



Research article

Impacts of the financialization of manufacturing enterprises on total factor productivity: empirical examination from China's listed companies

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Abstract: This paper examines the effects and mechanism of the financialization of manufacturing enterprises on total factor productivity (TFP). Thus, it provides evidence of the economic consequences of corporate financialization from the perspective of productivity. Using the panel data of China's listed manufacturing companies from 2007 to 2018, the level of corporate financialization is measured using the proportion of financial assets in the total assets. The results show that the deepening of the financialization of manufacturing enterprises significantly reduces TFP and the magnitude of the impacts of different types of financial assets variates. In addition, the effects of corporate financialization on TFP are heterogeneous in terms of their significance and degrees in different types of enterprises as well as in different levels of enterprises' TFP. The further analysis of the influencing mechanism shows that corporate financialization has different effects on the TFP of manufacturing enterprises through technological innovation and resource allocation efficiency.

Keywords: corporate financialization; manufacturing enterprises; total factor productivity; heterogeneous effect; influencing mechanism

JEL Codes: D21, D24, G31, G38

1. Introduction

Identifying the relationship between financialization of manufacturing enterprises and TFP is an important part of understanding the economic consequences of financialization at the micro-level. The process of economic financialization of developed countries such as the United States and the United Kingdom accelerates and expands globally from the late 1970s (Krippner, 2005; Stockhammer, 2010; Radzievska, 2016). At present, financialization appears in many developing countries (Bonizzi, 2013; Cibils and Allami, 2013; Karacimen, 2014; Tripathy, 2019; Xu et al., 2020). As the world's largest developing country, China's economy has become increasingly monetized and financialized in recent years (Wang, 2015; Sun, 2018). At the micro level, with the continuous development of the financial market (Qamruzzaman and Wei, 2019), more and more Chinese manufacturing companies transfer funds from production and operation to the financial market to obtain higher returns. It leads to the deepening of the degree of financialization of China's manufacturing companies (Chen, 2015; Lu et al., 2017). The acceleration of the financialization process of manufacturing enterprises will inevitably have corresponding economic consequences. Particularly, Krugman (1995) points out that "Productivity isn't everything, but in the long run it is almost everything", which suggests that the improvement of enterprise's TFP is the key to the long-term sustainable development of a country's economy or industry. China's manufacturing industry mainly relies on the factor inputs to achieve rapid development. Thus, it is particularly necessary to increase corporate productivity to accelerate the transformation of its extensive growth mode and to achieve high-quality development (Islam et al., 2006; Jin et al., 2018). Theoretically, the financialization of manufacturing enterprises has an important impact on TFP, mainly by the technological innovation and the resource allocation efficiency. In this context, it is of great necessity to conduct empirical studies on the impact of financialization of manufacturing enterprises on TFP.

However, there are few studies paying attention to the productivity effect of corporate financialization. Existing literature mainly focuses on investigating the economic consequences of financialization of non-financial enterprises or manufacturing enterprises from the aspects of the industrial investment (Orhangazi et al., 2008; Demir, 2009a; Kliman et al., 2015; Seo et al., 2016; Davis, 2018; Tori et al., 2018; Consolandi et al., 2019; Zheng et al., 2019) and the profitability (Demir, 2009b). Also, the research conclusions on the economic consequences of corporate financialization do not reach consensus. Taking the effect of corporate financialization on industrial investment as an example¹, many studies show that the financialization of non-financial or manufacturing enterprises has a significant "crowding out" effect on the level of industrial investment. Tori and Onaran (2018) takes the non-financial listed companies in the United Kingdom from 1985 to 2013 as the research object and finds that the deepening of corporate financialization leads to low physical investment. Based on the data of listed manufacturing companies from 2002 to 2017 in the United States, Cupertino et al. (2019) also finds a significant negative correlation between corporate financialization and the level of industrial investment. In the cases of developing countries, Demir (2009a) and Zheng et al. (2019) reach similar conclusions based on the data of real sector firms in Argentina, Mexico and Turkey, and data of China's listed companies in manufacturing industry respectively. However, the empirical results of Orhangazi (2008) shows that the financialization of non-financial companies in the United States has a significantly negative impact on the real capital accumulation of large companies, but it is insignificant for small companies.

¹At present, literature about the influence of corporate financialization mostly focuses on industrial investment.

Seo et al. (2016) takes the manufacturing listed companies in South Korea from 1990 to 2010 as an analysis sample and finds that the impact of corporate financialization on industrial investment is not statistically significant. Kliman and Williams (2015) also points out that the financialization of non-financial companies in the United States do not lead to a decline in physical investment. In addition, based on the data of non-financial listed companies in the United States from 1971 to 2013, Davis (2018) finds that the stock of financial assets does not have a “crowding out” effect on corporate investment, but shows a significant promotion effect.

The relatively complex conclusions of economic consequences of financialization of non-financial or manufacturing companies from the existing empirical literature can be more deeply understood from two aspects. On the one hand, it is necessary to comprehensively investigate the heterogeneity of the economic consequences of corporate financialization. Because different types of enterprises (for example, enterprises of different ownership types, different sizes and different industries with various technological levels, etc.) have differences in the motivation of financialization, financing constraints, and the external development environment and economic consequences of financialization may also differentiate. The existing literature basically examines the heterogeneity of the economic consequences of corporate financialization from the perspective of the difference in enterprise size (Orhangazi, 2008; Davis, 2018; Zheng et al., 2019), and it is of great necessity to analyze the heterogeneous effects from other aspects. On the other hand, the influencing mechanism of the economic consequences related to corporate financialization is another important issue deserving special attention. Through the investigation of the influencing mechanism, we can more clearly understand the impact channels of the economic consequences of corporate financialization, but there are few empirical studies paying attention to this issue.

In this paper, we use the data of China’s listed manufacturing companies to examine the effect and mechanism of the corporate financialization on TFP, and evaluate the economic consequences from the perspective of productivity. We regard TFP as the empirical focus mainly based on the following considerations. On one hand, since the core of a business organization is its operational function (i.e., the process of transforming inputs into outputs), productivity which captures the efficiency is an important indicator of firm performance (Palia et al., 1999; Sheu, 2006). Therefore, in order to comprehensively evaluate the economic consequences of financialization at the micro-level, special attention should be paid to productivity. On the other hand, the role of productivity in firm performance is of fundamental importance to the economy of developed countries (Palia et al., 1999). Increasing the TFP level of enterprises is also a key breakthrough for developing countries, like China, to achieve industrial upgrading and long-term sustainable development. Thus, analyzing the productivity effect of corporate financialization has important policy implications.

The contribution of this paper is as follows. First, it provides evidence of the economic consequences of the financialization of manufacturing enterprises from the perspective of productivity. Existing literature mainly focuses on the impact of corporate financialization on the indicators such as industrial investment and profitability, this paper expands the understanding of economic consequences of corporate financialization by examining its effect on TFP. Second, this paper comprehensively analyzes the heterogeneity of the productivity effects of manufacturing enterprises’ financialization. Besides the full-sample analysis, this study conducts the sub-sample comparative analysis of the productivity effects of corporate financialization based on the ownership type, the enterprise size, the industry and regional differences. In addition, the current study investigates the difference in the effect of corporate financialization at different TFP levels of enterprises by panel quantile regression model. Third, this paper analyzes the influencing mechanism of the financialization of manufacturing enterprises

on TFP. We examine the influencing mechanism of the financialization of manufacturing enterprises on TFP from two ways of technological innovation and resource allocation efficiency, which provides an in-depth understanding of the effect of corporate financialization on TFP.

The results of this paper show that increases in the level of financialization of China's manufacturing enterprises significantly reduces the TFP. However, the effects of corporate financialization differ among enterprises of different ownership types, sizes, industries and regions, as well as enterprises with different TFP levels. In the analysis of the influencing mechanism of corporate financialization on the TFP, we find that financialization has no significant impact on the resource allocation efficiency of manufacturing enterprises, but significantly inhibits the enterprises' technological innovation.

The remainder of this paper is structured as follows. Section 2 makes a theoretical analysis on the impact of financialization of manufacturing enterprise on TFP. Section 3 focuses on investigating the impact of financialization of manufacturing enterprises on TFP. In Section 4, we further examine the heterogeneous effect of corporate financialization on TFP from the perspective of the differences in enterprise types and TFP levels. Section 5 analyzes the influencing mechanism of financialization of manufacturing enterprises on TFP. Section 6 concludes this paper. The logical framework of this study is presented in Figure 1.

