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Industrial Promotion and Corporate Innovation: A Study Based on China's Five-Year Plans

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ABSTRACT

Industrial policy is the government's guidance and intervention in industrial development to achieve economic and social goals, and it seeks to steer the direction of industrial development, facilitate industrial structure upgrades, and improve social welfare. Based on panel data on 31 provinces in China from 2011 to 2022, this study examines the effects of industrial promotion from China's Five-Year Plans on corporate innovation performance using a difference-in-differences (DID) model. The study findings indicate that industrial promotion from China's Five-Year Plans promotes corporate innovation performance, and the basic conclusion remains robust when changing how firms' innovation is measured, removing provincial policy interference, excluding the four municipalities in China, and utilizing the PSM-DID model. Moreover, this paper explores how industrial promotion influences firms' innovation performance. The mechanism analysis reveals that industrial promotion from China's Five-Year Plans encourages firms' innovation through tax incentives, government subsidies, and credit support. In addition, heterogeneity tests find that industrial promotion has a more significant effect on corporate innovation among small-scale firms and firms operating in highly competitive industries and regions characterized by high marketization. The empirical findings presented provide evidence for enhancing corporate innovation performance through industry promotion in China's Five-Year Plans and offer insights that can refine the formulation of Five-Year Plans.

KEYWORDS

Industrial Policy; Industrial Promotion; Five-Year Plan; Corporate Innovation Performance; Difference-in-Differences Model

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1. Introduction

Industrial policy is generally viewed as government intervention for better economic development and social welfare. It involves optimizing production structures and allocating resources to sectors with growth potential. Although industrial policy is widely used in developed and underdeveloped countries to boost economic activities and technological advancement, there has yet to be a consensus on its effectiveness. Scholars hold diverse perspectives on industrial policy. Some scholars have expressed skepticism, contending that incomplete information hinders governments from accurately “picking winners” (Pack and Saggi, 2006). Another concern is that the execution of industrial policy provides additional opportunities for firms to engage in rent-seeking and arbitrage activities (Powell, 2005), which can lead to distortions in market competition and diminish economic efficiency, frequently resulting in policy implementation results inconsistent with policy expectations.

Nonetheless, no developing country has successfully bridged the gap with developed nations, and no developed country consistently maintains its leading position without employing industrial policy (Lin, 2017). Numerous scholars advocate for industrial policy, asserting that it has a favorable influence on industry development and industrial structural advancement (Criscuolo et al., 2012). One argument supporting industrial policy is its ability to rectify market failures, address suboptimal resource allocation, and mitigate market imperfections (Lin and Rosenblatt, 2012). Industries in less developed nations tend to be at the low end of the international value chain when lacking policy support and exclusively relying on the free market. This potentially erodes their competitive edge and leads to a “poverty trap” (Liu et al., 2020). Government support for relevant industries through industrial policy is imperative. Industrial policy can coordinate the improvement of “soft and hard infrastructure”, overcome market deficiencies, and then convert the industry’s potential comparative advantage into apparent comparative advantage (Lin, 2017). Lin and Chang (2009) point out that government intervention via industrial policy can address market failures arising from information asymmetry and externalities, such as the distortion of credit, labor, and knowledge markets, which improves the business environment of enterprises and removes the impediments on economic development imposed by information asymmetry and external risks. Moreover, the theory of dynamic comparative advantage proposes that industrial policy fosters effective competition of emerging industries and facilitates industrial structure advancement, enabling less developed economies to catch up with more powerful ones. Another argument supporting industrial policy is the protection of infant industries (Blonigen, 2016), a strategy nearly all currently developed nations have employed to advance their industrial development (Chang, 2002). Some developed nations even persisted in using interventionist approaches to shield fledgling industries after the Second World War (Aghion et al., 2015).

Industrial policy has been effective in various countries, contributing to the growth of renewable electricity supply in India (Amrutha et al., 2017), achieving the successful reform of the electricity sector and the successful establishment of a large-scale wind power system in Ireland (Gaffney et al., 2017), and facilitating the green energy transition in Germany (Pegels and Lütkenhorst, 2014). The effectiveness of industrial policy varies over time, across regions, and depends on specific conditions, so it is not meaningful to discuss the rationale, necessity, and effectiveness of industrial policy without considering the nation’s nature, level of economic development, and policy focus (Jiang and Li, 2010). As Chen et al. (2017) said, while the market economy is highly efficient in resource allocation, late-developing countries with immature market systems face higher transaction costs that hinder the development of key industries contributing to economic growth. Governments can mitigate these transaction costs and promote the development of potential industries through industrial policies. Hence, the role of industrial policy possesses economic rationale.

China, a nation with a fertile ground for implementing numerous industrial policies, uses a national program whose full name is “Guideline of the Five-Year Plan for National Economic and Social Development of the People’s Republic of China” (abbreviation: Five-Year Plan or FYP) to identify supporting industries. The national program significantly influences the national economic landscape, aims to set goals and development strategies for various industries over the next five years, and outlines the nation's development direction in multiple aspects, including the economy, society, environment, and innovation (Wu et al., 2019; Chen et al., 2017). China implemented its first Five-Year Plan in 1953 and has developed 14 Five-Year Plans to date, with 2011-2015 being the implementation period for the 12th Five-Year Plan and 2016-2020 being the implementation period for the 13th Five-Year Plan. China's National Development and Reform Commission (NDRC) leads the formulation of these Five-Year Plans, with subsequent approval and execution by the State Council. Developing these Five-Year Plans involves extensive policy deliberation and negotiation, with broad participation from the government, experts, scholars, and industry stakeholders. The Five-Year Plans formulated this way are at the national level and are called the National Five-Year Plan (abbreviated as NFYP). Besides the National Five-Year Plan, each Chinese province has its Five-Year Plan called Provincial Five-Year Plan (abbreviated as PFYP). Local governments of these provinces use the National Five-Year Plan as a reference to create their own Five-Year Plan tailored to their regions' unique economic and social requirements. In summary, the National and Provincial Five-Year Plans (NFYP and PFYP) are integral components of China's economic planning, collaborating to drive economic and social progress at both national and local levels.

An industry becomes eligible for substantial support from the government over the subsequent five years after it is designated as a supporting industry in a Five-Year Plan. This support encompasses a range of benefits, including but not limited to expedited customs clearance for imported equipment and components, precedence in procuring raw materials and electricity, financial assistance from special provincial funds, pre-tax deductions for research expenses, tax exemptions and double amortization of intangible asset costs. The effect of the Five-Year Plan in China is profound and multifaceted. It is a primary instrument for the Chinese government to execute national development strategies. These plans help shape national policies and steer economic growth. They also attract significant domestic and foreign investments, propelling China's rapid economic advancement.

