



# Measuring Barriers to Cross-Provincial Trade in the People's Republic of China

Master Thesis

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## Abstract

This thesis applies a methodology based on the Novy (2013) ratio of trade barriers to identify variations in barriers to cross-provincial trade in the People's Republic of China, econometrically tests for determinants of such variations, and together with the results of a field study determines the state of the current trade environment. Results of this study show the presence of such barriers to trade, and that those barriers have been varying over time as well as across provinces. Econometric testing shows that barriers to cross-provincial trade are highly dependent on transport infrastructure, international trade protection and industrialization. The field study contrasts both the results from the initial analysis and the econometric analysis. Implications and possible factors of this discrepancy are also discussed.

## 摘要:

本文应用 Novy (2013) 中的贸易壁垒比率, 通过实证分析研究了中华人民共和国国内省际贸易壁垒的变化和引起变化的原因, 并结合实地调查研究以确定当前国内的贸易环境。此项研究结果表明中国国内存在省际贸易壁垒, 且贸易壁垒随时间和地区差异而变化。实证分析结果显示中国省际贸易壁垒高度依赖于产业化、国际贸易保护及国内交通基础设施。实地调查结果与实证分析结果相左。本文还就二者差异产生的可能因素及其影响进行了相关讨论。

Supervisor: Maria Persson

Keywords: Cross-Provincial Trade, Trade Barriers, the People's Republic of China

关键词: 省际贸易, 贸易壁垒, 中华人民共和国

# 1 Introduction

In recent decades, the People's Republic of China (PRC) has experienced tremendous economic growth and also a surge in economic integration on a global scale with a massive increase in international imports and exports. The domestic economic integration in the PRC is not that clear cut however, and there are numerous disagreements among scholars on this topic. This study aims to further elaborate on this topic and contribute to the ongoing discourse with a long-run overview of the development of domestic market integration.

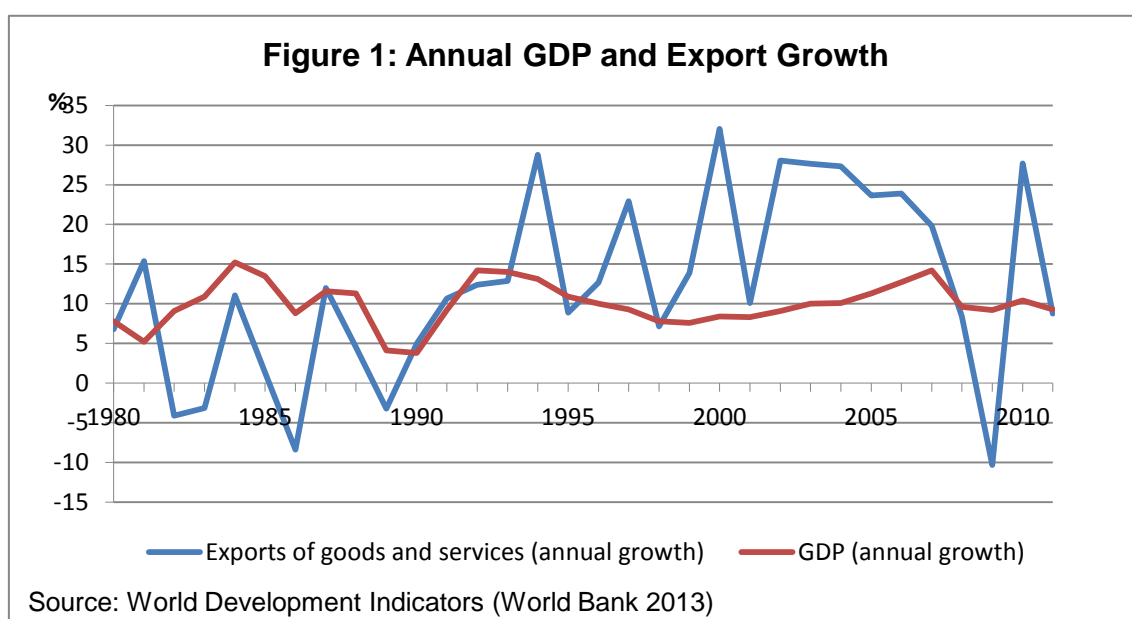
This paper has two main objectives. First, to determine whether or not there are domestic barriers to trade between provinces in the PRC, and if so, how they have varied over time. To capture these non-tariff barriers (NTBs) to domestic trade, an indirect methodology based on the Anderson and van Wincoop (2003) gravity model and Novy (2013) ratio of trade barriers is used. Intuitively, the methodology suggests that trade barriers can be estimated relatively among provinces. At any given point in time, several economies may have similar bilateral trade with a third outside economy. But if consumption of domestically produced goods differs among the economies, this implies that those economies have dissimilar patterns of trade, assuming the gravity equation to be true. This realization allows for an indirect method of estimation. Second, to identify factors that explain variation in these domestic trade barriers, or, put differently, to find the sources of the internal barriers. This question is approached from two rather different methodological perspectives. First, indirectly derived measures of domestic trade barriers are used (in analogy with the Wong (2012) study) as the dependent variable in a regression analysis, and include a rich set of explanatory variables to see whether they can explain any of the statistical variation. Second, in-depth interviews in the field with Chinese firms and foreign firms operating on the Chinese market are performed in order to determine what they perceive to be the causes of such trade barriers. While the first approach is useful by enabling formal statistical tests of hypotheses, the additional interviews allow for collection of much more detailed and case-specific information. In this sense, using these two methodological approaches in combination will lay the basis for well-founded conclusions in a way that using either one of them on its own would not. In particular, it will be very helpful for discussing realistic policy implications of the findings in this study.

This paper is arranged in the following manner. Chapter 2 consists of an historical overview of the economic situation in China. The possible effects of outward openness and fiscal reform on domestic integration are included. Chapter 3 discusses results of

previous research and relates previous findings to this study. Chapter 4 presents the indirect measurement of domestic trade barriers, the methodology used and results. Chapter 5 consists of an econometric approach, estimating trade barriers over time in a panel data regression. Chapter 6 discusses the field study method and results. Chapter 7 concludes the study.

## 2 Overview of the Economic Development in the PRC

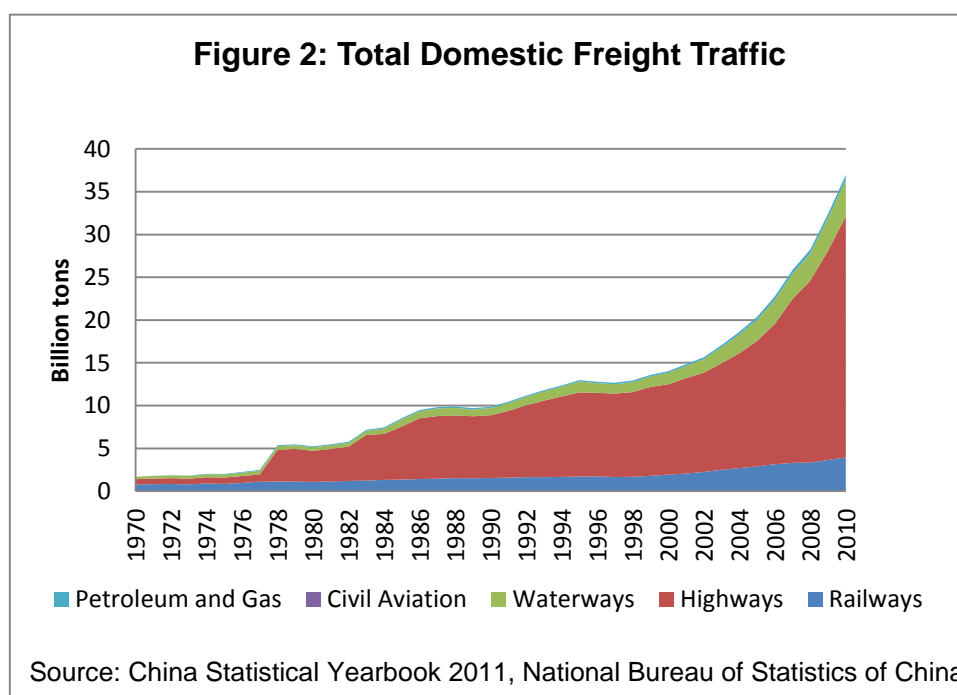
Chinese growth during the economic transition was accompanied by large exports, and international trade has indeed played a large role in the economic development. The market transition started with the opening up policies issued by Deng Xiaoping in 1979. For several years the PRC has experienced double digit Gross Domestic Product (GDP) growth rate, and massive development of foreign trade. The causal relationship between increased international integration and economic growth is still undetermined and is an ongoing debate among scholars. Nevertheless, it seems highly improbable that the PRC would have experienced this tremendous growth without foreign influence in trade and foreign direct investment. The overall development of output and export growth rates is shown in Figure 1.



Note the decline in both GDP and export growth rates in 1989 due to macroeconomic instability and high inflation rates. These led students to pour into the Tian'anmen Square in Beijing in protest against the handling of the economic situation and the increasing corruption within the governmental apparatus. The political crisis escalated and the conservative fractions of the leadership ordered the military to clear the square,

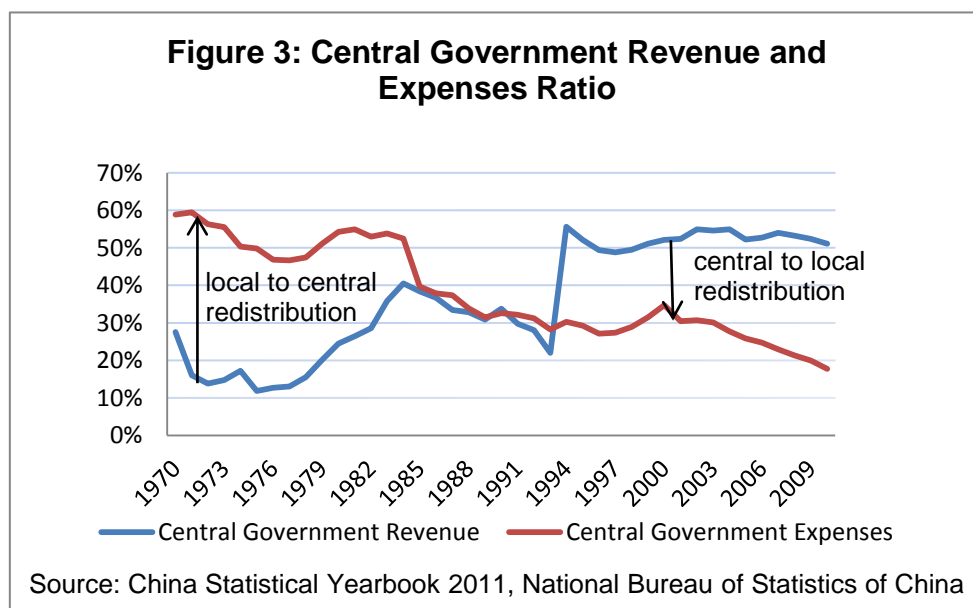
resulting in hundreds of people being killed. The international relations were stagnating and the international community held its breath. The 1989 - 1990 period is indeed the only one during the last 30 years when the GDP growth was below 5 per cent. After the Tian'anmen interlude the country experienced a series of unsuccessful reforms, and it was not until Deng Xiaoping's "Southern Tour" to the special economic zones in 1992 that the pendulum started swinging back and exports began booming. Since then the economy has been growing by around 10 per cent annually. Note also the rapid decrease in exports during the global recession 2008.

What happened to domestic trade during this period? We can see from Figure 2 that there has been a massive increase in domestic traffic since the opening-up reform in 1979. More interestingly, there seems to be a structural break in domestic trade around the time of World Trade Organization (WTO) entry in late 2001. This suggests that an increased international openness may have provided a larger domestic integration as well. The growth of domestic freight traffic is mostly due to the expansion of highways. There is also a growth of transport by water and railways, but not as remarkable as highways. Petroleum and gas freight traffic refers to transport by the means of pipelines. Petroleum and gas and Civil Aviation transport are negligible.



During the economic transition, the central government launched a number of reforms on institutional restructuring. The first era of economic reform (1979-1992), starting with the Deng Xiaoping open door policy, was overall decentralizing. Authority and resource allocation was shifted to provincial governments. The main policy implications of the

second era of reform are market unification, recentralization of resources and macroeconomic control (Naughton, 2007:91). In 1994, recentralization policies of fiscal control boosted tax revenue to the central government from 28 per cent of total tax revenue in 1993 to 55 per cent in 1994 (see Figure 3 below). The revenue to central government has been maintained at over 50 per cent till the present time. However, much of the expenses still burden the local governments, and a central to local redistribution is evident. (Statistical Yearbook of China 2011:278).



Fiscal decentralization may prove advantageous to market development. Qian and Roland (1998) present two main reasons. First, if factors of production are mobile the federal fiscal system gives rise to competition between provincial governments. Second, the fiscal decentralization may harden budget constraints for state-owned inefficient firms and provide incentives for local activities aimed at efficiency gains. Local governments have to compete in establishing a good business environment. If we assume that local firm performance has positive effects on tax revenue, local governments have incentives to make local firms prosper. Thus, local governments also have the incentive to protect firms from competition.

