3-1-2019

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JEL classification：F15; R12; R58

We are grateful to Yi Lu and Chu Wei for their helpful comments and suggestions. We thank Yingxin Gao and Yanxin Chen for their excellent research assistance. Research support from China's National Social Science Fund is gratefully acknowledged.

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Abstract

Following a two-region border effect model with consumption preference of local governments, this paper exams the segmentation of Chinese domestic market as well as its determinants. Through empirical tests, we find that the average border effect of domestic trade among provinces in China showed an upward trend during 1997-2002 and 2002-2010. The significant difference of border effects between western and eastern area of China indicates more regional trade barriers in western area than in eastern area. In addition, compared to agricultural products, there are less trade barriers on industrial products. This partially verifies that there are more trade protection and self-consumption from local government on raw materials. Under the local governments' preference for regional protection, the higher degree of financial autonomy and larger output share of SOEs will both significantly contribute to the trade barriers among provinces. Local governments' behavior is the key to understand the pattern of border effects among provinces.

Key words: border effect; consumption preference; market segmentation

1. Introduction

In the past three decades, China has gradually transited from a plan economy to a market orientated economy. Chinese provinces had long been thought as homogenous in economic structure before the economic reform in 1978. The landscape inherited from the centrally planned economy was more like a cluster of independent economies separated by various forms of artificial barriers, so that the market was not sufficient for interregional trade to develop (Sonin, 2010; Chen, 2004). Therefore the traditional free trade theories are of little help to guide China's development. Fortunately, the profound economic reforms initiated by Chinese authorities in 1980s make it possible to withdraw large government intervention from factor allocation, transportation and price setting of goods. The average degree of trade openness had grown from 14% in 1987 to 37% in 1997. The central government in China has paid more and more attention to the transition from planned economy to market one in order to get its main objective of forming a unified market. According to China's "twelfth five-year plan", it is the right time to narrow down the economy gap between different regions, promote the market integration and build a harmonious society.

However, the performance of domestic market integration in China was not clear（Bruna et al., 2002. Tiebout's (1956) "voting by foot" principle suggests that the decentralized system is necessary for the competition among provinces, local governments' efficiency improvement and

economic development. Many scholars held the view that the local interests were strengthened and more regional trade barriers had appeared in the process of reforms, especially after the tax decentralization reform in 1994. Several researches showed that there was a downward trend in inter-province domestic trade[1]. The declining imports from other provinces in total goods absorption was compensated by growing shares of both international and locally produced goods (Zhao et. al, 2013). Suffering from the lack of the direct data and interpretation problems, only a few studies have so far performed direct empirical tests on the evolution of domestic trade integration in China. Provincial input–output (IO) tables are probably the only data sources that enable researches on this topic. Naughton (2003) examines inter-provincial trade flows extracted from provincial IO tables. However, these analyses are limited to the years from 1987 to 1992, and few researches in previous literature have made direct empirical tests on the recent trend of domestic market integration in China after 1997.

This paper argues that the decrease in the intensity of inter-provincial trade flow is not only due to the internationalization process but also due to the increase in intra-provincial trade intensity (greater self-sufficiency of provinces), which may result in higher degree of the market segmentation in China. Because of the preferential policies to the coastal areas and the price distortion of "scissors difference" (Jian-dao-cha), the inner land has to adjust its strategy to develop the import-substituted industries. With the incentive of economic expansion, the local governments abuse their administrative powers to arrange or even decide the allocation of the resources, which promotes the economic growth by reducing the transaction cost, but leads to higher domestic segmentations.

We develop a two-region border effect model with consumption preference of local governments to check the degree and evolution of domestic market segmentation in China, and then further investigate the main determinants driving the inter-provincial border effects. Through empirical tests, we find that the average border effect of domestic trade among provinces in China showed an upward trend during 1997-2002 and 2002-2010. The difference of border effect between western and eastern area of China is significant, implicating more regional barriers in western area than in eastern area. In addition, the trade barriers on industrial products are looser than that on agricultural products, partially verifying that there is stronger trade protection by local governments on raw materials. Our empirical test on the determinates of border effects also indicates that the local governments' preference for regional protections, the autonomy on taxes and similar economy

[1] Using inter-provincial domestic trade data, Zhao et. al. (2013) got the similar conclusion to Naughton (1999) that the domestic trade occupies large percentage in both GDP and total trade volume. The domestic trade volume took up 54%, 50% and 38% of GDP in 1987, 1992 and 1997 respectively, which was much larger than the trade volume among countries or regions in Western Europe, NAFTA and ASEAN. However, the inter-provincial trade volume takes up 88%, 80% and 66% of total trade volume in 1987, 1992, and 1997 respectively, indicating a downward trend of domestic trade.

structures are the main causes of the trade barriers among provinces.

The main contribution of this paper is that we extend the traditional border effect model of international trade to a border effect model of domestic trade among Chinese provinces by incorporating Chinese local governments' consumption preference. We not only empirically show the recent evolution of the border effects in different provinces and industries in China from 1997 to 2005, but also test the determinants of the border effects. The empirical results of this paper will help us better understand the recent trend of domestic market segmentation in China as well as the reasons behind.

This paper proceeds as follows: Section 2 provides a brief review of the literature. Section 3 outlines the theoretical framework. It presents the two key factors that affect the pattern of trade, namely the "home bias" and the "consumption preference of public expenditure". Section 4 and 5 describe the data and calculate the border effect measures for different provinces in China. Section 6 investigates the main determinants of the border effects and undertakes several robustness checks. Section 7 makes a conclusion.

2. The Evolution of China's Domestic Market Integration

Historical evidences indicate that a well-developed network of trade existed in ancient China, forming market integration both locally, across provincial borders and even to other countries[2]. Interregional trade kept growing beyond the traditional agriculture and metal industry until Qing Dynasty disappeared. The following Second World War and an ongoing Chinese civil war had broken China's market into chaos. Ever since the Communist party came to rule after the war, it have had the authoritative control over China, with some disputes about who was going to be the leader later on until the 1980s (Fleisher and Yang, 2005). The political disaster and movements delayed the free market-reform.