Industrial policy is crucial for corporate innovation (Aghion et al., 2015). Peters et al. (2012) took the solar photovoltaic industry as an object of study and indicated that industrial promotion augments the industry's innovation output. Based on an industrial promotion plan for the new energy vehicle industry named "Ten Cities and One Thousand Vehicles Project" in China, Zhao et al. (2019) revealed that industrial promotion stimulates more invention patent applications among manufacturers of new energy vehicles. In the literature on industrial promotion from China's Five-Year Plans affecting firm innovation, Tang et al. (2020), Li et al. (2022) and Kesidou and Wu (2020) all focused on how stricter reduction targets of sulfur dioxide emission, as outlined in the 11th Five-Year Plan, affect firm innovation. Tang et al. (2020) found that the emission reduction targets outlined in the 11th Five-Year Plan negatively affect firms' efficiency in green innovation, particularly impacting state-owned and small enterprises in China. However, Li et al. (2022) demonstrated that emission targets in the 11th Five-Year Plan have increased patenting activity, thereby supporting China's "Porter's hypothesis". Additionally, Kesidou and Wu (2020) found that stricter pollution emission targets from China's 11th Five-Year Plan correlated with a rise in the number of green patents and the intensity of green innovations among Chinese manufacturing firms. Furthermore, Chai et al. (2022) contextualized their research within the framework of China's 13th Five-Year Plan and examined 100 listed enterprises in emission control zones of acid rain and sulfur dioxide (TCZs) and non-TCZs from 2014 to 2019. Their findings indicate that the energy conservation and emission reduction plan outlined in the 13th Five-Year Plan negatively impacts innovation within heavy-polluting enterprises.

Most research addressing industrial policy and innovation concentrates solely on the stricter emission regulations and environmental policies stemming from the Five-Year Plans. However, these studies often have a narrow scope, primarily examining environmentally friendly industrial policies and targeting specific industries, such as heavily polluting or manufacturing sectors. This limited approach fails to provide a comprehensive and in-depth understanding of the broad-ranging impacts of industrial promotion in China's Five-Year Plans. Therefore, this paper employs the documents of China's Five-Year Plans to comprehensively collate the positive and negative attitudes of industrial policies towards all industries and constructs a DID model through the changes of the supporting industries from the 12th to the 13th Five-Year Plan to investigate the influence of industrial promotion from China's Five-Year Plans on enterprise innovation performance and its underlying mechanisms.

Compared to the existing literature, this paper has three marginal contributions. Firstly, researching China's Five-Year Plans, we utilize the DID model to precisely identify the industrial promotion shock under a quasi-experimental framework, which efficiently addresses the endogeneity problem of industrial policy typically encountered in prior research on industrial policy and offers empirical evidence regarding the efficacy of industrial policy implementation. Secondly, this paper enhances and broadens the investigation into the influence of Five-Year Plans' industrial promotion on firms' innovation. Existing studies often concentrate solely on stricter emission regulation and environmental regulations brought by Five-Year Plans (Tang et al., 2020; Li et al., 2022; Kesidou and Wu, 2020) or are limited to green innovation of heavily polluting industries and manufacturing industries (Kesidou and Wu, 2020; Chai et al., 2022). In contrast, this paper broadens the scope of examination to encompass all industries supported by the Five-Year Plans, which offers a valuable supplement to existing research on industry promotion in Five-Year Plans. Thirdly, this paper delves into how industrial promotion from the Five-Year Plans fosters enterprise innovation by elucidating in depth the three mechanisms of tax incentives, government subsidies, and credit support. It enriches the analytical framework of existing literature and provides concrete paths for enterprises to improve their innovation level through industrial promotion.

2. Theory and hypotheses

Emerging economies often have underdeveloped market systems, leading to market failures (Han et al., 2017; Wu et al., 2019). Industrial policy plays a crucial role in addressing these failures (Lin and Rosenblatt, 2012), primarily through two mechanisms. The first involves information externalities. Innovation activities, successful or not, generate external information about new market opportunities and their potential profitability. However, this information is not exclusive to the innovators; other market participants, such as competitors, can access it without bearing any innovation costs (Lin and Chang, 2009). Consequently, the spillover effects of technological innovation can result in externalities that harm the innovators' own interests (Li and Zheng, 2016). Appropriate industrial promotion policies can compensate for these market deficiencies. Innovation subsidies and various innovation support provided by industrial promotion policy are crucial mechanisms for resolving innovation externalities, correcting market failures, and ultimately fostering innovation (Li and Zheng, 2016; Harrison and Rodríguez-Clare, 2010). The second concerns coordination issues. As innovation progresses, dynamic changes occur in capital requirements, production scale, market scope, and exchange values (Lin and Chang, 2009). These changes require simultaneous improvements in infrastructure, legal regulations, financial systems, and human capital, which exceed the capacity of individual enterprises (Lin, 2017). At this point, it becomes essential for the government to employ industrial promotion policies to coordinate enterprises' external environment (Pack and Saggi, 2006). Thus, by resolving coordination issues, industrial promotion policy rectifies market failures and creates a more supportive external environment for corporate innovation.

Additionally, initial production costs are high for infant industries with potential knowledge externalities and comparative advantages, rendering them less competitive compared to mature foreign industries (Aghion et al., 2015; Harrison and Rodríguez-Clare, 2010). In such cases, targeted and transitional industrial promotion policies, including domestic production subsidies, tariffs, and quotas, can help these infant industries overcome entry barriers (Blonigen, 2016). Through these measures, industrial promotion policy offers a range of direct support, effectively enhancing the learning-by-doing effects in the development of infant industries (Blonigen, 2016; Dai and Cheng, 2019). Cost reductions from learning-by-doing enable firms to boost investments in research and development, thereby incentivizing innovation (Aghion et al., 2015; Dai and Cheng, 2019).

Furthermore, to foster the healthy development of encouraged industries, the government may use industrial promotion policies to relax the approval processes for their investment projects and lower their market entry barriers (Yu et al., 2016). This decreases industry concentration, thereby enhancing market competition (Aghion et al., 2015). In response to this intense market competition, companies are motivated to pursue technological innovations and product upgrades to secure a more substantial competitive advantage and expand their market share (Li and Zheng, 2016). Weng et al. (2015) also indicated that competitive pressure can promote enterprises' innovation practices. Therefore, we propose the following hypothesis:

Hypothesis 1. Industrial promotion from China's Five-Year Plans can enhance corporate innovation performance.

