Exchange Rate Change, Factor Market Distortion and Company Performance

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Based on the matched data of China's tax survey and customs from 2007 to 2011, this paper studies the differential impact of exchange rate changes on the performance of companies by region from the perspective of factor market distortion. The results show that for import companies, the RMB appreciation significantly contributes to improving their performance and this phenomenon is more pronounced in areas with high factor market distortions. Channel tests show that the proportion of intermediate goods imported by final producers increases with regional factor market distortions. Therefore, the appreciation of the national currency is more favorable for areas with high factor market distortions (companies with high proportion of imported intermediate goods). In addition, the appreciation of the national currency will promote the production of China's upstream intermediate goods producers by expanding the output of downstream enterprises. This paper complements previous studies on the differential impact of RMB exchange rate changes on regional economic growth from a micro perspective.

Keywords: real effective exchange rate, factor market distortion, company performance, upstream-downstream relations

1. Introduction

As the market-oriented exchange rate reform is being implemented, the RMB exchange rate has become more resilient, resulting in more attention being paid to the economic impact of RMB exchange rate fluctuations. A lot of previous studies have been conducted to investigate the impact of RMB exchange rate on China's manufacturing companies from an export perspective, pointing out that the appreciation of the national currency may weaken the price advantage of China's export products and inhibit exports (Dai *et al*., 2013; Mei *et al*., 2013; Yu and Liang, 2014; Xu and Dai, 2016). Few articles have considered the impact of RMB exchange rate changes

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on companies' performance from an import perspective. From such a perspective, changes in the RMB exchange rate can affect company performance through the cost of imported intermediate goods. This impact depends on the proportion of intermediate goods imported by companies. A related academic question: what influences the proportion of intermediate goods imported by companies? The existing literature (Tian and Yu, 2013; Yu, 2015) has focused more on the impact of trade liberalization on companies' imports of intermediate goods, while few articles have explored such an issue from the perspective of the domestic market economy reform system. On April 9, 2020, the CPC Central Committee and China's State Council issued the *Guidelines on Improving Institutional Mechanism for Market-Based Allocation of Factors*, proposing to improve the market-based allocation of factors. In the context of this policy, this paper points out that domestic factor market distortions can cause differences in the proportion of intermediate goods imported between companies, which brings about differential effects of exchange rate changes on company performance.

Based on the matched data of tax survey and customs data from 2007 to 2011, this paper empirically analyzes the effect of exchange rate changes on the performance of importing companies and the role of domestic factor market distortions. The results show that the RMB appreciation significantly contributes to improving the performance of import companies and this phenomenon is more pronounced in areas with high factor market distortions. The improvement in companies' performance is reflected in increased revenues and higher total factor productivity. According to the channel test, the proportion of imported intermediate goods is what explains the variation of exchange rate effects on company performance with regional factor market distortions. In areas with higher factor market distortions, the cost of producing intermediate goods and the average proportion of intermediate goods imported by companies would be higher. When the local currency appreciates, the higher the proportion of imported intermediate goods, the more significant the performance improvement of companies. Thus, in areas with higher factor market distortions, the RMB appreciation will improve the performance of import companies more obviously. Finally, in the extended analysis section, the paper further considers the impact of real effective exchange rate (REER) changes on the performance of upstream companies. The empirical results show that the appreciation of downstream exchange rate significantly contributes to higher upstream company performance through production network effects.

The existing literature on the impact of exchange rate changes on company performance has focused more on the impact of exchange rate changes on companies' profits, noting that the RMB appreciation reduces companies' exports and profits (Li *et al*., 2011; Yu and Liang, 2014). The literature has paid less attention to the role of imported intermediate goods costs in the impact of exchange rate changes on company performance. A few articles discuss the role of RMB appreciation in enhancing product quality from other perspectives (e.g., competitive export pressure and product rotation

in export markets) (Yu and Zhang, 2017; Zhang and Ji, 2018). By considering the prevalence of imported intermediate goods of China's manufacturing companies,[1] it is necessary to study how exchange rate changes affect company performance by influencing the cost of intermediate goods imports. In addition, our study further examines the link between domestic factor market distortions and companies' import behavior of intermediate goods. At present, China is accelerating building a new development pattern whereby domestic and international markets reinforce each other, with the domestic market as the mainstay. Our study discusses the impact of changes in the cost of imported intermediate goods on the output of China's domestic companies as well as their upstream companies, corresponding to important production decisions in domestic and international circulations, respectively. By using exchange rate changes as exogenous shocks, this paper provides a framework for analyzing the impact of macro policies on companies' participation decisions in domestic and international circulations from the perspective of micro companies.