China's transition to a market system started with gradual experimentation such as on price reforms (Fung, Kummer, and Shen 2006). In 1993, "the decisions on solutions to build the economy system in socialism market economy" issued by the Third Plenum of the 14th CPC pointed out that it was necessary to build an free market with full competition, to integrate the domestic and international markets and to optimize the resource allocation. During this process, the central government gave local (provincial) government unprecedented authority to manage local economies. It also made systematic planning on the reforms of goods market, inputs market, and price formation system. The competition among provinces in the federalism framework is the key to China's success in moving toward a market system. However, the types of organizations that helped propel the move toward markets can also hinder the function of market forces, eventually

[2] For instance, the countries who paid tribute to the Imperial China, and the Silk trading between two empires (Roman Empire) in different continents (Francis, 2002).

becoming a roadblock to market development (Fang, Li, and Lin, 2013). However, the evidences had shown that market fragmentation has worsened as reforms deepened (Poncet 2003, 2005; Young 2000). In order to solve this problem, the governments put the reform issue, in 2000s, on improving the market system and accelerate the foundation of united market[3]. For instance, "the regulations of banning the regional blockades in market economy" issued by the State Council in April 2001 listed eight types of local protectionism and regional barriers, including price discrimination, geographic barriers and so on. According to the survey of Development and Research Center of State Council, all the eight types with forty-two kinds of specific protection behaviors exist in different industries to different degrees. The most serious ones are those restricting the flow of labors, products and technologies from other provinces. With the free market policies, the expected effect should be checked.

3. The Model

3.1 The Empirical Methods to Measure Border Effect

The literature on border effects was pioneered by McCallum (1995). Using data on inter-provincial trade in Canada as well as the cross-border trade between Canada and United States, McCallum (1995) showed that the border effect on US-Canadian trade in the period of 1988–90 was extremely high. He got the results that the provincial trade flow in Canada was 21 times more than that between provinces of Canada and States of United States. After that, several scholars have verified trade border effects from different aspects, such as tariff and non-tariff barrier (Helliwell, 1997). Based on the empirical evidence of wide existence of border effect, Obstfeld and Rogoff (2000) recognized it as "mystery of international trade" because a downward trend of border effect is expected with increasing integration of the world economy and declining trade barriers. In order to verify border effects, more theoretical models and empirical tests are emerging.

However, the studies following McCallum's (1995) had confronted some difficulties, mainly because it is difficult to get inter-provincial or inter-regional domestic trade flow data. Wei (1996) adopted a new way to calculate the domestic trade flow by subtracting the country's total exports (to foreign partners) from its total production. This method has been widely adopted because the border effects can be obtained even without recording the data of regional trade flow. Using Wei's method, Chen (2004) came to the conclusion that there are border effects among members of OECD as well as among members of EU. Head and Mayer (2002) pointed out that the results of border effects estimated by Wei's (1996) method depend on the measures of the distances between two regions[4]. Different means of measuring distances will affect the estimated results of the border

[3] In 2003, "the decisions on solutions to improve the economy system in socialism market economy" issued by the Third Plenum of the 16th CPC reemphasized the necessity.

[4] According to Wei (1996) ， What is traded within a country must be equal to the difference between its total production and its total exports to foreign countries. In order to obtain an estimate of the total production, Wei

effects (Wang and Wei, 2008). Bilateral trade between two countries or regions is not only restricted by their absolute distance between each other, but also affected by their geographical positions relative to other countries or regions. For example, the distance between Span and Sweden is almost equal to that between Australia and New Zealand, but the latter two countries have a higher border effect because they are far away from other markets (Anderson and van Wincoop, 2003). The above situation, combined with the absence of inter-provincial trade data, causes difficulties for applying gravity equation to estimate the border effects. Therefore, Matthias Helble (2006) used the logistics data between Germany and France, and adopted the model of gravity equation with fixed effects proposed by Anderson and Van Wincoop (2003) to control price index differences among countries and setup dummy variables to control whether two countries have the same currency, language or culture.

Our research applies the border effects of the gravity equation at provincial level to examine the inter-provincial trade barriers in China. A few literature related to China study provincial barriers through indirect index but not trade flows. Our paper verify the existence and seriousness of the trade barriers with direct measures. Furthermore, we check the recent trend of domestic market segmentation from 1997 to 2010 as well as its determinants.

3.2 A Two-Region Border effects model

Based on CES utility function and the monopolistic competition model which was promoted by Dixit-Stiglitz (1977) and Krugman (1980), many scholars (Anderson, 1999; Head and Mayer, 2000; Taglioni, 2006）got a quasi gravity function by deriving from the asymmetry of consumer preference, which easily estimates border effects. Specifically，Head and Mayer (2000) build a CES utility function for the trade between a home country and other countries, in which they also include domestic consumers' preference coefficients[5]. Based on their work， we will build a model

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(1996) takes the GDP and subtracts the services and the transport sector, which do not fall under bilateral trade data. This methodology allows Wei (1996) to approximate the volume of intra-national trade flows. In order to approximate the distance over which these goods are shipped, the author assumes that within a country the average distance is half of the distance from the economic center to the border. When a country has a land border with a neighbor, the author uses a quarter of the distance to the center of the nearest neighboring country. Finally, to calculate the distance between the economic centers of a country pair, the great-circle formula is used. Nitsch (2004) proved there was something wrong with Wei's (1996) assumption that all inner distances were the same. To measure the inner distance, two other basic methods were introduced: Given size of the regional area, the inner distance can be calculated by $\sqrt{area/\pi}$ (Leamer, 1997); or use the maximum road distance between two cities as a substitute (Wolf, 1997, Matthias Helble 2006).