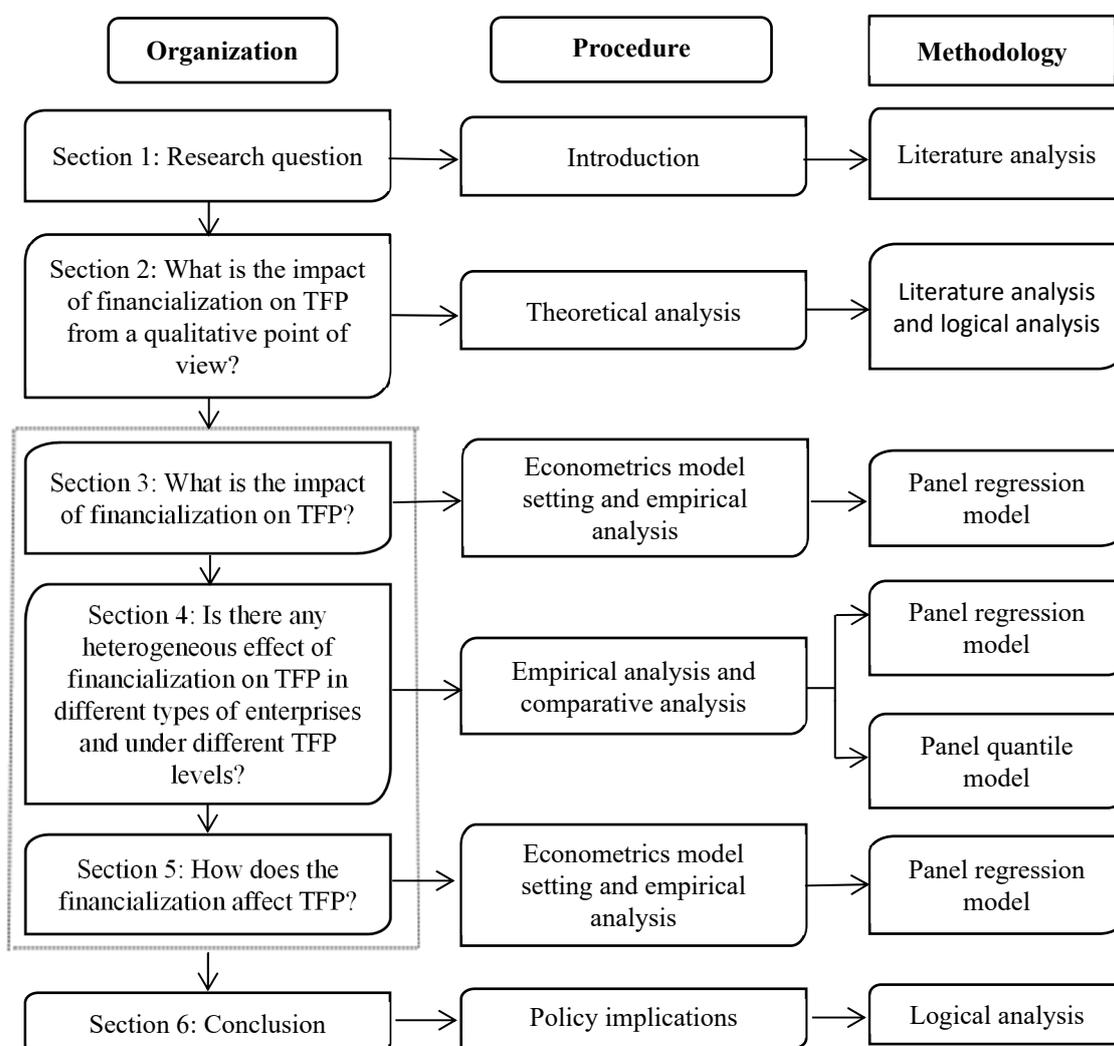


Figure 1. The logical framework of the study.

2. Theoretical analysis of the effect of financialization of manufacturing enterprises on TFP

From the perspective of the influencing mechanism, the improvement of TFP of manufacturing enterprises mainly depends on technological progress and the improvement of resource allocation efficiency (Hsieh and Klenow, 2009). Therefore, we discuss the impact of the financialization of manufacturing companies on TFP in two ways, technological innovation and resource allocation efficiency.

2.1. Corporate financialization and technological innovation

An enterprise's investment in innovation funds is the basis for its technological innovation activities. Technological innovation has the characteristics of long cycle, large capital demand and positive spillover effect (Holmström, 1989). Manufacturing enterprises usually face the difficulties of high risks and asymmetric information (Cooper et al., 1987) when conducting technological innovation activities. It results in the phenomenon of "difficulty in financing". Therefore, the innovation activities of enterprises mainly rely on internal financing (Hall, 2002). Hall (2005) also finds that when enterprises use internal funds for R&D activities, they face two problems, that is, internal financial instability and high adjustment costs for innovation activities.

Financial development can alleviate the problem of insufficient investment in technological innovation due to financing constraints. As an important part of financial development, financialization has an important impact on corporate innovation activities (Lapavitsas, 2013; Sawyer, 2013). A large number of theoretical and empirical studies prove that financialization greatly expands the channels of corporate capital sources and enhances the financing capabilities of enterprises (Bonfiglioli, 2008; Gehringer, 2013). According to the endogenous growth theory, capital is an endogenous variable of technological innovation, and the increase in the level of financialization helps to improve the technological innovation capacity of enterprises (Ang, 2010; Arizala et al., 2013).

Nevertheless, excessive financialization of enterprise brings about changes in production mode, shifting from non-financial business operations to financial asset investment (Orhangazi, 2008; Kliman et al., 2015; Kotz, 2009). This in turn weakens the foundation of technological innovation of enterprises. Internally, due to the decline in the profit of the main business of the manufacturing industry, the willingness of enterprises to withdraw industrial capital for financial investment increases, which further reduces the willingness and ability of enterprises to invest in technological innovation. Externally, with the downward trend of the threshold for the conversion of industrial capital to financial capital, financial capital is increasingly drawing industrial profits, which further prevents companies from investing in factories and equipment (Hudson, 2010; Monaghan et al., 2012). In addition, corporate financialization also affects the corporate governance structure, and further weakens the incentives of companies for technological innovation. Financialization leads to a large number of cross-shareholdings and participation of institutional investors, making the company's investment decisions increasingly affected by the preferences of external groups (Cetina et al., 2012) and increasingly subjected to the liquidity requirements of assets (Moreira et al., 2010). We can see that the salaries of employees, especially senior managers, are increasingly decoupled from their long-term performance and have a closer relationship with the short-term price fluctuations of stock (Rossman et al., 2006; Montgomerie, 2008). Using the data of non-financial listed companies in South Korea from 1994 to 2009, Seo et al. (2012) finds that corporate financialization has a significant negative impact on the R&D investment of non-financial companies.

Previous literatures show that the financialization of manufacturing enterprises has positive and negative effects on technological innovation. The overall impact of financialization of China's manufacturing companies on TFP via technological innovation is complex in theory. Thus, we need further conduct empirical study.

2.2. Corporate financialization and resource allocation efficiency

From the perspective of macro economy, one of the important functions of the financial system is resource allocation (Levine, 2004). Beck and Levine (2002), Qamruzzaman and Wei (2018) find that there is a positive relationship between financial development and capital allocation efficiency. When financial development matches economic growth, the financial system can play a role in optimizing resource allocation and increasing investment efficiency. If financial development is excessive, the financial system absorbs too many resources and restricts the development of other industries. Furthermore, a problem of resource misallocation may appear, which reduces the output efficiency of the real economy and negatively affects economic growth (Gregorio et al., 1995; Baum et al., 2006). From the perspective of micro economy, the financialization of manufacturing companies also has both positive and negative effects on resource allocation efficiency under different conditions.

On the one hand, investing in financial assets can effectively improve the resource allocation efficiency. To meet the needs of daily business activities and to avoid payment crises, companies usually hold a certain amount of cash (Baum et al., 2006). As cash is the most liquid asset among financial assets, it has the lowest profit margins. Thus, excessive cash holding reduces the profitability of funds (Doepke et al., 2006; Frésard, 2010). Financial assets, especially short-term financial assets, have the advantages of high liquidity and low conversion costs, which can be almost equivalent to cash. When a company faces financing constraints, it can sell a certain amount of financial assets to quickly realize cash to meet the capital needs. In addition, financial assets have excess returns (Borensztein et al., 1987) and lower opportunity cost compared with cash assets. Therefore, the allocation of financial assets by enterprises can realize capital preservation and appreciation, and improve the resource allocation efficiency. Additionally, the allocation of financial assets by enterprises may also put pressure on operation, which in turn prompts managers to reconsider the allocation of production factors, such as reducing the scale of excessive investment, reducing redundant resources and streamlining administrative and operational processes.

On the other hand, if an enterprise invests in financial assets for arbitrage purposes, it adversely affects the resource allocation efficiency. Specifically, due to limit of the funds, investment in financial assets correspondingly reduces investment in innovation activities, fixed assets, etc. Then, it further shrinks the enterprise size and leads to an increase in the unemployment rate and the waste of production resources, thereby reducing the resource allocation efficiency (Tabb, 2016; Mohamed, 2016). In addition, as the degree of corporate financialization deepens, the demand for financial talent increases and the demand for production talent decreases, which in turn leads to a labor mismatch.

To sum up, the financialization of manufacturing enterprises has both “reservoir” and “crowding out” effects on technological innovation and resource allocation efficiency (see Figure 2). The “reservoir” effect manifests itself in easing financing constraints, increasing operating income and reducing excessive investment. The “crowding out” effect manifests itself in “crowding out” innovation resources, weakening R&D motivation and reducing the efficiency of labor and capital allocation. Obviously, the overall effect of financialization of manufacturing enterprises on TFP is not clear in theory. In the

following context, we will attempt to conduct the empirical studies to comprehensively investigate the impact of financialization of manufacturing enterprises on TFP in China.