From 1994 and onwards, provincial governments are dependent on the redistribution of fiscal revenue from the central government, as the greater expenses are on the provincial level. This dependency may have encouraged protection of local firms, not only to secure some revenue and become less dependent on the central government, but also the fact that keeping employment and production running provides a greater possibility of approval from the central government. In 1994, the government of the PRC also issued the Company Law, providing legal status to privately owned

enterprises. This may also have created support for a protectionist policy, as competition increased when previously illegal businesses now had legal rights. Prior to the company law, non-state businesses faced the risk of immediate shut down, a risk now absent.

During the 1990s, economic reforms strengthened the institutions of the market economy, and emphasis was directed to macroeconomic control and regulations (Naughton, 2007:91). Those reforms were plain prerequisites for accession into the WTO. Extensive reforms in 1993 focused on the external sector and foreign exchange, and devaluation of the currency. Those were important steps towards a WTO membership which, after lengthy negotiations, were contracted in December 2001 (Naughton 2007:105). The WTO accession implies a further step towards global openness of the Chinese economy. The weighted average of most favored nation tariff rates has decreased dramatically from 32 per cent in 1992 to well below 5 per cent in 2010 (World Development Indicators 2013, World Bank). Reforms prior to the WTO entry consist of privatization of state owned enterprises and expansion of the private market by the distinctive dual-track system (双轨制). The intention was to maintain the planned economy while expanding the private sector, and gradually *grow out of the plan*. More export oriented reforms were passed in 1993 that unified the foreign exchange regime, currency devaluation and establishment of current-account convertibility. Steps towards a regulatory state were taken even further in the late 1990s with the establishment of stock markets and regulatory supervision of securities, intellectual property, and quality controls (Naughton 2007:104). Those steps towards an economy governed under the rule of law increase the possibility of investing in companies listed on the stock exchanges and trade in securities within the country. Such a development may also affect the trade in other commodities. Note the constant high export growth rates subsequent to the WTO entry in 2001, excluding the financial crisis 2008-2009 (Figure 1).

China has indeed taken steps towards global integration. Bransletter and Lardy (2006:3) provide an analysis of the major steps of the Chinese economic policies during the opening up period. The authors state that “the additional openings mandated under China’s WTO accession agreement will likely make China’s economy the most open of any large developing country, and, to date [2006], China has made reasonable progress toward meeting her obligations”.

Although the Chinese government has promoted outward openness to a large extent, much of the integration of the domestic market is still uncertain. Most studies

conducted on domestic trade patterns in China show that protectionist policies issued by local government indeed pose substantial barriers to trade. There is no consensus, however, on whether the domestic market is becoming more integrated or increasingly fragmented, and to what extent foreign integration affects domestic integration. This outward openness policy may have created a competitive environment, which the Chinese firms have been forced to adapt to in order to maintain business contracts. As firms become more acclimatized to a competitive environment, they might lobby for higher domestic integration as well.

Several anecdotes describe the nature of NTBs in interprovincial trade in China. Chen (1994:7-8) finds that regional disintegration started during the 1980s, and in 1986 the local government in Zhejiang province restricted the sale of silk cocoons to other provinces in order to favor local silk processing industries. To ensure profits for local automobiles production, local governments in Shanghai only allow taxi service cars to be a typical brand of car produced by the local joint venture firm with Volkswagen (Li, Qiu and Sun, 2003). Another anecdote tells of Shenzhen local government prohibiting a neighboring city, Guangzhou, from selling newspapers in order to keep profits from the local state-owned newspaper in Shenzhen (Gilley, 2001).

Trade barriers are inherently hard to measure as they appear in many forms. This is especially true for NTBs. Naughton (2000) points out that local governments in the PRC rarely close their borders to interprovincial trade, and do not impose tariffs. Barriers typically consist of benefits for local firms, fees on sales of non-local goods, commercial licensing and quotas. It is important to remember that barriers to trade should not only be interpreted as the possible policies implemented and enforced by potentates, but as all obstacles to trade, intended or unintended. However, local officials have high influence over the local regulatory system and the enforcement apparatus. This enables local governments to impose NTBs on outside economic actors that significantly increase cross-provincial investments. High local government ownership puts local officials in a situation where they have on the one hand the economic objectives of the enterprise, and on the other hand political interests in maximizing tax revenues and sustaining employment. Because of these dual aims, and the possession of regulatory power both in production and trade, there is a clear incentive to protect local firms from outside competitors. The Chinese Industrial Economics Research Institute (1998:264) states:

An appropriate number of producers in the same industry promotes competition, provides a diverse production mix of goods and services, reduces production costs and increases product quality. But it is also pointed out that an excessive number of

duplicative firms may create unsound competition and waste of resources. Today [1998], China's local economic practices have resulted in an unreasonable amount of duplicative firms. One factor behind this is that the aims of the local governments are driven by financial ambitions and the display of political achievements.

During the mid-1980s the government launched a series of foreign friendly reforms and established special economic zones in order to attract foreign capital (Fairbank and Goldman 2006:415). Very soon foreign companies moved manufacturing to mainland China. The international openness was soon to be interrupted by a political and economic crisis culminating in a civil uprising which shocked the western world and halted the foreign capital flow into the country. If domestic market integration was accompanied by foreign openness it is possible that the economic and social unrest in 1987-1988 prior to the Tian'anmen square protests did not only destroy foreign relations but also had an impact on the domestic market integration.

In conclusion, recent events may have affected the domestic trade environment in the PRC. First, the economic crisis and political turmoil in the mid-80s, resulting in mass protests in Tian'anmen square, substantially affected economic growth and international relations which may have affected the domestic market as well. Second, a fiscal reform and issuing of a Company Law in 1994 may have affected incentives for trade as firms were given the formal rights to do business, and may have spurred protectionist behavior from local policymakers. Third, the outward openness increased dramatically since the accession into the WTO in 2001. This outward openness may have created a competitive environment, which the firms have been forced to adapt to. As firms are more acclimatized to a competitive environment, they might lobby for higher domestic integration as well. Considering the descriptive statistics in Figure 1 and Figure 2, one could see simultaneous growth of foreign trade and domestic trade. This suggests that the WTO entry may have affected domestic trade. Finally, the global economic recession 2008 and the stimulus package increased final consumption expenditure by 15 per cent in 2009, at the same time as international exports decreased by 10 per cent. This may have caused Chinese firms to turn to the domestic market, spurring domestic integration. Events of interest are summed up in Table 1.



**Table 1: Important events**

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1989	Social and economic turmoil, foreign relations stagnated.
1994	Issuing of a Company Law. Formal rights for entrepreneurs to do business
2001	WTO entry. Considerable increase in foreign trade.
2008	Global Financial Crisis. Stimulus package to increase private consumption.

### **3 Previous Research**

Several studies find that the domestic economic integration in China does indeed differ from the international outward policies conducted by the central government. There is no consensus however on the question of whether barriers to trade have varied over time and if there is an increasing or decreasing trend. Young (2000) argues that the economic transition into a market economy resulted in increasing interregional competition between duplicative industries. This threatened the profitability of industries, leading local governments to impose various barriers to trade. With the rise of international openness, the domestic market became fragmented. Poncet (2001, 2003, and 2005) uses a model of monopolistic competition inspired by Krugman (1980) to analyze the degree of domestic integration in the PRC. Interesting findings in these studies are that on the one hand Chinese provinces seem to rely more on domestic trade than international trade. On the other hand, provincial trade barriers seem to have been high and rising during the years 1987-97. According to the author, this contradictory behavior is the result of a dual objective by local governments, namely socio-economic stability and maximization of fiscal revenue. Another study by Wong (2012) uses provincial input-output data for the period 1992-2002 in order to measure domestic trade barriers, and finds that domestic trade barriers indeed have been rising during this period. Interestingly, foreign trade and intra-provincial (local) purchases have risen, while the share of domestic cross-provincial trade has been decreasing. One reason could be that international trade has been substituted for domestic trade, but according to the findings of Wong it is more likely that domestic protectionism is high and rising. The Wong (2012) study applies the same methodology as in this paper to estimate cross-provincial trade barriers.

In contrast to the results of the Wong (2012) and Poncet (2001, 2003 and 2005), Xu and Li (2011) find support for a development in the opposite direction. They apply a traditional gravity equation approach using a dataset based on railway freight among all provinces from 1985 to 2007. This dataset allows for a gravity equation approach but note the trend in domestic freight traffic (Figure 2). Railway freight represents only a small part of total traffic, suggesting unreliable results. They find several biases in domestic trade patterns, including home bias, and a negative correlation between international and cross-provincial trade. The results also show a negative trend in border effects (down by 50 per cent during the period of study), implying that regional protectionism is decreasing. Li, Qiu and Sun (2003) examine the factors behind interregional protection, and find that high external trade protection and domestic fiscal decentralization (as during the economic transition of the PRC) are main factors. This also suggests that the domestic trade barriers will diminish as a result of the external trade liberalization and as a result of the accession to the WTO. The mechanism behind this causality can be explained by a two-sector model. Li, Qiu and Sun (2003:229) states:

Foreign firms and domestic firms are competing for profits in all local markets. [...] We confine internal decentralization to tax reform in which the central government lowers the rate of profit tax 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' incentives 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.

When international trade protection is high, the incentive is high for local governments to protect local industries for the purpose of maintaining tax revenue. Increased external openness, by for example entering the WTO, may therefore put pressure on cross-provincial trade protection as well. Considering the development of domestic freight traffic and international trade (Figure 1 and 2), the author's suggestions might be the case. Holz (2009) examines the results of Young (2000), and finds that the author's arguments are flawed and problematic, and the evidence is questionable. By comparing domestic trade in the PRC with the United States (US), Holz finds that domestic trade in the PRC is well within ordinary range. It might be the case that cross-provincial trade in China is as supple as in any developed country.

Numerous studies, applying various theoretical models and datasets, have been used in attempts to analyze regional protectionism in the PRC. There is no general consensus on whether or not the internal market of the PRC is characterized as a level playing field for all engaged in trade. In contrast to previous studies, this paper

presents a study on domestic trade barriers in the PRC, which applies data covering a long continuous time period. The outcomes contribute to an analysis of the long-run development of cross-provincial trade barriers in China.

## 4 Indirectly Measuring Internal Trade Barriers

This study applies an indirect method of estimating barriers to trade. Cross-provincial trade data for the PRC neither specify region of origin for imports nor destination of exports, making it impossible to estimate trade barriers with the traditional gravity equation approach. Due to the inherent difficulties in measuring barriers to trade and the limited access to data, trade barriers will be indirectly estimated by approximation using the Wong (2012) method. This is done in order to determine the magnitude of interprovincial trade protectionism, and to investigate if these barriers vary across provinces and if there have been any changes in those barriers over time.

An indirect measure of trade barriers is created, which includes all costs related to trade, including distance and NTBs in a single variable. The indirect measure is theoretically founded in the gravity model and is calculated using trade data from China Statistical Yearbooks (1981-2011), which is available and easy to access.

### 4.1 Theoretical Presumption

The theoretical model used to measure barriers to trade is the gravity equation<sup>1</sup> based on the Anderson and van Wincoop (2003) framework with exogenous trade costs:

$$X_{ir} = \frac{Y_i \cdot Y_r}{\sum_k Y_k} \left( \frac{t_{ir}}{P_i \Pi_r} \right)^{1-\sigma} \quad (1)$$

Consider two economies,  $i$  and  $r$ .  $X_{ir}$  is the nominal exports from economy  $i$  to  $r$ .  $Y_k$  is the nominal income of an economy  $k$ . The denominator  $\sum_k Y_k$  represents the total income of all individual economies. As a result of trade costs, due to distance between  $i$  and  $r$  and various trade barriers, there is a gross bilateral trade cost factor  $t_{ir}$ . A good originating from  $i$  with the price  $p_i$  in  $i$ , has a price  $p_{ir} = t_{ir}p_i$  in economy  $r$ . The bilateral trade cost  $t_{ir}$  includes not only tariffs but also geographical distance and various NTBs.  $1 - \sigma$  is the elasticity of substitution (EOS).  $P_i$  and  $\Pi_r$  represent price indices of each of the provinces.

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<sup>1</sup> Economic gravity models predict bilateral trade flows based on economic size and distance between two economies, mimicking the gravitational attraction described by Isaac Newton's law of gravity.

The insight of the gravity equation is derived from Isaac Newton's laws of motion. The implication is that bigger economies – *ceteris paribus* - trade more with each other. High trade costs  $t_{ir}$  reduce trade and are affected by the price indices of the economies.  $P_i$  and  $\Pi_r$  can be interpreted as multilateral resistance variables. Multilateral trade resistance in the trade barriers refers to the magnitude of barriers to trade which are faced by all trade partners for a particular economy.

