

Article

Government Background Customers and Private Enterprise Innovation from the Perspective of Supply Chain Risk Transmission

Zhanguang Chen ¹, Qiaowan Wang ¹ , Chao Dou ^{2,*} and Tian Liang ³

¹ School of Economics and Management, Tsinghua University, Beijing 100084, China; chenzg17@mails.tsinghua.edu.cn (Z.C.); wangqw3.15@sem.tsinghua.edu.cn (Q.W.)

² Business School, Central University of Finance and Economics, Beijing 100081, China

³ School of Business, Renmin University of China, Beijing 100872, China; 2018000635@ruc.edu.cn

* Correspondence: 0020170063@cufe.edu.cn; Tel.: +86-10-1565-279-8643

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Abstract: Private enterprises are major contributors to China’s market economy. In order to ensure the sustainability of economic development, China pays more attention to the role of science and technology in promoting the sustainability of the private economy. Based on a sample of all A-share listed companies in the Chinese capital market, we distinguished between government and non-government purchase order data, and examined the impact of large government background customers on private enterprise R&D innovation from the perspective of supply chain risk transmission. Due to the implementation of China’s new accounting standards and the delay in the public update of government procurement data, we selected samples from 2007-2015. The research results show that the government background customers can significantly increase the R&D investment of private enterprises, and this relationship is more significant in the sample of mid-level government background customers and private enterprises in poor areas; further analysis found that government background purchase orders can promote innovation investment by mitigating the risks facing a company. From a practical point of view, the research findings of this paper are helpful for understanding the impact of customer structure on the innovation activities of enterprises in a market economy environment.

Keywords: government clients; private enterprises; innovation risk

1. Introduction

Science and technology, as primary productive forces, have always been valued by the Chinese government in the search for sustainable economic development. The “Government Procurement Law” promulgated by China in 2014 clearly states that government procurement should help achieve the country’s policy goals of sustainable economic and social development. The government should strengthen the policy-oriented function of sustainable development, issue helpful guidance of government and corporate behavior, create economic benefits and policy effects, and exert an influence on resource allocation and industrial structure. Sustainable development is a higher-level efficiency function meant to improve government procurement policies, and is mainly reflected in the creation of economic and policy benefits. In order to test the sustainability-oriented method of rejuvenating the country through science and technology, this article focuses on the role of large customers from the government background in the sustainability of private enterprises in the supply chain.

Since the reform and opening-up, the guiding policy represented by the “invigorating the nation through science and technology” strategy and the “mass innovations” initiative has allocated huge financial subsidies each year to support R&D and innovation. However, in this process, some enterprises took advantage of policy loopholes and opportunism to obtain additional subsidies; the “Hanxin”

type of counterfeiting incidents are particularly lamentable [1,2]. With the government reducing the subsidy allocation for enterprise R&D in 2018, the private economy, especially that made up of small and medium-sized enterprises (SMEs), which are highly dependent on the government subsidy, has suffered a lot. However, the contribution of the private economy to China's economy is huge. According to relevant data from the 2019 private enterprise economic report by Ren Zeping, the chief economist of Evergrande Research Institute, from January to July 2019, the tax revenue of private enterprises accounted for 56.9%. As the main force of science and technology innovation in China, private enterprises accounted for 77.8% of patent applications, 77.4% of invention patent applications, and 75.8% of effective invention patents. In China's economic system, the financing difficulty of private enterprises is a big problem, which means some private enterprises with innovation ability do not have enough funds for R&D investment. By the end of September 2018, the loan balance of private enterprises only accounted for 22.8% of the loan balance of financial institutions. Especially since the financial deleveraging in the fourth quarter of 2016, overall financing has been tightened, and the credit spread of private enterprises has risen by 2.2 percentage points at the most; the problem of financing, however, is ongoing.

Against this background, there is a continued need for the government to explore other ways to promote corporate innovation. The procurement method is one possible way to solve the above problems. Since China officially promulgated the relevant laws in 2003, the scope and scale of procurement have grown year by year with the continuous improvement of government procurement mechanisms. According to statistics from the China Government Procurement Network, the scale of government procurement in China exceeded 3.5 trillion yuan in 2018, an increase of 11.7% over the previous year. In 2018, the contract value awarded by Chinese government procurement to SMEs was 2748.86 billion yuan, accounting for 76.7% of Chinese government procurement. The contract value awarded to SMEs was RMB 11.941 trillion, accounting for 43.4% of the contract value awarded to SMEs. In addition to government departments, state-owned enterprises have played an important role in the government's macrocontrol. This article also includes them in the broad definition of government background customers in its research definition.

Compared with traditional government subsidies, government procurement is on the demand side. With its huge demand, strong purchasing power, and high standards, it can increase corporate sales, enhance profitability, and improve corporate governance and technology progression. Unlike ordinary corporate customers, in addition to customers with a government background who simply conduct market transactions with the enterprise to purchase the required goods or services, procurement also plays a large role in macroeconomic control; that is, the state often uses government procurement to cooperate with certain policies (the "People's Republic of China's Government Procurement Law" clearly states: "Government procurement should help achieve the economic and social development policy goals, including protecting the environment, supporting underdeveloped regions and ethnic minority areas, and promoting the development of SMEs"), such as the implementation of industrial transformation and upgrading, elimination of backward production capacity, and encouragement of the promotion of new technologies. In view of the foreign government procurement experience, this special government action is indispensable for enterprises to strengthen R&D. Taking the United States as an example, the annual competition evaluation of the large amount of military orders and the selection of target companies in the defense sector has encouraged Boeing, Thor, and other military giants to increase their investment in R&D. Healthy competition in technology and the continuous emergence of new technologies and products have enabled the United States to be far ahead in terms of military science and technology. Based on the above statement, this article has strong practical and policy significance in that it explores whether customers with a government background can promote enterprise R&D and innovation under the macrosituation of subsidy landslide. Moreover, it proves the role of government procurement policy in the sustainable development of the private economy.

Due to the fact that companies often treat orders as trade secrets, making data difficult to obtain, existing research has only focused on traditional government support methods (such as subsidies) or

on the role of government procurement in regional and national economies. It pays less attention to how specific private enterprises are affected by the purchase of large customers from the government background from a micro level. Therefore, based on the perspective of supply chain risk transmission, it is explored how government support affects ordinary private enterprises' operation and development, especially their innovative R&D, which should become a new aspect of government intervention research. This article focuses on the following questions: will the purchase of large customers with a government background affect the future R&D investment of private enterprises? How does the administrative hierarchy of government background customers and the operating environment where the company is located affect the relationship between the two? What kind of effect does the procurement of large clients with government background have on the innovation and R&D of private enterprises? Using data from A-share private listed companies from 2007 to 2015, it is empirically found that: purchase orders from large government background customers help to enhance the innovation input of private enterprises; when the order comes from the central level or the company comes from a poor region in the Midwest, the relationship is stronger; the procurement of large clients with a government background can have a positive impact on R&D investment by reducing the operating risks of private enterprises; and compared with government subsidies, the procurement of large clients with government background is more conducive to enhancing the innovation investment of private enterprises.

