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The supply chain financing role of government's stock purchase rescue policy: Stock market stabilization funds and trade credit financing of Chinese listed firms

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ABSTRACT

Few studies on trade credit financing have addressed the government's specific behaviors or policies that support the healthy development of the stock market, even though the healthy development of the stock market will ultimately exert influence on the cooperative trust relationship between listed firms and upstream and downstream firms (UDFs) and consequently affect the listed firms' trade credit financing. Therefore, the research on trade credit financing cannot ignore the influences from the governmental behaviors that support the healthy development of the stock market, especially the government bailout programs. We use the introduction of the stock market stabilization funds (SMSFs) by the China Securities Regulatory Commission (CSRC) in 2015 as an external shock, finding that SMSFs can significantly enhance trade credit financing, implying that China's SMSFs have a supply chain financing promotion effect. The channel tests reveal that enhancing insider governance and the eye-catching star effect, reducing corporate operation risk, and improving accounting information quality are crucial channels for SMSFs to increase trade credit financing. Additionally, we discover that the positive effect of the SMSFs to enhance corporate trade credit financing is stronger when the level of SMSFs' shareholding is higher, SMSFs increase their shareholdings, SMSFs are among the top 10 shareholders and there are multiple SMSFs major shareholders. We also find that SMSFs have a higher beneficial impact on trade credit financing when a firm has weaker corporate governance, more severe financing constraints, and faces higher economic policy uncertainty (EPU). Furthermore, we find that SMSFs can increase corporate value while optimizing supply chain financing. Overall, we link the literature on government rescue, SMSFs, and trade credit financing. We broaden the study of the influencing factors on trade credit financing from the dual perspectives of governmental rescue actions that promote the stock market's healthy development and state-owned special institutional investors. Also, our research will help to deepen the understanding of the positive effects of China's SMSFs and offer valuable lessons for other East Asian or emerging economies.

1. Introduction

The question of whether and how corporate trade credit financing is affected by the specific government behavior or related policy

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of promoting healthy stock market development, especially the government bailout policies that have been pursued by many national or regional governments when faced with a huge impact on the capital market caused by the financial crisis in 2008, the outbreak of COVID-19 in 2020, or other major events, is still not fully and deeply understood and urgently needed to research. We respond to this issue using the 2015 Chinese government stock purchase bailout policy - the introduction of stock market stabilization funds (SMSFs) to purchase huge amounts of stocks directly on the stock market to rescue the stock market from dramatic turmoil - and explore new potential factors affecting firms' trade credit financing from the perspective of government bailout programs.

Due to the late start of capital market construction in China, the supporting financial support system and direct financing channels are not yet fully developed. Therefore, more and more firms rely on informal financing channels—trade credit financing—to meet their financing needs by tapping into the funds of suppliers and customers during specific transactions of goods or services with upstream and downstream firms (UDFs) in the supply chain, specifically by accessing the funds of upstream suppliers through accounts payable or notes payable and capturing the funds of downstream customers through advance receipts. All three studies—Allen et al. (2005), Ge and Qiu (2007), and Tang and Moro (2020)—discover that trade credit financing plays a significant role in Chinese enterprises' financing channels and is substantially more significant than bank loans. The essence of trade credit financing is the debt financing received by firms from UDFs, and the successful conclusion of debt contracts relies on the mutually beneficial trust principle, which is the basis for the survival of long-term cooperation between firms. To ensure the smooth signing of debt contracts and subsequent smooth performance and thus effectively maintain long-term cooperation, the lender of funds will continuously track and respond appropriately to the corporate governance, uncertainty, operational risks, and financial information quality of the demand side. More significantly, there is a huge difference in the capital cost or liquidity risk borne by the lenders and the demanders in the process of balancing supply and demand for trade credit, with the lenders typically sacrificing their liquidity costs and bearing the potential bad debt risk associated with the demanders' occupation of funds. As a result, suppliers and customers—UDFs—are very concerned about critical information like corporate governance, operational risks, and accounting information quality to ensure that the debt default risk is manageable and consequently affects the trade credit financing they provide to firms (Allen et al., 2005; Zhang et al., 2020; Jiang et al., 2021; Li et al., 2021).

A review of the literature reveals that scholars have enriched the influencing factors of trade credit financing from different perspectives such as corporate governance, credit level, trust relationship, and economic policy uncertainty (EPU). Studies have shown that with the improvement of corporate governance (Zheng et al., 2013; Li et al., 2021), credit level (Zhang et al., 2020), or trust relationship (Wu et al., 2014; Hasan and Habib, 2019; Kong et al., 2020; Xu et al., 2022), firms have easier access to trade credit financing; while EPU reduces their trade credit financing (Su et al., 2021). However, few studies have addressed the government's specific behaviors or policies that promote the stock market's healthy development, even though the stock market's healthy development will ultimately exert influence on the cooperative trust relationship between listed firms and UDFs and consequently affect the listed firms' trade credit financing. Therefore, the research on trade credit financing cannot ignore the influences from the governmental behaviors that promote the stock market's healthy development, especially the government bailout programs.

In developed countries like Europe and US, few government stabilization funds will directly enter the stock market to rescue the market when it is shocked by a massive collapse. The stabilization funds in Europe and US mainly buttress banks and other financial institutions to provide liquidity for the economy and have an exit period and will retreat after the market stabilizes. However, unlike developed countries in Europe and US, the governments of East Asian countries or regions, including China, Japan, South Korea, and Hong Kong, will introduce SMSFs to directly enter the stock market for a bailout, although their SMSFs differ in exit periods (Zhu et al., 2022). In 2015, China's stock market saw a super crash, and to help the market recover, the China Securities Regulatory Commission (CSRC) initiated SMSFs to trade on the stock market directly. The CSRC gave the SMSFs permission to continue their long-term presence in the stock market after they helped to stop the stock market crash, which helped to strengthen the stock market's resilience in China. Therefore, the introduction and long-term existence of China's SMSFs provides an opportunity to explore the long-term effects of the government's stock purchase rescue policy in times of crisis on corporate behavior in the post-crisis period. Moreover, rare existing research on corporate trade credit financing has focused on the impact of government action from SMSFs to advance healthy stock market development. Consequently, we attempt to explore the impact of Chinese SMSFs on corporate trade credit financing by using a quasi-natural experiment in which Chinese SMSFs enter the market and hold shares for a long period to fill the gaps in existing research. We can provide new empirical evidence on the impact of government bailout programs on corporate trade credit financing from the perspective of causality identification, as well as expand the research by linking the literature on both SMSFs and corporate trade credit financing, as well as provide valuable inspiration for the operation of SMSFs in the other East Asian economies and the healthy development of capital markets in other emerging economies.

SMSFs have a close tie to the CSRC and a special status among institutional investors in the Chinese capital markets, scholars believe that SMSFs play a dual role as the active market regulator and state-owned long-term institutional investor, and can significantly improve corporate governance and thus optimize corporate decisions, such as curbing corporate misconduct, improving innovation investment, and investment efficiency (Yu and Fang, 2020; Wen and Qiao, 2021; Feng and Wen, 2022). Simultaneously, from the perspective of maintaining stock price stability and alleviating market risk, SMSFs can effectively reduce stock price volatility and stock price crash risk (Li and Jin, 2019; Cheng et al., 2022), as well as suppress stock market indices' volatility (Yang et al., 2019). With the improvement of corporate governance quality and the reduction of market risk, the UDFs will be less worried about the insider (manager and controlling shareholder) interest encroachment and the rising risk of debt default of the firms held by SMSFs (SMSF firms), which objectively increases the UDFs' trust and thus helps to promote the SMSF firms' trade credit financing. By improving corporate governance, SMSFs may either help optimize corporate decisions and then possibly reduce corporate operation risk or may inhibit insiders' self-interest motives to strengthen accounting information governance and improve accounting information quality. We anticipate that SMSFs can improve the trust and cooperation relationship between SMSF firms and UDFs in the supply chain and

objectively increase the SMSF firms' trade credit financing since crucial information such as corporate governance, operational risk, and accounting information quality is the main decision bases for suppliers and customers to provide trade credit financing to listed firms (Allen et al., 2005; Zhang et al., 2020; Jiang et al., 2021; Li et al., 2021).

In view of this, based on the government's stock purchase rescue policy's role in supply chain financing, we examine whether the introduction of SMSFs by CSRC can affect the trade credit financing provided by UDFs in the supply chain to SMSF firms, or more specifically, whether the SMSFs can promote supply chain financing. We use the introduction of the SMSFs by the CSRC as an external shock event to construct a dynamic difference-in-differences model (DID) and select Chinese A-share listed firms' data for 2010–2020. We find that SMSFs can significantly enhance SMSF firms' trade credit financing, implying that China's SMSFs have a supply chain financing promotion effect. The channel tests reveal that increasing insider governance, enhancing the eye-catching star effect, reducing corporate operation risk, and improving accounting information quality are important channels for SMSFs to increase SMSF firms' trade credit financing. Further, we discover that the positive effect of the SMSFs to enhance corporate trade credit financing is stronger when the level of SMSFs' shareholding is higher, SMSFs increase their shareholdings, SMSFs are among the top 10 shareholders and there are multiple SMSFs major shareholders. Additionally, we find that the beneficial effect of SMSFs on enhancing trade credit financing is more pronounced when corporate governance is poor, financing constraints are more severe, and EPU is higher. Furthermore, we find that SMSFs can improve corporate value while enhancing trade credit financing.

This paper makes three marginal contributions to the extant literature. First, we link the literature on government bailout programs, SMSFs, and trade credit financing, and broaden the research to enrich the study of the economic consequences of government bailout programs and SMSFs from a supply chain financing perspective. The existing literature uses China's SMSFs as an entry point for government intervention or government rescue of the stock market or listed firms, however, there are controversies about the economic consequences of government intervention or government rescue. Government intervention or government rescue can reduce stock price volatility and stock price crash risk (Li and Jin, 2019; Cheng et al., 2022; Dang et al., 2024), which in turn further effectively suppress the volatility of stock market indices (Yang et al., 2019). Nonetheless, based on the stock price information content perspective, Dang et al. (2024) find that government intervention has both positive and negative effects. From the perspective of the institutional governance role played by SMSFs as the state-owned long-term institutional investor and active market regulator and thus exploring the potential corporate governance effects, studies have found that Government intervention or government rescue significantly reduce corporate violations and enhance innovative investments, and investment efficiency (Yu and Fang, 2020; Wen and Qiao, 2021; Feng and Wen, 2022). However, Jin et al. (2023) find that Government intervention or government rescue can distort corporate executives' access to relevant information for decision making, thereby reducing corporate investment efficiency. Therefore, we use the Chinese SMSFs as an entry point from the perspective of government intervention or government rescue to explore the impact of the Chinese SMSFs on corporate trade credit financing, which helps to further clarify the controversy over the economic consequences of government intervention or government rescue. Thus, our study can to help fill the gap in existing studies by linking the literature on government intervention or government rescue, SMSFs, and trade credit financing and expanding the study.

