Economic Research-Ekonomska Istraživanja

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

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To cite this article: Kai Zhao & Jun-mei Ye (2023) Implementation strategy of MEI policy and SME innovation: a Chinese analysis, Economic Research-Ekonomska Istraživanja, 36:1, 2120036, DOI: 10.1080/1331677X.2022.2120036

To link to this article: https://doi.org/10.1080/1331677X.2022.2120036

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2023, VOL. 36, NO. 1, 2120036
https://doi.org/10.1080/1331677X.2022.2120036

Implementation strategy of MEI policy and SME innovation: a Chinese analysis

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ABSTRACT
How to unify various policy tools into the same econometric model framework has always been an important research issue. This paper clarifies the connotation of MEI policy's tool combination, scientifically identifies the actual impact of R&D subsidy tool, tax incentive tool, and their combination on SME innovation, and explores the best implementation strategy of MEI policy, by designing a reasonable and applicable policy identification framework. This paper confirms that R&D subsidy tool and tax incentive tool of MEI policy can form the obvious complementary effect in promoting substantive innovation of SMEs, but the mutually exclusive effect in promoting strategic innovation of SMEs. It is shown that the single tax incentive is the best implementation strategy of MEI policy to stimulate innovation for SMEs located in the central region, and the policy tool combination strategy is the best implementation scheme of MEI policy for SMEs located in the western region.

ARTICLE HISTORY
Received 20 March 2021
Accepted 25 August 2022

KEYWORDS
MEI policy; SME innovation; control function method; multi-level treatment effect model; implementation strategy

SUBJECT CLASSIFICATION CODES
H25; O32; C31

1. Introduction

'Mass Entrepreneurship and Innovation' (MEI) is a major policy initiated by China on the basis of the needs for the transformation and development as well as domestic innovation potential, to optimise the environment for start-ups and innovation. Since Premier Li Keqiang proposes MEI at the 2014 Summer Davos in Tianjin, it has been viewed as a new engine for China's economic growth. Small and medium-sized enterprises (SMEs), as the key enterprises with the most innovative vitality and potential, are not only the indispensable force to promote the economic development, but also the strong support of technological progress. From the micro view, the technological innovation of SMEs is the driving force for their continuous development, which not only brings high profits to enterprises, but also greatly improves the enterprises' core competitiveness. From the macro view, technological innovation is a revolutionary force for a country to maintain economic growth, which can improve social

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productivity and promote economic and social development. Therefore, the Central Committee of the Communist Party of China and the State Council issue several opinions about MEI policy in 2015, which specifically emphasise the strengthening of support for fiscal and taxation policies, and encourage SMEs to engage in innovation activities through R&D subsidy and/or tax incentive tools. The R&D subsidy tool is the direct mean of the government to support SMEs in carrying out innovation in China (Xiang et al., 2021), while the tax incentive tool is the indirect support, which can reduce the tax burden of SMEs through tax reduction and exemption, so as to achieve the purpose of encouraging innovation. Nevertheless, in recent years, the practice of stimulating the innovation of SMEs by means of R&D subsidies and tax incentives has been questioned. The problems such as 'more subsidies, more losses', 'more concessions, more backwardness' are not uncommon. It can be seen that MEI policy is a double-edged sword. Analysing the relationship between the MEI policy and SME innovation, clarifying the differential effects of policy tools on SME innovation, and maximising the incentive effect of MEI policy are the important issues to be solved.

It is worth noting that the two MEI policy tools, R&D subsidy and tax incentive, have certain overlapping characteristics. In the research sample of this paper, 63.56% of SMEs are supported by the R&D subsidy tool, and 30.26% of SMEs are supported by tax incentive tool, while SME supported by these two policy tools account for 35.74% of the total. Therefore, it is necessary not only to investigate the policy-mixed-effect of these tools, but also to measure and reveal the possible interactions between these policy tools. In addition, there are still many confusions in the implementation of MEI policy. For example, government funds are scarce, which SME should be supported? MEI policy emphasises that SME should pay attention to both innovation quantity and innovation quality, which policy tool is the most effective? Is it necessary to encourage SMEs to innovate in the form of combination or synergy of MEI policy tools? Should the government adopt differentiated policy implementation strategies for SMEs with different ownership, different industries and different regions? Faced with the above questions, it is urgent to evaluate the actual effects of different policy tools and their combinations in promoting SME innovation.

To this end, this paper, from the perspective of the tool combination of MEI policy, makes an in-depth study of the influence of two different policy tools and their combination on SME innovation, reveals the different implementation strategies on different SME innovation behaviours, and digs out the optimal implementation strategy of MEI policy that can not only effectively increase the quantity of SME innovation but also improve the quality of innovation. It is found that R&D subsidies and tax incentives can form the obvious complementary effects in promoting substantive innovation of SMEs, but the mutually exclusive effects in promoting strategic innovation of SMEs. For SMEs in the central region, the single tax incentive is the best strategy to stimulate innovation; for SMEs in the western region, the policy tool combination strategy is the best implementation scheme of MEI policy.

The main contributions of this paper are shown as follows. First, the construction of the suitable measurement framework. How to unify various policy tools into the same econometric model framework has always been a difficult point in related fields.

In this paper, a structural econometric equation suitable for China's realistic background is established, and the Control Function Method (CFM) framework is designed according to the information mined from the data. This framework not only integrates two MEI policy tools, but also effectively deal with the endogenous problems. Second, the multi-perspective analysis. Existing studies mostly examine the impact of China's innovation policies on enterprise innovation from the perspective of a single policy tool, ignoring the important fact that diversified innovation policies of the government for micro-enterprise innovation enable enterprises to obtain the support of different types of policy tools at the same time. This will inevitably lead to treatment bias or even invalidity of existing findings. This paper clarifies the connotation of MEI policy's tool combination, and scientifically evaluate the actual impact of R&D subsidies, tax incentives and their combination on SME innovation, especially substantive innovation, in order to effectively avoid selection bias and endogenous problems. Third, the effective measurement of SMEs' innovation. Some research from the perspective of enterprise patent find that innovation measured by patent application is sometimes a 'strategic behaviour' (Hall & Harhoff, 2012). This means that the innovation of SMEs may be just a strategy of the management, and its purpose is not to substantially improve the technological competitiveness of enterprises, but to obtain certain benefits, which is often shown as catering to government policies. Drawing lessons from the existing study (Li & Zheng, 2016), this paper divides SME innovation into 'substantial innovation' and 'strategic innovation'. The former is a 'high-quality' innovation aiming at promoting technological progress and gaining competitive advantage of SMEs, and the latter is an enterprise innovation strategy that caters to government by pursuing the 'quantity' and 'speed' of innovation for the purpose of seeking other interests.

The rest of the paper proceeds as follows. Section 2 describes the literature review. Section 3 discusses the theoretical analysis and empirical hypothesis. Section 4 shows the methodology and data. Section 5 discusses the results obtained. Finally, conclusions are drawn in section 6.

