Interregional Protection in China: Implications of Tax Reform and Trade Liberalization

by

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(*Comments are welcome*)

Abstract

Empirical studies have shown that regional markets in China are highly fragmented. The observation leads to conclusion of interregional trade protection. In this paper, we develop a model, in which a country has many regions and faces import competition, to examine how and when interregional trade protection may arise. We find that domestic fiscal decentralization in general, and tax reform in particular, together with high external trade protection, causes interregional protection. This finding not only helps explain the rise of interregional protectionism in China, but also predicts that external trade liberalization (and its WTO accession in particular) can help tear down the existing interregional trade barriers.

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1. Introduction

It has increasingly been known that regional markets within China are highly fragmented. Market fragmentation prevents production from specialization in accordance with patterns of comparative advantage and from taking advantage of scale economies. For example, China has more than 120 companies, scattering all over the country, engaged in car manufacturing and assembly. Most of them do not make profits. Market fragmentation also leads to price dispersion across regions. For example, a bottle of Beijing's Yanjing beer was once sold at equivalent of 18 cents in Beijing but $1 in Sichuan province (Gilley, 2001). Going beyond anecdotal evidence, the careful statistical analysis by Young (2000) shows that in China there is widespread duplication of production between regions and significant divergence in regional prices.[1]

In China, lacking a good transportation network is responsible for but not sufficient to explain why the country's regional markets are so fragmented. Interregional protection by local governments also accounts for this outcome. Anecdotal evidence on interregional protection can be easily found. The Shanghai government in the late 1980s mandated that Santana, a local car produced by Shanghai Volkswagen joint venture, be the only legitimate taxi to run in the city. Gilley (2001) also provides some other examples. Henan and Anhui provinces ban tobacco products from Guizhou province. Agriculture products like grain, flour and soybeans are still subject to internal trade barriers in most places. In May 2001, Shenzhen city even banned sales of a newspaper from Guangzhou city because it stole readers from the local government-run newspapers.[2] Interregional trade barriers in China are so widespread and severe that they have led the State Council to issue many circulars and directives against them (Chen, 1994). In the most recent such directive, issued in April 2001, the central government explicitly outlaws regional blockades.[3]

Why does interregional protection arise in China? Young (2000) offers one convincing ex-

[1] Gilley (2001) also provides evidence on the increasing market fragmentation in China. Inter-provincial trade has fallen from the equivalent of 37% of national retail trade in 1985 to about 25% in 2001 while the average distance traveled by freight shipments within China fell to 310 kilometers in 2001 from 395 kilometers in 1978, despite the rapid expansion of national highways, ports and air-cargo facilities.

[2] See Young (2000) for some earlier cases.

[3] The empirical studies by Bai *et al* (2002) and Young (2000) support the hypothesis that local protectionism exists in China. The World Band (1994) study of China for the period of 1986-1991 and the recent study by Xu (2002) for the period 1991-1998 confirm that markets in China are not completely integrated. Naughton (1999) argues the opposite, however.

planation. China's economic reform, which started in 1978, is characterized as an incremental one, as opposed to the "big bang" reform. It frees some segments of the economy from the central government's control and plan and at the same time keeps some other segments under the control and plan. The freed segments find it profitable to exploit the rents in the remaining unreformed segments. Local governments then try to capture these rents and protect them. This induced interregional competition and protection leads to "the fragmentation of the domestic market and the distortion of regional production away from patterns of comparative advantage" (Young, 2000, p. 1091).

In this paper, we offer an alternative, but not mutually exclusive with Young's (2000), explanation: Internal (or domestic) fiscal decentralization[4] and external (or international) trade protection[5] together give rise to interregional protection. To demonstrate this proposition, we develop an economic model in which a country, China, consists of two regions and faces import competition. Foreign firms and domestic firms are competing for profits in all local markets. In the paper we confine internal decentralization to tax reform in which the central government lowers profit tax rate that local firms must remit to the state, combined with a reduction of revenue transfer from the central government to each region. Tax reduction increases regional governments' incentive to protect their local firms' profits although protection reduces consumer surplus. When the country's external trade protection is high, the gains from interregional protection will be sufficiently large to warrant local governments' imposition of interregional trade barriers.

To the best of our knowledge, the present study is the first theoretical analysis on the

[4]Taxation reform is one of the most important aspects of the fiscal decentralization in China. Yang (2002) has a comprehensive analysis of China's taxation system and reform. Before the economic reform, most tax revenues collected from localities were fully remitted to the central government, which then redistributed them to all provinces and cities according to its economic plan. Since 1979, the country has reformed its taxation system several times, with the most significant ones in 1980, 1984, 1988 and 1994. There are two important features in all those incremental reforms. First, more and more new taxes have been introduced. There are currently 24 major taxes in the country. Second, taxes are divided into three categories: state tax (all revenues from this category go to the central government, e.g., import tariffs), local tax (all revenues from this category go to local governments, e.g., personal and company income tax), and shared tax (revenues from this category are shared by the central and local governments, e.g., value-added tax). The taxation reform has included more and more taxes to the local-tax category and given local governments a larger share in the shared-tax category.

[5]It is well known that China had very high trade protection during the 1980s. Several rounds of unilateral trade liberalization have abandoned a lot of non-tariff barriers and reduced the average tariff rate to around 15% recently from its high level, over 50%, in the 1980s.

rationale for interregional protection in China. As mentioned earlier, Young (2000) just conducts an empirical study to show market fragmentation in China and offers a plausible explanation, i.e., interregional protection, to the observed phenomenon. Bai *et al* (2002) are the same as Young (2000) in this regard. Li and Zhang (2002) take interregional protection as given and examine, theoretically, how China's accession to the WTO affects regional and national welfare in the presence of interregional trade protection or liberalization. Their analysis is based on a model with perfect competition. In contrast, we consider imperfect competition and analyze local governments' incentives to impose interregional trade barriers.