Second, we expand the study of the influencing factors on trade credit financing from the dual perspectives of governmental rescue actions that promote the stock market's healthy development and state-owned special institutional investors. Existing studies on the factors influencing trade credit financing have rarely touched on government rescue actions that promote healthy stock market development. We provide empirical evidence on the causal relationship between SMSFs and trade credit financing by taking the entry point of SMSFs and the role of state-owned special institutional investors played by SMSFs into account, which is useful for understanding the impact of SMSFs on corporate trade credit financing from multiple perspectives through insider governance effect, operational risk governance effect, and accounting information governance effect.

Third, our study will shed meaningful light on the healthy development of capital markets in East Asian or other emerging economies. Unlike developed countries in Europe and US where few governments have used SMSFs to provide bailouts, in East Asian countries or regions, governments have initiated SMSFs to directly participate in bailouts. However, the existing research on SMSFs is relatively scarce. Our study finds that SMSFs optimize corporate trade credit financing, confirming their influence on long-term governance. We also reveal that EPU blocks the positive effect of SMSFs in enhancing trade credit financing, meaning that higher EPU poses serious challenges for government regulators in managing market expectations, which may interfere with the effective role of SMSFs in stabilizing market expectations and corporate governance. Therefore, our study will help to deepen the understanding of the positive effects of China's SMSFs and provide lessons for the operation of SMSFs in other East Asian economies and the healthy development of capital markets in other emerging economies.

2. Institutional background, theoretical analysis, and hypothesis

2.1. The SMSFs in China

Stabilization funds, also known as equalization funds, are mainly funded by huge temporary emergency financial assistance from the central government, either indirectly through financial institutions or directly in the secondary market, in times of financial crisis or severe capital market turmoil, and therefore they are temporary, mission-driven and cyclical in nature. In developed countries in Europe and US, stabilization funds mainly buttress banks and other financial institutions to provide liquidity for the economy and have an exit period, and will slowly retreat after the market stabilizes; however, unlike developed countries in Europe and US, the governments of East Asian countries or regions such as China, Japan, South Korea, and Hong Kong will introduce stock market stabilization funds (SMSFs, in China, people usually call it the "national team") to directly enter the stock market for a bailout, although they differ in their exit periods (Zhu et al., 2022).

In China, for example, when the stock market suffered a rare stock market crash in 2015, the Chinese government urgently deployed the People's Bank of China (PBOC), the Ministry of Finance (MOF), the Securities Regulatory Commission (SFC), the State Administration of Foreign Exchange (SAFE), the Shanghai Stock Exchange (SSE), Shenzhen Stock Exchange (SZSE) and other regulatory authorities in a coordinated effort. Through China Securities Finance Corporation (CSCF) and Central Huijin Investment Company Limited (Huijin) as the core, 21 super-large state-owned equity institutional investors were assembled to form China's SMSFs, pooling massive capital to buy stocks directly into the stock market through 21 SMSFs accounts and thus stabilize the stock market. In the wake of the stock market crash, China's SMSFs continue to invest in the stock market over the long term, as authorized by the CSRC, to support the Chinese stock market's healthy development. Zhu et al. (2022) confirm that China's SMSFs have not exited the stock market but are steadfastly present in the stock market in the long term after quelling the stock market crash.

According to the WIND database, the Stock Market Stabilization Funds (SMSFs) consist of 21 super-large state-owned equity institutional investors, divided into five groups: China Central Huijin Investment Limited Liability Company and China Central Huijin Asset Management Limited Liability Company; China Securities Finance Corporation (CSCF); 10 customized asset management plans of CSCF; 5 customized funds of CSCF; and 3 investment platforms of China State Administration of Foreign Exchange. Based on the final sample screened from the WIND database (see section 3.1), we present information about the SMSFs' shareholdings and firms held by SMSFs (SMSF firms) in Table 1.

We found that in 2015, China's SMSFs held a total of 64.079 billion shares of A-shares and 708 stocks, with a combined market value of RMB 715.507 billion; by 2020, China's SMSFs held a total of 62.159 billion shares of A-shares and 731 stocks, with a combined market value of RMB 758.941 billion. Panel B presents the year span distribution of SMSF firms over the sample period, which helps to visualize that SMSFs are long-term institutional investor investors from a data perspective. For example, a total of 708 firms were held by SMSFs in 2015, and have been held by SMSFs through 6 years to 2020. With a total of 731 firms held by SMSFs during the sample period, the 708 firms held by SMSFs in 2015 accounted for 96.85 %. Consistent with Zhu et al. (2022), we find that China's SMSFs have

Table 1
The Distribution of SMSFs Holdings.

Panel A: The Year-by-year Size of SMSFs Holdings in Final Sample

Year	The number of SMSF firms	The overall sample	The percentage of SMSF firms	The total number of stock holdings (billion stocks)	The total market value (billion RMB)
2015	708	1532	46.21 %	64.079	715.507
2016	716	1532	46.74 %	59.563	567.481
2017	724	1532	47.26 %	72.186	732.658
2018	727	1532	47.45 %	68.844	530.312
2019	730	1532	47.65 %	69.525	660.827
2020	731	1525	47.93 %	62.159	758.941

Panel B: The Year Span Distribution of SMSF Firms over the Sample Period

Starting Year	Year span to 2020	The number of additional SMSF firms	The number of SMSF firms	The number of all ultimate SMSF firms	Cumulative percentage
2015	6	0	708	731	96.85 %
2016	5	8	716	731	97.95 %
2017	4	8	724	731	99.04 %
2018	3	3	727	731	99.45 %
2019	2	3	730	731	99.86 %
2020	1	1	731	731	100.00 %

Panel C: Descriptive Statistics of the SMSFs' Real-time Shareholding Ratio in SMSF Firms

Variable	Obs	Mean	St.Dev	P50	Max
Share_Ratio	4336	0.032	0.031	0.024	0.367

Panel D: Relationship between SMSFs and Top 10 Largest Shareholders

Whether the shareholding ratio of the 21 SMSFs is greater than that of the 10th largest shareholder			Whether there is a single or more SMSFs among the top 10 largest shareholders.		
Yes or No	Obs	Percentage	Yes or No	Obs	Percentage
Yes	4133	95.32 %	Yes	1958	45.16 %
No	203	6.68 %	No	2378	54.84 %

Note: This table shows the distribution of SMSFs holdings. Panel A presents the year-by-year size of SMSFs holdings in final sample. Panel B presents the year span distribution of SMSF firms over the sample period. Panel C presents the descriptive statistics of the SMSFs' real-time shareholding ratio in SMSF firms. Panel D presents relationship between SMSFs and top 10 largest shareholders.

not exited the stock market but are steadfastly present in the stock market in the long term after quelling the stock market crash. Panel C presents the descriptive statistics of the SMSFs' real-time shareholding ratio in SMSF firms, the mean and max value of SMSFs' shareholding ratio are 0.032 and 0.367, implying that SMSFs can have substantial influence on firms. Panel D presents the relationship between SMSFs and top 10 largest shareholders, the sample with the shareholding ratio of SMSFs exceeding the 10th shareholder accounts for 95.32 % of the sample with the actual real-time shareholding of SMSFs, and the sample when one or more of the top 10 shareholders of the firm are SMSFs accounts for 45.16 % of the sample with the actual real-time shareholding of SMSFs. All of the above statistics show that SMSFs can have great impact on the capital market and listed firms.

Currently, there are still few studies on SMSFs. From the perspective of maintaining stock price stability and reducing market risk, studies find that China's SMSFs can effectively reduce stock price volatility and stock price crash risk (Li and Jin, 2019; Cheng et al., 2022; Dang et al., 2024), which in turn further effectively suppress the volatility of stock market indices (Yang et al., 2019). Nonetheless, based on the stock price information content perspective, Dang et al. (2024) find that government intervention has both positive and negative effects. On one hand, SMSFs being among the top 10 shareholders is significantly and positively associated with share price informativeness, supporting the positive effect of government intervention. On the other hand, when the SMSFs' shareholding ratio remains unchanged, this positive correlation is significantly suppressed and the positive effect of government intervention is significantly offset by the negative effect. From the perspective of the institutional governance role played by SMSFs as the state-owned long-term institutional investor and active market regulator and thus exploring the potential corporate governance effects, studies have found that SMSFs significantly reduce corporate violations and enhance innovative investments, and investment efficiency (Yu and Fang, 2020; Wen and Qiao, 2021; Feng and Wen, 2022). However, from the role of government intervener or government rescuer played by SMSFs, Jing et al. (2023) find that SMSFs can distort corporate executives' access to relevant information for decision making, thereby reducing corporate investment efficiency.

2.2. The relevant researches on the influencing factors of corporate trade credit financing

Most of the studies on the influencing factors of corporate trade credit financing are based on alternative financing theory on the demand side and buyer's market theory on the supply side. The demand for financing under credit constraints contributes to the substitution of trade credit financing for bank credit (Petersen and Rajan, 1997), and the higher the market position of a firm may force UDFs to offer trade credit for it (Fabbri and Klapper, 2016). As the research progresses, scholars enrich the influencing factors of trade credit financing from different perspectives including corporate governance, credit level, trust relationship, and EPU. When it comes to corporate governance or credit level, firms' trade credit financing rises significantly with the improvement of corporate governance or credit level such as internal control (Zheng et al., 2013), accounting information quality (Li et al., 2021), and corporate social responsibility (Zhang et al., 2020). In contrast, the deterioration of corporate governance or credit level, like dual class equity (Sah and More, 2022), controlling shareholder equity pledge (Jiang et al., 2021), and regulatory penalties (Wu et al., 2022), will reduce trade credit financing. The enhancement of trust relationships also facilitates firms' access to trade credit financing, and existing studies have verified from the perspectives of hometown relationship or surname relationship between firms' CEOs and UDPs' CEOs (Kong et al., 2020; Xu et al., 2022), and regional social trust or social capital (Wu et al., 2014; Hasan and Habib, 2019). EPU, on the other hand, reduces business credit financing at the macroeconomic level (Su et al., 2021).

2.3. Theoretical analysis and hypothesis

The essence of trade credit financing is the debt financing received by firms from UDFs, and the successful conclusion of debt contracts relies on the mutually beneficial trust principle, which is the cornerstone of sustained long-term cooperation between firms. To ensure the smooth signing of debt contracts and subsequent smooth performance and effectively maintain long-term cooperation, the lender of funds will continuously monitor and react appropriately to the corporate governance, uncertainty, operational risks, and financial information quality of the demand side. More importantly, in the process of balancing supply and demand for trade credit, there is a huge difference in the capital cost or liquidity risk borne by the lenders and the demanders, with the lenders typically sacrificing their liquidity costs and bearing the potential bad debt risk associated with the demanders' occupation of funds. Consequently, suppliers and customers—UDFs—are highly concerned about crucial information including corporate governance, operational risks, and accounting information quality to ensure that the debt default risk is manageable and thus affect the trade credit financing they provide to firms (Allen et al., 2005; Zhang et al., 2020; Jiang et al., 2021; Li et al., 2021).