2. Literature review

2.1. Influencing factors of SME innovation

SME innovation is a complex and ambiguous phenomenon that can take different forms and can be affected by various ways and factors (Bukowski & Rudnicki, 2019; López-Cabarcos, Piñeiro-Chousa, & Quiñoá-Piñeiro, 2021). Literature on influencing factors of SME innovation can be classified into three categories. The first category is environmental factors, including the macro environment and industrial market environment in which SMEs are located. This category of the study mainly focuses on the influence of marketisation, legal system environment, and market distortion on SME innovation (Hervás-Oliver et al., 2021). The second category is structural factors, including the relationship between SMEs and external organisations. This category of the study mainly investigates the impact of interaction among enterprises, technological opportunities, knowledge spillovers, demand conditions on SME innovation (Granovetter, 2005; Rodríguez-Pose et al., 2021). The third one is organisational factors, emphasising the importance of internal characteristics of SMEs, and mainly investigating the influence of enterprise scale, organisational structure, enterprise culture, and strategic management on enterprise innovation (López-Cabarcos, Piñeiro-Chousa, Quiñoá-Piñeiro, & Santos-Rodrigues, 2021).

2.2. Government policy tools and enterprise innovation

Innovation has the nature of quasi-public goods, and the government should intervene by implementing appropriate policies to resolve market failure. The intervention tools of innovation policies in various countries can usually be divided into R&D subsidies and tax incentives. R&D subsidies are *ex ante* incentives for enterprise innovation (Yu et al., 2016). In other words, the government provides financial support for enterprises and guides enterprises to increase investment in technological innovation. Different from R&D subsidies, tax incentives are *ex post* incentives (Rao, 2016). The government reduces enterprises' tax burden by means of tax exemption and deduction, so as to reduce enterprises' innovation cost and stimulate enterprises' innovation output (Lokshin & Mohnen, 2012).

2.2.1. Impact of R&D subsidies on enterprise innovation

There are many studies on the relationship between R&D subsidies and enterprise innovation. On theoretical ground, both an optimistic and sceptical view of R&D subsidies can be supported (Michael & Pearce, 2009; Spence, 1984). Nevertheless, no consistent conclusions have been reached on empirical ground. The opinions held by scholars are mainly divided into 'incentive effect view', 'inhibiting effect view', 'non-linear effect view' and 'dynamic effect view'. Scholars who hold the 'incentive effect view' believe that R&D subsidies can effectively promote the technological innovation of enterprises (Brautzsch et al., 2015). After receiving subsidies, enterprises can more easily establish close ties with universities or research institutes, thereby improving their innovation efficiency (Feldman & Kelley, 2006). The studies based on the data of German enterprises (Alecke et al., 2012), Italian enterprises (Bronzini & Piselli, 2016) and Chinese enterprises (Yang et al., 2018) confirm that subsidised enterprises have a higher patent application rate compared with enterprises that do not receive R&D subsidies. Deng et al. (2020) confirm the positive effect of government subsidies on innovation by small-cap enterprises is only statistically significant in regions with population densities above a certain level.

Some scholars hold the 'inhibiting effect view' and believe that subsidies may crowd out firm-financed R&D spending (Wallsten, 2000). The majority of studies that discuss the crowd-out effect of R&D subsidies in Belgium, Germany, and Spain, summarised by Aerts and Czarnitzki (2005). In China, there are information asymmetry and principal-agent problems between government and enterprises, which led to the fact that the government do not use scientific and reasonable standards to identify which enterprises should receive subsidies before subsidising innovation (An et al., 2009). As a result, subsidy resources are not allocated optimally. Besides, the government cannot ensure whether subsidies can be used in innovation activities, and there is a lack of effective methods to monitor the innovation behaviour of subsidised enterprises (Armstrong, 2001), which could make R&D subsidies inhibit technological innovation (Bergstrom, 2000).

Other scholars hold the 'non-linear effect view' and believe that the relationship between R&D subsidies and enterprise innovation is not a simple linear relationship, but an inverted U-shaped relationship (Mao & Xu, 2015). Based on the data of Chinese listed enterprises, Dong and Han (2016) find that there is a strong spatial heterogeneity and non-linear relationship between R&D subsidies and enterprise innovation. Shang and Huang (2019) focus on the listed enterprises in pharmaceutical manufacturing industry, and confirm the non-linear structural feature between government subsidies and enterprise innovation.

Concerning 'dynamic effect view', Jaklic et al. (2013) is the first to study the dynamic effects of R&D subsidies on corporate R&D spending behaviour. Afterwards, Barajas et al. (2016) discuss the dynamic effect of subsidy policy separately for a 2, 3, and 4 year. Vanino et al. (2019) try to differentiate between the short-term effect and medium-term effect. Mulier and Samarin (2021) and Biancalani et al. (2022) focus on the year-by-year effects up to several years after subsidisation. The majority of these studies find that the effects of subsidisation tend to get stronger over time.

2.2.2. Impact of tax incentives on enterprise innovation

Similar to R&D subsidies, there is no consensus on the relationship between tax incentives and enterprise innovation, which can be roughly divided into three categories: 'incentive effect view', 'inhibiting effect view' and 'moderate interval view'. The majority of scholars hold the 'incentive effect view', and consider that tax incentives are beneficial to increase the number of new products and patent applications of enterprises (Crespi et al., 2016; Czarnitzki et al., 2011; Kobayashi, 2014). Some scholars hold the 'inhibiting effect view', and believe that tax incentives will crowd out enterprises' investment in R&D, thus inhibiting enterprise innovation (Tassey, 2007). A few scholars hold the view of 'moderate interval view' and believe that tax incentives are a conditional and differentiated incentive for enterprise innovation. This incentive effect has a threshold, and the policy intensity only within the optimal threshold range can promote enterprise innovation (Zheng et al., 2020).

2.3. Policy tool combination and enterprise innovation

The innovation field is faced with market failure, system failure, especially the multiple failures in the process of innovation system transformation (Raven & Walrave, 2020), which provides nourishment and space for the existence and development of policy tool combination. With the increasing number of policies related to innovation, the policy system is becoming more and more complex, and the interaction between policy tools with different characteristics became more frequent gradually. The effect of policy tool combination depends not only on the effect of single policy tool, but also on the policy-mixed-effect (Ghazinoory et al., 2019). The policy tool combination mainly includes the combination of R&D subsidies and tax incentives, and the combination of supply-side tool and demand-side tool.

