising income, and sound economic policies promote trade, geographical barriers, cultural and social differences, transportation costs, and other trade barriers impede the flow of bilateral trade. Hence, *ex ante*, the estimate of β_1 is expected to be negative.[5]

In equation (14), *Home* is the dummy variable. It is equal to one for intra-regional

[5] In addition to the distance variable, Wolf (2000) included the GDP weighted average distance to measure the remoteness of state i for its exports to state j. Yet the estimate for the variable does not carry the expected sign, although it is statistically significant. Wolf (2000, p.557) argued that the inclusion of the remoteness variable added little to the overall explanatory power of the regression and did not significantly affect the other coefficients. We checked the results by including the same variable in various forms of our gravity model. The results reported in the paper do not change much, i.e., they are qualitatively the same and quantitatively similar. As in Wolf (2000), our estimate for the variable also carries the opposite sign as expected. Furthermore, it is sensitive to model specifications. This supports Anderson and Wincoop's (2003, p. 170) argument that "the remoteness index does not capture any of the other trade barriers that are the focus of the analysis."

trade and to zero for inter-regional trade. The estimate of the *Home* variable measures the border effect. In the absence of the border effect, the estimate of β_2 is expected to be statistically insignificant. But if the border effect is present, then the estimate is expected to be significantly positive, suggesting local residents' preference for intra-regional trade to inter-regional trade. The antilog for the estimate of β_2, namely, (exp (β_2) − 1), measures the size of the border effect (Chen, 2004).

The theoretical gravity model in section 2.1 suggests that the income share of regions i and j should be included in estimations. Specifically, a rising income share of region i will lead to a higher consumption demand in region i and thus reduces region i's exports to region j. Similarly, a rising income share of region j will lead to a higher consumption demand in region j and thus increases region j's imports from region i. Therefore, *ex ante*, the estimate of β_3 is expected to be negative, while the estimate of β_4 is expected to be positive.

The variables included in H_{ij} serve as control variables. In addition to income, many factors affect the volume of regional trade in China. Empirical results can be misleading if those important factors are not properly controlled in estimations (Xu 2002). In other words, the size of the border effect derived from the estimate of β_2 will be inaccurate and unreliable.[6] Therefore, the following proxies are constructed to measure the effects of regional intraindustry trade, transportation costs, and business environment that affect inter-regional and intra-regional trade in China.

Intraindustry trade has become increasingly important in modern trade, and a large

6 For example, Gorodnichenko and Tesar (2005) found that the border effect between the U.S. and Canada and the U.S. and Japan is negligible after controlling for the confounding factors such as the volatility and persistence of the nominal exchange rate and the cross-country heterogeneity in the distribution of within-country price differentials.

fraction of trade nowadays is intraindustry in nature, i.e., it is two-way trade in similar products. Since Balassa (1986) first coined the term of intraindustry trade, a great deal of studies have sought to explain this phenomenon (e.g., Krugman 1981, Greenaway, Hine and Milner 1995). Some studies have found correlations between trade barriers and the levels of intraindustry trade (e.g., Loertscher and Wolter 1980, Balassa 1986, and Balassa and Bauwens 1987). Davis (1995) showed that Ricardian technology differences could lead to intraindustry trade. Evenett and Keller (2002) showed that the share of intraindustry trade would rise when the products were subject to increasing returns to scale. Intraindustry trade is especially important when trade involves intermediate goods (e.g., Greenaway, Hine, and Milner 1994, and Fontagne, Freudenberg, and Peridy, 1998). Given its importance in modern trade, we construct an index to control for the intraindustry trade in China. The best known index of measuring intraindustry trade is the Grubel-Lloyd index (Grubel and Lloyd, 1975), which is given by:

$$IIT_{ij} = 100 * \left(1 - \frac{\sum_{k=1}^{n} \left| X_{ij,k} - M_{ij,k} \right|}{\sum_{k=1}^{n} \left(X_{ij,k} + M_{ij,k} \right)} \right) \tag{15}$$

where k is an identifier for a particular industry, and there are n different industries. $X_{ij,k}$ and $M_{ij,k}$ indicate the export (supply) and import (demand) in industry k, respectively. Theoretically, the value of IIT can be as high as 100 if all the trade of a region were intraindustry and if trade for each category were exactly balanced. The value of IIT can be zero, however, if none of the trade of a region is intraindustry trade but the overall trade is balanced. In this study, however, we need the information about regional intraindustry trade at a particular industry level. Therefore, we modify the Grubel-Lloyd index in (15) by not summing up the trade in all industries, namely,

$$IIT_{ij,k} = \left(1 - \frac{\left| X_{ij,k} - M_{ij,k} \right|}{\left(X_{ij,k} + M_{ij,k} \right)} \right) . \tag{16}$$

The index of intraindustry trade in equation (16) is similar to the one used by Hummels and Levinsohn (1993).[7] Since our dependent variable is the volume of total trade, we expect the estimate for the *IIT* variable to be positive.