Instead of using the Anderson and van Wincoop (2003) assumptions of bilateral trade, the model applied is altered by Novy's (2013) method, which provides an analytical solution for deriving resistance variables. This measure is based on the intuition that a ratio of local purchases to their bilateral trade is an expression of trade barriers. The intuition is as follows. Consider three economic regions A, B and C. Regions A and B has the same bilateral trade with C. But A consumes more locally produced goods than B. This is to say that A has a higher resistance towards trade and thus has higher trade barriers. This is true if the gravity equation is a correct representation of trade flows, and higher trade barriers result in lower trade volumes. Note that the measure of trade barriers includes all costs related to trade. Differences in resistance variables may be due to distance and other factors. The multilateral trade resistance for an economy  $i$  can thus be derived from equation (1).

$$P_i \Pi_i = \left( \frac{X_{ii}/Y_i}{\bar{Y}_i/\sum_k Y_k} \right)^{\frac{1}{\sigma-1}} t_{ii} \quad (2)$$

This equation (2) above is an explicit solution for the multilateral trade resistance  $P_i \Pi_i$  for an economy  $i$ . However, the equation (1) includes the multilateral trade resistance  $P_i \Pi_r$  for two economies  $i$  and  $r$ . A solution for this is to simply multiply equation (1) with the reversed trade route  $X_{ri}$ , namely bilateral trade from economy  $r$  to  $i$ . This gives the following expression.

$$X_{ir} X_{ri} = \left( \frac{Y_i \cdot Y_r}{\sum_k Y_k} \right)^2 \left( \frac{t_{ir} t_{ri}}{P_i \Pi_r P_r \Pi_i} \right)^{1-\sigma} \quad (3)$$

Now we can substitute  $P_i \Pi_i$  and  $P_r \Pi_r$  in the denominator with equation (2), and rearrange.

$$\frac{t_{ir} t_{ri}}{t_{ii} t_{rr}} = \left( \frac{X_{ir} X_{ri}}{X_{ii} X_{rr}} \right)^{\frac{1}{\sigma-1}} \quad (4)$$

Trade costs may not be symmetric, that is  $t_{ir}$  does not necessarily equal  $t_{ri}$ . The same goes for trade costs within the regions,  $t_{ij}$  and  $t_{ri}$ . To account for this, the geometric mean<sup>2</sup> is used. As mentioned earlier, the trade cost  $t$  represents a gross bilateral trade cost. In order to achieve an expression for the tariff equivalent trade costs a value of one (1) is subtracted. The tariff equivalent trade costs from  $i$  to  $r$  is denoted  $\tau_{ir}$ .

$$\tau_{ir} = \sqrt{\frac{t_{ir}t_{ri}}{t_{ii}t_{rr}}} - 1 = \left(\frac{X_{ir}X_{ri}}{X_{ii}X_{rr}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (5)$$

In this paper, the change of trade barriers over time is also of interest. This is denoted by a caret  $\hat{\cdot}$ , and the variable transformation is given by  $\hat{\tau}_{ir} = \frac{\tau_{ir}(\theta+1)}{\tau_{ir}(\theta)}$  where  $\theta$  is any given observed point of time (year). Hence we have the relation:

$$\hat{\tau}_{ir} = \sqrt{\frac{\hat{t}_{ir}\hat{t}_{ri}}{\hat{t}_{ii}\hat{t}_{rr}}} - 1 = \left(\frac{\hat{X}_{ir}\hat{X}_{ri}}{\hat{X}_{ii}\hat{X}_{rr}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (6)$$

As mentioned before, there is a limitation to domestic trade data in the PRC. Trade data is aggregated towards all outside provinces, and actual export destinations and import origin cannot be determined. To account for these, approximations similar to those done by Wong (2012) are carried out. Let us start with some definitions. Define the total set of provinces in China by  $C = \{S_1, S_2 \dots S_N\}$ . For any given province  $S_i$ , define all provinces but  $S_i$  as  $C \setminus S_i$ . The geometric average will serve as an approximation of the arithmetic average of province  $S_i$ 's imports from the rest of China<sup>3</sup>. Cardinality of  $C$  is given by  $|C|$ . An issue related to this method of approximation is the inequality of arithmetic and geometric means. The two means will be equal if and only if every number is the same, otherwise, if numbers are non-negative, the arithmetic mean will always be greater than the geometric mean. Hence, this approximation will produce a slightly under-valued estimation of trade barriers. The magnitude of the under-valuation is greater if there is a large variation among the numbers for which the mean is to be calculated. Nevertheless, this approximation is necessary in order to estimate trade barriers due to the specific nature of domestic trade data available.

Using this, the observed values of province  $S_i$ 's imports from the rest of China  $C \setminus S_i$  can be approximated by:

<sup>2</sup> A geometric mean of a set of data  $A = \{a_1, a_2, \dots, a_k\}$  is given by  $\sqrt[k]{\prod_{i=1}^k a_i}$ .

<sup>3</sup> Formally:  $\frac{X_{S_i C \setminus S_i}}{|C|} = \frac{\sum_{d \in C \setminus S_i} X_{P_i d}}{|C|} \approx \sqrt[|C|]{\prod_{d \in C \setminus S_i} X_{P_i d}}$

$$X_{S_i C \setminus S_i} \approx |C| \cdot \left( \prod_{d \in C \setminus S_i} \frac{Y_i \cdot Y_d}{\sum_{k \in C} Y_k} \left( \frac{t_{id}}{P_i \Pi_d} \right)^{1-\sigma} \right)^{\frac{1}{|C|}}$$

The geometric average approximation of the arithmetic mean for purchases from the rest of China, originating from *itself*,  $X_{C \setminus P_i C \setminus P_i}$  becomes:

$$\frac{X_{C \setminus S_i C \setminus S_i}}{|C|^2} = \frac{\sum_{d \in C \setminus S_i} X_{dd} + \sum_{b \in C \setminus S_i} \sum_{k \in C \setminus S_i, k \neq b} X_{bk}}{|C|^2} = \left( \prod_{b \in C \setminus S_i} \prod_{g \in C \setminus S_i} X_{bg} \right)^{\frac{1}{|C|^2}}$$

This can be approximated by:

$$X_{C \setminus S_i C \setminus S_i} \approx |C|^2 \cdot \left( \prod_{b \in C \setminus S_i} \prod_{g \in C \setminus S_i} X_{bg} \frac{Y_b \cdot Y_g}{\sum_{k \in C} Y_k} \left( \frac{t_{bg}}{P_b \Pi_g} \right)^{1-\sigma} \right)^{\frac{1}{|C|^2}}$$

By applying these approximated averages to the Novy (2013) ratio of trade flows (equation (4)), we achieve a rather muddled expression:

$$\frac{X_{S_i C \setminus S_i} X_{C \setminus S_i S_i}}{X_{S_i S_i} X_{C \setminus S_i C \setminus S_i}} \approx \frac{\left( \prod_{d \in C \setminus S_i} t_{id}^{1-\sigma} \right)^{\frac{1}{|C|}} \left( \prod_{d \in C \setminus S_i} t_{di}^{1-\sigma} \right)^{\frac{1}{|C|}}}{t_{S_i S_i}^{1-\sigma} \left( \frac{\prod_{b \in C \setminus S_i} \prod_{g \in C \setminus S_i} t_{bg}^{1-\sigma}}{\prod_{b \in C \setminus S_i} Y_b \left( \frac{1}{P_b \Pi_g} \right)^{1-\sigma}} \right)^{\frac{1}{|C|^2}}} \quad (7)$$

By defining the approximated trade barriers  $\bar{t}_{S_i C \setminus S_i}$ ,  $\bar{t}_{C \setminus S_i S_i}$ ,  $\bar{t}_{C \setminus S_i C \setminus S_i}$  as

$$\bar{t}_{S_i C \setminus S_i} \equiv \left( \prod_{d \in C \setminus S_i} t_{id} \right)^{\frac{1}{|C|}}, \bar{t}_{C \setminus S_i S_i} \equiv \left( \prod_{d \in C \setminus S_i} t_{di} \right)^{\frac{1}{|C|}} \text{ and } \bar{t}_{C \setminus S_i C \setminus S_i} \equiv \frac{\left( \prod_{b \in C \setminus S_i} t_{b C \setminus S_i} \right)^{\frac{1}{|C|}}}{\left( \prod_{b \in C \setminus S_i} Y_b \frac{1}{P_b \Pi_g} \right)^{\frac{1}{|C|^2}}}$$

we can rephrase the measured trade barriers in the Novy (2013) ratio in equation (7). The approximated tariff equivalent trade costs from  $S_i$  to  $C \setminus S_i$  can thus be derived from equation (4) and (7):

$$\bar{t}_{S_i C \setminus S_i} = \sqrt{\frac{\bar{t}_{S_i C \setminus S_i} \bar{t}_{C \setminus S_i S_i}}{t_{S_i S_i} \bar{t}_{C \setminus S_i C \setminus S_i}}} - 1 = \left( \frac{X_{S_i C \setminus S_i} X_{C \setminus S_i S_i}}{X_{S_i S_i} X_{C \setminus S_i C \setminus S_i}} \right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (8)$$

The variable  $\bar{\tau}_{S_i C \setminus S_i}$  derived from equation (8) will be used as the dependent variable in the econometric analysis. The interpretation of this trade barrier is an approximated geometric average of bilateral trade barriers between a province  $S_i$  and the rest of China  $C \setminus S_i$ , relative to local trade barriers, that is sales within the province. Keep in mind that this estimated trade barrier is a tariff equivalent approximation of the total trade costs, including transport and other *natural* obstacles to trade. Naturally, the variation of trade barriers over time can be expressed as:

$$\hat{\tau}_{S_i C \setminus S_i} = \sqrt{\frac{\hat{t}_{S_i C \setminus S_i} \hat{t}_{C \setminus S_i S_i}}{\hat{t}_{S_i S_i} \hat{t}_{C \setminus S_i C \setminus S_i}}} - 1 = \left( \frac{\hat{X}_{S_i C \setminus S_i} \hat{X}_{C \setminus S_i S_i}}{\hat{X}_{S_i S_i} \hat{X}_{C \setminus S_i C \setminus S_i}} \right)^{\frac{1}{2(\sigma-1)}} - 1 \quad (9)$$

Several studies have applied the Novy (2013) ratio of trade barriers in order to estimate trade barriers. Eaton, Kortum, Neiman and Romalis (2011) use this method to analyze changes in trade patterns in the aftermath of the world economic recession 2008-2009. Jacks, Meissner and Novy (2010) apply this method in order to analyze determinants of trade booms during the twentieth century. Wong (2012) uses provincial input-output data applied to the Novy (2013) ratio and applies the approximations above to estimate trade barriers in the PRC.

## 4.2 Data

Numerous previous studies on this topic use data ranging to 2007. However, from 2007 until the present day, several events may have affected trade patterns, not only internationally, but also within the PRC. To capture the possible effects of such events, the analysis conducted in this paper will apply interprovincial trade data ranging from 1981 to 2011. Several events may have affected the domestic trade environment in the PRC in recent decades (remember Table 1). Sector-specific domestic trade data on industry level can be considered sensitive to the local governments and is not available for public use. Input-output tables on provincial levels are published every five years, and contain industry level imports and exports. This data is frequently used to estimate domestic integration. There are two major weaknesses with this data, apart from the difficulties related to obtaining the dataset. First, the data is fragmented in time with a five year span between observations. Naturally, there is a possibility of some of those observed years being an exception from the long-run pattern, at least for some of the provinces, resulting in skewed data. Secondly, the input-output table data does not include place of origin of imports or destination of exports. This excludes the use of a traditional gravity model estimation of barriers to trade. The advantage of these tables is obviously the industry level details. Data on domestic trade may also be retrieved

from provincial and national statistical yearbooks. This data is aggregated, and does not specify origin and destination of trade, similar to the input-output tables. The advantage with statistical yearbook data is instead time consistency, with available annual data on domestic trade until the year 2011.

The analysis in this paper instead uses aggregated data retrieved from statistical yearbooks, which is available and easy to access. The primary reason for using this data is the continuity with respect to time, thus providing a better approach in estimating the effect of variables varying over time. The data is aggregated over sectors, with the exception of some yearbooks which discern trade in agricultural goods from trade in manufactures. However, as this is inconsistent, aggregate trade data is used. A table with definitions and sources of data used in this study is provided in Appendix 9.1.

Data for domestic exports ( $X_{S_i C \setminus S_i}$ ) can be retrieved from the statistical yearbooks, and data for domestic imports ( $X_{C \setminus S_i S_i}$ ) can be calculated as the difference between domestic exports and net exports (foreign trade included). Exchange rates are retrieved from Penn World Tables Database for calculation of foreign trade values. Consumption of locally produced goods ( $X_{S_i S_i}$ ) is calculated as province total imports subtracted from total consumption. The rest of China local purchases ( $X_{C \setminus S_i C \setminus S_i}$ ) are calculated as international exports and exports to province  $S_i$  subtracted from total output of the rest of China.

The data has several issues which must be taken into consideration. Firstly, during the time period in the dataset, some provinces have at least one observation where the value of trade exceeds the gross provincial consumption. This is true for most of the developed coastal areas but also some inland provinces. Presumably, the provinces in question have lower trade barriers as they have managed to establish such a trade-intensive business environment. Due to this, the concerned provinces<sup>4</sup> are dropped. The province of Hainan was a part of Guangdong province prior to 1988, and trade data is available from 1996. Data for the autonomous region of Tibet is available from 1994. Secondly, as trade data in statistical yearbooks refer to the total value of goods and commodities imported and exported, it becomes impossible to distinguish to what extent the trade consists of outright exportation, re-importation and processing and refining for further trade. Therefore, there is an uncertainty regarding the calculation of consumption of local goods. This identical methodology has been applied in a study by

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<sup>4</sup> Dropped provinces are: Beijing, Chongqing, Fujian, Guangdong, Hebei, Heilongjiang, Hubei, Jiangsu, Jilin, Liaoning, Shandong, Shanghai, Tianjin, Xinjiang and Zhejiang.