Could SMSFs under the Chinese government intervention (government bailout) alleviate UDFs' concerns about corporate key information they are interested in, and thus facilitate them in providing trade credit to firms? The key to answering this question is to clarify what role and degree of influence SMSFs really play in China's capital market. As state-owned long-term institutional investors under government intervention, SMSFs have stronger influence on the capital market, listed firms, and stakeholders than typical institutional investors. The essential differences between SMSFs and typical institutional investors are mainly reflected as follows.

First, there are differences in the degree of relationship with the central government and the degree of government intervention. In general, the decisions of the typical institutional investor are less susceptible to government influence. However, the SMSFs are the state-owned institutional investors formed by the Chinese government through gathering substantial state-owned capital during market crashes. Compared with typical institutional investors, SMSFs have a close relationship with the central government, and their decisions are inevitably and obviously influenced by the government intervention, and they shoulder the national mission of stabilizing stock market volatility; to this extent, SMSFs can be regarded as the role of the government rescuer in China's capital market. At the same time, due to the close relationship between SMSFs and the central government, the capital movements of SMSFs can convey

private information to the outside world about changes in the central government policies or capital market regulatory policies, and thus SMSFs can also be regarded as an implicit active market regulator in the capital market.

Second, there are differences in the roles played by institutional investors and the degree of their influence. Both SMSFs and typical institutional investors can play the role of institutional investors. However, especially in China's less developed capital markets, SMSFs have a more diversified role and greater ability to play a role than typical investors. In developed capital markets in US, institutional investors are numerous and dominant. While in China's capital market, the main investors are minority retail investors, with fewer institutional investors, especially the lack of long-term institutional investors. SMSFs are long-term professional state-owned institutional investors that promote the healthy development of China's stock market. Compared with typical institutional investors, SMSFs will have a stronger impact on micro-enterprises.

From the perspective of fund team allocation, Chinese SMSFs can be regarded as the "top group" of institutional investors in China's capital market. The Chinese SMSFs are composed of China's top state-owned institutional investors, which may have the unparalleled advantages of massive capital, elite talents, information data collection and mining capabilities, and professional knowledge and analysis capabilities compared with typical institutional investors. Therefore, SMSFs may have a stronger corporate governance effect in terms of regulatory deterrence on firms relative to typical institutional investors.

From the perspective of investment philosophy and investment horizon, compared with typical institutional investors, Chinese SMSFs have a greater sense of responsibility and mission to promote the healthy development of China's stock market, and they have a more long-term value investment orientation. This will enhance the identity positioning of Chinese SMSFs as the government rescuer and active market regulator, which in turn will enhance their motivation to promote corporate governance of listed firms.

From the perspective of capital market influence, China's SMSFs have a stronger influence than typical institutional investors, and they are naturally more eye-catching star effects. In underdeveloped capital market where institutional investors are relatively small, the capital movements of China's SMSFs have been widely followed. On the one hand, when a firm is held by China's SMSFs, it is continuously tracked by other investors in the capital market, financial intermediaries and the news media. This objectively brings continuous regulatory deterrence to corporate senior managers and controlling shareholders, which is conducive to mitigating information asymmetry and suppressing the agency costs of senior managers and controlling shareholders, and thus better optimizes corporate decision-making. On the other hand, SMSF firms will also enjoy more benefits from the star effect of SMSFs. To a certain extent, SMSFs play a stronger role as information authentication than typical institutional investors. This can send signals to the firm's stakeholders that the firm is supported by the government rescue and will enhance corporate governance, which in turn will increase the willingness and strength of stakeholders to voluntarily provide resources to the firm, and objectively promote corporate development.

It can be seen from the above analysis that SMSFs can serve at least the triple roles of the state-owned long-term institutional investor, government rescuer, and active market regulator, and they also have the eye-catching star effect, these will certainly have tremendous influence on listed firms and their stakeholders. Thus, in this study, we expect that SMSFs can enhance the trust and cooperation relationship between SMSF firms and UDFs in the supply chain by influencing corporate governance, operational risk, and accounting information quality of SMSF firms and objectively increase the trade credit financing of SMSF firms.

2.3.1. Insider governance effect

From the perspective of insider governance, SMSFs have the potential to significantly reduce the agency costs incurred by corporate insiders (executives and controlling shareholders) and thus enhance trade credit financing. In the specific institutional context of "high concentration of equity" and "insufficient legal protection for investors" in China, Chinese listed firms experience dual agency problems: executives' self-interest embezzlement and controlling shareholders' tunneling (Jiang and Kim, 2015). Due to information asymmetry and inconsistent target interests, the self-interest behaviors of executives and controlling shareholders can exacerbate the conflict of interest between insiders and creditors, raising concerns from suppliers and customers about the firm's ability to successfully repay trade credit arrears on time, which in turn reduces trade credit financing (Sah and More, 2022; Jiang et al., 2021). Contrarily, the SMSFs can exert a corporate governance effect that curbs insider self-interest, thus having a positive impact on corporate trade credit financing by reducing suppliers' or customers' worries about corporate insiders' interest-appropriating behavior.

Different from other institutional investors, the triple role of the state-owned long-term institutional investor, government rescuer, and active market regulator of SMSFs drives them to have more incentive and motivation to professionally monitor or deter the executives and controlling shareholders of the SMSF firms (Yu and Fang, 2020; Wen and Qiao, 2021; Feng and Wen, 2022), weakening the conflict of interest between insiders and creditors. Existing studies have found that SMSFs can strengthen internal controls (Wen and Qiao, 2021), and that SMSFs significantly increase R&D investment and improve corporate investment efficiency by restraining the embezzlement of the interests of executives and controlling shareholders (Yu and Fang, 2020; Feng and Wen, 2022). Accordingly, SMSFs can effectively improve corporate insider governance by curbing the dual agency conflicts between executives and controlling shareholders, weaken the concerns of UDFs about insiders' misappropriation of interests and the rising risk of debt defaults in SMSF firms, and improve the trust of suppliers or customers, which in turn helps to promote trade credit financing for SMSF firms.

2.3.2. Eye-catching star effect

From the perspective of the eye-catching star effect, the SMSFs have a significant impact on the capital market, and can be regarded as the "top group" of institutional investors in China's capital market, the capital movements of China's SMSFs have naturally been widely followed. Therefore, the SMSFs essentially provide positive signal effects to stakeholders, and then the SMSFs will attract the masses of investors, analysts, news media to continuously keep track on the SMSF firms. This objectively brings continuous high-

intensity supervision to corporate senior managers and controlling shareholders, which is conducive to reducing information asymmetry and suppressing the agency costs of senior managers and controlling shareholders, and thus better optimizes corporate decision-making. As a result, the SMSFs may attract stakeholders to stay focused on the SMSF firms through a positive signaling effect exerted by the eye-catching star effect, which may reduce information asymmetry and strengthen corporate governance, helping to increase UDFs' trust in the SMSF firms and ultimately increasing the SMSF firms' trade credit financing.

2.3.3. Operation risk governance effect

From the perspective of operational risk governance, SMSFs may effectively lower firms' operational risk and thus enhance trade credit financing. Operational risk may affect firms' ability to repay trade credit on time and thus increase the risk of debt default, so suppliers or customers will weaken their enthusiasm for providing trade credit (Ge and Qiu, 2007; Zhang et al., 2020). As long-term institutional investors, SMSFs can have a corporate governance effect on executives' inefficient investments or irregularities to reduce operational uncertainty. Feng and Wen (2022) find that SMSFs can optimize the investment decisions of executives and thus improve corporate investment efficiency and reduce investment risks. Wen and Qiao (2021) also discover that SMSFs can effectively reduce the tendency and frequency of corporate violations by enhancing internal control and curbing executive self-interest encroachment. The optimization of investment efficiency or the mitigation of corporate irregularity may help to reduce corporate operational risk. Meanwhile, SMSFs could play a stronger role as information authentication. This can send signals to the firm's stakeholders that the firm is supported by the government rescue and will enhance corporate governance, which in turn will increase the willingness and strength of stakeholders to voluntarily provide resources to the firm, and objectively reduce their business risks. Consequently, SMSFs may facilitate SMSF firms' access to trade credit financing by reducing their business risks and thus enhancing suppliers' or customers' credit ratings and trust.

2.3.4. Accounting information governance effect

In terms of accounting information governance, SMSFs may effectively improve the accounting information quality of SMSF firms and thus facilitate trade credit financing. Trust is a prerequisite for suppliers and customers to provide trade credit to firms, and the foundation for building mutual trust is information transparency. High-quality financial reports are crucial for creditors to interpret corporate information, evaluate credit risk, and build trust due to information asymmetry (Li et al., 2021), and have a significant influence on creditors' credit decisions (Zheng et al., 2013). Existing studies find that Chinese listed firms have a more severe earnings management phenomenon (Chen and Yuan, 2004; Yu et al., 2006), distorting the truthfulness and robustness of corporate accounting information. As a result of worries about corporate accounting information quality, suppliers or customers may reduce trade credit supply by reducing trust and increasing credit risk predictions. SMSFs, meanwhile, may successfully exert an accounting information governance effect of curbing earnings management, which aids in improving accounting information quality, enhancing creditors' trust, and may increasing SMSF firms' trade credit financing.

SMSFs have talent team support, information processing advantages, and professional accounting and financial analysis capabilities, which may improve the precise identification of earnings manipulation. SMSFs may also exert corporate governance effects to directly regulate corporate insider misconduct, which also raises the opportunity cost of the insiders' earnings manipulation. In addition, the room for firms to engage in earnings management may inevitably be compressed due to the continued high pressure of external supervision and tracking analysis brought about by the eye-catching star effect of the SMSFs. Therefore, SMSFs may successfully prevent corporate insider earnings management and thus improve accounting information quality, which may help to alleviate information asymmetry between creditors and SMSF firms, improve creditors' trust, and promote SMSF firms' trade credit financing.

Table 2
Sample Selection Process and Final Sample Distribution.

Panel A: Sample Selection

Sample	Observations	Number of firms
Initial sample of China's listed firms from 2010 to 2020	32,356	4126
Exclude: All observations for firms in financial industry	984	123
Exclude: All observations for firms that have ever been identified as ST (special treatment) or PT (particular transfer)	5169	485
Exclude: All observations for delisted firms	292	35
Exclude: All observations for all firms whose stocks have once been liquidated by SMSFs	4842	503
Exclude: Abnormal observations with asset-liability ratios greater than 1	13	
Exclude: All observations for IPO firms in 2015 and later	4848	1448
Exclude: Observations with missing main control indicators	590	
Final total sample	15,618	1531

Panel B: Group Distribution of whether Firms in the Final Total Sample Are Held by SMSFs

Group	Number of firms	Observations	Observations of final total sample	Percentage
SMSF Firms	731	7521	15,618	48.16 %
Non-SMSF Firms	800	8097	15,618	51.84 %

Based on the above analysis, we believe that SMSFs can enhance trade credit financing by optimizing corporate insider governance, reducing operational risk, and improving accounting information quality. Therefore, we propose the following hypothesis.

H1. All else being equal, SMSFs can promote the trade credit financing of the SMSF firms.

