Revisit the Silk Road: Railway Speed-Up and Export*

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Abstract: China's main railway line linking east and west was speeded-up in Oct. 21, 2000, which improves freight efficiency between eastern China and Xinjiang (the hub of China and Central Asia). This paper tests the impact of exogenous domestic accessibility variation on export. By employing a transaction-level customs database, empirical results find benefited exporters (use rail freight) increase the export value to Central Asia by around 30% compared with exporters use other freight modes, and exporters use rail freight but enjoy limited speeded-up mileage. The speed-up effect is due to mixed channels: net export creation, export diversion in freight modes and exporters. Increase in export value of related exporters is exerted by export expansion of existing exporters but not entry of new exporters. This paper also finds exports of medium value products benefit most from speed-up, which are more sensitive to shipping efficiency than low and high value products. Overall, speed-up effect on regional development of Xinjiang is two-fold. It weakens the function of Xinjiang as the hub, but promotes its export in other international markets by better accessibility to coast.

Keywords: Domestic transport costs; Transport infrastructure; China; Central Asia; Export; Hub;

JEL Classification: H54; F14; R40; D22

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1 Introduction

Domestic transport infrastructure improvement is important to international trade, since domestic freight costs account for a considerable proportion in total trade cost, particularly in large countries. In fact, it has been shown that domestic freight costs accounted for 36.6% of international transport costs in the United States a few decades ago (Rousslang and To, 1993). Transport burdens are magnified for firms in interior cities of China seeking to import low or medium-value inputs from the coast (World Bank, 2006). These suggest that domestic transport costs can be an important barrier to trade[1]. This feature is strengthened in China-Central Asia (Kazakhstan, Kirghizstan, Tajikistan, Uzbekistan, Turkmenistan) trade. First, China has a lot of landlocked territory in the western regions while its production mainly agglomerates in eastern regions. As a result, to move goods to Central Asia (west of China) (see in Figure 1), it is necessary to experience a long-distance domestic land transport by train or truck[2]. To reach these five countries, goods must go through the ancient Silk Road[3], that is, firstly reach Urumqi, the capital of Xinjiang, and then exit China through frontier ports. To go through the Silk Road, the transportation will experience a massive unpopulated area (desert), as a result, this route is unique (both for rail or road).

[Figure 1]

> *"Trade on the Silk Road was a significant factor in the development of the civilizations of China, the Indian subcontinent, Persia, Europe and Arabia. It opened long-distance, political and economic interactions between the civilizations."*
>
> *Jerry Bentley, 1993*

For example, goods shipped from Jiangsu (a province of eastern China) and exported to Central Asia, the domestic transportation distance is more than 4,000km (Jiangsu-Urumqi, 3,600km and Urumqi-Alashankou, 477km). As a result, due to the long domestic distance, most of the goods are not economical to export from eastern China to Central Asia. The domestic transportation shows to be too expensive and time-consuming, although eastern regions in China have much higher

[1] Except trade, Emran and Hou (2013) find the impact of domestic market access is significantly large on per capita consumption of households in rural China.

[2] There is no river for shipment, and air freight exports are rare.

[3] In the Chinese part of the Silk Road, it is a long distance land route from Xi'an to Alashankou, a straight valley which penetrates the Dzungarian Alatau mountain range along the border between Kazakhstan and Xinjiang.

productivity compared with that in western regions because of huge market, rich labor supply and agglomeration.

This situation is, to some extent, relieved in 2000. As the progress of China railway speed-up project (1997-2007), in the third round of this national railway speed-up project in Oct. 21, 2000, Longhai line (Lianyungang-Lanzhou) and Lanxin line (Lanzhou-Urumqi) are speeded-up simultaneously within one day. Travel time between Xinjiang and eastern China is significantly saved, and train capacity is increased by higher shift frequency. Also, the freight cargo to the west regions is given priority in cargo loading because of the policy-oriented China's Go West Campaign (People's Daily, 2000). This means the efficiency of long-haul domestic transportation in China-Central Asia trade is greatly improved[4].

This paper thus evaluates the railway speed-up impact on export from China to Central Asia. I set this speed-up project as a quasi-experiment to identify the role of domestic market accessibility in firms' export performance. Depending on the different freight modes, speed-up improves the domestic accessibility for railway freight exports (the treatment group) while for others (the control group) it remains the same. By contrasting exports in both groups before and after speed-up, and controlling for potential confounding factors, I can consistently estimate the impact of railway speed-up project on firms' exports. Precisely, I perform difference-in-differences estimations on firm transaction-level data that inform the exact geographical origin of the exports and the freight modes through which the products exit China. Then I am concerned on that the railway speed-up effects to exports are heterogeneous from the locations of origin. Exporters enjoyed more in the speeded-up mileage will naturally benefit more. By restricting only on the railway freight exports samples, I test the relation between speeded-up mileage variation and export performance. That is, I have two kinds of control groups, exports through non-rail domestic freight, and exports through rail but enjoy limited speed-up mileage. I carefully address the robustness concern by excluding specific samples (with respect to demand fluctuation of specific products and external economic shock, the 'Sept. 11 Attack') and conducting counterfactual analysis with data of other years.

I find railway speed-up increases annual export value to Central-Asia by around 30% in firm-product-destination country level, compared with exports through other freight modes, and com-

[4]Throughout this paper, speed-up refers to the speed-up project (containing up speed, expansed capacity and upgraded operation mode, et al.) but not up speed only.

pared with rail freight exports but enjoy limited speeded-up benefices. Positive impact on exporters' shipment frequency is also significant but extent is much weaker, suggesting speed-up helps export through expanding export scale per shipment. Consistently, results show intensive margin effect plays the major role in explaining the speed-up impact on export but not extensive margin.

Export creation effects show to be the dominate source of speed-up effect. Also, I find two kinds of diversion effects are mixed into export creation effect. To some extent, some exports once freighted by trucks tend to be transferred to trains because of improving efficiency in rails. And, Xinjiang exporters (Xinjiang is the hub of China and Central Asia, it enjoys limited speed-up), lose some of Central Asia market to exporters in other regions (far from Central Asia; competitive in manufacturing productivity) which obtain better domestic accessibility to Central Asia by speed-up. Customs data also shows exports of medium value products are most sensitive to speed-up, they benefit more than exports of high value products. For low value products, exports are not affected by speed-up because they are suitable for leisurely shipping, not elastic to change in transportation efficiency.

Additionally, I test the export performance with respect to speed-up in another direction, exports from Xinjiang exporters to other markets like Japan and U.S. In this case products must experience a long-haul freight from Xinjiang to eastern coastal lines. If products are moved by railway, then they use almost the full length of both Lanxin line and Longhai line. By comparing the export performance of Xinjiang in different markets, I find role of Xinjiang as a hub is weakened because of railway speed-up, while it gains better accessibility to other international markets.

My analysis might contribute to two different literatures. First, I provide evidences on the role of domestic accessibility on international trade participation, and investigate the channels of domestic transportation improvements effects on export in different angles, for which both the empirical and theoretical literatures are far from enough (see e.g., Ago et al., 2006; Albarrán et al., 2013; Martincus and Blyde, 2013; Faber, 2014). The most difficult in empirics is that, to properly identify such effects requires successfully addressing potential endogeneity problems affecting the relationship between domestic transport costs as determined by infrastructure and trade. In this paper, I combine micro firm transaction-level export data and exploit the railway speed-up project as an exogenous source of variation in transport efficiency. Second, I provide evidences on the externalities of large-scale transport infrastructure to hubs. Xinjiang, as the hub of China-Central Asia trade, its hub function

becomes weak because of improving domestic accessibility (similar theoretical results suggested in Mori (2012)), and on the other hand, improving domestic accessibility promotes its export to countries like US and Japan. There are two-sided externalities to the transport infrastructure investment effect on regional development of hubs.

The rest of this paper is organized as follows. Section 2 contains the background of the China railway speed-up project. In Section 3 and 4 I present the empirical strategy and results, respectively. Section 5 discusses the channels and heterogeneity of railway speed-up effects on export, and Section 6 is a simplified evaluation of overall export impacts on the hub Xinjiang. Section 7 concludes.

2 The China railway speed-up project

The China railway speed-up project refers to initiatives undertaken by the Ministry of Railways from 1997 to 2007 to increase the speed of train travel in China by improving the nation's railways. The project is implemented in six rounds and increases average speed of passenger trains in China from 48.1 km/h to 70.2 km/h (There is no official statement telling the degree of improvements in average speed of freight trains). Although the railway speed-up does not directly decrease monetary transport cost, it decreases the time cost through higher speed and more frequent shifts. Also, speed-up project improves China's railway system except speed by adopting new and advanced trains, modified operation mode.

The overall project is taken by six sub-rounds and only the selected railway lines are speeded-up. The treated railway lines are speeded-up at specific dates. Detailed information of these six rounds is as shown in Table 1. In first two rounds, treated lines are three capital lines from Beijing to Southern China, Eastern China and Northeastern China, respectively. Then in 2000, the third round, three main west-east lines are speeded-up. Two of them are concerned in this paper connecting Xinjiang and eastern China (Lanxin and Longhai lines). Another west-east line is Zhegan line, which is much shorter than the Lanxin and Longhai lines, and not directed related to Xinjiang. Also, Jingjiu line (Beijing-Kowloon), a capital line from Beijing to Southern China is speeded-up in 2000. Then in 2001, 2004, and 2007, many other lines are speeded-up successively, and some lines are speeded-up once more.

[Tables 1]

The achievement of the speed-up project (1997-2007) is significant, as shown in Table 2. In this decade, highest rail speed increased from less than 140 km/hour to 250 km/hour, and more and more passengers can reach their destinations (if less than 1,500km) within one night. For three main kinds of freight trains (five-set freight train[5], bulk cargo trains, and parcel trains), shift frequency is largely increased. For the speed-up in Oct. 2000, considerable new five-set freight trains are applied in speeded-up lines, as well as bulk cargo trains. Although there is no exact speed data on freight trains, for the passenger trains, around 20% of the travel time is saved for trips from Urumqi to Lanzhou (from 33 hours to 27 hours), Beijing (from 63 hours to 50 hours) and Shanghai (from 66 hours to 51 hours). For both speed and capacity, it's obvious that they are greatly improved because of speed-up project.

[Table 2 and Figure 2]

As shown in Figure 2, Longhai line (Lianyungang, Jiangsu Province-Lanzhou, Gansu Province) and Lanxin line (Lanzhou, Gansu Province.-Urumqi, Xinjiang Province) are the main routes from eastern China to Xinjiang, as well as, Central Asia. Total mileage of there two line are 3,651km, accounts for a large part of overall China-Central Asia transportation. Compared to the high density of China's railway network, most of the railways except Longhai and Lanxin lines do not be speeded-up in this round.