The main contributions of this paper are as follows. First, this study introduces the characteristic fact of domestic factor market distortion to analyze the differential impact of exchange rate changes on companies' performance in different regions. Previous studies have highlighted the impact of domestic factor market distortions on company performance. Most of them presented that domestic factor market distortions negatively affect the production performance of downstream manufacturing companies. In contrast, this paper endogenizes companies' decision on imported intermediate goods so that companies can weaken the negative effects of domestic factor market distortions by purchasing foreign intermediate goods. The appreciation of the national currency is more favorable to the performance of companies with high factor distortions. This paper complements previous studies on the differential impact of RMB exchange rate changes on regional economic growth from a micro perspective. Second, the data analyzed in this paper include small and medium-sized enterprises (SMEs) so that the performance impact of exchange rate changes on SMEs can be analyzed. Domestic market factor distortions act more significantly on small-scale manufacturing companies than on large-scale ones. Therefore, if small-scale manufacturers are excluded from the analysis sample, the impact of exchange rate on the performance of imported intermediate goods companies may be underestimated. On this basis, this paper uses China's national tax survey data (2007–2011) for empirical analysis. The tax survey database used in this paper is more suitable for studying the relations between domestic factor market distortions and imported intermediate goods than the database of industrial enterprises above the scale often used in previous studies on the impact of exchange rate changes on company performance. Third, in

[1] We match the tax survey data with the customs data, finding that about 50.4% of export companies have imported intermediate goods.

addition to analyzing the impact of exchange rate changes on enterprise performance from the perspective of the cost of imported intermediate goods, this paper also introduces the upstream-downstream relationship into the classical heterogeneous enterprise analysis framework and explores the impact of exchange rate changes on the performance of upstream manufacturing enterprises from a new perspective or the transmission perspective of the domestic intermediate goods demand.

The following sections are structured as follows. The second section presents the literature review; the third section presents the data; the fourth section analyzes the empirical results; and the last section provides conclusion and policy insight.

2. Literature Review

The research is closely related to three strands of literatares. The first strand of literature is about the studies on the impact of exchange rate changes on companies' trade activities (Berman *et al*., 2012; Chatterjee *et al*., 2013; Gopinath and Neiman, 2014; Li *et al*., 2015; Yu and Cui, 2018). It focuses on the impact of exchange rate changes on companies' exports and conducts further discussions from the perspective of corporate heterogeneity. In contrast to the above literature, this paper examines the impact of exchange rate changes on the performance of Chinese companies from the perspective of imported intermediate goods. Xu *et al*. (2015) also studied the impact of RMB exchange rate changes on the productivity of export companies from the perspective of capital-labor factor allocation effects, unveiling that the net effect of RMB appreciation on the productivity of China's manufacturing companies was positive. This article does not discuss the cost channel of imported intermediate goods. In addition, Liu and Huang (2016) researched the impact of RMB exchange rate changes on the efficiency of resource allocation within industries measured by the "markup dispersion", revealing that RMB appreciation reduces resource allocation distortions. Considering the possible differential impact of exchange rate fluctuations on regional economic growth (Ceng and Chen, 2006; Xu *et al*., 2007), this paper investigates the impact of exchange rate changes on the enterprise performance of imported intermediate goods in an analytical framework that combines both imported intermediate goods decisions and domestic factor market distortions. This research presents that RMB appreciation improves the performance of companies located in regions with high factor market distortions more.

The second strand of literature relevant to this paper examines the impact of China's factor market distortions on companies' production behavior. Overall, this literature presents that local governments intervene in factors such as capital, labor, land and technology to promote local economic development, resulting in pricing distortions in domestic factor markets. Some literature suggests that factor market distortions may inhibit company innovation and economic growth by reducing the efficiency of resource allocation (Gai *et al*., 2015; Dai and Liu, 2016; Gao *et al*., 2018; Chen *et al*., 2019). Based on the industrial

enterprise data from 1998 to 2007, Gai *et al*. (2015) found that factor market distortions not only directly reduce total factor productivity by affecting the resource allocation efficiency of incumbent companies, but also indirectly cut total factor productivity by changing companies' entry and exit behaviors through monopoly power. Chen *et al*. (2019) found that distortions in China's intermediate goods market significantly affect companies' location decisions on foreign direct investment. Discrimination against private companies in the domestic factor market can force them to produce more abroad. This explains why China has far more private multinationals than state-owned multinationals. Wang and Li (2021) presented that the trade liberalization of intermediate goods significantly reduced China's factor market distortions. The paper complements this study from the perspective of the link between factor market distortions and companies' imports of intermediate goods.

The third literature analyzes the production network effect of upstream and downstream companies. In theory, the input-output relations between industries transmit exogenous shocks, which amplify the impact of exogenous shocks (Acemoglu *et al*., 2012; Di Giovanni *et al*., 2014). Empirical studies have been conducted to test this theoretical prediction (Barrot and Sauvagnat, 2016; Acemoglu *et al*., 2016; Liu and Wang, 2020). For example, Liu and Wang (2020) found that exchange rate changes significantly affect employment of manufacturing companies through domestic production networks by analyzing industrial enterprises above the scale from 2000 to 2007. This research incorporates the analytical idea of demand shocks along the domestic production network and examines the impact of exchange rate changes on the production performance of upstream companies (domestic intermediate goods manufacturers).