The research contributions of this paper are mainly reflected in the following five aspects: first, this paper explores the influence factors of innovation by finding the public customer structure data of private enterprises and using the government customers as the starting point, which enriches the literature on macro-micro integration. It is helpful to understand the implementation effect of macro fiscal policy at the micro level. Secondly, this article expands the research scope of the supply chain. Based on the actual situation in China, we start from government background customers to study the nature of innovation activities for private enterprises, which makes the research on customers more in-depth; moreover, given the slow development of China's economy, the survival of private enterprises is more difficult, and financing difficulties and operating risks have limited their R&D activities. Also, local government procurement fraud and poverty alleviation issues have been the focus of regulatory agencies and the capital market in recent years. This article uses corporate-level data so that government procurement can better help private enterprises, especially those from poor areas, to develop and grow. Finally, a comparative study of government subsidies and government procurement methods in this paper shows that the impact of different forms of government intervention on enterprises is different. This is for the government to regulate the economy and improve innovation. Comprehensive consideration of various means led to the selection of the best choice of mechanism.

2. Literature Review and Research Hypotheses

2.1. Government Background Large Clients and Innovation Investment of Private Enterprises

Due to the limited data resources of corporate customers, there are few studies on how key customers with a government background affect corporate operations, and it is rare to discuss how this affects R&D activities. In sharp contrast, academia has paid a lot of attention to government interventions such as subsidies. In theory, government subsidies and other policy preferences should play an active role in improving corporate performance and promoting economic growth. However, the implementation effect often runs counter to the expected goals. Foreign scholars studied how government subsidies affect the operation and development of enterprises and found that this support method will negatively affect business operations for a long time [3], or, at the least, does not significantly improve their operating efficiency and profitability [4]; they generally believe that government subsidies are not beneficial to the normal development of enterprises. In China, research on government subsidies has reached similar conclusions. Some scholars found that, although government subsidies are helpful for enterprises to reap social benefits, they do not significantly

enhance their economic benefits [5], cannot enhance the market value of enterprises [6], and do not play a positive role above a certain threshold [7,8]. Other scholars have studied government subsidies in combination with other government interventions and found that local government subsidies and tax incentives have no substantial effect on the long-term performance of enterprises [9]. Corporate innovation investment will be significantly negatively affected by the co-existence of government subsidies [10]. In general, domestic and foreign studies on the economic consequences of government subsidies point out that this direct support model cannot effectively improve the performance of enterprises, but may become a “stumbling block” on the road to enterprise development. Furthermore, this one-way support method easily leads to dependence on the government, a lack of initiative, and the unreasonable use of this precious government resource, causing large number of hidden dangers, such as fraud and speculation by private enterprises [1,2], inefficiency, and even the existence of “zombie” enterprises (A zombie enterprise refers to an enterprise that has lost its ability to develop itself and must rely on non-market factors, that is, government subsidies or bank renewal to maintain its survival).

At the same time, the only literature that studies how government customers influence corporate development is mostly at the macro and theoretical analysis levels. As a result, relevant conclusions lack empirical evidence, and there is a certain conflict between the findings. Specifically, some scholars affirmed the positive effects of government procurement on economic development. On the one hand, they discussed the economic functions of government procurement policies from the perspective of theoretical analysis [11,12], and demonstrated the importance of strategic emerging industries. Development can be effectively supported by government procurement [13–15]. On the other hand, from the perspective of empirical research, it is found that, as a financial expenditure, government procurement is conducive to improving the economic level of underdeveloped regions [16], which can improve the macro performance by driving overall economic growth, promoting employment and supporting enterprise development [17], and promoting independent regional innovation [18,19]. However, some scholars have questioned the economic benefits of government procurement, arguing that government procurement will hinder regional technological innovation [20] and reduce the capacity utilization rate of enterprises [21,22]. Moreover, Cai et al. [23] investigated the influencing factors of enterprises obtaining government and state-owned enterprise orders. Their study found that corruption-related hospitality expenditure was one of the important influencing factors, but they did not pay attention to the economic consequences of business development. The above studies generally pay little attention to the micro-enterprise customer level, and do not deeply explore the characteristics of customers to analyze the impact of government-level large customer procurement on the company, especially how it affects its innovative R&D activities, so its research conclusions need further expansion and improvement. In recent years, a few scholars have explored the impact of government procurement on the development of companies based on micro-enterprises. Cai and Treisman [24] found that the proportion of government orders in corporate sales negatively affects its total factor productivity, but the research only uses the questionnaire statistics of 2004. These data are too old to explain the current problems. On the other hand, there are some flaws in the source reliability and index definition of government procurement. The impact of other sectors within the system, such as state-owned enterprises, was not considered during the inspection, which could interfere with the reliability of the conclusions. In foreign studies, Dan et al. [25] found that when there are government customers, the corporate financing cost is lower, but they have not considered the impact of this type of customer on corporate innovation activities. At the same time, some scholars have tried to explain the impact of large customers on the development of business operations from the perspective of a supply chain [26–28], but they focus on customer concentration. The research is not deep enough to discuss the type of customer structure, especially customers with a government background. Such special customer groups appear to be particularly critical in the government-dominated Chinese market.

As a kind of indirect support means, the procurement of large government background clients, with their huge demand, strong purchasing power, and high standards, can increase corporate sales,

enhance profitability and development potential, and substantially boost the development of the company. As far as R&D is concerned, on the one hand, customers with a government background have strong country backing, high credit ratings, strong financial resources, low risk, and low volatility [25]. The product demand is stable and large, which can help companies expand sales and reduce sales risks, thereby mitigating business risks, reducing the anxiety of the enterprise and its external environment, enabling it to be at ease and focus on technological innovation and business exploration, and creating good conditions for enterprise R&D. On the other hand, government background customers have higher requirements for the quality of products and services, and their requirements will continue to become stricter due to changes in technology. The increasingly standardized government procurement system has also made the bidding process more open and transparent. The competition among bidding companies has become more intense. To increase the probability of winning bids, companies can only make themselves stronger, provide cost-effective products through cost leadership and differentiation strategies, which will undoubtedly help them realize the necessity and urgency of technological innovation, upgrade and reform promptly, and continuously strengthen R&D to provide enterprises with the power to innovate. It is worth noting that, due to the natural relationship between state-owned enterprises and the government, they have enjoyed ample policy resources such as government subsidies and bank loans for a long time, so the government's procurement needs will inevitably greatly reduce the marginal promotion effectiveness. Private enterprises find it difficult to benefit from the country's policy preferences and privileges, and there is no government reputation as a guarantee, so they fully participate in market competition [29,30], which involves greater risks. The innovation ability of private enterprises is restricted by various external and internal factors [31]; moreover, as a market-oriented entity, high pressure, a sense of crisis [30], and more competitive power are involved. Therefore, given the characteristics of the government, the existence of large customers with a government background obviously makes market-oriented private enterprises more secure, effectively reduces the operating risks, makes private enterprises more aware of the importance of innovation through the requirements for product quality and functions, and finally promotes their innovation. Based on the above analysis, we propose the first research hypothesis of this article:

