



The Belt and Road Initiative, Regional Variation, and Firm Productivity

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Abstract. Using a difference-in-differences framework and panel data on A-share listed firms in Shanghai, Shenzhen, and Beijing from 2010 to 2024, this paper evaluates the effect of the Belt and Road Initiative on firm-level total factor productivity. The treatment group is innovatively defined along three spatial dimensions, including generalized, offshore core area, and onshore core area, and parallel estimations are conducted on the same full sample to identify spatial heterogeneity in policy effects. Empirical results indicate that the Initiative substantially increases productivity for firms located along the route overall, yet the gains are spatially selective and structurally heterogeneous. The marginal productivity improvement is larger in the land-based Silk Road Economic Belt core area than in the 21st Century Maritime Silk Road area. Non-state-owned enterprises and export-oriented firms experience significant benefits; by contrast, state-owned enterprises and firms oriented toward domestic demand exhibit no significant effects. This study advances policy evaluation from a binary assessment of effectiveness to a more refined identification of which actors and which locations benefit most, thereby contributing empirical evidence on the micro-level transmission mechanisms of national strategies and informing more targeted policy implementation.

Keywords: Belt and Road Initiative, Total Factor Productivity, Difference-in-Differences Model, Regional Heterogeneity, Firm Heterogeneity.

1 Introduction

Total factor productivity (TFP) is a core indicator for measuring firms' comprehensive production efficiency, capturing output improvements achieved through technological progress and more efficient resource allocation given fixed capital and labor inputs [1]. As China's economy transitions from a stage of rapid growth to one of higher-quality development, raising firms' TFP has become a primary channel for promoting structural optimization and shifting growth drivers. As a major national strategy to advance high-level opening-up, the Belt and Road Initiative (BRI) has generated unprecedented institutional conditions for firms to deepen participation in global value chains and expand overseas market opportunities by promoting infrastructure connectivity, trade and investment facilitation, and international production-capacity cooperation [2]. Within

this context, a rigorous assessment of the Initiative's impact on firm-level TFP not only clarifies its microeconomic consequences but also provides empirical guidance for policy design and improved resource-allocation efficiency, yielding both theoretical and practical significance.

The extant literature has examined multiple economic effects of the BRI, yet research perspectives and conclusions remain heterogeneous. Much of the work focuses on intermediate outcomes such as investment intensity and export composition, with comparatively less attention to the fundamental performance measure of firm production efficiency. More importantly, prior studies typically adopt a broad definition of the policy treatment group and therefore do not distinguish functional differences between the two spatial configurations of the Silk Road Economic Belt and the 21st Century Maritime Silk Road. When exploring firm heterogeneity, there is also a paucity of systematic tests concerning differential effects associated with firms' income structures. These gaps limit understanding of the mechanisms, boundary conditions, and regional variation through which the Initiative affects firm productivity, constraining precise policy evaluation and the formulation of targeted policy responses.

Using panel data on A-share listed firms in Shanghai, Shenzhen, and Beijing for 2010-2024 and a difference-in-differences (DID) identification strategy, this paper systematically examines the BRI's effects on firm TFP and associated heterogeneity. The paper contributes to the literature in three respects. First, thematically, it extends the evaluation of the Initiative beyond intermediate outcomes to the fundamental indicator of firm TFP, thereby illuminating micro-level transmission channels and enriching theory on the openness-productivity nexus. Second, methodologically, it moves beyond a single broad treatment definition by subdividing the treated group into the maritime core area and the onshore Silk Road Economic Belt core area and conducting parallel estimations on a common full sample, thereby identifying spatial heterogeneity in policy effects and offering a framework for analyzing spatial imbalance. Third, empirically, the study documents that productivity gains from the Initiative concentrate among non-state-owned and export-oriented firms, and that the marginal effect is stronger in the onshore Silk Road Economic Belt core area than in the maritime core area. This evidence indicates that the Initiative's effects are neither uniform nor universal but are selective and structured, providing guidance for shifting policy emphasis from broad coverage to greater precision.