[5] Head and Mayer (2000) propose an utility function of a representative consumer from country *j* as

$$U_j = \left(\sum_i \sum_{v=1}^{n_j} (s_{ij} c_{vij})^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \qquad (*)$$

where s_{ij} represents the consumer *j*'s preference coefficient on products from country *i relative to country j*.

with consumer preference according to consumption heterogeneity, to analyze the changes of trade flow among different regions, and provide a simple derivation of border effects. However, different from Head and Mayer (2000), our model investigates the border effects of domestic trade instead of international trade. Since domestic trade statistics are rarely available, we have to revise the model setting of Head and Mayer (2000) to obtain a simpler border effect model that can be empirically tested. First, we assume there are only two regions, a home province and ROC (the rest of China). All consumers have the same CES utility function as follows:

$$U = \left(C_H^{\frac{\theta-1}{\theta}} + aC_F^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}} \quad (1)$$

In equation (1), θ represents the elasticity of substitution（$\theta < 1$）, C_H is the consumption of products from home province H , C_F is the consumption of products from ROC, a is the relative consumer preference of home province，or the aversion to the products of ROC（$a = 1$ stands for consumption indifference). We introduce preference parameter with a main purpose to separate the effects of consumption home bias from the influence of trade cost on bilateral trade. Although Helpman (1999) finds no evidence of home bias of consumption after controlling income, Obstfeld (2000) argues that analyzing home bias through trade frictions is still inspiring.

Besides, suppose that ROC has the same utility function, and let C_H^* and C_F^* be its consumption combination. Y_H is the income for representative consumers in home province , while Y_F for the representative consumers in ROC. In home province, the prices of products from home province itself and ROC are P_H and P_F respectively. Then we get the income budget of the representative consumers in the province as $P_H C_H + P_F C_F = Y$. Following Wei's (1996) approach, we assume there is iceberg transportation cost τ , while $1-\tau$ stands for the cost input from ROC to home province, and t acts as the barriers tax (or "equivalent tariff") between the province and ROC. Because all the provinces are in one country, there is no need to consider the exchange rate. Therefore, in ROC, the prices of the products from ROC itself and home province are respectively as follows:

$$P_F^* = P_F /(1-\tau)(1-t) \quad (2)$$

$$P_H^* = P_H (1-\tau)(1-t) \quad (3)$$

assume $p \equiv P_F / P_H$ and $p^* \equiv P_F^* / P_H^*$ （P_H^*, P_F^* stand for the ROC prices of home province

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n_j represents the number of product categories in trade.。

products and ROC products respectively ），then

$$P \equiv p^*(1-\tau)^2(1-t)^2 \qquad (4)$$

Maximizing the utility function of the consumers of both home province and ROC yields:

$$\frac{C_H}{C_F} = (p/a)^{\theta}, \quad \frac{C_H^*}{C_F^*} = (p^*/a^*)^{\theta} \qquad (5)$$

Combine Eq. (4) with Eq. (5) , we can get

$$\frac{C_H}{C_F} = \frac{C_H^*}{C_F^*}(a/a^*)^{-\theta}(1-\tau)^{2\theta}(1-t)^{2\theta} \qquad (6)$$

In addition, how many goods from home province relative to ROC will be consumed in ROC is affected by the ratio of the incomes between these two areas, and thus C_H^*/C_F^* can be represented by a function of income ratio of these two areas, i.e. $C_H^*/C_F^* = f(Y_H/Y_F)$. Eq. (6) can be changed into the following form:

$$\ln\frac{C_H}{C_F} = \ln f(\frac{Y_H}{Y_F}) - \theta Ln(a/a^*) + 2\theta\ln(1-\tau) + 2\theta\ln(1-t) \qquad (7)$$

The Border Effect among regions is represented by the term $-\theta Ln(a/a^*)$, determined by the relative consumption preference a/a^*.

Suppose there are two sectors in the economy, the government and the private sector, and assume they have different relative consumer preference for local goods, i.e. $Ln(a/a^*)$ differs in the consumption of government and that of private sector. The government's intervention on the market (or the protection of the local goods) is reflected by the ratio of its expenditure on consumption of local goods (the higher the ratio is, the stronger is the local protection). Combine the above assumption with Eq. (7), we can get the consumption preference of local goods relative to ROC's goods as follows:

$$\ln(a/a^*) = \eta \bullet \ln(a/a^*)_{pub} + (1-\eta) \bullet \ln(a/a^*)_{priv} \qquad (8)$$

where η is the proportion of public consumption to the total local consumption, $(1-\eta)$ is the proportion of private consumption to the total local consumption, $\ln(a/a^*)_{pub}$ is home bias of government and $\ln(a/a^*)_{priv}$ is home bias of private sectors. Equation (8) implicates that the border effect among regions will be affected by the proportion of public consumption as well as those factors determining the consumption preference of the public sector, which will be further

investigated in the empirical part of this paper.

3.3 Empirical Setting

Based on the above two-region border effects model with local governments' preference, we further employ the gravity equation proposed by McCallum (1995) for its simplicity and flexibility, to test the border effects among provinces of China. The simple regression model of panel data on the basis of the total trade value in different province-year observations is as follows:

$$\ln(C_H^{it}/C_F^{it^*}) = \beta_1 \ln(Y_{it}/Y_{i^*t}) + \beta_2 \ln d_{ii^*} + \beta_4 \ln g_{pub,i} + \beta_3 East + bor_{prov} + bor_{year} + \varepsilon_{ii^*t} \quad (9)$$

$C_H^{it}/C_F^{it^*}$ is the local consumption ratio (the ratio of local goods consumption to ROC's goods consumption)，which is calculated by the ratio of trade flow; Y_{it}/Y_{i^*t} is the ratio of local income to ROC's income; d_{ii^*} is the distance between home province and ROC, which determines the iceberg transportation cost τ (calculated by the mean value of distance between home province and other provinces, with the weight of outputs.) Since the eastern provinces are closer to the overseas market than western provinces, we introduce a dummy variable for eastern provinces (the value of the dummy variable is 1 if the province locates at eastern China, and 0 otherwise). bor_{prov} and bor_{year} in Eq. (9) stand for fixed effects of province and year respectively, which reflect border effects of different provinces and the changes of border effects through years. Besides, $g_{pub,i}$ in Eq. (9) shows the ratio of public expenditure relative to the total consumption.