3. Data and Characteristic Facts

3.1. Data Description

This paper mainly adopts the matched data of China's national tax survey and customs from 2007 to 2011. Tax survey data is collected by China's State Taxation Administration and Ministry of Finance to better monitor the tax base and assess the impact of tax policies. Therefore, the data are of high quality and accuracy (Liu and Mao, 2019). The database provides detailed financial and tax information at the company level, including 100-plus financial and corporate variables from balance sheets, income statements and cash flow statements. We process the data in the following manner. First, since we mainly assess how exchange rate changes affect manufacturing enterprises through imported intermediate goods, we retain only manufacturing companies in our sample; second, we remove observations with missing key information such as total assets, total liabilities, sales and fixed assets as well as a sample of noisy companies that clearly do not comply with accounting standards; third, since China's national economy industry codes were changed in 2011, we adjusted

the industry information in 2011 according to the corresponding change to make it consistent with the industry classification from 2007 to 2010.[1]

The purpose of this paper is to investigate the effect of exchange rate changes on the performance of companies with different proportions of imported intermediate goods. To depict the exchange rate shock more accurately to each enterprise, we also use China's customs database to construct the REER of imported intermediate goods at the company level based on the annual imports of companies. China's customs database records information on every import or export transaction by company, including transaction amount, number of transactions, the HS code of a product, trade mode, destination country, etc. By matching the HS codes with the BEC codes,[2] we can distinguish imports into capital goods, intermediate goods and consumer goods. In this paper, we focus on the cost channel of imported intermediate goods where the exchange rate has an impact on the performance of companies. Therefore, in constructing the REER of companies, we calculate it based on their import of intermediate goods from countries.

Since the national tax survey data and the customs database use different enterprise codes, we also need to match enterprise codes of the two databases. Referring to Yu (2015), we matched the tax survey data with the customs database. Finally, we obtained 143490 company-year observations for 62865 companies. The sales of enterprises in the matched data account for 45% of that of all enterprises in the tax survey database. The imports of intermediate goods by enterprises in the matched sample make up approximately 25% of the total imports of intermediate goods in the customs database. The matched data are highly representative.

3.2. Real Effective Exchange Rate

The purpose of this paper is to examine how exchange rate changes affect the revenue performance of enterprises through the cost channel of imported intermediate goods. To accurately describe the exchange rate changes faced by each enterprise, we draw on the approach of Hongbin Li *et al*. (2011) to construct an enterprise-level REER ($reer_{it}$). $reer_{it}$ faced by the company i in period t is defined as follows:

$$reer_{it} = 100 \times \prod_{j=1}^{n} \left(\frac{E_{jt}}{E_{j0}} \times \frac{CPI_t}{CPI_{jt}} \right)^{w_{jt}}, \sum_{j=1}^{n} w_j = 1 \tag{1}$$

[1] The industry codes before and after the revision can be found on the website of China's National Bureau of Statistics http://www.stats.gov.cn/tjsj/tjbz/index_1.html. We matched industries prior to 2011 with those in 2011 based on their names.

[2] The matching table of HS and BEC codes comes from: https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp Products with BEC codes 111, 121, 21, 22, 31, 322, 42 and 53 are intermediate goods.

where, E_{jt} indicates the exchange rate of the currency of j to RMB in the period t. We use the indirect quotation method, i.e., the foreign currency that one unit of RMB can be exchanged for. E_{j0} denotes the exchange rate between the currency of j and RMB in the base period that is set in 2007 in this paper. CPI_t refers to China's consumer price index in the period t (set at 100 for the base period of 2007) and CPI_{jt} the consumer price index for j in the period t (set at 100 for the base period of 2007). w_{ijt} represents the proportion of the amount of intermediate goods imported from the country j to the total amount of intermediate goods imported by the enterprise i in the t period.[1] When companies make production decisions, it is possible that they may involve changes in import countries. This affects the import weights of each country and thus the REER at the enterprise level, leading to the endogeneity problem in the regression (Dai *et al*., 2013; Dai and Xu, 2017; Wang and Lu, 2018). To avoid the possible endogeneity problem, we refer to Wang and Lu (2018). In the benchmark regression, we set w_{ijt} as the mean value of each enterprise in the sample interval. To put it differently, the import share does not change over time. By definition, an increase in $reer_{it}$ indicates that an enterprise is facing an appreciation of the national currency, while a decrease in $reer_{it}$ suggests that an enterprise is facing a depreciation of the REER. The bilateral exchange rate data and the consumer price index used in this paper are obtained from the International Monetary Fund's International Financial Statistics Database. From 2007 to 2011, the mean values of the logarithm of enterprises' REER in the sample were 4.605, 4.692, 4.732, 4.718 and 4.739, respectively. During the period, the REERs of companies in the sample were appreciated by roughly 13.4%. In the regression equation, the REER is taken in logarithmic form.