Many earlier studies show that geographical barriers are an important factor in explaining economic growth and regional disparities (e.g., Démurger 2001; Redding and Venables, 2004). In addition to distances between regions, an appropriate measure of geographical barriers can be transportation costs. High transportation costs are a deterrent factor that discourages regional trade. Chen (2004) argued that the distance variable may not capture the effect that different goods are subject to different transportation costs when trade flows are disaggregated at the industry level. To control for such effects, Chen adopted the weight-to-value ratio proposed by Hummels (1999). Based on the data we have, we construct the following index to measure inter-regional transportation costs,[8]

$$TC_{ijk} = \frac{FT_{ijk}}{V_{ijk}} \tag{17}$$

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7 The index to measure intraindustry trade in Hummels and Levinsohn (1993) is $IIT_{ij,k} = \frac{2\min\{X_{ij,k}, X_{ji,k}\}}{\left(X_{ij,k} + X_{ji,k}\right)}$, where $X_{ij,k}$ are exports of industry k from region i to region j. To ensure that our results are robust and do not change as a result of different measures of intraindustry trade, we have in fact compared our results reported in the paper with the ones obtained using the index in Hummels and Levinsohn (1993). They are qualitatively the same and quantitatively similar with only a slight variation in the values of the estimates.

8 The index we constructed in equation (17) is similar to the ad-valorem freight rate discussed by Hummels. See Hummels (1999) for detail.

where i and j are identifies for regions i and j, while k reflects an industry. TC_{ijk} stands for transportation costs, FT_{ijk} is the value of freight traffic, including the goods in the warehouse waiting to be transported, and V_{ijk} is the value of total trade of the k industry between regions i and j, for $i \neq j$. For intra-regional transportation costs of the k industry in region i, the variable is calculated as the ratio of the value of freight traffic of the k industry in region i divided by the value of total trade of the k industry in region i. Since increases in transportation costs discourage regional trade, we expect a negative sign for the estimate.

In the literature, numerous studies show that political and economic environments are an important factor that affects trade and growth (e.g., Xu and Li 2008, and the references therein). Favorable political and economic policies promote economic growth and trade both within a region and between regions. Therefore, we construct a proxy to measure regional business environment in China. In 2003, the Development and Research Center of the State Council conducted a national survey concerning China's regional economic environment for investment and business operation. The survey covers various enterprises in China's 31 provinces and municipalities and lasted for more than four months. 3156 enterprises from all over China responded to the survey. The principle authors, Li and Hou (2008), reported the survey data in a book, entitled *China Coordinated Regional Development and Market Integration*, which was published by Economic Science Press in Beijing in 2008. Our variable for business environment in this study is a composite index, which is derived from the survey data reported in Chapter 13 of the book using the method of Principal Component Analysis. This composite index is computed based on the scores of five indices for China's regional environment for investment and business operation: legal, credit, financial, market, and social environments. The score for each index ranges from one to five. A higher score indicates better regional environment for investment and business operation. This regional composite index used in the estimations is the arithmetic mean of the scores for the corresponding provinces in the region. Since improvements in business environment promote regional trade, we expect the estimate for this variable to be positive.

3. The Data

The data needed for this study involves industry data at regional levels and is obtained from the Economic Forecast Division of China State Information Center, which compiled "Multi-regional Input-Output Model for China." The input-output model includes 30 sectors, covering 18 industries.[9] Because the final demand is not available for three industries (Smelting and Pressing of Ferrous and Non-Ferrous Metals, Machinery Repairing, and Recycling and Waste Disposal), they have to be excluded from the study. Consequently, our data covers 15 industries and 21 sectors, which are listed in Table 1. The first three digits (0XX) in the parenthesis correspond to China's industry code. The two digits after the letter C (CXX) in the parenthesis correspond to the code of a sector in China.

Mainland China has 31 provinces and municipalities. The input-output data compiled by China State Information Center, however, is only at the regional level. According to their geographical locations, the 31 provinces and municipalities are divided into eight regions. The eight regions and their corresponding provinces are listed in Table 2.[10]

Therefore, the data used in this study includes 960 observations, covering 15

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9 A sector here means a production sector, which is similar to a category based on SITI code but may not be exactly the same.

10 Because of the lack of data, Tibet is not included in the input-output table and thus in our study.

industries in China's eight regions. The summary statistics of the major variables are provided in Table 3. All variables, except the composite index of business environment, are expressed in natural logarithms.

4. Empirical Results

The estimations in this study were performed using *Stata* and *Eviews*. Because of strong evidence of the presence of heteroskedasticity, all tests were performed based on White heteroskedasticity-consistent errors.[11]

As a benchmark, we first estimate the model in equation (14) using OLS. But in cross-section studies, it is well-recognized that unobserved specific fixed effects may be correlated with some regressors. As a result, the OLS estimates may be inconsistent. Therefore, we performed the F-test to investigate if the fixed effects are indeed present in our data. The test results strongly reject the null hypothesis of no fixed effects. For example, for regional-specific fixed effects, the computed value of the F-statistic is 16.369 for the basic model under column (1) in Table 4, far greater than 2.658, the critical value at the 1% significant level with 7 and 950 degrees of freedom. For industry-specific fixed effects, the computed value of the F-statistic is 12.282 for the model under column (1) in Table 4, again far greater than the critical value of 2.101 at the 1% significant level with 14 and 943 degrees of freedom. For joint fixed effects, the computed value of the F-statistic is 15.812 for the model under column (1) in Table 4, greater than the critical value of 1.874 at the 1% significant level with 21 and 936 degrees of

[11] For example, based on White's Heteroskedasticity Test, the computed values of the test statistic are 50.955 and 238.36 for the models under column (1) and (2) in Table 4, respectively. They are far greater than 13.277 and 209.04, the critical values of the $\chi 2$ distribution at the 1% significance level with 4 and 164 degrees of freedom. The White's Heteroskedasticity Test for other models in tables 4 and 5 also strongly rejects the null hypothesis of no heteroskedasticity. Silva and Tenreyro (2006) demonstrated that the estimates of a log gravity model obtained using OLS could be highly misleading in the presence of heteroskedasticity.