In the two-region model of this paper, we take all other provinces as one region, ROC, constrained by the availability of data. The statistics yearbook of China only reports input-output table and some general data about both export and import of retail trade (or wholesale) between the given province and ROC, so that it's difficult to acquire the trade data between every two provinces. The characteristics of ROC, such as its production and consumption, as well as the distance between the home province and its partners, can only be represented by the total sum or average of all the rest of provinces.

3.4 Data

All the trade data are from the statistics yearbooks of provinces. To check the recent trend of domestic market segmentation after the tax decentralization reform in 1994, but constrained by the availability of data, this paper chooses 1997, 2002, 2005, 2007 and 2010 as sample years and collects the trade flow data of primary, secondary and tertiary industries of 28 provinces in China

from the provincial Input-Output Tables and the corresponding statistics year books [6]. The border effects are shown by the constant terms in Eq. (9) and we can observe the market segmentation and its evolution based on the coefficients on year and industry. If there is upward trend of border effects among provinces, it means the trade barriers are still hindering the market integration.

4. Estimation of Border Effects

The border effects between a given province and ROC can be considered as the trade barriers between these two areas. According to the estimation approach proposed by McCallum (1995), fixed constant terms can be presented in exponential form. It should be noted that there is little valuable information from absolute value of border effects of a single province. We need to check the border effects from a dynamic and comparative view, the evolution of border effects through time as well as the differences among different provinces.

With all the considerations above, a series of estimations are adopted to test the border effects from different aspects dynamically. Generally speaking, regression results in Table 1 are almost the same as expected. The coefficients on YearII(2005) and YearⅠ(2002) in column 1 are positively significant, implicating an upward trend of border effects during sample Ⅰ and sample Ⅱ. To test the robustness of our results, Eq 3-5 run regressions on sub-samples of related years (1997-2002, 2002-2005 and 2007-2010), whose results are consistent with the full sample regressions, so we find an increasing border effects during 2002-2010[7]. In column 1, the average border effects have raised from 28.5 [exp(3.35)] in 1997 to 33.8 [exp (3.35 +0.17)] in 2002, then to 34.5 [exp (3.35 +0.17+0.02)] in 2005. Excluding the factors of transportation cost, relative output and prices, the consumption of products from local province was 28.5 times of that from ROC in 1997, 33.8 times in 2002, and even higher in 2005.

The empirical tests above are similar to the analysis of McCallum (1995), Helliwell（1997） and Kyoji Fukao(2004), and the result is close to that of McCallum (1995) who found that the border effect had a value of 22 between US and Canada. However, we do not think it is suitable to make a border-effect comparison for the trade barrier between two locations within a country and trade barrier between two locations in different countries, even though the scholars such as Helliwell（1997）and Wolf（2000）found that inter-provincial trade barriers in Canada (or US) were similar to cross US-Canada border ones .We need to differentiate the domestic trade barriers from

[6] The recent trend of domestic market segmentation after the tax decentralization reform in 1994 is of great interests to public since the local governments financial autonomy has significantly increased after the tax reform. However, suffering from the lack of the direct data and interpretation problems, only a few studies have so far performed direct empirical tests on the evolution of domestic trade integration in China. Provincial input–output (IO) tables are probably the only data sources that enable researches on this topic. Unfortunately, the data of Input-Out tables is not available for each year..

[7]There are significant differences of border effects in related years at the 5% level.

the barriers in international trade. It might be inappropriate to directly compare our measures of border effects of domestic trade in China with those of the studies on multinational market integration in other countries or regions (like European Union, countries of OECD, Canada and American, etc.). First, all provinces in China are under the same administrative jurisdiction. The differences in regulations, legislation, language, culture and race among provinces of China are much smaller than those among western countries, OECD or countries in North America. Thus the main factors affecting the border effects among provinces in China may be quite different from those affecting multinational border effects. Second, China has a larger amount of labor resources than any western country and a larger density of workers within provinces than that within most states (or provinces) in US (or Canada), which implies that a Chinese province can deepen division of labor and enjoy the scale of economy within its own border, and thus be less dependent on other provinces or regions.

Table 1: Estimates of Border Effect for Domestic Trade

variable	EQ 1 (Total)	EQ2 (Total)	EQ 3 (Ⅰ)	EQ 4 (Ⅱ)	EQ 5 (Ⅲ)	EQ 6 (Ⅳ)	EQ 7 (Ⅴ)	EQ 8 (Total)
bor_{prov}	3.35*** （0.46）	3.12*** （0.54）	2.11** (0.93)	2.55*** (0.87)	3.26*** (0.82)	3.67*** (0.56)	2.72*** (0.05)	4.67*** (0.23)
$\ln(Y_i/Y_r)$	-0.82*** （0.12）	-0.24 （0.32）	0.49 （0.53）	-0.63* （0.33）	-0.47** （0.21）	0.12 （0.60）	-0.62* （0.42）	-0.32 （0.57）
$\ln g_{pub,i}$		0.17 （0.54）						0.06 （0.42）
Year Ⅱ	0.02** （0.01）	0.04 （0.03）				0.27*** （0.14）	-0.12*** （0.06）	0.27 （0.27）
Year Ⅰ	0.17** （0.15）	0.07** （0.04）				-0.11*** （0.04）	0.36*** （0.16）	0.52 （0.34）
$\ln d_{ii^*}$	0.72 （0.74）	0.62 （0.58）	0.40* （0.21）	0.53* （0.30）	0.86** （0.40）	-0.23 （0.95）	1.66*** （0.43）	0.46 （0.48）
East	-0.07** （0.04）	-0.12 （0.14）	0.11*** （0.02）	0.07 （0.09）	-0.04** （0.02）			0.12** （0.07）
Industrial products								0.11** （0.04）
Num	168	168	112	112	112	42	66	168
$\overline{R}$	0.42	0.60	0.51	0.43	0.49	0.33	0.63	0.53
Ramsey reset	0.62	0.65	0.40	0.61	0.47	0.56	0.85	0.55

Note: Standard errors in parentheses; ***, ** and * denote the significance at 1%, 5 % and 10% level respectively; industrial products is a dummy variable which takes the value of 0 if it belongs to industrial products, or 1 otherwise. SampleI,IIand III represent 1997-2002, 2002-2005, 2007-2010, respectively, IV and V for western and eastern.