Wong (2012). That study, in contrast to the one presented in this paper, does not suffer from the same data issues, presumably because of the limited time period of the study.

Despite the flaws in the data, it may still be useful to indirectly estimate barriers to cross-provincial trade in the PRC. This data allows for an analysis of long-run development, which is not possible with the sector-specific data published every fifth year.

### 4.3 Domestic Trade Barriers in the PRC

The approximated trade barriers are calculated by equation (8) with four different values for the EOS. Wong (2012) use values between 7 and 12 to represent the EOS. In contrast to the Wong study, which applies industrial sector specific data and therefore is able to choose values of EOS suitable for specific sectors, this assessment applies aggregate data. Because of the impossibility of determining different EOS in various sectors, and more specifically, various goods, lower values for EOS are used. This captures various degrees of substitutability between goods. Values of two (2), five (5), eight (8) and twelve (12) are used in this study. A higher EOS will generate a lower value of approximated bilateral trade costs. Some descriptive statistics of the approximated trade costs are presented in Table 2 and Table 3 below.

**Table 2: Standard deviation of estimated bilateral trade barriers  $\bar{\tau}_{P_i C \setminus P_i}$**

	Mean	Standard deviation		
		(overall)	(between)	(within)
EOS = 2	0.533	0.147	0.119	0.095
EOS = 5	0.271	0.089	0.077	0.051
EOS = 8	0.181	0.062	0.055	0.035
EOS = 12	0.125	0.044	0.039	0.024

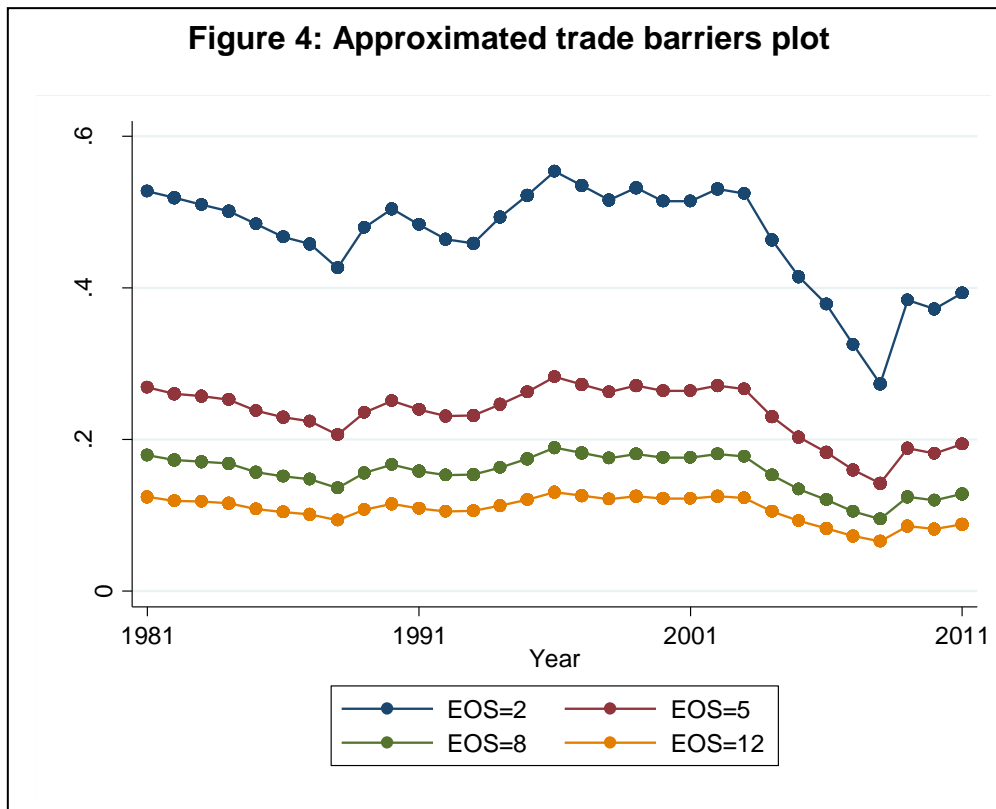
**Table 3: Mean of estimated bilateral trade barriers  $\bar{\tau}_{P_i C \setminus P_i}$  (selected years)**

	Mean over year			
	1981	1991	2001	2011
EOS = 2	0.528	0.483	0.514	0.393
EOS = 5	0.269	0.240	0.264	0.194
EOS = 8	0.179	0.159	0.177	0.129
EOS = 12	0.124	0.109	0.122	0.089

The descriptive statistics reveal variations in the cross sectional data (between) as well as in the time dimension of the dataset (within). The between standard deviation is thus the variation between provinces in the dataset, and the within standard deviation is

variation within a province over the period of time studied (1981-2011). From Table 2, we can see that the variation is larger between provinces over time, suggesting high variation in domestic integration between provinces. This is true for all values for EOS. The difference between the provinces with highest and lowest trade barriers is 0.22 in 1981 and 0.41 in 2011 (calculated with  $EOS = 5$ ). The difference is due to that some provinces have lowered trade costs considerably, while others are unchanged. Table 3 shows an overall decreasing, yet weak trend in average trade barriers across the entire time period in the data. This can also be seen in Figure 4 below. By ocular inspection of the average trend in domestic trade barriers in Figure 4, one could identify some possible structural tendencies. After the opening up reform initiated by Deng Xiaoping in the late 1970s until the economic and political turmoil during the late 1980s, the PRC seems to have experienced a development towards domestic integration. After the economic and political recovery it appears as if the domestic integration came to a standstill, and perhaps the federalist and local protectionist influences promoted a reverse development. Finally, after the WTO accession in December 2001, there is a noteworthy decrease in domestic trade barriers with the exception of the 2008 global financial meltdown.

The development of market integration in the PRC is fluctuating over time and there is no apparent long-run homogenous trend. It is obvious that shorter periods of time, for example the period 1992-2002 studied by Wong (2012), are not representative for a long-run development of market integration in the PRC.



Tests for structural breaks are performed to determine the existence of any significant trends in specific periods of time that differ from the long-run average. The test is constructed as a regression with the average of the estimated trade barrier  $\bar{\tau}_{S_1 C \setminus S_1}$  as dependent on time (EOS value of 2 is used). This time series is complemented with dummy variables for the intercept and a slope with a value of one (1) for the period which is tested, and a value of zero (0) otherwise<sup>5</sup>. Results are presented in Table 4. Tests show no significant results for the years after the Tian’anmen interlude, the fiscal reform 1994 – 2001 or the stimulus package in 2008 in the aftermath of the world financial crisis. However, since entry into WTO in 2001, the domestic market has experienced significant decreases in trade barriers. This suggests that the outward openness policy is indeed accompanied by domestic market reforms as well. This is also proposed in a previous study by Li, Qiu and Sun (2003).

<sup>5</sup> The equation  $\bar{\tau}_{it} = \alpha \cdot \text{year} + \beta_1 \cdot (\text{dum} \cdot \text{year}) + \beta_2 \cdot \text{dum} + c + u_{it}$  is estimated and coefficient values for  $\beta_1$  (slope dummy) and  $\beta_2$  (intercept dummy) are presented in Table 4.

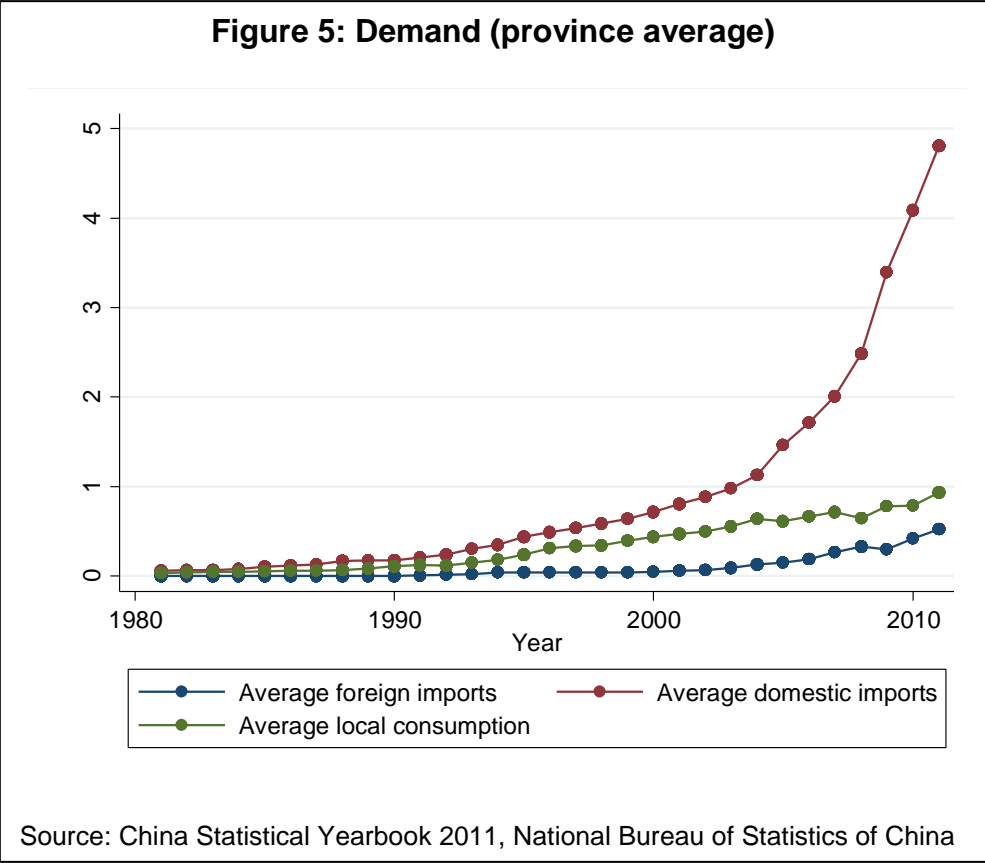
**Table 4: Test for structural breaks**

Event	Year	Dummy (EOS=2)		Dummy (EOS=12)	
		Intercept	Slope	Intercept	Slope
Social and Economic Turmoil	1989 -	-2.061 (11.410)	0.001 (0.005)	-1.782 (3.483)	0.001 (0.001)
Fiscal reform and Company Law	1994 -	-17.679 (13.191)	-0.009 (0.007)	-5.069 (4.018)	0.003 (0.002)
WTO Entry	2002† -	47.917*** (7.717)	-0.024*** (0.004)	13.123*** (2.369)	-0.007*** (0.001)
Stimulus Package	2008 -	-1.178 (30.809)	0.001 (0.016)	-0.095 (9.424)	0.000 (0.005)

Note: Standard error in parentheses. Coefficient significantly different from zero with 10% (\*), 5% (\*\*) and 1% (\*\*\*) confidence level (two tailed).

† WTO entry in December 2001, dummy created from 2002

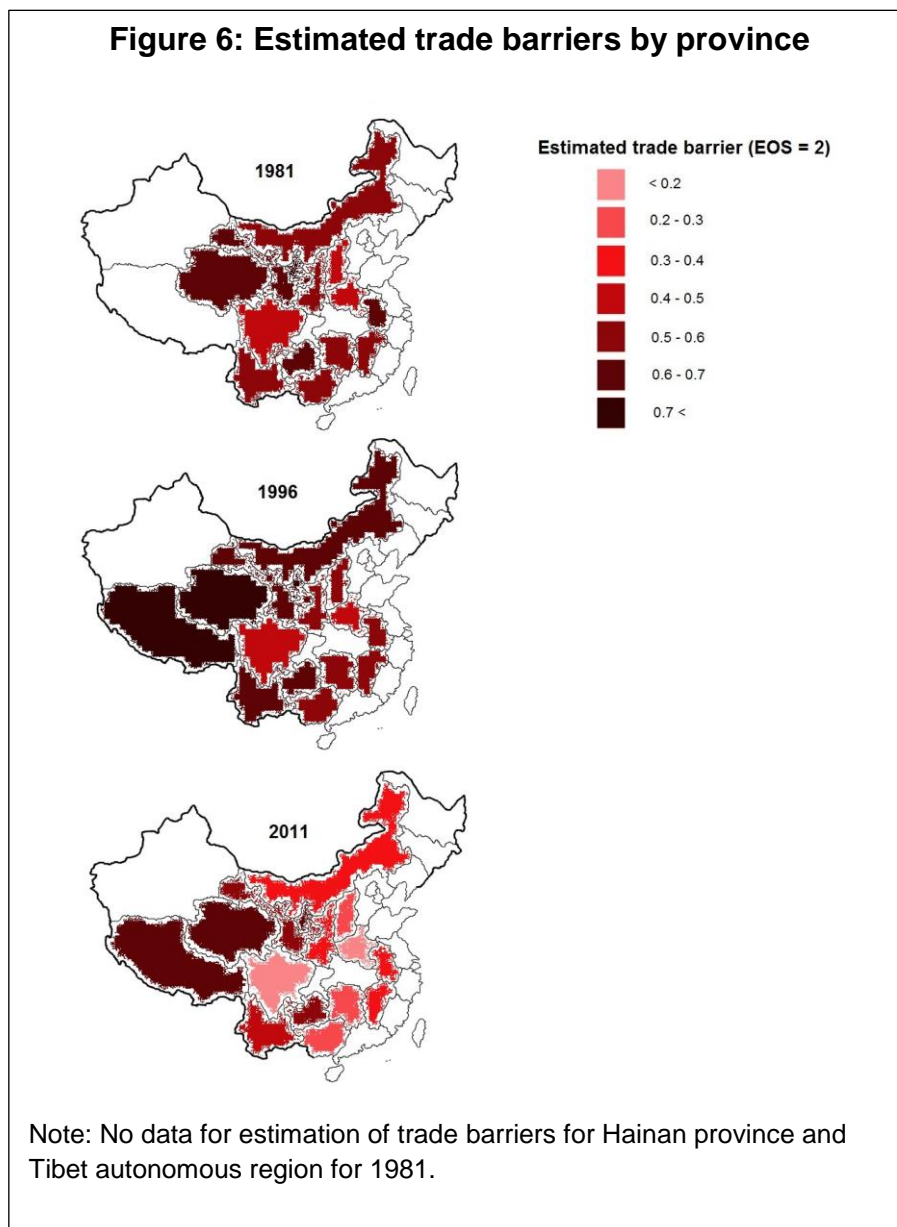
When examining the growth of demand for foreign, domestic and local goods, this development does seem to strengthen the argument for joint domestic and foreign market integration around the time of WTO entry. The development of demand for foreign, domestic and local goods is presented in Figure 5. Prior to the time around the WTO entry in 2001, demand for domestic imports, foreign imports and locally produced goods increased steadily at fairly equal pace. Starting around 2004, the growth in demand for domestic imports explodes. Note the figure shows province average, and size and economic development are highly dissimilar between provinces. Nevertheless, the cross provincial trade in the PRC has on average increased tremendously during the last decade.