[5]Five-set freight trains: freight trains with scheduled station, scheduled train number, scheduled route, scheduled time and scheduled price, with simplified freight procedures, reasonable price and, guaranteed time, capacity and cargo security. Railway freight is operated by China Railway Group with bureaucracy and complete monopoly, its passive market-oriented reform is argued to be a main reason for its low freight efficiency and decreasing freight market share. Compared to truck transportation, capacity availability and arrival time is not well set in railway freight system. Train shippers do not know the exact train and date the goods are loaded, and the exact date to arrive when they order a freight service. Cargo capacity for specific train in specific station and specific date is not set, and dependent on the usage rate of cargo capacity in previous stations, cargo demands in current stations, et al.. That is, in freight season, the travel time and capacity are hard to be guaranteed. As a result, truck becomes the premium mode for land freight in China, accounts for 72% in total national freight (Annual Report of Ministry of Transport of P. R. China, 2006). This poor situation is partially relieved by the five-set freight trains. Five-set freight train service enjoys simplified freight procedures, reasonable price, and guaranteed capacity, travel time, and cargo security. It is a new freight service of China Railway Group since 1997 to response to the decreasing market share.

3 Empirical strategy and data

The baseline empirical strategy is set in three steps. First of all, to clearly tell the story that railway speed-up project matters export, it is necessary to provide a more direct quantitative evidence that the national railway speed-up project indeed matters the regional transportation in China. To do so, I conduct a panel data estimation proving this argument. Among the entire national railway speed-up project 1997-2007 with six rounds, some railway lines got speed-up for at least one time while others never got speed-up. Hence I construct a panel data on the turnover/traffic growth of freight/passenger for the China's main railway lines and test whether or not railway lines got speed-up will have a higher turnover/traffic growth rate in the corresponding year (if the speed-up happens in April, I set that year as treated; if the speed-up happens in October, I set the following year as treated). The sample is 26 railway lines in 10 years. If railway line i gets speed-up treatment in year t, then I set $Treated_{i,t}$=1. I test the speed-up effects with equation (1). *Freight/Passenger turnover/traffic growth* represents the annual growth rate for the four indicators, and *Treated* is the binary variable as mentioned above. η and μ are line and year fixed effects.

$$\textit{Freight/Passenger turnover/traffic growth}_{i,t} = \alpha_0 + \alpha_1 \, \textit{Treated}_{i,t} + \eta_i + \mu_t + \epsilon_{i,t}. \tag{1}$$

[Table 3]

Results in Table 3 show to be suggestive. On the freight turnover and traffic growth, both of them present significant promotion effects in the treated samples and years, 6.6% and 10.8% higher than average annual growth rate, respectively, which are rather considerable. For column 1, the average annual growth rate in full sample is 6.5%, this suggesting growth rate is doubled for treated lines in speeded-up year, reaching 13.1%. For freight traffic, average annual growth rate is 5.6%, and speeded-up lines reach 16.4%, averagely. Passenger turnover was also promoted although it's not related to export issues here. Passenger traffic was not affected significantly. Quantitatively, the railway speed-up effects on railway transportation are presented, which suggest my following tests is reasonable.

My second approach is to compare the difference on export performance to Central Asia between 2000 and 2001, and between railway freight products and products with other freight modes.

First of all, I emphasize the exogenous concern of speed-up project on China-Central Asia export. Speed-up in 2000 is the third round of the entire speed-up project with six rounds. The entire project is mainly considered as the national long-term development strategy to promote regional integration, population (goods) transportation between inland and coastal regions, and guarantee the national defense. It's reasonable to assume the China-Central Asia trade is not determinant to this speed-up project. Actually, trade with Central Asia is pretty limited compared with China's total international trade. In 2000 China's total export was 249.71 billion USD while the export to Central Asia was 0.77 billion, accounts only for 0.31% of the national export (Source: China External Economics Statistical Yearbook 2001).

Secondly, speed-up promotes the transportation in railways but not other freight modes like roads, shipping, and air. In 2000, Lianhuo expressway (eastern China-Xinjiang) has not yet been finished construction. Also, in this speed-up round few railway lines were speeded-up except these two lines, which guarantee other railway routes unchanged. Thirdly, unlike the roads construction, this railway speed-up was finished simultaneously within one day, but not gradually. So the impact is more direct and observable. Although the speed-up date is told to the public before Oct. 21, 2000, as a result, it induces an expectation causing it not an absolute exogenous shock like the natural disaster. Export, to some extent, is time-sensitive and subject to contract obligation, that is, exporters cannot put off the shipping to meet speed-up project. So one can suppose the overall bilateral trade will not be much affected by the expectation of speed-up project.

Finally, unlike the most international trade, China-Central Asia trade is more dependent on rail and road freight since there is no river and sea for shipping, and the domestic transportation distance is rather long, representing the transportation efficiency (time and monetary cost, business risk) is considerable in total trade cost. These natural settings allow a quasi-experiment approach comparing the performance of China-Central Asia export between benefited exporters and other exporters, before and after.

I employ the firm transaction-level customs data from Chinese Longitudinal Firm Trade Transaction Database (CLFTTD), in which I could use the firm transaction-level export data showing the unique firm ID code, address of the firm, transaction date, export products (eight-digit Harmonized Commodity Coding System, HS-8), place of manufacture (city level), destination country,

freight mode[6], export value and unit value, et al.. I extract the records referring to the exports to Central-Asia in 2000-2001[7], and I employ only a short period data (two years) because customs data is not available before 2000, and long-term export performance tends to be affected by noise like roads constructions.

Hence, depending on the different freight modes, I assume domestic transport efficiency improves for rail freight exports that enjoyed speed-up while those for others remained the same, thus induces better export performance for rail freight products. In 2000-2001, within the total shipment records from China to Central Asia, 33% of the shipments are taken by railway and 57% are taken by roads, with the rest 10% by air or ocean shipment (indirect shipment that transfer in Russia), suggesting railway is an important freight mode in this bilateral trade. Figure 3 shows that in the four quarters of 2000, the ratios of rail/non-rail freight export in export value, number of shipment and number of exporters are stable. However, from the first quarter of 2001, two months after the speed-up in October, 2000, the related ratio of export value increases largely while for another two indicators, they keep the similar trend with that before speed-up. Figure 4 shows the export value per shipment, and export value per exporter immediately increase after the speed-up for rail freight exports, compared with that of non-rail freight exports.

[Figures 3 and 4]

From Figures 3 and 4 it is shown that the potential speed-up treatment effect happens in the first quarter of 2001, that is, 2000 is not affected by speed-up project. I use annual data instead of quarterly data to relieve the seasonal data noise. I aggregate the firm transaction-level data into firm-product (HS-8)-country (destination)-freight mode-year level. That is, I aggregate the transaction data with the same exporter, products (the same HS-8 code), destination country, freight mode (rail, road, air and ocean shipping) and year. Data description is presented in Table A.1. For many aggregated annual data, there is no pair data in the firm-product-country-freight

[6]The database records freight mode of each transaction when exiting China, I assume the domestic freight mode is equal to that when exiting China. It is reasonable since the domestic and foreign routes are connected in Alashankou/Kashi, and both are land transportation, to switch the freight mode needs a switching cost. What's more, generally speaking, railway freight goods and road freight goods are not homogeneous, roads are responsible for light industry goods while railway for heavy industry goods and raw materials. Hence, it is reasonable to assume the freight mode when exiting China is the same of that for domestic freight.

[7]Donation samples (government donation) are excluded. In the transaction records of Central Asia export, exporting firm and manufacturer are the same or belong to the same province for more than 95% of the samples. For the rest, they are domestically imported from other regions (place of manufacture) to Xinjiang, and then exported by firms in Xinjiang. I exclude these samples to ensure credibility in following identifications

mode-level. New exporters in 2001 have no positive export value in 2000, and vice versa for exporters exit this market. For the unpaired data I set the corresponding value in related year as 0. This induces a larger sample size in econometric estimation than in data summary. Baseline estimation equation is as follows:

$$ExportValue_{f,p,c,t,y} = \alpha_0 + \alpha_1 Rail_{f,p,c,y} + \alpha_2 Rail_{f,p,c,y} \times y2001_{f,p,c,t} + \alpha_3 y2001_{f,p,c,r} + \epsilon_{f,p,c,t,y}. \quad (2)$$

Rail is a dummy variable identifying the freight ways, *Rail*=1 if the export transaction is undertaken by railway freight and otherwise *Rail*=0. *y2001* is a dummy variable for year 2001, *y2001*=1 for the exporting records in 2001 and 0 for that in 2000. Subscripts f, p, c, t, y represent firm, product, country, transportation mode and year, respectively. I normalize the left side, export value, by minus the mean of annual export value (*Ann.Exp.*) in 2000-2001 to eliminate firm-product-country-transportation mode (f-p-c-t) level heterogeneity. Precisely, I set: $ExportValue_{f,p,c,t,y}$=$Ann.Exp._{f,p,c,t,y}$-($Ann.Exp._{f,p,c,t,2000}$+$Ann.Exp._{f,p,c,t,2001}$)/2, *y=2000, 2001.* By controlling for the f-p-c-t level heterogeneity, year and rail freight dummies (*y2001*, equal to 1 for year 2001 and 0 for year 2000; *Rail*, equal to 1 for rail freight exports and 0 for others), the interaction term $Rail \times y2001$ captures the potential railway speed-up effects. If the related exporting activities are promoted, it should show a positive coefficient.

For the third empirical approach, it's straightforward to suppose that railway speed-up effects to exports are heterogeneous from the locations of origin. For exporters with long-haul domestic freight, time cost and business risk (unexpected delivery delay or lose) are higher compared to that of short-haul exporters. Speed-up saves time for freight, and for the latter concern, push out of five-set freight trains partially solves this problem. 31 five-set freight trains are applied after speed-up of 2000 (see in Table 2), suggesting higher capacity and higher efficiency in west-east transportation. Further, although freight rate is not directly decreased in speed-up, the actual transportation cost might also decrease. Li and Chen (2013) find price difference goes to decrease between connected regions in the case of relieved transportation congestion, even if the freight rate is unchanged[8]. These factors suggest exporters to Central Asia market with long-haul domestic

[8]When said to inefficient capacity and congestion, long-haul transportation is more likely to suffer from it than short-haul transportation. For example, in railway peak season, long-haul tickets are always much tighter than short-haul tickets.

transportation are supposed to benefit more in speed-up. In estimation of equation (2) I drop this variation by uniformly setting a binary variable for rail freight exports, which inevitably causing information loss. I hence conduct an estimation fully using the variation on speeded-up mileage.