To figure out whether there are regional differences of market segmentation in different provinces, we further run regressions on the sub-samples of eastern and western China respectively. It is found that there are trade barriers during the sample period in general, though differences exist in the coefficients of the two groups. The comparison between column 6 and 7 indicates that the provinces in the western areas of China have higher degree of market segmentation, which can also

be concluded from the coefficients on the dummy variable *East* in other columns of regressions (The negative sign of the coefficients in most regressions indicates that the eastern provinces are more preferential to purchase goods from other provinces).

The coefficients on the basic variables (output and distance) in gravity equation are robust. All the coefficients on output variable (except column 3, 6 and 8) are negative, which implies that consumers' preference for local goods is declining with the increase of output. In both full sample and sub-sample regressions, the coefficients on distance are positive, which indicates that higher ratio of local goods will be consumed when the distance is greater.

The results in column 8 are also the same as expected. The coefficient on the ratio of public expenditure is positive, indicating stronger local protectionism and higher preference for local products when the ratio of public expenditure is higher. In column 8, the coefficient on the dummy variable "industrial product" is significantly positive, which shows different barriers on agricultural and industrial products.

To better understand the variations of border effects in different provinces, years and industries, we further category the full sample into industrial group and agricultural group, and then run regressions on the panel data of province-year observations in each group. The coefficients on provincial fixed effects reflect the average values of border effects in different provinces. Based on the regression results in Table 1, the border effects of different province-year observations can be obtained after the adjustment of yearly-increment of border effects. The result is shown in Table 2.

The average coefficients are similar to the results in table 1: the coefficients of industrial and agricultural products are significantly different and the protection for agricultural products has a downward trend from western China to eastern China. We should also pay attention to the large variations of border effects among different provinces: Guangdong province has the lowest border effects at 0.4 (or 1 in exponential value) while Xinjiang has the highest one at 5.5 (or 245 in exponential value), which is almost 13 times more than the former (the difference in exponential values is even much larger). Besides, the coastal provinces, such as Guangdong, Shandong, Shanghai, mostly have lower coefficients (similar to most relative researches), which indicates that the coastal provinces enjoy more convenient and developed transportation and higher openness to both the international market (higher ratio of dependence on foreign trade) and other provinces in China (easy to accept the bilateral trade, with low trade barriers strategy). At the same time, provinces in western and central part of China have bigger border effects, possibly due to poor transportation, lagged information, and long distance from eastern provinces.

Logistically, China's reform to free market should reduce the border effect. As for the provinces with higher level of marketization, the border effects are expected to be lower than others. We choose Fan Gang index to compare with our estimated border effects, and find the coefficient

of two indexes is - 0.125 in 1997 and -0.147 in 2005 for industry products. It means border barrier is negatively related to marketization, which test a basic fact for China's regional integration.

Table 2 Border Effects for Provinces in China

	Border effect（Agri-products）			Border effect（Indus-products）		
Prov.	Aver.	1997	2005	Aver.	1997	2005
East						
Beijing	22	25	30	27	30	37
Tianjing	11	12	15	12	13	16
Niaoning	122	134	164	4	4	5
Hebei	25	27	33	33	37	45
Shanghai	10	11	13	13	15	18
Jiangsu	30	33	40	25	27	33
Zhejiang	13	15	18	18	20	25
Shandong	6	7	8	20	22	27
Fujian	49	55	67	60	67	81
Guangdong	1	2	2	4	5	6
Hainan	33	37	45	10	11	13
Central						
Shanxi	20	22	27	9	10	12
Neimeng	90	99	122	60	67	81
Jilin	30	33	40	25	27	33
Heilongjiang	4	5	6	15	16	7
Anhui	27	30	37	37	40	49
Jiangxi	134	148	181	3	4	4
Henan	27	30	37	12	13	16
Hubei	15	16	20	6	7	8
Hunan	16	18	22	3	3	4
Guangxi	55	60	74	8	9	11
West						
Guizhou	55	60	74	22	25	30
Yunnan	40	45	55	25	27	33
Sichuan	18	20	25	12	13	16
Shan'xi	7	7	9	9	10	12
Gansu	110	122	148	55	60	74
Ningxia	45	49	60	45	49	60
Xinjiang	245	270	330	60	67	81

Note：The border effects are reported in exponential value, while those in 1997 and 2005 are adjusted values.

The previous literature studies into the border barriers related to products and emphasizes that higher border barriers are found for products difficult to transport (Hummels, 2001; Chen, 2004), which is coherent with our findings. However, our results further imply that significant border effects on agriculture products may be attributed to local protectionism. Local governments pay more attention to the price control on raw materials, such as wood, silk, cotton, corn and tobacco, to satisfy the development of local industry (Watson et al, 1996). Local governments may also have a

preference to protect industrial raw materials, such as electricity, coal and water[8]. But this paper fails to test the protection preferences among detailed industries because of the difficulty to obtain the complete industrial data.

5. Determinants of Border Effects

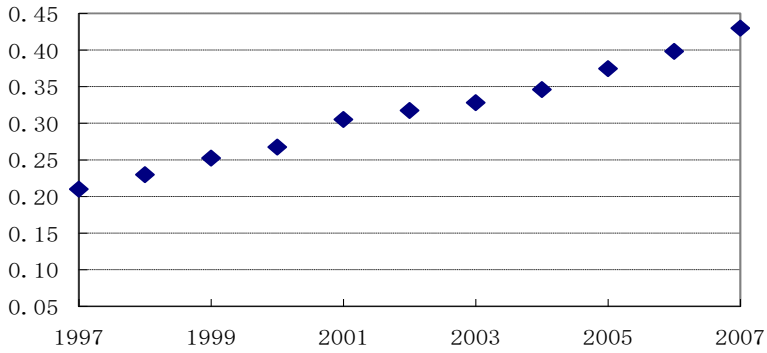
The empirical tests above show that there is an upward trend of border effects from the period of 1997-2002 to 2002-2010. A further question to ask is what are the determinants of the border effects hindering the market integration process? We tend to focus on variables representing local government's preference and protectionism.