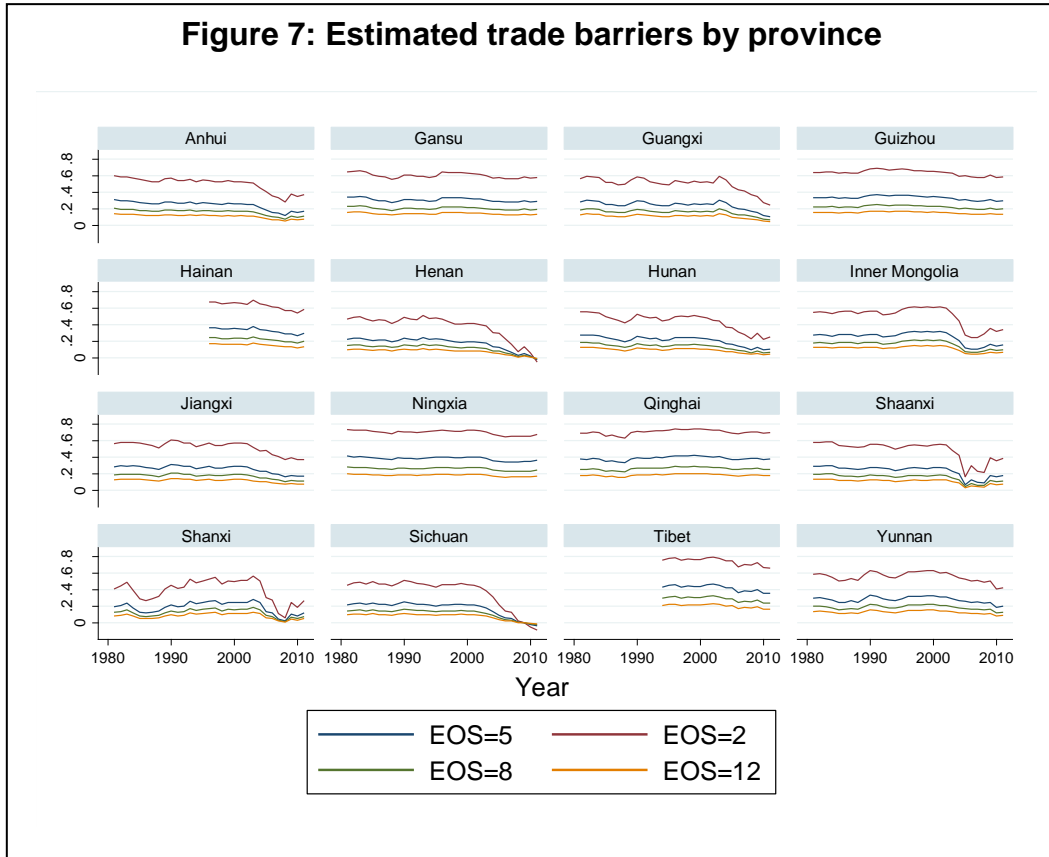
The change in cross provincial trade barriers differs between individual provinces (Table 2). The between-province standard deviation of approximated trade barriers is greater than the time variant standard deviation. This means explicitly that the variation in trade barriers between provinces is larger on average than the variation each province has experienced over the period 1981-2011. The overall trend of trade barriers which is estimated may therefore not be representative for any single province, but is better regarded as an indicator of domestic economic integration.

Further examination of the data is necessary in order to get a better view of the development of trade barriers for individual provinces. Figure 6 illustrates the between variation among the provinces. The provinces which experienced least market integration until 2011 are located in the western parts of China. The difference between 1981 and 1996 is marginal. It seems as if there is a more prevalent regional bias in 1996 suggesting that such a bias should be tested for in the econometric regression. In 2011, all of the provinces in the dataset examined experienced increased domestic economic integration by means of significantly decreasing barriers to cross-provincial trade. Estimation of trade barriers is lower in all provinces, but still high in western and northwestern regions. Graphs of continuous development of trade barriers in individual provinces are provided in Figure 7. By examining the different continuous trends, one

could see that some areas have experienced a tremendous change, while other areas have experienced almost no change since 1981.



**Figure 7: Estimated trade barriers by province**



#### 4.4 Conclusion

Barriers to cross-provincial trade are estimated using a method in analogy with the Wong (2012) study. The estimation is negatively biased due to inequality of arithmetical and geometrical means, implying that the actual trade barriers might be slightly higher than the calculated values. There are three main outcomes. First, there are internal barriers to cross-provincial trade in the PRC. Second, the estimated tariff equivalent barriers to cross-provincial trade have been shown to vary over time and have been, on average, significantly lower during the last decade. Third, the variation between provinces is huge. The economic reforms may have affected provinces differently. Even though the reforms are launched by the central government, the execution and enforcement may differ among the local governments. It might also be the case that provinces in the west and far north of the country are somewhat isolated from international trade. Assuming the positive correlation between increasing international economic integration and diminishing domestic trade barriers to be true, provinces with limited access to seaway transport and limited exposure to foreign influence do not experience this effect. Determinants of the estimated barriers are examined by an econometric analysis.

## 5 Regression Analysis

In order to identify factors that explain variation in the domestic trade barriers several regressions are made. Indirectly derived measures of domestic trade barriers as the dependent variable in a regression analysis are used, and include a set of independent variables to see whether they can explain any of the statistical variation.

The indirect measure of domestic trade barriers is used in a panel data regression analysis in order to examine possible determinants of changes in trade barriers over time. The method of econometric approach is a panel data with fixed effects capturing the unobserved independent heterogeneity between provinces. By using a fixed effects model we assume that the individual specific effects (the unobserved heterogeneity between provinces) are correlated with the independent variables. Provinces may have attributes that do not vary over time, or at least not during the period of study. These attributes may be related to business environment, cultural characteristics, geographical features etc. and they may or may not be observable. Regardless if they are observable or not, all time invariant variables will be captured by the fixed effects model.

### 5.1 Methodology and Data

The dataset used contains both a time-series (time dimension) and cross-section (individual provinces). This two-dimensional data (panel data) contains observations on multiple variables over multiple time periods. Panel data models may be specified as a pooled ordinary least squares (OLS) regression, or with specific individual effects which can be correlated with the independent variables (fixed effects model), or uncorrelated with the independent variables (random effects model). The regression equation to be estimated is therefore two-dimensional.

$$\bar{\tau}_{it} = \alpha + X'_{it}\beta + u_{it}$$

Dependent variable is the approximated trade barrier  $\bar{\tau}_{S_i C \setminus S_i}$ . Estimations of this barrier are done with various degrees of EOS but the correlations between estimates are well above 0,98. This suggests similar results regardless of which estimate is applied as dependent variable. EOS with a value of 2 is used for calculation of  $\bar{\tau}_{S_i C \setminus S_i}$  in the econometric analysis in this paper. Results from regressions applying other values of EOS are provided in Appendix 9.2. Higher values of EOS will generate lower coefficient values in absolute terms, but signs (+/-) are not affected.



Several independent variables ( $X_{it}$ ) are selected in order to try to explain the variation in trade barriers over time and across provinces. Hypotheses are constructed for each of the variables.

Independent variables include per capita GDP (gdp\_pc). It seems reasonable that more economically prosperous areas have relatively high consumer demand, and perhaps also a demand for a larger variety of goods. This will in turn affect the trade relations and may therefore affect trade barriers. A higher per capita GDP is expected to decrease barriers to trade. Per cent labor force in urban areas (urb\_emp) is an indicator of urbanization. Urban areas have easier access to transport routes. A relatively larger number of people benefiting from this access is expected to decrease barriers to trade. A variable for per cent of gross industrial output contributed by state owned enterprises (gio\_soe) is also added. If barriers to cross-provincial trade are induced by protectionist behavior of local governments, state owned firms with access to *political capital*, that is valuable connections to the local governments, can take advantage of this to facilitate trade procedures. A high ratio of state ownership is therefore expected to generate low cross-provincial trade barriers. Number of persons enrolled to higher education (edu) is an indicator of education. Higher education may provide a more developed ability to produce competitive goods. On the other hand, relatively low education levels may generate incentives for provincial governments to protect local producers of less competitive goods. A high education level is expected to decrease barriers to trade. Total length of railways (railways) and highways (highway) in the province is expected to decrease trade barriers due to better possibilities of engaging in trade. The sheer possibility of engaging in trade depends on access to adequate infrastructure. Industrialization of a region is likely to develop tradable goods at least to some extent. Share of contribution to GDP from secondary (gdp\_sec) and tertiary sector (gdp\_ter) is therefore expected to decrease barriers to trade for the same reason as a high per capita GDP. More tradable goods and relatively high welfare increase the demand for variety in goods and subsequently decrease trade barriers. The causality may also be the opposite, as decreasing trade barriers facilitates trade and provides the possibility of efficiency gains by trade in intermediate goods and utilize large scale production.

Dummy variables are created to check for time variant structural breaks and specific year dummies (year-dummy). Breaks are tested for periods during economic and social turmoil in 1987, fiscal reform in 1994, WTO entry in 2001, and stimulus package appointed to boost consumption in the aftermath of the global recession in 2008. A

regional dummy for remote provinces<sup>6</sup> (region\_remote) is constructed to determine if there is a regional bias. List of variables are presented in Appendix 9.1 and correlation matrix is presented in Appendix 9.2.

The Breusch Pagan Lagrangian multiplier test for random effects shows significant results at the 1 per cent confidence level, which implies that a model should be constructed with individual specific effects instead of a pooled OLS regression<sup>7</sup>. The Hausman test also shows significant results at the 1 per cent confidence level, suggesting differences between a fixed effects model and a random effects model<sup>8</sup>. The fixed effects model estimates are unbiased but variances may be high. A random effects model will generate more efficient estimates given the assumption that specific individual effects are uncorrelated with the independent variables. However, if this assumption is violated, the estimates will be biased. If possible, it is desirable to apply a random effects model as it is more efficient, but because it might be biased when using this data, a fixed effects model is constructed for the purpose of this analysis.

$$\bar{y}_{it} = \alpha_i + X'_{it}\beta + u_{it}$$

Naturally, we also assume spherical errors, that is homoskedasticity ( $\text{var}(u_{it}) = \sigma_u^2$ ) and no autocorrelation ( $\text{cov}(u_{it}, u_{js}) = 0 \forall i \neq j \text{ or } t \neq s$ ).  $\alpha_i$  is the unobserved individual heterogeneity and  $X_{it}$  is the independent variables matrix with coefficient values of  $\beta$ . Intuitively  $\alpha_i$  can be thought of as a series of dummy variables for each individual, and the model can in theory be estimated using least squares with identical estimates. However, the dummy variables will increase the number of parameters in the regression and decrease the degrees of freedom and thus efficiency. The individual heterogeneity will therefore encompass all parameters of variables that do not vary over time in a fixed effects model. Regional biases must therefore be tested with a random effects model. The constant effect  $\alpha$  is regarded as an average in the random effects model.

$$\bar{y}_{it} = \alpha + X'_{it}\beta + u_{it}$$

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<sup>6</sup> Qinghai, Tibet, Gansu, Ningxia and Inner Mongolia.

<sup>7</sup> The Breusch Pagan Lagrangian multiplier tests if there is any significant variance over entities, that is to see if there is any difference between units (a panel effect). The null hypothesis is that the variance is zero (no panel effect).  $X^2 = 772,21$  represents a p-value of 0,0000. As the null hypothesis can be rejected we assume a panel effect.

<sup>8</sup> The Hausman test evaluates which of two estimators, one which is consistent under the null and alternative hypothesis and the other which is consistent under the null only. If the null can be rejected there is probably a difference between the random effects model (null) and the fixed effects model (alternative).  $X^2 = 22,78$  represents a p-value of 0,0019.