Although the idea that domestic decentralization may trigger interregional protection is not completely new, our paper is the first to formalize it. By decentralization, the central government delegates the following three functions to local governments during the reform period: fiscal responsibility and taxation authority, investment and financing authority, and the authority of managing enterprises. After the decentralization, as argued by Yin and Cai (2001), local governments have a greater incentive to protect local firms in order to generate more revenues to their regions.[6] Our paper differs from Yin and Cai (2001) in two major aspects. First, they do not provide a formal analysis to demonstrate the above point. Second, we show that it is the domestic tax reform together with high external trade protection that leads to interregional protection, not as they argued, the general domestic decentralization alone.

Our paper not only provides an explanation to the rise of interregional protection in China during the reform period, but also gives a prediction on the impacts of China's WTO accession on interregional protection and market fragmentation.[7] Domestic decentralization in general, and tax reform in particular, is not totally responsible for the rise of interregional protection. High external trade protection is part of the reason. Our analysis predicts that external trade liberalization will eventually tear down interregional trade barriers.

Although the present study is motivated by observations from the Chinese economy, the

[6]Ping (1996. p. 393) also speculates that this is a reason for local protection. Bai *et al* (2002) in their empirical study on geographic concentration of China's industries also conjecture that fiscal decentralization gives local governments an incentive to protect local tax base by shielding local industries from interregional competition.

[7]There are many recent studies on the impacts of China's WTO accession on its economy. Li and Zhang (2002) contains some references in this literature. These papers focus on the impacts of WTO accession on China's overall economy and its specific sectors, but none of them examine the impacts on interregional protection, which is the focus of our paper.

model and results are far more general. Interregional protection is a universal phenomenon, albeit the degree varying across countries.[8] Unlike Young (2002) and most other papers on China, our model is not specific to transitional economies. The main features of our model is the explicit consideration of many regions within a country, domestic tax reform and external trade liberalization. All countries share these features. Hence, this paper provides an interesting hypothesis for empirical test using cross country data: Low profit tax together with high external trade protection is conducive to interregional protection.

The paper is organized as follows. We set up the basic model in Section 2. We analyze the equilibrium about interregional protection in Section 3. In Section 4, we reexamine the interregional protection issue under the extended model in which firms face entry costs. Section 5 concludes the paper.

2. The Model

We construct a minimal model to show the existence of incentives for interregional protection. Consider a country (say, China) which consists of two regions, A and B. There is one industry, in which there is one firm in each region possessing the technology to produce the industry's product.[9] We call them firm A and firm B, respectively. These two domestic firms have different productivities. Specifically, without loss of generality, we assume that firm B has zero marginal cost of production, while firm A has a constant marginal cost $c > 0$. The country is facing import competition. A foreign firm sells its product to both regions' markets, with zero marginal cost of production.

Assume that all three firms produce homogenous good and assume that markets in region A and region B are segmented. For simplicity, we further assume that the two regional markets have the same demand function given by $p(Q) = a - Q$, where a is a constant, which captures the size of each market, and Q is the total quantity consumed or sold in a given market.[10]

[8] In Canada, the First Ministers on July 18, 1994 signed the Agreement on Internal Trade, aiming to remove international trade barriers in Canada (information from Industry Canada's website). It is observed that in some industries in Canada, it is easier to trade with the US than it is to trade with the province next door. Brian Kappler published an opinion article "Petty protections ruin trade: It's easier to trade with the world than with other provinces" in *Edmonton Journal* on August 15, 2001, to argue the severity of interprovincial trade barriers in Canada by giving many examples.

[9] Our results derived from this minimal model clearly hold in a more general model with more regions, industries and firms.

[10] It will become clear later that allowing the two markets to have different demand functions will not

The central government has two policies. First, it has a fiscal policy which in this paper is defined as a combination of taxation and revenue transfer. Specifically, the fiscal policy consists of a uniform profit tax (rate), denoted by $t \in (0, 1)$, and a lump sum revenue transfer to each region, denoted by T_A and T_B, respectively. Second, it has an international trade policy, tariffs. It is a specific tariff, denoted by τ, imposed on each unit of import. We confine to the situation that τ is not too high to prohibit imports. Tariff revenue belongs to the central government.

A local government may impose trade barriers on products shipped into its region from the other region, but not on imported products. Hence, we call them *interregional trade barriers*. Since all these barriers are less visible than tariffs and are not explicitly promulgated by local governments, we assume that they are non-tariff barriers. If government A imposes an interregional barrier b_A, then when firm B sells its product to region A's market, it incurs an extra unit cost equal to b_A. Government B's interregional barrier b_B is defined in the same way. However, unlike import tariffs, these barriers do not generate direct revenues to the governments.

In order to focus on local governments' incentives to protect local firms, we assume that the central government's fiscal policy (t, T_A and T_B) and trade policy (τ) are fixed and exogenously given in this model. Let $\aleph = \{t, T_A, T_B, \tau\}$. We consider a two-stage game between the local governments and all firms. In the first stage, each local government sets its interregional barriers. In the second stage, each firm chooses its output level to compete in the markets. That is, the firms engage in quantity competition, *à la* Cournot.