freedom. The F-test for other models in tables 4 and 5 also strongly rejects the null hypothesis of no regional-specific and industry-specific fixed effects. But for comparisons, we report the results without the fixed effects under column (1) in Table 4.[12]

The results reported under columns (1) and (2) in Table 4 are the ones for the basic model in (12) without any regional and control variables. The estimates for both variables are statistically significant at the 1% level, and the adjusted R^2 ranges from 0.717 to 0.786, suggesting that the model explains the dependent variable reasonably well. The significantly negative estimate for the distance variable suggests regional trade in China is impaired by geographical distances. The estimate for the ***Home*** variable is significantly positive, indicating the presence of border effects in China's regional markets. But these results can be misleading because of omitted variable bias (see, Anderson and Wincoop 2003).[13] To correct the problem, we estimate various forms of the gravity model in (14) by including regional variables for transportation costs, business environment, and intraindustry trade as the control variables, as well as the income shares, to measure multilateral resistances. The results are reported under columns (3) – (8) in Table 4.

There are a few interesting observations from the results reported under columns (3) – (8) in Table 4. First, the estimates in the basic model all carry the same signs and remain statistically significant at the 1% level in the extended model, suggesting our results are robust. Second, the estimates for the income shares, θ_i and θ_j, carry the signs as expected, i.e., an increase in region *i*'s income reduces its exports to other regions and an increase in region

12 Egger (2000) argues that random effects specifications of gravity models are problematic and fixed effects specifications are superior to the random effects specifications.

13 We have performed various omitted variable tests for the basic model in (12) and found that the null hypotheses of no omitted variables are strongly rejected in all cases.

j's income increases its imports from region *i*. The estimate for θ_i is statistically significant at the 1% level under all models. The estimate for θ_j is statistically significant only at the 17% level for the models under columns (3) – (4) and (7) – (8) but becomes statistically significant at the 1% level for the models under columns (5) and (6) when the average border effect at the national level is broken down to regional border effects. Third, the estimates for transportation costs, business environment, and intraindustry trade all carry the signs as expected and are statistically significant at the 1% level. Since all variables, except the dummies, were measured in natural logarithms, the values of the estimates can be interpreted as the "elasticity" of bilateral trade volume with respect to a particular variable. Hence, a one percent increase in transportation costs, i.e., the ratio of the value of freight traffic of the *k* industry in region *i* divided by gross output of the *k* industry in region *i*, will reduce the regional trade volume by approximately 0.75%. On the other hand, a one percentage increase in the index of intraindustry trade will cause regional trade volume to rise by about 0.10%, while a one percentage increase in the composite index of business environment will promote regional trade flow by about 2.61% – 3.04%. Forth, among all the variables in the extended model, the variable for business environment has the largest impact on promoting regional trade volume. This result signifies not only the importance of business environment in nursing regional trade in China but also the need for governments at all levels in China to continue improving business environment. Finally, compared with the basic model, the extended model is better. The adjusted R^2 increases sharply with the control variables being included in the regressions. For example, the adjusted R^2 is 0.786 for the basic model under column (2), but it becomes more than 0.920 for the extended model under columns (3)-(4)

and (7)-(8) and 0.934 for the model under columns (5)-(6). In fact, we have used Schwarz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) to check for the choice of appropriate models. In all cases, both SBC and AIC pointed to the model under column (5) in Table 4 as the best model. The value of SBC (AIC) is 1.325 (1.142) for the model under column (5), as compared with higher values from other specifications.

Since the focus of this study is the border effect in China's domestic markets, the estimate for the ***Home*** variable deserves special attention. First, the estimate remains significantly positive at the 1% level under all forms of the extended model, suggesting the presence of the border effect in China's regional markets. Second, with the inclusion of regional variables to control of transportation costs, business environment, intraindustry trade, and regional and industry fixed effects, as well as the income shares, the values of the estimate for the ***Home*** variable are lower than those obtained under the basic model; the difference is statistically significant at the 1% level based on the Wald test. The value of the estimate for the ***Home*** variable under column (3) is 2.01, which translates to an overall regional border effect of 6.46 times at the national level, a much lower value than those found in earlier studies.

The border effect can be made more intuitive and explicit by calculating the tariff-equivalent of a border (Wei, 1996). The *ad valorem* of tariff equivalent of a border can be obtained by taking the antilog of the ratio of the estimate for the ***Home*** variable to the elasticity of substitution between home and foreign goods, i.e., $\exp(\hat{\beta}_4/(\sigma-1)-1)$, where $\hat{\beta}_4$ is the estimate for the ***Home*** variable and $(\sigma-1)$ measures the elasticity of substitution between home and foreign goods. This requires an assumption about the elasticity of substitution between the home and foreign goods, and we assume σ–1=8.[14] Therefore, based on the estimate for the ***Home*** variable under column (3) in Table 4 and the value of σ–1=8, the tariff-equivalent "border effect" in China at the national level is about 29%, which is seven percentage points lower than that obtained under the basic model under column (2).

With the knowledge of overall regional border effects at the national level, we further investigate if there are differences in the border effect across various regions. Therefore, we break down the average border effect obtained under column (3) from the national level to regional levels by including the dummy ***Home*Region.*** The results are reported under columns (5). The region with the lowest border effect is the Central Coastal Region (Region 4), which includes Shanghai, Jiangsu, and Zhejiang. Yet the region with the highest border effect is the North Municipalities (Region 2), which includes China's capital city Beijing and its neighbor Tianjin. The difference between the two regions is about 20 times.