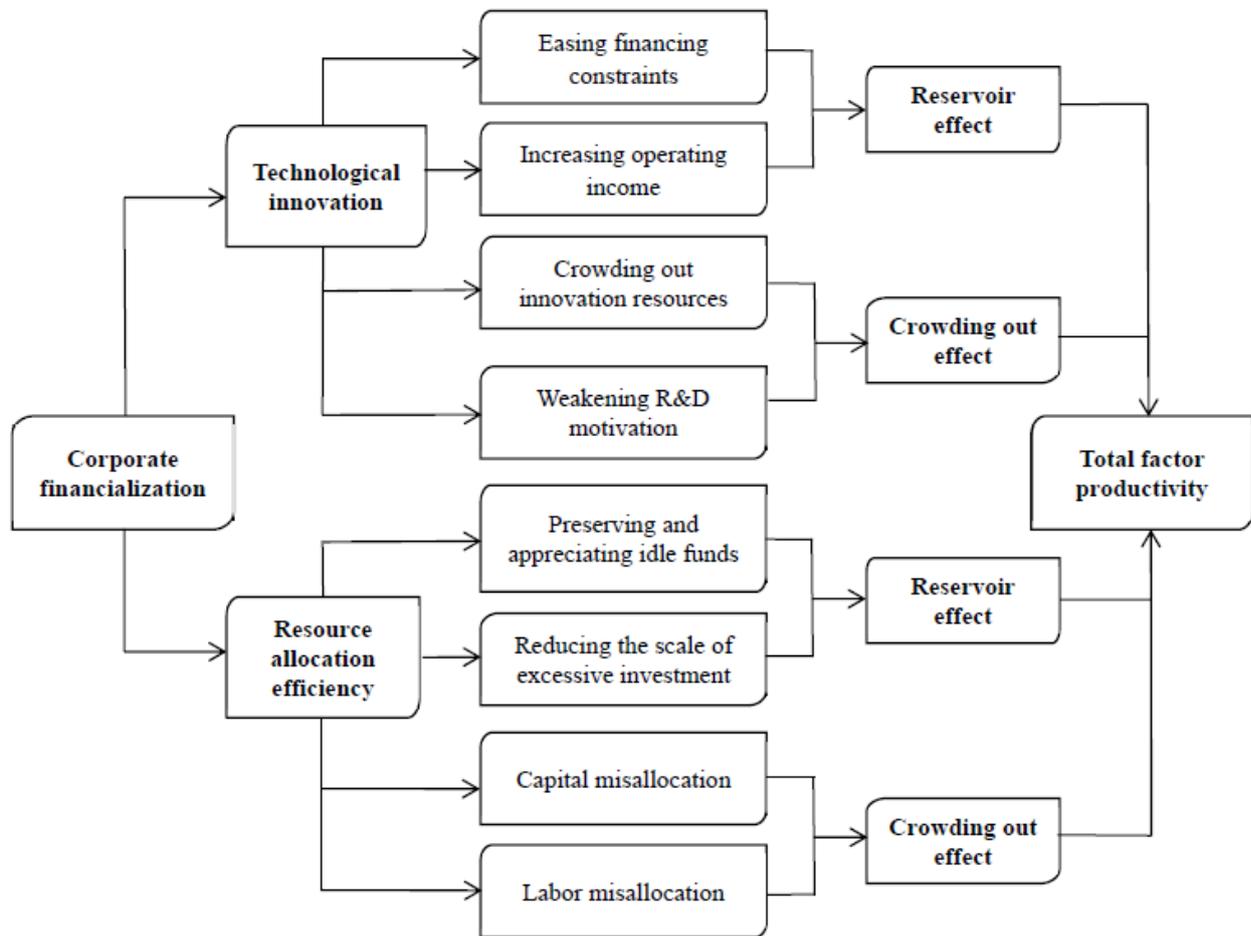


Figure 2. Influencing mechanism of the effect of corporate financialization on TFP.

3. Empirical analysis of the effect of financialization of manufacturing enterprise on TFP

3.1. Model specifications

In order to verify the effect of financialization of China's listed manufacturing companies on TFP, the econometrics model is formulated in Equation (1).

$$TFP_{it} = \beta_0 + \beta_1 Fin_{it} + \beta_2 Size_{it} + \beta_3 CS_{it} + \beta_4 CI_{it} + \beta_5 GA_{it} + \beta_6 Inno_{it} + \beta_7 OC_{it} + \beta_8 Age_{it} + \beta_9 Age_{it}^2 + \eta_t + \gamma_i + \varepsilon_{it} \quad (1)$$

where TFP_{it} represents the TFP level for company i and year t , Fin is the degree of corporate financialization measured by the ratio of corporate financial assets to total assets. We incorporate a set of variables, including firm size ($Size$), capital structure (CS), capital intensity (CI), growth ability (GA), innovation capacity ($Inno$), ownership concentration (OC) and firm age (Age). η and γ are included in the model specification to control the time effect and firm individual effect respectively. ε is the error term.

To identify whether there is a difference in the impact of different types of financial asset holdings on the TFP, we also use the proportion of short-term and long-term financial assets to the total assets as explanatory variables in the regression analysis. The econometrics model is shown as follows:

$$TFP_{it} = \beta_0 + \beta_{11}Fins_{it} + \beta_{12}Finl_{it} + \beta_2Size_{it} + \beta_3CS_{it} + \beta_4CI_{it} + \beta_5GA_{it} + \beta_6Inno_{it} + \beta_7OC_{it} + \beta_8Age_{it} + \beta_9Age_{it}^2 + \eta_t + \gamma_i + \varepsilon_{it} \quad (2)$$

where *Fins* and *Finl* are the proportion of short-term and long-term financial assets in the total assets respectively.

As discussed in Section 2, the financialization of manufacturing companies has both positive and negative effects on TFP. Some studies believe that moderate financialization of manufacturing companies should be beneficial to their production and operation, but excessive financialization may have a negative impact (Shibai, 2010; Lu, 2019). To verify the possible nonlinear relationship between the two, we further introduce the quadratic term of corporate financialization (Fin^2) to set the following regression model:

$$TFP_{it} = \beta_0 + \beta_{11}Fin_{it} + \beta_{12}Fin_{it}^2 + \beta_2Size_{it} + \beta_3CS_{it} + \beta_4CI_{it} + \beta_5GA_{it} + \beta_6Inno_{it} + \beta_7OC_{it} + \beta_8Age_{it} + \beta_9Age_{it}^2 + \eta_t + \gamma_i + \varepsilon_{it} \quad (3)$$

3.2. Data and variable

3.2.1. Data

Due to the sound financial information disclosure system of listed companies, we can obtain detailed information on financial assets and other indicators. In the research of non-financial or manufacturing corporate financialization related issues, many literatures choose listed companies as the research object (Zheng et al., 2019; Seo et al., 2012; Song et al., 2015). In this paper, we selected manufacturing companies listed on the China's A-share market from 2007 to 2018 as the research focus. The data was collected from the China Stock Market & Accounting Research (CSMAR) database. China's Ministry of Finance issued new accounting standards in 2006 and implemented them in listed companies starting from January 1, 2007. Therefore, using 2007 as the starting year can ensure the consistency of data.

To ensure the effectiveness of the empirical results, we excluded: (1) companies that were delisted or were Special Treatment (ST) or Special Treatment with Significant Delisting Risk (*ST) between 2007 and 2018 (Zhu et al., 2012); (2) companies with negative financial assets, operating income, net value of fixed assets, total assets, purchase of commodities and payment of labor expenses, or payable employee compensation less than or equal to 0 (Zhu et al., 2016); companies with fewer than 8 employees because companies with less than 8 employees are considered lack of a reliable accounting system; (3) the unreasonable data, such as ratio of corporate financial assets to total assets greater than 1, asset-liability ratio greater than 1, etc.; (4) companies with data less than or equal to 2 years.

Finally, we obtain 13971 observations from 1647 companies, which constitutes an unbalanced panel data. To minimize the influence of outliers, we winsorize continuous variables other than the enterprise age at 1% and 99%.