3.3. China's Factor Market Distortion

Referring to the research by Gao *et al*. (2018), we use the difference between the regional factor market development and the benchmark factor market development as an indicator to measure factor market distortions. This indicator can reflect both the spatial change in factor market distortions and the dynamically temporal characteristics of factor market distortions by region. The formula is as follows:

$$FMD_{pt} = \frac{Max\{factormarket_{pt}\} - factormarket_{pt}}{Max\{factormarket_{pt}\}} \tag{2}$$

where p denotes the province and t the year; FMD_{pt} is the factor market distortion at the

[1] Imported products can be distinguished as imported intermediate goods, capital goods and final goods. In this paper, we focus on the import of intermediate goods. Therefore, when calculating the real effective exchange rate at the company level, we calculate the weights based on the amount of imported intermediate goods.

province level; $factormarket_{pt}$ is the factor marketization index at the province level; $Max\{factormarket_{pt}\}$ denotes the maximum value of the factor marketization index in each province during the sample period.The marketization index of factors is derived from the Marketization Index of China's Provinces by Wang *et al*. (2018). In 2007, the regions with the lowest factor market distortion were Shanghai, Tianjin and Beijing, while those with the highest were Xizang, Xinjiang and Guizhou.

3.4. Proportion of Imported Intermediate Goods

The proportion of imported intermediate goods is defined as the share of the annual amount of imported intermediate goods in that of intermediate goods input by companies. The amount of imported intermediate goods can be calculated from the customs database. The annual amount of intermediate inputs of enterprises can be obtained from the tax survey database. It is worth noting that the amount of imported intermediate goods is denominated in US dollars, while that of intermediate goods inputs is denominated in RMB. We convert the amount of imported intermediate goods into RMB-denominated prices based on the average annual exchange rates of RMB and US dollars.

3.5. Other Variables

The dependent variable in this paper refers to companies' performance. In the regression, we use sales and total factor productivity as measures of their performance. Companies' sales are defined as the logarithm of their revenue, and total factor productivity is estimated using the method of Levinhson and Petrin (2003). The main idea is to use intermediate goods as a proxy variable for productivity and performing a two-stage regression, thus addressing the simultaneity bias that may result directly from the estimation of the OLS method.

Moreover, we control a range of company-level variables in the regression, including export intensity, capital intensity, wages and number of employees. Export intensity is defined as the ratio of a company's exports to revenue for that year. Capital intensity is defined as the division of a company's total fixed assets for that year by the number of employees. Wage is defined as the division of total wages by the number of employees. Capital intensity, wages and number of employees are taken in logarithmic form in the regression equation.

3.6. Descriptive Statistics

Table 1 demonstrates the descriptive statistics of key variables in this paper.

Table 1 Descriptive Statistics of Key Variables

Variable	Number of observations	Mean	Standard deviation	Minimum value	Maximum value
Sales	143490	11.147	1.758	6.773	15.545
Total factor productivity	133269	0.080	0.705	–14.580	6.770
Real effective exchange rate	143490	4.711	0.113	–0.861	5.420
Export intensity	143490	0.495	0.405	0.000	1.000
Capital intensity	143490	4.251	1.505	–0.560	7.875
Wage	143490	3.318	0.707	0.744	5.075
Number of employees	143490	5.278	1.381	0.000	16.653
Proportion of imported intermediate goods	114252	0.294	0.458	0.000	1.000
Factor market distortion	143490	0.314	0.188	0.000	0.829

Note: Sales, REER, total factor productivity, value added, capital intensity, number of employees and wages are taken in logarithmic form. The continuous variables in the table are all winsorized by 1%.

3.7. Regression Equation Setting

To study the impact of exchange rate changes on the performance of import companies and distinguish heterogeneous responses of companies located in regions with different factor market distortions, we set the regression equation as follows:

$$\ln\left(Perform_{it}\right)=\alpha\ln(reer_{it})+\beta\ln(reer_{it})\times FMD_{p}+\delta X_{i,t}+\mu_{i}+\theta_{jt}+\delta_{t}+\varepsilon_{it} \tag{3}$$

Wherein i denotes an enterprise, t the year, and $Perform_{it}$ the enterprise performance index. In the regression equation, we use sales and total factor productivity to represent a company's performance. $reer_{it}$ denotes the company-level REER, and FMD_{p} denotes the provincial factor market distortion indicator. To mitigate the endogeneity problem, we take the factor market distortion for each region at the beginning of the sample (2007). $X_{i,t}$ Enterprise-level control variables include export intensity, capital intensity, enterprises' wages and number of employees. μ_{i} denotes company fixed effects. θ_{jt} denotes the industry (CIC 2-digit code) × year fixed effect. δ_{t} represents year fixed effects. Standard error clustering is at the import enterprise level.