We have the following explanations for the drastic difference in border effects between the Central Coastal Region and the North Municipalities. First, total GDP in the North Municipalities is the smallest among the eight regions.[15] Anderson and Wincoop (2003, p 177) demonstrated that a uniform increase in trade barriers would raise multilateral resistance more for a small country than a large country. This implies that given the level of trade barriers, multilateral resistance (thus border effects) will be higher for the regions with

[14] The estimate for the log of relative price in the gravity model may be a good candidate for σ–1. However, Head and Mayer (2000) found that the elasticity of substitution between home and foreign goods obtained based on the estimate for the log of relative price was unreasonably small. Hence, they assumed σ–1=8, the average value of the elasticity of substitution found in Head and Ries (1999). Following Head and Mayer (22005), Poncet (2005) also made the same assumption about the value of the elasticity of substitution in calculating China's tariff-equivalent "border effect".

[15] For example, total regional GDP in 2008 (in billions of current RMB) is 2819.56 for the Northeast Region, 1684.24 for the North Municipalities, 4726.07 for the North Coastal Region, 6549.77 for the Central Coastal Region, 4797.88 for the South Coastal Region, 6318.80 for the Central Region, 2405.27 for the Northwest Region, and 3380.80 for the Southwest Region.

smaller total GDP than for the regions with higher total GDP. Second, it is widely believed that Jiangsu, Zhejiang and Shanghai are the most open area in China, whereas government regulations and controls are tighter in China's capital city of Beijing and its vicinity. It is without saying that more government regulations and controls translate to larger border effects for the North Municipalities and increase the cost of doing business in the region. Our findings here simply provide empirical evidence for this popular belief.

To check if there are differences in the border effect across various industries, we have introduced the interaction dummies between the ***Home*** variable and the industry dummies. The results are reported under column (7) in Table 4. The largest border effect is detected in the industry of Metal Products (015), while the smallest one is in the Petroleum and Coking industry (011). The former has a border effect of 8.71 times (exp(2.273) – 1), while the latter has a border effect of 5.13 times (exp(1.814) – 1). Again, there is clear evidence of significant differences in the border effect for China's different industries.

To control for commodity substitutions between similar products, we have constructed the index for intraindustry trade. Yet we want to explore further if the border effect discussed above is affected by local intraindustry trade activities. Hence, we introduced another regional variable, the interaction of the ***Home*** variable and the log of the index for intraindustry trade. The results are reported under columns (4), (6) and (8) in Table 4. The estimate for the dummy ***Home*Ln*(*IIT*)** is statistically significant at the national level under columns (4) and (8). The control of local intraindustry activities produces two outcomes. First, the effect of intraindustry trade on regional trade volumes increases by about 10%. Second, the average border effect has reduced from 6.46 times to 5.30 times at the national level.

Based on the estimate for the ***Home*** variable under column (4) in Table 4, the tariff-equivalent "border effect" in China at the national level is now less than 26%.

The estimate for the dummy ***Home*Ln*(*IIT*)**, however, is statistically insignificant at the regional level. This is expected because intraindustry trade should have little influence, if any, on the border effect of a particular region, which mainly results from local government protections and other regional trade barriers. To see if it is indeed the case, we performed tests by including the dummies ***Home*Region*$_x$***Ln*(*IIT*)** for every region, where $\boldsymbol{x}$ = 1, 2, …, 8. In all cases, none of the estimates for the dummies is statistically significant. Hence, it is evident that intraindustry trade does not affect regional border effects, and the differences in regional border effects reported under column (5) are mainly attributed to government policies and other regional trade barriers. To summarize, the estimate for ***Home*Ln*(*IIT*)** is statistically insignificant at the regional level, suggesting intraindustry trade has little influence on the border effect of a particular region. But including the dummy variable ***Home*Ln*(*IIT*)** in the regression reduces regional border effects, although the reduction is not as pronounced as that for the overall border effect at the national level.

Since intraindustry trade does not affect China's regional border effects, the noticeable reduction of the border effect at the national level, when the dummy ***Home*Ln*(*IIT*)** is included in the regression, must result from significant reductions of the border effect at the industry level. To verify, we performed the tests by adding the dummy to the models under column (7) in Table 4, and the results are reported under column (8) in the same table. The estimates for the dummy ***Home*Ln*(*IIT*)** are now statistically significant at the 2% level, suggesting that intraindustry trade is indeed an important factor that helps explain the border effect at the industry level. The inclusion of the variable produces the following interesting results. First, the effect of intraindustry trade on regional trade volumes increases from 0.093 to 0.100, a result that is consistent with the one reported above. Second, although the order of the border effect upholds for each industry, the size of the industrial border effect has been reduced significantly when the dummy is included as an additional regressor. The largest reduction occurs in the industries of Non-metal Mineral Products (013), Metal Products (015), Machinery Manufacture (016), and Instruments, Meter, Cultural and Clerical Machinery (020), a reduction of more than 10%. The smallest reduction occurs in the industries of Textile, Telecommunication, and Other industry, which are only 3.2%, 5.7% and 6.4%, respectively.