Hypothesis 1. *The purchase of large clients with a government background helps to increase the innovation investment of private enterprises.*

2.2. The Moderating Effect

China has formed two basic patterns of central and local government governance models. The differences in administrative levels are clear. Many scholars have confirmed the difference between central and local influences on corporate development from different perspectives, and find that the financial support of local governments is not conducive to the long-term performance growth of enterprises [9]; political connections can increase corporate value, but different choices of competitive strategies lead to different impacts [32,33]; the positive relationship between local political connections and debt maturity structure is significantly stronger than that of central political connections [34]; in central enterprises, the problem of excessive pay to politically-linked executives is more serious than that of local state-owned enterprises [35]. This difference is reflected in the procurement of government background customers. The central government usually not only has an overview of the overall situation and macrocontrol, but also pays relatively more attention to supervision when formulating policies. Therefore, this level of government background customer procurement is relatively fairer and more transparent, and the procurement process is more standardized. However, due to the relative lack of supervision and the limited vision, local governments usually have more short-sightedness in procurement. Therefore, their procurement often considers more related interests, and also faces various problems in the implementation process. Due to weak regulations, corruption and the "delinquencies" scandals that have frequently occurred in the procurement of local-level government background customers in recent years are good evidence. Therefore, we believe that,

compared with local-level government background customer procurement, central-level government background customer procurement can more effectively promote a company's future R&D activities.

At the same time, poverty alleviation, a hot topic worldwide, has been a focus of research for domestic and foreign government agencies, nonprofit organizations, and the academic community [36–38]. Compared with developed market mechanisms, sufficient industrial capital, and high-quality human resources, the development of poor areas has long been constrained by various software and hardware conditions [39], leading to it being difficult for enterprises to equally enjoy market resources and opportunities, especially private enterprises that lack political resources. Therefore, they not only lag behind enterprises in developed regions in terms of performance growth, but also in technological innovation and industrial upgrading. In this context, government support is particularly important. However, as mentioned earlier, traditional policies including government subsidies have in the past tended to lead to dependence on government financing support in many poor areas [40]. To assist companies to truly build core competitiveness, government-backed procurement activities should combine product demand and policy support to produce more three-dimensional support and achieve the long-term goal of helping the private economy. The Government Purchasing Law of the People's Republic of China clearly states: "Government procurement should help achieve the economic and social development policy goals, including protecting the environment, supporting underdeveloped regions and ethnic minority areas, and promoting the development of SMEs." Therefore, we should also be able to see more obvious traces of government procurement policies from private enterprises in poor areas. In this way, comparing the differences in the operating environment of the company's location can not only help us further clarify the impact of government-backed major customer purchases on the R&D innovation of private enterprises, but also to test the impact of this policy on regional poverty alleviation at a micro level. This has both theoretical and practical significance. Therefore, we put forward the second research hypothesis of this article from the perspective of customer characteristics and enterprise characteristics:

Hypothesis 2a. *Compared with large government-level customers at the local level, large-scale government-level customers at the central level can more effectively promote R&D investment in private enterprises.*

Hypothesis 2b. *Compared with private enterprises in developed regions, large clients with government background can more effectively promote R&D investment of private enterprises in poor areas.*

2.3. The Influence Mechanism of Government Clients on Innovation Investment

From the perspective of business operation risks, due to the great risk of technological innovation, failures in R&D and promotion of new products will create huge burdens for enterprises. Therefore, the nature of the customer and its relationship with the company have a great impact on R&D activities. Many domestic and foreign scholars have done research with customer concentration as the starting point. The vast majority of literature found that the higher the customer concentration, the higher the business risks facing the company [28,41–43]. The over-reliance on large customers means such companies' financial strategies tend to be conservative, with less innovation and R&D. However, some studies are based on specific environmental systems, with large customers considered to be beneficial to promote supply chain integration and reduce corporate risk [26], and enabling them to invest more resources in their development process. Compared with ordinary corporate customers, the largest difference between large government customers is that they have national credit and financial endorsements, so the state-owned sector has little risk of failure and its survival is relatively likely. Due to the unpredictable behavior of customers, the spread of risk, and the potential disadvantages of enterprises, the operating risks of enterprises are relatively low. Although the more frequent the traditional government intervention methods, the greater the impact on companies [44–47], the risks have also risen, but the government intervention method of purchase orders is on the demand side, which gives enterprises a lot of autonomy and flexibility in terms of production and operation; as long

as the final product meets the policy guidelines, the product requirements of the government are sufficient. Therefore, the product demand and policy orientation of the government background department are organically combined. The enterprise that obtains the order can develop fully and steadily, which will undoubtedly be of great benefit to reduce risk. Based on the above analysis, we propose a third research hypothesis for this article:

Hypothesis 3. *Large clients with a government background achieve positive effects on R&D investment by reducing the operating risks of private enterprises.*

3. Research Design

3.1. Sample Selection and Data Source

Regarding the definition of the main body of government procurement, China's government procurement law clearly states that it is state organs, institutions, and organizations at all levels; in the context of a socialist market economy with Chinese characteristics, state-owned enterprises have undertaken many social and economic functions under the guidance of the government. The participation of state-owned enterprises in the economy is one of the important means for the Chinese government to regulate the economy, and orders from state-owned enterprises also reflect the willingness of the government's industrial policies to a certain extent, so they belong to the category of large customers with a government background. Because specific company names do not have to be disclosed in the annual reports of listed companies, and most private enterprises chose not to disclose detailed customer information before 2007, the number of private enterprises that voluntarily disclosed customer information did not increase until 2007. Moreover, due to the lag in the update of the National Credit Information Publicity System and the complexity of the company's shareholding structure and hierarchy, the amount of relevant data screening and processing work is very large, so we have stopped with 2015. Thus, the research sample covers annual report data from 2007 to 2015. We used the names of customers disclosed in the annual report, combined with company shareholder investment information and company type data disclosed by the National Enterprise Credit Information Disclosure System, to accurately trace the information of state-controlled enterprises and government agencies among corporate customers, to match and identify government background customers. Other analytical data were obtained from the CSMAR database. To ensure the integrity and reliability of the data, our research objects must meet the following four requirements at the same time: (1) limited to private listed companies that disclosed the top five sales' customer names in their annual reports; (2) the structure of private equity of private listed companies is clear and can be traced to the controlling shareholder; (3) the top five customers with a concentration of less than 1% are deleted; (4) the financial data and R&D investment data for 2007-2015 are complete; the reason for removing the top five customers with a concentration of less than 1% is that, when corporate customers are too fragmented, it is difficult to measure the impact of a single type of customer on corporate sales. Through the above data screening, this article finally manually sorted and obtained a sample of 399 private listed companies, with a total of 1519 annual observations. The sample acquisition process is shown in Table 1A.

