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# *The Influence of Government-guided Fund Participation on the Innovation Performance of Venture Capital-Backed Enterprises*

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***Abstract.*** The large increase in government-guided investment funds (GGFs) in China shows a clear strategic move to promote venture capital activity and the development of technology. However, there is still some paradox between the policy's goal and the results: while GGFs have increased a lot in size and have pulled a large amount of private investment into the VC sectors, the impact of the GGFs on corporate innovation at the micro level is still open. This paper examines the link between the involvement of GGF as an LP intervention and the innovative results of the companies receiving VC support. Based on the above dual-impact analytical framework, the study argues that the participation of GGF could have a resource-enhancing effect, as it could mitigate the financial constraint and expand the accessible capital. On the contrary, it might have the goal misalignment effect, as it could bias the resource distribution and make the firms care more about the short-term, policy-oriented business rather than the long-term innovation. The analysis is based on a longitudinal data set of Chinese venture backer enterprises from 2008 to 2022, and the instrumental variable techniques and propensity score matching with difference-in-differences (PSM-DID) are used to deal with the potential endogeneity problem. The present research is based on the question of whether participation in GGF can increase the output of patents, but at the same time could decrease the quality of these patents. The results of this study are expected to contribute to the knowledge about the effect of the government and market forces, and, in addition, give some recommendations for the practice of increasing the management of and assessment of the GGF.

***Keywords:*** Government Guidance Funds, Venture Capital, Innovation Performance, Patent Quality

## 1. Introduction

Government-backed Investment Funds (GGFs) are a large-scale policy instrument in China to promote technological progress through venture capital investment [1]. Although these funds work on a large scale, it is found from the research that there is a strange inconsistency between the intention of the policy and the result, especially about their exact influence on the corporate innovation activities at the micro level. This paper tries to fill this gap in the knowledge by

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discussing the role of GGFs as financial backers in the innovation performance. We construct a conceptual model with two kinds of opposite mechanisms, a "resource augmentation effect" which can potentially increase the quantity of innovation, and an "objective misalignment effect" which can potentially damage the quality of innovation [2]. By taking data from 2008 to 2022 and using some careful causal analysis techniques, this paper explains these underlying processes, which provide some useful perspective for both policy making and academic discussion.

## 2. Literature review and hypothesis development

### 2.1. Theoretical foundation

Since government-backed financial institutions create a hierarchy in terms of governance, there are, a priori, contradictions between the profit motive and the public policy goals [3]. There are two kinds of effects that the dualism has on the invested enterprise: one is a resource augmentation effect because of the funding and repercussion of the reputation, and the other is an objective divergence effect because of the socio-political mandate. From the resource augmentation point of view, having a state involved provides not only money but also support effects that enhance the corporate reputation in the external markets. Such benefits can help to get some kind of additional funding and to reduce the risks of the investment choices that have to do with innovation. Thus, enterprises have more motivation to increase the research and development budget and intensify the patent filing activities. On the other hand, the existence of non-commercial directives may lead the firms to put into practice those initiatives that are more in line with governmental priorities rather than those that have better technological worth. This kind of strategic reallocation could lead to a worse distribution of resources and, in some cases, to a lower qualification of the innovative results.

### 2.2. Hypotheses

As financial resources are available, it is easier to have access to capital and thus more research and development efforts, and thus more patent filings. On the other hand, the fight for different goals may lead to a bad strategy, which shifts the focus to some short-term actions that respect the regulations but that can reduce the originality and the importance of the innovative outputs. From the literature so far, we know that external funding opportunities are of great importance for corporate innovation, especially for those ventures with a high level of uncertainty and a long development. The investments from a government-guided fund (GGF) remove the financial obstacles, which could incentivize the firms to increase their costs of innovation-related activities and increase their productivity in this area. On the other hand, the infusion of capital from government-affiliated entities could bring non-commercial priorities to the strategy of the corporate. The enterprises will also have external pressures to follow the policy directives, which could make them redirect their innovation agendas to less risky or more politically friendly ones instead of more transformative ones.

Building upon this dual-impact model, the present investigation advances the following proposition:

H1: GGF involvement leads to a rise in innovation output, as measured by patent volume.

H2: Government funding involvement reduces the quality of innovation (as measured by patent citations).

H3: The impact on innovation quantity is influenced by reduced financial constraints.

H4: The influence on innovation quality is driven by misallocated R&D investments.