2 Theoretical Basis and Research Hypotheses

2.1 The Relationship Between BRI and Corporate TFP

The theory of comparative advantage implies that countries or firms should specialize in industries in which they hold relative efficiency advantages and optimize resource allocation through international trade to raise production efficiency and economic growth [3]. The central mechanism of this theory is that when production factors can move and be reallocated on a larger scale, resources shift from less efficient sectors to more efficient ones, thereby increasing aggregate total factor productivity. With deeper economic globalization and a more refined international division of labor, firms' par-

ticipation in global value chains has intensified and the scope for comparative advantage has expanded. As a major strategy to promote high-level opening-up, the BRI has strengthened economic linkages between China and participating countries by facilitating trade, investment, and infrastructure development, thereby offering firms access to larger international markets. Expanded market opportunities enable firms to scale up production and realize economies of scale, improving production efficiency. Simultaneously, exposure to more intense international competition incentivizes firms to raise efficiency through technological innovation, process improvements, and managerial upgrading. Consistent with Melitz's heterogeneous firm framework, increased trade openness promotes industry-level productivity via selection and resource reallocation, i.e., more productive firms are more likely to enter export markets while less productive firms exit, concentrating resources in higher productivity firms and raising overall productivity [4]. Based on these theoretical and empirical considerations, the paper proposes the following Hypothesis 1.

H1: The implementation of the BRI positively affects firms' TFP.

2.2 Heterogeneity Test of Firm Characteristics

Compared with state-owned enterprises, non-state-owned firms typically exhibit greater flexibility and autonomy in decision-making, resource allocation, and market competition. Non-state firms rely more on market mechanisms to acquire resources, so that their production efficiency tends to be more responsive to external environmental changes [5]. By expanding international market opportunities through trade facilitation and cross-border investment, the BRI creates favorable conditions for non-state firms to engage in international competition. Prior literature indicates that ownership significantly affects resource allocation efficiency and productivity. Hsieh & Klenow (2009) argued that under resource misallocation, non-state firms, owing to their stronger reliance on market allocation, often allocate factors more efficiently than state-owned firms that face greater policy intervention, implying larger potential gains from efficiency improvements [6]. Brandt et al. (2012) showed that reallocation across ownership types might be an important source of productivity growth in Chinese industry, and firms in more marketized environments contribute more strongly to this process [7]. Moreover, non-state firms often confront tighter financing constraints, so when external opportunities expand, they have stronger incentives to enhance competitiveness through efficiency improvements. Hence, under the trade and investment opportunities associated with the BRI, non-state firms are likely to pursue greater gains in TFP via technology adoption, process optimization, and managerial enhancement. Consequently, the research proposes the following second hypothesis.

H2: Relative to state-owned enterprises, the BRI has a more pronounced positive effect on the TFP of non-state-owned enterprises.

2.3 Heterogeneity Test of Firm Revenue Structure

A firm's revenue structure reflects its market orientation and degree of internationalization and is a key determinant of its response to external policy shocks. Firms with

different revenue compositions differ systematically in internationalization motives, capability endowments, and risk exposure, resulting in heterogeneous sensitivity to and benefits from opening-up policies. Export-oriented firms typically possess more international experience and established overseas channels, and their operations are closely linked to cross-border trade [8]. Trade facilitation, improved connectivity, and expanded market access associated with the BRI can be directly exploited by such firms to enhance production efficiency. For example, measures that streamline port procedures and harmonize standards reduce cross-border transaction costs for exporters; infrastructure improvements open new foreign markets and enable scale economies; and international cooperation platforms facilitate deeper integration into global production networks and technology spillovers. By contrast, firms oriented toward domestic demand concentrate on the domestic market and generally have less international experience and capacity. For these firms, the Initiative's effects operate mainly through indirect channels such as supply chain linkages and multiplier effects, which are longer and weaker and more susceptible to domestic macroeconomic fluctuations. Hence, the research proposes a Hypothesis 3.

H3: The BRI's positive effect on firms' TFP is stronger for export-oriented enterprises than domestic demand-oriented enterprises.