Therefore, with the control of local intraindustry trade activities, our results reveal much smaller industrial border effects for all industries. Yet local intraindustry trade activities appear to have great impact on China's industries for producing capital and intermediate goods and little impact on the industries producing consumption goods. Greenaway, Hine, and Milner (1994) and Fontagne, Freudenberg, and Peridy (1998) argued that intraindustry trade is especially important when trade involves intermediate goods. Because of the heterogeneity nature of capital and intermediate goods, it is hard for the industry to substitute one product for another. As a result, one may observe heavy intraindustry trade activity. But the level of substitution is generally high for consumption goods. Therefore, it is not surprising if one observes higher levels of government protections and other regional trade barriers in those industries.

5. Empirical Results as Robust Tests

The results reported in the previous sections are the central results of the paper. But we want to know if they are robust when alternative measures of trade are used. Since our data includes regional expenditures on final goods and intermediate goods at the industry level, we use them to construct two alternative measures of regional trade. Our dependent variables are now the log of total expenditures on industry *k*'s final and intermediate goods imported from region *i* to region *j* weighted by the product of income in region *i* and rejoin *j*. The regression results with various specifications of the model are reported in Table 5.

We summarize the results in Table 5 as follows. First, all results reported in tables 4 are retained. Specifically, all estimates carry the signs as expected, i.e., income share in region *j*, business environment, and intraindustry trade all have positive effects on regional expenditures on final goods and intermediate goods at the industry level, while distances, income share in rejoin *i*, and transportation costs have negative effects on the dependent variables. They suggest that the empirical results reported in our paper are robust. Second, the estimates for business environment and intraindustry trade are statistically insignificant when expenditures on final goods are used as a measure of regional trade, whereas they are statistically significant when expenditures on intermediate goods are used as a measure of regional trade, suggesting that the control variables we adopted in this paper are appropriate.

Third, the estimate for the ***Home*** variable remains significantly positive, indicating the presence of the border effect in China's domestic markets and regional trade. The values of the estimates are equal to 2.102 (column 9) and 1.994 (column 15) at the national level. With the inclusion of regional variable to control for local intraindustry activities, however, the border effect has markedly reduced. The values of the estimates are now 1.852 (column 10) and 1.836 (column 16), translating to the border effect of 5.37 times for the final goods and 5.27 times for the intermediate goods. Still, there are significant differences in border effects in various regions and industries. The region displaying the highest border effect is the North Municipalities (Region 2), whereas the region showing the lowest border effect is the Central Coastal Region (Region 4). The former consists of China's capital city of Beijing and its neighboring municipalities of Tianjin, while the latter includes Shanghai, Jiangsu and Zhejiang. The border effect for the North municipalities is 24.29 times for the final goods but 21.27 times for intermediate goods. Yet for the Central Coastal Region, it is only 2.27 times for final goods and 2.54 times for intermediate goods. The industry showing the largest border effect is Metal Product (015) for both final and intermediate goods, while that with the lowest border effect is Telecommunications (019) for final goods but Petroleum and Coking (011) for intermediate goods.

Fourth, as reported in Table 4, the border effect becomes smaller with the control of local intraindustry trade activities. The largest reduction occurs in the industries of Non-metal Mineral products (013) and Instruments, Meters, Cultural and Clerical Machinery (020). The reduction is more than 20% for final goods and more than 10% for intermediate goods.

Finally, the estimate for business environment is positive and statistically significant at the 1% level under columns (15) – (20), suggesting the positive impact of improving environment for investment and business operation on regional trade in intermediate goods. Furthermore, the value of the estimate has been elevated when expenditures on intermediate goods are used as the dependent variable. For instance, compared with 3.031 under column (6) in Table 4, the estimate under column (18) in Table 5 is now 4.049, a 33% increase in the value of the elasticity. As evidenced from the results reported in Tables 4 and 5, our study shows that better business environment has the largest positive effects on regional trade in China.

6. Conclusions

Facing the recent global economic crisis, the Chinese central government revealed its intention to promote domestic demand and expand domestic markets, along with a massive bail-out plan in 2008. The new growth strategy can be a milestone in China's history because it signifies China's move onto the path of long-run sustainable growth. Yet the success of the strategy depends critically on integrations of China's domestic markets.

Market integrations are typically examined through the border effect. In this paper, we find evidence of border effects in China's regional markets; but they are smaller than some earlier studies suggested. With the inclusion of regional variables to control of transaction costs, business environment, and intraindustry trade, the estimated border effect ranges from 5.3 to 6.5 times at the national level. Yet we find significant differences in regional border effects. The North Municipalities (Beijing and Tianjin) show the highest border effect, ranging from 21 – 22 times. On the other hand, the Central Costal Region (Shanghai, Jiangsu and Zhejiang) displays the lowest border effect, about 2.3 times. The finding of such a drastic difference in border effects between the North Municipalities and the Central Costal Region is consistent with the observation that Jiangsu, Zhejiang and Shanghai are the most open area in China, while government regulations and controls are typically tighter in China's capital city of Beijing and its vicinity. It suggests that tighter government regulations and controls translate to larger border effects and increase the cost of doing business in the region.

Our results also show that the growth of income, reduction of transportation costs, and increase of intraindustry trade all have positive effects on the volume of regional trade in China. Among all the factors under investigation, better business environment robustly shows the largest positive impact on lifting China's regional trade. Therefore, improving business environment further should be the priority of governments at all levels in China.