2.1. Tax incentive mechanism

Industrial promotion generally offers tax incentives to encourage industries. Based on data disclosed by the National Bureau of Statistics of China, China's various types of tax and fee reductions amounted to one trillion yuan in 2016. China's Five-Year Plan for industrial promotion incorporates an R&D expense credit policy, which enables companies to deduct expenditures related to their R&D activities from their taxable income and incentivizes firms to invest more in R&D as they can reduce their tax payments. Tax incentives can diminish the incremental costs of innovative activities (Cai and Harrison, 2021) and minimize cash outflows associated with these activities and directly reduce the operating cost, thereby improving the endogenous financing of innovation activities (Duchin et al., 2010). For example, using panel data of manufacturing firms from the State Administration of Taxation of China from 2008 to 2011, Chen et al. (2021) indicated that income tax deductions for corporate R&D investments can increase corporate R&D expenditures. Thus, we propose the following hypothesis:

Hypothesis 2a. Tax incentives from industrial promotion have the potential to enhance corporate innovation performance.

2.2. Government subsidy mechanism

To effectively realize the industrial promotion objectives outlined in the Five-Year Plans, the government usually provides subsidies to industries it endorses. For example, in 2013, China's Ministry of Finance's pre-allocated renewable energy tariff surcharge subsidies for the new energy industry reached RMB 14.811 billion. Moreover, during the ten years from 2006 to 2016, China channeled a significant sum of $8 billion in subsidies towards new energy vehicles. China's Five-Year Plans allocate funding to bolster innovation initiatives within strategic emerging industries and high-technology sectors. The government would directly provide financial support or direct subsidies for R&D expenses to enterprises in supporting industries to mitigate funding shortfalls of these enterprises and encourage them to participate actively in innovative activities. For instance, Howell (2017) conducted a study evaluating the influence of subsidies provided by the Chinese government on firms' innovation levels, affirming that such grants foster innovation within high-technology sectors. Analyzing panel data of manufacturing industries in China from 1998 to 2007, Guo et al. (2016) studied the effects of government subsidies and innovation funds on Chinese small and medium-sized enterprises (SMEs); they observed that firms receiving this support tend to achieve more technological innovations. In a separate study, Decramer and Vanormelingen (2016) discovered that investment subsidies to SMEs yield notably positive outcomes for firms' output and productivity. Thus, we propose the following hypothesis:

Hypothesis 2b. Government subsidies from industrial promotion have the potential to enhance corporate innovation performance.

2.3. Credit support mechanism

Bank loans remain China's primary financing source for nonfinancial companies (Allen et al., 2005). The accessibility and cost associated with securing these loans are critical to the survival and development of firms. Studies have shown that China's equity and loan markets are subject to government control to varying degrees (Chen et al., 2017). To attain the objectives outlined in the Five-Year Plan, the government would ease bank credit approvals for industries receiving support and allocate substantial resources to these industries (Jiang and Li, 2010; Aghion et al., 2015; Wu et al., 2019). Based on four China's Five-Year Plans from 1991-2010, Chen et al. (2017) found that companies in supporting industries have experienced an increase in the proportion of long-term loans and the total amount of loans, and these companies have access to additional credit resources at a reduced cost. Research indicates that industries backed by China's industrial promotion could receive notably higher levels of long-term loans, equity refinancing opportunities, and IPO financing compared to other sectors. Support from industrial promotion can provide firms with substantial credit resources and lower their financing expenses (Baum et al., 2004). Furthermore, access to cost-effective financing makes it easier for firms to secure funds for R&D, new product development, and technological innovation, mitigating the financial risk associated with innovative projects. Therefore, we propose the following hypothesis:

Hypothesis 2c. Credit support from industrial promotion has the potential to enhance corporate innovation performance (Figure 1).

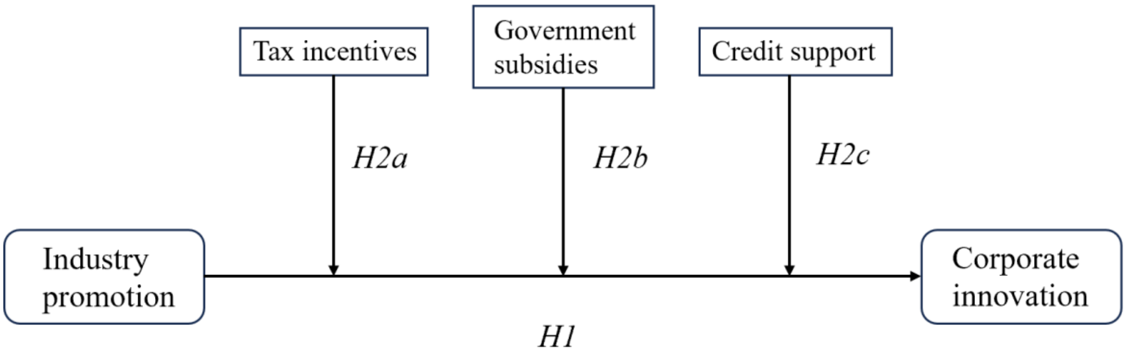

Figure 1. Conceptual model.

3. Data and methodology

3.1. Data

We take the "12th Five-Year Plan" and "13th Five-Year Plan" as our study period covering 2011-2020 and extract information on industrial promotion from the 12th and 13th National Five-Year Plans as well as 12th and 13th Provincial Five-Year Plan (from the 12th to the 13th). The patent data of listed firms are from the State Intellectual Property Office of China (SIPO). Province-level and industry-level data and corporate-level financial index are from the CSMAR (China Stock Market Trading Database) data center. Further, we exclude the following five types of samples: (1) firms with delisting risks; (2) firms in the financial sector; (3) firms whose capital is not offset by debts; (4) firms in Chaohu City, Anhui Province due to the abolition of Chaohu City in 2011; and (5) samples with missing data.

3.2. Model

We estimate the regression below for empirical analysis to determine if industrial promotion in Five-Year Plans improves corporate innovation performance.

$$Lnpat_{it} = \beta_0 + \beta_1 IPDID_{ipt} + \beta_2 Controls + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

where the subscript *t* denotes a year, *i* characterizes a firm, and *p* represents a province. *Lnpat* is the dependent variable, measured by the natural logarithm of the count of invention patents applied by firm *i* plus one in year *t*. *IPDID* is a difference-in-differences variable for industrial promotion and represents the independent variable. The *Controls* encompass enterprise, industry, and provincial control variables. δ_t and μ_i are year fixed effect and firm fixed effect respectively. ε_{it} signifies the random error term. The coefficient of *IPDID* in Model (1) elucidates the causal relationship between industrial promotion from China's Five-Year Plans and enterprise innovation performance. if it is positive, we have evidence that industrial promotion, as reflected in Five-Year Plans, could improve enterprise innovation performance.