3. The Rise and Fall of Interregional Protection

Let us analyze the second stage of the game first under any given interregional barriers $\Re = \{b_A, b_B\}$. Firms choose their quantities for each market to maximize their total profits. There are three firms competing simultaneously in two separate markets, A and B. Since the two markets are segmented and the firms have constant-returns-to-scale technologies, each firm will just choose its output for an individual market to maximize its profit derived from that market.

Let us analyze region A's market first. Taking others' output as given, each firm in A's market chooses its quantity, q_A for firm A, q_B for firm B and q_F for the foreign firm, to maximize its

alter the qualitative aspect of our results.

pre-tax profit,[11]

$$\begin{aligned}\pi_A &= (a - q_A - q_B - q_F - c)q_A,\\ \pi_B &= (a - q_A - q_B - q_F - b_A)q_B,\\ \pi_F &= (a - q_A - q_B - q_F - \tau)q_F.\end{aligned}$$

As a result, the Cournot-Nash equilibrium outputs are

$$\begin{aligned}q_A^*(b_A,\ \tau) &= (a - 3c + b_A + \tau)/4,\\ q_B^*(b_A,\ \tau) &= (a + c - 3b_A + \tau)/4,\\ q_F^*(b_A,\ \tau) &= (a + c + b_A - 3\tau)/4.\end{aligned} \tag{1}$$

The equilibrium profits are

$$\begin{aligned}\pi_A^*(b_A,\ \tau) &= (a - 3c + b_A + \tau)^2/16,\\ \pi_B^*(b_A,\ \tau) &= (a + c - 3b_A + \tau)^2/16,\\ \pi_F^*(b_A,\ \tau) &= (a + c + b_A - 3\tau)^2/16.\end{aligned} \tag{2}$$

In order to show how interregional barriers drive non-local firms out of a market, we assume that in the absence of interregional barriers, all firms produce positive outputs for each market. Using (1), this condition translates to the following condition which we assume to hold through the analysis:

$$\textbf{Condition 1:} \qquad c < \frac{a}{5} \quad \text{and} \quad \tau < \frac{a+c}{3}. \tag{C1}$$

From (1), we know that firm B enters region A's market if and only if

$$b_A < \bar{b}, \ \text{ where } \bar{b} \equiv \frac{a + c + \tau}{3}. \tag{3}$$

Hence, we need only to pay our attention to $b_A \leq \bar{b}$, because beyond this range a change in b_A will not affect anything.

Now we move back to the first stage of the game. Since regional markets are segmented and the firms have constant-returns-to-scale technologies, government A's optimal policy does not depend on firm A's profit derived from region B's market. Because of this, b_B does not affect

[11] It is identical to maximizing their after-tax profits.

government A's decision on b_B. Hence, government A simply chooses b_A to maximize the region's welfare derived from its local market. This welfare consists of three parts, firm A's after-tax profit from market A, consumer surplus and revenue transfer from the central government,

$$W_A(b_A;\aleph) = (1-t)\pi_A^*(b_A,\tau) + \frac{1}{32}(3a-c-b_A-\tau)^2 + T_A, \qquad b_A \in [0,\bar{b}]. \tag{4}$$

Note that $W_A(b_A;\aleph)$ is a continuous and differentiable function of b_A, and

$$\frac{\partial^2 W_A(b_A;\aleph)}{\partial b_A^2} = \frac{1-t}{8} + \frac{1}{16} > 0, \quad \forall\ b_A \in [0,\ \bar{b}].$$

That is, $W_A(b_A;\aleph)$ is a strictly convex function of b_A. Hence, the optimal b_A^* that maximizes $W_A(b_A;\aleph)$ will be always attained at the end points of the domain of b_A. Substituting (2) into (4) yields

$$W_A(b_A=0) = \frac{1-t}{16}(a-3c+\tau)^2 + \frac{1}{32}(3a-c-\tau)^2 + T_A,$$
$$W_A(b_A=\bar{b}) = \frac{1-t}{16}(a-3c+\bar{b}+\tau)^2 + \frac{1}{32}(3a-c-\bar{b}-\tau)^2 + T_A.$$

By comparing these two welfare levels, we obtain the optimal interregional barrier imposed by government A, as specified in Proposition 1 below. Define

$$t_A \equiv \frac{3(7\tau-a-9c)}{14(a-2c+\tau)}, \text{ and } t_A \in (0,\ 1) \text{ for } \tau > \frac{1}{7}(a+9c).$$

Proposition 1. *Given the central government's policy $\aleph$ and under condition (C1), local government A's optimal interregional barrier is*

$$b_A^* = \begin{cases} 0 & \textit{for}\ \ (i)\ \tau \le \frac{1}{7}(a+9c)\ \ \textit{or}\ \ (ii)\ \tau \in (\frac{1}{7}(a+9c),\ \frac{1}{3}(a+c))\ \ \textit{and}\ \ t \ge t_A, \\ \bar{b} & \textit{for}\ \ \tau \in (\frac{1}{7}(a+9c),\ \frac{1}{3}(a+c))\ \ \textit{and}\ \ t < t_A. \end{cases}$$

□ **Proof**: $W_A(b_A=\bar{b}) - W_A(b_A=0) = -f(t)(a+c+\tau)/288$, where $f(t) \equiv 3(a+9c-7\tau) + 14(a-2c+\tau)t$. Note that under condition (C1), $f'(t) = 14(a-2c+\tau) > 0$ and $f(1) = 17a-7c-7\tau > 0$. However, $f(0) = 3(a+9c-7\tau)$, which is positive for $\tau < (a+9c)/7$ and negative for $(a+9c)/7 < \tau < (a+c)/3$. Moreover, $f(t_A) = 0$. Based on this property of $f(t)$, we obtain the optimal b_A^* as specified in the proposition. *Q.E.D.*