3. Research design and variable description

3.1. Sample selection and data sources

To avoid the impact of the financial crisis in 2008 and the liquidity shock of China's four trillion-yuan investment, we select the data of China's listed companies from 2010 to 2020 as the initial sample. We then exclude the data as follows: all observations for firms in financial industry; all observations for firms that have ever been identified as ST (special treatment) or PT (particular transfer); all observations for delisted firms; all observations for all firms whose stocks have once been liquidated by SMSFs; abnormal observations with asset-liability ratios greater than 1; all observations for IPO firms in 2015 and later; observations with missing main control indicators. Our final sample has a total of 15,618 observations, including 7521 observations for the 731 SMSF firms and 8097 observations for the 800 non-SMSF firms. All continuous variables are winsorized at the 1 % and 99 % levels to remove the impact of extreme values. SMSFs data are from the WIND database, and other financial data are from the CSMAR database. We list the sample selection process and final sample distribution in Table 2.

3.2. Model settings and variable definition

Based on the perspective of the supply chain relationship spillover effect, SMSFs have a certain degree of exogenous effect on the changes of trust and cooperation relationship, as well as SMSFs entering the market also have a certain degree of exogenous shock characteristics for micro firms, thus the introduction of SMSFs provides a good quasi-natural experimental scenario for exploring the study of the economic consequences of the government's stock purchase rescue policy.

We draw on the relevant literature (Bertrand and Mullainathan, 2003; Heese et al., 2022) to assess the impact of SMSFs on corporate trade credit financing by using a dynamic DID model that simultaneously controls for firm-fixed effects and year-fixed effects. The model is designed as follows:

$$TC_{i,t} = \alpha_0 + \alpha_1 Treat\_Post_{i,t} + CV_{i,t} + Firm + Year + \varepsilon_{i,t} \quad (1)$$

where *Firm* and *Year* represent the firm fixed effects and year fixed effects, respectively, and ε represents the random error term.

In model (1), *TC* is the explanatory variable and represents trade credit financing. According to the existing literature (Fisman and Love, 2003 ; Long and Zhang, 2011), we use the sum of accounts payable, notes payable, and advance receipts to measure trade credit financing, normalized by total liabilities, which helps to comprehensively measure credit financing obtained from supply chain transactions from the perspective of both suppliers and customers. In the robustness test section, we refer to the existing literature and further employ multiple proxy variables to measure corporate trade credit financing.

Treat_Post is the focused explanatory variable, where *Treat* is a group dummy variable that is 1 when the firm is held by SMSFs and 0 otherwise, and *Post* is a time dummy variable of the firm held by SMSFs that is 1 if the firm is actually held in real time by SMSFs in 2015 or later years and 0 otherwise. *Treat_Post* equals the *Treat* multiplied by *Post*. We expect that the regression coefficient α_1 of the cross-product term *Treat_Post* should be significantly positive. In addition, we control for individual firm fixed effects (*Firm*) and year fixed effects (*Year*) to avoid noise disturbances such as individual firm omitted variables and macroeconomic changes.

CV is the set of control variables, and we refer to relevant literature to control for the following variables (Yu and Fang, 2020; Kong et al., 2020; Li et al., 2021; Jiang et al., 2021): firm size (*Size*), debt ratio (*Lev*), return on assets (*Roa*), operating income growth rate (*Growth*), cash flow (*Cfo*), the shareholding ratio of the largest shareholder (*First*), director size (*Bsize*), dual position (*Dual*), other

Table 3
Variable Definitions and Measurement Methods.

Variable types	Variables	Definition
Explained variables	*TC*	Corporate trade credit financing, (accounts payable + notes payable + advance receipts) / total liabilities
Explanatory variables	*Treat*	Group variable, 1 if the company is held by SMSFs, 0 otherwise
	Post	Time variable, 1 if the company is actually held in real time by SMSFs in 2015 or later years, 0 otherwise
	Size	Firm size, which is equal to the natural log of total assets
	Lev	Debt ratio, which is equal to total liabilities scaled by total assets
	Roa	Return on assets, which is equal to net income divided by total assets
	Growth	Operating income growth rate, (Operating income difference between current period and previous period)/ Previous period operating income
Control variables	*Cfo*	Cash flow, which is equal to the net cash-flow from operating activities scaled by total assets
	First	The shareholding ratio of the largest shareholder
	Bsize	Director size, the number of directors on the board
	Dual	Dual position, A dummy variable equal to 1 if the CEO and the chairman are the same person and 0 otherwise
	Oinsts	Other institutional shareholding ratios, Shareholding by non-SMSFS institutional investors
	Age	Years of listing, Natural logarithm of one plus the number of years listed

institutional shareholding ratios (*Oinsts*), and years of listing (*Age*), and the standard deviations in the empirical analysis are treated by firm-level clustering (Cluster). Details of the relevant variables are shown in Table 3.

3.3. Descriptive statistics of variables

Table 4 presents the descriptive results of the main variables. The analysis shows that: (1) The mean and standard deviation of trade credit financing (*TC*) of the sample firms during 2010–2020 are 0.401 and 0.228, respectively, and the minimum, median and maximum values are 0.025, 0.375 and 0.920, respectively, implying that trade credit financing varies significantly between different firms. (2) The mean value of the explanatory variable (*Treat_Post*) is 0.278, indicating that a total of 27.8 % of the annual sample is influenced by SMSFs.

4. Empirical results analysis and robustness test

4.1. The effect of SMSFs on corporate trade credit financing

Table 5 shows the regression results of the DID model, the explained variable is corporate trade credit financing (*TC*). In column (1), when there is no control variable, the regression coefficient of *Treat_Post* is 0.025 and significant at the 1 % level. In column (2), when all control variables are considered, the regression coefficient of *Treat_Post* is 0.016 and significant at the 5 % level, and its economic significance implies that SMSF firms can obtain 0.016 units more trade credit financing from UDFs in the supply chain relative to non-SMSF firms. The above results show that SMSFs can enhance corporate trade credit financing, verifying hypothesis H1.

4.2. Robustness test

4.2.1. Parallel trend test

One of the prerequisite assumptions of the DID model is a parallel trend test, that is, before the introduction of SMSFs, the trade credit financing of the SMSF firms (treatment group) was not significantly higher than that of the non-SMSF firms (control group). We use two methods for verification. In method 1, we only consider the sample observations before the introduction of SMSFs in 2015, and the result is shown in Table 4, where the regression coefficient of the treatment group variable *Treat* is not significant, verifying the parallel trend test. In method 2, we draw on Serfling (2016) and Dyreng et al. (2016) to validate the dynamic trend by setting the dynamic time trend variables *pre_k*, *current*, and *pos_k* when the firms belong to the treatment group and the firms are held by SMSFs in real time around the time window (−4,4), all taking the value of 1, otherwise taking 0, where k∈[1,4]. And then, we use the dynamic time trend variables for regression in the model (1), and the regression coefficients of the dynamic time trend variables are presented in Table 6 and Fig. 1. As shown in Table 6 and Fig. 1, the regression coefficients of the variables *pre_k* before the firms were held by SMSFs are insignificant and pass the parallel trend test, implying that, before the SMSFs' shareholding, there is no significant difference in the trade credit financing of SMSF firms in comparison with non-SMSF firms. When the firms are held by SMSFs in the current year and subsequent years, the regression coefficients of the variables *current*, *pos_k* are significantly positive, implying that, after the SMSFs' real-time shareholding, the SMSF firms' trade credit financing rises significantly, further verifying hypothesis H1.

4.2.2. Placebo test

The DID model assessment of validity necessitates the elimination of other potential policy noise interference, so we attempt to mitigate the noise interference by using a placebo test. We use two methods for verification. In method 1, we advance the year of the SMSFs holding the firms by two or three years respectively and generate a new dummy variable (*Treat_Post*) respectively. If the coefficient of the new dummy variable (*Treat_Post*) remains significantly positive, it implies that the increase in trade credit financing may be influenced by other policy factors rather than by SMSFs. If the coefficient of the new dummy variable (*Treat_Post*) is no longer significantly positive, it inversely suggests that the increase in trade credit financing is indeed influenced by SMSFs. The corresponding

Table 4
Descriptive Statistics of the Main Variables.

Variables	Num	Mean	St.Dev	Min	P25	P50	P75	Max
TC	15,618	0.401	0.228	0.025	0.215	0.375	0.567	0.920
Treat_Post	15,618	0.278	0.448	0.000	0.000	0.000	1.000	1.000
Size	15,618	22.370	1.333	19.800	21.410	22.170	23.110	26.220
Lev	15,618	0.422	0.199	0.050	0.264	0.420	0.575	0.841
Roa	15,618	0.041	0.051	−0.164	0.016	0.038	0.065	0.201
Growth	15,618	0.161	0.343	−0.505	−0.012	0.108	0.260	2.026
Cfo	15,618	0.049	0.066	−0.146	0.010	0.047	0.087	0.252
First	15,618	0.346	0.149	0.090	0.229	0.326	0.447	0.750
Bsize	15,618	10.270	2.558	5.000	9.000	10.000	12.000	18.000
Dual	15,618	0.235	0.424	0.000	0.000	0.000	0.000	1.000
Oinsts	15,618	0.071	0.101	0.000	0.005	0.029	0.095	0.579
Age	15,618	2.380	0.611	0.693	1.946	2.398	2.890	3.296

Table 5
The Effect of SMSFs on Corporate Trade Credit Financing.

Variables	(1)	(2)
	TC	*TC*
Treat_Post	0.025***	0.016**
	(3.33)	(2.34)
Size		−0.022***
		(−3.13)
Lev		−0.360***
		(−14.56)
Roa		−0.049
		(−1.24)
Growth		0.017***
		(4.85)
Cfo		0.304***
		(11.88)
First		−0.060
		(−1.52)
Bsize		0.001
		(1.29)
Dual		−0.005
		(−0.88)
Oinsts		0.037*
		(1.86)
Age		−0.069***
		(−5.46)
_cons	0.440***	1.196***
	(91.60)	(7.99)
Firm FE	Y	Y
Year FE	Y	Y
N	15,618	15,618
R-squared	0.096	0.222

Note: This table shows the empirical results of impact of SMSFs on corporate trade credit financing. The dependent variable is *TC*. Detailed definitions of all variables are reported in Table 1. All variables are winsorized at the 1 % and 99 % levels. *t-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

test results are shown in column (1) and column (2) of Panel A in Table 7, where the coefficients of the new dummy variable (*Treat_Post*) are insignificant and pass the placebo test. In method 2, we randomly assign the treatment and control groups, and then regress the DID model (1) on the new sample of newly generated randomly simulated. Further, we repeat the entire process of randomly assigning groups and then regressing them using the DID model as described above 500 times. According to the placebo test results (Panel B in Table 7 and Fig. 2), the difference in the percentage of regression coefficients that are significantly positive or negative is quite small, suggesting that the dummy treatment effect is not present, and inversely confirming that the increase in trade credit financing are driven by SMSFs.