Freight and passenger transportation in rail are operated separately in most of the cases. Coding system for freight train is not tractable, as a result, I cannot exactly get the speed-up mileage from the route for each freight train. I use that of the passenger trains as a proxy measuring the speeded-up mileage. Although the routes for freight train and passenger train from the same starting station and same terminal station are not necessary the same, it's reasonable to use it as a proxy.

Instead of calculating the accurate railway mileage from each firm to frontier ports, I, for simplicity, choose the distance, from the capital of province the firms are located, to Urumqi, to represent the total mileage for each firm to Alashankou and Kashi (All of the exports from China to Central Asia will go through the route from Urumqi to Alashankou or Kashi, and these routes were not speeded-up, so I need not consider these routes.). I calculate the total railway mileage and travel route (with respect to the operating rail trips) based on the minimal transportation times (first screening principle), minimal total mileage (second screening principle) (Data is based on the official Train Time Table in 2000 (*Lieche Shike Biao*)). Under this calculation strategy, for example, the total railway mileage from Fuzhou (Capital of Fujian Province) to Urumqi is 4555km and the trip will be divided into two parts: Fuzhou-Zhengzhou (1476km) and Zhengzhou-Urumqi (3079km). In this case I set the speeded-up mileage as 3079km since the second part was speeded-up in Oct. 2000. Generally speaking, cities within Xinjiang Province also enjoy considerable speeded-up mileage (up to 500km) because Xinjiang has a rather large land size. In the calculation of the speeded-up mileage, I set the location of firms in the provincial level for simplicity, that is, cities within Xinjiang are set as 0km in speeded-up mileage. The detailed speeded-up mileage is presented in Table A.2[9].

Estimation strategy is shown in equation (3). I use only the samples of rail freight exports to avoid the disturbances from fluctuations on non-rail freight exports. I set *Mileage* as the logarithm of speeded-up mileage. *ExportValue* and *y2001* are the same variables as in equation (2). To fit my assumption, the estimated coefficient of interaction term between *Mileage* and *y2001* is supposed

[9]When calculating the speeded-up mileage, I consider also another two lines speeded-up in Oct. 21, 2000: the Zhegan line and Jingjiu line. The speeded-up mileage in these two lines is also included in the calculation of speeded-up mileage.

to be significantly positive.

$$ExportValue_{f,p,c,y} = \alpha_0 + \alpha_1 Mileage_f + \alpha_2 Mileage_f \times y2001_{f,p,c} + \alpha_3 y2001_{f,p,c} + \epsilon_{f,p,c,y}. \quad (3)$$

4 Baseline results and robustness tests

4.1 Baseline results

In column 1 of Table 4 I present the estimation results for equation (2). The interaction term is found to be significantly positive. The concerned interaction coefficient is 0.0957, that means averagely the railway speed-up project promotes the related firm-product-country-level rail freight exports by 95.7 thousand USD per year. Since the mean of annual export value for rail freight products in firm-product-country-level is 137.8 thousand USD in 2000 (see in Table A.1), I might inference that the speed-up promotes a 69% increase in related exports[10]. This result sounds to be extremely large but still reasonable, first, the basement for China-Central Asia export is small, thus a large growth rate is easy to achieve; and export shock on non-rail freighted products leads to an overestimation on this result (will be shown in robustness tests). Further, in columns 2-4 I present the estimated results with data aggregated in other levels. Column 2 refers to an estimation with firm-product-freight mode-year level data, that is, I do not distinguish the destination countries to Central Asia. And columns 3 and 4 refer to estimations with firm-country-freight mode-year level data and product-country-freight mode-year level data. Results are all significant and suggest a positive export promotion effects from railway speed-up project.

Furthermore, I present the same estimation of equation (2) but with data of other years as a placebo test in columns 5-8 of Table 4. I set the placebo test with data of 2001-2002 (2001 is set as 'control' year and 2002 is set as the 'treated'), both of these two years are after the speed-up in

[10] In estimations I use the absolute value of export as the dependent variable instead of logarithm of export value because there are many unpaired data. For the unpaired data, export value in the year without positive export records is naturally set as 0 after taking logarithm (assume the export value is 1 USD), the export performance change thus will be noisy to statistical estimation. For example, when compare the performance between two exporters: exporter A (export value is 0 USD in 2000, and 1,000 USD in 2001) and exporter B (export value is 10,000 USD in 2000, and 100,000 USD in 2001). The actual export growth is obviously larger for exporter B. However, the growth is totally noised by taking logarithm: for exporter A the growth is ln1000-ln1=6.9, and for exporter B is ln100000-ln10000=2.3. When I restrict samples only on the records have positive pair data, baseline result is still consistent. Estimated interaction coefficient is 0.4208 at 10% significance level, suggesting speed-up increase related export value by 52.3%.

2000[11]. If the baseline results on speed-up effects are unbiased and exclusively originated from the railway speed-up project, placebo test result is supposed to be insignificant[12]. As shown in columns 5-8, I find results are not consistent with baseline estimations, neither of the interaction terms between *Rail* and *y2002* is significant and all the coefficients have much smaller absolute values than baseline estimations. This implies the estimated speed-up effect is not systematically biased.

[Table 4]

Then I further consider the within rail freight exports variation on speed-up project. Before conducting estimation of equation (3), in Figure 5 I present the kernel density of export transaction distribution with respect to speeded-up mileage for the rail freight exports in 2000 and 2001. Descriptively, for the post speed-up year, 2001 (dash line), higher share of the transactions to Central Asia is taken by exporters located in regions more than 3000km far away from Urumqi, and share of transactions by exporters located within Xinjiang decreased compared with that in 2000. This suggests Central Asia exports are more likely to be taken by coastal exporters instead of Xinjiang exporters, because of the improving domestic transport efficiency. Figure 6 shows before-and-after the speed-up, the ratio of export (Xinjiang/other regions) decreases largely.

[Figures 5, 6 and Table 5]

Column 1 of Table 5 tells the related econometric results of equation (3). By restricting the samples in rail freight exports, consistently, interaction term is significantly positive, which suggests the long distance west-east railway speed-up helps more on the long-distance exporters. Average speeded-up mileage in 2001 in firm-product-country-freight mode level is 1772km, than compared to the case without speed-up, the promotion effect is 0.040 million USD (=0.0053×(ln1773-ln1)) (I set the $Mileage$ as ln(Speeded-up_mileage+1) to avoid zero value for logarithm). Mean of rail freight exports in firm-product-country level in 2000 with positive speeded-up mileage is 0.142 million USD, suggesting averagely speed-up promote related export by 28%. This is much smaller

[11]To ensure the pre-treatment parallel trend in rail freight and non-rail freight exports, the preferred placebo test is to compare export performance difference between 1999 and 2000. Unfortunately, customs data in 1999 is not available. In Oct. 2001, there is another railway speed-up (fourth round of national railway speed-up project), however, this round focuses on other railway lines, and it does not affect China-Central Asia trade.

[12]Based on customs data it's impossible to clearly identify whether or not manufacture exporters (road freight exports) in western China benefit from railway speed-up by alternative way, a decrease in transportation cost of imported raw materials intermediates (rail freight imports) from coastal regions or other countries. Placebo test using data of 2001-2002 systematically relieves this concern.

than the estimation on equation (2).

I also test using other aggregated level data and results are presented in columns 2 and 3. In firm-country level, results come to be insignificant. Since I need the location information to obtain the speeded-up mileage, here I do not conduct the estimation with product-country-rail-year level data, as Table 4. Then, the same as the baseline estimations, the counterfactual analysis in columns 4-6 of Table 5 does not overthrow the baseline conclusions. In 2001-2002, there is no positive difference-in-difference result since there is no railway speed-up project in this period benefiting the Silk Road.

As discussed in Section 3, only the export value of rail freight exports increases by speed-up in 2001, but shipment frequency does not increase proportionally. This is a natural result, when facing demand increase, exporters will choose to increase export value per shipment but not increase shipment frequency to save freight cost (each shipment has a fixed cost, and unit cost in freight has increasing return feature). This is shown in Panel B of Table A.1, rail freight exports increase the value per shipment compared to that of non-rail freight exports. I use the number of shipment (in firm-product-country-freight mode-year level) to Central-Asia as the dependent variable testing equations (2) and (3). In Table 6, I present the results with 2000-2001 data in first two columns and then put the placebo test in column 3-4. Column 1 shows railway speed-up promotes the benefited exporters by 0.22 times per year in number of shipment. Noting that the related average number of shipment in 2000 is 2.55 times, 0.22 (9%) is a considerable, however, much smaller growth than that of export value. This suggests the promotion effect plays the role by increasing export value per shipment but not shipment frequency. Columns 2-4 refer to estimations of equation (3) and placebo tests, results are consistent to my assumptions, although in column 4, related coefficient comes to be negative.

[Table 6]

4.2 Robustness tests

Robustness tests are mainly concerned on the disturbance from falling or rising of specific products exports and external economic shock. It's obvious from Table A.1 that in 2001 non-rail freight exports experience a sharp decrease. Although it might be partially caused by a diversion effect of

freight mode, that is, from non-rail freight to rail freight because of the efficiency improvement in rail freight from railway speed-up. It is necessary to take into account the potential disturbance from export demands shock. The main products exported to Central Asia through railway are machines, chemical raw materials and building materials while through non-rails are clothes, shoes, textiles, and household appliances. Exporting products of heavy industry are mainly freighted through railway and light industry through non-rails, mainly the roads (see the details of the exporting categories in the bottom of Table 7).

Since the main products are heterogeneous between rail freight and non-rail freight products, it raises a potential disturbance to my baseline identification. Rising or falling of short-term demand for specific products that are freighted exclusively by rail or non-rail will affect the baseline results. For example, even if the export of rail freight products are actually not affected by speed-up project, the baseline estimation will still be positively significant as presented in baseline result, if there is an unexpected falling on the exports of clothes, shoes, textiles, household appliances, and et al. (dominated by non-rail freight) in 2001 compared with that in 2000. Also, if there was a rising on the demand of heavy products like machines, chemical raw materials and building materials, it will also induce the same results.