Table 1 shows the distribution of the samples. From the statistical distribution of the nature of customers in Table 1B, we see that many private enterprises have both government background customers and other general corporate customers. We also find that there are 303 samples of government department orders, accounting for about 20% of the total sample. The sample that includes government and state-owned enterprise orders accounts for about 65% of the total sample. The industry distribution of the sample is summarized in Table 1C. It can be seen that private enterprises in the manufacturing and information service industries are more willing to disclose specific customer information. The distribution is in line with the overall industry distribution of private listed companies. The secondary industry is dominated by manufacturing. The research on such companies can better test

the impact of the purchase of large clients with government background on the real economy. Table 1D counts the persistence of government background customer orders, indicating that the purchase orders of government background customers show a relatively stable trend. Among them, 33.08% of private enterprises have a duration of 4-6 years, and 11.28% of private enterprises have a duration of 7-9 years.

Table 1. Sample screening and distribution table.

<i>A. Sample Screening</i>		
Initial observations		19,690
Less: Names of the top five sale's customers are not disclosed in the annual report		13,027
The equity structure of the client company is not clear, and the controlling shareholder cannot be traced back		49
The top five customers' concentration is less than 1%		28
Financial data and R&D investment data are incomplete		2908
Nonprivate enterprise		2159
Final samples		1519
<i>B. Customer nature</i>		
Customer nature	Number of samples	Percent of samples
Government department	303	19.95%
Government background	985	64.85%
Other enterprises (foreign enterprises, private enterprises)	1257	82.75%
Total	1519	
<i>C. Industrial Distribution</i>		
Industry name	Number of samples	Percent of samples
Mining industry	65	4.28%
Electricity, heat, gas and water production and supply	7	0.46%
Real estate	1	0.07%
Construction industry	2	0.13%
Agriculture, forestry, animal husbandry and fishery	14	0.92%
Wholesale and retail trade	6	0.39%
Information Transmission, Software and Information Technology Services	129	8.49%
Manufacturing	1209	79.59%
Others	86	5.66%
Total	1519	100.00%
<i>D. Persistent distribution</i>		
Purchase duration (year)	Number of samples	Percent of samples
[1, 3]	222	55.14%
[4, 6]	132	33.08%
[7, 9]	45	11.28%
Total	399	100%

3.2. Model Design

Multiple panel data regression is adopted to construct empirical models. Panel data multivariate regression analysis is a new statistical method developed in recent decades. The methodology can overcome the problem of multicollinearity in time series analysis, and provides more information, more changes, less collinearity, more degrees of freedom, and higher estimation efficiency. The unit root test and cointegration analysis of panel data are among the most advanced methods. Drawing on the study of Ke and Petroni [48], we designed the following regression model to test Hypothesis 1:

$$R\&D_{i,t+1} = \beta_1 + \beta_2 Procurement_{i,t} + \beta_3 NonProcurement_{i,t} + \beta_4 R\&D_{i,t} + \beta_5 Sub_{i,t} + \beta_6 Size_{i,t} + \beta_7 Lev_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Managhd_{i,t} + \beta_{10} CF_{i,t} + \beta_{11} Age_{i,t} + \beta_{12} Insthld_{i,t} + \varepsilon_{i,t+1}. \quad (1)$$

Here, the dependent variable $R\&D_{i,t+1}$ is the R&D investment of company i in the next period, specifically the ratio of R&D investment in $t + 1$ period to the operating income of private enterprises. The independent variable Procurement is the proportion of the purchase amount of the major customers with government background in the t^{th} period of the total sales of private enterprises. In specific regression analysis, Procurement is represented by government procurement (*Govper*) and government background customer procurement (*Stateper*). Under the special economic system and

social background of our country, the national policy and development plan are usually led by the government, with the support of various state-owned enterprises. Therefore, this article not only uses government procurement (*Govper*) as a proxy variable for government background major customers, but also incorporates state-owned enterprises into the category of government background major customers to comprehensively consider the procurement strength of government background major customers, that is, *Stateper*. Based on Hypothesis 1, the regression coefficient of Procurement is expected to be significantly positive.

In terms of controlling variables, as the current R&D investment of private enterprises may have an impact on the next period, this article controls the current R&D investment of company *i* ($R\&D_{i,t}$). In view of the fact that the procurement of government background big customers and government subsidies are both important means for the government to intervene in the economy, some private enterprises usually get a large number of government subsidies at the same time, besides the orders from government background customers. In order to avoid the endogenous impact of the two on the operation and development of private enterprises, this paper also controls the government subsidies (*Sub*) obtained by the company in the same period. At the same time, the proportion of nongovernmental background customers' purchase orders (*NonProcurement*) is also considered; in addition, referring to mainstream literature such as Hou et al. [49] and Krolikowski and Yuan [28], this paper also controls some enterprise financial and equity structure variables, including company size (*Size*), debt level (*Lev*), total return on assets (*ROA*), operating cash flow (*CF*), cumulative listing year (*Age*), Management shareholding (*Managhld*), and institutional investor shareholding (*Insthld*).

In order to test Hypothesis 3, this paper further designs the regression models in Equations (2) and (3) on the basis of Equation (1), constructs a complete intermediary effect model to test whether the procurement of government background big customers can affect the innovation R&D of enterprises by reducing the risk of private enterprises (*Vartq*), and adjusts the control variables accordingly:

$$Vartq_{i,t+1} = \beta_1 + \beta_2 Procurement_{i,t} + \beta_3 NonProcurement_{i,t} + \beta_4 Sub_{i,t} + \beta_5 Size_{i,t} + \beta_6 Lev_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Growth_{i,t} + \beta_9 TQ_{i,t} + \beta_{10} CR_{i,t} + \varepsilon_{i,t+1} \quad (2)$$

$$R\&D_{i,t+1} = \beta_1 + \beta_2 Procurement_{i,t} + \beta_3 NonProcurement_{i,t} + \beta_4 Vartq_{i,t} + \beta_5 R\&D_{i,t} + \beta_6 Sub_{i,t} + \beta_7 Size_{i,t} + \beta_8 Lev_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} Managhld_{i,t} + \beta_{11} CF_{i,t} + \beta_{12} Age_{i,t} + \beta_{13} Insthld_{i,t} + \varepsilon_{i,t+1}. \quad (3)$$

Equation (2) not only controls the nongovernmental background customers' purchase order proportion (*NonProcurement*) and government subsidy (*Sub*), drawing on the literature of Zhong et al. [50], but also controls some corporate financial variables, including company size, debt level (*Lev*), return on total assets (*ROA*), growth rate of business income, Tobin Q (*TQ*), and current ratio (*CR*). In Equation (3), based on Equation (1), the intermediary variable: company risk (*Vartq*) is added. According to Hypothesis 3, the regression coefficient of procurement in Equation (2) is significantly negative, and that of *Vartq* in Equation (3) is significantly negative. The specific definitions of variables are shown in Table 2.

Table 2. Variable definitions.