4.2.3. Propensity score matched difference-in-differences (PSM-DID) regression

We further employ the PSM-DID method for re-testing in this paper. Firstly, we adopt the PSM method with non-repeated put-back, and perform the logit regression with the control variables of the model (1) on the group variable *Treat* and obtain the propensity score; then we re-match the sample groups 1:1 using nearest neighbor matching with a more stringent caliper value set at 0.001; finally, we evaluate the matched samples with the DID model. The result of PSM-DID is presented in Table 8. Columns (1) to (5) show the results of the intergroup difference test before and after PSM. Before the PSM, the intergroup differences of control variables are significant, and after the PSM, the intergroup differences of control variables are not significant, which implies that the PSM significantly reduces the intergroup differences of control variables. Columns (6) shows the empirical results of PSM-DID test. SMSFs still significantly enhance corporate trade credit financing, verifying hypothesis H1.

4.2.4. Heckman-DID two-stage model test

SMSFs may select firms with firms' good governance characteristics, resulting in a serious noise disturbance of sample self-selection bias. To verify the robustness of the findings in a more comprehensive way, following Feng and Wen (2022), we further adopt the Heckman-DID two-stage regression model to mitigate the latent sample self-selection bias. In the first stage, we use the Probit model to estimate the determinants of a firm's shareholding by SMSFs, we use the experimental group variable *Treat* as an explanatory variable, we also add the ration of firms other than the current firm in the same industry and same year that are held by SMSFs as an explanatory variable (*RInd_OSMSFs*), and then calculate the Inverse Mills Ratio (*IMR*), accordingly. In the second stage, we add the *IMR* to the benchmark regression model (1) to regress on corporate trade credit financing. The results are shown in Table 9. After controlling for

Table 6
Parallel Trend Test.

Variables	Sample observations before 2015	Dynamic effects
	(1)	(2)
	TC	*TC*
Treat	0.003	
	(0.30)	
pre_4		−0.004
		(−0.56)
pre_3		−0.005
		(−0.67)
pre_2		0.004
		(0.51)
pre_1		0.010
		(1.30)
current		0.027***
		(3.36)
pos_1		0.020**
		(2.51)
pos_2		0.028***
		(3.69)
pos_3		0.016**
		(2.08)
pos_4		0.014**
		(2.04)
Other controls	Y	Y
Industry FE	Y	
Year FE	Y	Y
Firm FE		Y
N	6433	15,618
R-squared	0.268	0.223

Note: This table shows the empirical results of parallel trend test. The dependent variable is *TC*. Since the group variable *Treat* is time-invariant, we consider controlling industry fixed effects and year fixed effects here. Detailed definitions of all variables are reported in Table 1. Detailed definitions of *pre_4*, *pre_3*, *pre_2*, *pre_1*, *current*, *pos_1*, *pos_2*, *pos_3*, and *pos_4* see in section 4.2.1. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

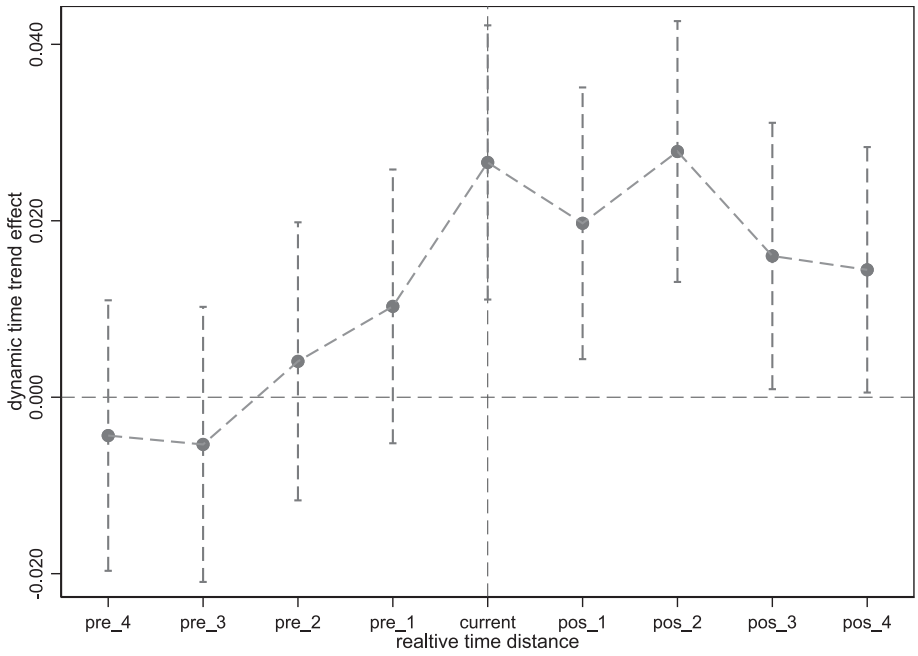

Fig. 1. The dynamic time trend effect of parallel trend test.

Table 7
Placebo Test.

Panel A: The Placebo Tests for Move Forward Two or Three Years		
Variables	Move forward two years	Move forward three years
	(1)	(2)
	TC	*TC*
Treat_Post	0.011	0.008
	(1.45)	(1.01)
Size	−0.025***	−0.027***
	(−3.41)	(−3.62)
Lev	−0.335***	−0.311***
	(−12.92)	(−11.90)
Roa	0.006	0.010
	(0.12)	(0.19)
Growth	0.018***	0.021***
	(4.83)	(5.42)
Cfo	0.293***	0.281***
	(11.85)	(11.18)
First	−0.028	0.002
	(−0.68)	(0.04)
Bsize	0.001	0.001
	(0.81)	(0.71)
Dual	−0.005	−0.009
	(−0.74)	(−1.33)
Oinsts	0.016	0.017
	(0.92)	(1.01)
Age	−0.080***	−0.083***
	(−6.36)	(−6.61)
_cons	1.212***	1.217***
	(7.87)	(7.90)
Firm FE	Y	Y
Year FE	Y	Y
N	14,174	13,366
R-squared	0.169	0.156

Panel B: The Distribution of t-value of Regression Coefficient for 500 Placebo Tests								
Variable	Statistic	Mean	P5	P25	P50	P75	P95	St.Dev
TC	coefficient	0.000	−0.003	−0.002	0.000	0.002	0.004	0.002
	t-value	0.003	−1.628	−0.690	0.011	0.664	1.780	1.004

Note: This table shows the empirical results of placebo test. The dependent variable is *TC*. All variables are winsorized at the 1 % and 99 % levels. Panel A shows the placebo tests for move forward two or three years. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests. Panel B shows the statistical results of the distribution of t-value of regression coefficients for 500 placebo tests.

IMR, the regression coefficients of *Treat_Post* are still significantly positive, which is consistent with the results of the benchmark regression.

4.2.5. Key variable substitution of corporate trade credit financing

Drawing on existing literature (Kong et al., 2020; Jiang et al., 2021), we reshape the measure of trade credit financing to construct the trade credit financing variables *TC1* (sum of accounts payable and notes payable, normalized by total liabilities), net trade credit financing *NTC* ((accounts payable + notes payable - accounts receivable - notes receivable)/total assets), and net trade credit financing *NTC1* ((accounts payable + notes payable - accounts receivable - notes receivable) / operating income). The results are shown in columns (1) to (3) of Table 10. The coefficients of *Treat_Post* are all significantly positive, implying that after re-measuring the trade credit financing variables with other proxy indicators, the SMSFs still significantly enhance corporate trade credit financing, which is consistent with the basic regression results and validates hypothesis H1.

4.2.6. The test of substitute variables for SMSFs

We further consider robustness tests with SMSFs holding level *SMSFs_R* and holding change *SMSFs_C*. *SMSFs_R* is the ratio of SMSFs' shareholdings. *SMSFs_C* is a dummy variable for changes in SMSFs' shareholdings, which is 1 when the change occurs and 0 otherwise. The results are shown in columns (1) and (2) of Table 11, where the regression coefficients of *SMSFs_R* and *SMSFs_C* are both significantly positive, consistent with the benchmark regression results. Meanwhile, we also consider adding a sample of observations of firms that had been liquidated by SMSFs, and then we re-regress the dummy variables *SMSFs_D* (it is equal to 1 when the firm is held

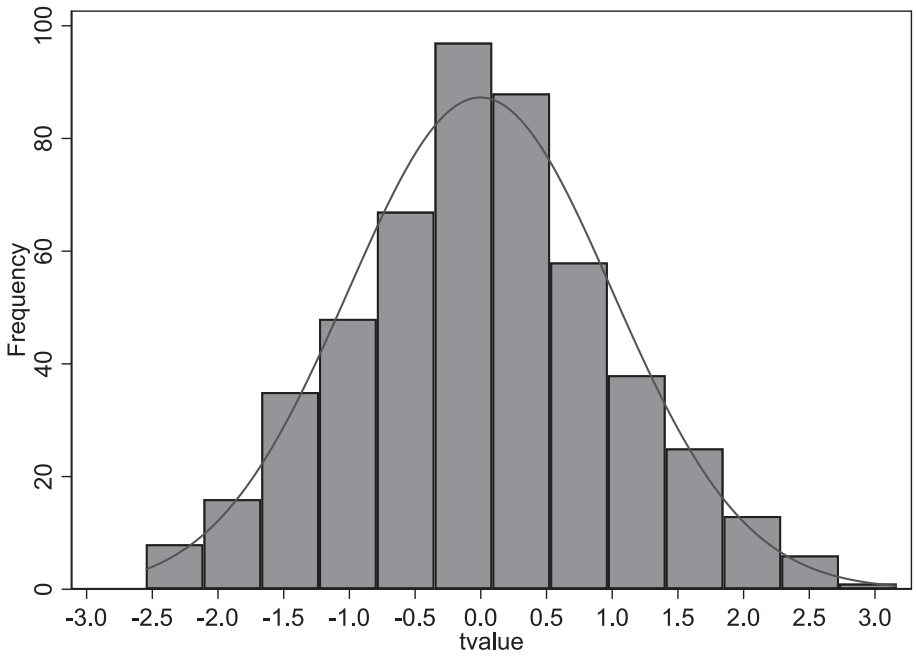

Fig. 2. The Distribution of Regression Coefficient t-value for 500 Placebo Tests.

Table 8
The Results of PSM-DID.