To test this assumption, firstly, in column 2 of Table 7 I exclude 5 product categories from full samples for which they have highest export value in rail freight exports (Top 5 in rail), and estimate the equation (2). Interaction term coefficient becomes slightly smaller to 0.0804, and keep significant at 1% level. When I only include these 5 categories, result is also positively significant. Then in column 4 I exclude 5 categories from full samples for which they have highest export value in non-rail freight exports (Top 5 in non-rail), concerned coefficient becomes much smaller although it is still significant at 1%. It could be explained that there was a falling in the demands of exports for non-rail dominated exports, which caused the overestimate of baseline results in column 1. After excluding the specific non-rail exports, coefficient decreases to 0.0377, means 37.7 thousand USD increase in related annual exports value (increase by 27%)[13]. Similarly, in columns 5-8 I present

[13]In the case of excluding top 10 product categories in non-rail freight exports, this figure further decreases to 23% and still statistically significant at 1%. Actually top 5 product categories in non-rail freight exports account for 67% of total exports with non-rail freight. For top 10, the share reaches 82%, exclude top 10 non-rail freight exports almost removes all the control samples. Hence, exclude top 5 product categories is supposed to well exclude the disturbance from non-rail exports demand shocks. Also, if the export decrease in non-rail freight exports is not caused by intra-industry demands shock but overall economic fluctuation, the estimated promotion effects is underestimated. Thus, I can suppose the actual treatment effect should be around 30%. For number of shipment,

the placebo tests with data in 2001-2002 in which neither of the concerned interaction terms is significant, suggesting the baseline estimation results are not biased by specific products exports.

[Table 7]

Secondly, on the external economic shock, 2001 is a special year on international trade both for China and World. In Dec. 2001, China joined in WTO as its 143th member, which promotes China's international trade greatly in the following years. However, this variation does not affect my estimations in this paper since I set the treated and control samples within year 2000-2001, namely, these two years' export performance actually is not affected by the WTO agreement issued by the end of 2001. Then, another economic shock is the 'Sept. 11 Terrorist Attack', as a consequence, the world trade shows an unexpected negative growth. 2001 is the only year with negative growth in world trade since 1980s. World trade value increases by 13% in 2000, but drops by 4% in 2001 because the global economic and political instability. Then in 2002 it recovers by increasing 4% (Source: International Trade Statistics, WTO). Overall, Xinjiang is sensitive to terrorism because of its geographic location as a border area, and historical ethnic conflict, so the 'Sept. 11 Attacks' affects greatly the China-Central Asia export. The ratio of export value to Central Asia (Sept.-Dec./annual) in 2000-2003 fell in 2001 due to the 'Sept. 11 Attack', dropping from higher than 0.4 (in 2000, 2002, 2003) to less than 0.3. In the period of Sept.-Dec. 2001, it's obvious that China-Central Asia export experienced abnormal decline, as the world trade, because of the terrorist attacks. I test the stability of my baseline results concerning on this macro economic and political fluctuation. I exclude the exports in Sept.-Dec. in both years since exports are seasonal heterogeneous. Then I estimate the placebo test with also the data excluding Sept.-Dec..

In column 1 of Table 8, interaction term between *Rail* and *y2001* keeps significant and valued 0.0769, slightly smaller than that of the baseline estimation 0.0957. Similarly, in column 2 I keep the rail freight export samples only and insert the speeded-up mileage into estimation, result is also unchanged. Columns 3 and 4 give the placebo test with consistent results. After the 'Sept. 11 Attack', it's reasonable to assume the export of light industry products (for household using) might be more sensitively affected than that for heavy industry products (for social production using). As a result, it will disturb the baseline re-

related result decreases to around 13%.

sults, however, this concern has already been addressed by the estimations excluding the top 5 product categories of exports both by rail freight and non-rail freight (Table 7).

[Table 8]

5 Mechanisms

In this section I investigate the channels of the speed-up effect on China-Central Asia export. Precisely, I try to distinguish between diversion effect and creation effect, time-related and capacity-related causes, intensive margin effect and extensive margin effect. Then I test the heterogeneity on export promotion with respect to unit price and firm size.

5.1 Channels of the speed-up effect on export

Speed-up effect on export is observed in the results of baseline estimations. Except the export creation effect, latent diversion effects also might contribute to the baseline estimations if exports once taken by trucks are transferred to trains because of up speed and expansed capacity in rail. In this case diversion effect and creation effect are mixed. I divide exports by the freight mode to distinguish export diversion effect from creation effect. If a product (HS-8 level) is freighted both by trains and trucks within the same firm-product-country level export, I set is as multiple freight mode export. Otherwise, it is identified as single freight mode export. For the first case, it is supposed to have diversion effect from non-rail to rail.

Results of columns 1 and 2 of Table 9 suggest for multiple freight mode products, the coefficient term of interaction term is much higher than baseline estimations and that of single freight mode products. Based on the estimated coefficients and mean value in related aggregated level, the export promotion effect of railway speed-up in multiple freight mode products is 167%, and for the rest, it is 64%. When I test using number of shipment instead of export value, the difference also exists, the extent is 42% (multiple) and 12% (single), respectively (results are available upon request). Obviously, multiple freight mode products enjoy a greater promotion effect because of a latent diversion effect from non-rail freight mode to rail. However, multiple freight mode samples account only for 18% of rail freight exports to Central Asia in 2000-2001, it suggests the diversion effect from non-rail to rail freight mode cannot fully explain the railway speed-up effects on export.

Result of column 2 suggests export creation effect dominates the speed-up effect from evidences of the rest 82% rail freight exports. Then in columns 3 and 4, I identify the exports with multiple and single freight mode in product (p) level instead of f-p-c level. Estimated diversion effects become weak, both the magnitude and extent are similar in these two groups. This shows the export diversion effect exists but not the main driving force, creation effect matters more.

Second, I am concerned on another kind of diversion effect, the diversion of Central Asia exports between Xinjiang and other regions of China. As shown in Table 5, exporters with longer speed-up mileage will benefit more from speed-up. It is straightforward to suppose export in Xinjiang (enjoys limited speeded-up mileage) will be transferred to other regions like Jiangsu and Zhejiang (coastal regions in eastern China), which have relative higher manufacturing productivity and competitive advantage than Xinjiang. Column 5 presents a simple estimation similar to Table 5. $Xinjiang$ is a dummy variable equal to 1 for Xinjiang exporters and 0 for other exporters. Within the rail freight exports, Xinjiang exporters have weaker performance than their competitors in other regions after the speed-up. Referring to the estimated coefficient, Xinjiang exporters with rail freight decrease the export value in 2001 by 31% compared with that in 2000.

[Table 9]

Additionally, in column 6 I conduct alternative estimation to evaluate this diversion effect. For a product that is exported to Central Asia both by Xinjiang exporters and exporters in other regions in 2000, I set it as 'both' product and set 'both' dummy equal to 1, for other product exports taken by either Xinjiang exporters or exporters in other regions, I set 'both' variable equal to 0. Within Xinjiang exports, I find export value of 'both' products declines compared with other products in Xinjiang by 39% in 2001 than that in 2000. Columns 5 and 6 suggest Xinjiang exporters are negatively affected by the diversion effect from speed-up.

Then in Table 10 I test the differential domestic access effects with respect to time saving and capacity expansion. Speed-up improves both the railway speed and cargo capacity. Perishable products are most sensitive to travel time while machinery are generally of big size and thus capacity sensitive. I test using these two kinds of products to distinguish between the role of time effect and capacity effect. In column 1 I conduct estimation of equation (2) within food exports, and in column 3 I restrict samples within rail freight exports and set a dummy variable for food (equal to 1 for

food exports and 0 for others). Although in first estimation I choose non-rail freight food exports as the control and in column 3 I set rail freight non-food exports as the control, interaction terms of both estimations capture the time effect. In column 2 and 4 I use machinery exports instead of food and run the same estimations with columns 1 and 3, interaction terms thus capture the capacity effect. Obviously, time effect is not statistically significant in columns 1 and 3, while machinery exports benefit from speed-up significantly by 31% (column 1) and 45% (column 3). Results suggest capacity expansion is the more important factor than time saving in railway effect[14].

[Table 10]

Finally, I test the speed-up effect on export in the viewpoint of extensive/intensive margin effects. For the extensive margin, I estimate the variation of number of exporters response to speed-up project followed by equation (4). Dependent variable is the number of exporters in product (HS-8)-country-freight mode-year level. *Rail* and $y2001$ dummy and equation settings are identical as equation (2).

$$Number.Exporters_{p,c,t,y} = \alpha_0 + \alpha_1 Rail_{p,c,y} + \alpha_2 Rail_{p,c,y} \times y2001_{p,c,t} + \alpha_3 y2001_{p,c,t} + \epsilon_{p,c,t,y}. \quad (4)$$

In column 1 results show the number of exporters increase by 8% (mean of the related indicator is 1.40 in 2000) because of the railway speed-up. Magnitude on extensive margin effect is not large, in spite of positive and significant coefficient. This is latently caused by the diversion effect as shown in columns 5-6 of Table 9. Because of railway speed-up and improving domestic accessibility to Xinjiang, on the one hand, exporters in other regions tend to participate in the Central Asia market, on the other hand, Xinjiang exporters tend to exit this market due to weak competitive power. In this case, extensive margin is not significant if the overall exporters do not increase, even if there is a switch between exporters in Xinjiang and other regions. In columns 2 and 3, I separately test the extensive margin for Xinjiang exporters and exporters in other regions to avoid such kind of offset effect. Results suggest this is not the case, extensive margin is limited even if taking into account the offset effect. For Xinjiang exporters, there is no significant decrease in

[14]However, the insignificant time effect might be latently caused by two facts: food exported to Central Asia is not always perishable, for example, wheat flour and rice are not so sensitive to time in trade, exactly perishable products like fruits are rare in export to Central Asia; the travel time saved by speed-up in freight trains is not as much as in passenger trains.

number of exporters and for other regions, extensive margin is significantly positive but the extent is still less than 10%. In column 4 I estimates in p (HS-4)-c level instead of p (HS-8)-c level, result is unchanged both in significance and magnitude of extensive margin (8%).

On the intensive margin effect, I keep only the existing exporters in f-p-c level that have export records in 2000 and run estimations of equation (2). the promotion effect is 58% in export value (column 5) and 23% in number of shipment (column 7), only slightly smaller than the results with full sample. In column 6 and 8 I present the results of equation (3) when keeping only the samples from existing exporters and rail freight exports. Results come to be similar with that in full samples (contain the new exporters in 2001). Based on these estimations, results suggest intensive margin plays the major role, speed-up effect on export originates from extensive margin is limited.