<i>Symbols</i>	<i>Variable Name</i>	<i>Definition</i>
<i>Dependent variables</i>		
$R\&D_{i,t+1}$	Investment in innovation	Company i , $t + 1^{th}$ R&D investment / Business income
$Vartq_{it}$	Company risk	Variance of company i 's <i>TOBIN'Q</i> during the sample period
<i>Independent variables</i>		
Gov_{it}	Is there a major government client?	Dummy variable. If company i has government departments (including party, government, military, and government institutions at all levels) before the t^{th} period, it is 1, otherwise it is 0.
$State_{it}$	Is there a major client with a government background?	Dummy variable, if company i has government background departments (including party, government, military departments, government institutions, and state-owned enterprises) in the top five customers of period t , it is 1, otherwise it is 0
$Govper_{it}$	Proportion of major government orders	Proportion of company i 's t^{th} government departments (party, government, military and government institutions at all levels) as a percentage of total sales
$Stateper_{it}$	Proportion of major customers with government background	Company i 's t^{th} government departments (party, government, military and government institutions at all levels) and state-owned enterprises' share of total sales
<i>Control variables</i>		
$Non-Govper_t$	Proportion of large non-governmental customers	Proportion of non-government departments (unit groups except party, government, military and government institutions at all levels) in the total sales
$Non-Stateper_t$	Proportion of large customers with non-governmental background	Proportion of purchases by major customers of non-government departments and non-state-owned enterprises in t
$Size_t$	Company Size	Natural logarithm of total assets at the end of period t
Lev_t	Debt ratio	Total liabilities at the end of period t divided by total assets at the end of period t
Sub_t	government subsidy	Total government grants at the end of period t divided by total assets at the end of period t
ROA_t	Roa	Net profit/total asset balance at the end of period t
$Managhd_t$	Management shareholding ratio	Shareholding ratio of company management at the end of period t
CF_t	Operating cash flow	Net cash flow from operating activities in year t /total assets in year t
Age_t	Cumulative listing year	Number of years since the company's stock was first listed and the year t from the sample year
$Insthld_t$	Institutional investor shareholding	Shareholding ratio of institutional investors at the end of period t
$Growth_t$	Operating income growth rate	Period t operating income minus period $t - 1$ operating income, and then divided by period $t - 1$ operating income
TQ_t	Tobin q	The market value of equity at the end of period t plus the book value of liabilities is divided by the total assets at the end of period $t + 1$
CR_t	Current ratio	At the end of period t , current assets/current liabilities
FR_t	Provincial fiscal revenue	Logarithm of fiscal revenue (billion) of the province where the company is registered in period t

3.3. Descriptive Statistics

Descriptive statistics of the variables are shown in Table 3. It can be seen that, among the 303 samples that received government major customer orders, direct procurement by government departments accounted for more than 11% of the sales of private listed companies. If state-owned enterprise procurement is also taken into account, this proportion will be nearly 23%, indicating that the procurement of large customers with a large government background is relatively high, which has a significant impact on private enterprises. In addition, the distribution of *R&D* and operating risk of private enterprises measured by *Vartq* is also quite different, which may make it possible to study how large clients with government background influence private enterprises' investment and operating risks.

Table 3. Variable descriptive statistics.

Variable Name	Mean	Num.	Sd.	25%	Median	75%
R&D	0.028	1519	0.030	0.011	0.028	0.111
Vartq	1.198	1519	1.001	0.560	1.025	1.464
Gov	0.199	1519	0.399	0	0	0
State	0.648	1519	0.478	0	1	1
Govper (%)	11.816	303	13.344	1.818	7.195	13.085
Stateper (%)	22.566	985	23.681	6.446	15.293	30.711
Non-Govper (%)	28.243	1519	24.906	11.958	21.939	39.260
Non-Stateper (%)	15.967	1519	18.110	6.317	17.603	33.095
Sub	0.010	1519	0.009	0.002	0.007	0.014
Size	11.914	1519	1.922	9.495	13.013	13.263
Lev	0.480	1519	0.442	0.336	0.516	0.710
Managhld _t	0.207	1519	0.170	0.124	0.197	0.414
CF	0.040	1519	0.074	−0.010	0.036	0.065
Insthld	0.171	1519	0.264	0.073	0.203	0.345
ROA	0.043	1519	0.080	0.004	0.034	0.075
Age	15.312	1519	6.015	9	15	25
Growth	0.205	1519	0.251	0.009	0.097	0.394
TQ	4.582	1519	7.927	1.813	3.908	5.076
CR	1.133	1519	1.099	1.011	1.104	1.640

4. Results

4.1. Government Background Key Customers Procurement and R&D Investment of Private Enterprises

In order to test the relationship between the procurement of key customers with a government background and the innovation input of private enterprises, we first carried out a corresponding regression analysis according to Equation (1). The results are shown in Table 4. In the first and second columns, the dummy variables *Gov* and *State* were introduced, and the 0-1 variable analysis was carried out asking whether the top five customers of private enterprises have government departments and state-owned enterprises. It was found that there was a positive correlation between big government customers and R&D investment ($\beta = 0.006$), and there was a positive correlation between big government background customers and R&D investment ($\beta = 0.005$); the results were significant at the level of 10%. This shows that the R&D investment of private enterprises with a government background is significantly higher than that of private enterprises without such customers. In the third and fourth columns, continuous variables are introduced. The proportion of government big customer procurement is positively correlated with R&D investment ($\beta = 0.042$), which is significant at the level of 1%. Taking state-owned enterprises into account, the proportion of procurement of government background big customers *Stateper* is also positively correlated with R&D investment ($\beta = 0.030$), and the result is significant at the level of 5%, indicating that the higher the proportion of government (government background department) procurement in total sales, the more significant the proportion of R&D investment is than that of private enterprises. It should be noted that, in Table 4, the regression coefficient to measure the procurement of large customers with a government background is significantly weaker. Considering that the proportion of procurement can measure the impact of large customers with a government background on private enterprises, this paper mainly uses the ratio of procurement volume of large customers with government background to total sales volume in the subsequent empirical analysis as the main research variable. In addition, the regression coefficient of *Sub* is positive, but the significance is poor, which shows that the effect of government subsidies on the innovation activities of private enterprises is not very clear, and the promotion effect of multiple government interventions is not as good as that of procurement. To sum up, government background key customers can lead to increased R&D investment to private enterprises, which is consistent with the expectations of Hypothesis 1.

Table 4. Regression analysis of government background key customer procurement and innovation level of private enterprises.