4. Regression Results

4.1. Baseline Results

The table reports this paper's baseline results. Columns (1) and (2) report the regression results when the dependent variable is sales of an enterprise. In column (1), we analyze the relationship between the REER and an enterprise's sales. The results

show that the coefficient of REER is significantly positive at the 10% level. For every 10% appreciation of the REER, corporate sales increase by an average of 0.66%. In considering the median corporate sales of RMB 69 million, a 0.66% increase in sales corresponds to approximately RMB 460000. From the results of control variables, the coefficients of export intensity, capital intensity, enterprise wages and number of employees are significantly positive, indicating that enhancement of such variables significantly contributes to the sales expansion of enterprises.

In column (2), we further examine the effect of heterogeneity in the REER. Specifically, we study the differential impact of the REER on the performance of companies located in regions with different factor market distortions. We include in column (2) a cross term between the REER and the factor market distortion in each province. To mitigate the endogeneity problem, we select factor market distortions for all provinces at the beginning of the sample (2007). The results show that the cross-term coefficient of the REER and the factor market distortion are positive and significant at the 1% level. In other words, the enhancing effect of RMB appreciation on enterprise performance is more pronounced in regions with high factor market distortions. The result is equally significant in an economic sense. Take the coefficients in column (2) as an example. When RMB appreciates by 10%, the sales of companies in a province rise by an average of 1.52% ($-0.105 \times 0.1 + 0.431 \times 0.596 \times 0.1 = 1.52\%$) for the province with factor market distortions in the 90th percentile (factor market distortion = 0.596). For provinces with factor market distortions in the 50th percentile (factor market distortions = 0.317), the sales of enterprises in that province rise by an average of 0.32%. For provinces with factor market distortions in the 10th percentile (factor market distortions = 0.042), the sales of companies in that province fall by an average of 0.87%. This result suggests that the positive impact of RMB appreciation on the sales of enterprises in regions with higher factor market distortions.

Columns (3) and (4) report the regression results when the dependent variable is total factor productivity. The results in column (3) show that the coefficient of REER is significantly positive at the 5% level, indicating that RMB appreciation also contributes to the increased total factor productivity of enterprises. The results in column (4) show that the cross-term coefficient of REER and factor market distortion are also significantly positive, indicating that the effect of RMB appreciation on companies' total factor productivity is stronger in regions with high factor market distortions. Regarding the coefficient of control variables, the coefficients of export intensity, capital intensity and companies' wages are significantly positive, while the coefficient of number of employees is significantly negative.

The results in Table 2 are consistent with expectations. Factor market distortions raise the cost of domestic intermediate goods by reducing the efficiency of resource allocation. Consequently, companies are less likely to purchase domestic intermediate goods and more likely to import them. As such, through the import channel, the effect

of higher REER on higher enterprise performance become stronger in regions with high factor market distortions.

Table 2. Baseline Regression

Dependent variable	(1)	(2)	(3)	(4)
	Enterprise sales		Total factor productivity	
Real effective exchange rate	0.066*	–0.105*	0.066**	–0.076
	(0.035)	(0.058)	(0.033)	(0.051)
Real effective exchange rate × factor market distortion		0.431***		0.363***
		(0.154)		(0.127)
Export intensity	0.034***	0.033***	0.038***	0.037***
	(0.010)	(0.010)	(0.010)	(0.010)
Capital intensity	0.135***	0.135***	0.024***	0.024***
	(0.007)	(0.007)	(0.006)	(0.006)
Wage	0.151***	0.151***	0.073***	0.073***
	(0.005)	(0.005)	(0.005)	(0.005)
Number of employees	0.619***	0.619***	–0.197***	–0.197***
	(0.013)	(0.013)	(0.009)	(0.009)
Company fixed effects	Yes	Yes	Yes	Yes
Industry×year fixed effects	Yes	Yes	Yes	Yes
Number of observations	119020	119020	107219	107219
R-squared	0.972	0.972	0.714	0.714

Note: The table reports the baseline results. All columns in the table control company fixed effects and industry×year fixed effects. Factor market distortion refers to that of each province in 2007, as defined in the variables section. Sales, REER, capital intensity, wages and number of employees are taken as logarithms. Robust standard errors are in parentheses and standard error clustering is at the enterprise level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4.2. Channel Test

In previous regressions, we found that RMB appreciation results in the higher performance of companies and this phenomenon is concentrated in regions with high factor market distortions. According to the previous analysis, one of the channels at play is the effect of domestic factor market distortions on companies' imported intermediate goods decisions: factor market distortions make companies more inclined to use imported intermediate goods by raising the cost of producing domestic intermediate goods. The higher the proportion of imported intermediate goods, the greater the impact of import exchange rate changes on companies' performance. Therefore, through the import channel of intermediate goods, the effect of higher REER on higher enterprise performance is strong in regions with high factor market distortions. This subsection provides an empirical test of the channel.

4.2.1. Factor Market Distortion and Proportion of Imported Intermediate Goods

First, we directly examine the relationship between factor market distortions and the proportion of imported intermediate goods, after controlling industrial and regional characteristics and productivity. If the hypothesis holds, we should observe that the coefficient of factor market distortion is significantly positive, i.e., the proportion of intermediate goods imported by companies is significantly higher in areas with higher factor market distortions.