A modified Wald test for group-wise heteroskedasticity shows significant signs of heteroskedasticity and a Wooldridge test for autocorrelation in the panel data shows signs of autocorrelation. First differences show no signs of autocorrelation, implying that the model suffers from AR(1) disturbances. A Variance-covariance matrix is adjusted with heteroskedasticity consistent standard errors by applying a clustered matrix<sup>9</sup>. Usually one would assume that the errors are independently and identically distributed. However, as the model generates non-spherical errors, thus violating this assumption, we instead have a more general assumption that the error terms are clustered. Errors in one specific individual are correlated in some way with each other, but uncorrelated to errors in other individuals. We keep the assumption of no correlation across provinces, but allow for within province correlation.

## 5.2 Results

Results from the regressions are shown in Table 5. An initial regression includes all the independent variables. This regression shows signs of over-specification, and the omitted variables test statistic represents a p-value of way below five per cent. In order to remedy the misspecification of the model, variables with low explanatory power<sup>10</sup> are dropped in the second regression. The third regression estimates first order differences in all variables. First order difference estimation is done to determine how fast the trend returns to its average after a random shock. Dummy variables for passages in time are added in the fourth regression in order to test for structural breaks. The fifth and sixth regressions are the random effects model, where the individual heterogeneity of the provinces is assumed to be normally distributed. The individual effects are instead estimated as an average. This is done in order to provide the option to include time-invariant variables. More specifically, a dummy for remote regions is added.

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<sup>9</sup> Clustered variance-covariance matrix in Panel data regressions in STATA is applied by the regress option *vce(r)*.

<sup>10</sup> Variables for per capita GDP, higher education and length of highways are dropped as coefficients of those variables are low, and the initial regression suffers from misspecification.

**Table 5: Regression analysis results**

Dependent variable: $\bar{\tau}$ (EOS = 2)						
Regression	1: FE	2: FE	3: FE	4: FE	5: RE	6: RE
Variable	1 <sup>st</sup> order differences					
gdp_pc	-0.000*** (0.000)	-	-	-	-	-
urb_emp	0.0904 (0.2150)	-0.1254 (0.4608)	0.0481 (0.0968)	-0.3996 (0.3455)	-0.0741 (0.1643)	-0.1155 (0.1140)
gio_soe	-0.0622 (0.0515)	-0.1092** (0.0494)	0.0124 (0.0091)	-0.0162 (0.0439)	-0.0685 (0.0522)	0.0305 (0.0412)
edu	-0.0025*** (0.0005)	-	-	-	-	-
railway	0.0891 (0.0910)	-0.2207 (0.1327)	0.1675 (0.1301)	-0.2040* (0.1011)	-0.4190*** (0.0615)	-0.3846*** (0.0641)
highway	-0.0015 (0.0023)	-	-	-	-	-
gdp_sec	-0.2575 (0.2391)	-0.6088*** (0.1761)	-0.6339*** (0.1517)	-0.8641*** (0.2152)	-0.5499*** (0.1096)	-0.6416*** (0.1122)
gdp_ter	-0.1479 (0.1605)	0.1781 (0.2961)	-0.0338 (0.0967)	0.0907 (0.1381)	-0.1589 (0.2532)	-0.0281 (0.1260)
time_1987 (social turmoil)	-	-	-	-0.0051 (0.0149)	-	-0.0029 (0.0136)
time_1994 (fiscal reform)	-	-	-	-0.0311** (0.0114)	-	0.0334*** (0.0109)
time_2002 (WTO entry)	-	-	-	-0.0501*** (0.0167)	-	-0.0384*** (0.0143)
time_2008 (global crisis)	-	-	-	-0.0330 (0.0154)	-	-0.0370 (0.0186)
region_remote	-	-	-	-	0.1762*** (0.0352)	0.1582*** (0.0299)
Year-dummy	YES	YES	NO	NO	YES	NO
Constant	0.7475*** (0.1346)	1.0181 *** (0.1722)	0.0045*** (0.0010)	1.0739 *** (0.1597)	0.9248*** (0.0935)	0.8521*** (0.0686)
F-statistic (p-value)	0.0000 <sup>†</sup>	0.0000 <sup>†</sup>	0.0007	0.0000	0.0000 <sup>†</sup>	0.0000
R <sup>2</sup> within	0.7750	0.6490	0.1016	0.5212	0.6411	0.5063
R <sup>2</sup> between	0.5130	0.0518	0.0524	0.0977	0.7564	0.7766
R <sup>2</sup> overall	0.4872	0.2427	0.0991	0.1797	0.7055	0.6780
$\rho$	0.8454	0.8420	0.0787	0.8088	0.2211	0.1514
Observations	407	407	407	407	407	407

Note: Robust standard error in parentheses. Coefficient significantly different from zero with 10% (\*), 5% (\*\*) and 1% (\*\*\*) confidence level (two tailed).

†: Due to the year-dummies added there are more parameters than clusters in the model and a regular F-test is therefore not possible to perform. The test conducted is instead a joint test if the other parameters are equal to zero (year-dummy variables excluded)

What do the results tell us? Per capita GDP was expected to have a negative coefficient. Surprisingly, the estimated coefficient is significantly very close to zero, and dropped due to misspecification. Length of highways as well as high education levels seem to lower trade costs, as expected. Urbanization does not seem to have any unambiguous effect on trade barriers. Both positive and negative values of coefficients are present, and none are significantly different from zero. The effect of state ownership in firms is also ambiguous. There is however a significant result in the second regression of a negative effect, that is lower trade barriers correlate with higher state ownership. It might be the case that state owned firms have well established contacts within the provincial regulatory bodies and can therefore gain access to facilitated trade routes. Coefficients in the other regressions are on the other hand both positive and negative, and there is no obvious inference. Developed transport infrastructure by means of railway expansion seems to lower trade costs. The fourth fixed effects regression and both of the random effects regressions show highly significant negative coefficients. Intuitively a more advanced and far reaching transport system lowers transport costs, and thus total trade costs. The very high coefficients of size of the second industrial sector are interesting. This supports the hypothesis of a connection between growth in the second industrial sector and diminishing barriers to domestic trade. The rational explanation could very well be that, as a second industrial sector is developed and industries expand, a wider range of tradable products arise on the market. Firms will lobby for trade facilitating policies in order to broaden their customer base, thus reducing trade barriers. Naturally, the causality may also be the opposite. Reduced trade costs and increased trade provide opportunities of trade in intermediate goods and large scale production in an industrialized environment. An expansion of the tertiary sector which provides intangible services does not immediately require trade facilitating measures due to the inherent features in trade in services. The positive effects found in some of the regression analyses can be explained as a relative decrease in easy-to-trade first and second sector products, rather than an increase in the service sector.

The economic reforms in the mid-80s preceding the political turmoil in the late 1980s do not seem to have affected the domestic barriers to trade to any substantial level. It might be the case that the opening up reform and the invitation to foreign companies to establish factories in the PRC did not at this early stage affect the domestic integration. Fiscal reforms and the issuing of a company law in 1994 do seem to have had a negative effect on trade barriers. Qian and Roland (1998) claim, in contrast to this result, that fiscal centralization may prove harmful for market development, due to

softening of budget constraints and decreased competition. However, this theory is based on free movement of factors of production, which is hardly the case in the PRC. The government controls the distribution of several inputs and the provision of credit through the ownership of banks. Competition may indeed have increased as provincial governments now have to establish profitable industries in order to be given the grace of the central government, and subsequently be provided with a beneficial share of capital through the redistribution of tax revenue. Competition among firms might have risen further by the issuing of the Company Law which ensured private companies their legitimacy. Prior to the existence of the Company Law, managers may not have been able to compete without fear of termination of their business by the government. This was now possible, and managers had less to fear.

As discussed in previous sections of this essay, and by Li, Qiu and Sun (2003), domestic integration is probably connected to international openness. Considering this econometric assessment, this connection is very clear. After WTO entry in late 2001 barriers to cross provincial trade decreased significantly. The stimulus package launched in 2008 may have decreased trade barriers even further, due to an increase in consumption and thus an increased demand for local, non-local and foreign products. There is no significant result that supports this however. There is support for the hypothesis that the WTO accession had a negative effect on domestic trade barriers in the PRC.

There is a very high and significant regional bias against remote provinces. Remote provinces have significantly higher cross-provincial trade costs. Coefficients represent a tariff equivalent iceberg trade cost which corresponds to a 15.8 – 17.6 per cent higher cost in remote areas of the country for goods with a low value of elasticity of substitution ( $EOS=2$ ). For higher values, for example  $EOS = 12$ , the regional bias corresponds to an increased trade cost of 5.3 – 5.8 per cent. This further supports that domestic integration is correlated with foreign trade and access to foreign trade routes. Costs of engaging in trade with those regions are presumably higher due to higher transport costs to remote locations.

What information does this provide to policymakers? Three main factors of increased domestic integration can be identified expansion of transport infrastructure, industrialization and foreign openness. Thus, an initial message is that in order to further lower trade costs in the PRC there is a need for expansion of infrastructure and means of communication and transport. Infrastructural development is naturally a prerequisite for facilitated trade. Secondly, further industrialization and production of

tradable goods are indeed associated with lower barriers to cross-provincial trade. In many regions of the country people still live in poverty and are engaged in low productive labor. The development gap between the prosperous coastal provinces and the poor under-industrialized inland regions is a possible explanation of the regional bias found in the regression analysis. Agrarian societies far from the coast have small or no possibilities of engaging in business with foreign partners. They lack products to sell and adequate means of transport if they have any. If governments are to reduce barriers to trade they must initially focus on increasing the productivity through promoted industrialization and the establishment of a satisfactory transport system. Such policies will support domestic integration through the increased supply of tradable goods and lower trade costs by facilitated transport. The regional bias can neither be explained by under-industrialization nor inadequate infrastructure as indicators of such were included in the analysis. It can however be explained by the lack of access to foreign investment and international trade. Most of the foreign investments in China are indeed located in the coastal and central areas (Sauvant, Zhao and Huo 2012). If domestic trade barriers are affected by international integration, it seems reasonable that this effect is less significant in areas which are not exposed to foreign partners. Policies which attract foreign capital to remote areas may therefore remedy the bias against those regions and reduce barriers to cross-provincial trade.

## **6 Study in China**

To get a more thorough understanding of the form and structure of barriers to trade, a field study in China was conducted. This adds a new dimension to this research, and contributes the experiences of businessmen and other actors on the Chinese market. The indirect measurement of trade barriers and the econometric analysis in this paper reveals the overall development in domestic trade barriers, but in order to fully understand the effects of the actual situation in China, a qualitative study was desirable. Qualitative interviews with Chinese entrepreneurs or representatives of firms as well as foreign firms located in China operating towards the Chinese domestic market are essential to this research. The interviews do not, and were not intended to generate datasets applicable to further econometric assessment, but are instead focused on the everyday issues related to domestic trade. It is possible that domestic trade barriers in the PRC are partly built on non-tariff protectionist policies from local government, and the nature of these barriers might vary greatly depending on sector and province. Furthermore, it can also be the case that barriers to trade are unconsciously generated by several economic actors. Barriers to trade should not be interpreted as the sole active aspiration of hindering trade by tariffs and policies. It is likely that there exists

trade protection without any distinct motive from any party. The estimated trade barriers include all barriers to trade, including transportation costs and other *natural* barriers to trade.

Hence, the field study had two objectives. First, understanding the nature of barriers to domestic trade in the PRC is essential. Do firms experience any barriers to trade, what are the actual trade barriers, and are the barriers shared among all firms? Second, do firms in the PRC experience that those barriers have changed over time, and are there any distinct events in history that had a distinguishable impact on domestic trade, positive or negative? Does the experience of Chinese managers conform to the econometric results found prior to the field trip? Those questions were to be answered by this field study. Interviews were conducted as open and non-linear as possible, where the manager or representative of the firm is given the opportunity to steer the discussion within relevant topics, stressing the issues which are most relevant for the firm in question. Typically, the initial question was: “does the company you represent do business in many parts in China?” and “Do you find that firms on the Chinese market, regardless of origin, compete on even terms?”

The initial stages of the field study were directed through an invitation by the Nordic Centre at Fudan University in Shanghai, which is a joint project between Fudan University and several universities in the Nordic countries undertaking research projects and educational activities. The invitation regarded a weeklong course in international economics, with a focus on China, in the beginning of April 2013. This course consisted of lectures on the Chinese economy by teachers at Fudan University, but also seminars on the business environment in China incorporating managers and representatives from business enterprises and firms. This created a unique opportunity to get a comprehensive insight into the Chinese day-to-day business management, and provided a knowledgebase for the continuation of the field work.

### **6.1 Experiences of Chinese Firms**

Several representatives of firms were contacted for the purpose of this study. Contributors are listed in Table 6. Interestingly, none of the contributors could pinpoint any specific barrier to cross-provincial trade in the PRC.