[Table 11]

Based on a series of estimations, picture of the channels of speed-up effect on export becomes clear. In the total speed-up effect (increase related export by 69% as in baseline estimations (Table 4), and at least 27% as in robustness checks after removing various disturbances (Table 7, 8)), export creation effect plays the main role (column 2 of Table 9), with limited diversion effect from non-rail to rail freight exports (column 1 of Table 9). Within rail freight export, to some extent, it is transferred from Xinjiang exporters to exporters in other regions of China (mainly the coastal regions) because of improving transportation accessibility to Xinjiang (columns 5 and 6 of Table 9). Capacity expansion is the more direct factor promoting export rather than the up speed (Table 10). I use only a short period (two years) data, exporters might not choose to enter/exit market immediately response to railway speed-up, but existing exporters increase/decrease the related exports, as a result, intensive margin comes to be the major source of speed-up effect but not extensive margin (Table 11).

5.2 Heterogeneous effect with respect to unit price of exporting products, and firm size

As the opinion of World Bank (2006), interior cities in China are more likely to be able to compete in the production of bulk goods (e.g., coal) suitable for leisurely shipment or high value goods (e.g., computer chips) suitable for air cargo. Transport will tend to have the most deleterious impact on

medium value goods for inland cities of China, hence, they are most sensitive to transport improvement. To take this into account, I averagely divide the exporting products into three categories based on the unit price: low value, medium value, and high value products. Table 12 gives the consistent results with World Bank (2006). Both the estimations with dependent variables as export value and number of shipment present significant promotion effects for medium value products. And for low value products, neither of the results is significant. That is, low value products tend to enjoy a leisure shipment, thus not sensitive to the up speed and capacity expansion in rail. Actually, when restrict the samples in raw materials export (enjoy leisure shipment), there is no significant speed-up effected observed (results are available upon request). For the high value products, results are not consistent, test with respect to export value is significantly positive while test with respect to number of shipment is insignificant, suggesting the speed-up project raised the export value per shipment for high value products. It is reasonable because exports to Central Asia is dominated by low and medium value products. Even for the high value products in this classification (not less than 4 USD in unit price), most of them cannot afford the air cargo. And as shown in Section 4, number of shipment is not increased as much as export value from speed-up project, the insignificant result on column 6 is not contradictory to that on column 3. Overall, export of medium value product is promoted by 135%, for high value product is 86%, for low value product is insignificant[15].

[Table 12]

Then, on the firm size of exporters, there is no data directly corresponding the size, I use the average value per shipment representing the firm size. Specifically, I calculate the mean of export value per shipment for each firm based on the data of 2000-2001, and set the medium value as the threshold. Firms whose average export value per shipment larger than the medium value are seen as a large firm, and otherwise small firm. Results in Table 13 are both significant for two kinds of exporters, and with two indicators: export value and num-

[15]I test the variation on unit price itself. I use the unit price instead of export value as the dependent variable for the samples have records in both two years, results are not significant as shown in Table A.3. Unit price is F.O.B price containing the producer price and domestic freight costs. Within f-p-c level, actually there is no price change since the speed-up does not directly decrease monetary freight costs. Although there might be an indirect decrease in freight cost because of capacity expansion and relieved congestion (as suggested by Li and Chen (2013)), and increasing return in transportation (as suggested by Mori (2012)) if exporters increase their export volume, it is reasonable that unit price does not react immediately to cost change. Lu et al. (2013) estimates the unit price effect of China's export response to US anti-dumping investigation, although export volume greatly decreased and the anti-dumping duty is high to 44%-300% of export value, the unit price does not significantly change.

ber of shipment. However, the extent is greatly different. For large exporters, rail freight export in 2001 increased by 85% compared with that in 2000. and that for small exporters is relative small, by 25%. On the number of shipment, the difference becomes much small with 16% and 13%, respectively. Large exporters benefit more than small exporters in speed-up. This is reasonable, larger exporters are more likely to be restricted by railway cargo capacity, and by increasing cargo capacity, they benefit more from increasing return of transportation.

[Table 13]

6 Exports of the hub Xinjiang

In this section I investigate the overall speed-up effect on the export performance of the Xinjiang, the hub of China and Central Asia. As shown in previous results there is a diversion of exports from Xinjiang to other regions. In the case of high transportation costs, Xinjiang plays the role of a hub between China and Central Asia, and Xinjiang itself is the main exporter to Central Asia although it has no comparative advantages on production but its proximity to market. However, by an increasing market accessibility for other regions to Xinjiang, the importance of comparative advantage matters more, which potentially negatively affects Xinjiang regional development. As mentioned in Mori (2012), when the travel time between Tokyo and Osaka (the largest two cities, also the largest two transportation hubs, in Japan) decreased from 20 hours in 1889, to 8 hours (1935), and further to 2.5 hours (2005), the population size in Tokyo is 1.1 (1889), 1.6 (1935) and 2.7 times (2005) as large as Osaka, respectively. This is similar to the ratio of export to Central Asia taken by Xinjiang exporters. In 2010, 70% of exports exit China through Urumqi custom (most to Central Asia, few to Middle East, et al.) are from non-Xinjiang exporters (Wu, 2011). While in 2000, non-Xinjiang exporters account only for 29% of exports to Central Asia (Source: customs database). This huge transformation happens consistently on the decade China experiences sharp expansion on transportation infrastructure.

On the other hand, except the Central Asia market, speed-up also increases the market accessibility to other international markets for exporters in Xinjiang. Xinjiang exporters might gain higher accessibility to China's coastal lines and ports, as well as markets in Japan, US, et al. Although Xinjiang does not have comparative advantages in export compared to coastal regions because

its remoteness to coast, it has comparative advantages in specific heavy industry production that is heavily dependent to energy and raw materials since it has rich mineral resource endowment. Previous quantitative evidences have proven domestic accessibility is important to export participation, hence I estimate the speed-up effect on export performance of Xinjiang exporters to other international market.

Similarly to the exports from eastern China to Central Asia, exports from Xinjiang have to experience the land move through Silk Road to reach the coastal lines in the case of ocean shipping to destination country. I extract the export records from Xinjiang exporters and go for two directions: countries that located in the west of Xinjiang, namely, Central Asia and Middle East, for which goods exit China through Urumqi custom. This direction is less affected by the railway speed-up and the domestic freight distance is short. Another direction is countries for which goods are freighted through ocean shipping, like Japan, U.S., et al., that is, these exports have to experience a long-haul domestic freight from Xinjiang to coastal ports, like Tianjin port, Shanghai port or Guangzhou port. In these ports Shanghai port is most frequently used based on the export records. If products are moved by railway, then to reach Shanghai port they use almost the full length of both Lanxin line and Longhai line, which are speeded-up in Oct. 2000. This provides a good opportunity observing the railway speed-up effects when I limit the export samples in Xinjiang exporters and go for two exiting customs: Urumqi and Shanghai[16].

I identify the domestic accessibility change based on the exiting customs. Rail freight exports from Xinjiang exporters and exit through Urumqi custom are set as the control group and rail freight exports from Xinjiang exporters and exit through Shanghai custom are set as the treatment group. Estimation equation is as follows, *ShanghaiCustom* is a dummy variable equal to 1 if the transaction is finished in Shanghai custom and equal to 0 in the case of exit China through Urumqi, other variables and equation settings are identical with equation (2):

$$\begin{aligned} ExportValue_{f,p,c,y} = \alpha_0 + \alpha_1 ShanghaiCustom_{f,p,c,y} + \alpha_2 ShanghaiCustom_{f,p,c,y} \times y2001_{f,p,c} \\ + \alpha_3 y2001_{f,p,c} + \epsilon_{f,p,c,y} \end{aligned} . \quad (5)$$

[16] Although for some export cases it is possible to firstly use rail or roads to reach Yangtze River (from Xinjiang to Chongqing, or Wuhan), and then transfer in the Yangtze riverside, that is, they transfer to ship freight, and finally exit China through Yangtze river. Such cases are pretty rare, since Yangtze river is far from the Silk Road, so it is not economical to use the Yangtze River for transport from Xinjiang to Shanghai.

One identification problem arises from this estimation strategy. For the exports from Xinjiang and exit through Urumqi (control group), it is easy to identify the domestic freight mode from customs database (the freight mode when exiting China). For the treated group, exports from Xinjiang to countries like Japan and U.S., the domestic freight mode might be roads or rails, but the exiting mode is ocean shipping. Customs data records only the exiting freight mode is ocean shipping, but not presents the domestic modes for each transaction. In such cases I divide them based on the export records from eastern China to Central-Asia (the opposite direction), since they need experience the same domestic route. Specifically, for one kind of export product (HS-2 level), if in exports from eastern China to Central Asia, it is mainly freighted by rail/road, then I assume in export from Xinjiang to coast, it is also freighted by rail/road. This is reasonable because the products freighted by rail and road are naturally differential[17][18].

[Table 14]

In columns 1 and 4 of Table 14, for both treated and control samples, I restrict only for rail freight goods. Results are suggestive, after the railway speed-up, Xinjiang exporters increase their export through Shanghai custom compared to the that through Urumqi custom by 70% in export value and 144% in number of shipment. For the latter one, it is obviously larger than in the

[17] I identify the freight mode from Xinjiang to coast based on the two-digit customs classification code (HS-2) that mostly exported in opposite direction. Eight-digit customs classification code (HS-8) with specific goods and the related freight mode is a possible exercise in this case, but I find in HS-8 level, exporting products moving from Xinjiang to coast, and exporting products moving from eastern China to Central Asia via Xinjiang are totally different. In HS-2 level, I find most of the heavy industry products are undertaken by trains but not trucks, while light industry products are mainly undertaken by trucks. Precisely, I divide the export records based on HS-2, and then choose the top ten categories in export value. In these top 10 categories, I identify each category the related freight mode: railway or road, based on the main freight modes for the same category in China-Central Asia export (opposite direction). The top ten categories in HS-2 (based on export value) are: 85, 52, 29, 84, 60, 61, 82, 62, 55, 63. I keep only 85, 52, 29, 84, 82 as railway freighted since in the China-Central Asia export, such exports are mainly taken by rail, and they are heavy industry product (82,84,85: machine tools, 52: chemistry raw materials) and agriculture product (55: cotton). For 60-63 and 55, they are light industry product (textile, fabric, clothes, et al.) and seen as road freighted. These top five heavy industry product accounts for 39.3% of the total exports from Xinjiang (22.8% in number of shipment). In columns 1 and 4, I choose the treated samples (Shanghai custom) as exports of these five categories, and the control samples (Urumqi) as rail freighted exports from Xinjiang and exit through Urumqi custom.

