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High-Speed Rail and Stock Return Comovement in China

Abstract

This study explores the impact of China's high-speed rail network on reducing local bias and fostering capital market integration. Our research reveals that implementing high-speed rail in a city decreases the return comovement of its local stocks but increases its return comovement with the national stock market. Our results are robust and consistent across various model specifications. After examining the underlying economic mechanism, we find that the impact of high-speed rail on stock return comovement is stronger for small firms, non-state-owned enterprises (non-SOEs), firms with poor corporate governance, and firms' headquarters in more segmented and less-developed regions. This effect did not change after controlling for other information-dissemination channels and regional economic development. Overall, geographical proximity contributes to information transfer and market efficiency.

Keywords: High-Speed Rail; Return Comovement; Information Transfer; Local Bias

JEL: G10, G12, G14

1. Introduction

Geographical distance hinders information dissemination and has a significant impact on investment decisions (Kuang et al., 2021). China has made tremendous efforts in high-speed rail (HSR) construction to address the increasing need for improved geographical proximity, resulting in a total HSR distance exceeding 23,000 miles by the end of 2020. The rapid development of HSR in China has sparked research interest in investigating its effects on the urban economy (e.g., Wu et al., 2014; Diao et al., 2017; Lin, 2017; Lawrence et al., 2019). Recently, attention has also shifted towards examining the impact of HSR on China's capital markets (e.g., Kuang et al., 2021; Lin et al., 2023; Chen, Qu, Shen, Wang, Xu, 2022; Chen, Guo, Jiang, Xiong, Yang, 2022). However, the influence of HSR on stock return comovement remains largely unexplored. This study aims to investigate how improved geographical proximity affects two types of stock return comovement: comovement with local peers and comovement with the national stock market.

The comovement of a stock's return with its local peers implies the stock's exposure to local bias. Local bias, a concept that refers to a preference for investing in locally based stocks, has been well documented in previous studies (e.g., Coval and Moskowitz, 1999; Ivković and Weisbenner, 2005; Pirinsky and Wang, 2006; Seasholes and Zhu, 2010). Excessive local influence is driven by the advantage of local information arising from the proximity between investors and companies (Coval and Moskowitz, 2001), investor familiarity bias (Cao et al., 2011), and social interactions (Hong et al., 2005; Pool et al., 2012). Several studies have shown that local bias can be alleviated by decreasing the fixed costs of information and increasing the variety of information (e.g., Morck et al., 2000; Inaba, 2020). From this perspective, high-speed rail (HSR) increases geographical proximity to familiarize investors with non-local firms. Therefore, we conjecture that HSR contributes to alleviating local bias and reducing local bias in stock returns.

A stock's return comovement with the national stock market indicates the extent to which it is integrated into the overall market. HSR accelerates information dissemination and provides more diverse information to the market, leading to an information explosion. However, investor attention is scarce (Peng and Xiong, 2006). Taking Peng and Xiong's (2006) limited investor attention perspective,

the latter studies find that investors generally pay more attention to market-level information than firm-specific information when the information set is more diverse (Peng et al., 2007; Huang et al., 2019). HSR implementation contributes to the incorporation of local firms into the national market. Specifically, we hypothesize that HSR implementation increases the national comovement of stock returns. In summary, we conjecture that HSR implementation helps stocks suffer less from local bias and associate more with the national market.

We use the opening of high-speed rail as an exogenous shock for the capital market. Our sample includes all listed firms in China from 2004 to 2019. Our empirical findings show that HSR opening decreases a stock's return comovement with its local peers but increases its return comovement with the national stock market. In other words, HSR reduces local bias and promotes national market integration. We investigate the shock of the inter-city high-speed rail opening on the capital market and demonstrate that the effect is more pronounced in cities with inter-city HSR lines. However, having both types of HSR in a city does not amplify the effect of HSR on local bias and market integration. Firms located in cities with more HSR stations exhibit less local stock return comovement and greater national stock return comovement.

This study further examines the effect of HSR on stock return comovement, contingent on firm size, state ownership, capital structure, and other plausible regional explanatory factors relevant to information dissemination. The results suggest that the impact of HSR on stock return correlations is stronger among small firms, non-SOEs, firms with poor corporate governance, and firms' headquarters in more segmented and less-developed regions. We also conduct a battery of robustness tests, such as controlling for the effects of information dissemination through other channels and regional macroeconomic variables. We also test parallel assumptions, employ propensity score matching (PSM) method to address the self-selection issue and conduct placebo tests for robustness. Different econometric specifications do not alter our conclusions.

A novel contribution of our study is that, instead of merely investigating stock comovement with the national market, we comprehensively examine the effect of HSR on local and national comovement. The implementation of HSR significantly reduces the local comovement of stock returns

but increases their national comovement. Our findings demonstrate that HSR enhances geographical proximity, facilitates information dissemination, rectifies local biases, and mitigates market segmentation. Overall, we provide compelling evidence highlighting how HSR improves the efficiency of capital markets.

The remainder of this paper is organized as follows: Section 2 reviews the institutional background and prior literature and develops the hypotheses. Section 3 describes the data and empirical specifications. The main results are presented in Section 4. Section 5 discusses the underlying mechanisms. Section 6 presents additional robustness tests. Section 7 concludes.

2. Institutional Background and Hypotheses

2.1 Institutional background of market segmentation in China

From an institutional economics perspective, China's economic system reform is a process of decentralization in the market, in which local governments often use their administrative intervention power to segment the market and maintain the local economy. For example, Young (2000) states that "continued reform and growing interregional competition between duplicate industries threatened the profitability of these industrial structures, leading local governments to impose a variety of interregional barriers to trade". Cai and Treisman (2004) show that local authorities use fiscal policies to protect local district interests. Local authorities are entitled to the power to interfere in the market during China's economic revolution. To protect local competitiveness and development, local authorities implement regional protectionism policies such as sales restrictions, price controls, stricter inspections of non-local products, and discriminative funding constraints for non-local firms. These policies interfere with exchanging information and production factors, compromising market integration. Bai et al. (2004, 2008) also emphasize that local protectionism and bureaucratic integration measures lead to regional specialization in China's industries, which damages the market integration process.

Stock prices reveal the severity of market segmentation. For example, Errunza and Miller (2000) document a significant decline of 42% in the cost of capital after financial market liberalization. Menzly and Ozbas (2010) support the argument that value-relevant information spreads gradually in financial markets because of investor specialization and market segmentation. More importantly, severe market

segmentation in China indicates significant local bias in its capital markets (Li et al., 2014).

2.2 Institutional background of high-speed rail network

China has the world's largest passenger-only HSR network, operating over 2,600 pairs of high-speed trains per day. It is designed primarily for passenger transport and operates at speeds of 250 km/h and 350 km/h. In 2004, China initially proposed the construction of four vertical (north-south) and four horizontal (east-west) high-speed rail (HSR) networks, aiming for a total length of over 12,000 km by 2020. In 2008, the target area increased to 16,000 km. The 2016 Medium and Long Term Railway Network Plan ('the Plan') established a new blueprint for eight north-south and east-west high-speed rail networks. According to the plan, 30,000 km of the HSR should be built by 2020, connecting most prefectural and municipal cities. China's HSR construction has continuously updated its plans and achieved new milestones with the issuance of these documents. As of 2016, China has completed approximately 22,000 km of high-speed rail networks and connected over 195 cities, representing approximately 60% of all cities in China. By 2025, China's HSR network is projected to reach all large and medium-sized cities, shortening the travel time between these cities to within 1 to 4 hours and reducing the travel time between regional centers to 1.5 to 2 hours.

The expansion and rapid development of high-speed rail (HSR) networks have reshaped how people travel in China. With its quick and convenient transportation, reasonable pricing, and frequent departure times, high-speed rail has become a highly competitive option, and the value generated during transportation was far greater than expected. According to Wu et al. (2014), conventional rail was the dominant mode of travel along this corridor until the Wuhan–rail line opened in December 2009. However, after their launch, HSR trains accounted for 41.22% of the overall transport market (56,400 passengers per day) and 52% of HSR passengers shifted from conventional rail, while air traffic declined by 50% in 2010. According to Lawrence et al. (2019), 18% of passengers said that they would not travel without an HSR. Similarly, Lin (2017) indicates that HSR connections increase passenger flow across cities by 10%. Furthermore, the impact of HSR development extends beyond the transportation sector, promoting urban development, increasing tourism, and contributing to regional economic growth. For example, Diao et al. (2017) show that HSR development promotes land

appreciation in nearby areas, complementing the large-scale development of new urban areas.

The implementation of HSR has effectively reduced both the time and cost associated with inter-city travel and enhanced the connectivity between cities. It has been argued that improved connectivity is likely to foster economic interactions, particularly in terms of integration, between cities. Recent studies have delved into the benefits of HSR in mitigating market segmentation. For instance, Niu et al. (2020) conduct a study using HSR construction as a natural experiment and found that as HSR expands, the value of trade increases and market segmentation decreases, suggesting that the movement of people facilitates the movement of goods. He et al. (2022) reveal a positive correlation between the proximity of cities to HSR systems and a reduction in market segmentation. Kong et al. (2022) indicate that five years after HSR's introduction, the HSR has significantly promote urban economic growth quality. Xu et al. (2022) discover that the extensive development and functioning of HSR systems possess the potential to alleviate the dependence of specific cities on natural resources by mitigating regional market segmentation. Li et al. (2023) find that the development of high-speed rail can improve the efficiency of labor investment in enterprises. These impacts of HSR are attributed to the substitution effect between HSR and conventional railroads in passenger services, as well as the accelerated exchange of information and knowledge spillover.

2.3 Literature on stock return comovement

Although the classic Capital Asset Pricing Model posits that stock returns are determined by systematic risk, enormous evidence has shown that the market is not perfectly efficient and stock prices comove with irrational beliefs (Firth et al., 2017). For example, the comovement of a certain stock and an index increases (decreases) after it is added (deleted) to the stock index (Vijh, 1994; Barberis et al., 2005; Greenwood and Sosner, 2007; Claessens and Yafeh, 2013). Due to limited attention, comovement in returns is higher among stocks with similar trading patterns (Kumar and Lee, 2006) or similar ownership structures (Pindyck and Rotemberg, 1993), and among stocks classified into the same style by investors (Barberis and Shleifer, 2003).