The literature concerning the combination of R&D subsidy tool and tax incentive tool can be classified into 'inter-policy combination' and 'intra-policy combination'. Most scholars believe that policy inter-combination is beneficial to stimulating enterprise innovation. Based on the data of Belgian enterprises, Neicu (2019) confirms that the combination of R&D subsidy tool and tax incentive tool can effectively motivate enterprises to innovate. Radas et al. (2015) find that the combination of R&D subsidies and tax incentives can promote enterprises' innovative output by using the data of Croatian SMEs. Some scholars believe that in the inter-policy combination, the introduction of one policy tool may reduce the incentive effect of another policy tool. Dumont (2017) finds that implementing R&D subsidies and tax incentives at the same time has less impact on enterprise innovation than using single policy tool. In terms of intra-policy combination, scholars consider that different kinds of tax incentive combinations or R&D subsidy combinations have positive effects on enterprise innovation. Radicic and Pugh (2017) analyse the data of SMEs from 28 European countries and find that the combination of R&D subsidies at different levels (European level and national level) is conducive to promoting enterprise innovation. Hottenrott et al. (2017) find that two kinds of R&D subsidies, namely research subsidy and development subsidy, have certain complementary effects on enterprise innovation, and their combination is beneficial to strengthen the incentive effect of subsidies.

Research on the combination of supply-side and demand-side policy tools is relatively abundant. Guerzoni and Raiteri (2015) suggest that supply-side policy and demand-side policy have a greater impact on enterprise innovation than single policy tool based on micro-enterprise survey data. Kalcheva et al. (2018) show that the combination of supply-side and demand-side policy tools is more conducive to achieving high-quality innovation, using the data of micro-enterprises of private medical devices in the United States. Nevertheless, some studies confirm that the combination of supply-side and demand-side policy tools may be inefficient in developing countries. Based on micro-enterprise data of Ecuador, Fernandez-Sastre and Montalvo-Quizhpi (2019) find that the combination of policy tools has no significant or negative impact on enterprise innovation.

To sum up, the existing studies mostly examine the impact of innovation policies on enterprise or SME innovation activities from the single policy tool perspective (Castellacci & Lie, 2015). Although some studies involve the relationship between the combination of policy tools and enterprise innovation, few of them pay attention to the policy-mixed-effect and the possible policy-cross-effect on enterprise innovation caused by enterprises receiving R&D subsidies and tax incentives at the same time (Busom et al., 2017).

3. Theoretical analysis and empirical hypothesis

In this section, we set up a simple two-stage game model to theoretically analyse the impact of the possible strategies adopted by the government in implementing the MEI policy on SME innovation, and put forward an empirical hypothesis on this basis.

Suppose there are two SMEs indexed respectively by i and j competing in a Cournot market. The SME i is local, while the SME j is foreign. q_i and q_j represent respectively the output of SME i and j , $Q = q_i + q_j$ is the total output of the market. The market price is given by $p = a-(q_i + q_j)$, where a represents the market size. As far as the cost function is concerned, c_i and c_j represent respectively the marginal cost of local SME i and that of foreign SME j . Consider that the foreign SME is superior in technology and productivity, the marginal cost of SME j is low (c_{low}). Local SME tries to improve its productivity by investing in R&D. Note that investing in R&D is expensive, we assume the R&D input of local SME is x and the unit R&D cost is ω . If the R&D succeeds, then $c_i = c_{low}$; otherwise, $c_i = c_{high}$ with $c_{high}>c_{low}>0$. Suppose that the probability $\phi(x)$ of successful R&D of local SME i is related to the intensity of R&D input, and $\phi'(x)>0$,$\phi''(x) \leq 0$. This assumption means that the more investment in R&D, the higher the probability of marginal cost $c_i = c_{low}$ will be. To simplify, we define $\phi(x) = x^k$, where $k \in (0, 1)$. The timing of the game is as follows: 1st stage, local SME can maximise its profit by selecting the optimal R&D input; 2nd stage, the outputs are decided simultaneously by two SMEs. In general, governments have three alternative strategies: (1) single R&D subsidy; (2) single tax incentive; (3) policy tool combination.

3.1. Single R&D subsidy tool

The government implements R&D subsidy (Sub) to local SME i , and the profit function of local SME is

$$\pi_i = pq_i-c_iq_i-x(\omega - Sub) \tag{1}$$

and the profit function of foreign SME j is

$$\pi_j = pq_j-c_jq_j \tag{2}$$

The model is solved by backward induction. At 2nd stage, when the local SME succeeds in R&D, the marginal costs of the two SMEs are c_{low}, and their outputs are $q_{i,s} = q_j = \frac{a-c_{low}}{3}$; when the local SME fails in R&D, the outputs of the two SMEs are respectively $q_{i,f} = \frac{a-2c_{high}+c_{low}}{3}$, $q_j = \frac{a+c_{high}-2c_{low}}{3}$, where the subscripts '$s$' and '$f$' represent respectively 'success' and 'failure'. Therefore,

$$q_i = \frac{a-2c_i + c_{low}}{3}, \quad q_j = \frac{a + c_i-2c_{low}}{3}, \quad \text{where } i = \{high, low\} \tag{3}$$

At 1st stage, the local SME maximises the profit by choosing its R&D input x. When the local SME succeeds in R&D, the profit function is $\pi_{i,s} = pq_{i,s}-c_{low}q_{i,s}-x\omega$; when the local SME fails in R&D, the profit function of local SME will be $\pi_{i,f} = pq_{i,f}-c_{low}q_{i,f}-x\omega$. The problem of maximising the expected profit of local SME $i$is shown as follows

$$\underset{x}{\mathrm{Max}}\,\mathrm{E}\left[\phi(x)\cdot\pi_{i,s}+(1-\phi(x))\pi_{i,f}\right] \tag{4}$$

Based on the first-order conditions of Eq. (4), we obtain the optimal R&D input of local SME

$$x^{*}=\left[\frac{4k(a-c_{high})(c_{high}-c_{low})}{9(\omega-Sub)}\right]^{\frac{1}{1-k}} \tag{5}$$

Due to $\frac{\partial x^{*}(Sub)}{\partial Sub}$>0and $\frac{\partial^{2}x^{*}(Sub)}{\partial Sub^{2}}$>0, it can be inferred that R&D subsidy tool can encourage local SME to carry out innovation activities.

3.2. Single tax incentive tool

Tax incentive is a government measure that is intended to reduce the tax burden of SMEs. Assume that the government implements tax incentive tool (Tax) to reduce the cost of local SEM, and the profit function of SEM $i$will be

$$\pi_i=pq_i-(c_i-Tax)q_i-x\omega \tag{6}$$

By maximising the profit function of the local SME i (Eq. (6)) and the foreign SME j(Eq. (2)), and combining the obtained first-order conditions, the equilibrium output of the SMEs can be deduced

$$q_i=\frac{a-2c_i+c_{low}+2Tax}{3},\quad q_j=\frac{a+c_i-2c_{low}-Tax}{3} \tag{7}$$

By maximising the expected profit of local SME i, we have

$$x^{**}=\left[\frac{4k\left(a-c_{high}+2Tax\right)(c_{high}-c_{low})}{9\omega}\right]^{\frac{1}{1-k}} \tag{8}$$

It is clear that $\frac{\partial x^{**}(Tax)}{\partial Tax}$>0,$\frac{\partial^{2}x^{**}(Tax)}{\partial Tax^{2}}$>0, and tax incentive tool can encourage local SME to carry out innovation activities.