A typical transitional economy's policy $\aleph$ can be divided into three regimes. In the *centralization-cum-protection* regime (C-P regime, in short), the central government sets a large t and a large

τ, together with a sufficiently large T_A to support each locality. In the *decentralization-cum-protection* regime (D-P regime, in short), the central government sets a small t and a large τ, together with a small or zero T_A. In the *decentralization-cum-liberalization* regime (D-L regime, in short), both t and τ, are small, together with a small or zero T_A. Proposition 1 implies that when a country moves from a C-P regime to a D-P regime, interregional protection arises, from $b_A^* = 0$ to $b_A^* = \bar{b}$, when it moves from a D-P regime to a D-L regime, interregional protection disappears, from $b_A^* = \bar{b}$ to $b_A^* = 0$.

Let us now explain the reasons behind Proposition 1. Imposing an interregional barrier raises the local firm's profit, but lowers consumer surplus. It is clear that the latter effect dominates the formal effect when profit tax rate is very high ($t \geq t_A$ in this model). Hence, government A should make its interregional protection as low as possible. This also implies that the only case for imposing a high interregional barrier is when the profit tax rate is sufficiently high. However, even it is high, interregional barriers are not very effective in helping the local firm to increase its profit if the firm is facing intensive market competition any way, which is the case when τ is sufficiently low ($\tau \leq (a + 9c)/7$ in this model). Thus, it is optimal for government A to impose a high interregional barrier when and only when the profit tax is low and import tariff is high.

Let us now turn to region B's market to derive the optimal interregional barrier imposed by government B. Given b_B, the three firms choose their respective outputs for this market, q_A, q_B and q_F, to maximize their respective pre-tax profits,

$$\begin{aligned} \pi_A &= (a - q_A - q_B - q_F - b_B - c)q_A, \\ \pi_B &= (a - q_A - q_B - q_F)q_B, \\ \pi_F &= (a - q_A - q_B - q_F - \tau)q_F. \end{aligned}$$

As a result, the Cournot-Nash equilibrium outputs are

$$\begin{aligned} q_A^x(b_B,\ \tau) &= (a - 3c - 3b_B + \tau)/4, \\ q_B^x(b_B,\ \tau) &= (a + c + b_B + \tau)/4, \\ q_F^x(b_B,\ \tau) &= (a + c + b_B - 3\tau)/4. \end{aligned} \tag{5}$$

The equilibrium profits are

$$\pi_A^x(b_B,\ \tau) = (a - 3c - 3b_B + \tau)^2/16,$$

$$\pi_B^x(b_B,\ \tau) \ = \ (a+c+b_B+\tau)^2/16, \tag{6}$$
$$\pi_F^x(b_B,\ \tau) \ = \ (a+c+b_B-3\tau)^2/16.$$

From (5), we know that firm A enters region B's market if and only if

$$b_B < \tilde{b},\ \text{ where } \tilde{b} \equiv \frac{a-3c+\tau}{3}. \tag{7}$$

Hence, we can restrict our attention to $b_B \leq \tilde{b}$, because beyond this range a change in b_B will not affect anything.

Moving back to the first stage of the game, we examine how government B will choose b_B to maximize the region's welfare derived from the local market:

$$W_B(b_B;\aleph) = (1-t)\pi_B^x(b_B,\tau) + \frac{1}{32}(3a-c-b_B-\tau)^2 + T_B, \qquad b_B \in [0,\ \tilde{b}] \tag{8}$$

Define

$$t_B \equiv \frac{3(7\tau-a+3c)}{2(7a+3c+7\tau)},\ \text{ and } t_B \in (0,\ 1) \text{ for } \tau > \frac{1}{7}(a-3c).$$

We then have a result similar to Proposition 1.

Proposition 2. *Given the central government's policy* $\aleph$ *and under condition (C1), local government B's optimal interregional barrier is*

$$b_B^* = \begin{cases} 0 & \textit{for} \ \ (i)\ \tau \leq \frac{1}{7}(a-3c) \ \ \textit{or} \ \ (ii)\ \tau \in (\frac{1}{7}(a-3c),\ \frac{1}{3}(a+c)) \ \ \textit{and} \ \ t \geq t_B, \\ \bar{b} & \textit{for} \ \ \tau \in (\frac{1}{7}(a-3c),\ \frac{1}{3}(a+c)) \ \ \textit{and} \ \ t < t_B. \end{cases}$$

□ **Proof**: It is easy to show that $W_B(b_B)$ is a strictly convex function and $W_B(b_B = \tilde{b}) - W_B(b_B = 0) = g(t)\tilde{b}/32$, where $g(t) \equiv (-2a+6c+6\tau+3\tilde{b}) - 2(2a+2c+2\tau+\tilde{b})t$. Note that under condition (C1), $g'(t) = -2(2a+2c+2\tau+\tilde{b}) < 0$ and $g(1) = -(19a-9c-5\tau)/3 < 0$. However, $g(0) = (-a+3c+7\tau)$, which is negative for $\tau < (a-3c)/7$ and positive for $(a-3c)/7 < \tau < (a+c)/3$. Moreover, $g(t_1) = 0$. This property of $g(t)$ yields the optimal b_B^* as specified in the proposition. *Q.E.D.*

The intuition behind Proposition 2 is the same as Proposition 1. Proposition 2 also indicates that when a country moves from a C-P regime to a D-P regime, even the region that has competitive advantage in the industry still imposes interregional protection, from $b_B^* = 0$ to

$b_B^* = \tilde{b}$, and when the country moves from a D-P regime to a D-L regime, interregional protection by this region disappears, from $b_B^* = \tilde{b}$ to $b_B^* = 0$.