5.1 Explanatory variables and the hypothesis

Public expenditure ($g_{pub,i}$): $g_{pub,i}$ in Eq. (9) shows the ratio of public expenditure relative to the total consumption. Based on the similar logic as Sonin（2010），it is reasonable for us to believe that the local governments usually have a preference for local protectionism (similar as the trade protectionism at the country level). So we have:

Hypothesis 1: The local governments' interventions on the local market are mainly reflected by their consumptions on the local goods. Thus a higher ratio of public expenditure to total local consumption could represent a stronger power of local governments' intervention on the market. This means that under the local governments' protection on local enterprises and goods, the regions with higher ratio of public expenditure will set up more regional trade barriers, and thus are more likely to have larger border effects.

Figure 1. the Ratio of Public Expenditure Relative to Total Consumption,1997–2007



Note: The data of public expenditure and total consumption is from China Statistical Yearbook (available from: www.stats.gov.cn)

Output share of SOEs: Besides of the effect of public expenditures, Lin and Liu(2005) mentioned that the SOEs' policy burden and their soft budget constraint problem, as well as

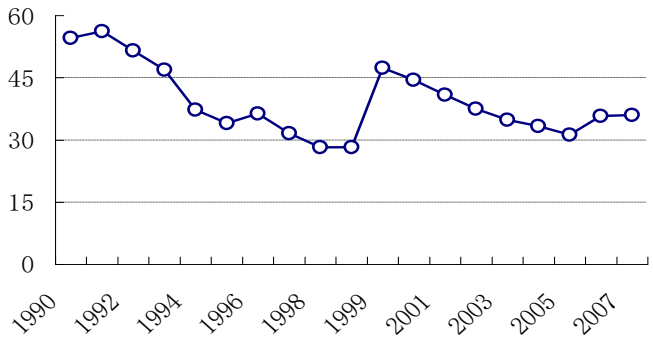
[8] Lu（2002) and Naughton (2003) analyzed the local protection preference on industrial products.

different provinces' catch-up strategies have an important effect on the market structure, especially on the market segmentation. The decentralization reform and local government-oriented catch-up strategy in China may lead to higher local protectionism and market segmentation. Our following empirical analysis would try to verify the second hypothesis.

Hypothesis 2: Public sectors are more closely related to local governments, and thus the provinces with larger market shares of regional SOEs intuitively tend to have stronger market intervention and local protection.

In addition, the absence of a clear line between the functions of the government and the operations of enterprises can easily leads to regional protectionism. The managers of SOEs and collective enterprises are usually selected from former officials of local governments. Since the local governments are the owners or ultimate controller of these enterprises, they serve as both "judge" and "athlete" at the same time. In this case, local protectionism may become the rational choice of the local governments, especially when the rules and systems to regulate their behaviors are weak. The following figure shows the downward trend of industrial output share of SOEs by provincial average from 1990 to 2007.

Figure 2. the Industrial Output Share of SOEs By Provincial Average,1990–2007



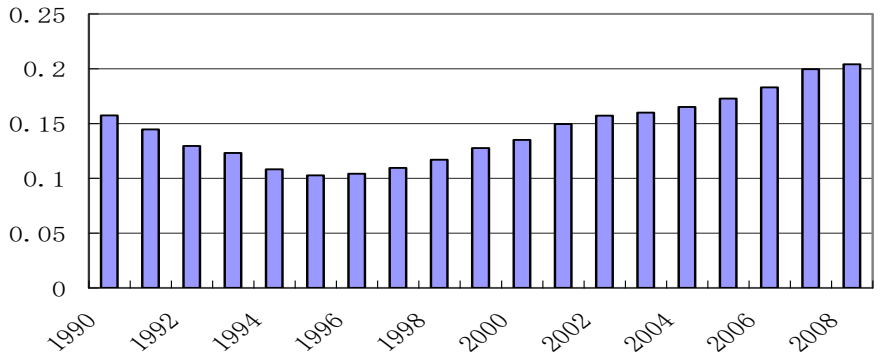
Note: The data of industrial output of SOEs and total industrial output is from China Statistical Yearbook (available at www.stats.gov.cn)

Financial autonomy: The local government gets higher degree of financial autonomy after the tax reform in 1990's. The central government in China had transferred more and more responsibility of public expenditures to local governments, while some obligations are regulated by laws, e.g. the expenditure on education must reach 4% of GDP and that on medicine and health must increase no less than income growth. As a result, the local governments have to collect more fiscal income to deal with the policy burdens. Then we have:

Hypothesis 3: With the incentive of maximizing the local economic performance, local governments with higher financial autonomy may be more protective. Furthermore, Deficiency of

fiscal income can cause pressure on fiscal expenditure, which can possibly leads to the regional blockade and protectionism.