3.2.2. Variable measurements

Dependent variable

The dependent variable in this paper is the TFP which cannot be obtained directly, and it needs to be estimated through the production function. Consider the following Cobb-Douglas production function:

$$Y_{it} = A_{it} L_{it}^{\alpha} K_{it}^{\beta} \quad (4)$$

where Y , A , L , and K represent output, TFP, labor input, and capital input respectively. We take the logarithm of the both sides of (4) and get the following linear form:

$$\ln Y_{it} = \alpha \ln L_{it} + \beta \ln K_{it} + \varepsilon_{it} \quad (5)$$

In the calculation of TFP, the classic method is to estimate by the least square method with (5), and use the residual term as the estimated value of TFP. However, this method leads to simultaneity bias and sample selection bias. Therefore, Olley and Pakes (1992), and Levinsohn and Petrin (2003) propose the OP method and LP method respectively to use investment and intermediate inputs as proxy variables for unobserved productivity and estimate the production function in two stages, which solves the above problems to some extent. Therefore, these two methods are widely used in the measurement of TFP (Kasahara et al., 2008; Dai et al., 2017; Zhang et al., 2017; Morris, 2018). In recent years, more and more literature proposes that the OP method and the LP method may have collinearity issues and heteroscedasticity problems (Ackerberg et al., 2015; Tsionas et al., 2019). Later, Ackerberg et al. (2015) developed the ACF method to improve the OP and LP methods, but the estimation result of the ACF method is highly dependent on the selection of the initial value in the estimation process (Mollisi et al., 2018). Wooldridge (2009) uses the GMM method to replace the two-stage estimation method, which not only improves the estimation efficiency, but also effectively solves the problems of collinearity and heteroscedasticity. However, the Wooldridge method uses the lagged value of the variable as an instrumental variable to lose a large number of observations, especially in the estimation of short panel data. Therefore, Mollisi and Rovigatti (2018) developed the MrEst method, using the dynamic panel model with an instrument variable proposed by Blundell and Bond (1998) under the framework of Wooldridge. This new estimator proves to be consistent and to perform better than Wooldridge's as the number of individuals increases. Considering the "large N, small T" panel datasets are analyzed in this paper, we employ the MrEst method to measure the TFP of China's A-share listed manufacturing companies². To ensure the robustness of the empirical results, we also use the TFP measured by the OP and LP methods to conduct a robustness test.

Table 1 shows the indicators involved in measuring the TFP of China's manufacturing companies using the MrEst method. We use the companies' main business income to measure the output. This indicator does not consider non-operating income and other business income, and thus can measure the income generation capacity of the enterprises' main business. The net fixed assets is used to measure the capital input. Labor input is reflected in the payroll payable, since this indicator can better reflect the differences in human capital costs among different companies compared with the number

²In Stata, command *prodest* provided by Mollisi and Rovigatti (2018) allows the MrEst estimation for production function.

of employees commonly used in existing literature (Sterlacchini, 1989; Sulaiman, 2012). Intermediate input is measured by cash payment for goods and labor services. To ensure the comparability of the data, we use the producer price index (PPI) for industrial products to deflate each year's main business income of manufacturing enterprises, the price indices of investment in fixed assets to deflate the net fixed asset value of each year, and the consumer price index (CPI) to deflate labor input and intermediate input. The indicators are measured at the constant price of 2007.

Table 1. Main variables related to the calculation of TFP.

Variable	Notation	Definitions and explanations
Output	Y	Main business income
Capital input	K	Net fixed assets (Fixed assets after depreciation and impairment)
Labor input	L	Payroll payable
Intermediate input	INT	Cash payment for goods and labor services

Core independent variable

Existing literature measures the degree of corporate financialization from two main perspectives, that is, financial asset holdings and financial returns. However, financial return can be easily affected by various factors such as the macroeconomic environment. Since investment in financial assets can be independently selected by the enterprise, it can more objectively and stably reflect the degree of corporate financialization from the perspective of motivation. Therefore, referring to the practice of Song and Yang (2015), we classify the following nine subjects into financial assets according to the division of corporate balance sheets, that is, trading financial assets, net short-term investment, available-for-sale financial assets, loans and payments on behalf, derivative financial assets, entrusted loans, financial products, trust products, held-to-maturity investment, investment property, long-term debt investment, and long-term equity investment in financial institutions. The degree of corporate financialization is measured by the proportion of financial assets in total assets. In addition, we also use the return of financial assets as a proxy variable for the degree of corporate financialization to conduct a robustness analysis to ensure the robustness of the empirical results.

Control variables

With reference to relevant literature, the control variables selected in this paper include company size, capital structure, capital intensity, growth ability, innovation capacity, ownership concentration and firm age.

Company size (*Size*): In theory, as the size increases, the company can achieve economies of scale and has certain advantages in terms of production costs and management costs. In addition, larger enterprises can often invest more in R&D, which is conducive to improving the TFP. In this paper, the logarithmic value of firms' total assets is used to measure company size (Li et al., 2020).

Capital structure (*CS*): The capital structure is regarded as an important factor affecting TFP and always expressed by the asset-liability ratio. Specifically, there is a theoretically negative relationship between the asset-liability ratio and TFP (Pushner, 1995; Pozzolo et al., 2005). The higher the asset-liability ratio, the greater the financial risk of the enterprise and the more likely that the enterprise faces difficulty in raising funds. This fact may lead to a negative impact on the TFP.

Capital Intensity (CI): Enterprises with higher capital intensity in China are basically from monopolistic industries. They may lack the motivation for technological innovation due to the monopoly profits. Therefore, it is expected that capital intensity affects negatively to the TFP. The capital intensity is expressed by the logarithm of the ratio of fixed assets to the number of employees.

Growth ability (GA): It is generally believed that companies with higher growth ability have more investment opportunities, thereby increasing the level of TFP. Palia and Lichtenberg (1999) find that there is a significant positive correlation between the growth ability and the TFP. The growth ability of an enterprise is measured by Tobin Q, which is expressed by the ratio of the market value of the enterprise to the replacement cost of assets. The specific measurement method is shown in Table 2.

Innovation capacity (Inno): Technological innovation can optimize the input of production factors by so-called “innovation effect” and “learning effect”, and further improve the TFP. Considering most existing research practices (Pavitt, 1982; Love et al., 1999) and the fact that R&D expenditure is required to disclose compulsorily for listed companies in China with high-quality data, we use R&D expenditure of the company to reflect its technological innovation ability. Since the R&D expenditure of a firm may be 0, we follow Stucki and Martin (2019) to express it as the logarithmic value of R&D expenditure plus 1.

Ownership concentration (OC): Ownership concentration, reflecting whether the company’s shareholding is more concentrated or dispersed, can affect TFP by corporate governance. Generally, the higher the concentration, the stronger the internal supervision of the company, thereby improving the management’s investment efficiency and promoting the improvement of TFP. The ownership concentration is reflected by the sum of shareholding ratio of top 10 shareholders.

Firm age (Age): General, enterprises with short establishment time are more likely to face the problems of shortage of funds and difficulty in financing, while enterprises with longer establishment time have a sound financing system and are more capable of investing in R&D activities and further improve the TFP. However, companies with a short establishment time may be more willing to purchase advanced equipment and introduce talents, and thus may have a higher level of the TFP. Therefore, we also introduce the quadratic term of enterprise age to test the possible non-linear relationship between the firm age and TFP.

The definition of all the variables are shown in Table 2:

Table 2. Definition of variables.

Variable category	Variable name	Variable definition
Dependent variable	Total factor productivity (<i>TFP</i>)	Calculated by the MrEst method (Mollisi and Rovigatti, 2018)
	Degree of financialization (<i>Fin</i>)	Financial assets/total assets
Core independent variable	Proportion of short-term financial assets (<i>Fins</i>)	Short-term financial assets/total assets
	Proportion of long-term financial assets (<i>Finl</i>)	Long-term financial assets/total assets
	Enterprise size (<i>Size</i>)	Ln (total assets)
	Capital structure (<i>CS</i>)	Asset-liability ratio
Control variables	Capital intensity (<i>CI</i>)	Ln (Fixed assets / number of employees)
	Growth ability (<i>GA</i>)	(Total debt + tradable stock market value + number of non-tradable shares * net assets per share)/total assets
	Innovation capacity (<i>Inno</i>)	ln (R&D expenditure + 1)
	Ownership concentration (<i>OC</i>)	Sum of the ratio of top 10 shareholders' shareholding
	Firm age (<i>Age</i>)	Sample year minus year of establishment + 1

3.2.3. Descriptive statistics

Table 3 reports the descriptive statistical results of the main variables in this paper. According to the descriptive statistical results, the minimum value of TFP of China's manufacturing enterprises is 4.36 and the maximum value is 6.16, and its distribution is right-skewed. There are large differences in the degree of financialization among enterprises. Some companies do not hold financial assets, while the highest value of the proportion of financial assets reaches 51%. The mean and median of *Fin* are 6% and 2% respectively, indicating that there are not many companies that hold an extremely high proportion of financial assets, and the ratio of most companies is less than 6%.

Table 3. Descriptive statistics of main variables.

Variables	Median	Mean	SD	Max	Min
<i>TFP</i>	5.09	5.13	0.36	6.16	4.36
<i>Fin</i>	0.02	0.06	0.10	0.51	0.00
<i>Fins</i>	0.00	0.03	0.07	0.35	0.00
<i>Finl</i>	0.01	0.03	0.06	0.39	0.00
<i>Size</i>	21.72	21.86	1.14	25.31	19.81
<i>CS</i>	0.38	0.39	0.19	0.80	0.05
<i>CI</i>	13.60	13.60	0.76	15.47	11.74
<i>GA</i>	1.68	2.04	1.15	7.23	0.86
<i>Inno</i>	17.46	15.27	6.27	21.39	0.00
<i>OC</i>	0.14	0.16	0.11	0.55	0.02
<i>Age</i>	15.00	15.20	5.48	39.00	1.00

As shown in Figure 3, the degree of financialization of China's manufacturing listed companies has a characteristic of periodic changes. From 2007 to 2011, the degree of corporate financialization continues to decrease, especially after 2008, which may be related to the financial cycle under the background of global financial crisis (Liu et al., 2020). Specifically, under the influence of the financial crisis, the uncertainty of the benefits of investing in financial assets increases. Therefore, companies are constantly selling financial assets for operational safety. From 2012 to 2018, the degree of financialization of manufacturing enterprises increases significantly. This is mainly due to the continuous expansion of the gap between the investment return of industrial investment and the return of the finance market and real estate market. Thus, more and more manufacturing companies increase their financial investment and the proportion of financial assets in total assets also rises rapidly.