■ **Comparison**. By comparing Propositions 1 and 2, we obtain some interesting observations. First, suppose that tariff is sufficiently high that interregional barriers are possible to arise in both regions, which is the case if $\tau > \frac{1}{7}(a + 9c)$. Then, before a tax reform (i.e., t is large), no local government imposes an interregional barrier. As tax reform starts and goes deeper (i.e., t starts and continues to drop), we will first see $t \in (t_A,\ t_B)$ because $t_A < t_B$. That is, government B erects an interregional barrier earlier than government A. This seems counterintuitive because it says that the more competitive region (B) introduces interregional trade barriers first. But it can be easily explained. Region B receives more profit than region A and hence when the local firms can keep a larger proportion of their profits, government B will have a stronger incentive than government A to firstly enlarge its firm's pre-tax profit by erecting an interregional barrier.[12]

Second, suppose that the tax rate is sufficiently low that both local governments may impose interregional barriers, which is case when $t < t_2$. Then, before trade liberalization takes place in the country (i.e., when $\tau > \frac{1}{7}(a + 9c)$), there are interregional barriers in both regions. As trade liberalization starts and goes deeper, we will first encounter the case in which $\tau \in (\frac{1}{7}(a - 3c),\ \frac{1}{7}(a + 9c)]$. Government A will remove its interregional barrier earlier than government B. Since trade liberalization reduces local firms' profits and raises consumer surplus, it makes interregional protection less attractive. Government A gives up protection first because the region enjoys less profit than region B.

Third, although government B erects interregional barriers under more circumstances than government A, whenever both governments impose interregional barriers, government A's barrier is higher than government B's, $\bar{b} > \tilde{b}$. This is simply because a higher barrier is needed for government A than for government B in order to prohibit the non-local rivalry from entering the local market.[13]

[12]Bai *et al* (2002) provide an indirect empirical support to this comparison. They find that local governments have a stronger incentive to protect those industries that enjoyed more profits in the past. In the case of the present paper, firm B enjoys a larger profit than firm A when they face the same policy environment.

[13]In the multiple industries case, the implications of Propositions 1 and 2 are as follows. As domestic tax reform proceeds, a local government will impose interregional trade barriers on its competitive

4. Entry Costs and Strategic Interregional Protection

In this section, we consider the case where the two domestic firms have identical (zero) marginal costs of production, i.e., $c = 0$, but face different costs of entering the industries. To highlight the difference between the two regions, we assume that firm B faces zero industry-entry cost, and firm A faces an industry-entry cost $k > 0$. Other specifications remain the same as in Section 3.

4.1. Low Tariffs

In this subsection, let us consider the simplest case in which $\tau = 0$. For obvious reason, we should focus on the case where entry cost k is neither too high to always keep firm A from entering the industry nor too low that no policy can discourage firm A from entering the industry. In particular, we assume that firm A will enter the industry when there is no interregional protection in both markets, but will not enter the industry if government B imposes a prohibitive barrier ($\tilde{b}$) in market B and government A does not protect firm A in market A. From the analysis in Section 3, this condition is equivalent to

$$\textbf{Condition 2:} \qquad \frac{a^2}{16} < k < \frac{a^2}{8}. \tag{C2}$$

Suppose $b_B = 0$, then from Proposition 1 it is clear that government A's optimal response is to set $b_A = 0$.

Suppose $b_A = 0$, we derive government B' s optimal response below. There are two possible outcomes from the imposition of b_B: firm A enters the industry or it does not. By condition (C2), firm A enters if $b_B = 0$, but it does not enter if $b_B = \tilde{b}$. Note that for a given k satisfying condition (C2), a b_B lower than $\tilde{b}$ can be sufficient to deter firm A's entry to the industry. However, on the one hand, as long as firm A is deterred from entering, region B's welfare is equal to that at $b_B = \tilde{b}$. On the other hand, as long as firm A is not deterred from entering B's market, government B should set $b_B = 0$ as indicated by Proposition 2. Hence, we need to only compare region B's welfare at $b_B = 0$ and $b_B = \tilde{b}$. Region B's welfare is the sum of the after-tax

advantageous sectors earlier than on its competitive disadvantageous sectors. As the country's trade liberalization starts, a local government will remove interregional trade barriers from its competitive disadvantageous sectors earlier than from its competitive advantageous sectors. When a local government has interregional barriers on all sectors, those for the less competitive sectors are higher than those for the more competitive sectors.

profits from two markets (A and B), consumer surplus and the central government's revenue transfer, which can be easily obtained as

$$\hat{W}_B(0) = (1-t)\frac{a^2}{8} + \frac{9a^2}{32} + T_B, \quad \text{and} \quad \hat{W}_B(\tilde{b}) = (1-t)\frac{2a^2}{9} + \frac{2a^2}{9} + T_B.$$

Direct comparison yields

$$\hat{W}_B(0) - \hat{W}_B(\tilde{b}) \begin{cases} > 0 & \text{for } t > 11/28, \\ = 0 & \text{for } t = 11/28, \\ < 0 & \text{for } t < 11/28. \end{cases}$$

The above result can be easily understood. With a high interregional barrier, region B's loss in consumer surplus outweighs its gain in producer profit derived from the local market. However, there is an additional profit gain in region A's market because firm A's entry is deterred. When profit tax is sufficiently low, the after-tax profit gain outweighs the loss in consumer surplus. In that case, prohibitive interregional barrier is optimal.