[18] I am also concerned the fact that export from the same firm with same destination country and product might exit China through different customs, my identification might be affected by this endogeniety. That is, because of the speed-up, for the same firm, product and destination country, the exit port might change to meet the higher freight efficiency, such as transfer from Dalian port to Shanghai port. This will also increase the export through Shanghai port. I evaluate such cases as follows: if in the firm-product-country level, there is at least one transaction happened in Shanghai custom in 2000-2001, I assume for this firm-product-country level data, all the transactions in 2000-2001 are seen as happened in Shanghai, even if for some transactions they actually happen in other customs. The fact is that such cases are rather rare in export from Xinjiang, less than 200 cases in two years. For the same firm-product-country level export, if firms choose to exit from Shanghai custom, in most of the cases they will not use other exiting ports. Thus concern on the switching ports could be omitted.

opposite direction and suggests speed-up benefits the small-sized exporters in Xinjiang. Then I conduct estimations with the control samples as road freight exports. Because the rail freight exports from Xinjiang through Urumqi custom tend to be transferred to coastal exporters based on the results of Table 9, thus the control group in this estimation is also affected by treatment. However, road freight exports of Xinjiang (exit through Urumqi custom) are not affected by this kind of diversion effect. Results in columns 2 and 5 come to be consistent. Significant export promotion effects still exist, and the placebo tests in columns 3 and 6 are insignificant when I contain roads freight exports in both treated and control samples, that is, neither of the groups is affected by speed-up project.

For the export flows from Xinjiang to China's coast, I do not conduct a series of estimations investigating the channels because identification on freight mode is not novel due to data restrictions. However, the limited results still show to be informative. The overall effects to Xinjiang from this sudden exogenous variation is two-fold. A higher domestic market access induces the declining role of Xinjiang as the hub in China-Central Asia trade. However, better domestic market access also improves the accessibility of Xinjiang to international market through coast. When said to the overall export performance of Xinjiang, although there is a temporary decline in export value in 2001 (partially because of the 'Sept. 11 Attack'), from 2002 it continues a rapid growth on international trade. In the Tenth-Five period (2001-2005), its annual trade growth is 28.5% (33.2% in export and 22.3% in import), much higher than its GDP growth 10.1% and Total Investment in Fixed Assets growth 17.2% in these five years, also higher than national annual trade growth 24.6% (Source: Statistical Communiquá of the National Economic and Social Development, 2005).

7 Implications

I investigate the effect of domestic accessibility improvement on export performance using the variation from China's railway speed-up project. I find exports from China to Central Asia through railway increase by (at least) around 30% after the speed-up, compared with exports through other freight modes. Domestic accessibility proves to be important to international trade participation, and it has heterogeneous effects on exporters and products. And I test the net welfare gains of hub region Xinjiang from speed-up project. Impacts on Xinjiang are mixed, exporters have less

exports to Central Asia but more exports to other international markets like US and Japan. By the increasing transportation efficiency, the function of transport hubs are changing, and the economic development of hub regions is thus structurally affected.

Although China-Central Asia export is not crucial, in the sense of export value, to Chinese economy, the implication of domestic accessibility could be extended. First, social return from railway investment shows to be considerable and prospective. Railway holds a considerable share of freight for raw materials in China, but for manufacturing goods, its share is less than 15% (China Transportation Yearbook, 2006). Roads is still the dominated freight mode, it undertakes 72% of total freight in China (Annual Report of Ministry of Transport of P. R. China, 2006). This is not reasonable since railway has lower unit cost in long-haul freight than roads, effective investment on improving railway freight efficiency might be promising.

Second, transportation infrastructure investment is always beneficial to overall national welfare, but not necessary to specific regions. China pushes forward to reach a balanced regional development between coastal regions and inland landlocked regions, and put priority on investment in inland regions like 'Go-West Campaign'. Transport infrastructures in these regions are what most supported. On the one hand, higher domestic accessibility helps productive inland exporters participate in export. On the other hand, China tries to extend domestic demand instead of export-oriented economy for future economic growth, which is seen as the chance for the development of inland regions because of huge local population, and potentially strong local demand. However, with high domestic accessibility, coastal regions tend to dominate both the international market and domestic inland market (manufacturing sector) if coastal regions comprehensively keep advantages on competitive power. It is necessary for policy maker to take this trade-off into account.

References

Ago, T., I. Isono, T. Tabuchi (2006) Locational Disadvantage of the Hub, *Annals of Regional Science* 40, 819–848.

Albarrán, P., R. Carrasco, A. Holl (2013) Domestic Transport Infrastructure and Firms' Export Market Participation, *Small Business Economics* 40(4), 879–898.

Bentley, J. (1993) Old World Encounters: Cross-Cultural Contacts and Exchanges in Pre-Modern Times. Oxford University Press, New York, p32.

Emran, M.S., Z. Hou (2013) Access to Markets and Rural Poverty: Evidence from Household Consumption in China, *Review of Economics and Statistics* 95(2), 682–697.

Faber, B. (2014) Trade Integration, Market Size, and Industrialization: Evidence from China's National Trunk Highway System, *Review of Economic Studies*, forthcoming.

Li, Z., Y. Chen (2013) Estimating the Social Return to Transport Infrastructure: A Price-Difference Approach Applied to A Quasi-Experiment, *Journal of Comparative Economics* 41(3), 669–683.

Lu, Y., Z. Tao, Y. Zhang (2013) How Do Exporters Respond to Antidumping Investigations?, *Journal of International Economics* 91, 290–300.

Martincus, C.V., J. Blyde (2013) Shaky Roads and Trembling Exports: Assessing the Trade Effects of Domestic Infrastructure Using A Natural Experiment, *Journal of International Economics* 90, 148–161.

Mori, T (2012) Increasing Returns in Transportation and the Formation of Hubs, *Journal of Economic Geography* 12, 877–897.

People's Daily (2000) Interpretation of Train Diagram 2000 (in Chinese), October 23, p12.

Rousslang, D., T. To (1993) Domestic Trade and Transport Costs as Barriers to International Trade, *Canadian Journal of Economics* 26, 208–221.

World Bank (2006) Governance, Investment Climate, and Harmonious Society: Competitiveness Enhancements for 120 Cities in China, Report No. 37759-CN. (http://siteresources.worldbank.org/INTCHINA/Resources/318862-1121421293578/120cities_en.pdf)

Wu, H (2011) The Trade Relationship between China and Central Asia (in Chinese), *Russian, Central Asian & East European Market*. (http://euroasia.cass.cn/news/494692.htm)

Tables

Table 1: Schedule of railway speed-up project

Date	Speeded-up lines
Apr. 1, 1997	Jingguang line (Beijing-Guangzhou), Jinghu line (Beijing-Shanghai), Jingha line (Beijing-Harbin)
Oct. 1, 1998	Jingguang line (Beijing-Guangzhou), Jinghu line (Beijing-Shanghai), Jingha line (Beijing-Harbin)
Oct. 21, 2000	Longhai line (Lianyungang-Lanzhou), Lanxin line (Lanzhou-Urumqi), Zhegan line(Hangzhou-Zhuzhou), Jingjiu line (Beijing-Kowloon)
Oct. 21, 2001	Jingguang line (Beijing-Guangzhou), Jingjiu line (Beijing-Kowloon), Zhegan line (Hangzhou-Zhuzhou), Huhang line (Shanghai-Hangzhou), Hada line (Harbin-Dalian)
Apr. 18, 2004	Jinghu line (Beijing-Shanghai), Jingha line (Beijing-Harbin)
Apr. 18, 2007	Jingha line (Beijing-Harbin), Jingguang line (Beijing-Guangzhou), Jinghu line (Beijing-Shanghai), Jingjiu Line (Beijing-Kowloon), Longhai line (Lianyungang-Lanzhou), Lanxin line (Lanzhou-Urumqi), Zhegan line (Hangzhou-Zhuzhou)

Table 2: Achievement of railway speed-up project

Panel A: Overall achievement of speed-up project (1997-2007)

	Before 1997	1997	1998	2000	2001	2004	2007
Highest speed (km/hour)	n.a.	140	160	n.a.	n.a.	200	250
Five-set freight trains (line)	0	40	40	71	79	92	121
Bulk cargo trains (line)	n.a.	n.a.	119	138	157	180	406
Parcel trains (pair line)	0	0	8	14	15	19	n.a.
Average speed of passenger trains (km/hour)	48.1	54.9	55.2	60.3	61.6	65.7	70.2
Passenger train Lines start at daybreak and arrive at sunset (line)	n.a.	78	228	266	n.a.	305	337

Panel B: Travel time change between main cities due to speed-up in Oct. 21, 2000

	pre-speed-up	post-speed-up	saved by
Urumqi-Lanzhou (1892km)	33 hours	27 hours	18%
Urumqi-Beijing (3216km)	63 hours	50 hours	21%
Urumqi-Shanghai (4077km)	66 hours	51 hours	23%

Sources: Various sources based on author's collection.

Table 3: Railway turnover and traffic w.r.t. speed-up project

	Annual growth rate of			
	Freight turnover	Freight traffic	Passenger turnover	Passenger traffic
	(1)	(2)	(3)	(4)
Treated	0.0660**	0.1080*	0.1135*	-0.0149
	(0.0316)	(0.0577)	(0.0599)	(0.0808)
With two-way fixed effects				
Observations	235	236	189	186
R-squared	0.0139	0.0233	0.0128	0.0001

Notes: *Treated* is a binary variable but not a typical dummy variable. It is set as 1 only for the lines in speeded-up year. Some lines are exclusively devoted for cargo transport, so the sample size for passenger turnover/traffic is relatively small. For column 1, the average annual growth rate in full sample is 6.5%, suggesting growth rate is doubled for treated lines in speeded-up year, reaching 13.1%. For freight traffic (column 2), average annual growth rate is 5.6%, and speeded-up lines reach 16.4% averagely.