3.3. Variables

3.3.1. Dependent variable: Corporate innovation performance (*Lnpat*)

Existing literature widely suggests that measuring a firm's innovative capacity is more accurate through innovation output rather than input. Cornaggia *et al.* (2015) employed the count of patents that firms apply to stand for firms' innovation. Furthermore, according to China's Patent Law, patents are categorized into three types: design, utility model, and invention. In contrast to the other two patent types, invention patents are more difficult to obtain, have higher requirements and provide a more precise reflection of a company's innovation output. Consequently, we utilize the natural logarithm of the count of invention patents plus one as a proxy of enterprise innovation.

3.3.2. Independent variable: Industrial promotion from China's Five-Year Plans (*IPDID*)

The Chinese central government releases a "Five-Year Plan" document during each Five-Year Plan period. For instance, prior to 2011, the inception year of the 12th Five-Year Plan, the Chinese central government issued the "12th Five-Year Plan" document detailing its strategic positioning and support for various industries. The "Five-Year Plan" document issued by the central government is referred to as "National Five-Year Plan" (NFYP for short). Concurrently, the economic development across various regions in China displays an imbalance, so the supporting industries in the National Five-Year Plan issued by the central government may not be in line with the actual circumstances of the regions. Following the publication of the "National Five-Year Plan" by the central government, regional governments [1] will create their own "Five-Year Plan" documents, aiming to recalibrate supporting industries based on their specific circumstances like industrial composition and resource allocation, the "Five-Year Plan" documents specific to each region are referred to as "Provincial Five-Year Plan" (PFYP for short). Therefore, whether a specific industry is a supporting industry may differ between the NFYP and the PFYP.

Specifically, referring to Wu et al. (2019), if a particular industry is described with terms such as "to vigorously develop", "to actively develop", "to accelerate", "to expand", "to prioritize", "to deeply implement", "to enlarge and strengthen", "key supporting industry", "pillar industry", "focusing on cultivation" in the "National Five-Year Plan" document, We then categorize the industry as a supporting industry in NFYP. Similarly, we employ the same criteria to identify supporting industries in the "Provincial Five-Year Plan" (PFYP). This way, we obtain a list of supported or encouraged industries in NFYP and PFYP. Subsequently, we define a new variable, "*IMP*", which is assigned a value of one if an industry is identified as a supporting industry by both the NFYP and PFYP in a given Five-Year Plan period, and a value of zero if it is acknowledged as a supporting industry solely by one of them or not endorsed by either.

[1] China has 23 provinces, 5 autonomous regions, and 4 municipalities directly under the central government.

To address possible endogeneity issues, we utilize the alterations in supporting industries during the transition from the 12^{th} to the 13^{th} Five-Year Plans as an exogenous shock and identify the impact of industry promotion on firms' innovation with a difference-in-differences (DID) model to eliminate the possible impact of inter-industry disparities. Specifically, we categorize the industries supported in the 12^{th} Five-Year Plan (the value of *IMP* is one in the 12^{th} FYP) but not supported in the 13^{th} Five-Year Plan (the value of *IMP* is zero in the 13^{th} FYP) as the control group. Conversely, the treatment group comprises industries supported in both the 12^{th} FYP and the 13^{th} FYP (the value of *IMP* is one in both the 12^{th} FYP and the 13^{th} FYP). We also define a dummy variable named "*Treat*". *Treat* is assigned a value of one in the treatment group and zero in the control group. We define the initiation year of the 13^{th} FYP (2016) as the onset of the policy shock. "*Post*" represents a time dummy variable. For 2016 and subsequent years, *Post* is coded as one. For years prior to 2016, *Post* is coded as zero. *IPDID* is the interaction term of *Treat* and *Post*, constituting a DID variable.

$$IPDID_{ipt} = Treat_{ipt} \times Post_t \tag{2}$$

Endogeneity occurs when the explanatory variables correlate with a model's error term. The Difference-in-Differences (DID) method is a research design for estimating causal effects. It overcomes the endogeneity problem that arises when policy is used as an explanatory variable (Chen and Wu, 2015). DID, or Difference-in-Differences, involves two differences (Bertrand et al., 2004). The first difference helps alleviate endogeneity issues arising from time-invariant factors specific to each group (Chen and Wu, 2015). Under the assumption of parallel trends, the average potential changes over time for the treatment and control groups are identical (Lechner, 2011). Therefore, the second difference eliminates potential changes caused by time trends, mitigating endogeneity issues arising from time-varying factors (Huang et al., 2022). Consequently, by employing the two differences, the DID model can diminish the influence of other observable and unobservable factors that might affect the innovation levels of the treatment and control groups. This method resolves endogeneity problems, thereby precisely identifying the average treatment effect of the policy on the treatment group.

3.3.3. Control variables (*Controls*)

In this paper, we choose control variables at the firm, industry, and province levels. (1) Profitability (*Roa*). *Roa* is denoted by the net profit of the enterprise divided by the total assets. (2) Corporate growth (*Grow*). *Grow* is denoted by the growth rate of business revenue. (3) Asset-liability ratio (*Lev*). *Lev* is denoted by the total liabilities divided by a firm's total assets. (4) Firm size (*Size*). *Size* is measured using the natural logarithm of the total assets of the publicly listed corporations. (5) The ownership of an enterprise (*Soe*). *Soe* is noted as 1 if it is a state-owned enterprise, otherwise 0. (6) Cash flow (*Cash*). *Cash* is denoted using net cash flow from business operations divided by total assets. (7) Industry profitability (*ROA*). *ROA* is measured using industry net profit divided by industry total assets. (8) Industry operating margins (*PROFI*). *PROFI* is measured with industry operating profit divided by the industry operating revenue. (9) GDP growth (*GDP*). *GDP* is denoted using the GDP growth rate of various Chinese provinces. (10) Regional financial revenue (*FAV*). *FAV* is measured using the natural logarithm of fiscal revenues of Chinese provinces. Table 1 below displays the definition, abbreviation, and description of the primary variables. Table 2 below displays the descriptive statistical data of the main variables.

Table 1. Definition of primary variables.