If government B sets $\tilde{b}$, what's government A's optimal response? Government A's decision is whether to choose $b_A = 0$ or to choose a sufficiently large b_A to induce firm A's entry to the industry. First, note that a necessary and sufficient condition to induce firm A's entry (when $b_B = \tilde{b}$) is that firm A's pre-tax profit is nonnegative, i.e., $(a + b_A)^2/16 - k \geq 0$, or $b_A \geq b^e \equiv 4\sqrt{k} - a$. However, region A's barrier is capped by $\bar{b} = a/3$. Hence, under condition (C2), the above analysis shows that firm A is induced to enter the industry (only marekt A) if and only if $k \in (a^2/16,\, a^2/9)$ and $b_A \geq b^e$. As a result, for $k \in [a^2/9,\, a^2/8)$, government A is not able to induce firm A to enter the industry.

Second, suppose $k \in (a^2/16,\, a^2/9)$. Then, region A's welfare at $b_A \geq b^e$ is

$$\hat{W}_A(b_A) = (1-t)\left[\frac{(a+b_A)^2}{16} - k\right] + \frac{1}{32}(3a - b_A)^2 + T_A.$$

Since $\hat{W}_A'(b_A) = -[(1+2t)a - (3-2t)b_A]/16 < 0$ for all $b_A \leq \bar{b}$, as long as government A wants to induce firm A's entry, it is optimal to set $b_A = b^e$. Hence, we only need to compare

$$\hat{W}_A(b_A = 0) = \frac{2a^2}{9} + T_A \quad \text{and} \quad \hat{W}_A(b_A = b^e) = \frac{1}{2}(a - \sqrt{k})^2 + T_A.$$

We find that $\hat{W}_A(0) < \hat{W}_A(b^e)$ because $k < a^2/9$. That is, whenever government A can choose a high interregional barrier to induce firm A's entry to the industry, it always does so.

Third, if government A sets $b_A = b^e$, as indicated by Proposition 2, it is optimal for government B to set $b_B = 0$ since it cannot deter firm A's entry anyway.

Finally, if $b_B = 0$, it is optimal for government A to set $b_A = 0$, but which will induce government B to set $b_B = \tilde{b}$. Hence, there is no pure strategy Nash equilibrium for $k \in (a^2/16, a^2/9)$ and $t < 11/28$.

We can now summarize the above analysis in Proposition 3.

Proposition 3. *Suppose condition (C2) holds and* $\tau = 0$. (i) *Then the equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = 0\}$ *if* $t \geq \frac{11}{28}$. (ii) *The equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = \tilde{b}\}$ *if* $t < \frac{11}{28}$ *and* $k \in [\frac{1}{9}a^2, \frac{1}{8}a^2)$. (iii) *There exists no pure strategy Nash equilibrium interregional barriers if* $t < \frac{11}{28}$ *and* $k \in [\frac{1}{16}a^2, \frac{1}{9}a^2)$.

The equilibrium is obvious and less interesting when condition (C2) does not hold. If $k \leq a^2/16$, the entry cost is so low that firm A always enter the industry with and without government A's protection. Then, we are back to the no-entry-cost case as in Section 3. Since $\tau = 0$, Propositions 1 and 2 say that the equilibrium is no interregional protection. If $k > a^2/8$, the entry cost is so high that firm A cannot enter the industry anyway. Then, government A's optimal choice is $b_A^{**} = 0$ and government B also sets $b_B^{**} = 0$ since it does not have to rely on interregional protection to deter firm A's entry to the industry.

Compared to Propositions 1 and 2, Proposition 3 shows the increase of interregional protection in the presence of entry cost. In the absence of entry costs and for $\tau = 0$, no local government imposes any interregional barrier. However, for sufficiently high entry cost (i.e., $k \in [a^2/9, a^2/8)$) and low profit tax rate (i.e., $t < 11/28$), government B imposes the prohibitive interregional barrier. Government B strategically protects its local market in order to help its firm get a higher profit in the other region's market.[14]

According to Proposition 3(iii), there exists no pure strategy Nash equilibrium if $t < 11/28$ and $k \in [a^2/16, a^2/9)$. We can prove that there exits a unique mixed strategy Nash equilibrium. That is, there exists a unique $\theta_A \in (0, 1)$ and $\theta_B \in (0, 1)$ such that government A sets $b_A = 0$ with probability θ_A and $b_A = b^e$ with probability $1 - \theta_A$, and government B sets $b_B = 0$ with probability θ_B and $b_B = \tilde{b}$ with probability $1 - \theta_B$. In this case, the "average" degree of interregional protection is higher than in the case where there is no entry cost.

[14]The result is similar to the idea of import protection as export promotion, but without increasing returns to scale.

Corollary. *Suppose condition (C2) holds and* $\tau = 0$. *There exists a unique mixed strategy Nash equilibrium interregional barriers if* $t \geq \frac{11}{28}$ *and* $k \in [\frac{1}{16}a^2, \frac{1}{9}a^2)$.

Proof. See Appendix.