In particular, investors' trading behavior shows patterns of local preferences, that is, the

synchronicity of stock returns in the same regions (Pirinsky and Wang, 2006; Li et al., 2014). The main explanation for local comovement is the geographic segmentation of domestic capital markets (Pirinsky and Wang, 2006). From an information-related perspective, previous studies argue that local investors enjoy the advantages of local information. Coval and Moskowitz (1999) and Ivković and Weisbenner (2005) argue that institutional and individual investors take advantage of local knowledge as locals perform better on local stocks. Malloy (2005) find that financial analysts are more accurate in predicting local companies' earnings, whereas Uysal et al. (2008) show that geographical proximity is an informational advantage in acquisitions. Furthermore, local preferences can arise from behavioral biases. For example, Benartzi (2001) suggests that investors within the same district show coordinated trading behavior that is irrelevant to firms' fundamentals but relevant to the closeness of location and a biased belief in knowledge. Bikhchandani et al. (1992) and Hong et al. (2005) also point out that such a herding behavior could be because of social interactions among investors within the region, i.e., the "word of mouth" effect.

2.4 Hypotheses Development

HSR implementation affects the comovement of stock returns through three channels. First, geographical proximity reduces the local comovement of stock returns by facilitating the flow of private information about firms to institutional investors. Institutional investors implicitly include private stock price information while trading. Baik et al. (2010) find that geographical distance increases the information costs of non-local investments, limiting the informational role of institutional investors. Because HSR implementation improves the proximity between firms and investors, it will make it easier for institutional investors to incorporate firm-specific information into stock prices, thereby reducing the local comovement of stock returns. Secondly, geographical proximity improves information disclosure and facilitates the incorporation of firm-specific information into stock prices. Following Haggard et al. 's (2008) finding that transparent disclosure reduces local comovement of stock returns, we argue that HSR implementation can reduce local comovement of stock returns by improving the quality of information disclosure. Third, introducing HSR expands the portfolio of local investors by allowing them to include more non-local equities, which facilitates risk sharing. A shared investor base

among stocks in connected cities results in shared liquidity, consumption, and sentiment shocks, translating into an increase in inter-city stock comovement and a decrease in intra-city stock comovement. Therefore, we hypothesized the following:

H1a: Local comovement of firms' stock returns decreases after the opening of the HSR.

H1b: The national comovement of firms' stock returns increases after the opening of the HSR.

Related studies show increased travel following the introduction of HSR (e.g., Lin, 2017; Lawrence et al., 2019). A Morgan Stanley report notes that HSR is less competitive for travel distances over 1,500 km because long-distance travelers tend to opt for flights.¹ The report argues that HSR is more attractive for short-distance travel than for long-distance travel. Therefore, we further distinguish the effect of HSR based on two types: inter-city HSR (short distance) and regular HSR (long distance). Inter-city HSRs have shorter route lengths and more frequent departures, whereas regular HSRs are long-distance lines with speeds higher than 200 km/h. Due to the attractiveness of inter-city HSR, we expect that inter-city HSR bring a stronger spillover effect to the metropolitan area because of its high passenger volume and intensive coverage. Hence, we hypothesized the following:

H2a: Inter-city HSR incrementally reduces the local comovement of stock returns after controlling for the effects of regular HSR.

H2b: Inter-city HSR has an incremental effect on increasing the national comovement of stock returns after controlling for the effects of regular HSR.

3. Data and Model Specifications

Our sample period is from 2004 to 2019. We include all the listed A-share stocks with the following filters: 1) exclude financial industry firms; 2) exclude firms that relocate their headquarters during the sample period; 3) exclude firms that have missing observations during the sample period; 4) exclude the firm headquarters cities that have fewer than three listed firms; 5) exclude firms that have fewer than 26 weekly return observations within a year; and 6) exclude HSR implementation events

¹ See the Morgan Stanley 2011 report "China High-Speed Rail on the Economic Fast Track".

that did not occur between 2004 and 2019. We obtain 15,859 observations for 1,286 firms from 2004 to 2019. We divide the sample into treatment and control groups. A firm-year observation is recognized as a treatment if a firm is in a city connected by HSR after its implementation.

The key dependent variable in our model is the comovement of stock returns. We measure stock comovement using the beta loading of stock returns regressed on regional (national) aggregate stock returns, following the framework of Barberis et al. (2005). Specifically, we first calculate weekly aggregate regional stock returns and weekly aggregate national stock returns. The aggregate returns are value-weighted averages². We then estimate our baseline regression:

$$R_{i,t} = \alpha + \beta_1 Cvrate_{i,t} + \beta_2 Mvrate_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t}$ is the weekly stock return of stock i at week t , $Cvrate_{i,t}$ is the weekly aggregate regional stock return of stock i at week t , $Mvrate_{i,t}$ is the weekly aggregate national stock return of stock i at week t , β_1 is the weekly local comovement ($Cvcom_{i,t}$) and β_2 is the national comovement ($Mvcom_{i,t}$). We obtain both local and national comovement measures for each individual stock i .

One concern is the endogeneity between high-speed rail opening and capital market segmentation. In other words, the choice of firm location and the firms' market activities and performance have causal and reverse causal relationships. However, the macroeconomic determinants of a firm's location choice, such as political, legal, and policy-related factors, are difficult to measure. The expansion of high-speed rail is mainly influenced by the nation's development strategy rather than locally listed firms; therefore, it could be seen as an exogenous shock for firms. Using the high-speed rail opening as a natural experiment alleviates the endogeneity issues related to firm location and economic outcomes.

To test H1a and H1b, our regression model specifications are noted as Equation (2) and Equation (3), respectively.

² Our conclusions also hold when using the equal-weighted average to aggregate the return.

$$Cvcom_{i,t} = \alpha + \beta_1 Trainpost_{i,t} + \beta_2 Control_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t}, \quad (2)$$

$$Mvcom_{i,t} = \alpha + \beta_1 Trainpost_{i,t} + \beta_2 Control_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t}, \quad (3)$$

where the variables $Cvcom_{i,t}$ and $Mvrate_{i,t}$ remain consistent with the Equation (1). $Trainpost_{i,t}$ equals 1 if any one of $Intercity_{i,t}$, $Regular_{i,t}$ and $Twotrain_{i,t}$ does not equal 0. Table 1 presents definitions of the main variables.

[Table 1]

Table 2 reports the descriptive summary statistics of the variables in our research design. The mean of $Trainpost_{i,t}$ is 0.595, indicating that 59.5% of our samples are observations after the opening of HSR.

[Table 2]

Table 3 lists the correlation coefficient matrices. Table 3 shows that $Trainpost_{i,t}$ is significantly and negatively correlated with $Cvcom_{i,t}$, whereas $Trainpost_{i,t}$ has a positive and significant correlation coefficient with $Mvcom_{i,t}$. This implies that stock returns' local comovement decreases after HSR implementation, whereas stock returns' national comovement increases after HSR implementation, which is in line with our hypothesis.

[Table 3]

4. Baseline Empirical Tests

Table 4 presents the regression results for testing the effect of HSR on stock comovement with national and regional markets.

[Table 4]

Table 4 shows that the implementation of HSR significantly negatively affects stock returns' local comovement at 1% level, while significantly positively affects stock returns' national

comovement at 1% level. The results in Table 4 are consistent with our hypotheses H1a and H1b. It suggests that the implementation of HSR pushes local firms to associate more with the aggregate national market. Therefore, implementing HSR efficiently breaks local protectionism and boosts the information transfer among cities.

To mitigate the endogeneity issue of the industrial spillover effect from geographical economics theory (Glaeser et al., 1992; Davis and Henderson, 2008), we control for the industry fixed effect in the last four columns of Table 4. Neither the significance nor the signs of the coefficients of $Trainpost_{i,t}$ change after controlling for industry fixed effects. The industrial spillover effect cannot fully explain the effects of HSRs.

[Table 5]

Table 5 reports the regression results for distinguishing the impact between two types of HSRs. It shows that both $Intercity_{i,t}$ and $Regular_{i,t}$ significantly reduce stock returns' local comovement and significantly increase stock returns' national comovement, while the effect of $Intercity_{i,t}$ is stronger than $Regular_{i,t}$ with larger magnitude of coefficients and higher levels of significance of $Intercity_{i,t}$. In line with our hypothesis H2a and H2b, it suggests that the effect of HSR on stock returns' comovement is stronger for short distance connections, i.e., inter-city HSR. Both the long- and short-distance high-speed rails consistently and robustly alleviate the local bias and improve the national stock market integration.

5. Underlying Mechanisms

This section initially examines the impact of HSR on the comovement of stock returns, taking into account the firm's fundamental characteristics, shareholder ownership, and regional differences in the cross-section. These characteristics reflect the varying levels of exposure that firms have to national and local information, as well as their ability to incorporate such information into stock prices. Furthermore, we conduct tests to assess the effect of HSR while controlling for other plausible channels of information transfer.

5.1 Firm size and state ownership

Previous studies document that investors' local preferences are stronger for small-cap firms. For example, Coval and Moswitz (2001) find that fund managers prefer large companies when investing remotely and small companies when investing locally. Prinsky and Wang (2006) also show that local comovement of stocks is stronger for small companies. Therefore, we add firm size and the interaction term between firm size and $Trainpost_{i,t}$ to Models (2) and (3). We expect the effect of HSR on the comovement of stock returns from local to national markets to be stronger for small firms. The regression results are presented in Table 6.

[Table 6]

The first two columns of Table 6 show that our major conclusions remain the same regarding the effect of HSR on local and national comovements. The coefficient of the interaction term $Trainpost_{i,t} * Size_{i,t}$ is significantly positive in the local comovement and significantly negative in the national comovement, indicating that the effect of HSR is stronger for small-cap firms than for large-cap firms.