Category	Variable name	Variable description
Independent variable	Industrial promotion from China's Five-Year Plan (*IPDID*)	A DID variable representing an exogenous shock of the changes in supporting industries between the 12^{th} and 13^{th} Five-Year Plans. *IMP* is assigned a value of 1 if an industry is identified as a supporting industry by both the NFYP and PFYP; otherwise, 0.
Dependent	Corporate innovation	The natural logarithm of the count of invention patents applied by enterprises plus

variable	performance (*Lnpat*)	one
Control variables	Profitability (*Roa*)	The net profit of the enterprise divided by the total assets
	Corporate growth (*Grow*)	The growth rate of business revenue
	Asset-liability ratio (*Lev*)	The total liabilities divided by a firm's total assets
	Firm size (*Size*)	The natural logarithm of firms' total assets
	Ownership (*Soe*)	A value of 1 indicates state ownership of an enterprise, while 0 signifies otherwise.
	Cash flow (*Cash*)	Net cash flow from business operations divided by total assets
	Industry profitability (*ROA*)	Industry net profit divided by the industry total assets
	Industry operating margins (*PROFI*)	Industry operating profit divided by the industry operating revenue
	GDP growth (*GDP*)	The GDP growth rate of various Chinese provinces
	Regional financial revenue (*FAV*)	The natural logarithm of fiscal revenues of Chinese provinces
Mechanism variables	Corporate income tax (*Tax*)	Corporate income tax divided by the total assets of a firm
	Government subsidies (*Subs*)	The natural logarithm of the amount of innovation subsidies received by firms plus one
	Financing constraint index (*FC*)	FC index for financing constraints
	Financing scale (*Tba*)	The long-term and short-term loans of firms divided by their total assets

Table 2. Descriptive statistics.

Variables	Observations	Mean	Median	SD	Min	Max
Lnpat	18386	2.060	2.079	1.548	0.000	8.839
IPDID	18386	0.510	1.000	0.500	0.000	1.000
IMP	18386	0.635	1.000	0.294	0.000	1.000
Roa	18386	0.038	0.042	0.058	-0.275	0.107
Grow	18386	0.122	0.111	0.227	-0.515	0.514
Lev	18386	0.376	0.371	0.181	0.050	0.666
Size	18386	21.91	21.81	1.033	14.94	23.73
Soe	18386	0.310	0.000	0.462	0.000	1.000
Cash	18386	0.044	0.046	0.058	-0.143	0.130
ROA	18386	0.061	0.060	0.025	-0.005	0.104
PROFI	18386	0.077	0.089	0.178	-1.505	0.206
GDP	18386	0.085	0.089	0.034	0.005	0.143
FAV	18386	8.337	8.478	0.685	6.176	9.249

4. Empirical results

4.1. Baseline regression

The baseline regression results regarding the influence of industrial promotion from China's Five-Year Plan on corporate innovation performance are listed in Table 3. We conduct the baseline estimation without control variables in the first column, and the value of the coefficient of *IPDID* is 0.1239 and positive at the 1% level of significance. It implies that, relative to the control group, the innovation performance of the treatment group supported by industrial promotion has increased by 12.39%. The estimation in the first column is followed by the estimation with control variables for enterprise characteristics in column (2), control variables for enterprise and industry characteristics in column (3), and all control variables in column (4). The *IPDID* coefficients are all positive at the significance level of 1%. In column (4), for instance, the coefficient of *IPDID* is positive and estimated at 0.1207, with a 1% significance level. It indicates that the industrial promotion in China's Five-Year Plan has elevated the innovation performance of the treatment group by 12.07% in contrast to the control group. The sign and magnitude of the four estimated *IPDID* coefficients indicate that industrial promotion from China's Five-Year Plan profoundly improves corporate innovation performance. The regression results prove Hypothesis 1.

Table 3. Benchmark regression results.

	(1) *Lnpat*	(2) *Lnpat*	(3) *Lnpat*	(4) *Lnpat*
IPDID	0.1239***	0.1168***	0.1153***	0.1207***
	(3.55)	(3.36)	(3.31)	(3.46)
Roa		0.0802*	0.0904*	0.0888*
		(1.69)	(1.86)	(1.83)
Grow		-0.0164	-0.0131	-0.0112
		(-0.90)	(-0.72)	(-0.61)
Lev		-0.1400**	-0.1438**	-0.1539**
		(-1.97)	(-2.02)	(-2.17)
Size		0.5449***	0.5448***	0.5416***
		(24.03)	(23.96)	(23.89)
Soe		0.0086	0.0081	0.0007
		(0.17)	(0.16)	(0.01)
Cash		-0.0093	0.0115	0.0206
		(-0.08)	(0.10)	(0.18)
ROA			-0.7965***	-0.8147***
			(-2.66)	(-2.73)
PROFI			-0.0190	-0.0173
			(-0.50)	(-0.46)
GDP				0.3601
				(1.13)
FAV				0.2680***
				(3.47)
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
N	18016	18016	18016	18016
Adj.R^2	0.7609	0.7767	0.7768	0.7770

*Note: (1) * denotes significance levels of 10%, ** represents 5% and *** denotes 10%. (2) The t-statistics in parentheses correspond to heteroskedasticity robust standard errors. The same below.*

Moreover, the estimated results of some control variables are in accordance with our anticipated outcomes. For example, the coefficients of profitability (*Roa*) in columns (2), (3), and (4) are significantly positive and estimated at around 0.08, suggesting that the more net profit per unit of assets a corporation has, the more invention patents the corporation may have. The estimated coefficients of corporation size (*Size*) in the three columns of Table 3 are positive at the 1% level, indicating that the larger the corporation, the better the firm's innovation levels. In addition, the significantly positive coefficients of provincial financial revenue (*FAV*) suggest that firms in economically advanced provinces likely have better innovation performance.

4.2. Parallel trends

The DID model requires that the target variables in the treatment and control groups demonstrate analogous time trends before policy implementation (Bertrand *et al.*, 2004); in other words, the two groups should satisfy the "parallel trend" assumption. Thus, we perform a parallel trend analysis on the study samples. Figure 2 shows no significant disparity in corporate innovation performance between the treatment group and the control group during the 12^{th} FYP period from 2011 to 2015. However, after the industrial promotion shock from 13^{th} FYP happened, the difference in innovation performance between the two groups significantly exceeded zero, and the policy effect strengthened annually. The figure for parallel trends suggests that the control and treatment groups share a common temporal trend before the industrial promotion shock. Thus, we have evidence that the DID model utilized in this research fulfils the parallel trends assumption.