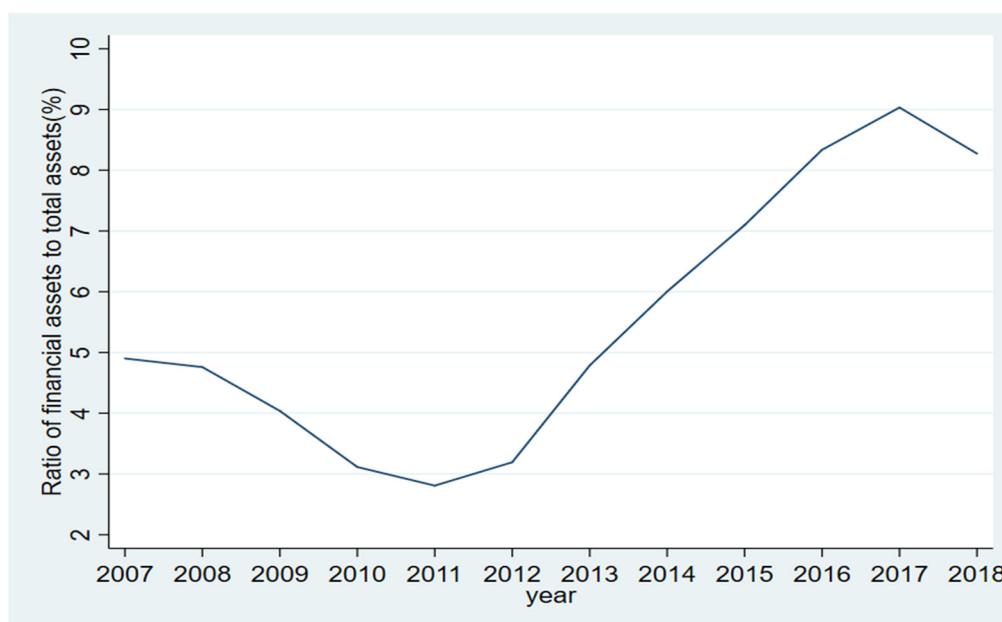


Figure 3. Ratio of financial assets to total assets of China's listed manufacturing companies from 2007 to 2018 (%).

3.3. Empirical results

Columns 2 to 4 of Table 4 summarize estimation results based on ordinary least square (OLS), fixed effects (FE), and random effects (RE) estimators, respectively. The results show that the coefficient of the *Fin* (i.e., corporate financialization) is significantly negative at 10% significance level under different estimation strategies, reflecting that an increase in the level of financialization of China's listed manufacturing companies has an adverse effect on the TFP. This suggests that the "crowding out" effect of corporate financialization on TFP is more prominent compared with the "reservoir" effect. Since the results of the F test and Hausman test shown at the bottom of Table 4 indicate a preference for the FE specification, FE models are selected to estimate the parameters of Equation (2) and Equation (3) in the following context.

The results in Column 5 of Table 4 show that holding both short-term and long-term financial assets has a significantly negative impact on TFP. However, the absolute values of the coefficient of *Finl* (0.288) is much larger than that of *Fins* (0.101), suggesting that the negative effect of long-term

financial assets is more prominent. This may be because short-term financial assets have stronger liquidity and lower conversion costs than long-term financial assets. The “reservoir” effect of such financial assets is stronger, and the negative effect on TFP of manufacturing enterprise is relatively weaker. Enterprises hold long-term financial assets mainly for the purpose of speculation and arbitrage, which results in that the “crowding out” effect of long-term financial assets on TFP is more prominent. Column 6 in Table 4 further shows the estimated result of Equation (3) where the quadratic term of corporate financialization Fin^2 is introduced in the econometrics model. The results show that corporate financialization still exerts a significantly negative effect on TFP, but the coefficient of Fin^2 is insignificant. Therefore, the inverted U-shaped relation between financialization of manufacturing enterprises and TFP is not observed in this study.

In terms of control variables, the enterprise size (*Size*) has a significant positive effect on the TFP. This is because the larger the enterprise size, the stronger its ability to purchase advanced equipment and attract technical talents and the more sufficient funds are invested in R&D activities, which further increases TFP (Sleuwaegen et al., 2002). The capital structure (*CS*) measured by asset-liability ratio is negatively correlated to TFP. This is because the increase in the leverage ratio increases its probability of default, which results in the increase of financing costs and thus has an adverse effect on the TFP (Kato et al., 1997). This also shows the importance of deleveraging to improve the TFP. Capital intensity (*CI*) is significantly negatively correlated with TFP, since companies with high capital intensity are basically from monopolistic industries, and the scale effect of these companies is insufficient, making their production efficiency inefficient. Firms’ growth ability (*GA*) measured by the Tobin Q value is significantly positively correlated with the TFP, suggesting that the better the growth of the enterprise, the greater its investment expenditure, and the faster the company’s product service and technology update rate, thereby further improving the TFP. Innovation capacity (*Inno*) has a significant positive impact on TFP, since R&D activities can enable companies to develop new products and promote technological progress. Ownership concentration (*OC*) is significantly and positively correlated with enterprises’ productivity, indicating that an increase in ownership concentration can reduce inefficiencies caused by principal-agent problems, reduce agency costs, and thus improve resource allocation efficiency. Firm age (*Age*) is significantly positively correlated with TFP, while its square term Age^2 is not significant, indicating that there is no inverted U-shaped relation between enterprise age and TFP.

Table 4. Results of the effect of financialization of manufacturing enterprise on TFP in the full sample.

Variables	OLS	FE	RE	FE	FE
<i>Fin</i>	-0.190*** (0.055)	-0.169*** (0.039)	-0.155*** (0.037)		-0.274*** (0.082)
<i>Fin</i> ²					0.293 (0.201)
<i>Fins</i>				-0.101** (0.046)	
<i>Finl</i>				-0.288*** (0.076)	
<i>Size</i>	0.214*** (0.006)	0.161*** (0.010)	0.181*** (0.007)	0.159*** (0.010)	0.161*** (0.010)
<i>CS</i>	-0.212*** (0.039)	-0.147*** (0.035)	-0.170*** (0.031)	-0.139*** (0.034)	-0.148*** (0.035)
<i>CI</i>	-0.048*** (0.008)	-0.027*** (0.008)	-0.037*** (0.007)	-0.026*** (0.008)	-0.027*** (0.008)
<i>GA</i>	0.038*** (0.006)	0.018*** (0.003)	0.021*** (0.003)	0.018*** (0.003)	0.018*** (0.003)
<i>Inno</i>	0.003** (0.0012)	0.001* (0.0006)	0.001** (0.0006)	0.001* (0.0006)	0.001* (0.0006)
<i>OC</i>	0.250*** (0.051)	0.180** (0.081)	0.206*** (0.056)	0.173** (0.079)	0.177** (0.081)
<i>Age</i>	0.003** (0.001)	0.015*** (0.002)	0.003** (0.001)	0.015*** (0.002)	0.015*** (0.002)
<i>Age</i> ²	-2.85e-06 (0.0001)	5.21e-05 (0.0001)	5.95e-05 (9.62e-05)	4.31e-05 (0.0001)	4.61e-05 (0.0001)
Constant	0.959*** (0.141)	1.708*** (0.209)	1.475*** (0.151)	1.735*** (0.208)	1.707*** (0.209)
Time effect	Yes	Yes	Yes	Yes	Yes
Individual effect	No	Yes	Yes	Yes	Yes
F test	13.00***			12.93***	13.00***
Hausman test	222.13***			242.20***	222.72***
<i>N</i>	13971	13971	13971	13971	13971
<i>R</i> ²	0.476	0.302	—	0.303	0.303

Note: The dependent variable is the TFP of listed manufacturing companies. *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets.

3.4. Robustness check

In order to ensure the robustness of the empirical results, we further develop the following alternative estimations. Firstly, we know that the possible reverse causality between corporate financialization and TFP or the fact that unobserved factors not included in the estimation framework may jointly affect the changes in the level of corporate financialization and TFP may lead to the endogenous issues, which in turn leads to biased estimation. Thus, to address the potential endogenous issues, the fixed effects instrumental variables (FE-IV) estimator is used to re-estimate Equation (1). With regard to the choice of instrumental variables, we refer to the practice of most literature (Reed, 2015), and take the one-year lagged value of corporate financialization as the instrumental variable. The results in Column 2 of Table 5 indicate that corporate financialization still has a negative impact on TFP, which is in line with those shown in the baseline (Column 3 of Table 4).