3 Empirical Testing

3.1 Sample Selection and Data Source

The empirical sample comprises annual observations of Chinese A-share listed firms on the Shanghai, Shenzhen, and Beijing exchanges for 2010-2024. Financial data are drawn from the *Choice* Financial Terminal. Industry classification follows the China Securities Regulatory Commission 2012 standards. To ensure data quality, the initial sample is subjected to the following treatments. First, financial firms are excluded since their accounting and financial structures differ from those of nonfinancial firms. Second, firms with abnormal operating status during the sample period and firms with persistent abnormal operations are removed. Third, observations with missing values on any variable are deleted. Finally, noncategorical variables are winsorized at the 1st and 99th percentiles to mitigate the influence of extreme outliers. After these procedures, the final dataset contains 27,831 firm-year observations.

3.2 Variable Definition and Measurement

Explained Variable – Total Factor Productivity (TFP). The dependent variable is firm-level TFP, which captures firms' production efficiency conditional on observed inputs and reflects output gains attributable to technological progress and improved resource allocation. It is estimated using the semi-parametric Levinsohn-Petrin (LP) method, and the production function is specified as the following equation (1) [1].

$$\ln Y_{i,t} = \alpha_0 + \alpha_L \ln L_{i,t} + \alpha_K \ln K_{i,t} + \alpha_M \ln M_{i,t} + \omega_{i,t} + \varepsilon_{i,t} \quad (1)$$

$Y_{i,t}$ denotes firm i 's total output in year t measured by operating revenue; $K_{i,t}$ denotes capital input proxied by fixed assets; $L_{i,t}$ denotes labor input proxied by number of employees; $M_{i,t}$ denotes intermediate input proxied by operating costs; $\varepsilon_{i,t}$ is an error term, and $\omega_{i,t}$ is the unobserved productivity term, interpreted as firm TFP. The LP method uses intermediate inputs as proxy variable to address simultaneity and selection biases in production function estimation. Higher estimated $\omega_{i,t}$ indicates greater firm-level productivity.

Explanatory Variable – Implementation of the BRI (BR). To identify the policy effects of the BRI, this paper constructs a DID treatment variable. Following Chen & Liu (2018), the treatment group is defined by regional registration: firms registered in provinces explicitly designated as key Belt and Road provinces (for example Xinjiang, Shaanxi, Guangxi, Fujian, etc.) are assigned $BR_policy = 1$; all other firms are assigned $BR_policy = 0$ [9]. China formally announced the BRI in 2013, which provides an institutional shock facilitating firms' participation in international markets. Accordingly, the post-treatment period is defined as $BR_time = 1$ for 2013 and thereafter, and $BR_time = 0$ for 2010–2012.

Recognizing that the Initiative comprises two spatial configurations, the Silk Road Economic Belt and the 21st Century Maritime Silk Road, and that regions differ in functional positioning, industrial base, and opening pathways, the paper further subdivides the treatment group to examine regional heterogeneity in policy effects. The broad treatment definition includes all provinces associated with either the Silk Road Economic Belt or the Maritime Silk Road and is used to capture the Initiative's aggregate effect; this variable is the core explanatory variable denoted BR in subsequent regressions. The maritime core area comprises five coastal provinces and municipalities, including Shanghai, Fujian, Guangdong, Zhejiang, and Hainan. This region leverages port advantages and a marine economic base, with emphasis on maritime trade channels and external opening [10]. The onshore Silk Road Economic Belt core area comprises thirteen provinces, autonomous regions, and municipalities, including Xinjiang, Shaanxi, Gansu, Ningxia, Qinghai, Inner Mongolia, Heilongjiang, Jilin, Liaoning, Guangxi, Yunnan, Tibet, and Chongqing. This region relies on land routes and inland opening, emphasizing infrastructure connectivity and westward openness. Each of these treatment definitions interacts with the BR_time variable to form three parallel DID variables: BR , $BR_offshore$, and $BR_onshore$. All three models are estimated on the same full sample, differing only in the spatial scope of the treatment indicator, to identify overall and subregional policy effects.

Control Variables. Consistent with the literature on determinants of firm TFP, the regressions control for potential confounders including the share of overseas revenue (OR), firm size ($SIZE$, calculated as the natural logarithm of total assets), leverage ratio (LEV), return on assets (ROA), growth rate of operating revenue ($GROWTH$), operating cash flow ratio (CF , i.e., the operating cash flow divided by total assets), capital intensity (CAP , calculated as fixed assets divided by total assets), and firm age (AGE).