In addition, non-state-owned firms are more constrained by regional market segmentation. For example, Li et al. (2014) point out that non-SOEs generally expend extra effort to nourish political connections with the government to facilitate their businesses. In contrast, state-owned enterprises are closely connected to the government. They have greater information advantages regarding the policies. Hence, we hypothesize that non-SOEs gain more knowledge of national policies after HSR connections than state-owned enterprises. We include a dummy for state-owned enterprises, $SOE_{i,t}$, and its interaction term with $Trainpost_{i,t}$ in the baseline regressions. The $SOE_{i,t}$ equals 1 when the firm is state-owned; otherwise, it equals 0. Columns 3 and 4 of Table 6 show that the results are consistent with our expectations. HSR contributes more to correcting the local bias to which non-SOE firms are the subject. The effect of HSR on integrating non-SOEs into the national aggregate market is more remarkable than that of SOEs.

5.2 Institutional ownership

Share ownership variables are highly significant in explaining the cross-sectional variations in

the local comovement of stock returns (Pirinsky and Wang, 2006). Geographical proximity can reduce comovement by facilitating the flow of private information from firms to institutional investors. Previous studies examine the informational role of institutional investors (Piotroski and Roulstone, 2004) who implicitly include private information in stock prices when trading as informed investors. Baik et al. (2010) find that geographical distance increases the information costs of non-local investments and limits the informational role of institutional investors. As the introduction of HSR to a city can improve the proximity between firms and investors, it will be easier for institutional investors to incorporate firm-specific information into stock prices, thereby reducing the national comovement of stock returns. Hence, we expect a weaker effect of HSR on the national comovement of stock returns in firms with higher institutional ownership. We add the proportion of institutional ownership, $Nos_{i,t}$, and its interaction term with $Trainpost_{i,t}$ to the baseline models. The results are summarized in Table 7. Consistent with our conjecture, the effect of HSR on the national comovement of stock returns is weaker for firms with higher institutional ownership.

[Table 7]

We further explore how the effect of HSR on stock return comovement varies among firms with different numbers of shareholders. Empirical studies show that firms with larger shareholders have less local bias (Pirinsky and Wang, 2006). This may be because companies with more shareholders are more visible (Pirinsky and Wang, 2006) and are likely to have been more integrated into the national market prior to HSR connections. Therefore, we expect the effect of HSR on national comovement of stock returns to be weaker for firms with more shareholders. To test this hypothesis, we add the number of total shareholders, $Numins_{i,t}$, and its interaction term with $Trainpost_{i,t}$ into the baseline models and report the results in Columns 3 and 4 of Table 7. Consistent with our hypothesis, the significantly negative coefficient of the interaction term indicates that HSRs have a weaker effect on the national comovement of stock returns for firms with more shareholders.

5.3 Cross-Regional Heterogeneity

In this section, we test whether the effect of HSR on stock comovement varies according to regional characteristics. First, Pirinsky and Wang (2006) find that the number of listed firms within a

region positively affects the comovement of local stock returns. More listed firms in a region indicate greater local bias (Coval and Moskowitz, 1999; Ivković and Weisbenner, 2005; Almazan et al., 2010), larger spillover effects arising from industrial agglomeration (Glaeser et al., 1992; Davis and Henderson, 2008), resulting in a higher level of market segmentation. Therefore, we add the number of listed firms within each region, $Nof_{i,t}$, to proxy for the level of market segmentation and its interaction term with $Trainpost_{i,t}$, to capture the additional effect of HSR on stock return comovement. The results are summarized in Table 8. The coefficient of the interaction term $Nof_{i,t} * Trainpost_{i,t}$ is significantly negative for local comovement and significantly positive for national comovement. This shows that the effect of HSR on stock return comovement from local to national is stronger in more segmented regions.

[Table 8]

Second, local economic development can significantly and negatively affect the comovement of stock returns (Pirinsky and Wang, 2006). Local economic development can be used as a proxy for residents' financial sophistication (Pirinsky and Wang, 2006). Recent studies show that investors' financial sophistication is significantly associated with their tendency to engage in imitative trading. Brown et al. (2008) show that investor interaction within a region is stronger for households with less financial sophistication and for investors with similar income levels. Therefore, we expect the effect of HSR to be stronger in less financially developed regions. We measure the economic development of a region by $Poor_{i,t}$, the natural log of regional GDP per capita multiply by -1. We add $Poor_{i,t}$, and its interaction term with $Trainpost_{i,t}$ into the baseline models. Columns 3 and 4 of Table 8 report the regression results. Consistent with our hypothesis, the significantly negative coefficient of the interaction term for local comovement and the significantly positive coefficient of the interaction term for national comovement indicate that the effect of HSR on stock return comovement from local to national is stronger for less-developed regions.

5.4 Other plausible channels

Introducing HSR to a city will accelerate information transfer and thus reduce market segmentation. However, market segmentation may arise from developing other information dissemination channels. Therefore, we add additional variables to control for other channels of

information dissemination: the log of province high-speed road passenger volume ($Inroad_{i,t}$), the log of province railway passenger volume (HSR excluded) ($Inrail_{i,t}$), the log of province total water carriage passenger volume ($Inwater_{i,t}$), the log of province high-speed road freight volume ($Imroad_{i,t}$), the log of province railway freight volume (HSR excluded) ($Imrail_{i,t}$), the log of province total water carriage freight volume ($Imwater_{i,t}$), the log of city-level airport passenger ($Inair_{i,t}$), freight volume ($Imair_{i,t}$) and the log of internet users ($ImInternet_{i,t}$). The results are summarized in Table 9 reports. results.

The results in Table 9 show that the effects of $Trainpost_{i,t}$ on local and national comovements are consistent and robust after controlling for the effects of other information transfer channels. Our conclusions remain unchanged after controlling for additional factors related to other channels through which information is transferred.

[Table 9]

Another plausible explanation for reducing local bias and market segmentation is regional economic development. The regional differences are salient and significant. For example, Loughran and Schultz (2005) and Loughran (2008) posit that information asymmetry is more severe for rural firms than for urban firms because of the number of investors. Additionally, investors in more developed markets are less likely to be subject to herding behavior and local bias (Glaeser et al., 1992, Pirinsky and Wang, 2006). Therefore, we controlled for other regional determinants that might affect market segmentation. We add proxies for the development level of the regions' capital markets into our baseline regressions, including the province-level fiscal income ($Fininc_{i,t}$), CPI ($CPI_{i,t}$), number of patents ($Patent_{i,t}$), number of university and college students ($Student_{i,t}$), fixed investment ($Fixinv_{i,t}$), population ($Population_{i,t}$), and GDP contribution ($Gdp_{i,t}$). Table 10 presents the results after controlling for regional differences. Our findings remain robust after controlling for regional differences.

[Table 10]

6. Robustness Tests

6.1 Alternative proxies for stock returns' local comovement

In this section, we follow Pirinsky and Wang (2006) and use three alternative proxies for the local comovement of stock returns: the number of shareholders $Nos_{i,t}$, the proportion of institutional ownership $Inspro_{i,t}$, and the cities' total amount of money for trading activities $Trade_{i,t}$. In line with Pirinsky and Wang (2006), we argue that firms with more shareholders and institutional owners should have less local bias and cities with more trading money should have more financial sophistication; hence, these cities should have less local bias. Therefore, we expect that the introduction of an HSR to a city should reduce the local comovement of stock returns; that is, increase the number of shareholders $Nos_{i,t}$, the proportion of institutional ownership $Inspro_{i,t}$, and the cities' total money for trading activities. In the additional regression tests, we control for the population of cities ($Population_{i,t}$), city land size ($Landsize_{i,t}$), population density ($Popden_{i,t}$), fiscal budget income ($Fisin_{i,t}$), fiscal budget expense ($Fisout_{i,t}$), GDP per capita ($Avegdp_{i,t}$), loan value ($Loanval_{i,t}$), and total savings ($Totsave_{i,t}$). The regression results are presented in Table 11. Consistent with our baseline results, Table 11 shows that HSR expansion can reduce local bias by increasing the number of shareholders, the proportion of institutional investors, and the trading money of cities.

[Table 11]

6.2 Alternative proxies for HSR implementation

In this section, we use the number of HSR stations as an alternative proxy for HSR implementation and examine the effect of HSR on stock comovement. A larger number of HSR stations implies higher passenger capacity and more frequent information exchange. Therefore, we argue that firms located in cities with more HSR stations have lower local comovements and higher national comovements. Table 12 reports the findings on the effects of the number of HSR stations.

[Table 12]

We replace $Trainpost_{i,t}$ with the number of stations $Station_{i,t}$ to examine how the comovement of stock returns changes after passenger volume increases. The findings in Table 12 show

that $Station_{i,t}$ have a significantly negative impact on $Cvcom_{i,t}$ and a significantly positive effect on $Mvcom_{i,t}$, at the 1% significance level. Opening an additional station reduces the comovement beta of local stock returns by 0.005 and increases the comovement beta of national stock returns by 0.007. Hence, consistent with our hypothesis, our results indicate that HSR significantly reduces local stock returns and increases national stock returns.

6.3 Parallel assumption test

One concern is that the control and treatment groups may have systematic differences. Hence, we examine the relationship dynamics between HSR and stock price comovement following Pirinsky and Wang's (2006) framework. We include a series of dummy variables in the standard regression to trace the year-by-year effects of HSR on stock price comovement.

$$Cvcom_{i,t} = \alpha + \beta_1 D_{i,t}^{-6} + \beta_2 D_{i,t}^{-5} + \dots + \beta_{11} D_{i,t}^5 + \beta_{12} D_{i,t}^6 + \beta_2 Control_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t}, \quad (4)$$

$$Mvcom_{i,t} = \alpha + \beta_1 D_{i,t}^{-6} + \beta_2 D_{i,t}^{-5} + \dots + \beta_{11} D_{i,t}^{+5} + \beta_{12} D_{i,t}^{+6} + \beta_2 Control_{i,t} + \sum Year + \sum Id + \varepsilon_{i,t}, \quad (5)$$

where the deregulation dummy variables, the "D's," equal 0, except as follows: $D_{i,t}^{-j}$ equals 1 for states in the j^{th} year before the expansion of HSR, while $D_{i,t}^{+j}$ equals 1 for states in the j^{th} year after the expansion of HSR. We exclude the year of HSR expansion, thus estimating the dynamic effect of HSR on comovement relative to the year of deregulation. At the endpoints, $D_{i,t}^{-6}$ equals 1 for all years that are more than five years before the expansion of HSR, whereas $D_{i,t}^{+6}$ equals 1 for all years that are more than five years after the opening. The estimation results are presented in Table 13. Figure 1 plots the results and 95% confidence intervals with standard errors clustered at the firm level.