Source: China Railway Yearbook 1999-2008.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 4: Baseline and placebo regressions

	Export Value							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2000-2001				2001-2002			
Rail*y2001	0.0957***	0.1027***	0.6326***	0.1950***				
	(0.0176)	(0.0202)	(0.2348)	(0.0383)				
Rail*y2002					0.0075	0.0070	-0.0980	-0.0158
					(0.0161)	(0.0160)	(0.1323)	(0.0286)
Sample type	f-p-c	f-p	f-c	p-c	f-p-c	f-p	f-c	p-c
Observations	12916	12058	2216	6990	15390	15098	2836	7996
R-squared	0.0038	0.0036	0.0049	0.0057	0.0032	0.0034	0.0075	0.0069

Notes: Coefficients of single terms, and constant term are not reported. This applies for all the following estimations.

f-p-c: firm-product-country-freight mode-year level data;

f-p: firm-product-freight mode-year level data;

f-c: firm-country-freight mode-year level data;

p-c: product-country-freight mode-year level data, these apply for following tables.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 5: Regressions w.r.t. speeded-up mileage

	Export Value					
	(1)	(2)	(3)	(4)	(5)	(6)
	2000-2001			2001-2002		
Mileage*y2001	0.0053*	0.0057*	0.0202			
	(0.0028)	(0.0030)	(0.0158)			
Mileage*y2002				-0.0010	-0.0009	-0.0355
				(0.0042)	(0.0041)	(0.0308)
Sample type	f-p-c	f-p	f-c	f-p-c	f-p	f-c
Observations	5102	4788	1120	6428	6344	1508
R-squared	0.0013	0.0014	0.0039	0.0022	0.0024	0.0053

Notes: See the Table 4.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 6: Regressions with number of shipment

	Number of Shipment			
	(1)	(2)	(3)	(4)
	2000-2001		2001-2002	
Rail*y2001	0.2213***			
	(0.0482)			
Rail*y2002			-0.0595	
			(0.0370)	
Mileage*y2001		0.1076***		
		(0.0076)		
Mileage*y2002				-0.0379***
				(0.0063)
Samples	all	rail	all	rail
Observations	12916	5102	15390	6428
R-squared	0.0183	0.0478	0.0654	0.0868

Notes: Estimations results are based on firm-product-country-freight mode-year level data. This applies for following tables without specification.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 7: Controlling for demand fluctuations from specific products

	Export Value							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2000-2001				2001-2002			
	Full	ex Top 5 rail	ex Top 5 rail	ex Top 5 non-rail	Full	ex Top 5 rail	ex Top 5 rail	ex Top 5 non-rail
Rail*y2001	0.0957***	0.0804***	0.0690**	0.0377***				
	(0.0176)	(0.0210)	(0.0341)	(0.0121)				
Rail*y2002					0.0075	-0.0001	(0.0143)	0.0163
					(0.0161)	(0.0143)	(0.0445)	(0.0167)
Observations	12916	9822	3094	9656	15390	11050	4340	12142
R-squared	0.0036	0.0062	0.0046	0.0007	0.0030	0.0080	0.0001	0.0014

Notes: See the Tables 4 and 6.

Customs database records the eight-digit customs classification code (HS-8) for each transaction, for simplicity, I cut the first two digit of the HS-8 (HS-2) and classify the cargo of China-Central Asia export into 89 categories. The details could be checked in: http://www.allmyinfo.com/eng/services/index1-3.asp. Top 5 in rail: 84,27,28,85,73 (ranked); Top 5 in non-rail: 64,62,61,58,85 (ranked). Products that the HS-2 refers to:

27: Coal, Asphalt, Lubricating oil, Vaseline and et al.;

28: Chemical products (Iodine, Calcium, Phosphorus and et al.);

58: Various textile;

61, 62: Suits, Coat, Skirt, Sportswear, Shirt, Trousers, Underwear and et al.;

64: Shoes, Accessories of shoes;

73: Pipe, Screws, Steel building materials and et al.;

84: Engine, Air conditioning, Refrigerator, Machine tools and et al.;

85: Telephone, Digital cameras, Television, Lamp, Microwave, Cookers and et al.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 8: Regressions controlling for the ``Sept. 11 Attacks (2001)" disturbance

	Export Value			
	(1)	(2)	(3)	(4)
	Jan.-Aug., 2000-2001		Jan.-Aug., 2001-2002	
Rail*y2001	0.0769***			
	(0.0155)			
Rail*y2002			0.0029	
			(0.0135)	
Mileage*y2001		0.0069**		
		(0.0033)		
Mileage*y2002				-0.0000
				(0.0025)
Samples	all	rail	all	rail
Observations	9264	3660	10622	4520
R-squared	0.0031	0.0015	0.0007	0.0000

Notes: See the Tables 4 and 6.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 9: Two kinds of diversion effects

	Export Value					
	(1)	(2)	(3)	(4)	(5)	(6)
	Freight mode (rail & non-rail)				Origin (Xinjiang & others)	
	Multiple: f-p-c	Single: f-p-c	Multiple: p	Single: p	Full	Within Xinjiang
Rail*y2001	0.4057***	0.0768***	0.0903***	0.1054***		
	(0.1346)	(0.0144)	(0.0237)	(0.0262)		
Xinjiang*y2001					-0.0418*	
					(0.0222)	
Both*y2001						-0.0656**
						(0.0319)
Samples	all				rail	
Observations	1120	11796	7650	5266	5102	2092
R-squared	0.0244	0.0029	0.0053	0.0025	0.0013	0.0021

Notes: See the Tables 4 and 6.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 10: Distinguish between time and capacity effects

	Export Value			
	(1)	(2)	(3)	(4)
	Time-sensitive	Capacity-sensitive	Time-sensitive	Capacity-sensitive
Rail*y2001	0.0068	0.0659*		
	(0.0134)	(0.0392)		
Food*y2001			0.0022	
			(0.0412)	
Machinery*y2001				0.0966***
				(0.0250)
Samples	Food	Machinery	Rail	Rail
Observations	1032	2586	5102	5102
R-squared	0.0069	0.0046	0.0006	0.0035

Notes: See the Tables 4 and 6.

Time-sensitive: food, refers to products with HS-2 (01-24).

Capacity-sensitive: machinery and equipment, refer to products with HS-2 (84-89).

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 11: Distinguish between extensive marginal and intensive margin

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Extensive Margin				Intensive Margin			
	Number of Exporters				Export Value		Number of Shipment	
Rail*y2001	0.1048***	-0.0415	0.0727***	0.1447***	0.1068***		0.4651***	
	(0.0365)	(0.0455)	(0.0241)	(0.0523)	(0.0256)		(0.0585)	
Mileage*y2001						0.0051***		0.0807***
						(0.0028)		(0.0086)
Samples	all	only Xinjiang	exclude Xinjiang	all	existing	existing &rail	existing	existing &rail
Sample type	p (HS-8)-c	p (HS-8)-c	p (HS-8)-c	p (HS-4)-c	f-p-c	f-p-c	f-p-c	f-p-c
Observations	6990	3530	4256	3918	8052	3138	8052	3138
R-squared	0.0221	0.0303	0.0026	0.0223	0.0139	0.0099	0.2693	0.3214

Notes: See the Tables 4 and 6.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 12: Regressions w.r.t. products with different unit prices

	Export Value			Number of Shipment		
	(1)	(2)	(3)	(4)	(5)	(6)
	Low	Medium	High	Low	Medium	High
Rail*y2001	0.0199	0.1040***	0.1394***	0.0550	0.3127***	0.0691
	(0.0168)	(0.0355)	(0.0347)	(0.1014)	(0.0851)	(0.0651)
Observations	4026	4804	4086	4026	4804	4086
R-squared	0.0032	0.0050	0.0033	0.0127	0.0458	0.0006

Notes: See the Tables 4 and 6.

Low: F.O.B. price≤0.8 USD; Medium: F.O.B. price >0.8 USD & <4 USD; High: F.O.B. price≥4 USD. Price is based on the average unit price in f-p-c level in 2000.

Top 5 categories (based on export value) in low value products, HS-2 in rail: 27, 9, 28, 73, 55; HS-2 in non-rail: 58, 61, 54, 95, 63.

27: Coal, Asphalt, Lubricating oil, Vaseline and et al.;

9: Tea, Coffee beans, Paprika and et al.;

28: Chemical products (Iodine, Calcium, Phosphorus and et al.);

73: Pipe, Screws, Steel building materials and et al.;

55: Fabric;

58: Various textile;

61: Suits, Coat, Skirt, Sportswear, Shirt, Trousers, Underwear and et al.;

54: Cloth and Gauze;

95: Toy, Poker, Accessories of sporting goods;

63: Bedspread, Bath towel, Rag and et al.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 13: Regressions w.r.t. firm size of the exporters

	Export Value		Number of Shipment	
	(1)	(2)	(3)	(4)
	Large	Small	Large	Small
Rail*y2001	0.1537***	0.0037***	0.3093***	0.1801***
	(0.0276)	(0.0012)	(0.0697)	(0.0501)
Observations	8150	4766	8150	4766
R-squared	0.0059	0.0014	0.0322	0.0021

Notes: See the Tables 4 and 6.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Table 14: Regressions on export performance of Xinjiang (Jan.-Aug., 2000-2001)

	Export Value			Number of Shipment		
	(1)	(2)	(3)	(4)	(5)	(6)
ShanghaiCustom	0.0754***	0.1238***	0.0552	1.6801***	1.4831***	0.2454
*y2001	(0.0320)	(0.0322)	(0.0572)	(0.1260)	(0.1233)	(0.2137)
Samples						
#treated (Shanghai)	rail	rail	road	rail	rail	road
#control (Urumqi)	rail	road	road	rail	road	road
Observations	1976	4852	4510	1976	4852	4510
R-squared	0.003	0.008	0.007	0.091	0.042	0.030

Notes: See the Tables 4 and 6.

I extract only the export records in first eight months (Jan.-Aug.) of related years to relieve “Sept. 11 Attack” effects, and exclude the postal and air freight exports, and government donation exports.

Standard errors in parentheses

* p<0.1, ** p<0.5, *** p<0.01

Appendix: Other Tables

Table A.1: Descriptive summary of dataset

Panel A: Summary of variables (2000-2001)

	Variable	Obs.	Mean	Std. Dev.	Min	Max
Rail	Export value (US$)	2851	169021	810416	152	2.10E+07
	Number of shipment	2851	1.80	2.00	1	23
	Number of exporter	2060	1.38	1.06	1	17
	Unit price (US$)	6879	16341	258353	0.002	1.07E+07
Non-rail	Export value (US$)	4421	181593	1204678	220	4.00E+07
	Number of shipment	4421	2.37	2.90	1	31
	Number of exporter	2253	1.96	2.19	1	25
	Unit price (US$)	12798	1471	32173	0.003	2.90E+06

Notes: Export value and number of shipment are based on aggregated firm-product (HS-8)-country-freight mode-year level data, number of exporter is based on aggregated product (HS-8)-country-freight mode-year level data, and unit price is based on transaction level data.

Panel B: Statistical summary of main indicators

	2000	2001	2000	2001
	Rail		Non-rail	
Export value (total, US$ 1,000,000)	216.4	266.14	553.62	251.9
Number of shipment (total)	2849	2293	6103	4387
Number of export firms (total)	248	331	241	319
Value per shipment (medium, US$ 1,000)	17.82	23.33	14.4	15.84
Value per shipment (mean, US$ 1,000)	75.96	116.07	90.22	57.48
Annual value per firm-product-country (medium, US$ 1,000)	17.5	19.8	10.7	12
Annual value per firm-product-country (mean, US$ 1,000)	137.8	207.2	224.1	128.4
Unit price (medium, US$)	1.3	1.6	1.2	1.1
Unit price (mean, US$)	62.2	71.6	16.9	29.5

Notes: unit price (mean, US$) is gotten based on winsorized 95% of total samples to avoid disturbance from outliers (extremely large in unit price).