Figure 3. the Percentage of Fiscal Income to GDP in China,1997–2007

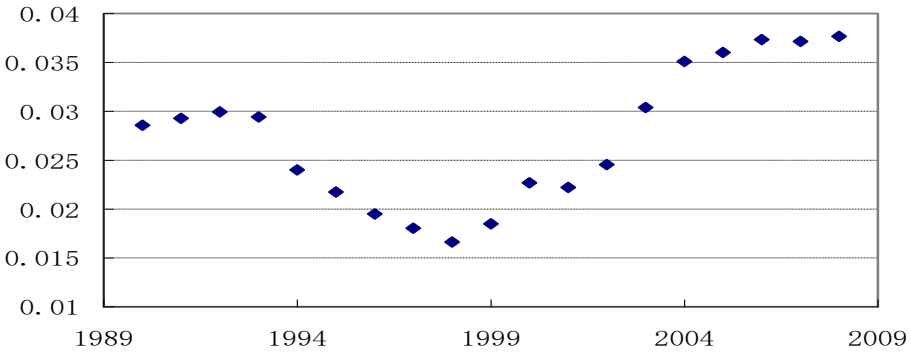


Note: The data of fiscal income and GDP is from China Statistical Yearbook (available at www.stats.gov.cn)

Import rate: The import rate reflects the degree of openness of a region to some extent. Figure 4 shows that China's Import rate (or openness) experiences two stages, a declining stage during the period of 1990-1999, and a rising stage during the period of 2000-2009. A high import rate in a province may implicate that its export departments are making an significant progress. Besides, the imports from abroad will substitute the demand for goods from other domestic provinces. If the expansion of imports from abroad targets at technology upgrading of the domestic goods, then the local government may set up more technological trade barriers to other provinces. So obtain the fourth hypothesis.

Hypothesis 4: An export-oriented province may expand its production by importing primary or intermediate goods and re-export to foreign markets. With its limited production resources, the province has to reduce the supply to the domestic market, which may leads to the regional blockade and protectionism.

Figure 4. Import Rate (or Openness) in China, 1990–2008



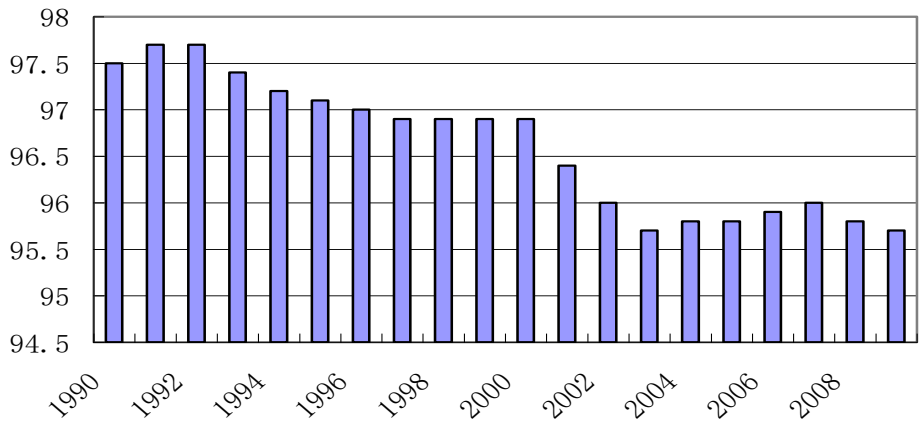
Note: Import rate is calculated by (Total Imports / GDP), where the data of total imports and GDP is from China Statistical Yearbook (available at www.stats.gov.cn)

Employment rate: In the provinces with a high unemployment rate, to avoid political unrest and social chaos, the governments must focus more on economic growth and job provisions. In this case, the governmental authorities tend to provide more protections to their local industries and job opportunities. The last hypothesis follows as:

Hypothesis 5: The more a province enjoys massive labor employment, the less incentives the authorities have to provide protection to local business activities, which leads to lower border effects.

Since higher level of employment rate means less adjustment costs resulting from bankruptcies of SOEs, The domestic trade barriers can stem from the governments' need to protect vulnerable and labor-intensive enterprises (French, 2013). We depict the evolution of China's employment rate by provincial average as follows. Figure 5 shows that employment rate has a slow downward trend during the period of 1997-2009, which is consistent with the increase of China's economic growth rate.

Figure 5. Employment Rate by Provincial Average in China, 1997–2009



Sources: China Statistical Yearbook (available at www.stats.gov.cn)

Table 3 reports the results of descriptive statistics and pair-wise correlations. The results reveal that all the series such as border effect, $\ln g_{pub,i}$, output share of SOEs, financial autonomy, Import rate and employment have normal distributions. This is confirmed by our Jarque – Bera test. The pair-wise correlation analysis exposed that a positive correlation exists between $\ln g_{pub,i}$ and indus-products Border effect and same is true for agri-products border effect. Output share of SOEs, import rate and financial autonomy are positively linked with border effect but employment is inversely correlated with border effect. So we have expectation sign for corresponding variables based on the above hypothesis. The correlation of output share of SOEs and Import rate with employment is positive but $\ln g_{pub,i}$ and financial autonomy are negatively linked with it. The correlation between output share of SOEs and import rate is positive and, negative correlation is

found for financial autonomy and Import rate with output share of SOEs.

Table 3 Descriptive statistics, correlation matrix and expectation sign

Variable	Border effect (Indus-products)	Ⅰ $\ln g_{pub,i}$	Ⅱ Output share of SOEs	Ⅲ Financial autonomy	Ⅳ Import rate	Ⅴ Employment
Mean	22.5714	0.3471	0.4533	0.1455	0.2846	0.9610
Variance	348.9430	0.0048	0.0061	0.0058	0.0014	0.0003
Maximum	81.0000	0.5394	0.7862	0.2975	0.0517	0.9949
Minimum	3.0000	0.1742	0.1932	0.0820	0.0170	0.9318
Jarque－Bera1	0.2124	1.2429	0.1376	2.0917	1.84152	0.0412
Hypothesis		1	2	3	4	5
Expectation Sign		+	+	+	+	-
Border effect	1.0000					
Ⅰ	0.2356	1.0000				
Ⅱ	0.4916	0.4402	1.0000			
Ⅲ	0.1896	0.3148	-0.0133	1.0000		
Ⅳ	0.3400	0.3744	-0.2144	0.0852	1.0000	
Ⅴ	-0.3514	-0.1065	0.3148	-0.1847	0.2306	1.0000

5.2 Empirical analysis

From Table 2, we have already known that there are big differences of trade barriers (border effects) among provinces. In this section, we will take the estimated coefficients on border effects as dependent variables to test the potential determinants of the border effects.