[Table 13]

The results in Table 13 show that $D_{i,t}^{-j}$ has almost no significant impact on either local or national comovement in this new sample. This means that before the expansion of the HSR, there was no statistically significant difference between the control and treatment groups. In other words, there was no systematic difference in stock comovement trends before the sample period. In contrast, $D_{i,t}^{+j}$

shows a significant impact over several years. This means that after the expansion of the HSR, there is a pronounced difference between the control and treatment groups.

[Figure 1]

According to the results in Figure 1, before the expansion of the HSR, there was no pronounced difference between our control group and the treatment group, but there is a pronounced difference between our control group and the treatment group after the expansion of the HSR.

6.4 Propensity score matching method

In this paper, we consider the opening of high-speed rail as a quasi-natural experiment, and it is essential to provide further clarification on the rationale behind this assumption. The implementation of HSR is a strategic decision influenced by various factors, including political, economic, cultural, and social considerations. Additionally, the selection of geographical locations for HSR deployment involves planning and strategic considerations. As a result, there is a potential connection between the opening of HSR and the characteristics of the companies located in those areas. The existence of such a connection could significantly impact the regression results and affect the validity and robustness of our empirical conclusions.

In our sample, not all firms are situated in cities with HSR, which raises the question of whether the differences in characteristics between these two groups of firms, other than the presence of HSR, might be driving our results. To address this concern, we employ Propensity Score Matching methodology, which allows us to account for potential selection biases and minimize the influence of confounding factors, thereby strengthening the reliability of our findings.

First, we create a control sample that matches the propensity for open HSR. The benefit of using a control sample is that it allows us to compare firms located in cities with HSR that are similar in all observable dimensions, thus allowing us to attribute the effect more clearly to HSR rather than to the firm characteristics associated with the opening of HSR. To identify the propensity score-matched control sample, we first use a probit model to estimate the probability of opening an HSR for all control variables in our baseline regressions. We then calculate the propensity scores, the conditional probability that a firm is located in a city with HSR on all observable data, for each treated observation.

For each treated observation, we select the control observation with the nearest propensity score, which constituted our control sample. Finally, we re-estimate Equations (2) and (3) using the matched samples. Table 14 reports the results, which show patterns similar to those of the full sample. This implies that the effect of HSR on stock return comovement does not change after controlling for sample selection bias.

[Table 14]

6.4 Placebo tests

To rule out the possibility that the relationship between stock comovement and HSR expansion of HSR happens through pure luck or other random factors, we conduct the placebo tests by randomly changing the event time of HSR expansion. We follow the placebo-test framework in Cornaggia et al. (2015) and keep the empirical distribution of the years of HSR shocks on firms but disrupt the assignments of HSR shocks on firms. For example, in any given year, if there are 47 firms gaining access to the HSR in a city, we randomly choose 47 firms in the treatment group and assign a pseudo HSR opening shock to those randomly chosen 47 firms. We do this for the observations each year to ensure that the opening shock of HSR to firms has an identical annual distribution. In each randomly generated placebo sample, we run the four DID (Difference-In-Differences) regressions in Table 4 with our pseudo $Trainpost_{i,t}$ and stored the coefficient estimates for the interaction terms $Trainpost_{i,t}$ respectively for each regression. We repeat this procedure 10,000 times to obtain a distribution of the placebo estimates and then test our original regression coefficients in the bootstrap distributions.

The results of the placebo tests are shown in Figure 2. Table 4 reports the non-parametric distribution of the coefficient estimates of the interaction terms $Trainpost_{i,t}$ in the placebo tests of the DID models. The yellow bars represent the histograms of the coefficient estimates generated from the placebo simulations, the green line is the normal density curve, and the vertical red line is the original interaction term coefficient. Each figure indicates the 5th and 95th percentiles of the simulated distributions. We would expect the placebo HSR shock to continue to affect stock comovement with the local and national markets if the timing of shocks mostly drives the results. The red lines indicate that the coefficients of $Trainpost_{i,t}$ in the true event sample are all significant in the four distributions

at the 5% significance level. This means that our baseline $Trainpost_{i,t}$ has a more salient effect on stock comovement than placebo HSR shocks. In addition, we conduct a t-test on the 10,000 simulated coefficients of the interaction term against zero and failed to reject the null hypothesis. The histograms of the $Trainpost_{i,t}$ in the four panels also show that the mean approaches zero. The t-test results show that the placebo interaction term $Trainpost_{i,t}$ does not explain local or national comovement. If the regression coefficients of $Trainpost_{i,t}$ are still significantly different from zero, this indicates that the changes in comovement are more likely to be attributed to other stochastic factors; otherwise, the changes in comovement are caused by HSR expansion. The results in Figure 2 are inconsistent with our baseline DID findings, indicating that the effect of HSRs on the changes in comovement we find does not occur by pure luck.

[Figure 2]

7. Conclusion

The high-speed rail serves as a crucial solution for addressing regional segmentation in China. This study presents abundant evidence demonstrating that the implementation of HSR reduces the local comovement of stock returns while increasing the national comovement of stock returns. Furthermore, we establish that inter-city HSR has an additional effect on reducing local comovement and increasing national comovement of stock returns, even after accounting for the impact of regular HSR. By treating the introduction of HSR as a quasi-natural experiment, we employ the Difference-in-Differences (DID) method to examine the effect of HSR on stock return comovement for all A-share listed stocks from 2004 to 2019.

Our findings indicate that HSR implementation enhances geographical proximity, facilitates information transfer among cities, and contributes to the shift of stock return comovement from local to national markets. These results support the notion that HSR implementation is beneficial in overcoming regional segmentation, mitigating local investor bias, and fostering integration in capital markets. Moreover, we observe that the effect of HSR on stock return comovement is more pronounced for inter-city HSR compared to regular HSR. Additionally, the addition of more HSR stations in a city

significantly affects stock return comovement, whereas introducing different types of HSR does not yield the same impact. Our conclusions remain robust across various tests and methodologies employed to address endogeneity concerns.

Furthermore, we conduct heterogeneity tests to explore the differential effects of HSR on stock return comovement based on firm characteristics, shareholder ownership, and regional disparities. Our findings indicate that the influence of HSR on stock return comovement, transitioning from local to national, is more prominent for small firms, non-state-owned enterprises (non-SOEs), firms with a smaller number of shareholders and institutional investors, and firms headquartered in cities with a higher concentration of listed firms and less developed regions. In summary, the effect of HSR on stock return comovement is stronger for firms facing more significant challenges related to market segmentation.

Overall, this study exploits the effect of implementation of HSR on capital market and demonstrates that HSR contributes to stock return comovement from local to national, alleviating local bias and accelerating the integration of the national stock market.

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Table 1 Definitions and Data Source of Key Variables

	Variable description	Source
$Cvcom_{i,t}$	regional stock return comovement, see β_1 in equation (1).	
$Mvcom_{i,t}$	national stock return comovement, see β_2 in equation (1).	
$Trainpost_{i,t}$	$Trainpost_{i,t}=1$ after the opening of HSR, otherwise be 0.	CNRDS
$Intercity_{i,t}$	$Intercity_{i,t}=1$ after the opening of intercity HSR, otherwise be 0.	CNRDS
$Regular_{i,t}$	$Regular_{i,t}=1$ after the opening of regular HSR, otherwise be 0.	CNRDS
$Station_{i,t}$	The number of HSR stations.	CNRDS
$Size_{i,t}$	Company market capitalization: scale index.	WIND, CSMAR
$SOE_{i,t}$	$SOE_{i,t}=1$ if it is a state-owned firm, otherwise be 0.	WIND, CSMAR
$Lev_{i,t}$	Asset-liability ratio: capital structure index.	
$Roa_{i,t}$	Net interest rate of total assets: profitability index.	WIND, CSMAR
$Turnvol_{i,t}$	Annual turnover: the annual market quotation index.	WIND, CSMAR
$Turnrate_{i,t}$	Annual average turnover rate: annual market index.	WIND, CSMAR
$Trade_{i,t}$	The ratio of tradable shares to the total share capital: the share capital index.	WIND, CSMAR
$Nos_{i,t}$	The number of shareholders' households.	WIND, CSMAR
$Numins_{i,t}$	Number of holding institutions: shareholder index. The proportion of institutional ownership.	WIND, CSMAR
$Lartenown_{i,t}$	Total shareholding ratio of the top ten shareholders.	WIND, CSMAR
$Inspro_{i,t}$	Total institutional shareholding ratio: shareholder indicator.	WIND, CSMAR
$Poor_{i,t}$	The natural log of regional GDP per capita multiply by -1.	WIND, CSMAR
$Nof_{i,t}$	The number of listed firms within each region.	WIND
$Inroad_{i,t}$	The natural log of province high-speed road passenger volume.	WIND
$Inrail_{i,t}$	The natural log of province railway passenger volume (HSR excluded).	WIND
$Inwater_{i,t}$	The natural log of province total water carriage passenger volume.	WIND
$Imroad_{i,t}$	The natural log of province high-speed road freight volume.	WIND
$Imrail_{i,t}$	The natural log of province railway freight volume (HSR excluded).	WIND
$Imwater_{i,t}$	The natural log of province total water carriage freight volume.	WIND
$Inair_{i,t}$	The natural log of city-level airport passenger.	WIND
$Imair_{i,t}$	The natural log of city-level airport freight volume.	WIND
$ImInternet_{i,t}$	The natural log of internet users.	CSMAR
$Population_{i,t}$	Cities' population.	WIND
$Landsize_{i,t}$	City land size.	WIND
$Popden_{i,t}$	Population density.	WIND
$Fisin_{i,t}$	Fiscal budget income.	WIND
$Fisout_{i,t}$	Fiscal budget expense.	WIND
$Avegdp_{i,t}$	GDP per capita.	WIND
$Loanval_{i,t}$	Loan value.	WIND
$Totsave_{i,t}$	Total savings.	WIND

This table reports the definitions and data sources of the main variables employed in this paper.