Table A.2: Speeded-up mileage to Urumqi (Xinjiang)

Starting point (Province)	Speed-up point (Station)	Speeded-up mileage (km)	Total mileage (km)
Xinjiang	Urumqi	0	0
Gansu	Lanzhou	1892	1892
Ningxia	Lanzhou	1892	2008
Qinghai	Lanzhou	1892	2120
Beijing	Lanzhou	1892	3216
Tianjin	Lanzhou	1892	3240
Inner Mongolia	Lanzhou	1892	3000
Liaoning	Lanzhou	1892	4007
Tibet	Lanzhou	1892	4080
Hebei	Lanzhou	1892	2822
Chongqing	Baoji	2395	3345
Guizhou	Baoji	2395	3840
Sichuan	Baoji	2395	3026
Hainan	Baoji	2395	5214
Yunnan	Baoji	2395	5564
Shaanxi	Xi'an	2568	2568
Shanxi	Xi'an	2568	2597
Henan	Zhengzhou	3079	3079
Shandong	Zhengzhou	3079	3134
Fujian	Zhengzhou	3079	4555
Guangdong	Zhengzhou	3079	4684
Anhui	Zhengzhou	3079	3723
Guangxi	Zhengzhou	3079	5493
Hunan	Zhengzhou	3079	3977
Hubei	Zhengzhou	3079	4342
Shanghai	Xuzhou	3428	4077
Jiangsu	Xuzhou	3428	3776
Zhejiang	Xuzhou	3428	4168
Heilongjiang	Xuzhou	3428	4490
Jilin	Xuzhou	3428	4244
Jiangxi	Nanchang	4129	4129

Table A.3: Regressions w.r.t. unit price change

	Δ (Unit price)	
	(1)	(2)
Xinjiang	0.0195	0.0954
	(0.0552)	(0.0767)
Samples	rail	rail
Sample type	f-p-c	p-c
Observations	257	148
R-squared	0.0005	0.0105

Notes: Δ (Unit price)=Unitprice2001/Unitprice2000. Regress equation is as: $\Delta\ (\text{Unit price})_{f,p,c}=\alpha_0+\alpha_1 \text{Xinjiang}_f+\epsilon_{f,p,c}$. *Xinjiang* is a dummy variable (=1 for exports originate from Xinjiang and =0 for others).

I compare the unit price change between rail freight products originate from Xinjiang and other regions. If there is a decrease in transportation cost, there should be a decrease in F.O.B. unit price since F.O.B. unit price contains domestic transportation cost.

I drop the samples if the unit price difference is abnormally large. I keep only the samples that Δ (Unit price) is larger than 1/3 and less than 3. I use the mean unit price in related sample types for specific year. For column 1, I keep only pair data in f-p-c level. For column 2, I identify in p-c level in two regions (Xinjiang and other regions). I keep only pair data in specified p-c level if both Xinjiang and other regions have pair data in this p-c level (four records (twoyears*tworegions) should be matched in each p-c).

Figures

Figure 1: The Geographic proximity of China and Central Asia (five countries circled in red lines)

Figure 2: China's railway network in 2009

Note: Lanxin (Lanzhou-Urumqi) line in green and Longhai (Lianyungang-Lanzhou) line in blue. These two lines were speeded-up in Oct. 21, 2000. Alashankou and Kashi are two main frontier ports for China and Central Asia trade.

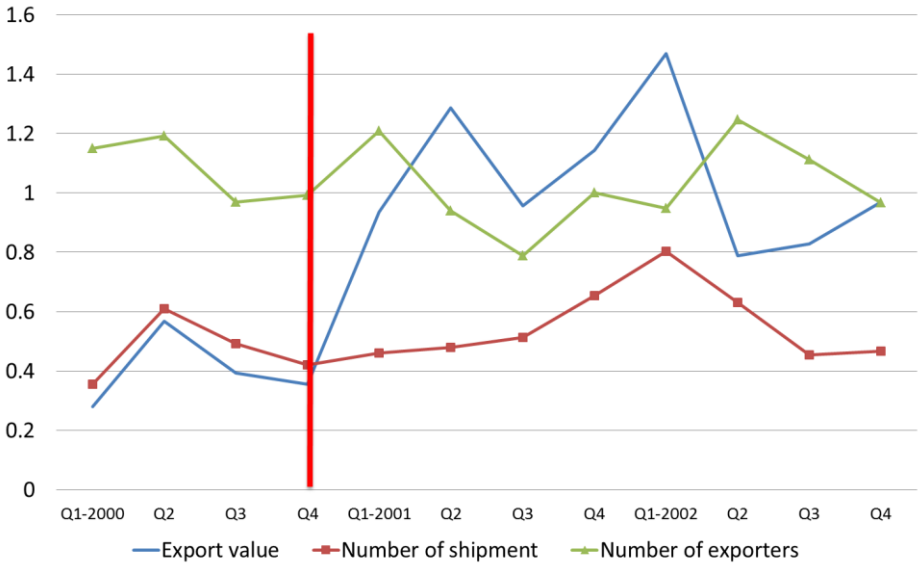

Figure 3: Ratio of rail/non-rail freight exports from China to Central Asia

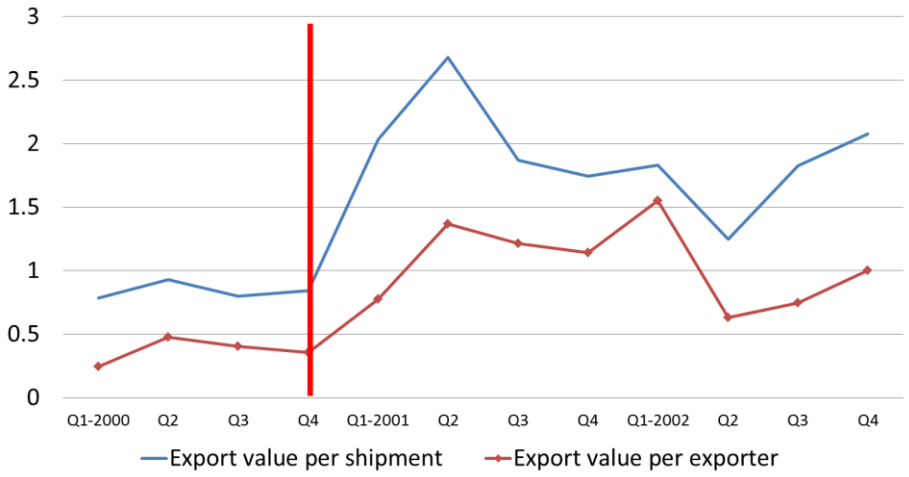

Figure 4: Ratio of rail/non-rail freight exports from China to Central Asia

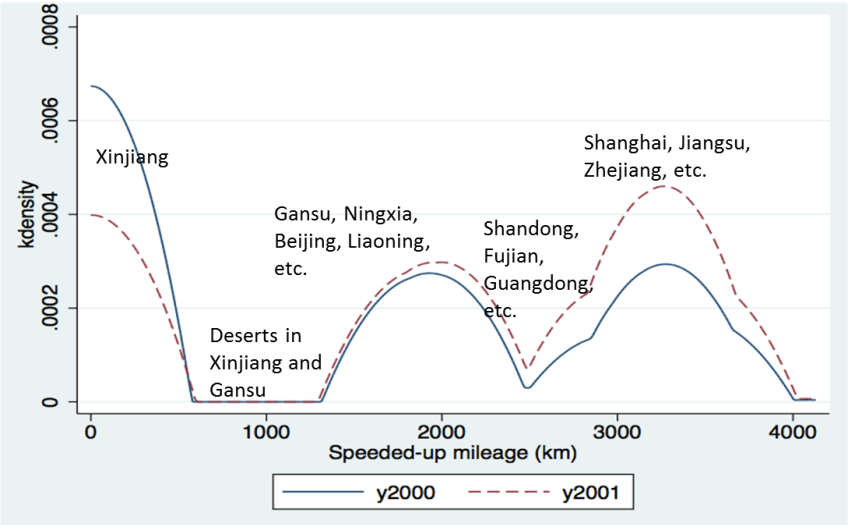

Figure 5: Kernel density of export transaction distribution w.r.t. speeded-up mileage

Notes: Although cities within Xinjiang also enjoy considerable speeded-up mileage (up to 500km) because Xinjiang has a rather large land size. In the calculation of the speeded-up mileage, I set the location of firms in the provincial level for simplicity. As a consequence, all exports originate from Xinjiang, no matter from Urumqi (capital of Xinjiang), or other cities in Xinjiang, are seen as identical with speeded-up mileage with 0km. Figure is based only for the data of railway freight exports to Central Asia in 2000 and 2001.

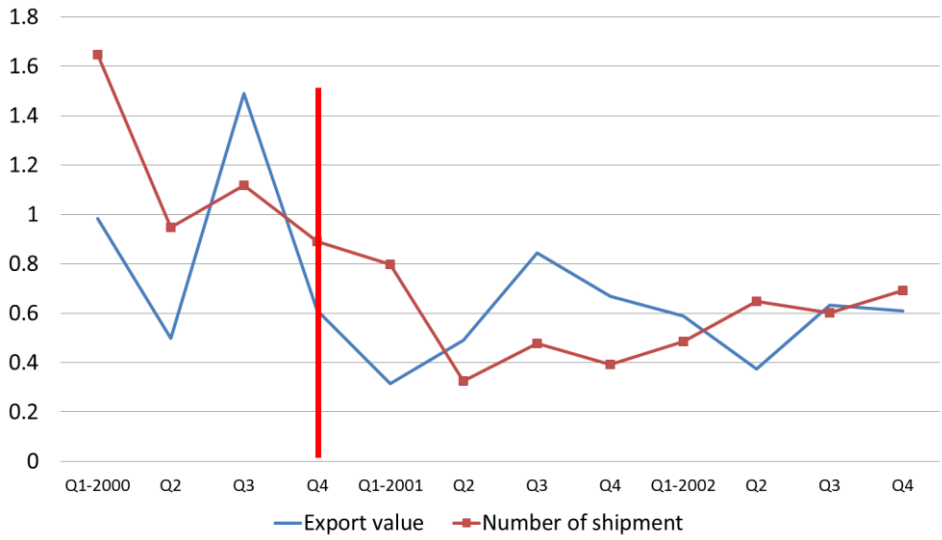

Figure 6: Ratio of railway freight exports from China (Xinjiang/other regions) to Central Asia