According to the analysis in the above section, It is expected that higher ratio of public expenditure or output share of SOEs will lead to higher local government's intervention and protection[9], and thus stronger border effects. Financial autonomy variable (the percentage of fiscal income to GDP) may also affect border effects in the sense that the government will play a more dominant role if it has a larger fiscal income.

Besides, the import rate, which is considered to be a key factor affecting domestic trade, and the employment rate are also introduced as control variables in our regressions. We believe that the one of the important motivations for local blockade and protectionism is to promote local economic growth and employment rate.

The OLS regression results are listed in table 4. It can be seen that the impacts of the output share of SOEs and financial autonomy on the border effects are significantly positive, verifying our assumption 2 and 3 that when the output share of SOEs or the degree of financial autonomy is higher, the local governments will have stronger preference and power of intervention to carry out

[9] The local governments usually pay more attention to SOEs since the SOEs can bring them high tax revenues and promote the local employment. In the aspects of administration and personnel mobilization, the local governments and the state owned enterprises are also highly interactive, implicating a high correlation of their interests.

the strategy of regional protection. But the variable $\ln g_{pub,i}$ has the opposite sign to our assumption 1.

Table 4 Explaining Border Effects of Interregional Trade

variable	(a)	(b)	(c)	(d)	(e)	(f)
Constant	-8.12	8.67	-13.81	11.10	-11.46***	-10.93*
	(15.76)	(9.90)	(13.7)	(14.02)	(5.11)	(7.19)
$\ln g_{pub,i}$	-2.50	-7.86	2.71	-8.82		
	(12.43)	(10.18)	(10.64)	(12.96)		
Output share of SOEs	7.79**	1.22	6.90*			7.97**
	(4.62)	(3.81)	(4.39)			(4.44)
Financial autonomy	5.36**		4.64**		3.07**	5.45***
	(2.32)		(2.12)		(1.86)	(2.22)
Import rate	-1.39			-0.10	-0.33	-1.23
	(1.62)			(1.63)	(1.36)	(1.40)
Employment	0.32			0.13	0.26	0.31
	(1.45)			(1.55)	(1.49)	(1.42)
R-squared	0.22	0.12	0.20	0.19	0.20	0.22

Note： Standard errors in parentheses, with ***, ** and * denoting the significance at 1%, 5% and 10% level respectively.

Lin and Liu (2005) also pointed out that decentralization reform endowed local government more powers to intervene with the market economy, which intensified the market segmentation. Our empirical result partially verifies their argument. The significantly positive coefficient on financial autonomy variable demonstrates that higher degree of financial autonomy may lead to stronger local government protection and border effects. Thus we can possibly infer that the trade barriers have not been reduced but enhanced after the tax reform in 1994 which increase local governments' financial autonomy. Nevertheless, we need to be cautious about the possible effect of market segmentation itself on the local government's preference and protective behaviors, which is ignored in this paper[10]. It might be useful for further studies to investigate more about the rules and mechanisms of local governments' behaviors, which may provide us deeper insights on the problem of market segmentation in China.

The results in Table 4 also shows a negative correlation between import rate and border effects (though not significant), which is not our expectation of assumption 4. It indicates that the

.[10] There is a possibility that market segmentation may reversely affect local governments' preference and protective behaviors. For example, in the case of high market segmentation, the local governments possibly have to develop local economy through self-circulation, which means that the local governments' preference for local goods will be higher. Obviously, reverse-causation problem will make the study much more complicated. Although we do not thoroughly solve this problem in this paper, it might be good for us to point out this limitation for future research.

international market is probably not a substitute for the domestic market as we expected earlier. Conversely, international market improves the domestic trade and reduces the border effects. The positive coefficient on employment rate is not our expectation. It reflects that keeping high employment rate is an important concern of the local governments to protect their local markets, leading to higher degree of market segmentation.

As robustness checks, Column b and c report OLS regression results without controlling the employment rate and import rate. Generally speaking, the main results do not change, i.e. the coefficients on output share of SOEs and financial autonomy are still positive. A further concern is the possible multicollinearity problem caused by high correlation among public expenditure rate $\ln g_{pub,i}$, fiscal autonomy and output share of SOEs from the correlation matrix. It can be found that the first and the latter two factors are highly correlated (the correlation coefficients are higher than 0.8). We thus further run regressions without putting all these three factors together. The results shown in column d, e, f further verify that the output share of SOEs and higher financial autonomy have robust and significant effect on the border effects.

6. Conclusion

This paper extends the traditional border effects model of international trade to a two- region border effects model of domestic trade among Chinese provinces with the incorporation of Chinese local governments' consumption preference. Applying this two-region border effects model, we not only empirically show the recent evolution of the border effects, i.e., the evolution of domestic market segmentation, in different provinces and industries in China from 1997 to 2005, but also test the determinants of the border effects. Probably due to poorer geographic conditions, less availability of information and insufficient transportation infrastructures, the border effects in the western area of China are found to be significantly stronger than the eastern area of China. In addition, the border effect on industrial products is weaker than that on agricultural products, partially verifying that there are more trade protections by local governments on raw materials.

Our empirical test on the determinants of border effects shows that the local governments' financial autonomy and the output share of SOEs have a robust positive effect on border effects. This result supports the views of Lin and Liu (2005), arguing that under local governments' preference for protectionism, higher degree of local governments' financial autonomy and their power to control economy may enhance trade barriers (or domestic market segmentation) among Chinese provinces. These findings put in question the existence of a systematic positive relation between financial autonomy, local protectionist and trade liberalization. Our result also verifies from an opposite side that the grown-up of Non-SOEs without the protection of local governments can help improve the market operation mechanism and promote market integration.

Rather than a single market, China appears as a collection of separate regional economies protected by barriers. As far as political implications are concerned, if economic reforms can favor the reduction of internal barriers through the reduction of the public sector, the private sector can alternatively grows faster than expected, Then market privatization as the resulting effect can limit local governments' economic interventionism. On the 13th five-year plan, The Chinese central government faces the unchanged challenges in order to promote domestic market integration.

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