3.3. Policy tool combination

When the government implements both R&D subsidy (Sub) and tax incentive (Tax) tools, the profit function of local SME $i$will be

$$\pi_i=pq_i-(c_i-tax)q_i-x(\omega-Sub) \tag{9}$$

By maximising the expected profit of local SME i, we find the R&D input equilibrium of local SME

$$x_i^{***} = \left[\frac{4k\left(a - c_{high} + 2Tax\right)\left(c_{high} - c_{low}\right)}{9(\omega - Sub)} \right]^{\frac{1}{1-k}} \tag{10}$$

According to Eq. (10), we have $\frac{\partial x^{***}}{\partial Sub} > 0, \frac{\partial x^{***}}{\partial Tax} > 0$and $\frac{\partial^2 x^{***}}{\partial Sub \cdot \partial Tax} > 0$. It can be inferred that the policy effect of one tool on innovation activities of SME could be affected by another tool. Overall, the theoretical section gives the following hypothesis to be tested empirically.

Hypothesis: *There is the cross effect of the MEI policy tools on SME innovation activities.*

4. Methodology and data

4.1. Methodology

When evaluating the effectiveness of MEI policy, the self-selection of SMEs for policy and the 'picking-the-winner' strategy (Radicic et al., 2016) of government may generate the endogenous issue. Therefore, we use two quasi-natural experiment methods to realise unbiased estimation, and accurately examine the impact of MEI policy on SME innovation. Firstly, by constructing an estimation framework based on the Control Function Method (CFM), we analyse the actual effect of two main policy tools (R&D subsidy and tax incentive) in China's MEI policy on SME innovation, as well as the possible cross effects between policy tools. Secondly, using multi-level treatment effect model, we investigate the impact of the combination of two policy tools on SME innovation, and discuss the optimal implementation strategy of MEI policy that can effectively stimulate the quantity and quality of SME innovation.

4.1.1. CFM design

Referring to the idea of CFM proposed by Wooldridge (2015), the following estimation framework is adopted

$$\begin{cases} y_{it} = \alpha_0 + \beta_1 sub_{it} + \beta_2 tax_{it} + \mathbf{Z_{it}} \boldsymbol{\lambda} + \theta_i + \gamma_t + \varepsilon_{it} & (a) \\ sub_{it} = \alpha_1 + \mathbf{X_{1,it}} \boldsymbol{\eta_1} + \theta_i + \gamma_t + \upsilon_{it} & (b) \\ tax_{it} = \alpha_2 + \mathbf{X_{2,it}} \boldsymbol{\eta_2} + \theta_i + \gamma_t + \mu_{it} & (c) \end{cases} \tag{11}$$

The explained variable y in the Eq. (a) of Formula (11) represents SME innovation, which involves innovation output, substantive innovation and strategic innovation. The explanatory variables *sub* and *tax* respectively represent two different tools of MEI policy, namely R&D subsidy and tax incentive. **Z** is a series of control variables (i.e., return on assets, cash flow, liquidity ratio), and $\boldsymbol{\lambda}$ represents the corresponding coefficient vector. θ_i and γ_t represent the individual fixed effect and the time fixed effect respectively, and ε_{it} is a random disturbance term. In the CFM with *sub* as the dependent variable (Eq. (b) of Formula (11)), $\mathbf{X_1}$ represents a series of factors that affect whether a SME can get the support of R&D subsidy tool. Similarly, in the CFM with dependent variable *tax* (Eq. (c) of Formula (11)), $\mathbf{X_2}$ represents the vector of factors that influence SMEs to obtain the support of tax incentive tool. To clarify the factors involved in $\mathbf{X_1}$ and $\mathbf{X_2}$, we use the panel logit model shown as follows.

$$\ln\left[\frac{\Pr(supported_{it}=1|x_{it},\boldsymbol{\beta},\mu_i)}{\Pr(supported_{it}=0|x_{it},\boldsymbol{\beta},\mu_i)}\right]=\mathbf{X_{it}}\boldsymbol{\beta}+\mu_i \tag{12}$$

where the dummy variable $supported_{it}$ represents whether SME i is supported by policy tools. If the SME is supported by MEI policy tool, $supported_{it}=1$; otherwise 0.

4.1.2. Multi-level treatment effect model design

Further, we use the multi-level treatment effect model to compare the different implementation strategies of MEI policy on SME innovation, so as to explore the optimal strategy to stimulate innovation. Consider the SME data with n observations in which each SME has been assigned one of $J+1$ possible treatment levels $j=0,1,\ldots,J$. For each SME $i=1,2,\ldots,n$, we observe the random vector $\mathbf{z}_i=(y_i,T_i,\mathbf{x}'_i)'$, where y_i is the observed outcome of SME innovation, T_i denotes the treatment level administered, and $\mathbf{x}'_i$ is a $k_x\times 1$ vector of covariates, including enterprise characteristics, industry characteristics, regional characteristics and other control variables. In our study, $j=0$ if the SME is only supported by R&D subsidy tool; $j=1$ if the SME is only supported by tax incentive tool; $j=2$ if the SME is supported by both R&D subsidy and tax incentive tools. We define the indicator variables $d_i(j)=\mathbf{1}(T_i=j)$, which take the value 1 if SME i received treatment j and otherwise 0. We use the classical potential-outcome framework in the context of multivalued treatment effects to describe the estimators of interest. This model distinguishes between the observed outcome y_i and the $J+1$ potential outcomes $y_i(j)$ for each treatment level $j=0,1,\ldots,J$. The observed explained variable is given by

$$y_i=d_i(0)y_i(0)+d_i(1)y_i(1)+\cdots+d_i(J)y_i(J) \tag{13}$$

where $\{y_i(0),y_i(1),\ldots,y_i(J)\}'$ is an independent and identically distributed draw from $\{y(0),y(1),\ldots,y(J)\}'$ for each SME $i=1,2,\ldots,n$. The distribution of each $y(J)$ is the distribution of the explained variable that would occur if SME were given treatment level j; it is known as the potential-outcome distribution of treatment level j.