**Table 6: Contributors**

<b>Contact</b>	<b>Company</b>	<b>Profession</b>	<b>Consumer Base</b>
Tong Qi	CMS	Senior Associate	Shanghai, Beijing
Jia Ying	CSR & Company China	Founding Partner	Entire China
Cai Kaifang	TOPWAY International Education	Founder	Entire China
Lars Fabricus	Alfa Laval Production Facility	Factory Manager	Entire China
Eric L. Brubaker	SKF Global Technical Centre Asia	Manager	Entire China
Alex Peng	JAC Motors	Passenger Car Asia Sales Manager	Entire China
N/A	Nissan Motor Company	Exhibitor	Entire China
N/A	Mazda Motor Corporation	Exhibitor	Entire China

CMS is a provider of legal and tax advice to both Chinese and foreign clients. With expertise in the Chinese legal and regulatory framework, the senior associate Tong Qi provided insights regarding judicial and regulatory issues. Most important are the functions of the Hujī system (户籍制度), more commonly known as the Hukou (户口). This is a household registration required by the law and originates from ancient China. Every citizen in China is officially identified as a resident of the area where they were born, and certain privileges and social security are usually only available within that designated area. This regulatory system does indeed give rise to migration barriers within China. The regulations only affect social issues such as daycare and schooling for children, and do not affect the possibility of starting businesses outside the Hukou. Tong Qi stresses that the Hukou system does not pose any formal obstacle to starting a business in regions from where the person does not originate. It is therefore possible for companies to establish subsidiary companies in other parts of China and engage in frictionless trade in intermediate goods or complementary products.

At the Nordic Centre at Fudan University I came into contact with several Chinese entrepreneurs, among them Jia Ying, founding partner of CSR & Company China focusing on corporate social responsibility issues in China. He is also co-founder of several other Chinese NGOs. He has never experienced any issues, or worked with any companies which experienced issues, concerning cross provincial trade. To his knowledge, the barriers to trade found in previous studies are possibly incorrect, and he pointed out that in any supermarket in China you find domestic products originating from all parts of the country. He has been in business since 2004 and is unaware of any prior trade barriers. He suggests that if there still are any significant barriers to trade they would be present in sectors protected by the government, local or central. Another entrepreneur and founder of TOPWAY International Education, Cai Kaifang also supports this view.

The experience of Lars Fabricus, factory manager at Alfa Laval Production Facility in Kunshan outside Shanghai is similar to the Chinese entrepreneurs. Alfa Laval is a leading producer of separators of solutions, fluid transfers and heat transfers and has customers all over the world, and all across China. 75 per cent of the manufacturing in Kunshan is produced for the Chinese market and 25 per cent for international direct sales. Those distributors are located in various provinces and Alfa Laval does not experience any obstacles related to cross provincial trade. Competition has been increasingly fierce, mostly due to the rise of several Chinese companies producing substitutable products.

This is also true for Eric L. Brubaker, manager of the Global Technical Centre Asia for SKF, a company producing ball bearings, seals and lubrication systems. Those two foreign firms employ local distributors to supply Chinese customers. They sell products to all of China through distributors and do not experience any barriers to trade between provinces.

Protected sectors would be any of the strategic industries presented in the five year plans presented at the plenary sessions of the Central Committee. The guidelines of the twelfth and current plan include several strategic sectors, among them the automobile industry. Michael Dunne (2013), an expert on China's automobile industry, also points out that the automobile sector is indeed a heavily protected sector, at least externally. If international trade protection is high, the incentive is high for local governments to protect local industries as the survival of local firms is essential for maintaining high tax revenue. Increased external openness can therefore affect cross-provincial trade barriers.

During the 15th Shanghai International Automobile Industry Exhibition over 2000 Chinese and foreign exhibitors were present. This event presented the opportunity to get in touch with the supposedly highly protected automobile industrial sector. Regardless of the high protection, several automobile producers, both Chinese and foreign, have the same opinion as the previously interviewed company representatives. Alex Peng is the Passenger Car Asia Sales Manager for JAC Motors, a Chinese automobile company located in Anhui province. JAC Motors is a state owned enterprise founded in 1964 and producing over 500 000 vehicles annually, both for the Chinese market and for exporting to over 100 countries worldwide. According to Peng there is no protectionism within the automobile sector. He does point out that domestic producers have an advantage over foreign as they have more experience of consumer demand in China. However, this advantage is rapidly diminishing as foreign actors adjust to the Chinese market. Furthermore, he points out that the competition on the automobile market is very fierce, and there are many producers. The cross provincial trade does not pose any obstacle to competition according to him. With respect to the ownership structure of JAC Motors, Peng admits that the local government of Anhui province may support the company through various channels, but he cannot see any direct protectionist behavior or trade related interventions by the government.

Considering the high presence of foreign automobile producers in China and their access to various markets in the country, there do not seem to be any biases. Naturally, higher activities of foreign firms are found in the coastal provinces and in economically more developed areas. Both Japanese companies, Nissan Motor Company and Mazda Motor Corporation, have over four hundred resellers in China. Representatives of these companies find that the Chinese market is unified and are not able to pinpoint any direct regulatory or administrative differences between provinces regarding trade procedures in doing business. The overall market access has most probably improved since the WTO accession.

## **6.2 Summary and Comments of the Field Study**

Experiences of the Chinese and foreign entrepreneurs and company representatives are homogenously negative towards the perception of any barriers to cross-provincial trade. None of the representatives interviewed during the field study had experienced any barriers to trade. This is truly an interesting outcome. According to the indirect measurement of trade barriers presented in this paper, and the econometric assessment, such barriers are indeed present. Estimated trade barriers vary between provinces and over time. Those barriers have certainly decreased substantially during

the past decade, but they are still present. Trade barriers for 2011 were estimated to be 10-40 per cent on average depending on EOS (see Figure 4).

There is undeniably a discrepancy. How can it be the case that all those interviewed during the field study agree that there are no barriers to cross-provincial trade in the PRC? Two main reasons for this inconsistency can be highlighted. First, it might be that the econometric results of this and other studies are incorrect due to inferior data or modeling problems. Second, there might very well exist barriers to cross-provincial trade in the PRC, but the barriers are not of an administrative or political nature and are therefore not apparent for the entrepreneurs and companies operating on the Chinese market. Nevertheless, there still are barriers present and other things being equal provinces are consuming more locally produced goods rather than importing.

If we assume the results from the trade barrier estimation to be true and that trade barriers do exist, why would those barriers to trade not be experienced by the businessmen and businesswoman operating on the market? There are several reasons why obstacles to trade may not be perceived as direct barriers to trade by the entrepreneurs. First, consumers may tend to purchase locally produced goods and services. Imported products may indeed be substitutable for the locally produced goods, but tend to differ slightly. Consumers choosing between similar goods tend to purchase locally produced goods as they have purchased those goods before. This is a safe choice and the consumer is sure to be satisfied. Another study by Xu and Li (2011) do indeed find such an effect. In international economics, this is called a *home bias*. Second, firms tend to sell products locally as they know the demands and consumer preferences on the local market better than foreign markets. Other advantages of the local market may be easy access to finance and insurances due to personal contact networks and knowledge of local rules and regulations. Even in the case of similar regulations between provinces, the effort in order to gain access to this information may still be higher. Theoretically this can be compared to the heterogeneous firm model in international economics (Melitz, 2003) and the importance of fixed costs related to trade. Third, NTB may of course be regarded as *natural* costs related to trade. This can be costs related to transport. This cost can be reduced by development of infrastructure and transport routes. This is supported by the results of the econometric analysis. The construction of railways is negatively correlated to trade costs. This study does not control for all infrastructural development but trade costs are nonetheless related to the possibility of eased trade, and transport costs of goods are reasonably always present in some form.

## 7 Conclusions

This paper has aimed to answer two main questions. First, the question was posed whether there are domestic barriers to trade between provinces in the PRC, and if so, how they have varied over time. To capture these NTBs to domestic trade, I used an indirect methodology based on the Anderson and van Wincoop (2003) gravity model and Novy (2013) ratio of trade barriers. Second, the thesis also sought to identify factors that can explain variation in these domestic trade barriers, or, put differently, to find the sources of the internal barriers. This question was approached from two rather different methodological perspectives. First, the indirectly derived measures of domestic trade barriers were used as the dependent variable in a regression analysis, where a rich set of explanatory variables was included to see whether they can explain any of the statistical variation. Second, in-depth interviews were also performed in the field with Chinese firms and foreign firms operating on the Chinese market in order to determine what they perceive to be the causes of such trade barriers.

The first part of the analysis, where indirectly derived measures of domestic trade barriers were calculated, led to three main conclusions. First, there are indeed internal barriers to cross-provincial trade in the PRC. The exact magnitude of these depends on several underlying assumptions, but given reasonable assumptions, the average domestic trade barriers correspond to an iceberg trade cost of 0.12 – 0.53 in 1981 and 0.09 – 0.39 in 2011 depending on the value of elasticity of substitution. Second, the estimated tariff equivalent barriers to cross-provincial trade vary over time. Importantly, they are on average significantly lower during the last decade. Estimated trade barriers decreased by approximately 25 per cent from 1981 to 2011. Third, there is a huge variation between provinces. In fact, comparing the provinces with the lowest and the highest domestic barriers, there was a 22 per cent difference in 1981 and 41 per cent difference in 2011. Some provinces lowered trade costs considerably over this period of time, while others were unchanged.

Having established that there are indeed domestic trade barriers and that they vary both over time and across provinces, the essay then sought to explain these differences. The first part of this analysis, where the estimated trade barriers were analyzed in a panel data regression, led to four notable results. First, there is a significant connection between decreasing domestic trade barriers and WTO entry. This suggests that cross provincial protectionism is high as a result of external protectionism and domestic fiscal decentralization. Predictions of diminishing trade barriers as a result of international openness and WTO accession also fit the

econometric results of this paper. Second, development in transport infrastructure (specifically railways) significantly decreases trade costs. This is not surprising, because the establishment of a functioning and frictionless transport network is generally seen as essential for facilitating trade.

Third, growth in the second industrial sector is also correlated with low trade costs. The thesis argues that there exists a two-way causality between industrialization and lowered trade costs. On the one hand, increased industrialization provides a broader range of tradable customer products. Producers need to expand their customer base and have incentives to lobby for reduced trade costs. However, similar effects are not obvious with respect to the third industrial sector due to the inherent nature of services. On the other hand, it could of course also be possible that the causality is the opposite. Lower trade costs can facilitate the development the industrial sector. Fourth, there is a regional bias against remote areas regarding cross-provincial trade barriers. Provinces located in the western and northern parts of China have significantly higher cross-provincial trade costs, presumably because of longer transports. The average trade costs in remote provinces correspond to an iceberg trade cost 0.15 – 0.17 higher than in other areas of the country assuming  $EOS = 2$ , and approximately 0.05 assuming  $EOS = 12$ .

The question of what causes the (variation in) domestic trade barriers was also approached by conducting field interviews with company representatives and entrepreneurs in Shanghai, China. Interestingly, the field study conducted in China and the econometric testing of the estimated trade barriers show contradicting results. Chinese and foreign entrepreneurs and company representatives contributing to this study were consistently negative regarding the perception of any barriers to cross-provincial trade. In other words, their assessment was that it was as easy to sell products within a given province as it was to ship the goods to another province and sell them there. This, of course, stands in contrast to both the results from the initial analysis, which established that there are indeed barriers, and the subsequent econometric analysis where several causes of the barriers were found. While pinpointing the exact reason for this anomaly is beyond the scope of this paper, several possible explanations were discussed; home bias effect, heterogeneous firms and fixed costs in production, and *natural* trade costs such as transport of goods. One should keep in mind two facts in relation to this. First, there is a difference between *perceived* barriers to trade and *actual* barriers to trade. Company managers may primarily only take into consideration tariffs and policies aiming at trade related issues. This does not have to be the case. Second, the approximated trade barriers include all costs related

to trade, including transport costs. Transport costs are likely to be substantial considering the many mountainous and hard to access rural regions of the spatially vast country. Furthermore, there was a possibility of using inaccurate data in this study, which subsequently gave rise to this anomaly.

What can policymakers in China learn from this study? Well, I would certainly like to stress that there are issues with the data used and that the results are also to some extent dependent on the underlying assumptions that are made. One should therefore not take the results too literally. Keep in mind the high variation between provinces, implying that the estimated trade barriers may not be representative for any single province, but is to be regarded as an indicator for overall domestic market integration. In general, the inconsistency between outcomes of the econometric analysis and the field study imply that one must realize that NTBs are problematic to countervail, not only because of the inherent difficulties of quantification, but also because they may not be perceived as barriers to trade. Nevertheless, the essay does point in the direction of several lessons worth learning. Policymakers in China ought to consider transport costs in order to promote cross-provincial trade. Remote areas of the country have generally higher trade barriers and an adequate quality of infrastructure is essential for development. The economic development in China is unevenly progressive in various regions, and incorporation of remote areas through for example infrastructure is essential for further development in those areas. Increased domestic trade facilitates the industrialization process of rural areas, and the importance of domestic economic integration must be highlighted. Furthermore, as international cooperation and exposure to foreign competition are correlated to diminishing cross-provincial trade barriers, a continued open foreign policy is appreciated.

Compared to the previous literature, this paper uses a methodology based on the gravity equation to indirectly estimate barriers to trade applied on a long-run dataset ranging from 1981 to 2011. The outcomes of this analysis contribute to the ongoing debate in the sense that they provide an overview of the long-run development of trade barriers in China. Previous studies applying data for short periods of time, for example the period 1992-2002 studied by Wong (2012) and 1987-1997 studied by Poncet (2001) are obviously not representative for a long-run development of market integration. This further explains the lack of consensus on the question of whether trade barriers in the PRC are increasing or decreasing, as several outcomes are possible depending on the applied time period. During some periods, trade barriers were rising and previous analysts (Wong 2012, Young 2000, Poncet 2001, 2003 and 2005) therefore found a harmful development in China. I am hopeful that this study can offer a significant

contribution to the growing literature on domestic economic integration in China. Still, there are of course many issues where further research could prove to be very fruitful. For instance, the definite causality between decreasing barriers to trade and the development of a second industrial sector is still undetermined. Precise mechanisms in this relation have to be identified if more detailed policies are to be discussed.