4.2. Large Tariffs

In the preceding section, we have shown that in the case of $\tau = 0$, government B uses interregional barrier as a strategical device to deter firm A's entry to the industry. There will be no interregional protection in either region in the absence of such strategical behavior. In this section, we argue that the same result holds in a more general situation, i.e., $\tau \neq 0$. To address this point as clearly as possible, we focus on the case in which interregional protection will not arise otherwise. That is, according to Propositions 1 and 2, we should confine our analysis to (i) $\tau \leq \frac{1}{7}a$ and (ii) $\tau \in (\frac{1}{7}a, \frac{1}{3}a)$ with $t \geq \bar{t}$, where

$$\bar{t} \equiv \frac{3(7\tau - a)}{14(a + \tau)}.$$

For obvious reason, we should focus on the case where entry cost k is neither too high to always keep firm A from entering the industry nor too low that no policy can discourage firm A from entering the industry. In particular, we assume that firm A will enter the industry when there is no interregional protection in both markets, but will not enter the industry if government B imposes a prohibitive barrier ($\tilde{b}$) in market B and government A does not protect firm A in market A. From the analysis in Section 3, this condition is equivalent to

$$\textbf{Condition 3:} \qquad \frac{(a+\tau)^2}{16} < k < \frac{(a+\tau)^2}{8}. \tag{C3}$$

Denote $t_0 \equiv (11a + 35\tau)/28(a + \tau)$. For the case $\tau \leq \frac{1}{7}a$, we obtain the following proposition.

Proposition 4. *Suppose condition (C3) holds and* $\tau \in (0, \frac{1}{7}a)$.

(i) *Then the equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = 0\}$ *if* $t \geq t_0$.

(ii) *The equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = \tilde{b}\}$ *if* $t < t_0$ *and (a)* $k \in [\frac{1}{9}(a - 2\tau)^2, \frac{1}{9}(a + \tau)^2)$, *or (b)* $k \in [\frac{1}{16}(a + \tau)^2, \frac{1}{9}(a - 2\tau)^2)$ and $\tau \in (\frac{1}{11}a, \frac{1}{7}a)$.

(iii) *There exists no pure strategy Nash equilibrium interregional barriers if* $t < t_0$, $k \in [\frac{1}{16}(a + \tau)^2, \frac{1}{9}(a - 2\tau)^2)$ *and* $\tau < \frac{1}{11}a$.

Proof. See Appendix.

For the case $\tau \in (\frac{1}{7}a, \frac{1}{3}a)$ and $t \geq \bar{t}$, we obtain the following proposition. The proof is similar to that of Proposition 4 and so we omit it.

Proposition 5. *Suppose condition (C3) holds,* $\tau \in (\frac{1}{7}a, \frac{1}{3}a)$ *and* $t \geq \bar{t}$.

(i) *Then the equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = 0\}$ *if* $t \geq t_0$.

(ii) *The equilibrium interregional barriers are* $\{b_A^{**} = 0, b_B^{**} = \tilde{b}\}$ *if* $t < t_0$.

The general message from Propositions 4 and 5 is that government B will use interregional trade protection to deter firm A's entry to the industry when t is not too large and k is moderate.

5. Conclusion

China's domestic markets are fragmented partly due to interregional trade protection. In this paper, we argue that interregional protection may arise because of domestic fiscal decentralization and international trade protection. We also predict that China's accession to the WTO will reduce local governments' incentive to maintain interregional trade barriers.

The paper's finding and prediction leads to an empirically testable hypothesis: Other things being equal, countries with low profit tax but high international trade protection tend to have more interregional trade protection.

Instead of erecting interregional trade barriers, local governments can also assist local firms through other protectionist devices such as production or entry subsidies. Like interregional trade barriers, subsidies will also distort protection structure away from patterns of comparative advantage. However, the analysis of optimal subsidies could be very different from non-tariff barriers because non-tariff barriers do not generate tariff revenue to local welfare and subsidies require government budget. We leave the topic on the comparison of various forms of interregional protection for future research.

Appendix

A1. Proof of Corollary.

By Nash Theorem (1950), we know that in a finite static game of complete information, there exists at least one Nash Equilibrium, possibly involving mixed strategy Nash Equilibrium. Since there doesn't exist any pure strategy Nash Equilibrium when $t \geq \frac{11}{28}$ and $k \in [\frac{1}{16}a^2, \frac{1}{9}a^2)$, there must exist at least one mixed strategy Nash Equilibrium. Now it is left to show that there exists at most one mixed strategy Nash Equilibrium. We can use the method of reaction function to show this point.

Note that government A has two pure strategies ($b_A = 0$, $b_A = b^e$) and government B has two pure strategies ($b_B = 0$, $b_B = \tilde{b}$) . Let π_{ij}^m denote the welfare of region m (=A,B) when government A chooses strategy i (=1,2) and government B chooses strategy j (=1,2). Let $\theta_m \in (0,1)$ be the probability of government m setting $b_m = 0$.

Since there doesn't exist any pure strategy Nash Equilibrium, government m will be indifferent between strategy 1 and strategy 2 given the other government's mixed strategy. That is, $\theta_m \pi_{11}^m + (1-\theta_m)\pi_{12}^m = \theta_m \pi_{21}^m + (1-\theta_m)\pi_{22}^m$. From this, we get government m's reaction, given any θ_{-m} chosen by the other government, as

$$\theta_m(\theta_{-m}) = \frac{\pi_{22}^m - \pi_{12}^m}{\pi_{11}^m + \pi_{22}^m - \pi_{12}^m - \pi_{21}^m}.$$

It can be verified that $\theta_m(\theta_{-m}) \in (0,1)$.

It is clear that the two reaction curves $\theta_A(\theta_B)$ and $\theta_B(\theta_A)$ have and only have one intersection. *Q.E.D.*

A2. Proof of Proposition 4.