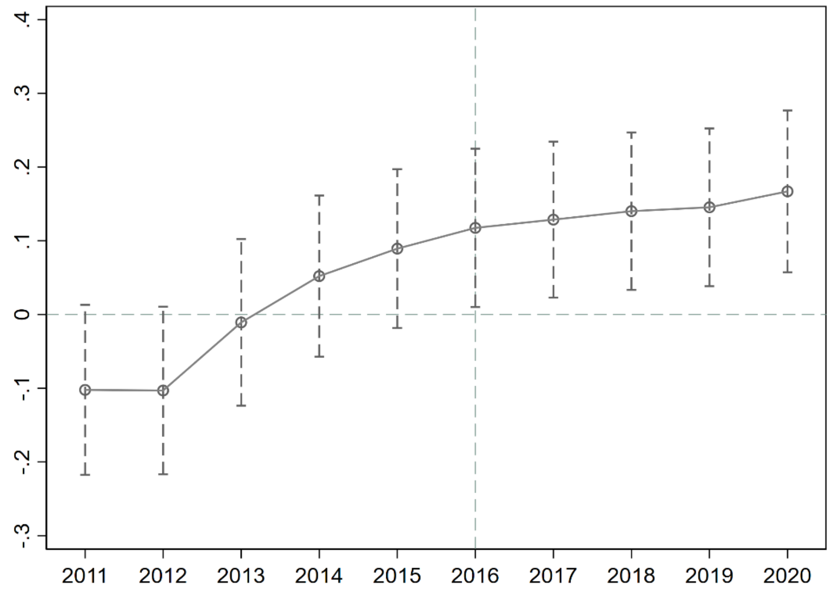

Figure 2. Parallel trend test.

5. Robustness tests

5.1. Substitution of explanatory variables

As previously discussed, a firm's level of innovation is better indicated by its invention patents compared to other patent types. In our primary regression, we quantify enterprise innovation by the count of invention patents applied by the enterprise. In the robustness test, we examine the potential positive impact of industry promotion on all patents (*Patsum*), utility model patents (*Patsy*), and design patents (*Patwg*) filed by enterprises. We independently regress industry promotion on these patent types, presenting the regression results in columns (1), (2), and (3) of Table 4, and the coefficients of *IPDID* are 0.1149, 0.1050, 0.0932 in the respective columns, all statistically significant at the 1% level. For example, the magnitude and significance of the coefficients of *IPDID* in column (1) indicate that compared to the control group, the industrial promotion from China's Five-Year Plan has elevated the total patents of the treatment group by 11.49%.

Table 4. Robustness tests.

	(1) *Patsum*	(2) *Patsy*	(3) *Patwg*	(4) *TFP*	(5) *Lnpat*	(6) *Lnpat*	(7) *Lnpat*	(8) *Lnpat*	(9) *Lnpat*
IPDID	0.1149***	0.1050***	0.0932***	0.0657***	0.1144***	0.0867**	0.0908***		
	(2.93)	(2.81)	(2.71)	(4.24)	(3.01)	(2.11)	(2.67)		
IPDID1								0.0940	
								(1.19)	
IPDID2									0.0833
									(1.03)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Pro-Y FE					YES				
N	18003	18003	18003	16085	18008	14738	18006	18016	18016
Adj.R^2	0.7744	0.7697	0.7042	0.8851	0.7624	0.7480	0.7773	0.7623	0.7162

On the other hand, the optimization of firms' innovation capacity ultimately enhances firms' productivity. Thus, we also include the regression of industry promotion on firms' total factor productivity (*TFP*) as one of the robustness tests. Considering that the classical OLS estimation method for total factor productivity can hardly overcome the endogeneity problem caused by reverse causality, this paper adopts the commonly used OP method to calculate enterprise total factor productivity. The regression results in column (4) of Table 4 reveal an estimated coefficient of *IPDID* at 0.0657, which is statistically significant at the 1% level, demonstrating that industry promotion effectively boosts enterprise total factor productivity. The above regression outcomes confirm the robustness of the baseline findings.

5.2. Removing provincial policy interference

The business environment and development plans among provinces in China may be different. This study introduces a "province-year" joint fixed effect (Pro-Y FE) into the Model (1) to mitigate potential impacts caused by provincial policy interference that may change over time. Column (5) of Table 4 presents the robustness test result of controlling provincial policy interference. The coefficient of *IPDID* is significantly positive even with the "province-year" joint fixed effects and estimated at 0.1144, with a 1% significance level. The regression result indicates that the benchmark regression findings remain immune to changing provincial policies, thereby reaffirming the validity of Hypothesis 1 presented in this paper.

5.3. Excluding the four municipalities in China

Given the different economic statuses of the four municipalities (Beijing, Shanghai, Chongqing, and Tianjin) in China, industrial promotion introduced for these municipalities may differ from those for other provinces and cities. To ensure that the presence of municipalities does not affect the baseline estimation results, we exclude corporations in the four municipalities for a robustness test. The estimation outcome is presented in the sixth column of Table 4, revealing that the estimated coefficient of IPDID is 0.0867 and positive at a 5% significance level, suggesting that Hypothesis 1 is reliable.

5.4. PSM-DID model

The precision of policy effect estimation can be compromised by sample selection issues often resulting in selectivity bias. In simpler terms, specific samples are more prone to being chosen as the treatment group, resulting in bias. To mitigate potential interference from differences in the characteristics between the treatment and control groups, this research utilizes the propensity score matching (PSM) method to ensure maximum similarity between the two groups in all aspects except the industrial promotion from the 13^{th} FYP. We opt for the 1:1 nearest neighbor matching method and employ the logit model as the propensity score estimation model. Then, we employ Model (1) for another DID estimation. The PSM-DID model results are presented in column (7) of Table 4; the *IPDID* coefficient is 0.0908, whose significance level is 1%, reinforcing the robustness of the DID regression outcomes.

5.5. Placebo tests

To address concerns that the observed treatment effect may stem from unobservable factors unrelated to the industrial promotion policy, we conduct two types of placebo tests. The first is a placebo test fabricating the treatment group. By repeatedly sampling the original sample 500 times, we obtain falsified treatment and control groups and generate Kernel Density and P-value distribution plots for the coefficient β_1 in Model (1). The results of the placebo test are shown in Figure 3. The P-values are predominantly above the horizontal dashed line, indicating that the P-values are mostly greater than 0.1. Additionally, the coefficient values cluster around zero. Therefore, the results of this placebo test do not pass the significance test. The second is a placebo test altering the year of policy implementation. Specifically, drawing on Li and Jiang (2019), we choose the first two years preceding the actual industrial policy implementation as fictitious implementation points and generate a new dummy variable, *Post1*. *Post1* is assigned a value of one for 2014 and beyond; otherwise, it is noted as zero. The new study period includes 2011-2013 as the pre-implementation period and 2014-2022 as the post-implementation period. We also select 2018 as another fictitious implementation year and generate a second dummy variable, *Post2*. After the steps above, we obtained two new DID variables: *IPDID1* (=*Treat*×*Post1*) and *IPDID2* (=*Treat*×*Post2*). We regressed the dependent variable *Lnpat* on *IPDID1* and *IPDID2*, respectively. The regression results are presented in columns (8) and (9) of Table (4). The regression coefficients for *IPDID1* and *IPDID2* are insignificant, thus enhancing the credibility of the baseline regression results.