To satisfy the random distribution conditions of causal inference, the multi-level treatment effect model should meet the Conditional Independence Assumption (CIA) and the Overlap Assumption (OA). CIA requires that the distribution of each potential-outcome $y(j)$ is independent of the random treatment variable $d(j)$ given covariate $\mathbf{x}'_i$, in other words, $y(j)\perp d(j)|\mathbf{x}$. OA requires that the probability that the SMEs are arranged in any treatment state based on covariate is positive, namely $p_j(\mathbf{x})=\Pr(T=j|\mathbf{x})>0$. According to the abovementioned assumptions, the functional expression of conditional expectation value of SME innovation can be written as

$$\mathrm{E}[y(j)|\mathbf{x}]=\mathrm{E}[y_i|T_i=j,\mathbf{x}]=\beta_{0j}+\mathbf{x}\beta_{1j} \tag{14}$$

The General Propensity Score (GPS) is used to calculate the inverse-probability weighted (IPW) of the observed values of covariates $\mathbf{x}$ in each treatment level T_i, so as to ensure the balance among different treatment levels (Imbens, 2000). Referring to the ideas of Cattaneo (2010) and Cattaneo et al. (2013), the Average Treatment Effect (ATE) when the treatment level changes from T_i to k ($k \in \{0, 1, \ldots, J\}$) can be estimated, namely

$$ATE_{jk} = \left(\hat{\beta}_{0j} - \hat{\beta}_{0k}\right) + \frac{1}{n}\sum\nolimits_{i=1}^{n} x_i\left(\hat{\beta}_{1j} - \hat{\beta}_{1k}\right) \tag{15}$$

4.2. Data

As this study focuses on the impact of MEI policy on the innovation of SMEs, it is reasonable to select listed enterprises of A-share Small-and-Medium-Sized board and Growth Enterprises Market (GEM) board as research samples. The enterprise data of China's A-share Small-and-Medium Sized board and GEM board from 2010 to 2017 are mainly from CSMAR database and WIND database. The missing patent information of SMEs is manually collected and summarised after consulting the databases of the State Intellectual Property Office and the Chinese Academy of Sciences. Furthermore, according to the 'Statistical Measures for the Division of Large, Medium and Small Enterprises' released by the National Bureau of Statistics, large enterprises that do not meet the criteria for SMEs are excluded from the data. For example, listed industrial enterprises with more than 1000 employees and operating income exceeding 4 billion are excluded, and listed enterprises in construction industry with operating income and total assets exceeding 8 billion are excluded. To ensure the validity and integrity of data, the ST and PT enterprises and the enterprises with missing key indicators are excluded. Finally, we have 7644 observations.

The quantity of patent applications (*patent*) is used to measure the innovation of SMEs for two reasons: first, the quantity of patent applications is not easily interfered by external factors, such as bureaucratic factors, patent maintenance fees; second, the patent application data is easy to obtain, and can be used as a stable and objective standard to effectively measure the innovation of SMEs (Hottenrott & Lopes-Bento, 2014). Furthermore, to clarify the influence of MEI policy, we follow the idea of Li and Zheng (2016) and distinguish the different innovation behaviours of SMEs. Specifically, the innovation behaviours of SMEs can be divided into two categories: substantive innovation and strategic innovation. The former is the core of SME innovation and the main driving force for SME development, which is measured by the quantity of 'Patent for Invention' of SMEs (*inn*); the latter is the strategic behaviour adopted by SMEs to cater to the government, which is measured by the sum of the quantity of 'Patent for Utility Model' and 'Patent for Industrial Design' of SMEs, in other words, 'Patent for Non-Invention' (*sinn*).

The government implements the MEI policy in two ways: R&D subsidy and tax incentive. We define the dummy variable (*sub*) to describe whether SMEs receive R&D subsidy. When SMEs are supported by R&D subsidy, $sub = 1$; otherwise 0. The detail information of R&D subsidy is shown in the annual report of the listed enterprise. Referring to the practice of Hu and Wu (2018), we use the intensity of tax incentives to measure whether SME enjoys tax incentives (see more in Table 1). Besides, we select the following SME characteristics which have important influence on innovation as control variables. Return on assets (*roa*) and cash flow (*cash*) are usually used to measure the profitability of SMEs. Generally, SMEs with high ROA and abundant cash flow are more inclined to invest in R&D activities (Peng & Mao, 2017). The growth rate of operating income (*grow*) is the comparison between the annual growth of operating income and the total operating amount of the previous year. This index reflects the development prospect of SMEs. Operating income (*rev*) refers to the income obtained by a SME from its main business. Liquidity ratio (*liqui*) is the proportion of current assets owned by SMEs in owner's equity. The higher the liquidity ratio, the stronger the operating capacity of SMEs will be (Zhang et al., 2015). Capital density (*cap*) is used to measure the gap of innovation ability among different SMEs. The high level of shareholding ratio (*top*10) of SME signifies that the decision-making power of the SME is concentrated, which may reduce the innovation willingness of the SME due to the private interests of control (Zhao et al., 2021). In China, SMEs with different forms of ownership (*soe*) have great differences in their resource endowments and innovative logic (Liang et al., 2012), and there is innovation heterogeneity due to SOE's different dynamic shift of objective functions (Shi & Zhang, 2018). There is a close relationship between the business direction and the innovation activities of SOEs. High-tech enterprises ($high-tech$) have strong enthusiasm for innovation because they need to rely on innovation to occupy a place in the highly competitive market (Duan et al., 2021). In addition, China has a vast territory and unbalanced distribution of resources, which leads to great differences in innovation resources and policy environment among different regions. Therefore, it is necessary to control the region where SMEs locate ($east\backslash west\backslash mid$). The description of the abovementioned variables is summarised in Table 1.

Table 2 reports the basic statistical characteristics of the main variables, which are not logarithmically treated. As far as patent applications are concerned, most SMEs in the dataset prefer to apply for 'Patent for Utility Model', followed by 'Patent for Invention' and 'Patent for Industrial Design'. From the average value of R&D subsidies and tax incentives, it can be seen that the vast majority of SMEs in the dataset enjoy the benefits from the MEI policy.

5. Analysis

5.1. Target selection, mixed effect, cross effect of MEI policy tools

5.1.1. Target selection of MEI policy tools

The characteristics of SMEs have an important influence on whether they can get the support of MEI policy and what kind of policy tools they can get. Based on the estimated results of panel logit model shown in Table 3, we can clarify the influencing factors $\mathbf{X_1}$ and $\mathbf{X_2}$ in the control functions (b and c) of formula (11).

The column (1) of Table 3 shows the estimated result with 'whether SME can be supported by R&D subsidy tool' as the explained variable. It is found that the return on assets, the capital density, the industry type and the location of SMEs are the

Table 1. Variable description.