The regression results are reported in Table 3. Column (1) controls industry fixed effect and year fixed effect and examines the relations between factor market distortions and the proportion of intermediate goods imported by companies. In addition, we further include a dummy variable for SOEs and an indicator for enterprise size to control the effects of enterprise nature and size on the proportion of imported intermediate goods. Company size is defined as the logarithm of the amount of a company's assets. Finally, we also control a series of company-level control variables, including total factor productivity, export intensity, capital intensity, company age and wages. The results unveil that the coefficient of factor market distortion is significantly positive, which supports the hypothesis of this paper. Furthermore, the coefficient on the dummy variable for SOEs is significantly negative. In other words, SOEs have a significantly lower proportion of imported intermediate goods compared with private companies. The coefficient of company size is also significantly negative, i.e., the proportion of imported intermediate goods is significantly higher for small companies compared with large ones. The results in column (1) show that the proportion of imported intermediate goods is indeed significantly higher for enterprises in regions with high factor market distortions, when the characteristics of the industry and enterprises are controlled.

Column (2) controls the effect of the quality of imported intermediate goods. In addition to factor market distortions that can push up the proportion of imported intermediate goods, the difference in the quality of imported and domestic intermediate goods may also lead to that in the proportion of imported intermediate goods. To obtain the quality of imported intermediate goods at the enterprise level, this paper adopts the following approach that referring to the practice of Fan *et al*. (2015), we estimate the product quality of each kind of imported intermediate goods. Product quality is calculated based on the ex-post-facto inverse method. The basic logic is to assume that for two products at the same price, higher demand reflects higher quality of a product. Then, we calculate the company-level weighted average quality of imported intermediate goods by weighted average of imported products. The results show that the coefficient of the quality of intermediate goods imported by companies is significantly positive. This indicates that the higher the quality of imported intermediate goods, the higher the proportion of imported intermediate goods. In the meantime, the coefficient of factor market distortion remains significantly positive after the quality of imported intermediate goods is controlled.

In column (3), we consider the differences between coastal and non-coastal regions. As China's eastern coastal areas are close to ports, a lot of import and export enterprises gather in the areas to cut transportation costs. There may also be significant differences in factor market distortions between coastal and non-coastal areas, which may interfere with the results of this paper. For this reason, we control dummy variables for eastern coastal areas in column (3).[1] If a company is located in eastern coastal areas, the dummy variable takes the value of 1. The data show that about 85% of the samples of import enterprises come from eastern coastal areas. The results suggest that the coefficient of the dummy variable for coastal areas is significantly positive. To put it differently, the proportion of intermediate goods imported by companies in eastern coastal areas is significantly higher, a result that is in line with expectations. After coastal factors are controlled, the coefficient of factor market distortions remains significantly positive and is larger than that in column (1). This suggests that factor market distortions have a greater impact on the proportion of imported intermediate goods after the factor of coastal areas is controlled. The factor of coastal areas does not significantly interfere with the paper's conclusion.

Table 3. Channel Analysis: Factor Market Distortion and Proportion of Imported Intermediate Goods

	(1)	(2)	(3)
Factor market distortions	0.065***	0.056***	0.083***
	(0.010)	(0.010)	(0.011)
Quality of imported intermediate products		0.034***	
		(0.001)	
Dummy variable for eastern coastal areas			0.027***
			(0.005)
Enterprise size	–0.003*	–0.010***	–0.003*
	(0.002)	(0.002)	(0.002)
State-owned enterprises	–0.094***	–0.089***	–0.090***
	(0.004)	(0.004)	(0.004)
Enterprise-level variable	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Number of observations	111302	111302	111302
R-squared	0.185	0.201	0.185

Note: This table reports the results of the channel analysis. The dependent variable in the table refers to the proportion of imported intermediate goods. Enterprise-level variables include total factor productivity, export intensity, capital intensity, enterprise age, and wages. Company size is defined as the logarithm of the amount of a company's assets. Robust standard errors are in parentheses and standard error clustering is at the enterprise level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

[1] The eastern coastal areas include Shandong, Hebei, Tianjin, Liaoning, Jiangsu, Zhejiang, Fujian, Shanghai, Guangdong and Hainan.

The results in Table 3 confirm that the proportion of imported intermediate goods is significantly higher for enterprises in regions with high factor market distortions, after the variables concerning the industry, provinces and enterprises are controlled.