3.3 Empirical Models

To test the hypotheses, a DID model is specified to compare the change in TFP among firms affected by the BRI and those not affected. The baseline specification is shown in the following equation (2).

$$TFP_{i,t} = \beta_0 + \beta_1 BR_time_{i,t} + \beta_2 BR_policy_{i,t} + \beta_3 (BR_time_{i,t} \times BR_policy_{i,t}) + \beta_4 ControlVar'_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (2)$$

Here, $\sum Industry$ is an industry dummy that controls for systematic differences across sectors arising from technological characteristics, competitive structure, factor intensity, and related factors, thereby mitigating confounding industry effects. $\sum Year$ is a time dummy that controls for common macroeconomic shocks, policy cycle fluctuations, and other temporal trends affecting all sample firms, ensuring estimates are not driven by systematic time effects. $\varepsilon_{i,t}$ denotes the idiosyncratic error term capturing unobserved random disturbances. The statistical significance of coefficient β_3 provides evidence for or against the Hypothesis 1.

4 Research Results and Analysis

4.1 Descriptive Analysis

Table 1 reports descriptive statistics for the main variables. The treatment indicator *BR* has a mean of 0.5176 and a standard deviation of 0.4997, indicating a relatively balanced distribution between treated and control observations and supporting the comparability required for DID estimation. The sample mean of TFP is 1.7827 with a standard deviation of 0.6355; the mean exceeds the median, suggesting a right-skewed distribution driven by a minority of firms with exceptionally high productivity. The average share of overseas revenue (*OR*) is 0.2071 with a standard deviation of 0.2253, implying that most firms remain primarily domestically oriented while a subset exhibit high dependence on foreign markets, as reflected by the maximum value of 0.9124. Other variables display distributions within expected ranges.

Table 1. Descriptive statistical results.

Variable	Sample number	Average value	Standard deviation	Minimum	Median	Maximum
<i>BR</i>	27831	0.5176	0.4997	0	1	1
<i>BR_time</i>	27831	0.9147	0.2794	0	1	1
<i>BR_policy</i>	27831	0.5675	0.4954	0	1	1
<i>TFP</i>	27831	1.7827	0.6355	1.0403	1.6426	5.7631
<i>OR</i>	27831	0.2071	0.2253	0.0002	0.1235	0.9124
<i>CF</i>	27831	0.0918	0.1266	-0.3148	0.0850	0.4808
<i>A</i>	27831	21.8087	1.4616	19.0604	21.5977	26.0294

Variable	Sample number	Average value	Standard deviation	Minimum	Median	Maximum
<i>LEV</i>	27831	0.4246	0.1934	0.0593	0.4195	0.8752
<i>CAP</i>	27831	0.2071	0.1365	0.0052	0.1838	0.6279
<i>GROWTH</i>	27831	0.1272	0.2878	-0.4709	0.0899	1.4076
<i>AGE</i>	27831	20.0484	6.1054	8.0000	20.0000	38.0000

4.2 Multicollinearity Test

To ensure the validity and reliability of the regression estimates, multicollinearity among the principal explanatory variables is assessed using the variance inflation factor (VIF). After testing, all VIF values are shown to be well below the conventional threshold of 10, and the mean VIF is 1.1651, indicating minimal linear dependence among regressors. Consequently, coefficient standard errors are unlikely to be substantially inflated by multicollinearity, and the subsequent inference based on the model estimates is reliable.