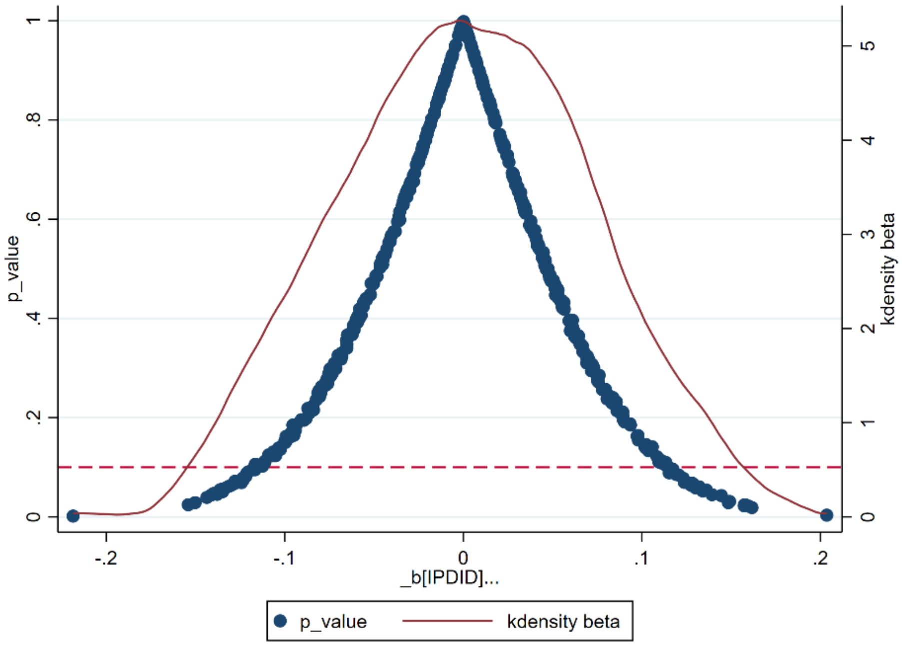

Figure 3. Placebo test.

6. Influence mechanisms

In the theory and hypotheses section, we analyze that industry promotion would enhance firms' innovation performance through tax incentive, government subsidy, and credit support mechanisms. Corporate income tax plays a crucial role in regulating the economy. The government can achieve specific economic objectives by adjusting corporate income tax revenues (Pang et al., 2024). By setting different tax rates and offering tax incentives, the government can encourage companies to increase their investment in research and development, thereby enhancing their technological innovation capabilities. Cai and Harrison (2021) also noted that tax incentives can stimulate increased corporate investment. Government subsidies can help businesses overcome externalities they cannot address on their own, thereby providing essential support and assurance for corporate innovation. Lin and Chang (2009) also pointed out that government subsidy is an effective means to compensate for innovation externalities and incentivize innovation. Bank loans remain China's primary financing source for nonfinancial companies (Allen et al., 2005). The availability of ample funding significantly impacts corporate innovation, and credit support provides the necessary funding for innovation and technological advancement. Yu et al. (2021) also argued that reduced financing constraints can promote firm innovation. Additionally, a distinctive feature of China's industrial promotion policy is its close coordination with fiscal and financial policies. Consequently, tax incentives, government subsidies, and credit support mechanisms work together in a complementary and mutually reinforcing manner. Therefore, in this section, we will empirically investigate the validity of these three mechanisms using mediation effect models.

6.1. Level 2 heading

For the test of the tax incentive mechanism, we measure the mediating variable "*Tax*" by corporate income tax divided by the total assets and model the mediating effect as follows.

$$Tax_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{3}$$

$$Lnpat_{it} = \alpha_0 + \alpha_2 IPDID_{ipt} + \alpha_3 Tax_{it} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{4}$$

Model (3) estimates the effect of industrial promotion from China's Five-Year Plan on corporate income tax. Model (4) demonstrates the validity of the mediation effect model with corporate income tax (*Tax*) as the mediating variable. As stated in the theoretical analysis section, industrial promotion has the potential to enhance corporate innovation levels by leveraging tax incentives. Thus, we anticipate that the effect of industrial promotion on corporate income tax should be significantly negative. Columns (1) and (2) of Table 5 examine whether industrial promotion improves innovation performance through tax incentives. As shown in the first column, the regression coefficient of industrial promotion on corporate income tax is -0.005 and significant at the 10% level, indicating that industrial promotion indeed provides firms with tax incentives. Table 5, column (2) reveals that the estimated coefficient of *IPDID* on corporate innovation (*Lnpat*) is 0.0931, significant at the 1% level. Additionally, the regression coefficient of the mediating variable (*Tax*) on *Lnpat* is -2.7541, showing a significant negative correlation at the 5% significance level. These regression results suggest that industrial promotion from China's Five-Year Plan can foster corporate innovation performance through tax incentives. Hypothesis 2a has been confirmed.

Table 5. Influence mechanisms.

	(1) *Tax*	(2) *Lnpat*	(3) *Subs*	(4) *Lnpat*	(5) *FC*	(6) *Lnpat*	(7) *Tba*	(8) *Lnpat*
IPDID	-0.0005*	0.0931***	0.1021**	0.0907***	-0.0332***	0.0929***	0.0169***	0.1143***
	(-1.68)	(2.71)	(2.03)	(2.68)	(-4.97)	(2.69)	(4.28)	(3.28)
Tax		-2.7541**						
		(-2.06)						
Subs				0.0035***				
				(3.40)				
FC						-0.2690***		
						(-4.14)		
Tba								0.5714***
								(6.77)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
N	17966	17966	18012	18012	17611	17611	18016	18016
Adj.R^2	0.5088	0.7777	0.3202	0.7780	0.7798	0.7785	0.6306	0.7617

6.2. Government subsidy mechanism

As described in the theoretical analysis section, the government grants a series of innovation subsidies to industries supported by the Five-Year Plan to stimulate their engagement in innovation activities. Thus, we portray government subsidies (Subs) as the natural logarithm of the total innovation subsidies received by firms plus one. We also develop the mediation effect models below to examine the government subsidy mechanism.

$$Subs_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{5}$$

$$Lnpat_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \alpha_2 Subs_{it} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{6}$$

Model (5) estimates the effect of industrial promotion on innovation subsidies received by firms. Model (6) demonstrates the validity of the mediation effect model with innovation subsidies (Subs) as the mediating variable. Columns (3) and (4) of Table 5 test whether industrial promotion enhances firms' level of innovation by providing them with innovation subsidies. Column (3) shows the regression results of industrial promotion on the mediating variable innovation subsidies (Subs); the coefficient of IPDID is 0.1021 and significantly positive at the 5% level, indicating that industrial promotion facilitates firms in obtaining innovation subsidies. In column (4), the regression coefficients of industrial promotion (IPDID) and innovation subsidy (Subs) on firms' innovation performance (Lnpat) are 0.0907 and 0.0035, respectively, and both of which are positive at the 1% significance level, suggesting that industrial promotion plays a crucial role in enhancing firms' innovation levels through the government subsidies. Hypothesis 2b has been validated.