In addition, we also test the robustness of the estimation results by changing the measurement methods of the two core indicators, that is, TFP and the degree of corporate financialization. Columns 3 and 4 show the results with OP and LP methods used for calculating the TFP respectively. The results indicate that the increase in corporate financialization still reduces the TFP. Recall that in addition to the perspective of assets holding, some scholars also define corporate financialization from the perspective of return. Corporate financialization is also manifested by that the accumulation of corporate profits mainly comes from financial channels rather than trade and goods production (Krippner, 2005; Milberg, 2008). Thus, we further use the return of financial assets, that is the ratio of financial asset returns to financial assets, to measure the degree of corporate financialization. Column 5 in the table further confirms the significant and adverse impact of corporate financialization on TFP, when the degree of corporate financialization is measured from the perspective of financial returns.

Table 5. Results of robustness checks.

Variables	FE-IV	OP-TFP	LP-TFP	R-Fin
<i>Fin</i>	-0.305*** (0.100)	-0.217*** (0.076)	-0.205*** (0.042)	-1.454*** (0.199)
<i>Size</i>	0.171*** (0.011)	0.489*** (0.021)	0.283*** (0.011)	0.162*** (0.010)
<i>CS</i>	-0.184*** (0.037)	-0.081 (0.067)	-0.118*** (0.036)	-0.139*** (0.034)
<i>CI</i>	-0.024*** (0.009)	-0.110*** (0.016)	-0.050*** (0.009)	-0.023*** (0.008)
<i>GA</i>	0.024*** (0.004)	0.024*** (0.006)	0.022*** (0.003)	0.018*** (0.003)
<i>Inno</i>	0.001 (0.0007)	0.004*** (0.0012)	0.001** (0.0006)	0.001 (0.0006)
<i>OC</i>	0.113* (0.075)	0.288* (0.157)	0.203** (0.083)	0.183** (0.079)
<i>Age</i>	0.011 (0.002)	0.014* (0.008)	-0.005** (0.002)	0.015*** (0.002)
<i>Age</i> ²	-0.0001 (0.0001)	0.0003 (0.0002)	6.76e-06 (0.0001)	7.23e-05 (0.0001)
Constant	1.933*** (0.109)	3.135*** (0.466)	2.351*** (0.227)	1.647*** (0.210)
Time effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes
<i>N</i>	12295	12808	13971	13971
<i>R</i> ²	0.284	0.456	0.368	0.309

Note: The dependent variable is the TFP of listed manufacturing companies. *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets. In column OP-TFP (Column 3) and LP-TFP (Column 4), the TFP are calculated by OP method and LP method, respectively. In column R-Fin (Column 5), the ratio of financial asset returns to financial assets is taken as the proxy of corporate financialization.

4. Heterogeneity analysis of the effect of financialization of manufacturing enterprises on TFP

4.1. Results and analysis under different types of enterprises

Heterogeneous effects are widely investigated in the study of financial issues (Hong et al., 2020; Li et al., 2021). To test whether there is a difference in the impact of corporate financialization on the TFP of different manufacturing enterprises, we further conduct analysis with heterogeneity of four aspects, that is, different types of enterprise ownership, enterprise sizes, enterprise in different industries and different locations of the enterprise. To deal with the potential endogenous problems, we use one-year lagged value of corporate financialization as an instrumental variable, and employ a fixed-effect instrumental variable model for parameter estimation. The results based on different subsamples are shown in Table 6.

(1) Different types of enterprise ownership: In the context of China's transition from a planned economy to a market economy, there are large differences in conditions like financing constraints between state-owned enterprises (SOE) and non-state-owned enterprises (NSOE), and the effects of corporate financialization on TFP may also differ. Thus, we divide the sample into two sub-samples accordingly. The results in Columns 2 and 3 of Table 6 show that increase in degree of corporate financialization has a significant negative impact on the TFP for both SOE and NSOE. However, the absolute value of the *Fin* coefficient in SOE (0.326) is greater than that in NSOE (0.285), indicating that the negative impact of financialization on productivity is more prominent in SOE. Specifically, on the one hand, the relationship between SOE and the government in China is always closer, and it is easier to obtain financial support from the government and loans from financial institutions. In the production process, they face fewer financing constraints and have stronger speculation motivations. On the other hand, SOE have more serious agency conflict problems. Managers usually show "short-sighted" behavior for short-term performance and use financial assets for speculative arbitrage. Overall, SOE have stronger speculative motivation on the financialization, which poses a larger "crowding out" effect on enterprises' production and innovation activities. Thus, the negative effect on productivity turns out to be more prominent.

(2) Different enterprise sizes: We compare and analyze the differences in the effect of corporate financialization on TFP under the differences in enterprise size. The enterprise size is divided into large enterprises, medium-sized enterprises and small and micro enterprises, according to the "Statistical Methods for the Classification of Large, Medium, Small and Micro Enterprises (2017)" issued by the National Bureau of Statistics of China. Manufacturing enterprises with an operating income of more than 40 million yuan and more than 1,000 employees are classified as large enterprises. Those with operating income between 20 million and 40 million yuan and between 300–1000 employees are medium-sized enterprises, and the rest are small and micro enterprises. Considering the small sample size of medium-sized enterprises and small and micro enterprises in the group of listed companies, we merge them into one group, small and medium enterprises (SME). Results in Columns 4 and 5 of Table 6 show that the increase in the degree of corporate financialization has a significantly negative impact on the TFP for large enterprises. It is observed that the productivity effect of financialization of manufacturing SMEs is also negative, but not statistically significant. This shows that the financialization of manufacturing enterprises has different effects on the productivity of enterprises of different sizes. Recall that Orhangazi (2008) investigated the impact of the financialization of non-financial companies on industrial investment in the United States and found that financialization has a significant negative impact on the industrial investment of large companies, but it is not significant on small companies. This may be due to the more prominent financing constraints faced by SMEs compared with large enterprises. SMEs allocate more financial assets to industrial operations rather than speculative arbitrage, and the "crowding out" effect on productivity of corporate financialization is not significant.

(3) Enterprise in different industries: We refer to the "Catalog for High-technology Industries Statistics Classification" released by the National Bureau of Statistics of China, and classify the sample enterprises as high-tech industries and non-high-tech industries. High-tech industries include six sub-industries, that is, computer, communications and other electronic equipment manufacturing; pharmaceutical manufacturing; special equipment manufacturing; general equipment manufacturing; railways, ships, aerospace and other transportation equipment

manufacturing; and instrumentation manufacturing. The results in Columns 6 and 7 of Table 6 indicate that the increase in the degree of corporate financialization significantly reduces the TFP of enterprises in both high-tech and non-high-tech industries. However, the absolute value of the *Fin* coefficient of companies in high-tech industries (0.343) is greater than that in non-high-tech industries (0.280), indicating that the negative effect of manufacturing companies' financialization on productivity is more prominent in high-tech industries. Overall, the companies in high-tech industries are more favored by investors and supported by government subsidies. Then, there are fewer capital constraints in the production process, and the higher possibility of speculative arbitrage activities. Thus, the negative effect of financialization on TFP is correspondingly greater for the companies in high-tech industries.

(4) Different locations of the enterprise: There are significant differences in the economic development levels in different regions of China. To test whether the effects of financialization of manufacturing companies on TFP differ among various regions, we divide the sample of enterprises into eastern coastal region and central and western inland region according to the province where the enterprise is registered³. Then, we conduct empirical analysis of subsamples in different regions. According to the estimation results shown in Columns 8 and 9 of Table 6, although the coefficient of *Fin* is negative in different regions, it is only significant in the eastern region and not statistically significant in the central and western regions. Due to the higher development level of the financial market in eastern China and richer financial investment channels, manufacturing companies are more likely to invest in financial assets. As a result, the companies transfer more funds from production and operation to the financial market, and the negative effect of corporate financialization on TFP is also greater for the companies in eastern China.

³According to National Bureau of Statistics of China, the eastern region of China includes 11 provinces, i.e., Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan. The central region of China contains 8 provinces, that is, Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan. Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang belong to the Western region of China. Additionally, considering that the number of listed manufacturing companies in the central and western regions of China is relatively small, and the economic development levels of the central and western regions are relatively close, we combine the samples of the central and western regions.

Table 6. Results of the effect of financialization of manufacturing enterprise on TFP in different subsamples.