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## 9 Appendices

### 9.1 Definitions of Data

<b>Variable</b>	<b>Definition and unit</b>	<b>Source</b>
Domestic Exports	The value of commodities sold by the establishments to other establishments and individuals of different status of registration. 100 million Yuan.	Statistical Yearbooks retrieved from China Data Online Database.
Net Exports	The exports of goods and services minus the imports of goods and services. 100 million Yuan.	Statistical Yearbooks retrieved from China Data Online Database.
Exchange Rate	National currency units per US dollar. 100 million Yuan.	Penn World Tables 7.1.
Total Imports	The purchase of commodities by wholesale and retail establishments. 100 million Yuan.	Statistical Yearbooks retrieved from China Data Online Database.
Total Consumption	The total expenditure of resident units on final consumption of goods and services. 100 million Yuan.	Statistical Yearbooks retrieved from China Data Online Database.
International Exports	The value of commodities exported beyond the boundary of China. 1000 USD.	Statistical Yearbooks retrieved from China Data Online Database.
Total Output	The final products of all resident units in a country (or a region). 100 million Yuan.	Statistical Yearbooks retrieved from China Data Online Database.
Per capita GDP (gdp_pc)	The final products of all resident units in a country (or a region) divided by the number of inhabitants. Yuan per person.	Statistical Yearbooks retrieved from China Data Online Database.
Urban employment (urb_emp)	Per cent labor force in urban areas. Permanent residents of working age in the urban areas engaged in non-agricultural activities.	Statistical Yearbooks retrieved from China Data Online Database.
gio_soe	Per cent of the final products of all resident units in a country (or a region) contributed by companies registered as state owned enterprises.	Statistical Yearbooks retrieved from China Data Online Database.
Number of persons enrolled in higher education (edu)	Number of persons enrolled in higher education. They include full-time universities, colleges, high professional schools and short-term professional universities. 10 000 persons.	Statistical Yearbooks retrieved from China Data Online Database.

Length of railways (railway)	The total length of the trunk line for passenger and freight transportation (including both full operation and temporary operation). 10 000 km.	Statistical Yearbooks retrieved from China Data Online Database.
Second industrial sector (gdp_sec)	Per cent share of contribution to GDP from secondary industry (including mining and quarrying, manufacturing, production and supply of electricity, water and gas) and construction	Statistical Yearbooks retrieved from China Data Online Database.
Third industrial sector (gdp_ter)	Per cent share of contribution to GDP from tertiary industry (all other industries not included in primary or secondary industry). Primary industry includes agriculture (including farming, forestry, animal husbandry and fishery).	Statistical Yearbooks retrieved from China Data Online Database.

## 9.2 Additional Regression Results

Dependent variable:  $\bar{\tau}$  (EOS = 5)

Regression	1: FE	2: FE	3: FE 1 <sup>st</sup> order differences	4: FE	5: RE	6: RE
Variable						
gdp_pc	-0.0000*** (0.0000)	-	-	-	-	-
urb_emp	0.0126 (0.1224)	-0.0811 (0.2443)	0.0354 (0.0650)	-0.2424 (0.1797)	-0.0335 (0.0949)	-0.0708 (0.0702)
gio_soe	-0.0241 (0.0281)	-0.0476* (0.0254)	0.0106 (0.0062)	0.0009 (0.0232)	-0.0281 (0.0270)	0.0229 (0.0216)
edu	-0.0013*** (0.0003)	-	-	-	-	-
railway	0.0456 (0.0597)	-0.1106 (0.0776)	0.0751 (0.0717)	-0.1016* (0.0558)	-0.2554*** (0.0397)	-0.2392*** (0.0391)
highway	0.0000 (0.0010)	-	-	-	-	-
gdp_sec	-0.1861 (0.1466)	-0.3625*** (0.1074)	-0.3744*** (0.0726)	-0.4974*** (0.1209)	-0.3343*** (0.0663)	-0.3859*** (0.0665)
gdp_ter	-0.1516 (0.0941)	-0.1527 (0.1566)	0.0005 (0.0550)	-0.0822 (0.0742)	-0.1318 (0.1367)	-0.0332 (0.0691)
time_1987 (social turmoil)	-	-	-	-0.0011 (0.0089)	-	-0.0008 (0.0087)
time_1994 (fiscal reform)	-	-	-	0.0225*** (0.0069)	-	0.0233*** (0.0070)
time_2002 (WTO entry)	-	-	-	-0.0281*** (0.0084)	-	-0.0202*** (0.0073)
time_2008 (global crisis)	-	-	-	-0.0159* (0.0082)	-	-0.0173 (0.0092)
region_remote	-	-	-	-	0.1145*** (0.0224)	0.1047*** (0.0196)
Year-dummy	YES	YES	NO	NO	YES	NO
Constant	0.4213*** (0.0798)	0.5528*** (0.0967)	-0.0023*** (0.0006)	0.5807*** (0.0859)	0.4997*** (0.0547)	0.4600*** (0.0418)
F-statistic (p-value)	0.0000 <sup>†</sup>	0.0000 <sup>†</sup>	0.0007	0.0000	0.0000 <sup>†</sup>	0.0000
R <sup>2</sup> within	0.7846	0.6865	0.1031	0.5503	0.6757	0.5334
R <sup>2</sup> between	0.2715	0.0282	0.1092	0.0713	0.7975	0.8140
R <sup>2</sup> overall	0.3643	0.1994	0.1092	0.1439	0.7440	0.7196
$\rho$	0.9022	0.8893	0.0884	0.8561	0.2633	0.1916
Observations	407	407	407	407	407	407

**Dependent variable:  $\bar{\tau}$  (EOS = 8)**

Regression	1: FE	2: FE	3: FE 1 <sup>st</sup> order differences	4: FE	5: RE	6: RE
Variable						
gdp_pc	-0.000*** (0.000)	-	-	-	-	-
urb_emp	-0.001 (0.0852)	-0.0592 (0.1652)	0.0251 (0.0464)	-0.1700 (0.1208)	-0.0225 (0.0656)	-0.0510 (0.0495)
gio_soe	-0.0143 (0.0192)	-0.0297 (0.0172)	0.0080* (0.0044)	0.0026 (0.0156)	-0.0172 (0.0180)	0.0167 (0.0144)
edu	-0.0008*** (0.0002)	-	-	-	-	-
railway	0.0306 (0.0424)	-0.0726 (0.0536)	0.0477 (0.0489)	-0.0666* (0.0380)	-0.1768*** (0.0284)	-0.1663*** (0.0274)
highway	0.0001 (0.0007)	-	-	-	-	-
gdp_sec	-0.1344 (0.0970)	-0.2506*** (0.0748)	-0.2591*** (0.0487)	-0.3412*** (0.0824)	-0.2328*** (0.0466)	-0.2684*** (0.0463)
gdp_ter	-0.1159* (0.0655)	-0.1136 (0.1053)	-0.0030 (0.0381)	-0.0618 (0.0503)	-0.0978 (-0.0926)	-0.0262 (0.0472)
time_1987 (social turmoil)	-	-	-	-0.0004 (0.0062)	-	-0.0003 (0.0062)
time_1994 (fiscal reform)	-	-	-	0.0163*** (0.0048)	-	0.0168*** (0.0050)
time_2002 (WTO entry)	-	-	-	-0.0192*** (0.0056)	-	-0.0136*** (0.0049)
time_2008 (global crisis)	-	-	-	-0.0104* (0.0056)	-	-0.0112* (0.0061)
region_remote	-	-	-	-	0.0813*** (0.0160)	0.0747*** (0.0140)
Year-dummy	YES	YES	NO	NO	YES	NO
Constant	0.2890*** (0.0553)	0.3747*** (0.0662)	-0.0015*** (0.0004)	0.3930*** (0.0581)	0.3383*** (0.0381)	0.3117*** (0.0294)
F-statistic (p-value)	0.0000 <sup>†</sup>	0.0000 <sup>†</sup>	0.0007	0.0000	0.0000 <sup>†</sup>	0.0000
R <sup>2</sup> within	0.7848	0.6943	0.1031	0.5561	0.6826	0.5386
R <sup>2</sup> between	0.1875	0.0214	0.1241	0.0632	0.8045	0.8203
R <sup>2</sup> overall	0.3255	0.1860	0.1017	0.1332	0.7507	0.7270
$\rho$	0.9124	0.8990	0.0928	0.8664	0.2779	0.2061
Observations	407	407	407	407	407	407

**Dependent variable:  $\bar{\tau}$  (EOS = 12)**

Regression	1: FE	2: FE	3: FE 1 <sup>st</sup> order differences	4: FE	5: RE	6: RE
Variable						
gdp_pc	-0.0000*** (0.0000)	-	-	-	-	-
urb_emp	-0.0045 (0.0605)	-0.0433 (0.1152)	0.0197 (0.0333)	-0.1210 (0.0840)	-0.0158 (0.0464)	-0.0370 (0.0354)
gio_soe	-0.0092 (0.0134)	-0.0197 (0.0118)	0.0059* (0.0032)	0.0026 (0.0108)	-0.0112 (0.0125)	0.0121 (0.0100)
edu	-0.0006*** (0.0001)	-	-	-	-	-
railway	0.0213 (0.0304)	-0.0497 (0.0378)	0.0321 (0.0343)	-0.0455 (0.0266)	-0.1247*** (0.0205)	-0.1175*** (0.0195)
highway	0.0002 (0.0005)	-	-	-	-	-
gdp_sec	-0.0970 (0.0683)	-0.1768*** (0.0530)	-0.1829*** (0.0329)	-0.2397*** (0.0578)	-0.1649** (0.0332)	-0.1900*** (0.0328)
gdp_ter	-0.0861* (0.0465)	-0.0833 (0.0731)	-0.0035 (0.0270)	-0.0456 (0.0351)	-0.0717 (0.0647)	-0.0198 (0.0332)
time_1987 (social turmoil)	-	-	-	-0.0001 (0.0044)	-	-0.0002 (0.0044)
time_1994 (fiscal reform)	-	-	-	0.0118*** (0.0034)	-	0.0121*** (0.0035)
time_2002 (WTO entry)	-	-	-	-0.0135*** (0.0038)	-	-0.0095*** (0.0034)
time_2008 (global crisis)	-	-	-	-0.0071* (0.0039)	-	-0.0076* (0.0042)
region_remote	-	-	-	-	0.0582*** (0.0115)	0.0536*** (0.0101)
Year-dummy	YES	YES	NO	NO	YES	NO
Constant	0.2031*** (0.0391)	0.2615*** (0.0465)	0.0010*** (0.0003)	0.2741*** (0.0405)	0.2360*** (0.0270)	0.2176*** (0.0210)
F-statistic (p-value)	0.0000 <sup>†</sup>	0.0000 <sup>†</sup>	0.0007	0.0000	0.0000 <sup>†</sup>	0.0000
R <sup>2</sup> within	0.7845	0.6983	0.1031	0.5589	0.6862	0.5412
R <sup>2</sup> between	0.1422	0.0177	0.1321	0.0585	0.8078	0.8233
R <sup>2</sup> overall	0.3029	0.1781	0.1003	0.1270	0.7538	0.7305
$\rho$	0.9175	0.9040	0.0956	0.8719	0.2869	0.2150
Observations	407	407	407	407	407	407

Note: Robust standard error in parentheses. Coefficient significantly different from zero with 10% (\*). 5% (\*\*) and 1% (\*\*\*) confidence level (two tailed).

†: Due to the year-dummies added there are more parameters than clusters in the model and a regular F-test is therefore not possible to perform. The test conducted is instead a joint test if the other parameters are equal to zero (year-dummy variables excluded)



### 9.3 Variable Correlations

#### Correlation matrix

Variable	Unit	Correlation								
		tar_est	gdp_pc	urb_emp	gio_soe	edu	railway	highway	gdp_sec	gdp_ter
$\bar{\tau}$ (EOS=2)	Per cent	1.0000	-	-	-	-	-	-	-	-
gdp_pc	Yuan per person	-0.4141	1.0000	-	-	-	-	-	-	-
urb_emp	Per cent	0.1628	0.1375	1.0000	-	-	-	-	-	-
gio_soe	Per cent	0.4786	-0.7752	0.0127	1.0000	-	-	-	-	-
edu	10 000 persons	-0.7280	0.6437	-0.2242	-0.6219	1.0000	-	-	-	-
railway	10 000 km	-0.5305	0.2809	0.1605	-0.2481	0.3102	1.0000	-	-	-
highway	10 000 km	-0.6473	0.6139	-0.2901	-0.5771	0.7829	0.4199	1.0000	-	-
gdp_sec	Per cent	-0.4089	0.3609	0.1277	-0.2429	0.3858	0.2511	0.3205	1.0000	-
gdp_ter	Per cent	0.0245	0.5580	0.2349	-0.5487	0.3016	0.0143	0.2604	0.0150	1.0000