4.2.2. Exchange Rate Changes, Proportion of Imported Intermediate Goods and Enterprise Performance

Table 4 further examines the heterogeneous effects of exchange rate changes on the performance of enterprises with different proportions of imported intermediate goods. If the proportion of imported intermediate goods is indeed responsible for the different impacts of exchange rate changes in factor market distortion areas, we should observe that the impact of import exchange rate changes on enterprise performance is greater for companies with a higher proportion of imported intermediate goods. To test this hypothesis, we calculate the proportion of imported intermediate goods for each enterprise and add the cross term of REER and the proportion of imported intermediate goods to the regression equation. If the proportion of imported intermediate goods is indeed the mechanism behind the benchmark results, we should observe that the cross-term coefficient be significantly positive. In other words, the higher the proportion of imported intermediate goods, the stronger the performance-boosting effect of import exchange rate appreciation for enterprises. To alleviate the endogeneity problem of the proportion of imported intermediate goods, we adopt the following two methods.

First, we use the proportion of intermediate goods imported by each enterprise in the initial period (2007). The indicator does not change over time but can better mitigate the endogeneity of the proportion of imported intermediate goods. The results are reported in column (1) of Table 4. The results demonstrate that the cross term between the REER and the proportion of intermediate goods imported by companies in the initial period is indeed significantly positive. This supports the previous hypothesis that the higher the proportion of imported intermediate goods, the greater the impact of exchange rate changes on enterprise performance. Based on robustness analysis considerations, column (2) further uses the mean value of the proportion of imported intermediate goods during the sample period. The results show that the cross term between the exchange rate and the mean proportion of imported intermediate goods is significantly positive.

Second, referring to the study of Yu (2015), we incorporate into the regression equation the predicted proportion $\widehat{ImRatio}_{it}$ of imported intermediate goods rather than the true proportion of imported intermediate goods. Consistent with Yu (2015), we use changes in tariffs as exogenous shocks to predict the proportion of intermediate goods imported by companies. Specifically, we calculate the weighted average tariff rate at the enterprise level based on the annual tariff for each kind of intermediate goods, with the weight calculated according to the proportion of the amount of each-

kind imported intermediate goods. To mitigate the endogeneity problem, we use the mean weight of companies over the sample period for weighting. In particular, the tariff data is obtained from the WTO tariff database. When the tariff of intermediate goods decreases, the cost of imported intermediate goods falls. It is expected that enterprises may import more intermediate goods, thus increasing the proportion of imported intermediate goods. In addition, We also simultaneously control a range of enterprise-level characteristics with a one-period lag such as total factor productivity, export intensity, capital intensity and wages. Considering the problem of possible sample selectivity bias caused by the proportion of imported intermediate goods, we use the Heckman two-step method for regression analysis. Column (3) reports the regression results using the predicted proportion of imported intermediate goods. The results suggest that the cross term between the REER and the predicted proportion of imported intermediate goods is also significantly positive, thus further supporting the previous hypothesis that the positive impact of the exchange rate on the performance is more pronounced for companies with a high share of imported intermediate goods.

Taken together, the results in Table 3 and Table 4 confirm that the difference in the proportion of imported intermediate goods is important in explaining the benchmark results in this paper. In regions with high factor market distortions, enterprises import a significantly higher proportion of intermediate goods and the import exchange rate has a greater impact on their performance.

Table 4. Exchange Rate Changes, Proportion of Imported Intermediate Goods and Enterprise Performance

	(1)	(2)	(3)
		Enterprise sales	
Real effective exchange rate	0.005 (0.035)	0.018 (0.030)	–0.006 (0.048)
Real effective exchange rate × initial proportion of imported intermediate goods	0.082*** (0.026)		
Real effective exchange rate × mean proportion of imported intermediate goods		0.130* (0.075)	
Real effective exchange rate × predicated proportion of imported intermediate goods			0.075** (0.036)
Predicated proportion of imported intermediate goods			–0.174 (0.187)
Company fixed effects	Yes	Yes	Yes
Industry×year fixed effects	Yes	Yes	Yes
Control variable	Yes	Yes	Yes
Number of observations	111213	111213	51023
R-squared	0.971	0.971	0.981

Note: This table reports the results of the channel analysis. Dependent variables in columns (1)–(3) are sales from companies. The company-level control variables are consistent with those in Table 2. Robust standard errors are in parentheses and standard error clustering is at the enterprise level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4.3. Expansion Test: The Impact of Exchange Rate Changes on Upstream Enterprises

The previous analysis has shown that the national currency appreciation promotes enterprise performance by cutting the cost of imported intermediate goods. However, the national currency appreciation may also cause domestic enterprises to rely excessively on imported intermediate goods, thereby reducing the use of domestic intermediate goods. If this hypothesis holds, then the national currency appreciation may worsen the performance of domestic upstream enterprises that provide intermediate goods. To verify whether this phenomenon exists, we include domestic production networks in our empirical analysis and examine how exchange rate changes faced by downstream enterprises affect upstream enterprise performance. Referring to Liu and Wang (2020), we define the exchange rate change faced by an upstream enterprise as the weighted average of the exchange rate changes faced by each downstream industry of that enterprise, where the weight is the proportion of intermediate goods in each (upstream) industry that are allocated to each downstream industry.[1]

Specifically, we first measured the change in the REER by industry (CIC-4 digit). The REER at the industry level is defined as the average of the REERs (logarithm) of all companies in the industry. Based on the input-output table, we can measure the proportion of intermediate goods from each (upstream) industry that are allocated to each other industry. The higher the proportion, the more intermediate goods are allocated to the downstream industry, and the greater the impact of REER changes faced by that downstream industry on enterprises in that upstream industry. By using the allocation ratio as a weight, we calculate the (downstream) changes of REER faced by each upstream industry based on the REER of each downstream industry. The changes are defined as the weighted average of REER of each downstream industry that has a production network association with that upstream industry.