	Name	Symbol	Definition
Explained variables	Innovation	*patent*	Ln(number of patent applications + 1)
	Substantial innovation	*inn*	Ln(number of 'Patent for Invention' + 1)
	Strategic innovation	*sinn*	Ln(sum of the number of 'Patent for Utility Model' and 'Patent for Industrial Design' + 1)
Explanatory variables	R&D Subsidy	*sub*	Dummy variable. SMEs receiving R&D subsidies is defined as 1, otherwise 0.
	Tax incentive	*tax*	Dummy variable. If the result calculated based on $\frac{1-ER}{TR}$ is greater than 1, tax = 1; otherwise 0. ER means 'effective tax rate' namely $ER = \frac{income\ \ tax\ \ expense}{gross\ \ profit}$. TR means legal tax rate, TR = 25% according to relevant tax regulations.
Control variables	Return on assets	*roa*	Measure the profits created by enterprises using assets
	Cash flow	*cash*	Measure the debt repayment ability and management ability of enterprises
	Growth rate of operating income	*grow*	Measure the development prospect of the enterprise
	Operating income	*rev*	Measure the operating conditions of enterprise
	Liquidity ratio	*liqui*	The proportion of current assets owned by enterprises in owner's equity
	Capital density	*cap*	Ln(net fixed assets/number of employees)
	Shareholding ratio of the top ten shareholders	*top*10	The proportion of shares held by the top ten shareholders of enterprise
	State-owned enterprise	*soe*	Dummy variable. State-owned enterprise is defined as 1, otherwise 0.
	High-tech enterprise	*high−tech*	Dummy variable. High-tech enterprise is defined as 1, otherwise 0.
	Eastern region	*east*	Dummy variable. If the enterprise is located in eastern region, it will be 1, otherwise 0. The eastern region includes Beijing, Shanghai, Hebei, etc.
	Western region	*west*	Dummy variable. If the enterprise is located in western region, it will be 1, otherwise 0. The western region includes Sichuan, Yunnan, Guizhou, etc.
	Central region	*mid*	Dummy variable. If the enterprise is located in central region, it will be 1, otherwise 0. The central region includes Jilin, Anhui, Shanxi, etc.

Source: The authors.

important factors that affect whether SMEs can get the support of R&D subsidy tool. The results of column (2) confirm that the cash flow, the return on assets, the capital density the shareholding ratio of the top ten shareholders, the industry type and the location of SMEs are the important factors for SMEs supported by tax incentive tool. According to the above results, the vectors in the control functions of formula (1) should be defined as $\mathbf{X_1} = (roa, cap, high - tech, east, west)$ and $\mathbf{X_2} = (roa, cash, cap, top10, high - tech, west)$.

5.1.2. Analysis of mixed effects of MEI policy tools

Table 4 summarises the test results of mixed effects of two different policy tools on SME innovation based on CFM framework. Column (1) and column (2) respectively show the estimated results with SME innovation and substantive innovation as the explained variables. The estimated coefficients of R&D subsidy and tax preference are both significantly positive at 1% statistical level. This indicates that the two policy tools of MEI generate the

Table 2. Statistical characteristics of main variables.

Variables	Sample size	Mean	Standard deviation	Min	Max
Number of 'Patent applications'	7644	41.299	109.736	0	3096
Number of 'Patent for Invention'	7644	17.128	53.337	0	1995
Number of 'Patent for Utility Model'	7644	19.323	57.363	0	1863
Number of 'Patent for Industrial Design'	7644	4.849	20.919	0	571
R&D subsidy	7644	0.993	0.085	0	1
Tax credit	7644	0.660	0.474	0	1
Return on assets	7644	0.047	0.059	−0.959	0.964
Growth rate of operating income	7644	9.021	681.990	−2.780	59411.550
Operating income （Unit: 10 million）	7644	227	605	2.29	18800
Capital density	7644	12.939	1.188	0.000	17.700
Cash flow	7644	0.241	0.175	0.002	0.928
Liquidity ratio	7644	0.623	0.172	0.017	0.991
Shareholding ratio of the top ten shareholders	7644	62.254	13.602	13.980	100
State-owned enterprise	7644	0.106	0.307	0	1
High-tech enterprise	7644	0.310	0.463	0	1
Eastern region	7644	0.790	0407	0	1
Western region	7644	0.080	0.270	0	1
Central region	7644	0.130	0.336	0	1

Source: The authors.

Table 3. Relationship between SME characteristic factors and MEI policy tools.

	(1) R&D subsidy tool	(2) Tax incentive tool
roa	−3.412***	−2.679**
	(0.898)	(1.256)
cash	−0.193	−0.647*
	(0.254)	(0.369)
grow	0.463	−0.784
	(0.292)	(0.477)
rev	0.001	0.000
	(0.002)	(0.004)
liqui	0.013	0.011
	(0.030)	(0.037)
cap	0.257***	0.638***
	(0.047)	(0.067)
*top*10	0.001	−0.026***
	(0.003)	(0.004)
soe	0.083	−0.259
	(0.116)	(0.189)
high−tech	0.318***	0.226*
	(0.085)	(0.119)
east	−0.399***	0.034
	(0.101)	(0.167)
west	0.423***	−0.465*
	(0.136)	(0.280)

Note: ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

remarkable incentive effects on SME innovation, especially high-quality (substantive) innovation. Column (3) shows the estimated results with strategic innovation as the explained variable. Although the estimated coefficient of R&D subsidy tool is positive, it is not statistically significant, while the tax incentive tool is significantly positive at 1% statistical level. This means that compared with R&D subsidy tool, the incentive effect of tax incentive is more obvious in stimulating SMEs' strategic innovation.

Table 4. Mixed effect of two policy tools on SME innovation.

	(1) Innovation	(2) Substantive innovation	(3) Strategic innovation
sub	1.760***	2.861***	0.552
	(0.401)	(0.491)	(0.416)
tax	1.954***	2.793***	1.041***
	(0.328)	(0.401)	(0.340)
Control variables	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observation	7197	7197	7197

Note: *** means significant at the level of 1%; robust standard error is shown in brackets ().
Source: The authors.

Table 5. Cross effects of two policy tools on SME innovation.

	(1) Innovation	(2) Substantive innovation	(3) Strategic innovation
sub	1.801***	2.986***	0.531
	(0.395)	(0.503)	(0.409)
tax	1.617***	2.949***	1.219***
	(0.397)	(0.505)	(0.412)
$sub \times tax$	0.078	0.037***	−0.191***
	(0.055)	(0.007)	(0.057)
Control variables	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observation	7197	7197	7197

Note: ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

5.1.3. Analysis of cross effects of MEI policy tools

Following the practice of Zhang (2021), we introduce the interaction term of two policy tools into the CFM framework, in order to test the complementary or mutually exclusive effects of the MEI policy tools in stimulating SME innovation. Column (1) in Table 5 shows that the estimated coefficient of the cross term of R&D subsidies and tax incentives $sub \times tax$ is not statistically significant, which indicates that there is no obvious complementary or mutually exclusive effect between R&D subsidies and tax incentives in stimulating SME innovation. In terms of stimulating substantive innovation of SMEs (column 2), the R&D subsidy tool and the tax incentive tool can form the obvious complementary effect. The estimated results in column (3) confirm that R&D subsidy tools cannot stimulate the strategic innovation of SMEs. Moreover, there is an obvious mutually exclusive effect between R&D subsidies and tax incentives, and the combination of these policy tools may inhibit the strategic innovation of SMEs. On the whole, there is the cross effect of the MEI policy tools on SME innovation activities, the hypothesis is verified.