Variables	Intergroup difference test before and after PSM					Empirical results of PSM-DID
	Match	Mean of treatment group	Mean of control group	Mean difference	*t*-test	*TC*
	(1)	(2)	(3)	(4)	(5)	(6)
Treat_Post						0.022***
						(2.61)
Size	before-match	22.890	21.880	1.010	51.15***	−0.027***
	after-match	22.100	22.090	0.001	0.38	(−3.46)
Lev	before-match	0.442	0.405	0.037	11.70***	−0.394***
	after-match	0.403	0.409	−0.006	−1.50	(−13.68)
Roa	before-match	0.049	0.033	0.016	20.32***	−0.086*
	after-match	0.042	0.040	0.002	1.124	(−1.66)
Growth	before-match	0.154	0.168	−0.014	−2.54**	0.012**
	after-match	0.164	0.162	0.002	0.26	(2.38)
Cfo	before-match	0.058	0.041	0.017	16.39***	0.313***
	after-match	0.048	0.047	0.001	0.96	(9.74)
First	before-match	0.375	0.320	0.055	23.14***	−0.043
	after-match	0.334	0.335	−0.001	−0.39	(−0.93)
Bsize	before-match	10.640	9.930	0.710	17.49***	0.001
	after-match	10.130	10.090	0.004	0.75	(0.99)
Dual	before-match	0.185	0.282	−0.097	−14.39***	0.001
	after-match	0.243	0.247	−0.004	−0.46	(0.08)
Oinsts	before-match	0.081	0.062	0.019	11.84***	0.056**
	after-match	0.070	0.067	0.003	0.99	(2.25)
Age	before-match	2.433	2.330	0.103	10.56***	−0.077***
	after-match	2.336	2.346	−0.010	−0.79	(−5.04)
_cons						1.320***
						(8.02)
Firm FE						Y
Year FE						Y
N						9441
R-squared						0.241

Note: This table shows the empirical results of PSM-DID test. The dependent variable is *TC*. All variables are winsorized at the 1 % and 99 % levels. Columns (1) to (5) show the results of the intergroup difference test before and after PSM. Columns (6) shows the empirical results of PSM-DID test. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

Table 9
The Results of the Heckman-DID Two-stage Model.

	First phase	Second phase
Variables	(1)	(2)
	Treat	*TC*
RInd_OSMSFs	2.336***	
	(6.60)	
Treat_Post		0.017**
		(2.39)
IMR		−0.012
		(−0.50)
Size	0.530***	−0.026**
	(14.73)	(−2.52)
Lev	−0.901***	−0.355***
	(−4.37)	(−12.58)
Roa	2.857***	−0.074
	(5.76)	(−1.24)
Growth	−0.283***	0.020***
	(−7.69)	(3.55)
Cfo	1.071***	0.294***
	(3.64)	(9.55)
First	0.670***	−0.060
	(2.84)	(−1.49)
Bsize	0.033***	0.000
	(3.52)	(0.60)
Dual	−0.144**	−0.004
	(−2.29)	(−0.58)
Oinsts	0.229	0.034*
	(1.02)	(1.70)
Age	−0.132**	−0.066***
	(−2.02)	(−5.20)
_cons	−12.549***	1.292***
	(−16.33)	(5.39)
Firm FE		Y
Industry FE	Y	
Year FE	Y	Y
N	15,618	15,618
R-squared	0.176	0.222

Note: This table shows the results of the Heckman-DID two-stage model. *RInd_OSMSFs* is the percentage of other firms in the same industry year that are held by SMSFs, excluding the firm itself. *IMR* is the inverse Mills ratio calculated by the Probit model in the first stage of the Heckman-DID two-stage model. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests. Other control variables are not listed here.

in real time by SMSFs in year t and 0 otherwise) and the shareholding ratio *SMSFs_R*. The results show that the coefficients of *SMSFs_D* and *SMSFs_R* are still significantly positive, which implies that SMSFs still significantly increase corporate trade credit financing after expanding the sample of observations of firms that had been liquidated by SMSFs, which is robustly consistent with the results of the benchmark regression.

5. Mechanisms and extension test

5.1. Mechanisms

Our previous study found that SMSFs can significantly improve corporate trade credit financing. The essence of trade credit financing is the debt financing that firms receive from UDFs, and trust is the cornerstone of debt financing. Meanwhile, information asymmetry, corporate governance, and corporate risk are the main factors that influence suppliers and customers to provide trade credit financing to firms. In the previous section of the theoretical analysis, we argue that SMSFs may enhance the trust cooperation relationship between SMSF firms and UDFs through the insider governance effect, eye-catching star effect, business risk governance effect, and accounting information governance effect, which objectively increase suppliers' and customers' trade credit support to SMSF firms. We further conduct empirical tests to identify the specific mechanism.

5.1.1. Insider governance channel

As we discussed in section 2.3.1, China's SMSFs can effectively improve corporate insider governance by reducing the dual agency

Table 10
Test of the Substitution Variables of Corporate Trade Credit Financing.

Variables	(1)	(2)	(3)
	TC1	*NTC*	*NTC1*
Treat_Post	0.016***	0.006*	0.015**
	(2.70)	(1.92)	(2.05)
Size	−0.019***	0.011***	0.003
	(−3.05)	(3.03)	(0.43)
Lev	−0.326***	0.099***	0.282***
	(−14.12)	(8.53)	(10.39)
Roa	−0.031	−0.092***	−0.029
	(−0.85)	(−4.23)	(−0.61)
Growth	0.011***	0.004*	0.008*
	(3.53)	(1.94)	(1.74)
Cfo	0.091***	0.158***	0.231***
	(4.26)	(12.71)	(8.67)
First	−0.022	−0.006	−0.037
	(−0.62)	(−0.36)	(−1.05)
Bsize	0.000	0.000	0.001
	(0.89)	(1.22)	(0.88)
Dual	−0.006	−0.001	−0.003
	(−1.19)	(−0.22)	(−0.41)
Oinsts	0.005	0.022**	0.037*
	(0.27)	(2.30)	(1.69)
Age	−0.058***	−0.021***	−0.060***
	(−5.37)	(−3.84)	(−4.83)
_cons	0.978***	−0.253***	−0.122
	(7.45)	(−3.41)	(−0.86)
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
N	15,618	15,618	15,618
R-squared	0.151	0.110	0.088

Note: This table shows the test of the substitution variables of corporate trade credit financing. The dependent variables are *TC1, NTC1*, and *NTC1*. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

costs of executives and controlling shareholders, thereby weakening UDFs' concerns about insider misappropriation and rising debt default risks of the SMSF firms, and improving the trust of suppliers or customers, thus helping to promote SMSF firms' trade credit financing. Therefore, we test whether SMSFs have insider governance effects from the perspective of dual agency costs of executives and controlling shareholders.

We refer to Ang et al. (2000) to choose the management expense ratio (*Gmfee*, management expense/operating revenue) to measure executive agency costs, and the higher its value implies higher executive agency costs. Following Chen et al. (2018), we choose related party transactions (*Rpt*, the sum of annual related party transactions/total assets and adjusted for the industry) to measure controlling shareholders' tunneling, and the higher its value implies the more serious the controlling shareholders' tunneling.

Columns (1) and (2) of Table 12 show the regression results of SMSFs on the management expense ratio (*Gmfee*) and the related party transactions (*Rpt*), respectively. The results show that both SMSFs significantly reduce the management expense ratio and related party transactions at the 1 % level, implying that Chinese SMSFs can indeed exert an insider governance effect of curbing the dual agency costs of executives and controlling shareholders. Jiang et al. (2021), Sah and More (2022) both find that the dual agency costs of executives and controlling shareholders can reduce trade credit financing, so the suppression of dual agency costs for executives and controlling shareholders by the SMSFs can help to facilitate firms' access to trade credit financing, therefore improving insider governance is indeed a potential channel for SMSFs to enhance trade credit financing.

5.1.2. Eye-catching star effect channel

As we discussed in section 2.3.2, China's SMSFs can attract stakeholders to stay focused on the SMSF firms through a positive signaling effect exerted by the eye-catching star effect, which may reduce information asymmetry and strengthen corporate governance, helping to increase UDFs' trust in the SMSF firms and ultimately increasing the SMSF firms' trade credit financing. Therefore, we test whether SMSFs have the eye-catching star effect to attract the masses of investors, analysts, news media to continuously keep track on the SMSF firms and bring continuous high-intensity supervisory deterrence. We construct the masses of investors variable (*Breadth*, the natural logarithm of the number of investors), construct the analyst focus variable (*Analyst*, the natural logarithm of the number of analysts) and the news coverage variable (*Coverage*, the natural logarithm of news coverage).

The columns (3) to columns (5) of Table 12 show the regression results of SMSFs on the number of investors (*Breadth*), the analyst focus (*Analyst*), and the news coverage (*Coverag*), respectively. The results show that both SMSFs significantly increase the number of investors, the analyst focus, and the news coverage at the 1 % level, implying that Chinese SMSFs can indeed have the eye-catching star

Table 11
The Results for Substitute Variables for SMSFs and for the Samples Containing Firms Whose Stocks Were Liquidated by SMSFs.

Variables	(1)	(2)	(3)	(4)
	TC	*TC*	*TC*	*TC*
SMSFs_R	0.272***		0.198***	
	(2.91)		(3.20)	
SMSFs_C		0.011**		
		(2.37)		
SMSFs_D				0.008**
				(2.57)
Size	−0.023***	−0.023***	−0.020***	−0.020***
	(−3.20)	(−3.24)	(−8.10)	(−8.03)
Lev	−0.360***	−0.360***	−0.367***	−0.368***
	(−14.53)	(−14.52)	(−34.93)	(−34.95)
Roa	−0.045	−0.048	−0.040	−0.042*
	(−1.14)	(−1.20)	(−1.64)	(−1.71)
Growth	0.017***	0.018***	0.016***	0.016***
	(4.84)	(4.89)	(5.93)	(5.95)
Cfo	0.304***	0.303***	0.291***	0.291***
	(11.90)	(11.85)	(17.93)	(17.91)
First	−0.060	−0.060	−0.062***	−0.062***
	(−1.51)	(−1.51)	(−3.97)	(−3.95)
Bsize	0.001	0.001	0.001*	0.001*
	(1.31)	(1.20)	(1.77)	(1.74)
Dual	−0.005	−0.005	−0.006**	−0.006**
	(−0.90)	(−0.87)	(−2.01)	(−1.99)
Oinsts	0.037*	0.034*	0.038***	0.037***
	(1.88)	(1.74)	(3.18)	(3.10)
Age	−0.068***	−0.071***	−0.063***	−0.064***
	(−5.34)	(−5.65)	(−10.68)	(−10.93)
_cons	1.205***	1.219***	1.136***	1.135***
	(8.05)	(8.13)	(21.32)	(21.27)
Firm FE/Year FE	Y	Y	Y	Y
N	15,618	15,618	19,720	19,720
R-squared	0.222	0.222	0.212	0.212

Note: In this table, Columns (1) and (2) show the results of substitute variables for SMSFs, and Columns (3) and (4) show the results of the sample containing firms whose stocks were liquidated by SMSFs. The sample size has changed due to the addition of new samples and the missing values for the main variables. *SMSFs_R* is the ratio of SMSFs' shareholdings. *SMSFs_C* is a dummy variable for changes in SMSFs' shareholdings, which is 1 when the change occurs and 0 otherwise. *SMSFs_D* is a dummy variable that is 1 when the firm's stock is held in real time by SMSFs in year t and 0 otherwise. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

effect to provide positive signal effects to stakeholders. With the increase in the number of investors, analyst focus, and news coverage, the information asymmetry and agency costs of the SMSF firms will decrease, and the trust with UDFs will increase, thus facilitating trade credit financing. Therefore, the eye-catching star effect is indeed a potential channel for SMSFs to enhance trade credit financing.

5.1.3. Operation risk governance channel

As discussed in section 2.3.3, SMSFs may facilitate firms' access to trade credit financing by reducing their operational risks and thereby enhancing suppliers' or customers' credit ratings and trust. Following John et al. (2008), we use the volatility of industry-average-adjusted return on assets over a 3-year period to measure the operation risk (*Risk*), and the higher volatility means that the firm faces higher operation risk.