Table 1: The 15 industries and 21 sectors

Industries	**Sectors**
Food and Tobacco (006)	Food Production (C14); Manufacture of Tobacco (C16)
Textile (007)	Manufacture of Textile (C17)
Garments, Leathers and Fiber Products (008)	Garments and Other Fiber Products (C18); Leathers, Furs, Down and Related Products (C19)
Timber Processing and Furniture Manufacture (009)	Timber Processing, Bamboo, Cane, Palm Fiber and Straw Products (C20); Manufacture of Furniture (C21)
Paper, Printing, and Cultural and Sports Goods (010)	Papermaking and Paper Products (C22); Printing, Reproduction of Recording Media (C23); Cultural, Educational and Sports Goods (C24)
Petroleum and Coking (011)	Petroleum Refining and Coking (C25)
Chemical (012)	Raw Chemical Materials and Chemical Products (C26)
Nonmetal Mineral Products (013)	Nonmetal Mineral Products (C31)
Metal Products (015)	Manufacture of Metal Products (C34)
Machinery Manufacture (016)	Manufacture of General Purpose Machinery (C35); Manufacture of Special Purpose Machinery (C36)
Transport Equipment (017)	Manufacture of Transport Equipment (C37)
Electrical Machinery and Equipment (018)	Electrical Machinery and Equipment (C40)
Telecommunications (019)	Electronic and Telecommunications (C41)
Instruments, Meters, Cultural and Clerical Machinery (020)	Instruments, Meters, Cultural and Clerical Machinery (C42)
Other Manufacture (022)	Other Production (C43)

Table 2: The Eight Regions and the Provinces in Each Region

Regions	**Provinces**
(1) Northeast Region	Heilongjiang, Jilin, and Liaoning
(2) North Municipalities	Beijing and Tianjin
(3) North Coastal Region	Hebei and Shandong
(4) Central Coastal Region	Shanghai, Jiangsu, and Zhejiang
(5) South Coastal Region	Fujian, Guangdong, and Hainan
(6) Central Region	Shanxi, Henan, Anhui, Hubei, Hunan, and Jiangxi
(7) Northwest Region	Inner Mongolia, Shaanxi, Ningxia, Gansu, Qinghai, and Xinjiang
(8) Southwest Region	Sichuan, Chongqing, Yunnan, Guizhou, Guanxi, and Tibet

Table 3: Summary Statistics [1]

	Obs	Mean	Std. Dev.	Minimum	Maximum
$Ln(X_{ij,k})$	960	11.571	2.056	5.352	17.467
$Ln(Y_{i,k})$	960	15.345	1.126	11.875	17.698
$Ln(Y_j)$	960	18.191	0.479	17.269	18.741
$Ln(\theta_i)$	960	-2.395	0.838	-4.310	0.798
$Ln(\theta_j)$	960	-2.181	0.479	-3.103	-1.631
$Ln(Wei_{ij})$	960	6.767	0.800	4.497	7.718
$Ln(Transport_{ij,k})$	960	-3.582	1.144	-6.644	-0.062
Env	960	3.282	0.180	3.032	3.569
$Ln(IIT_{ij,k})$	960	-0.561	0.486	-3.064	0.000
$Ln(FE_{ij,k})$	960	10.017	2.303	1.946	16.730
$Ln(IE_{ij,k})$	960	11.163	2.047	5.226	17.412

1 $Ln(X_{ij,k})$ is the supply from region i to region j, including both inter-regional $X_{ij,k}$ ($i \neq j$) and intra-regional $X_{ij,k}$ ($i = j$) trade volumes. $Ln(Y_{i,k})$ is the value of production in region i in industry k, while $Ln(Y_j)$ is region j's income measured by the value-added in the region. $Ln(\theta_i)$ and $Ln(\theta_j)$ are the income shares of regions i and j. $Ln(Wei_{ij})$ is the distance measure based on Wei (1996). $Ln(Transport_{ij,k})$ is the index of transportation costs. ***Env*** is the composite index for business environment. $Ln(IIT_{ij,k})$ is the index for intraindustry trade. $Ln(FE_{ij,k})$ and $Ln(IE_{ij,k})$ are expenditures on final goods and intermediate goods supplied by region i to region j. ***Ln*** is the identifier for natural logarithms.

Table 4: Border Effects in China's Regional Markets[1]

Dependent variable: $Ln(z_{ij,k})$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
***Ln*(Wei_{ij})**	-0.864[2]	-0.755[2]	-1.022[2]	-1.018[2]	-0.974[2]	-0.973[2]	-1.017[2]	-1.014[2]
	(0.064)	(0.062)	(0.039)	(0.039)	(0.037)	(0.037)	(0.040)	(0.039)
Home	2.270[2]	2.496[2]	2.010[2]	1.841[2]				
	(0.135)	(0.142)	(0.090)	(0.119)				
***Ln*(θ_i)**			-0.142[2]	-0.130[2]	-0.143[2]	-0.140[2]	-0.140[2]	-0.128[2]
			(0.031)	(0.031)	(0.029)	(0.029)	(0.031)	(0.032)
***Ln*(θ_j)**			0.049	0.049	0.167[2]	0.167[2]	0.046	0.047
			(0.036)	(0.036)	(0.035)	(0.035)	(0.036)	(0.036)
***Ln*(*Transport*)**			-0.746[2]	-0.740[2]	-0.750[2]	-0.749[2]	-0.736[2]	-0.731[2]
			(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)
Ln(Env)			2.651[2]	2.653[2]	3.036[2]	3.031[2]	2.608[2]	2.618[2]
			(0.308)	(0.306)	(0.309)	(0.310)	(0.310)	(0.309)
Ln(IIT)			0.089[2]	0.098[2]	0.101[2]	0.103[2]	0.093[2]	0.100[2]
			(0.033)	(0.033)	(0.032)	(0.033)	(0.033)	(0.033)
Home*Ln(IIT)				-0.953[2]		-0.208		-0.939[3]
				(0.385)		(0.258)		(0.416)
Home*Region1					2.682[2]	2.639[2]		
					(0.101)	(0.104)		
Home*Region2					3.129[2]	3.096[2]		
					(0.104)	(0.112)		
Home*Region3					1.299[2]	1.277[2]		
					(0.113)	(0.116)		
Home*Region4					1.225[2]	1.198[2]		
					(0.108)	(0.106)		
Home*Region5					2.087[2]	2.045[2]		
					(0.128)	(0.139)		
Home*Region6					1.805[2]	1.769[2]		
					(0.097)	(0.108)		
Home*Region7					2.322[2]	2.270[2]		
					(0.112)	(0.134)		
Home*Region8					2.291[2]	2.255[2]		
					(0.115)	(0.122)		
Home*I006							1.977[2]	1.859[2]
							(0.215)	(0.221)
Home*I007							2.114[2]	2.047[2]
							(0.282)	(0.279)
Home*I008							1.888[2]	1.724[2]
							(0.250)	(0.257)
Home*I009							1.992[2]	1.816[2]
							(0.221)	(0.243)
Home*I010							2.116[2]	1.944[2]
							(0.207)	(0.213)
Home*I011							1.814[2]	1.633[2]
							(0.218)	(0.261)