Table 2 Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
<i>Cvcom_{i,t}</i>	15,859	0.301	0.583	-0.817	1.470
<i>Mvcom_{i,t}</i>	15,859	0.784	0.676	-0.488	2.081
<i>Trainpost_{i,t}</i>	15,859	0.595	0.491	0.000	1.000
<i>Intercity_{i,t}</i>	15,859	0.090	0.286	0.000	1.000
<i>Regular_{i,t}</i>	15,859	0.363	0.481	0.000	1.000
<i>Twotrain_{i,t}</i>	15,859	0.142	0.349	0.000	1.000
<i>Size_{i,t}</i>	15,859	22.305	0.961	20.706	24.077
<i>Lev_{i,t}</i>	15,859	47.445	19.001	11.729	77.978
<i>Roa_{i,t}</i>	15,859	3.954	4.812	-4.491	20.377
<i>Turnvol_{i,t}</i>	15,859	23.355	1.137	20.884	25.169
<i>Turnrate_{i,t}</i>	15,859	2.405	1.778	0.486	9.704
<i>Trade_{i,t}</i>	15,859	76.499	25.069	25.000	100.000
<i>Nos_{i,t}</i>	15,859	10.522	0.792	8.886	11.883
<i>Numins_{i,t}</i>	15,859	2.859	1.129	0.693	4.554
<i>Lartenown_{i,t}</i>	15,859	55.575	14.387	32.000	83.240
<i>Inspro_{i,t}</i>	15,859	36.734	23.132	0.431	74.404

This table reports the descriptive statistics of the main variables.

Table 3 Correlation coefficient matrix

	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Trainpost_{i,t}$	$Size_{i,t}$	$Lev_{i,t}$	$Roa_{i,t}$	$Turnvol_{i,t}$	$Turnrate_{i,t}$	$Trade_{i,t}$	$Nos_{i,t}$	$Numins_{i,t}$	$Lartenown_{i,t}$	$Inspro_{i,t}$
$Cvcom_{i,t}$	1.000												
$Mvcom_{i,t}$	-0.860***	1.000											
$Trainpost_{i,t}$	-0.097***	0.118***	1.000										
$Size_{i,t}$	-0.119***	0.082***	0.366***	1.000									
$Lev_{i,t}$	-0.008	-0.002	0.013	-0.023***	1.000								
$Roa_{i,t}$	-0.047***	-0.013*	-0.053***	0.324***	-0.367***	1.000							
$Turnvol_{i,t}$	-0.011	0.100***	0.365***	0.763***	-0.022***	0.157***	1.000						
$Turnrate_{i,t}$	0.165***	-0.083***	-0.219***	-0.082***	-0.078***	-0.027***	0.316***	1.000					
$Trade_{i,t}$	-0.063***	0.093***	0.516***	0.208***	0.100***	-0.132***	0.381***	-0.253***	1.000				
$Nos_{i,t}$	-0.035***	0.081***	0.161***	0.437***	0.157***	-0.135***	0.459***	-0.069***	0.268***	1.000			
$Numins_{i,t}$	-0.126***	0.103***	0.386***	0.817***	-0.040***	0.339***	0.632***	-0.224***	0.306***	0.279***	1.000		
$Lartenown_{i,t}$	-0.051***	-0.018**	-0.080***	0.208***	-0.077***	0.235***	-0.157***	-0.146***	-0.424***	-0.285***	0.128***	1.000	
$Inspro_{i,t}$	-0.107***	0.063***	0.395***	0.509***	0.041***	0.192***	0.327***	-0.372***	0.526***	0.002	0.593***	0.345***	1.000

This table presents the correlation coefficients of the main variables used in the study. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4 The effect of HSR on national and local comovement

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Cvcom_{i,t}</i>	<i>Cvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>	<i>Cvcom_{i,t}</i>	<i>Cvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>
<i>Trainpost_{i,t}</i>	-0.080*** (-4.704)	-0.067*** (-3.955)	0.060*** (2.970)	0.056*** (2.731)	-0.079*** (-4.674)	-0.067*** (-3.927)	0.061*** (2.980)	0.055*** (2.701)
<i>Size_{i,t}</i>		-0.115*** (-6.363)		-0.103*** (-5.002)		-0.115*** (-6.362)		-0.103*** (-4.999)
<i>Lev_{i,t}</i>		-0.001 (-1.354)		0.000 (0.161)		-0.001 (-1.277)		0.000 (0.135)
<i>Roa_{i,t}</i>		-0.004*** (-2.876)		0.001 (0.420)		-0.004*** (-2.688)		0.000 (0.283)
<i>Turnvol_{i,t}</i>		0.064*** (4.941)		0.194*** (13.031)		0.064*** (4.940)		0.195*** (13.104)
<i>Turnrate_{i,t}</i>		0.017*** (3.344)		-0.043*** (-7.333)		0.016*** (3.296)		-0.043*** (-7.454)
<i>Trade_{i,t}</i>		-0.001 (-1.383)		-0.001* (-1.785)		-0.001 (-1.418)		-0.001* (-1.826)
<i>Nos_{i,t}</i>		0.022 (1.610)		-0.011 (-0.695)		0.023* (1.654)		-0.012 (-0.728)
<i>Numins_{i,t}</i>		-0.005 (-0.486)		0.008 (0.676)		-0.005 (-0.536)		0.008 (0.670)
<i>Lartenown_{i,t}</i>		0.001 (1.103)		0.001 (1.186)		0.001 (1.130)		0.001 (1.036)
<i>Inspro_{i,t}</i>		0.001* (1.768)		-0.001 (-1.034)		0.001* (1.716)		-0.001 (-0.978)
Constant	0.248*** (11.076)	1.063*** (3.434)	0.799*** (33.218)	-1.053*** (-2.860)	-0.044 (-0.562)	0.751** (2.361)	0.953*** (9.349)	-0.921** (-2.423)
Fixed effect	Firm, Year	Firm, Year	Firm, Year	Firm, Year	Industry, Firm, Year	Industry, Firm, Year	Industry, Firm, Year	Industry, Firm, Year
Cluster at firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,859	15,859	15,854	15,854	15,854	15,854
R-squared	0.054	0.066	0.073	0.090	0.056	0.067	0.075	0.091

This table presents baseline DID regression estimations. The dependent variables are local comovement (*Cvcom_{i,t}*) and national comovement (*Mvcom_{i,t}*). *Trainpost_{i,t}* is 1 after the high-speed rail is opened and 0 otherwise. Columns (1) and (3) present the results without firm-level control variables, whereas Columns (2) and (4) present the results with control variables. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 5 The Effects of Intra-City and Regular HSR

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Intercity_{i,t}$	-0.094*** (-4.175)	-0.081*** (-3.656)	0.076*** (2.726)	0.071** (2.524)
$Regular_{i,t}$	-0.060*** (-3.301)	-0.049*** (-2.641)	0.043* (1.948)	0.040* (1.820)
$Size_{i,t}$		-0.114*** (-6.312)		-0.104*** (-5.049)
$Lev_{i,t}$		-0.001 (-1.457)		0.000 (0.228)
$Roa_{i,t}$		-0.004*** (-2.984)		0.001 (0.492)
$Turnvol_{i,t}$		0.064*** (4.950)		0.194*** (13.030)
$Turnrate_{i,t}$		0.016*** (3.250)		-0.042*** (-7.251)
$Trade_{i,t}$		-0.001 (-1.415)		-0.001* (-1.768)
$Nos_{i,t}$		0.023* (1.664)		-0.012 (-0.734)
$Numins_{i,t}$		-0.005 (-0.490)		0.008 (0.678)
$Lartenown_{i,t}$		0.001 (0.994)		0.001 (1.262)
$Inspro_{i,t}$		0.001* (1.780)		-0.001 (-1.043)
Constant	0.252*** (11.253)	1.043*** (3.379)	0.796*** (33.120)	-1.037*** (-2.820)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,859	15,859
R-squared	0.056	0.067	0.074	0.090

This table shows the relationship between different types of HSR and stock return comovement. The dependent variables are local comovement ($Cvcom_{i,t}$) and national comovement ($Mvcom_{i,t}$). $Intercity_{i,t}$ equals 1 after the inter-city HSRs is opened and 0 before the inter-city HSRs are opened. $Regular_{i,t}$ takes the value of 1 after the opening of a regular HSR and 0 before the opening of a regular HSR in each city. Columns (1) and (3) present the results without firm-level control variables, whereas Columns (2) and (4) present the results with control variables. All regressions have control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 6 Heterogeneity of the firm characteristics