Column (6) of Table 12 shows the results of the regression of the SMSFs on the operation risk (*Risk*), which shows that the coefficient of *Treat_Post* is significantly negative at the 1 % level, implying that SMSFs can significantly reduce the operation risk. Zhang et al. (2020) argue that both the higher financial health and lower operational risk of a firm are more conducive to obtaining trade credit financing. And we find that SMSFs can effectively reduce firms' operational risk, which objectively helps to facilitate corporate trade credit financing. Consequently, improving operational risk governance is indeed a potential channel for SMSFs to enhance trade credit financing.

5.1.4. Accounting information governance channel

As discussed in section 2.3.4, China's SMSFs may effectively inhibit corporate insider earnings management and thus improve accounting information quality, which may help to alleviate information asymmetry between creditors and SMSF firms, improve creditors' trust, and promote SMSF firms' trade credit financing.

Following Hribar and Craig Nichols (2007), we use earnings management (*DA*) measured by manipulable accrued profits as a proxy variable for the accounting information quality, with the higher the earnings management (*DA*), the worse the quality of accounting information. Column (7) of Table 12 shows the regression results of SMSFs on the earnings management (*DA*), and the coefficient of

Table 12
Results of Channel Tests.

Variables	Insider governance		Eye-catching Star Effect			Operation risk	Accounting information
	Mgfee	*Rpt*	*Breadth*	*Analyst*	*Coverage*	*Risk*	*DA*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treat_Post	−0.007***	−0.028***	0.247***	0.516***	0.809***	−0.010***	−0.007***
	(−4.04)	(−3.07)	(3.95)	(4.97)	(10.90)	(−10.50)	(−2.97)
Size	−0.010***	−0.051***	0.305***	0.557***	0.175***	−0.009***	−0.007***
	(−5.48)	(−5.73)	(7.93)	(19.30)	(8.09)	(−13.70)	(−3.06)
Lev	−0.041***	0.325***	−0.053	−0.414***	0.165**	0.012***	0.028***
	(−6.21)	(10.07)	(−0.41)	(−3.95)	(2.09)	(4.07)	(3.07)
Roa	−0.192***	−0.056	0.209	3.941***	0.565***	−0.202***	−0.083***
	(−13.13)	(−0.93)	(0.78)	(17.84)	(3.63)	(−30.40)	(−2.72)
Growth	−0.019***	0.003	−0.133***	0.010	0.049***	0.002**	0.017***
	(−12.99)	(0.52)	(−6.50)	(0.52)	(3.29)	(2.29)	(6.60)
Cfo	−0.023***	0.010	0.139	−0.166	0.065	0.026***	−0.197***
	(−3.34)	(0.29)	(0.81)	(−1.37)	(0.69)	(5.98)	(−10.40)
First	−0.015	0.064	−0.785***	−0.429**	−0.619***	−0.029***	−0.012
	(−1.47)	(1.14)	(−2.76)	(−2.52)	(−5.33)	(−6.57)	(−1.00)
Bsize	0.000**	0.001	−0.009*	−0.008**	0.005**	0.001***	0.001**
	(2.31)	(1.43)	(−1.72)	(−2.50)	(1.98)	(4.94)	(2.52)
Dual	−0.002	−0.007	−0.018	0.006	0.011	0.001	0.000
	(−0.89)	(−0.94)	(−0.41)	(0.24)	(0.53)	(1.27)	(0.18)
Oinsts	0.016***	−0.003	0.171***	0.106***	0.085***	0.003	0.042***
	(2.93)	(−0.14)	(4.63)	(3.18)	(3.30)	(1.06)	(5.34)
Age	−0.011***	0.009	1.153***	−0.339***	−0.004	0.006***	0.026***
	(−3.33)	(0.56)	(10.43)	(−5.78)	(−0.09)	(3.03)	(6.65)
_cons	0.357***	1.089***	1.911**	−9.583***	1.252***	0.226***	0.161***
	(9.21)	(5.75)	(2.43)	(−15.42)	(2.72)	(15.36)	(3.51)
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
N	15,618	15,618	15,618	15,618	15,618	15,618	15,618
R-squared	0.236	0.056	0.108	0.311	0.324	0.053	0.065

Note: This table shows the results of channel tests. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

Treat_Post is significantly negative at the 1 % level, implying that SMSFs can significantly reduce corporate earnings management, improve the quality of accounting information, and exert the accounting information governance effect. Li et al. (2021) find that high-quality accounting information helps to enhance corporate trade credit financing; therefore, the improvement of the accounting information quality by SMSFs is beneficial to corporate trade credit financing, so reducing earnings management is indeed a potential channel for SMSFs to enhance corporate trade credit financing.

5.2. The moderating effect related to the shareholding characteristics of SMSFs

The positive effect of SMSFs under government intervention or government rescue in promoting corporate trade credit financing is inevitably affected by their shareholding characteristics. We conduct a comprehensive and in-depth analysis from four perspectives, namely, the high or low percentage of shareholding, the direction of the change in the shareholding, whether belonging to the top 10 shareholders, as well as the number of them belonging to the top 10 shareholders.

When the SMSFs' shareholding ratio is higher, and when SMSFs are among the top 10 shareholders, the SMSFs are more likely to proactively supervise listed firms, which objectively reduces information asymmetry and agency costs, and facilitates the provision of trade credit for listed firms by UDFs. When there are multiple SMSFs that are the top 10 shareholders, i.e., when there are multiple SMSFs major shareholders, the tunneling of controlling shareholders will be suppressed as the degree of equity checks and balances increases. In order to avoid greater losses arising from the self-interested misappropriation of controlling shareholders and corporate managers, multiple SMSFs major shareholders can strengthen the simultaneous and cooperative supervision of controlling shareholders and corporate managers, which will significantly enhance the effectiveness of supervision, thus effectively reducing information asymmetry and improving corporate governance, and objectively facilitating the provision of trade credit for listed firms by the UDFs. In addition, if the SMSFs increase their purchases of shares, this will signal to the public that the firm will improve its corporate governance and that it has good prospects for growth as a result of the government rescue, due to the SMSFs' eye-catching star effect and the role of information authentication. Stakeholders of listed firms will proactively provide resources to the firms, which may reduce their debt default risk, and to a large extent will enhance the willingness and motivation of UDFs to provide trade credit to listed firms. Therefore, based on the above analysis, we expect the positive effect of SMSFs to increase the corporate trade credit financing is stronger when the SMSFs hold a higher shareholding ratio, the SMSFs increase their share purchases, the SMSFs belong to the top 10 shareholders, and there are multiple SMSFs among the top 10 shareholders.

We use *DSMSFs_R* to measure the level of SMSFs' shareholding (it is 1 when it is above the industry annual median and 0 otherwise), use *Increase* to measure the change direction of their shareholdings (it is 1 when SMSFs increase their shareholdings and 0 otherwise), use *DTop10_SMSFs* to measure whether the SMSFs are among the top 10 shareholders (it is 1 when the SMSFs are among the top 10 shareholders and 0 otherwise), and use *Multi_Top10_SMSFs* to measure multiple SMSFs major shareholders (it is represented by the number of SMSFs in the top 10 shareholders). To further analyze the relationship between SMSFs and corporate trade credit financing under the influence of SMSFs shareholding characteristics, we include the moderating variable *Moderator* and its interaction term *Treat_Post_Moderator* in the benchmark regression model, where *Moderator*∈{*DSMSFs_R*, *Increase*, *DTop10_SMSFs*, *Multi_Top10_SMSFs*}. Since *Moderator* are characteristics of SMSFs, we do not control for it and its interaction term *Treat_ Moderator* in the model to avoid full multicollinearity.

The results are shown in Table 13, and consistent with our expectations, we find that the coefficients of the interaction term *Treat_Post_Moderator* are all significantly positive, and these results imply that the positive effect of the SMSFs to enhance corporate trade credit financing is more stronger when the level of SMSFs' shareholding is higher, SMSFs increase their shareholdings, SMSFs are among the top 10 shareholders and there are multiple SMSFs major shareholders.

5.3. The moderating effect of internal and external factors in firms

The providers of funds for trade credit financing are UDFs in the supply chain, and their decisions about credit provision are heavily influenced by information transparency and low-risk preference. Given that corporate governance, financing constraints, and EPU are important factors that increase information asymmetry and induce corporate risk, to ensure that debt funds can be recovered timely and credit default risk can be controlled, suppliers or customers will certainly analyze and judge the firm's internal and external characteristics and provide corresponding credit assessment when making optimal trade credit supply decisions. Therefore, the positive effect of SMSFs on trade credit financing may be affected by the heterogeneity of corporate governance level, financing

Table 13
Analysis of Moderating Effects Related to the Shareholding Characteristics of SMSFs.

	(1)	(2)	(3)	(4)
Variables	The level of shareholding	The change direction of shares held	The identity of the top 10 biggest shareholders	The number of SMSFs belonging to the top 10 biggest shareholders
	Moderator = *DSMSFs_R*	*Moderator* = *Increase*	*Moderator* = *DTop10_SMSFs*	*Moderator* = *Multi_Top10_SMSFs*
	TC	*TC*	*TC*	*TC*
Treat_Post	0.016***	0.011*	0.016***	0.013*
	(3.71)	(1.88)	(3.65)	(1.87)
Treat_Post_Moderator	0.008*	0.013***	0.009**	0.002**
	(1.72)	(3.30)	(1.98)	(2.01)
Size	−0.013***	−0.021***	−0.016***	−0.022***
	(−5.31)	(−3.20)	(−6.54)	(−3.12)
Lev	−0.343***	−0.366***	−0.330***	−0.360***
	(−30.53)	(−15.03)	(−29.44)	(−14.57)
Roa	−0.030	−0.036	−0.021	−0.047
	(−1.07)	(−0.91)	(−0.74)	(−1.18)
Growth	0.013***	0.021***	0.014***	0.017***
	(4.26)	(5.90)	(4.71)	(4.86)
Cfo	0.298***	0.293***	0.286***	0.305***
	(16.37)	(11.47)	(15.79)	(11.92)
First	0.006	−0.053	−0.012	−0.060
	(0.39)	(−1.36)	(−0.76)	(−1.52)
Bsize	0.001**	0.001	0.001*	0.001
	(2.13)	(0.87)	(1.84)	(1.30)
Dual	−0.006*	−0.004	−0.006*	−0.005
	(−1.91)	(−0.76)	(−1.71)	(−0.89)
Oinsts	0.051***	0.022	0.050***	0.039**
	(3.91)	(1.13)	(3.87)	(1.97)
Age	−0.047***	−0.072***	−0.053***	−0.068***
	(−8.97)	(−7.66)	(−9.75)	(−5.38)
_cons	1.195***	1.193***	0.989***	1.192***
	(8.00)	(8.95)	(19.89)	(7.96)
Firm FE/ Year FE	Y	Y	Y	Y
N	15,618	15,618	15,618	15,618
R-squared	0.222	0.198	0.222	0.223

Note: This table shows the analysis of moderating effects related to the shareholding characteristics of SMSFs. Detailed definitions of *DSMSFs_R*, *Increase*, *DTop10_SMSFs*, and *Multi_Top10_SMSFs* see in section 5.2. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

constraints, and EPU among different firms.