Variables	SOE	NSOE	LE	SME	High-tech	Non-high-tech	East	Central-West
<i>Fin</i>	-0.326* (0.182)	-0.285** (0.124)	-0.292** (0.116)	-0.299 (0.244)	-0.343** (0.160)	-0.280** (0.128)	-0.275*** (0.102)	-0.438 (0.275)
<i>Size</i>	0.136*** (0.020)	0.184*** (0.013)	0.147*** (0.013)	0.182*** (0.032)	0.188*** (0.017)	0.157*** (0.015)	0.184*** (0.014)	0.148*** (0.021)
<i>CS</i>	-0.072 (0.069)	-0.237*** (0.043)	-0.161*** (0.041)	-0.200** (0.081)	-0.204*** (0.065)	-0.163*** (0.044)	-0.210*** (0.044)	-0.134* (0.069)
<i>CI</i>	-0.009 (0.011)	-0.037*** (0.012)	-0.017* (0.009)	0.007 (0.034)	-0.036** (0.014)	-0.014 (0.011)	-0.034*** (0.009)	-0.003 (0.018)
<i>GA</i>	0.023*** (0.006)	0.024*** (0.004)	0.030*** (0.004)	0.018** (0.007)	0.026*** (0.005)	0.022*** (0.005)	0.022*** (0.004)	0.026*** (0.008)
<i>Inno</i>	0.0008 (0.0009)	0.0008 (0.0010)	0.0008 (0.0007)	0.0008 (0.0021)	0.0011 (0.0013)	0.0006 (0.0008)	0.0007 (0.0009)	0.0008 (0.0011)
<i>OC</i>	0.081 (0.112)	0.144 (0.099)	0.075 (0.075)	0.338 (0.231)	0.220* (0.125)	0.045 (0.094)	0.101 (0.084)	0.165 (0.148)
<i>Age</i>	0.016*** (0.003)	0.010*** (0.003)	0.015*** (0.002)	0.005 (0.006)	0.009** (0.004)	0.013*** (0.003)	0.011*** (0.003)	0.013*** (0.004)
<i>Age</i> ²	-0.0003 (0.0002)	-0.00002 (0.0002)	-0.0002* (0.0001)	0.00002 (0.0003)	-0.0001 (0.0002)	-0.0002 (0.0002)	-0.0001 (0.0001)	-0.0002 (0.0003)
Constant	2.058*** (0.400)	1.481*** (0.272)	1.951*** (0.261)	0.899 (0.646)	1.361*** (0.361)	1.713*** (0.310)	1.411*** (0.267)	1.767*** (0.471)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	3863	8432	9403	2892	5228	7067	8455	3840
<i>R</i> ²	0.303	0.274	0.288	0.123	0.277	0.293	0.306	0.251

Note: The dependent variable is the TFP of listed manufacturing companies. *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets. In column SOE (Column 2) and NSOE (Column 3), the results are estimated based on the subsamples of state-owned enterprises and non-state-owned enterprises, respectively. In column LE (Column 4) and SME (Column 5), the results are estimated based on the subsamples of large enterprises and small and medium enterprises, respectively. In column High-tech (Column 6) and Non-high-tech (Column 7), the results are estimated based on the subsamples of enterprises in high-tech industries and non-high-tech industries, respectively. In column East (Column 8) and Central-West (Column 9), the results are estimated based on the subsamples of enterprises located in eastern region, central and western regions of China, respectively.

4.2. Results and analysis under the difference levels of TFP

In order to further verify whether financialization of manufacturing enterprise has varying effects at different points in the conditional distribution of TFP, the quantile regression technique which is widely applied in the financial field (Boumparis et al., 2017; Broni et al., 2019; Li et al., 2020), is adopted in the current study. In panel data estimation, to capture unobservable individual heterogeneity,

Koenker (2004) takes account of individual fixed effects in the quantile regression model which is widely used in empirical analysis (Yan et al., 2019; Xi et al., 2020). Combined with the research in this paper, the fixed-effect panel quantile regression model can be expressed as follows:

$$Q_{TFP_{it}}(\tau_k | \gamma_i, X_{it}) = \gamma_i + X_{it}^T \beta(\tau_k) \quad (6)$$

where, $\tau \in (0,1)$ is quantile, $Q_{TFP_{it}}(\tau_k | \gamma_i, X_{it})$ denotes the conditional distribution function of TFP given explanatory variables with τ th quantile. X is the matrix of explanatory variables, including the core independent variable and control variables. The regression parameter of the τ th quantile $\beta(\tau_k)$ can be estimated as followed:

$$\arg \min_{(\gamma, \beta)} \sum_{k=1}^K \sum_{t=1}^T \sum_{i=1}^N W_k \rho_{\tau_k}(TFP_{it} - \gamma_i - X_{it}^T \beta(\tau_k)) + \lambda \sum_{i=1}^n |\gamma_i| \quad (7)$$

where K is the number of quantiles; ρ_{τ_k} is the loss function; W_k is the weight corresponding to k th quantile, controlling the contribution of different quantile levels in the estimation of fixed-effect model; and λ is the adjustment coefficient.

We refer to the practice of literature (Dept et al., 2009; Okada et al., 2012; Hou et al., 2020) and choose five representative quantiles such as 0.1, 0.25, 0.5, 0.75 and 0.9 for analysis.

Table 7 shows the results of panel quantile regression. According to Table 7, it can be observed that the estimated coefficients of *fin* are significantly negative at the quantiles of 10%, 25%, 50%, 75%, and 90%, indicating that corporate financialization has adverse impact on TFP under different levels of enterprises' TFP. The results are similar to those of the fixed effect model described above. However, the absolute values of the coefficients of *Fin* decrease sequentially at the quantiles of 10%, 25%, 50%, 75%, and 90%, indicating that heterogeneity is shown at different quantiles. Specifically, for companies with low levels of TFP, the adverse effect of financialization on TFP is higher than average. For companies with high TFP levels, the negative effect is lower. This means that the negative impact of corporate financialization on TFP weakens as the level of TFP increases. Compared with enterprises with low TFP levels, enterprises with high TFP level allocate more financial assets to R&D activities and main business investment in general. Thus, the motivation for arbitrage is relatively weak, and the negative effect of corporate financialization on productivity is correspondingly smaller.

Table 7. Results of panel quantile regression.

Variables	$\tau=0.1$	$\tau=0.25$	$\tau=0.5$	$\tau=0.75$	$\tau=0.9$
<i>Fin</i>	-0.175*** (0.051)	-0.172*** (0.037)	-0.169*** (0.028)	-0.166*** (0.038)	-0.163*** (0.053)
<i>Size</i>	0.179*** (0.011)	0.172*** (0.008)	0.162*** (0.006)	0.151*** (0.008)	0.143*** (0.011)
<i>CS</i>	-0.251*** (0.041)	-0.208*** (0.030)	-0.150*** (0.023)	-0.087*** (0.031)	-0.040 (0.043)
<i>CI</i>	-0.052*** (0.009)	-0.042*** (0.007)	-0.028*** (0.005)	-0.012* (0.007)	-0.0003 (0.01)
<i>GA</i>	0.021*** (0.004)	0.020*** (0.003)	0.018*** (0.002)	0.016*** (0.003)	0.015*** (0.005)
<i>Inno</i>	0.002* (0.0010)	0.002** (0.0007)	0.001** (0.0005)	0.001 (0.0007)	0.001 (0.001)
<i>OC</i>	0.143* (0.085)	0.158** (0.063)	0.179*** (0.047)	0.201*** (0.064)	0.217** (0.089)
<i>Age</i>	0.013*** (0.003)	0.014*** (0.002)	0.015*** (0.002)	0.016*** (0.002)	0.017*** (0.003)
<i>Age</i> ²	-0.0001 (0.0001)	-5.07e-06 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0002 (0.0001)
Time effect	Yes	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes	Yes
<i>N</i>	13,971				

Note: The dependent variable is the TFP of listed manufacturing companies. *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets.

5. Empirical analysis of the impact mechanism of financialization of manufacturing enterprises on TFP

As discussed above, we conduct the empirical study from two channels of technological innovation and resource allocation efficiency to further examine the mechanism of the impact of corporate financialization on TFP. We examine the effect of corporate financialization on technological innovation by the following empirical model:

$$Inno_{it} = \beta_0 + \beta_1 Fin_{it} + \beta_2 Size_{it} + \beta_3 CS_{it} + \beta_4 Sub_{it} + \beta_5 ROE_{it} + \beta_6 OC_{it} + \beta_7 Age_{it} + \eta_t + \gamma_i + \varepsilon_{it} \quad (8)$$

As discussed above, *Inno* denotes innovation capacity, which is measured by the logarithmic value of R&D expenditure plus 1; *Fin* represents the level of corporate financialization; Control variables includes enterprise size (*Size*), capital structure (*CS*), government subsidies (*Sub*), rate of return on common

stockholders' equity (*ROE*), ownership concentration (*OC*) and firm age (*Age*). Among them, the measurement of *Size*, *CS*, *OC*, and *Age* are introduced in subsection 3.2.2. *Sub* is calculated by the ratio of government subsidies to revenue. *ROE* is calculated by dividing net profit by net assets.

For enterprises, the change in resource allocation is mainly reflected in the change in capital allocation, while the flow of other production resources is often accompanied by the flow of capital. This paper thus uses capital allocation efficiency to reflect resource allocation efficiency (Ren et al., 2019). In the existing analysis methods for investigating the determinants of capital allocation efficiency, the so-called "regression coefficient method" proposed by Wurgler (2000) is widely used, but this method cannot directly measure the allocation efficiency of enterprises at the micro-level. Therefore, as done by Chen et al. (2017), we refer to Mclean et al. (2012) and introduce corporate financialization to test its impact on the capital allocation efficiency. The econometric model is described as follows:

$$I_{it+1} / K_{it+1} = \beta_0 + \beta_1 Q_{it} + \beta_2 Fin_{it} + \beta_3 Q_{it} \times Fin_{it} + \beta_4 CF_{it} / K_{it} + \beta_5 Size_{it} + \beta_6 CS_{it} + \eta_t + \gamma_i + \varepsilon_{it} \quad (9)$$

where *I* represents the investment expenditure, *K* represents the net fixed assets, *Q* is Tobin Q, *CF* represents the net cash flow generated from operating activities, *Size* and *CS* denote firm size and capital structure respectively. We focus on the coefficient β_3 in Equation (9), which reflects the difference in the capital allocation efficiency of financial asset investment. To be more specific, if β_3 is significantly positive, the corporate financialization can improve the efficiency of corporate capital allocation.