4.3 Panel Regression Analysis

Results of Hypothesis 1. Table 2 presents baseline DID estimates of the BRI’s effect on firm-level TFP. Column (1) uses the broad treatment definition that includes all designated provinces, column (2) adopts the maritime core area definition, and column (3) adopts the onshore Silk Road Economic Belt area definition. The coefficient on the main treatment indicator under the broad definition (column (1)) is 0.0635 and is statistically significant at the 1% level, indicating that, on average, the Initiative increases firm TFP in designated provinces. This finding supports the Hypothesis 1 that the Initiative enhances firms’ comprehensive production efficiency. Under the maritime core area definition (column (2)), the treatment coefficient (*BR_offshore*) equals 0.0360 but is not statistically significant, implying no measurable productivity effect in maritime core provinces. A plausible explanation is that these coastal regions (Shanghai, Fujian, Guangdong, Zhejiang, Hainan) are already highly open, with well-developed infrastructure and industrial bases prior to the Initiative, leaving limited scope for observable marginal productivity gains. By contrast, the onshore Silk Road Economic Belt core area coefficient (*BR_onshore*) in column (3) is 0.0931 and statistically significant at the 5% level, indicating a pronounced positive effect on firm TFP in onshore provinces. This result may reflect the larger pre-policy infrastructure deficits and lower initial openness in central and western regions (Xinjiang, Shaanxi, Gansu, Chongqing, Yunnan, etc.), which allow infrastructure investment and trade opening under the Initiative to generate larger marginal productivity improvements. Overall, the results demonstrate clear regional heterogeneity. The productivity-enhancing effect of the BRI is stronger in the onshore Silk Road Economic Belt core area than in the maritime core area.

Table 2. Regression results for Hypothesis 1.

	<i>BR</i>	<i>BR_offshore</i>	<i>BR_onshore</i>
<i>BR</i>	0.0635***	/	/
<i>BR_offshore</i>	/	0.0360	/
<i>BR_onshore</i>	/	/	0.0931**
<i>BR-time</i>	0.0304	0.0464**	0.0589***
<i>BR-policy</i>	-0.0543**	/	/
<i>BR_offshore policy</i>	/	-0.0659***	/
<i>BR_onshore policy</i>	/	/	0.0398
<i>OR</i>	-0.2152***	-0.2113***	-0.2074***
<i>CF</i>	1.3120***	1.3167***	1.3103***
<i>A</i>	-0.0179***	-0.0189***	-0.0184***
<i>LEV</i>	-0.7500***	-0.7475***	-0.7567***
<i>CAP</i>	-0.8300***	-0.8394***	-0.8397***
<i>GROWTH</i>	0.2282***	0.2288***	0.2292***
<i>AGE</i>	-0.0058***	-0.0056***	-0.0060***
<i>Year FE</i>	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes
<i>R-squared</i>	0.266	0.266	0.268
<i>N</i>	27831	27831	27831

Note: The data in the table are regression coefficients of each variable, and ***, **, and * are significant at the significance level of 1%, 5% and 10% respectively.

Results of Hypothesis 2. To examine heterogeneous policy effects across ownership types, the study estimates the baseline specification on subsamples of state-owned and non-state-owned firms. Table 3 reports grouped regression results for each ownership type under the three treatment definitions. For the state-owned subsample, the coefficients on the treatment indicators under all three definitions are statistically insignificant. This finding suggests that the BRI does not materially affect TFP among state-owned firms. Several factors may account for this null result. State-owned firms often have substantial involvement in infrastructure and strategic projects prior to the Initiative, rendering the marginal impact of the policy relatively limited. Institutional constraints, including tighter budgetary and administrative oversight, can impede efficient resource reallocation and weaken incentives for technological innovation, reducing the channel through which policy dividends translate into productivity gains [11]. Furthermore, the concentration of state-owned firms in capital-intensive sectors implies stronger diminishing marginal returns to capital, which can further attenuate observed policy effects. By contrast, the treatment effects for non-state-owned firms are economically and statistically meaningful. Under the broad treatment definition (column (4)), the *BR* coefficient is 0.0592 and significant at the 5% level. Under the maritime core definition (column (5)), the coefficient on *BR_offshore* is not significant. Under the onshore definition (column (6)), the *BR_onshore* coefficient is 0.1195 and significant

at the 5% level. These results indicate that the Initiative substantially increases TFP among non-state firms, with the stronger gains concentrated in the onshore Silk Road Economic Belt core area. Possible explanations for the impact observed in column (4) include greater managerial and operational flexibility among non-state firms, superior responsiveness to market opportunities, and relatively more efficient factor allocation that facilitates conversion of policy opportunities into technological upgrading and productivity improvement. The pronounced effect in the onshore core area may reflect lower initial openness and more binding institutional constraints prior to the Initiative, leaving greater scope for marginal gains following liberalization. In contrast, maritime core regions might be already relatively open and competitive prior to the Initiative, limiting the observable marginal productivity gains for non-state firms.