5.2. Comparison of implementation strategies of MEI policy

Further, based on the multi-level treatment effect model, we compare the different implementation strategies of MEI policy (including single R&D subsidy strategy $w = 0$, single tax incentive strategy $w = 1$, policy tool combination strategy $w = 2$) on SME innovation, and explores the best strategy to stimulate SME innovation.

Table 6. ATEs of different implementation strategies.

	Comparison	(1) Innovation	(2) Substantive innovation	(3) Strategic innovation
ATE	1 Vs.0	0.518***	0.439***	0.018
		(0.079)	(0.078)	(0.011)
	2 Vs. 0	0.546***	0.496***	0.002
		(0.048)	(0.049)	(0.007)
	2 Vs. 1	0.028	0.057	−0.016
		(0.072)	(0.071)	(0.009)

Note: 'Vs.' is the abbreviation of Versus; '0' in the column 'Comparison' stands for the single R&D subsidy strategy, '1' stands for the single tax incentive strategy, and '2' stands for the policy tool combination strategy; ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

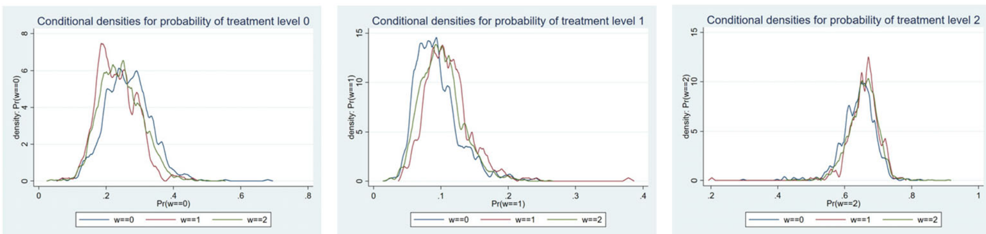

Figure 1. Densities for different strategies of MEI policy.
Source: The authors.

5.2.1. Average treatment effect of different implementation strategies

Table 6 shows the estimated results of average treatment effect of different implementation strategies on technological innovation, substantive innovation and strategic innovation of SMEs. As far as single policy tools are concerned, tax incentives are always better than R&D subsidies. By comparing the policy tool combination strategy with single tool strategy, it is found that the combination of R&D subsidies and tax incentives is better than single R&D subsidy strategy. However, compared with tax incentives, the policy tool combination strategy failed to show absolute advantages. The estimated results in column (3) show that there is no significant difference between the single policy tool strategy and the policy tool combination strategy in stimulating strategic innovation of SMEs.

5.2.2. Robustness

5.2.2.1. Overlap assumption check. Overlap assumption is a necessary condition for multi-level treatment effect model analysis. We need to check that all the predicted probabilities are sufficiently greater than 0 and less than 1. If some predicted probabilities are too close to either 0 or 1, the parameters may not be identifiable. According to Figure 1, neither graph shows any mass too close to 0 or 1, the estimated results in Table 6 are accurate and reliable.

5.2.2.2. Data shrinkage check. We remove the 1% sample of SMEs with the highest and lowest innovation output, substantive innovation and strategic innovation in turn, and then use the General Propensity Score (GPS) to reconstruct the multi-level treatment effect model. Compared with the results in Table 6, the estimated results

Table 7. Data shrinkage check.

	Comparison	(1) Innovation	(2) Substantive innovation	(3) Strategic innovation
ATE	1 Vs. 0	0.503***	0.427***	0.017
		(0.077)	(0.077)	(0.010)
	2 Vs. 0	0.538***	0.491***	0.002
		(0.047)	(0.048)	(0.006)
	2 Vs. 1	0.034	0.064	−0.015
		(0.070)	(0.068)	(0.010)

Note: 'Vs.' is the abbreviation of Versus; '0' in the column 'Comparison' stands for the single R&D subsidy strategy, '1' stands for the single tax incentive strategy, and '2' stands for the policy tool combination strategy; ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

Table 8. Estimated results based on the difference of SME ownership.

	State-owned SME group			Non-state-owned SME group		
Comparison	Innovation	Substantive innovation	Strategic innovation	Innovation	Substantive innovation	Strategic innovation
1 Vs. 0	1.237***	1.323***	0.019	0.410***	0.309***	0.022*
	(0.226)	(0.223)	(0.034)	(0.083)	(0.083)	(0.010)
2 Vs. 0	1.245***	1.474***	0.006	0.455***	0.383***	0.002
	(0.130)	(0.145)	(0.020)	(0.051)	(0.052)	(0.007)
2 Vs. 1	0.008	0.150	0.013	0.044*	0.074*	−0.019*
	(0.217)	(0.217)	(0.032)	(0.021)	(0.037)	(0.009)

Note: 'Vs.' is the abbreviation of Versus; '0' in the column 'Comparison' stands for the single R&D subsidy strategy, '1' stands for the single tax incentive strategy, and '2' stands for the policy tool combination strategy; *** and * respectively mean significant at the level of 1% and 10%; robust standard error is shown in brackets ().
Source: The authors.

after data shrinkage (Table 7) show that, there is no significant change in the estimated value or significance level. This further proves that the estimated results have good robustness.

5.3. Heterogeneity of MEI implementation strategies

5.3.1. Ownership

In China, state-owned SMEs and non-state-owned SMEs are different not only in management mode and decision-making mechanism, but also in social status and economic position. To investigate the heterogeneity of innovation effects of different implementation strategies among SMEs with different ownerships, we divide the research sample into two sub-samples of state-owned SME group and non-state-owned SME group according to the dummy variable *soe*. The estimated results of the two sub-samples are shown in Table 8.

Judging from the estimated results of state-owned SME group, both the single tax incentive strategy and the policy tool combination strategy have significant advantages in stimulating innovation output and substantive innovation of SMEs, compared with single R&D subsidy strategy. However, there is no obvious difference among the three strategies in stimulating strategic innovation of SMEs. Judging from the results of non-state-owned SME group, the policy tool combination strategy has absolute advantages in encouraging SME innovation, especially in improving the level of high-

Table 9. Estimated results based on the difference in industry.

	High-tech SME group			Non-high-tech SME group		
Comparison	Innovation	Substantive innovation	Strategic innovation	Innovation	Substantive innovation	Strategic innovation
1 Vs. 0	0.558***	0.507***	0.052***	0.458***	0.357***	0.014
	(0.152)	(0.149)	(0.018)	(0.089)	(0.092)	(0.013)
2 Vs. 0	0.626***	0.658***	0.037***	0.511***	0.414***	−0.003
	(0.095)	(0.095)	(0.012)	(0.055)	(0.058)	(0.008)
2 Vs. 1	0.067	0.151	−0.016	0.054	0.056	−0.016
	(0.135)	(0.132)	(0.015)	(0.081)	(0.084)	(0.012)

Note: 'Vs.' is the abbreviation of Versus; '0' in the column 'Comparison' stands for the single R&D subsidy strategy, '1' stands for the single tax incentive strategy, and '2' stands for the policy tool combination strategy; ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

quality innovation, and it is the best MEI implementation strategy. Nevertheless, in terms of stimulating strategic innovation of SMEs, the single tax incentive strategy is the most effective implementation strategy.