VARIABLES	(1)	(2)	(3)	(4)
	<i>Cvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>	<i>Cvcom_{i,t}</i>	<i>Mvcom_{i,t}</i>
<i>Trainpost_{i,t}</i>	-0.843*** (-2.671)	1.959*** (5.457)	-0.114*** (-5.577)	0.087*** (3.572)
<i>Trainpost_{i,t} * Size_{i,t}</i>	0.035** (2.460)	-0.085*** (-5.305)		
<i>Trainpost_{i,t} * SOE_{i,t}</i>			0.097*** (4.449)	-0.063** (-2.466)
<i>Size_{i,t}</i>	-0.135*** (-6.855)	-0.056** (-2.508)	-0.106*** (-5.794)	-0.110*** (-5.266)
<i>SOE_{i,t}</i>			-0.039 (-1.411)	0.037 (1.165)
<i>Lev_{i,t}</i>	-0.001 (-1.450)	0.000 (0.358)	-0.001 (-1.541)	0.000 (0.259)
<i>Roa_{i,t}</i>	-0.004*** (-2.816)	0.000 (0.299)	-0.004*** (-3.001)	0.001 (0.501)
<i>Turnvol_{i,t}</i>	0.067*** (5.164)	0.187*** (12.527)	0.066*** (5.055)	0.193*** (12.992)
<i>Turnrate_{i,t}</i>	0.016*** (3.128)	-0.040*** (-6.842)	0.014*** (2.831)	-0.041*** (-7.008)
<i>Trade_{i,t}</i>	-0.001* (-1.687)	-0.001 (-1.244)	-0.001 (-1.400)	-0.001* (-1.781)
<i>Nos_{i,t}</i>	0.019 (1.323)	-0.002 (-0.106)	0.025* (1.822)	-0.013 (-0.828)
<i>Numins_{i,t}</i>	-0.007 (-0.723)	0.014 (1.155)	-0.004 (-0.450)	0.008 (0.659)
<i>Lartenown_{i,t}</i>	0.001 (0.686)	0.002** (2.160)	0.001 (0.736)	0.002 (1.413)
<i>Inspro_{i,t}</i>	0.001** (2.082)	-0.001* (-1.682)	0.001 (1.473)	-0.001 (-0.871)
Constant	1.488*** (4.308)	-2.095*** (-5.104)	0.868*** (2.755)	-0.930** (-2.488)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,858	15,858
R-squared	0.067	0.093	0.068	0.090

This table shows the effect of HSR, conditional on firm size and state ownership. The dependent variables are local comovement (*Cvcom_{i,t}*) and national comovement (*Mvcom_{i,t}*). *Trainpost_{i,t}* is 1 after the high-speed rail is opened and 0 otherwise. *SOE_{i,t}* is 1 when the company is state-owned and 0 otherwise. Columns (1) and (2) present results contingent on firm size, whereas columns (3) and (4) present results contingent on state ownership. All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 7 Heterogeneity of the shareholder ownership

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$
$Trainpost_{i,t}$	-0.173*** (-4.925)	0.228*** (5.498)	-0.580*** (-3.771)	0.683*** (3.846)
$Trainpost_{i,t} * Numins_{i,t}$	0.038*** (3.427)	-0.061*** (-4.762)		
$Trainpost_{i,t} * Nos_{i,t}$			0.049*** (3.348)	-0.060*** (-3.542)
$Size_{i,t}$	-0.117*** (-6.430)	-0.101*** (-4.882)	-0.108*** (-5.874)	-0.113*** (-5.411)
$Lev_{i,t}$	-0.001 (-1.481)	0.000 (0.339)	-0.001 (-1.538)	0.000 (0.349)
$Roa_{i,t}$	-0.004*** (-2.785)	0.000 (0.292)	-0.004*** (-2.957)	0.001 (0.509)
$Turnvol_{i,t}$	0.068*** (5.268)	0.187*** (12.579)	0.070*** (5.278)	0.188*** (12.416)
$Turnrate_{i,t}$	0.016*** (3.151)	-0.041*** (-7.032)	0.013** (2.566)	-0.038*** (-6.405)
$Trade_{i,t}$	-0.001* (-1.953)	-0.001 (-1.050)	-0.001 (-1.117)	-0.001** (-2.050)
$Nos_{i,t}$	0.017 (1.235)	-0.003 (-0.181)	-0.005 (-0.321)	0.022 (1.189)
$Numins_{i,t}$	-0.030** (-2.524)	0.050*** (3.430)	-0.007 (-0.742)	0.011 (0.933)
$Lartenown_{i,t}$	0.000 (0.481)	0.002** (2.116)	0.001 (1.018)	0.001 (1.293)
$Inspro_{i,t}$	0.001*** (2.604)	-0.001** (-2.229)	0.001 (1.573)	-0.001 (-0.829)
Constant	1.154*** (3.729)	-1.200*** (-3.262)	1.090*** (3.528)	-1.086*** (-2.950)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,859	15,859
R-squared	0.067	0.092	0.067	0.091

This table shows the effects of HSR, conditional on shareholder ownership. The dependent variables are local comovement ($Cvcom_{i,t}$) and national comovement ($Mvcom_{i,t}$). $Trainpost_{i,t}$ is 1 after the high-speed rail is opened and 0 otherwise. $Numins_{i,t}$ indicates the proportion of institutional ownership. $Nos_{i,t}$ indicates the number of shareholders. Columns (1) and (2) present the effects of $Numins_{i,t}$, whereas columns (3) and (4) present the effects of $Nos_{i,t}$. All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 8 Cross-Regional Heterogeneity

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$
$Trainpost_{i,t}$	-0.030 (-1.526)	0.015 (0.620)	-0.688*** (-3.231)	0.693*** (2.751)
$Trainpost_{i,t} * Nof_{i,t}$	-0.001** (-2.349)	0.001** (2.377)		
$Trainpost_{i,t} * Poor_{i,t}$			-0.056*** (-2.920)	0.058** (2.535)
$Nof_{i,t}$	0.002*** (3.894)	-0.002*** (-3.798)		
$Poor_{i,t}$			0.091*** (4.736)	-0.107*** (-4.664)
$Size_{i,t}$	-0.113*** (-6.244)	-0.106*** (-5.141)	-0.113*** (-6.249)	-0.106*** (-5.173)
$Lev_{i,t}$	-0.001 (-1.519)	0.000 (0.298)	-0.001 (-1.363)	0.000 (0.166)
$Roa_{i,t}$	-0.004*** (-2.800)	0.001 (0.350)	-0.004*** (-2.860)	0.001 (0.399)
$Turnvol_{i,t}$	0.064*** (4.977)	0.194*** (13.062)	0.064*** (4.915)	0.195*** (13.084)
$Turnrate_{i,t}$	0.016*** (3.204)	-0.042*** (-7.186)	0.017*** (3.342)	-0.043*** (-7.339)
$Trade_{i,t}$	-0.001 (-1.491)	-0.001* (-1.734)	-0.001 (-1.409)	-0.001* (-1.784)
$Nos_{i,t}$	0.021 (1.543)	-0.010 (-0.618)	0.021 (1.532)	-0.010 (-0.608)
$Numins_{i,t}$	-0.006 (-0.641)	0.010 (0.805)	-0.005 (-0.512)	0.008 (0.697)
$Lartenown_{i,t}$	0.001 (1.046)	0.001 (1.256)	0.001 (1.018)	0.001 (1.278)
$Inspro_{i,t}$	0.001* (1.831)	-0.001 (-1.081)	0.001* (1.745)	-0.001 (-0.997)
Constant	0.965*** (3.143)	-0.951*** (-2.597)	1.965*** (5.465)	-2.117*** (-4.784)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,859	15,859
R-squared	0.070	0.093	0.068	0.091

This table shows the relationship between regional differences and the effects of HSR. The dependent variables are local comovement ($Cvcom_{i,t}$) and national comovement ($Mvcom_{i,t}$). $Trainpost_{i,t}$ is 1 after the high-speed rail is opened and 0 otherwise. $Nof_{i,t}$ denotes the number of local firms. $Poor_{i,t}$ indicates average local GDP multiply by -1. Columns (1) and (2) present the effects of $Nof_{i,t}$, while Columns (3) and (4) present the effects of $Poor_{i,t}$. All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 9 Controlling for Other Channels of Information Transfer

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Trainpost_{i,t}$	-0.074*** (-3.797)	-0.067*** (-3.398)	0.068*** (2.876)	0.071*** (2.970)
$Size_{i,t}$		-0.075*** (-3.440)		-0.093*** (-3.724)
$Lev_{i,t}$		-0.000 (-0.621)		-0.000 (-0.004)
$Roa_{i,t}$		-0.004** (-2.307)		-0.001 (-0.645)
$Turnvol_{i,t}$		0.058*** (3.479)		0.202*** (10.721)
$Turnrate_{i,t}$		0.013** (2.441)		-0.034*** (-5.279)
$Trade_{i,t}$		-0.001 (-1.441)		-0.000 (-0.256)
$Nos_{i,t}$		0.036** (2.200)		-0.016 (-0.814)
$Numins_{i,t}$		-0.017 (-1.377)		0.012 (0.840)
$Lartenown_{i,t}$		0.000 (0.319)		0.003*** (2.651)
$Inspro_{i,t}$		0.001 (1.218)		-0.000 (-0.648)
$Inroad_{i,t}$	-0.018 (-0.676)	-0.021 (-0.775)	0.036 (1.162)	0.030 (0.957)
$Inair_{i,t}$	-0.426*** (-5.183)	-0.402*** (-4.900)	0.473*** (5.019)	0.488*** (5.164)
$Inrail_{i,t}$	0.065 (1.581)	0.071* (1.740)	-0.021 (-0.443)	-0.044 (-0.950)
$Inwater_{i,t}$	0.024** (2.473)	0.025** (2.543)	-0.018* (-1.676)	-0.017 (-1.541)
$Imroad_{i,t}$	-0.002 (-0.069)	0.002 (0.060)	-0.029 (-0.679)	-0.016 (-0.381)
$Imair_{i,t}$	0.084 (1.608)	0.076 (1.473)	-0.143** (-2.284)	-0.154** (-2.461)
$Imrail_{i,t}$	-0.278*** (-6.230)	-0.291*** (-6.543)	0.322*** (6.207)	0.298*** (5.779)
$Imwater_{i,t}$	-0.160*** (-5.417)	-0.156*** (-5.397)	0.173*** (5.233)	0.166*** (5.230)
$ImInternet_{i,t}$	0.059 (1.240)	0.061 (1.285)	-0.062 (-1.106)	-0.026 (-0.471)
Constant	9.096*** (8.152)	8.831*** (7.651)	-8.814*** (-6.974)	-11.123*** (-8.213)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	10,987	10,987	10,987	10,987
R-squared	0.095	0.104	0.107	0.123

The table control for the province high-speed road passenger volume ($Inroad_{i,t}$), the province railway passenger volume ($Inrail_{i,t}$, HSR excluded), the province total water carriage passenger volume ($Inwater_{i,t}$), province high-speed road freight volume ($Imroad_{i,t}$), province railway freight volume ($Imrail_{i,t}$, HSR excluded), province total water carriage freight volume ($Imwater_{i,t}$), the city-level airport passenger ($Inair_{i,t}$) and freight volume ($Imair_{i,t}$) and the internet users ($ImInternet_{i,t}$). All regressions control for firm and year fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 10 Controlling for Regional Economy Development