Table 3. Regression results for Hypothesis 2.

	State-owned firms			Non-state-owned firms		
	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>
<i>BR</i>	-0.0056	/	/	0.0592**	/	/
<i>BR_offshore</i>	/	-0.0244	/	/	0.0264	/
<i>BR_onshore</i>	/	/	0.0447	/	/	0.1195**
<i>BR-time</i>	-0.0718	-0.0699	-0.0786	0.0646**	0.0833***	0.0915***
<i>BR-policy</i>	-0.0277	/	/	-0.0440	/	/
<i>BR_offshore policy</i>	/	-0.0551	/	/	-0.0513*	/
<i>BR_onshore policy</i>	/	/	0.0470	/	/	0.0326
<i>OR</i>	-0.2833***	-0.2744***	-0.2654***	-0.2072***	-0.2037***	-0.2006***
<i>CF</i>	1.1072***	1.1109***	1.1100***	1.3377***	1.3425***	1.3355***
<i>A</i>	0.0076	0.0078	0.0084	-0.0245***	-0.0258***	-0.0256***
<i>LEV</i>	-0.7302***	-0.7443***	-0.7254***	-0.7674***	-0.7602***	-0.7730***
<i>CAP</i>	-0.7862***	-0.8084***	-0.7772***	-0.8315***	-0.8389***	-0.8436***
<i>GROWTH</i>	0.2254***	0.2266***	0.2236***	0.2297***	0.2297***	0.2312***
<i>AGE</i>	0.0004	0.0010	-0.0001	-0.0064***	-0.0063***	-0.0066***
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>R-squared</i>	0.225	0.228	0.226	0.271	0.271	0.274
<i>N</i>	5276	5276	5276	22555	22555	22555

Note: The data in the table are regression coefficients of each variable, and ***, **, and * are significant at the significance level of 1%, 5% and 10% respectively.

Results of Hypothesis 3. To examine heterogeneity by firms’ revenue structure, the sample is partitioned by *OR*. For each year and industry, the median *OR* is calculated; firms with *OR* greater than or equal to the industry-year median are classified as export-oriented, and firms with *OR* below the median are classified as domestic demand-oriented. This industry-year median-based grouping controls for systematic industry and year differences and preserves comparability across groups. Table 4 reports grouped

regression results. Columns (1)–(3) present estimates for export-oriented firms ($N=13,982$), and columns (4)–(6) present estimates for domestic demand-oriented firms ($N=13,849$). Each panel reports results for the three treatment definitions described above.

For export-oriented firms, the Initiative's effect is economically and statistically meaningful. Under the broad treatment definition (column (1)), the *BR* coefficient is 0.0857 and significant at the 1% level. Under the maritime core definition (column (2)), *BR_offshore* equals 0.0557 and is significant at the 10% level. Under the onshore definition (column (3)), *BR_onshore* is 0.1134 but not statistically significant. These patterns are consistent with theoretical expectations. Export-oriented firms possess greater international experience and channels, so that reductions in cross-border transaction costs and improvements in port logistics and connectivity associated with the Initiative can be directly translated into productivity gains. The significance under the maritime core definition reflects the direct benefits to firms reliant on maritime trade. The nonsignificant *BR_onshore* coefficient may reflect the continued predominance of maritime routes for exporters, limiting the direct influence of land-based channels. By contrast, estimated treatment effects for domestic demand-oriented firms are insignificant across all three definitions (columns (4)–(6)). This suggests that the Initiative produced no measurable direct effect on TFP for firms primarily serving the domestic market. The likely mechanism is that these firms' operations depend less on foreign markets, so that trade facilitation and overseas market expansion produce limited direct productivity gains. Although indirect channels, such as infrastructure investment stimulating domestic demand or upstream and downstream linkages, may affect domestic demand-oriented firms, such effects may be weaker, more diffuse, or harder to capture within the core DID specification.

Table 4. Regression results for Hypothesis 3.