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## 3. Research design and methodology

### 3.1. Data sources

This study employs a panel data set from 2008 to 2022, which is composed of information from three sources, namely, Zero2IPO (for venture capital and government guidance fund), CNIPA (for the patent), and CSMAR (for the financial indications) [4]. Based on the information from the very reliable information from the Zerone Database, the National Intellectual Property Administration, and the CSMAR Database, this study provides a good evidential base to see how the government guidance fund affects the innovative ability of the venture capital-supported firm. As for the figures about the government guidance funds, the Zerone Database is recognized as the best one in the non-private equity market intelligence in China. Before December 2022, in China, 2,107 such funds had been set up, and about 12.84 trillion yuan of capital was projected and 6.51 trillion yuan of actual committed funds. Those numbers provide us with some necessary information about the magnitude and participation for these kinds of financial instruments at a national level.

In addition, the official records of the National Intellectual Property Administration are also the basic metric for evaluating the companies' innovation results. The patent data. The data shows that by the end of 2024, the number of Chinese companies with active invention patents is about 3.506 million, which is about three times 1/4 of the total patents of China; the commercialization rate of the corporate invention patent at that time is 53.3%, and the economic output of the patent-intensive industry is 13.38% of the gross domestic product of the country. These two indicators indicate the innovation effect in both of the two aspects of volume of production (measured by the patent accumulation) and economic contribution (measured by the commercialization rate and industrial output value). The CSMAR Database is a good source of getting corporate financial and governance information. The one-called Company Research Series, in it, has some specialized data sets (financial statements, performance, innovation, etc) so that the researchers could set up the control parameters, such as the scale of organizations, operating time, debt, financial performance, research amount, etc. This also helps to compute some important measures, such as the SA index, which is a common measure of the financial constraint. Many previous scholars' research (including the study of the connection between the Government and the business) uses this database for the empirical study. In this study, an empirical study is conducted to discuss the relation of government guidance funds and different signs of the corporations (e.g., ESG performance and cash dividend policy) by using panel data. The data set is constructed by combining investment information in Zerone, the patent records from the National Intellectual Property Administration and the financial indicators in CSMAR. This paper shows that using these three different data sources can tell us about the involvement of the government fund (by Zerone), the evaluation of the innovation result and its quality (by the patent office data) and taking the firm-specific characteristic into account (by the CSMAR financial data). Therefore, the combination of these datasets gives us a good empirical basis to discuss the double effect of the government guidance fund on the quantity and the quality of the innovation.

### 3.2. Variables

In this section, we present the main variables included in the research to have the correspondence between the theoretical constructs and the empirical investigation.

(1) Dependent Measures: Innovation Quantity: the natural log of one added to yearly patent filings. Innovation Quality: the logarithm of one plus five-year forward citations [5].

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(2) Primary Explanatory Variable: GGF-Participation: This is a dichotomous variable that is equal to 1 if a firm got an investment supported by GBF.

(3) Controls: Firm size, age, leverage, profitability, tangibility, and year/industry/province fixed effects.

## 3.3. Empirical strategy

### 3.3.1. Baseline model

The baseline two-way fixed effects model is:

$$\text{Innovation}_{\{i,t\}} = \alpha + \beta 1 * \text{GGF\_Participation}_{\{i,t-1\}} + \gamma * \text{Controls}_{\{i,t-1\}} + \mu_i + \lambda_t + \varepsilon_{\{i,t\}} \quad (1)$$

The purpose of the proposed framework is to study the relation between the engagement in GGF undertaking and the enterprise-level measure of innovation taken into consideration, considering the enterprise level and the temporal unobserved variables. The enterprise-specific fixed components are meant to take into account stable characteristics of the enterprise, such as the competencies of the leaders or the spirit of the enterprise, while the temporal fixed components are meant to take into account big economic variations and shifts in the regulation. Adding such fixed elements reduces the bias that could be due to any excluded variable and also provides for more precise estimates of the parameters. The main parameter that we study is the mean effect of the GGF involvement on the indicator of innovation.

This methodology strategy is widely accepted in quantitative corporate financial analysis and in the study of technological advancement, and so it is quite appropriate for the study of such longitudinal data in this kind of domain.