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Trainpost_{i,t}$	-0.125*** (-6.957)	-0.114*** (-6.344)	0.119*** (5.497)	0.117*** (5.389)
$Size_{i,t}$		-0.088*** (-4.592)		-0.112*** (-5.136)
$Lev_{i,t}$		-0.000 (-0.773)		-0.000 (-0.447)
$Roa_{i,t}$		-0.004** (-2.535)		-0.000 (-0.078)
$Turnvol_{i,t}$		0.071*** (4.926)		0.205*** (12.267)
$Turnrate_{i,t}$		0.015*** (2.906)		-0.043*** (-7.078)
$Trade_{i,t}$		-0.001 (-1.623)		-0.001 (-1.227)
$Nos_{i,t}$		0.027* (1.884)		-0.024 (-1.445)
$Numins_{i,t}$		-0.015 (-1.392)		0.007 (0.547)
$Lartenown_{i,t}$		0.001 (0.777)		0.002 (1.431)
$Inspro_{i,t}$		0.001 (1.356)		-0.000 (-0.561)
$Fininc_{i,t}$	-0.001 (-0.012)	0.016 (0.231)	0.019 (0.232)	0.020 (0.242)
$CPI_{i,t}$	0.001 (0.125)	0.002 (0.158)	0.017 (1.417)	0.014 (1.210)
$Patent_{i,t}$	0.080*** (3.655)	0.076*** (3.493)	-0.055** (-2.203)	-0.057** (-2.267)
$Student_{i,t}$	0.014 (0.187)	0.014 (0.180)	-0.011 (-0.129)	-0.004 (-0.041)
$Fixinv_{i,t}$	-0.063* (-1.805)	-0.067* (-1.928)	0.022 (0.507)	0.017 (0.388)
$Population_{i,t}$	1.739*** (9.154)	1.704*** (9.068)	-2.015*** (-9.025)	-1.980*** (-8.953)
$Gdp_{i,t}$	-0.122 (-1.277)	-0.115 (-1.247)	0.166 (1.571)	0.184* (1.786)
Constant	-13.680*** (-8.069)	-13.452*** (-7.964)	14.789*** (7.486)	12.836*** (6.569)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	13361	13361	13361	13361
R-squared	0.083	0.094	0.097	0.113

The table shows the relationship between HSR and stock return comovement. Compared to the original equation, we added more control variables. We further control for the proxies for the development level of the region's capital market: the provincial level of fiscal income ($Fininc_{i,t}$), CPI ($CPI_{i,t}$), number of patents ($Patent_{i,t}$), number of university and college students ($Student_{i,t}$), fixed investment ($Fixinv_{i,t}$), population ($Population_{i,t}$), and GDP contributions ($Gdp_{i,t}$). All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 11 Alternative proxies for stock returns' local comovement

VARIABLES	(1)	VARIABLES	(2)	VARIABLES	(1)
	<i>Nos_{i,t}</i>		<i>Inspor_{i,t}</i>		<i>Trade_{i,t}</i>
<i>Trainpost_{i,t}</i>	0.077*** (3.953)	<i>Trainpost_{i,t}</i>	2.958*** (4.402)	<i>Trainpost_{i,t}</i>	12.600** (2.426)
<i>Size_{i,t}</i>	0.199*** (10.429)	<i>Size_{i,t}</i>	-1.038** (-2.012)	<i>Population_{i,t}</i>	0.736*** (2.999)
<i>Lev_{i,t}</i>	-0.001 (-1.322)	<i>Lev_{i,t}</i>	0.058*** (4.042)	<i>Landsize_{i,t}</i>	-0.001 (-0.175)
<i>Roa_{i,t}</i>	-0.021*** (-15.424)	<i>Roa_{i,t}</i>	-0.103** (-2.514)	<i>Popden_{i,t}</i>	0.378* (1.665)
<i>Turnvol_{i,t}</i>	0.219*** (21.069)	<i>Turnvol_{i,t}</i>	-0.934*** (-3.220)	<i>Fisin_{i,t}</i>	1.175** (2.549)
<i>Numins_{i,t}</i>	-0.054*** (-5.526)	<i>Numins_{i,t}</i>	9.652*** (32.492)	<i>Fisout_{i,t}</i>	-0.656* (-1.876)
<i>Lartenown_{i,t}</i>	-0.016*** (-19.623)	<i>Lartenown_{i,t}</i>	0.283*** (12.554)	<i>Avegdp_{i,t}</i>	-0.001 (-1.392)
<i>Stateown_{i,t}</i>	0.092*** (2.886)	<i>Stateown_{i,t}</i>	1.030 (1.245)	<i>Loanval_{i,t}</i>	-0.022** (-2.308)
<i>Inspro_{i,t}</i>	-0.007*** (-15.990)	<i>Nos_{i,t}</i>	-7.546*** (-16.574)	<i>Totsave_{i,t}</i>	0.015 (1.461)
Constant	2.553*** (7.939)	Constant	90.206*** (9.780)	Constant	-570.846*** (-3.028)
Year & Id	Yes	Year & Id	Yes	Year & City	Yes
Cluster at firm	Yes	Cluster at firm	Yes	Cluster at city	Yes
Observations	15,858	Observations	15,858	Observations	2,945
R-squared	0.476	R-squared	0.610	R-squared	0.574

This table shows the effect of HSR on other measures of local comovement of stock returns. The dependent variables are the number of shareholder households, total institutional shareholding ratio, and magnitude of the cities' total trading activities. The control variables are the population of cities (*Population_{i,t}*), city land size (*Landsize_{i,t}*), population density (*Popden_{i,t}*), fiscal budget income (*Fisin_{i,t}*), fiscal budget expense (*Fisout_{i,t}*), GDP per capita (*Avegdp_{i,t}*), loan value (*Loanval_{i,t}*), and total savings (*Totsave_{i,t}*). The regression results are presented in Table 9. All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 12 Alternative proxies for HSR implementation

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Station_{i,t}$	-0.005*** (-2.881)	-0.005*** (-2.895)	0.006*** (3.005)	0.007*** (3.472)
$Size_{i,t}$		-0.117*** (-6.439)		-0.102*** (-4.940)
$Lev_{i,t}$		-0.001 (-1.431)		0.000 (0.211)
$Roa_{i,t}$		-0.004*** (-2.862)		0.001 (0.386)
$Turnvol_{i,t}$		0.064*** (4.921)		0.195*** (13.078)
$Turnrate_{i,t}$		0.018*** (3.609)		-0.044*** (-7.586)
$Trade_{i,t}$		-0.001 (-1.547)		-0.001* (-1.723)
$Nos_{i,t}$		0.020 (1.469)		-0.009 (-0.572)
$Numins_{i,t}$		-0.005 (-0.509)		0.008 (0.681)
$Lartenown_{i,t}$		0.001 (1.179)		0.001 (1.099)
$Inspro_{i,t}$		0.001* (1.804)		-0.001 (-1.042)
Constant	0.248*** (11.134)	1.118*** (3.611)	0.800*** (33.389)	-1.108*** (-3.012)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	15,859	15,859	15,859	15,859
R-squared	0.053	0.066	0.074	0.090

This table shows the relationship between the number of HSR stations and stock returns comovement. The dependent variables are local comovement ($Cvcom_{i,t}$) and national comovement ($Mvcom_{i,t}$). $Station_{i,t}$ denotes the number of HSR stations. Columns (1) and (3) present the regression results without firm-level control variables, whereas Columns (2) and (4) report the results with the control variables. All regressions control for firm- and year-fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 13 Parallel assumption test

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Before_5$	0.000 (0.002)	-0.009 (-0.194)	0.016 (0.274)	0.021 (0.365)
$Before_4$	-0.036 (-0.821)	-0.042 (-0.952)	0.039 (0.751)	0.040 (0.747)
$Before_3$	0.047 (1.210)	0.043 (1.122)	-0.050 (-1.073)	-0.050 (-1.063)
$Before_2$	0.068* (1.954)	0.061* (1.773)	-0.074* (-1.762)	-0.074* (-1.736)
$Before_1$	-0.020 (-0.627)	-0.022 (-0.698)	0.001 (0.027)	-0.000 (-0.013)
$After_1$	-0.047* (-1.872)	-0.045* (-1.829)	0.030 (1.008)	0.027 (0.908)
$After_2$	-0.092*** (-3.878)	-0.087*** (-3.669)	0.071** (2.455)	0.072** (2.511)
$After_3$	-0.044** (-2.019)	-0.040* (-1.835)	0.017 (0.650)	0.011 (0.412)
$After_4$	-0.056*** (-2.694)	-0.049** (-2.391)	0.027 (1.068)	0.027 (1.066)
$After_5$	-0.058*** (-2.664)	-0.066*** (-3.064)	0.074*** (2.829)	0.079*** (2.983)
Constant	0.281*** (5.309)	1.126*** (3.569)	0.764*** (12.321)	-1.154*** (-3.063)
Control Variables	Yes	Yes	Yes	Yes
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	16146	15859	16146	15859
R-squared	0.058	0.069	0.078	0.093
F	37.86	33.62	44.93	39.94
Prob > F	0.000	0.000	0.000	0.000

This table reports the dynamic Difference-in-Differences estimations. $Before_t$ equals 1 in the t year before the high-speed rail implementation for the treatment group, and 0 in other years. $After_t$ equals 1 in the t year after the opening of the HSR for experimental group, otherwise it takes 0. All regressions control for firm and year fixed effects. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