	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}
Gov_t	0.006 *			
	(1.93)			
State_t		0.005 *		
		(1.68)		
Govper_t			0.042 ***	
			(2.80)	
Stateper_t				0.030 **
				(2.45)
Non-Govper _t	-0.026 **		-0.012 *	
	(-2.04)		(-1.93)	
Non-Stateper _t		-0.019		-0.032 *
		(-1.60)		(-1.79)
R&D _t	0.137 **	0.184 ***	0.155 ***	0.104 **
	(2.44)	(2.82)	(2.59)	(2.47)
Sub _t	1.025 *	1.078	0.853	0.880 *
	(1.69)	(1.40)	(1.30)	(1.77)
Size _t	0.002 ***	0.002 ***	0.003 **	0.002 ***
	(3.00)	(3.30)	(2.10)	(3.39)
Lev _t	-0.089 ***	-0.073 **	-0.074 ***	-0.109 ***
	(-3.13)	(-2.40)	(-3.13)	(-3.50)
ROA _t	0.456 ***	0.373 ***	0.420 ***	0.506 ***
	(6.95)	(7.95)	(8.39)	(7.98)
CF _t	0.704	0.629 *	1.039 *	0.812 **
	(1.48)	(1.73)	(1.91)	(2.41)
Age _t	-0.004 ***	-0.003 ***	-0.003 ***	-0.002 ***
	(-3.08)	(-2.68)	(-3.23)	(-2.67)
Managhld _t	0.090	0.095	0.142	0.091
	(1.09)	(1.51)	(0.81)	(1.29)
Insthld _t	0.114 ***	0.103 ***	0.062 ***	0.079 ***
	(3.93)	(3.80)	(4.70)	(4.49)
Constant	0.068 ***	0.071 ***	0.082 **	0.098 ***
	(2.98)	(3.34)	(2.35)	(3.29)
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1519	1519	1519	1519
R-squared	0.237	0.199	0.301	0.280

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

4.2. The Moderating Effect

This paper considers the impact of the political level. On the basis of previous studies, the government background key customers are divided into central government (central enterprise) level and local government (local state-owned enterprise) level for comparative study. The results are shown in Table 5. When the control variables are not considered, the central government procurement *Govper-Central* is positively correlated with the innovation input of enterprises ($\beta = 0.029$), and the local government procurement *Govper-Local* is also positively correlated with the innovation input of enterprises ($\beta = 0.011$); the results are significant at the level of 1% and 10%, respectively. Similarly, the central government background customer procurement *Stateper-Central* is positively correlated with the innovation input of enterprises There was a positive correlation ($\beta = 0.024$) between the purchase of *Govper-Local* by local government background customers and the innovation investment of enterprises ($\beta = 0.007$); the results were significant at the level of 5% and 10% respectively. The regression coefficient of the central level is larger and more significant than that of the local level, indicating that the central level government (government background) procurement can significantly

improve the innovation investment of private enterprises. After adding control variables to the third and fourth columns, the conclusion remains the same. For the sake of robustness, this paper also calculates the standardized regression coefficient of each variable to test whether the influence of central-level government background customers on enterprise innovation investment is greater than that of local-level government background customers. The regression results show that the standardized regression coefficient of *Govper-Central* (*Govper-Local*) is 0.016 (0.007), and the coefficient of *Govper-Central* is significantly greater than that of *Govper-Local*, indicating that the influence of government customers is greater at the central level. Similarly, the standardized regression coefficient of *Stateper-Central* (*Stateper-Local*) is 0.010 (0.004), and the coefficient of *Stateper-Central* is also significantly greater than that of *Stateper-Local*, which indicates that central-level government background customers have a greater impact, which supports Hypothesis 2a.

Table 5. Regression analysis of procurement proportion of key customers with government background and innovation level of private enterprises (central level vs. local level).

	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}
Govper-Central _t	0.029 *** (2.94)		0.033 *** (2.78)	
Govper-Local _t	0.011 * (1.79)		0.014 * (1.84)	
Stateper-Central _t		0.024 ** (2.51)		0.021 *** (2.98)
Stateper-Local _t		0.007 * (1.69)		0.009 (1.40)
Non-Govper _t			−0.008 * (−1.94)	
Non-Stateper _t				−0.032 * (−1.68)
R&D _t			0.158 ** (2.44)	0.109 *** (3.09)
Sub _t			0.664 (1.04)	1.093 * (1.88)
Size _t			0.003 ** (2.36)	0.003 *** (4.90)
Lev _t			−0.063 *** (−2.87)	−0.107 ** (−2.53)
ROA _t			0.433 *** (9.32)	0.513 *** (7.14)
CF _t			0.692 * (1.81)	1.063 ** (2.01)
Age _t			−0.003 ** (−2.27)	−0.002 *** (−3.50)
Managhld _t			0.112 (0.82)	0.093 * (1.72)
Insthld _t			0.057 *** (4.49)	0.083 *** (3.43)
Constant	0.022 ** (2.39)	0.025 ** (2.11)	0.110 *** (3.07)	0.106 *** (3.67)
Firm fixed effect	No	No	Yes	Yes
Year fixed effect	No	No	Yes	Yes
N	1519	1519	1519	1519
R-squared	0.013	0.020	0.311	0.298

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

At the same time, in order to test whether the business environment of the enterprise location has an impact on the relationship between government background key customers and innovation investment of private enterprises, this paper classifies and compares the development degree of the

region where the enterprise is registered. According to the 12th Five-Year Plan for the development of the western region issued by the State Council, the research samples are divided into two categories. The regions where the enterprises are registered belong to the scope of the development of the western region and are classified into the poor areas; the rest are classified into the developed areas in the Middle East. The results are shown in Table 6. For private companies in developed areas, the proportion of government background large customers' procurement is significantly weaker than that in poor areas in terms of the significance and the value of the regression coefficient. The *Chow* test on the coefficients of the two groups of samples in the last row of the table also proves the existence of this difference. This shows that, compared with private enterprises in developed areas, the marginal effect of the government background big customers on the private enterprises in the poor areas of central and western China is stronger; that is, the orders of the government background customers can better promote private enterprises in poor areas to increase their innovation investment, while the private enterprises in developed areas have a relatively weak promotion role due to the rich market resources and the government procurement. Hypothesis 2b is proved.

Table 6. Regression analysis of procurement proportion of government background key customers and innovation level of private enterprises (developed regions vs. poor regions).

	Developed	Poor	Developed	Poor
	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}
Govper _t	0.032 * (1.78)	0.049 *** (2.99)		
Stateper _t			0.022 * (1.92)	0.043 *** (2.68)
Non-Govper _t	-0.016 ** (-2.35)	-0.013 ** (-2.18)		
Non-Stateper _t			-0.035 * (-1.78)	-0.034 (-1.42)
R&D _t	0.140 * (1.72)	0.139 *** (2.75)	0.107 *** (3.14)	0.132 *** (2.67)
Sub _t	0.628 (1.35)	0.876 (0.96)	1.074 * (1.87)	1.093 * (1.74)
Size _t	0.004 ** (2.47)	0.002 * (1.89)	0.004 *** (3.82)	0.005 *** (3.39)
Lev _t	-0.043 *** (-2.85)	-0.069 ** (-2.48)	-0.107 *** (-3.13)	-0.120 *** (-4.19)
ROA _t	0.427 *** (9.71)	0.345 *** (8.36)	0.568 *** (7.73)	0.522 *** (8.25)
CF _t	0.717 * (1.74)	0.806 (1.42)	1.023 (1.61)	0.917 * (1.88)
Age _t	-0.002 ** (-2.27)	-0.003 *** (-2.70)	-0.002 ** (-2.36)	-0.002 *** (-3.15)
Managhld _t	0.118 (0.84)	0.121 (1.38)	0.066 (1.42)	0.107 (1.27)
Insthld _t	0.074 *** (3.71)	0.089 *** (5.16)	0.068 *** (3.18)	0.092 *** (4.19)
Constant	0.113 *** (3.38)	0.076 *** (3.29)	0.082 *** (3.70)	0.103 *** (3.85)
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1089	430	1089	430
R-squared	0.246	0.339	0.240	0.327
Govper/Stateper: Developed = poor [<i>p</i> -value]		0.053 *		0.036 **