The poorer the level of corporate governance and the higher the degree of financing constraints of a firm, the lower the trust of suppliers and customers in the firm, and the higher the concern of credit default risk, which in turn will shrink the trade credit financing provided to the firm. However, the SMSFs can better magnify the supply chain financing effect brought about by improving suppliers' and customers' trust via exerting insider governance effect, operational risk governance effect, and accounting information governance effect. Meanwhile, EPU may reduce trade credit financing (Su et al., 2021). However, SMSFs may be beneficial in offsetting negative shocks from EPU through market stabilizing effects and positive effects of state-owned long-term institutional investors and government rescuers. Thus, higher EPU may more strongly amplify the positive effect of SMSFs on trade credit financing. Combining these analyses, we predict that SMSFs are more likely to play a significant positive role in enhancing corporate trade credit financing when the level of corporate governance is poorer, the degree of financing constraints and EPU are higher.

We follow Jiang et al. (2021) to create the corporate governance index *G_index* using principal component analysis and divide it into dummy variables *DGV* according to the industry annual median, with 1 indicating a high level of corporate governance when above the median and 0 indicating the opposite. We construct the financing constraint index *KZ* in the Chinese context, following Kaplan and Zingales (1997), and we divide it into dummy variables *DKZ* according to the industry annual median, with 1 denoting a severer financing restriction for the firm and 0 denoting the opposite. The economic policy uncertainty indicator *EPU* in this paper is derived from the China Economic Policy Uncertainty Index constructed by Huang and Luk (2020). To further analyze the relationship between SMSFs and corporate trade credit financing under the influence of firms' internal and external characteristics, we include the moderating variable *Moderator* and its interaction term *Treat_Moderator* and *Treat_Post_Moderator* in the benchmark regression model, where *Moderator*∈{*DGV*, *DKZ*, *EPU*}.

Table 14 presents the analysis of the moderating effect of the firm's internal and external characteristics. The coefficient of *DGV* in column (1) is significantly positive, implying that the higher the level of corporate governance, the easier it is to obtain trade credit financing; the coefficient of *Treat_Post_DGV* is significantly negative, meaning that corporate governance and SMSFs show a governance substitution relationship. The coefficient of *DKZ* in column (2) is significantly negative, implying that the more severe the financing constraint of firms, the harder it is to obtain trade credit financing; the coefficient of *Treat_Post_DKZ* is significantly positive, meaning that the SMSFs can lessen the negative impact of financing constraint on trade credit financing, thus optimizing firm financing. The coefficient of EPU in column (3) is significantly negative, implying that the higher the EPU, the less trade credit financing for firms; the coefficient of *Treat_Post_EPU* is significantly positive, meaning that EPU can amplify the positive effect of the SMSFs on trade credit financing.

Combining the results in Table 14 shows that, consistent with our expectation, Chinese SMSFs are more likely to significantly enhance corporate trade credit financing when corporate governance is poor, financing constraints are more severe, and EPU is higher.

5.4. The economic consequence test of the SMSFs enhancing trade credit financing

In the previous section, we find that the SMSFs can significantly increase trade credit financing by improving the insider governance effect, the eye-catching star effect, the operational risk governance effect, and the accounting information governance effect. Thus, can the SMSFs improve corporate value while optimizing supply chain financing? The existing studies have also found that China's SMSFs significantly reduce corporate violations and enhance corporate innovation, and investment efficiency (Yu and Fang, 2020; Wen and Qiao, 2021; Feng and Wen, 2022). In our study, we find that SMSFs can suppress the dual agency costs of executives and major shareholders, and also play the signaling effect to attract investors, analysts, and news coverage to continuously track and supervise the SMSF firms, as well as reduce the SMSF firms' operational risk and improve the accounting information quality. Thus, after raising trade credit financing, the SMSFs can optimize corporate decision-making by reducing the dual agency costs of executives and major shareholders, which in turn may enhance corporate value. Consequently, we expect that the SMSFs can enhance firm value while optimizing trade credit financing. We construct the model (2) to test whether the SMSFs can improve corporate value while increasing trade credit financing:

$$\begin{aligned} MV_{i,t} = {} & \beta_0 + \beta_1 Treat\_Post_{i,t} + \beta_2 TC_{i,t} + \beta_3 Treat\_TC_{i,t} \\ & + \beta_4 Treat\_Post\_TC_{i,t} + CV_{i,t} + Firm + Year + \varepsilon_{i,t} \end{aligned} \tag{2}$$

where *Firm* and *Year* represent the firm fixed effects and year fixed effects, respectively, and ε represents the random error term. In model (2), The explanatory variable *MV* represents the corporate value variable, which is represented by *TobinQ* and *Adj_TobinQ* (adjusted by the annual industry median), respectively. *Treat_TC* equals the *Treat* multiplied by *TC*, *Treat_Post_TC* equals the *Treat_Post* multiplied by *TC*. We expect that the regression coefficient β_4 of the cross-product term *Treat_Post_TC* should be significantly positive. The control variables (*CV*) are the same as in baseline model (1).

The results are shown in Table 15, and consistent with our expectations, we find that the coefficients of the interaction term *Treat_Post_TC* are all significantly positive, and these results imply that the SMSFs can improve corporate value while increasing trade credit financing.

6. Conclusion

The question of whether and how corporate trade credit financing is affected by the specific government behavior or related policy of promoting healthy stock market development is not yet fully and deeply understood and urgently needs to be researched. Based on

Table 14
Analysis of Moderating Effects of Firms' Internal and External Characteristics.

Variables	(1)	(2)	(3)
	Corporate governance	Financing constraints	EPU
	Moderator = DGV	*Moderator = DKZ*	*Moderator = EPU*
	TC	*TC*	*TC*
Treat_Post	0.023***	0.010	0.005
	(3.02)	(1.22)	(0.54)
Moderator	0.009*	−0.020***	−0.025*
	(1.72)	(−4.29)	(−1.80)
Treat_Moderator	0.002	0.002	−0.013**
	(0.28)	(0.23)	(−2.14)
Treat_Post_Moderator	−0.016*	0.012*	0.015**
	(−1.92)	(1.68)	(1.99)
Size	−0.022***	−0.024***	−0.022***
	(−3.08)	(−3.42)	(−3.15)
Lev	−0.359***	−0.338***	−0.360***
	(−14.52)	(−13.37)	(−14.55)
Roa	−0.048	−0.067*	−0.050
	(−1.21)	(−1.70)	(−1.25)
Growth	0.017***	0.016***	0.018***
	(4.76)	(4.57)	(4.90)
Cfo	0.304***	0.261***	0.304***
	(11.90)	(9.36)	(11.89)
First	−0.052	−0.060	−0.060
	(−1.32)	(−1.53)	(−1.52)
Bsize	0.001*	0.001	0.001
	(1.75)	(1.26)	(1.26)
Dual	−0.006	−0.005	−0.005
	(−1.05)	(−0.99)	(−0.88)
Oinsts	0.034*	0.037*	0.039*
	(1.73)	(1.87)	(1.95)
Age	−0.065***	−0.063***	−0.068***
	(−5.15)	(−5.00)	(−5.41)
_cons	1.168***	1.234***	1.229***
	(7.79)	(8.24)	(7.86)
Firm FE/ Year FE	Y	Y	Y
N	15,618	15,618	15,618
R-squared	0.223	0.224	0.222

Note: This table shows the analysis of moderating effects of firms' internal and external characteristics. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

the government's stock purchase rescue policy's role in supply chain financing, we use the introduction of SMSFs by CSRC to explore whether the SMSFs have a supply chain financing promotion effect. We use the introduction of the SMSFs by the CSRC in 2015 as an external shock event to construct a DID model and select Chinese A-share listed firms' data for 2010–2020. We find that SMSFs can significantly improve trade credit financing, implying that China's SMSFs have a supply chain financing promotion effect. The channel tests find that enhancing insider governance and eye-catching star effect, reducing corporate operation risk, and improving accounting information quality are important channels for SMSFs to increase trade credit financing. Further, we find that the positive effect of the SMSFs to enhance corporate trade credit financing is stronger when the level of SMSFs' shareholding is higher, SMSFs increase their shareholdings, SMSFs are among the top 10 shareholders and there are multiple SMSFs major shareholders. Additionally, we find that the Chinese SMSFs are more likely to considerably increase corporate trade credit financing when corporate governance is poor, financing constraints are more severe, and EPU is higher. Furthermore, we find that SMSFs can increase corporate value while optimizing corporate trade credit financing.

Overall, we link the literature on government rescue, SMSFs and trade credit financing, and broaden the research to enrich the study of the economic consequences of government bailout programs and SMSFs from a supply chain financing perspective. We expand the study of the influencing factors on trade credit financing from the dual perspectives of governmental rescue actions that promote the stock market's healthy development and state-owned special institutional investors. And, our study will help to deepen the understanding of the positive effects of China's SMSFs and provide meaningful lessons for the operation of SMSFs in other East Asian economies and the healthy development of capital markets in other emerging economies.

CRediT authorship contribution statement

Zheng Yang: Writing – original draft, Methodology, Conceptualization. **Xingquan Yang:** Writing – review & editing, Supervision, Funding acquisition, Formal analysis. **Xiaoyi Ren:** Writing – review & editing, Software, Project administration, Formal analysis.

Table 15
Analysis of the economic consequence test of the SMSFs enhancing trade credit financing.

Variables	(1)	(2)
	TobinQ	*Adj_TobinQ*
Treat_Post	0.252***	0.145***
	(4.75)	(2.78)
TC	0.009	0.006
	(0.09)	(0.08)
Treat_TC	−0.118	−0.011
	(−0.80)	(−0.08)
Treat_Post_TC	0.148**	0.051**
	(2.42)	(2.16)
Size	−0.569***	−0.544***
	(−16.68)	(−15.23)
Lev	0.565***	0.559***
	(5.00)	(4.78)
Roa	4.176***	3.985***
	(14.25)	(13.49)
Growth	−0.031	−0.059***
	(−1.45)	(−2.91)
Cfo	0.582***	0.524***
	(4.21)	(3.69)
First	−0.393**	−0.273
	(−2.14)	(−1.48)
Bsize	0.009***	0.010***
	(2.74)	(3.06)
Dual	−0.017	−0.021
	(−0.59)	(−0.75)
Oinsts	1.991***	1.827***
	(15.35)	(14.31)
Age	0.846***	0.805***
	(14.16)	(13.26)
_cons	12.577***	9.965***
	(17.55)	(13.27)
Firm FE/ Year FE	Y	Y
N	15,618	15,618
R-squared	0.387	0.160

Note: This table shows the analysis of the economic consequence test of the SMSFs enhancing trade credit financing. All variables are winsorized at the 1 % and 99 % levels. *T-statistics* reported in parentheses below the coefficients are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % levels using two-tailed tests.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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