Table 5 demonstrates the impact of exchange rate changes on the performance of upstream companies. The core explanatory variable is the downstream exchange rate. In accordance with the previous analysis, the downstream exchange rate faced by each enterprise is the weighted average of REERs of each downstream industry of that enterprise's sector, where the weight is the share of intermediate goods produced by the industry that are allocated to each downstream industry. If our previous hypothesis holds that the national currency appreciation causes downstream industries to be overly dependent on imported intermediate goods, which in turn reduces the demand for intermediate goods from upstream companies and depresses the performance of upstream companies, then we should observe a significantly negative downstream exchange rate coefficient.

We use sales, profitability, value added and total factor productivity to measure

[1] "Upstream" is a relative concept corresponding to the "input-output" relationship in the input-output table rather than the concept of "upstreamness" mentioned in the literature.

enterprise performance. The results in Table 5 show that the downstream exchange rate coefficients are all significantly positive. When the downstream exchange rate increases, the performance of upstream companies improves, as evidenced by sales expansion, increased profitability, and significant increases in value added and total factor productivity. The economic intuition is that the national currency appreciation first promotes improved enterprise performance by reducing the cost of imported intermediate goods. The improved performance of downstream companies spills over to upstream industries through production network effects (Barrot and Sauvagnat, 2016), which in turn improves the performance of enterprises in upstream industries.

Table 5. Impact of Exchange Rate Changes on the Performance of Upstream Companies

	(1) Sales	(2) Profit margin	(3) Value added	(4) Total factor productivity
Downstream exchange rate	1.235***	0.298**	10.968**	3.002***
	(0.387)	(0.122)	(4.639)	(0.385)
Export intensity	0.022*	0.003	0.307***	0.030**
	(0.012)	(0.004)	(0.057)	(0.012)
Capital intensity	–0.073***	–0.013***	–0.105***	0.090***
	(0.007)	(0.002)	(0.029)	(0.008)
Company age	0.376***	0.042***	0.429***	0.062***
	(0.017)	(0.005)	(0.086)	(0.015)
Wage	0.103***	0.011***	0.243***	0.089***
	(0.005)	(0.001)	(0.030)	(0.005)
Company fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	107444	107337	92357	96110
R-squared	0.966	0.663	0.661	0.712

Note: The table reports the impact of exchange rate changes in downstream industries on the performance of upstream companies. All columns in the table control for company fixed effects and year fixed effects. In the regression equation, sales, value added and total factor productivity are taken in logarithmic form. The downstream exchange rate is defined as the weighted average of REERs of each downstream industry in an enterprise's industry, where the weight is the proportion of intermediate goods produced by the industry that are allocated to each downstream industry. The distribution ratio of intermediate goods is calculated according to the WIOD input-output table. Robust standard errors are in parentheses and standard error clustering is at the enterprise level. *, **, and *** indicate significance at the 10%, 5% and 1% levels, respectively.

5. Conclusion

Based on the matched data between China's tax survey and customs data from 2007 to 2011, this paper investigates the role of domestic factor market distortions in explaining the impact of import exchange rates on enterprise performance. The

results show that import companies with high domestic factor market distortions are more affected by the RMB exchange rate changes. According to the channel analysis, the effect of domestic factor market distortions on companies' import behavior of intermediate goods is an important explanation for the correlation between domestic factor market distortion, import exchange rate and enterprise performance. Based on the further analysis, the RMB appreciation does not cause China's manufacturing companies to be overly dependent on imported intermediate goods, but instead promotes the performance of China's upstream suppliers of intermediate goods by improving the performance of downstream companies.

This paper has the following policy implications. First of all, domestic factor market distortion may push up the cost of domestic intermediate goods, so we should continue to vigorously promote the market allocation of factors. Enterprises of all types of ownership can have equal access to factors through competition and other market means, leaving more room for themselves to choose independently. They can enhance the competitiveness of domestic intermediate goods and manufacturing enterprises. Second, the import behavior of intermediate goods by China's manufacturing enterprises is common. When the impact of exchange rate marketization is assessed, the effect of exchange rate on the performance of manufacturing enterprises by affecting the cost of imported intermediate goods needs to be covered. Finally, the national currency appreciation may not cause downstream enterprises to be overly dependent on imported intermediate goods. A moderate appreciation may instead promote the expansion of upstream enterprises' output through channels such as the improvement of downstream enterprises' performance.

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