The results of the effect of corporate financialization on technological innovation are shown in Table 8. In Columns 2 and 3 of Table 8, it is found that regardless of control variables, the coefficient of *Fin* is significantly negative, revealing that corporate financialization has a negative effect on the investment in R&D activities. According to Column 4 of Table 8, when we consider the potential endogenous issues, the results of the panel instrumental variable model (one-year lagged value of corporate financialization is chosen as the instrumental variable) show that the coefficient of *Fin* is still significant and negative. This demonstrates the "crowding out" effect of financialization of China's listed manufacturing companies on technological innovation. We further introduce the ratio of short-term (*Fins*) and long-term financial assets (*Finl*) into the model to test the difference in the impact of different types of financial assets on technological innovation. The results in Column 5 of Table 8 show that different types of financial assets both have a significantly adverse effect on the investment of technological innovation, but the negative effect of long-term financial assets is greater than that of short-term financial assets. As discussed above, short-term financial assets have the advantages of low risk, good liquidity and low conversion cost, which can be equivalent to the cash held by the enterprise. For the purpose of preventive savings, companies hold some short-term financial assets that are easy to realize to solve the problem of high financial costs caused by financing constraints. Short-term financial assets can play the role of "reservoir". Thus, its inhibitory effect on corporate technological innovation is relatively small. Compared with short-term financial assets, long-term financial assets occupy more funds and have the characteristics of greater risk, long investment cycle, and poor liquidity. When a company holds a large amount of long-term financial assets for a certain period of time, it increases the company's financial risk and is not able to provide stable and lasting cash flow for R&D activities. Therefore, its "crowding out" effect on the company's technological innovation is more prominent.

Table 8. Results of the effect of financialization of manufacturing enterprise on technological innovation.

Variables	Dependent variable: Innovation capacity (ln(1+RD))			
<i>Fin</i>	-2.177*** (0.571)	-1.955*** (0.566)	-2.995** (1.504)	
<i>Fins</i>				-1.813*** (0.629)
<i>Finl</i>				-2.971*** (1.130)
<i>Size</i>		0.675*** (0.135)	0.652*** (0.158)	0.665*** (0.134)
<i>CS</i>		-1.263*** (0.419)	-1.267** (0.498)	-1.238*** (0.423)
<i>Sub</i>		4.398 (5.350)	-0.730 (5.783)	4.258 (5.356)
<i>ROE</i>		1.572*** (0.506)	1.054* (0.591)	1.538*** (0.505)
<i>OC</i>		3.221*** (1.087)	2.797** (1.292)	3.149*** (1.090)
<i>Age</i>		1.571*** (0.024)	1.739*** (0.027)	1.572*** (0.024)
Constant	0.342** (0.136)	-27.71*** (2.662)	-30.50*** (3.126)	-27.48*** (2.647)
Time effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes
<i>N</i>	13,971	13,971	12295	13,971
<i>R</i> ²	0.708	0.710	0.625	0.711

Note: *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets. In Column 4, the results are estimated based on the FE-IV model, and the instrumental variable is the one-year lagged value of corporate financialization.

Table 9 shows the empirical results of the impact of corporate financialization on resource allocation efficiency. The results in Columns 2 and 3 show that regardless of control variables, the coefficient of the interaction term $Q \times Fin$ is insignificant. For the parameter estimation of Equation (9), all the independent variables are one-year lagged, which can avoid the endogeneity problem to a large extent. However, the introduction of interaction terms may lead to the problem of multicollinearity. We centralize the variables Q and Fin respectively, and then introduce their interaction terms in the econometric model to address the issue of potential multicollinearity. As shown in Column 4 of Table 9, the coefficient of $Q \times Fin$ is still not statistically significant. This implies that the financialization of manufacturing enterprises has no significant impact on the efficiency of capital allocation. In addition, according to Column 5 of Table 9, the estimated coefficients of $Q \times Finl$ and $Q \times Fins$ are not statistically significant. It further reflects that the resource allocation efficiency effect of the financialization of manufacturing enterprises is not significant from the perspective of both short-term and long-term financial asset holdings.

Table 9. Results of the effect of financialization of manufacturing enterprises on resource allocation efficiency.

Variables	Dependent variable: I_{t+1}/K_{t+1}			
Q	0.006** (0.0027)	0.005* (0.0028)	0.005** (0.0025)	0.005* (0.0029)
Fin	-0.038 (0.056)	-0.059 (0.058)	-0.059* (0.033)	
$Q \times Fin$	0.00328 (0.020)	-0.00001 (0.021)	-0.00001 (0.021)	
$FinS$				0.079 (0.078)
$FinL$				-0.213** (0.101)
$Q \times FinS$				-0.028 (0.024)
$Q \times FinL$				0.027 (0.038)
CF/K		-0.017 (0.023)	-0.017 (0.023)	-0.017 (0.023)
$Size$		-0.029*** (0.007)	-0.029*** (0.007)	-0.030*** (0.007)
CS		-0.082*** (0.024)	-0.082*** (0.024)	-0.078*** (0.024)
Constant	0.233*** (0.009)	0.875*** (0.150)	0.882*** (0.149)	0.892*** (0.151)
Time effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes
N	11705	10617	10617	10617
R^2	0.061	0.072	0.072	0.073

Note: *, **, and *** indicate the significance levels of 10%, 5%, and 1%, respectively. Robust standard errors are shown in brackets.

Based on the above analysis of the influencing mechanism, we find that the financialization of manufacturing enterprises does not improve the resource allocation efficiency, but poses a significant “crowding out” effect on the technological innovation. This also to a large extent explains why the productivity effect of financialization of manufacturing enterprises is significantly negative.

6. Conclusion

With the acceleration of the process of the economic financialization globally, the trend of financialization of manufacturing companies is becoming more and more obvious, whose economic consequences are also widely concerned by academia. Existing literature mainly focuses on the impact of financialization of manufacturing companies on the industrial investment and profitability. In this paper, we systematically examine the effect and mechanism of financialization of manufacturing

enterprises on TFP and provide evidence of the economic consequences of corporate financialization from the perspective of productivity, utilizing the data of manufacturing companies listed on the China's A-share market from 2007 to 2018. The main conclusions can be summarized as follows.

First, the deepening of the financialization of manufacturing enterprises significantly reduces TFP, and the magnitude of the impacts of different types of financial assets varies. Specifically, we find that the negative productivity effects of corporate financialization are robust to the change in the measurement of TFP and corporate financialization, as well as controls for possible endogeneities. In addition, from the perspective of the holdings of different types of financial assets by enterprises, the negative effect of long-term financial assets on TFP is greater than that of short-term financial assets.

Second, the effects of corporate financialization on TFP are heterogeneous in terms of their significance and degrees in different types of enterprises as well as in different levels of enterprises' TFP. From the perspective of different types of enterprises, the effect of corporate financialization on productivity is significantly negative among enterprises with different ownership types and industries of different technology levels. Especially, the negative impact is more prominent for state-owned enterprises and enterprises in high-tech industries. Regarding enterprises of different sizes, corporate financialization has a significant and negative impact on the TFP of large enterprises, but it is not statistically significant among small and medium enterprises. For companies in different regions, the "crowding out" effect of corporate financialization on productivity is significant in eastern China, but not in central and western China. The results of the panel quantile regression model show that as the level of enterprises' TFP increases, the negative impact of corporate financialization gradually weakens.

Third, financialization of manufacturing enterprises has different effects on TFP through two ways of resource allocation efficiency and technological innovation. Specifically, corporate financialization has no significant impact on the resource allocation efficiency, but it significantly reduces the enterprise's investment in technological innovation. In particular, the inhibitory effect of long-term financial assets on technological innovation is more prominent.

The findings of this paper have obvious policy implications. The results of this paper show that the financialization of manufacturing enterprises cannot effectively improve the resource allocation efficiency, and it inhibits the activities of technological innovation and the increase in productivity. From the perspective of government, in order to promote the transformation, upgrading, and long-term sustainable development of China's manufacturing industry, authorities should focus on manufacturing enterprises' financing issues and help them increase the investment in R&D by reducing financing costs and expanding financing channels. With the heterogeneity of the effects of corporate financialization on productivity, the government should also consider adopting different policy measures for different types of enterprises. In addition, the government should promote the establishment of a sound financial market system and rules. From the perspective of the enterprise itself, especially for those companies whose negative productivity effects of financialization are particularly prominent, the enterprise should raise awareness of the risks of financialization, clarify the strategic positioning, and attach importance to technological innovation. Only by coordinating the relationship between the main business and the allocation of financial assets can we avoid weakening the core competitiveness of enterprises due to excessive financialization. If manufacturing companies want to achieve long-term development, they should be based on the development of their main business. Relying on the return of financial asset investment is not a long-term plan.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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