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

4.3. The Influence Mechanism of Government Background Big Customers' Purchase on the R&D of Private Enterprises

Through the test of the previous hypothesis, can find that the purchase orders of government background key customers play a significant role in promoting the innovation investment of private enterprises. In the daily operation of private enterprises, their R&D activities are often limited by the operational risks faced by the company. Therefore, in order to study the mechanism of the role of customer structure on R&D innovation, this paper intends to explore the influence channels of government background big customers on the R&D investment of private enterprises from the perspective of corporate risk. According to the design of Equations (2) and (3), the regression analysis is carried out in Table 7. The first two columns show the regression results of the proportion of private enterprise operation risk and government (government background customer) procurement. It is found that the proportion of government (government background customer) procurement in total sales is negatively related to the risk degree of private enterprise, the coefficient $\beta = -0.203$ (-0.215), and the result is significant at 1% (5%) level, indicating that the greater the proportion of government (government background customers) procurement in the total sales volume obtained by private enterprises, the smaller the operational risk they face. Furthermore, in the last two columns of Table 7, the R&D investment is regressed by adding the government background key customers and the company risk variables at the same time. The results show that under the two different measurement methods of the government background customers, the intermediary role played by the company risk is different. Among them, the regression coefficients of *Govper* and *Vartq* are, significantly, not 0, indicating that corporate risk is part of the intermediary variable of government key customers influencing innovation and R&D; *Stateper* is not significant, while *Vartq* is, significantly, not 0, indicating that corporate risk is a part of intermediary variable for government key customers to influence R&D. On this basis, we also conducted a *Sobel* test, and the statistical results showed that the *Z* value (*Govper* 1.94, *Stateper* 2.47) is also significantly greater than the critical value of 0.97, indicating that corporate risk is indeed an important intermediary for the government background customer relationship to affect the innovation and R&D of private enterprises. All in all, the smaller the uncertainty faced by private enterprises with large customers with a government background, the more confidence they will have to increase their R&D investment, which is in line with the expectations of Hypothesis 3.

Table 7. Regression analysis of the proportion of government background key customer procurement and innovation level of private enterprises (intermediary effect analysis).

	Vartq _{t+1}	Vartq _{t+1}	R&D _{t+1}	R&D _{t+1}
Govper _t	-0.203 *** (-2.63)		0.032 * (1.94)	
Stateper _t		-0.215 ** (-2.08)		0.028 (1.57)
Vartq _t			-0.003 ** (-2.03)	-0.002 *** (-2.60)
Control Variables	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
N	1519	1519	1519	1519
R-squared	0.231	0.229	0.319	0.293

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

5. Robustness Test

5.1. Alternative Variable Test

First of all, this paper takes the R&D cost ($R\&D'_{t+1}$) of the natural logarithm and the number of researchers (RN_{t+1}) of the natural logarithm as alternative indicators of R&D investment, and tests the

impact of government background big customers on the innovation investment of private enterprises. The results are shown in columns 1 to 4 of Table 8; the coefficients of *Govper* and *Stateper* are significantly positive on the whole, which supports Hypothesis 1, indicating that the procurement of large customers with a government background is conducive to enhancing the R&D investment of private enterprises. Secondly, this paper uses Chen (2016) as a reference to measure the enterprise risk by using the variance of *ROA* during the research period. The results are shown in columns 5 and 6 of Table 8. The proportion of orders from government background customers is still significantly negatively related to the company risk, which shows that large customers with a government background can significantly reduce the business risk of enterprises.

Table 8. Regression analysis of purchasing proportion of government background key customers and innovation investment of private enterprises.

	R&D' _{t+1}	R&D' _{t+1}	RN _{t+1}	RN _{t+1}	Varroa _t	Varroa _t
Govper_t	3.575 ** (2.11)		1.440 * (1.74)		−0.013 ** (−2.22)	
Stateper_t		2.617 ** (2.06)		1.208 * (1.90)		−0.009 * (−1.89)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	1519	1519	1519	1519	1519	1519
R-squared	0.316	0.285	0.223	0.239	0.208	0.211

Note: *t* values are shown in the brackets. ** and * are significant at the level of 5% and 10%, respectively.

5.2. Self-Selection of Samples

As the top five customers information belongs to the voluntary disclosure category for listed companies, the research conclusions of this paper may be affected by the problem of sample selection. Therefore, we tested the relationship between the disclosure of the top five customers (measured by the variable *Disclosure*: the disclosed enterprise is 1; others are 0) and the innovation input of private enterprises. It can be seen from Table 9 that whether there are control variables or not, and whether the enterprise discloses the top five customers' information or not, the future innovation investment are not significant, which to some extent nullifies the sample self-selection problem.

Table 9. Regression analysis of whether private enterprises disclose key customer information and future innovation investment.

	R&D _{t+1}	R&D _{t+1}
Disclosure_t	0.009 (1.28)	0.006 (0.85)
Control Variables	No	Yes
Firm fixed effect	No	Yes
Year Fixed effect	No	Yes
N	11,764	11,764
R-squared	0.025	0.118

Note: *t* values are shown in the brackets.

Furthermore, in view of the fact that customer information belongs to the voluntary disclosure category of annual reports, in order to alleviate the impact of sample selection bias, this paper also uses the Heckman two-stage model to conduct a robustness test. The results are shown in Table 10. The inverse mills matrix coefficient IMR is not significant, which indicates that sample selection bias is not obvious in this paper, and in the two-stage regression results, the variables (*Govper/Stateper*) to measure the orders of key customers with a government background are still significant, which satisfies

Hypothesis 1. This shows that government background key customers can help private enterprises to improve their level of innovation investment.

Table 10. Regression analysis of purchasing proportion of government background key customers and innovation investment of private enterprises (Heckman two-stage).