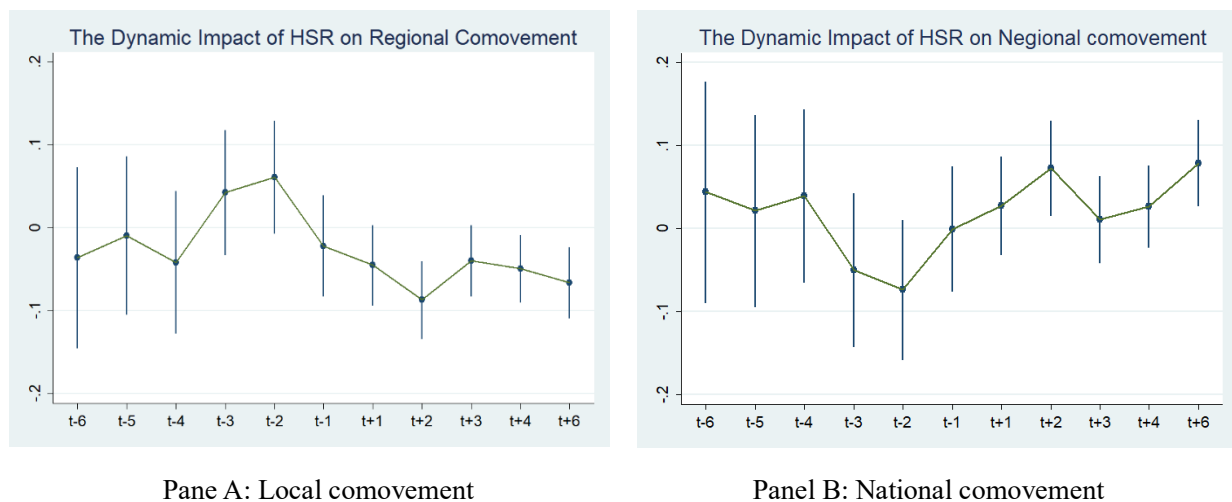


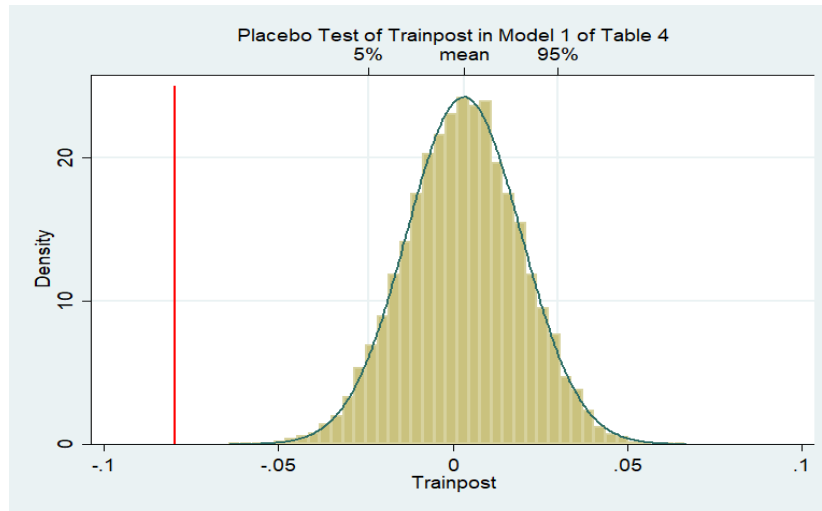
Figure 1: Parallel assumption test – Dynamic Difference-in-Difference Results

This figure plots the dynamic causal effect of HSR on regional and national stock return comovements in panels A and B, respectively. We estimated a 10-year window spanning five years before the opening of the HSR to five years after its opening. The vertical lines represent 95% confidence intervals adjusted for firm-level clustering.

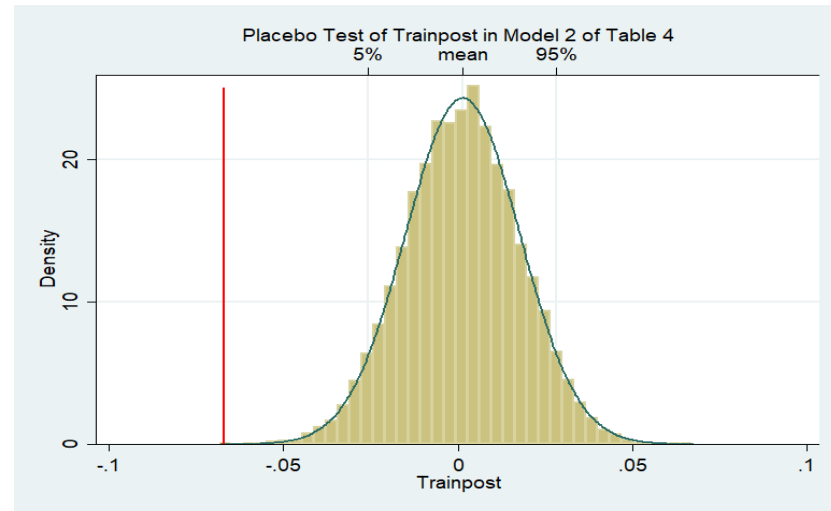
Table 14 PSM method

VARIABLES	(1)	(2)	(3)	(4)
	$Cvcom_{i,t}$	$Cvcom_{i,t}$	$Mvcom_{i,t}$	$Mvcom_{i,t}$
$Trainpost_{i,t}$	-0.113*** (0.028)	-0.104*** (0.028)	0.073** (0.032)	0.074** (0.032)
$Size_{i,t}$		-0.172*** (0.036)		-0.120*** (0.038)
$Lev_{i,t}$		-0.000 (0.000)		-0.000 (0.000)
$Roa_{i,t}$		-0.001 (0.001)		0.001 (0.001)
$Turnvol_{i,t}$		0.065*** (0.022)		0.257*** (0.024)
$Turnrate_{i,t}$		0.028*** (0.011)		-0.075*** (0.012)
$Trade_{i,t}$		-0.002** (0.001)		-0.000 (0.001)
$Nos_{i,t}$		0.022 (0.025)		-0.017 (0.028)
$Numins_{i,t}$		0.020 (0.017)		-0.023 (0.020)
$Lartenown_{i,t}$		-0.000 (0.002)		0.004** (0.002)
$Inspro_{i,t}$		0.002** (0.001)		-0.002** (0.001)
Constant	0.074 (0.124)	2.105*** (0.647)	0.997*** (0.131)	-1.912*** (0.688)
Year & Id	Yes	Yes	Yes	Yes
Cluster at firm	Yes	Yes	Yes	Yes
Observations	9633	9633	9633	9633
R-squared	0.019	0.029	0.037	0.054

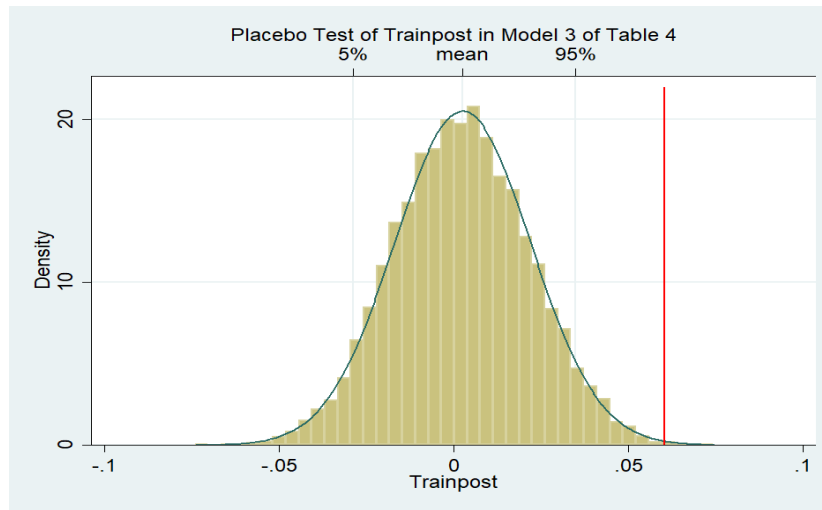
This table presents our regression estimations in the 1:1 matching sample. The dependent variables are local comovement ($Cvcom_{i,t}$) and national comovement ($Mvcom_{i,t}$). $Trainpost_{i,t}$ is 1 after the high-speed rail is opened, and 0 otherwise. Columns (1) and (3) present the results without firm-level control variables, while Columns (2) and (4) present the results with control variables. Robust standard errors are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.



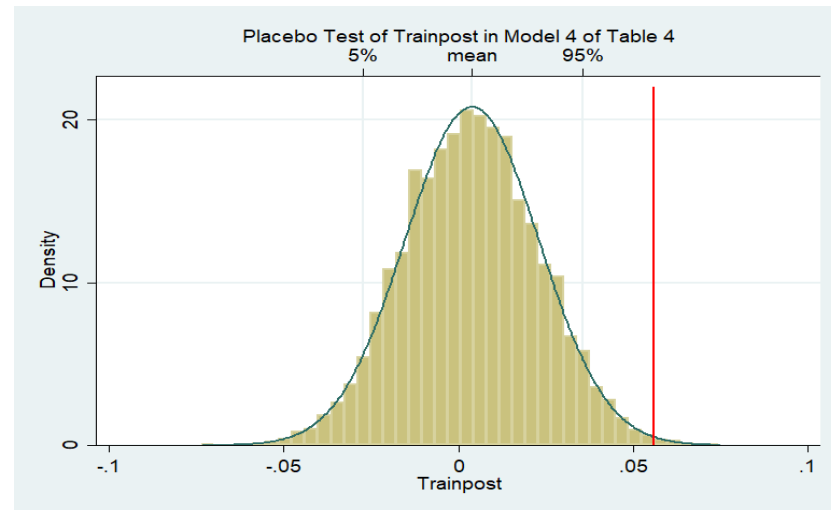
Panel A Local comovement and HSR without control variables



Panel B Local comovement and HSR with control variables



Panel C National comovement and HSR without control variables



Panel D National comovement and HSR with control variables

Figure 2: Placebo tests – the nonparametric distribution of the coefficient estimates of the interaction term Trainpost in DID model

This figure reports the non-parametric distribution of the coefficient estimates of the interaction term Trainpost in the placebo tests of the DID models in Table 4. The yellow bars represent the histograms of the coefficient estimates generated from the placebo simulations, the green line is the normal density curve, and the red line is the original interaction term coefficient.