	Export-oriented firms			Domestic demand-oriented firms		
	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>
<i>BR</i>	0.0857***	/	/	0.0378	/	/
<i>BR_offshore</i>	/	0.0557*	/	/	0.0138	/
<i>BR_onshore</i>	/	/	0.1134	/	/	0.0718
<i>BR-time</i>	0.0345	0.0542*	0.0728***	0.0348	0.0453	0.0496
<i>BR-policy</i>	-0.0598*	/	/	-0.0426	/	/
<i>BR_offshore policy</i>	/	-0.0456	/	/	-0.0772	/
<i>BR_onshore policy</i>	/	/	-0.0469	/	/	0.0956
<i>OR</i>	-0.0540	-0.0523	-0.0527	-1.1310***	-1.1108***	-1.0511***
<i>CF</i>	1.1773***	1.1779***	1.1780***	1.4214***	1.4310***	1.4181***
<i>A</i>	-0.0277***	-0.0280***	-0.0280***	-0.0081	-0.0104	-0.0091
<i>LEV</i>	-0.5460***	-0.5450***	-0.5475***	-0.9408***	-0.9332***	-0.9532***

	Export-oriented firms			Domestic demand-oriented firms		
	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>	<i>BR</i>	<i>Offshore</i>	<i>Onshore</i>
<i>CAP</i>	-0.8158***	-0.8190***	-0.8233***	-0.8199***	-0.8340***	-0.8352***
<i>GROWTH</i>	0.2085***	0.2081***	0.2090***	0.2469***	0.2491***	0.2484***
<i>AGE</i>	-0.0052***	-0.0052***	-0.0052***	-0.0068***	-0.0064**	-0.0071***
<i>Year FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Industry FE</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>R-squared</i>	0.311	0.311	0.311	0.252	0.254	0.256
<i>N</i>	13982	13982	13982	13849	13849	13849

Note: The data in the table are regression coefficients of each variable, and ***, **, and * are significant at the significance level of 1%, 5% and 10% respectively.

5 Conclusion

Using panel data on A-share listed firms in Shanghai, Shenzhen, and Beijing for 2010–2024 and a DID identification strategy, this paper systematically assesses the BRI’s effect on firm-level TFP and its heterogeneity. The main findings are as follows. First, the Initiative significantly increases TFP for firms in designated provinces, consistent with theoretical predictions that opening-up policies enhance firm efficiency via market expansion, competitive incentives, and more efficient resource allocation. Second, the policy effect exhibits marked regional heterogeneity, since the marginal impact in the onshore Silk Road Economic Belt core area is substantially larger than in the maritime core area, suggesting that productivity gains are especially pronounced in inland central and western regions where pre-policy openness is lower and scope for marginal improvement greater. Third, the ownership heterogeneity analysis indicates that productivity gains are concentrated among non-state-owned firms, while effects for state-owned firms are not significant, underscoring the importance of market-oriented mechanisms for converting policy opportunities into productivity improvements. Fourth, heterogeneity by revenue structure shows that export-oriented firms obtain significant benefits from the Initiative, whereas firms oriented toward domestic demand do not, implying that firms’ internationalization capacity determines their ability to capture policy dividends.

Policy implications follow from these results. For policymakers, it is recommended to refine the regional emphasis and firm-targeting of the Initiative by increasing support to the onshore Silk Road Economic Belt to exploit its larger marginal returns, while diagnosing and addressing the weaker effects in maritime core areas through tailored measures that mobilize coastal participation. In addition, policymakers should advance market-oriented reforms and strengthen incentive mechanisms for state-owned enterprises to remove institutional barriers that inhibit efficient resource allocation and responsiveness to external policy shocks. Furthermore, they should design participation and support mechanisms to integrate domestic-demand oriented firms into international production networks, for example through industrial chain support, information plat-

forms, and risk-sharing arrangements, thereby broadening the set of beneficiaries. Turning to firm-level implications, non-state enterprises should proactively leverage market advantages to expand along Belt and Road markets and convert external opportunities into endogenous innovation and efficiency gains. Export-oriented firms should consolidate maritime advantages while exploring complementary land-based channels to diversify market access; domestic-demand oriented firms should progressively build international capabilities to obtain technology spillovers and competitive incentives. Overall, shifting policy emphasis from broad coverage to precision targeting and dynamically aligning policy design with firm capabilities and regional conditions would improve implementation effectiveness and support higher-quality enterprise development.

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