Home*I012							1.897[2]	1.770[2]
							(0.194)	(0.202)
Home*I013							2.186[2]	1.945[2]
							(0.191)	(0.207)
Home*I015							2.273[2]	2.062[2]
							(0.180)	(0.230)
Home*I016							2.114[2]	1.859[2]
							(0.204)	(0.227)
Home*I017							1.981[2]	1.829[2]
							(0.195)	(0.213)
Home*I018							1.994[2]	1.867[2]
							(0.225)	(0.218)
Home*I019							1.829[2]	1.730[2]
							(0.182)	(0.183)
Home*I020							2.100[2]	1.864[2]
							(0.184)	(0.199)
Home*I022							1.977[2]	1.781[2]
							(0.217)	(0.253)
Constant	-16.406[2]	-17.521[2]	-21.527[2]	-21.492[2]	-22.151[2]	-22.138[2]	-21.467[2]	-21.450[2]
	(0.448)	(0.446)	(0.490)	(0.488)	(0.469)	(0.470)	(0.491)	(0.489)
Fixed Effects 1:	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects 2:	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R2	0.717	0.786	0.921	0.922	0.934	0.934	0.920	0.921
F-statistic	1215.3	154.5	400.3	389.3	390.3	379.2	265.2	260.4

1 The dependent variable is $\boldsymbol{Ln(z_{ij,k})} \equiv x_{ij}/y_i y_j$, the log of the supply of industry *k*'s products from region *i* to region *j* weighted by the product of income in regions *i* and *j*. There are a total of 960 observations in each regression. The values in the parentheses are the standard errors for the estimates. Because heteroskedasticity is found in the regressions, the White Heteroskedasticity-consistent standard errors are reported. ***Fixed Effects 1*** stands for the control of regional-specific fixed effects, while ***Fixed Effects 2***stands for the control of industry-specific fixed effects. ***Adj R²*** is the adjusted R^2.

2 The estimates are significant at the 1% level.

3 The estimates are significant at the 5% level.

Table 5: Border Effects in China — Expenditure on Final Goods & Intermediate Goods[1]

Dependent variable: ***Ln($zf_{ij,k}$)*** **&** ***Ln($zi_{ij,k}$)***

	Ln($zf_{ij,k}$)						Ln($zi_{ij,k}$)					
	(9)	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**
Ln(Wei_{ij})	-1.006[2]	-1.001[2]	-0.956[2]	-0.954[2]	-1.001[2]	-0.997[2]	-1.012[2]	-1.009[2]	-0.964[2]	-0.963[2]	-1.008[2]	-1.006[2]
	(0.053)	(0.052)	(0.051)	(0.051)	(0.053)	(0.053)	(0.043)	(0.043)	(0.041)	(0.041)	(0.043)	(0.043)
Home	2.102[2]	1.852[2]					1.994[2]	1.836[2]				
	(0.124)	(0.165)					(0.096)	(0.122)				
Ln(θi)	-0.158[2]	-0.140[2]	-0.159[2]	-0.152[2]	-0.156[2]	-0.136[2]	-0.140[2]	-0.128[2]	-0.140[2]	-0.137[2]	-0.138[2]	-0.127[2]
	(0.045)	(0.045)	(0.043)	(0.043)	(0.045)	(0.046)	(0.033)	(0.034)	(0.030)	(0.031)	(0.033)	(0.034)
Ln(θj)	0.038	0.039	0.163[2]	0.162[2]	0.034	0.037	0.049	0.050	0.163[2]	0.163[2]	0.046	0.047
	(0.046)	(0.046)	(0.046)	(0.047)	(0.046)	(0.047)	(0.036)	(0.036)	(0.035)	(0.035)	(0.037)	(0.037)
Ln(Transport)	-0.722[2]	-0.712[2]	-0.726[2]	-0.723[2]	-0.710[2]	-0.702[2]	-0.737[2]	-0.731[2]	-0.740[2]	-0.738[2]	-0.727[2]	-0.724[2]
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.022)
Ln(Env)	0.063	0.066	0.555	0.541	0.016	0.032	3.687[2]	3.688[2]	4.055[2]	4.049[2]	3.648	3.656[2]
	(0.411)	(0.409)	(0.419)	(0.419)	(0.412)	(0.410)	(0.321)	(0.320)	(0.327)	(0.327)	(0.323)	(0.322)
Ln(IIT)	0.040	0.052	0.055	0.059	0.040	0.053	0.138[2]	0.146[2]	0.149[2]	0.151[2]	0.142[2]	0.149[2]
	(0.042)	(0.042)	(0.042)	(0.042)	(0.043)	(0.043)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)
Home*Ln(IIT)		-1.407[2]		-0.533		-1.547[2]		-0.889[3]		-0.220		-0.791[3]
		(0.526)		(0.418)		(0.563)		(0.386)		(0.270)		(0.413)
Home*Region1			2.598[2]	2.488[2]					2.773[2]	2.727[2]		
			(0.172)	(0.187)					(0.115)	(0.118)		
Home*Region2			3.230[2]	3.145[2]					3.104[2]	3.068[2]		
			(0.179)	(0.193)					(0.114)	(0.122)		
Home*Region3			1.287[2]	1.229[2]					1.332[2]	1.308[2]		
			(0.173)	(0.178)					(0.126)	(0.128)		
Home*Region4			1.185[2]	1.114[2]					1.264[2]	1.235[2]		
			(0.215)	(0.218)					(0.106)	(0.107)		
Home*Region5			2.094[2]	1.987[2]					2.079[2]	2.035[2]		
			(0.173)	(0.193)					(0.147)	(0.154)		