(i). Suppose $b_B = 0$, then from Proposition 1, government A's optimal response is to set $b_A = 0$.

(ii). Suppose $b_A = 0$, we derive government B' s optimal response below. There are two possible outcomes from the imposition of b_B: firm A enters the industry or it does not. By condition (C3), firm A enters if $b_B = 0$, but it does not enter if $b_B = \tilde{b}$. Note that for a given k satisfying condition (C3), a b_B lower than $\tilde{b}$ can be sufficient to deter firm A's entry to the industry. However, on the one hand, as long as firm A is deterred from entering, region B's

welfare is equal to that at $b_B = \tilde{b}$. On the other hand, as long as firm A is not deterred from entering B's market, government B should set $b_B = 0$ as indicated by Proposition 2. Hence, we need to only compare region B's welfare at $b_B = 0$ and $b_B = \tilde{b}$. We have (to save notations, we use the same notations as in the proof for Proposition 3)

$$\begin{aligned}\hat{W}_B(0) &= (1-t)\frac{(a+\tau)^2}{8} + \frac{(3a-\tau)^2}{32} + T_B,\\ \hat{W}_B(\tilde{b}) &= (1-t)\frac{2(a+\tau)^2}{9} + \frac{(2a-\tau)^2}{18} + T_B.\end{aligned}$$

Direct comparison yields

$$\hat{W}_B(0) - \hat{W}_B(\tilde{b}) \begin{cases} \geq 0 & \text{for } t \geq \bar{t},\\ < 0 & \text{for } t < \bar{t}.\end{cases}$$

(iii). Suppose $b_B = \tilde{b}$. First, note that a necessary and sufficient condition to induce firm A's entry (when $b_B = \tilde{b}$) is $b_A \geq b^e \equiv 4\sqrt{k} - a - \tau$. However, region A's barrier is capped by $\bar{b} = (a+\tau)/3$. Hence, under condition (C3), the above analysis shows that firm A is induced to enter the industry (only marekt A) if and only if $k \in (a^2/16,\, a^2/9)$ and $b_A \geq b^e$. As a result, for $k \in [\frac{1}{9}(a+\tau)^2,\, \frac{1}{8}(a+\tau)^2)$, government A is not able to induce firm A to enter the industry. In this case, $b_A = 0$.

Now, suppose $k \in (\frac{1}{16}(a+\tau)^2, \frac{1}{9}(a+\tau)^2)$. Then, region A's welfare at $b_A \geq b^e$ is

$$\hat{W}_A(b_A) = (1-t)\left[\frac{(a+b_A+\tau)^2}{16} - k\right] + \frac{1}{32}(3a - b_A - \tau)^2 + T_A. \tag{A1}$$

From (A1), we have

$$\hat{W}_A(b^e) - \hat{W}_A(\bar{b}) = \frac{1}{6}\left(a+\tau-3\sqrt{k}\right)\left(a-\tau-3\sqrt{k}\right) + t\left[\frac{1}{9}(a+\tau)^2 - k\right],$$

which is positive if and only if $t \geq t^*$, where

$$t^* \equiv -\frac{\left(a+\tau-3\sqrt{k}\right)\left(a-\tau-3\sqrt{k}\right)}{9\left[\frac{1}{9}(a+\tau)^2 - k\right]}.$$

If $\sqrt{k} \in (\frac{1}{4}(a+\tau), \frac{1}{3}(a-\tau)]$, we have $t^* < 0$. Hence, $\hat{W}_A(b^e) > \hat{W}_A(\bar{b})$. Then we need to compare region A's welfare between $b_A = 0$ and $b_A = b^e$. From (A1) we have $\hat{W}_A(0) > \hat{W}_A(b^e)$ iff $\sqrt{k} > \frac{1}{3}(a-2\tau)$. This allows us to get the following result: For $\sqrt{k} \in (\frac{1}{4}(a+\tau), \frac{1}{3}(a-\tau)]$, the optimal b_A is

$$b_A = \begin{cases} 0 & \text{for } \tau \in (\frac{1}{11}a, \frac{1}{7}a) \text{ or } \tau \leq \frac{1}{11}a \text{ and } \sqrt{k} \in (\frac{1}{3}(a-2\tau), \frac{1}{3}(a-\tau)]\\ b^e & \text{for } \tau \leq \frac{1}{11}a \text{ and } \sqrt{k} \in (\frac{1}{4}(a+\tau), \frac{1}{3}(a-2\tau)].\end{cases}$$

Next, if $\sqrt{k} \in (\frac{1}{3}(a-\tau), \frac{1}{3}(a+\tau))$, we have $t^* > 1$. Hence, $\hat{W}_A(b^e) < \hat{W}_A(\bar{b})$. Then we need to compare region A's welfare between $b_A = 0$ and $b_A = \bar{b}$. From (A1) we have $\hat{W}_A(0) > \hat{W}_A(\bar{b})$ iff $t < \left[k - \frac{1}{9}(a^2 + \tau^2 - 4a\tau)\right] / \left[\frac{1}{9}(a+\tau)^2 - k\right]$, which holds because $t < t^*$ and t^* is less than the RHS of the inequality. Hence, its always optimal for region A to set $b_A = 0$.

(iv). Suppose $b_A = b^e$. Then, it is optimal for government B to choose $b_B = 0$ according to Proposition 2 since it is impossible to deter firm A's entry to the industry any way.

Concluding from the above four parts leads the proposition. *Q.E.D.*

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