	Gov _t	State _t		R&D _{t+1}	R&D _{t+1}
			Govper_t	0.039 ** (2.27)	
			Stateper_t		0.028 ** (2.08)
			IMR	0.004 (1.23)	0.002 (1.60)
			Non-Govper _t	−0.012 ** (−2.02)	
			Non-Statevper _t		−0.027 * (−1.68)
FR _t	0.008 ** (2.42)	0.011 *** (2.86)	R&D _t	0.125 *** (2.65)	0.104 *** (2.74)
Sub _t	0.161 ** (2.12)	0.233 ** (2.10)	Sub _t	0.783 (1.17)	0.865 (1.37)
Size _t	0.017 ** (2.06)	0.025 * (1.90)	Size _t	0.002 * (1.67)	0.002 *** (2.77)
Lev _t	−0.229 ** (−2.50)	−0.356 *** (−2.89)	Lev _t	−0.067 *** (−2.89)	−0.086 *** (−3.76)
ROA _t	1.021 ** (2.18)	1.654 * (1.83)	ROA _t	0.472 *** (8.46)	0.503 *** (9.43)
CF _t	0.801 ** (2.23)	1.363 ** (2.34)	CF _t	0.886 * (1.95)	0.710 ** (1.99)
Age _t	0.003 (1.20)	0.005 (1.10)	Age _t	−0.003 *** (−3.89)	−0.002 ** (−2.21)
Managhld _t	0.145 (1.04)	0.287 (1.05)	Managhld _t	0.113 (0.91)	0.076 (1.54)
Insthld _t	0.132 (1.18)	0.201 (1.23)	Insthld _t	0.060 *** (4.38)	0.099 *** (5.03)
Constant	0.113 * (1.91)	0.167 ** (2.01)	Constant	0.079 ** (2.32)	0.105 *** (3.93)
Firm fixed effect	Yes	Yes	Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes	Year fixed effect	Yes	Yes
N	11,764	11,764	N	1519	1519
R-squared	0.097	0.086	R-squared	0.329	0.308

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

5.3. Endogenous Problems

There may be serious endogenous problems between the innovation input of private enterprises and the orders of government background customers. That is to say, whether the government background customer order drives private enterprises to increase R&D investment, or the level of R&D investment leads private enterprises to obtain more government background customer orders, will have a significant impact on our conclusions. If it is high R&D investment that leads private enterprises to obtain more orders from government background customers, there will be a significantly positive relationship between the innovation investment of private enterprises in the current year and the proportion of future orders from government background customers. However, it can be seen from Table 11 that, although there is a positive relationship between the R&D investment of private enterprises in the current year and the order proportion of future government background customers, it is not significant. This result also excludes the interference of endogenous problems in the research conclusions of this paper to some extent.

Table 11. Regression analysis of innovation investment of private enterprises in the current year and order acquisition of key customers with government background in the future.

	Gov _{t+1}	State _{t+1}	Gov _{t+1}	State _{t+1}
R&D_t	0.185 (0.85)	0.263 (1.12)	0.219 (1.15)	0.270 (1.36)
Control Variables	No	No	Yes	Yes
Firm fixed effect	No	No	Yes	Yes
Year Fixed effect	No	No	Yes	Yes
N	1519	1519	1519	1519
R-squared	0.006	0.005	0.114	0.120

Note: *t* values are shown in the brackets.

5.4. Other Robustness Tests

In order to control the endogenous problem of private enterprises getting government background customers' orders, this paper also uses the method of Propensity Score Matching (*PSM*) to match each private enterprise that gets government background customers' orders with a private enterprise that does not get such orders. We ran a regression analysis according to government procurement and government background big customer procurement. The results are listed in the first and second columns of Table 12. The proportion of government procurement is positively correlated with innovation input of private enterprises ($\beta = 0.047$), and the proportion of government background customer procurement is positively correlated with innovation input of private enterprises ($\beta = 0.036$). The regression results also show that the R&D investment of private enterprises that obtain orders from government background customers is significantly higher than that of private enterprises that do not obtain such orders, which confirms Hypothesis 1.

Table 12. Regression analysis of procurement ratio of large clients with government background and innovation investment of private enterprises.

	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}	R&D _{t+1}
Govper_t	0.047 *** (2.94)		0.035 (1.60)		0.046 ** (2.47)	
Stateper_t		0.036 ** (2.28)		0.020 * (1.86)		0.031 ** (2.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
N	606	1970	1688	1688	1511	1511
R-squared	0.233	0.246	0.320	0.328	0.334	0.315

Note: *t* values are shown in the brackets. ***, **, and * are significant at the level of 1%, 5%, and 10%, respectively.

Considering that when the enterprise customers are too scattered it is difficult to measure the impact of a single type of customers on private enterprises, during data processing in the previous paper we removed samples with a concentration of top five customers of less than 1%. In order to ensure the reliability of the results, full samples were used for the regression. The results are listed in the third and fourth columns of Table 12. The proportion of government procurement is positively correlated with innovation investment, but the significance level is weak. The proportion of government background large customer procurement is positively correlated with private enterprise R&D investment. In general, this shows that even within the scope of the whole sample, the more purchase orders of government background key customers, the greater the R&D investment.

When the China Securities Regulatory Commission revised the "Content Disclosure Standards and Formats for Companies that Offer Securities to the Public No. 2—Contents and Formats of Annual

Reports" in 2007, they began to recommend that listed companies disclose major customer information. Therefore, our study sample was the smallest in 2007, accounting for less than 1% of the total sample. In order to better test the hypotheses of this paper, we deleted the sample in 2007 for the regression; the results are listed in the fourth and fifth columns of Table 12. The proportion of procurement of large customers with a government background is significantly positively correlated with the innovation investment of private enterprises at the level of 5%, which proves the previous test results, supports Hypothesis 1, and ensures the robustness of the research findings.

6. Discussion and Implications

This paper uses the customer order data of A-share private listed companies from 2007 to 2015 to systematically examine the impact of government-backed purchases on the innovation investment of private enterprises, from the perspective of supply chain risk transmission. The empirical results show that the procurement of large government background customers can significantly increase the future innovation investment of private enterprises, and this effect is more significant in the sample of central-level government-background customers and private enterprises in poor areas. Government background big customer procurement can significantly alleviate the business risks faced by private enterprises, which enhances the confidence of private enterprises in increasing their innovation investment.

The research conclusions of this paper are at three levels of significance: first, at the government level, the proportion of Chinese government procurement does not meet the international standards. This shows that there is still much room for growth in terms of Chinese government procurement. The Chinese government can further increase public budget expenditure and fully support government procurement. At the same time, the government should increase transparency and standardization in procurement to ensure that more companies participate. Second, at the enterprise level, government procurement has promoted the strength of the enterprise itself. Despite the large scale of government procurement, there are relatively stringent requirements for companies participating in the bidding. Only by continuously strengthening the strength and competitiveness of enterprises and improving the quality of enterprise services can more government procurement be obtained, especially for SMEs. Third, for key support industries, government procurement should be strengthened, such as in the environmental protection industry and technology, to stimulate enterprise R&D and innovation from the demand side. This article focuses on promoting private enterprise innovation through government procurement, providing a new perspective on innovation research, with the guiding significance of theory and practice. Based on the above analysis, for developing countries with a similar government procurement scale and the same small and medium-sized enterprise problems as China, this paper looks at government background customers in a new attempt to enhance economic sustainability and promote micro private economy sustainability by macro means, which could provide an important reference.

Because listed companies rarely disclose their sales order data in detail, and the relevant regulations do not require listed companies to disclose specific customer information, the research in this article has unavoidable flaws in terms of the sample scope, which cannot cover all private listings. For the company, the sales of the top five customers in the second year cannot represent the overall sales of the company. Therefore, we cannot conduct a comprehensive and in-depth study of the effect of government-level major customer procurement on the role of private enterprises. In addition, our current data cannot obtain the specific product content purchased by large customers with government background, and we cannot conduct more detailed research in different categories. These factors account for the deficiency of this article, but it can still provide a reference for future research.

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