Home*Region6	1.961[2]	1.867[2]			1.755[2]	1.716[2]		
	(0.139)	(0.160)			(0.107)	(0.118)		
Home*Region7	2.633[2]	2.499[2]			2.204[2]	2.149[2]		
	(0.176)	(0.226)			(0.124)	(0.146)		
Home*Region8	2.602[2]	2.508[2]			2.211[2]	2.173[2]		
	(0.154)	(0.172)			(0.134)	(0.142)		
Home*I006			2.025[2]	1.830[2]			1.973[2]	1.873[2]
			(0.221)	(0.231)			(0.209)	(0.217)
Home*I007			2.391[2]	2.281[2]			1.960[2]	1.904[2]
			(0.398)	(0.402)			(0.290)	(0.286)
Home*I008			1.895[2]	1.625[2]			2.025[2]	1.887[2]
			(0.298)	(0.313)			(0.226)	(0.227)
Home*I009			1.996[2]	1.707[2]			1.969[2]	1.821[2]
			(0.343)	(0.370)			(0.216)	(0.239)
Home*I010			2.235[2]	1.952[2]			2.107[2]	1.963[2]
			(0.248)	(0.270)			(0.217)	(0.220)
Home*I011			2.025[2]	1.728[2]			1.780[2]	1.627[2]
			(0.214)	(0.253)			(0.228)	(0.270)
Home*I012			1.959[2]	1.750[2]			1.885[2]	1.778[2]
			(0.252)	(0.266)			(0.207)	(0.214)
Home*I013			2.175[2]	1.778[2]			2.206[2]	2.003[2]
			(0.205)	(0.232)			(0.205)	(0.221)
Home*I015			2.402[2]	2.054[2]			2.263[2]	2.085[2]
			(0.302)	(0.361)			(0.185)	(0.227)
Home*I016			2.213[2]	1.794[2]			2.090[2]	1.875[2]
			(0.261)	(0.281)			(0.208)	(0.242)
Home*I017			2.111[2]	1.861[2]			1.927[2]	1.798[2]
			(0.180)	(0.202)			(0.236)	(0.255)
Home*I018			2.020[2]	1.809[2]			2.008[2]	1.900[2]
			(0.244)	(0.234)			(0.242)	(0.237)
Home*I019			1.865[2]	1.702[2]			1.806[2]	1.722[2]
			(0.228)	(0.231)			(0.214)	(0.216)
Home*I020			2.288[2]	1.898[2]			2.057[2]	1.858[2]
			(0.377)	(0.403)			(0.209)	(0.224)
Home*I022			2.046[2]	1.724[2]			1.942[2]	1.777[2]

					(0.292)	(0.345)					(0.199)	(0.228)
Constant	-19.134[2]	-19.082[2]	-19.857[2]	-19.824[2]	-19.060[2]	-19.031	-23.634[2]	-23.601[2]	-24.263[2]	-24.249[2]	-23.582[2]	-23.567[2]
	(0.637)	(0.634)	(0.621)	(0.622)	(0.638)	(0.635)	(0.520)	(0.519)	(0.510)	(0.512)	(0.522)	(0.521)
Fixed Effects 1:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects 2:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R2	0.892	0.893	0.903	0.903	0.891	0.892	0.915	0.915	0.927	0.927	0.914	0.914
F-statistic	283.4	276.1	256.5	249.5	187.6	184.9	368.8	358.0	351.1	341.1	244.2	239.3

1 The dependent variable, $\mathbf{Ln(zf_{ij,k})} \equiv FE_{ij,k}/y_i y_j$, is the log of total expenditure on industry *k*'s final goods imported from region *i* to region *j* weighted by the product of income in regions *i* and *j*, while the dependent variable, $\mathbf{Ln(zi_{ij,k})} \equiv IE_{ij,k}/y_i y_j$, is the log of total expenditure on industry *k*'s intermediate goods imported from region *i* to region *j* weighted by the product of income in regions *i* and *j*, . See footnote 1 in Table 4 for other explanations.

2 The estimates are significant at the 1% level.

3 The estimates are significant at the 5% level.

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