### 3.3.2. Addressing endogeneity

Two different methodological approaches are used to avoid possible reverse causality problems. The first technique is an Instrumental Variable framework, where the ratio of the municipal expenditure and revenues is used as the instrumental variable to deal with endogeneity problems [6]. The other approach is a Propensity Score Matching combined with Difference-in-Differences methodology, that produces comparable samples between firms which receives the fund of government guided and firms which receives the fund of private venture capital [7]. The PSM-DID methodology first finds comparable firms according to the observable attributes and then does the comparison in time of the innovation outcome of the firms pre and post investment. In this way, selection bias is reduced and the causality conclusions are more valid.

## 4. Empirical results and analysis

### 4.1. Main results

Baseline regressions support the dual-effect hypothesis. GGF participation has a positive coefficient for patent quantity (H1 supported) and a negative coefficient for citation quality (H2 supported), indicating a quantity-quality trade-off (see Figure 1).

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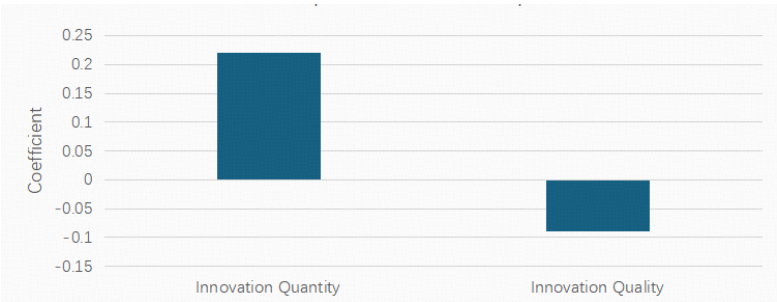


Figure 1. Coefficient comparison of GGF participation effects

## 4.2. Robustness and causality

Robustness checks with alternative measures confirm the results. The IV estimates (using local fiscal pressure) and PSM-DID estimates both support a causal interpretation of the baseline findings (see Figure 2).

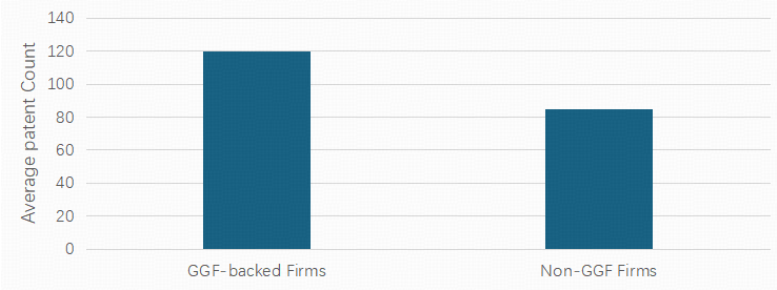


Figure 2. Patent quantity comparison

## 4.3. Heterogeneity and mechanisms

Effects are heterogeneous. The negative quality effect is stronger in low-marketization regions and for lower-level GGFs (see Figure 3). Mediation tests support the proposed channels: GGF participation eases financing constraints (SA index), supporting H3 [7], and shifts patenting toward policy-prioritized technology fields, indicating R&D distortion supporting H4 [8].

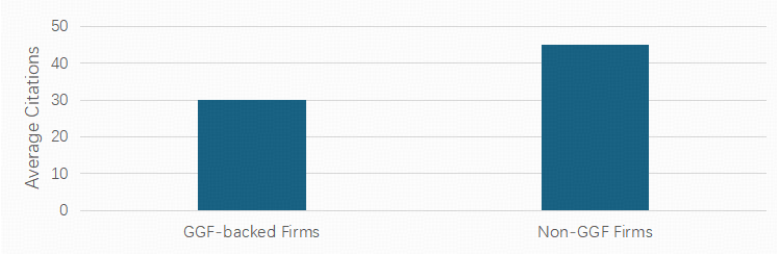


Figure 3. Patent quality (citations) comparison

## 5. Conclusion

We have shown in our work that the interaction between Chinese GGFs increases the amount but lowers the quality of the innovation of the involved firms. This two-sided result is due to the opposite effects of the resource availability and of conflicting goals. These results suggest designing

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policies in which financial help is provided, but also the possible disturbance to the innovative activities is lowered.

There are some limits of the present research that should be pointed out as well. Firstly, the work does not contain the study of the exact processes of the inefficient distribution of the resources. Furthermore, other methodological approaches, such as the qualitative case analyses, were not used to support the results of the research. Next works could improve the study of the inefficiency of the allocation of the resources and study some particular provisions of the regulation that are contained in the GGF contractual arrangements.

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