5.3.2. Industry

There is a close relationship between the industry and the innovation activities of SMEs. High-tech industries are knowledge-intensive and technology-intensive, SMEs must rely on innovation to occupy a place in these highly competitive markets. However, SMEs in non-high-tech industries such as agriculture, forestry, animal husbandry, fishery, wholesale and retail can continue to operate without engaging in innovative activities. To investigate the heterogeneity of innovation effects of different implementation strategies on SMEs in different industries, we divide the research sample into two sub-samples of high-tech SME group and non-high-tech SME group according to the dummy variable $high-tech$. The estimated results are shown in Table 9.

It is found that no matter what kind of industry, the single tax incentive strategy and the policy tool combination strategy are always better than the single R&D subsidy strategy in promoting the innovation quantity and quality of SMEs. It is worthwhile to note that for non-high-tech SMEs, there is no obvious difference among the three strategies in stimulating strategic innovation of SMEs. The reason may be that most non-high-tech SMEs actively choose low-quality 'strategic innovation' for seeking the support of MEI policy. This makes the strategic innovation of SMEs less susceptible to the implementation strategy of MEI policy (Zhao et al., 2020), which leads to no obvious difference in the effect of different implementation strategies in stimulating strategic innovation of SMEs.

5.3.3. Location

According to the cities or provinces where the SMEs are located (dummy variables *east*, *west*, *mid*), we divide the research sample into three sub-samples (the eastern region SME group, the central region SME group and the western region SME group) to investigate the heterogeneity of innovation effects of different implementation strategies on SMEs in different regions. The estimated results are shown in Table 10.

Table 10. Estimated results based on the difference in location.

Comparison	Eastern region SME group			Central region SME group			Western region SME group		
	Innovation	Substantive innovation	Strategic innovation	Innovation	Substantive innovation	Strategic innovation	Innovation	Substantive innovation	Strategic innovation
1 Vs. 0	0.507***	0.447***	0.011	0.517***	0.446**	0.043*	0.977***	0.747**	0.062***
	(0.090)	(0.091)	(0.013)	(0.174)	(0.194)	(0.020)	(0.301)	(0.313)	(0.029)
2 Vs. 0	0.561***	0.488***	0.002	0.543***	0.637***	−0.012	0.452***	0.638***	0.038**
	(0.057)	(0.058)	(0.008)	(0.120)	(0.119)	(0.017)	(0.140)	(0.158)	(0.015)
2 Vs. 1	0.053	0.042	−0.009	0.026	0.190	−0.055**	0.524*	−0.108	−0.024
	(0.080)	(0.081)	(0.011)	(0.161)	(0.183)	(0.023)	(0.207)	(0.326)	(0.029)

Note: 'Vs.' is the abbreviation of Versus; '0' in the column 'Comparison' stands for the single R&D subsidy strategy, '1' stands for the single tax incentive strategy, and '2' stands for the policy tool combination strategy; ***, ** and * respectively mean significant at the level of 1%, 5% and 10%; robust standard error is shown in brackets ().
Source: The authors.

As far as SMEs in the eastern region are concerned, the single tax incentive strategy and the policy tool combination strategy are better than single R&D subsidy strategy in stimulating innovation, especially substantive innovation. Concerning SMEs in the central region, the single tax incentive is the best implementation strategy in stimulating both substantive innovation and strategic innovation. As far as SMEs in the western region are concerned, the policy tool combination is the best strategy for the implementation of MEI policy.

6. Conclusion

By designing a reasonable and applicable policy identification framework, this paper empirically examines the actual effects of R&D subsidies, tax incentives and their combination on the substantive and strategic innovation of Chinese SMEs, and explores the optimal implementation strategy of MEI policy that can effectively stimulate the innovation quantity and quality of different SMEs. This study not only helps to scientifically evaluate the effect of MEI policy, but also provides empirical evidence and practical guidance for improving the design of policy system.

The main findings of this paper are as follows. (1) From the viewpoint of mixed effect, R&D subsidy tools have a significant incentive effect on SME innovation, especially substantive innovation, while tax incentive tools have a significant positive effect on the quantity and quality of SME innovation. (2) From the perspective of cross effect, R&D subsidies and tax incentives can form the obvious complementary effects in promoting substantive innovation of SMEs, but the mutually exclusive effects in promoting strategic innovation of SMEs. (3) Both the single tax incentive strategy and the policy tool combination strategy are better than the single R&D subsidy strategy in stimulating substantive innovation of SMEs. (4) As far as non-state-owned SMEs are concerned, the policy tool combination is the best MEI policy implementation strategy in stimulating innovation, especially high-quality innovation, and the single tax incentive strategy is conductive to stimulating strategic innovation of SMEs. (5) For SMEs in the central region, the single tax incentive is the best strategy to stimulate innovation; for SMEs in the western region, the policy tool combination strategy is the best implementation scheme of MEI policy.

Based on the conclusions of this study, the following policy recommendations are put forward. First, strengthen the dominant position of tax incentives in the MEI policy toolbox. Relevant departments should ensure that the tax burden of all industries is 'only reduce but not increase', continuously promote the implementation of tax incentive tools and rationally expand the scope of tax incentive implementation. Second, improve the implementation effect of MEI policy on state-owned SMEs. In stimulating the innovation of state-owned SMEs, there are relatively few effective strategies available in the policy toolbox. Relevant departments should speed up the reform of state-owned SMEs, awaken the sensitivity of state-owned SMEs to the MEI policy, and promote state-owned SMEs to become the main force of high-quality innovation and key core technological innovation. Third, ameliorate the government support scheme. Relevant departments should actively introduce and learn from other countries' emerging policy tools, create new tools suitable for domestic innovation and development, expand the toolbox of MEI policy, and provide more alternative strategies for optimising the performance of MEI policy. Fourth, realize the optimal matching between policy implementation strategy and policy target selection. Relevant departments should design targeted policy implementation strategies and strive to achieve 'tailored measures' based on the heterogeneity of SMEs, to avoid adverse selection and other problems.

There are still some imperfections in this study, which can be expanded in the following aspects. First, this study cannot identify whether the role of R&D subsidy and tax incentive tools of MEI policy in promoting innovation depends on the external environment, for example population concentration. Future research can construct an appropriate theoretical model and conduct proper empirical tests based on a novel setting to evaluate the role of MEI policy tools in promoting SME innovation more accurately. Second, management innovation and marketing innovation of SMEs are also the results of innovation; however, this study focuses only on technological innovation. Future research can integrate the management innovation and the marketing innovation of SMEs into the research framework, in order that the findings are more general.

Acknowledgments

We are grateful to two anonymous reviewers and editor for thoughtful comments and suggestions.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This research was funded by National Social Science Foundation of China, grant number 20FJYB017.

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