6.3. Credit support mechanism

According to the theoretical analysis, banks will ease credit approval processes for industries supported in the Five-Year Plan. The support of industrial promotion can help alleviate financial constraints and offer enterprises more affordable loans. On the one hand, the alleviation of corporate financing constraints can preferably indicate that enterprises have benefited from credit support. This paper, referring to Hadlock and Pierce (2010) and Gu et al. (2020), measures corporate financing constraints with FC index (*FC*) and takes it as a mediating variable. Based on the analysis of the credit support mechanism, we anticipate that industry promotion could markedly alleviate firms' financing constraints. We establish the following mediation effect models to evaluate the credit support mechanism.

$$FC_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{7}$$

$$Lnpat_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \alpha_2 FC_{it} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{8}$$

Model (7) estimates the effect of industrial promotion on financing constraints of firms. Model (8) demonstrates the validity of the mediation effect model with financing constraints (*FC*) as the mediating variable. Corresponding estimation results are displayed in columns (5) to (6) of Table 5. In column (5), the estimated coefficient of *IPDID* on financing constraints (*FC*) is significantly negative with a value of -0.0332, indicating effective alleviation of firms' financing constraints through industry promotion. In column (6), the coefficient of industry promotion (*IPDID*) on firms' innovation performance (*Lnpat*) is 0.0929 and significant at the 1% level, while the estimated coefficient of financing constraints (*FC*) is -0.2690, exhibiting significant negative impact at the 1% level, suggesting that industry promotion contributes to enhancing firms' innovation by easing financing constraints. Consequently, Hypothesis 2c is supported by the findings.

On the other hand, the expansion of the financing scale can also reflect credit support to a certain extent. We measure the financing scale (*Tba*) by long-term and short-term loans of firms divided by their total assets and anticipate that industry promotion will substantially expand the financing scale. The following mediation effect models are used to test the credit support mechanism.

$$Tba_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \tag{9}$$

$$Lnpat_{it} = \alpha_0 + \alpha_1 IPDID_{ipt} + \alpha_2 Tba_{it} + \beta_0 Controls + \mu_i + \delta_t + \varepsilon_{it} \quad (10)$$

Model (9) estimates the effect of industrial promotion on the financing scale of firms. Model (10) demonstrates the validity of the mediation effect model with financing scale (*Tba*) as the mediating variable. In column (7) of Table 5, the coefficient of *IPDID* is 0.0169, signifying significance at the 1% level and indicating that industrial promotion improves firms' financing scale. In column (8), the regression coefficients of industry promotion (*IPDID*) and financing scale (*Tba*) on firm innovation (*Lnpat*) are both significantly positive at 1% level, the coefficient for *IPDID* is 0.1143, and for *Tba*, it is 0.5714. The above regression results show that industry promotion can promote firm innovation through credit support. Hypothesis 2c has been confirmed.

7. Heterogeneity analyses

7.1. Heterogeneity of corporate size

Bank loans are a major funding source for enterprises in China. Banks, aiming to mitigate default risk, tend to provide loans to larger-scale enterprises. Therefore, before the implementation of industrial policy, large firms generally have substantial financial resources and face fewer financing constraints. This indicates that these large firms can allocate more funds to their R&D and innovation practices and employ highly skilled personnel to effectively transform innovative knowledge. Conversely, small firms typically encounter more pronounced financing constraints compared to large firms, posing a challenge to their innovation efforts. After implementing industrial promotion policy, small enterprises in supporting industries can access more credit and subsidies for innovation, thereby enhancing their innovation performance to a higher degree. Additionally, industrial policy support for small businesses sends a positive market signal, improving small enterprises' visibility and investment attractiveness (Meuleman and De Maeseneire, 2012). This raises external investors' optimistic expectations about small businesses, thereby effectively broadening their funding sources and encouraging more innovation. Thus, this study anticipates that the smaller the firm size, the stronger the effect of industry promotion policy on enterprises' innovation performance.

Using the median total assets of firms as a classification threshold, we categorize companies with assets more incredible than the median assets of firms as large firms and categorize those with fewer assets as small firms. The regression results of heterogeneity of corporate size are listed in Table 6. In the small firm samples of column (1), the coefficient of *IPDID* is quantified at 0.1399, which is at the 5% level and surpasses the coefficient value of *IPDID* of 0.0883 in the large firm samples in column (2). The finding suggests that industrial promotion from FYP contributes to improving innovation performance in small firms.

Table 6. Heterogeneity analyses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Corporate size		Industry competitiveness		marketization degree	
	Lnpat	*Lnpat*	*Lnpat*	*Lnpat*	*Lnpat*	*Lnpat*
IPDID	0.1399**	0.0883*	0.1559***	0.0873*	0.1444***	0.1059*
	(2.51)	(1.78)	(2.93)	(1.75)	(3.25)	(1.82)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
N	9775	7998	11062	6513	10726	7279
Adj.R^2	0.6689	0.8311	0.8030	0.7407	0.7595	0.7880

7.2. Heterogeneity of industry competitiveness

Industry competition refers to the actions firms within the same industry take to compete for market position, customer resources, profits, and technological advantages. In highly competitive industries, firms face an increased number of rivals. To secure necessary profits for growth and maintain a leading market position, firms must actively engage in innovation (Yu et al., 2016; Li and Zheng, 2016). Thus, the more intense the industry competition, the more essential innovation becomes for firms to survive or capture a larger market share. Liu and Qi (2022) also noted that competitive environments stimulate these market entities' creativity and innovative drive. Consequently, we anticipate that the industrial promotion from China's Five-Year Plans will exert a more pronounced influence on the innovation of firms operating in highly competitive industries.

We define industry competition *Comp* = 1-*HHI*, with *HHI* representing the Herfindahl Index for the industry. The Herfindahl Index is a composite measure of industrial concentration. Higher values indicate greater market concentration and increased monopolization. Thus, a higher *Comp* value signifies greater market competition. Samples with *Comp* values above their median are categorized as high-competition, while those below the median are categorized as low-competition. Table 6 also contains the estimation outcomes of heterogeneity of industry competitiveness. The outcomes of the grouped estimations are presented in columns (3) and (4). In the high-competition samples of column (3), the estimated coefficient of *IPDID* stands at 0.1559 and is at the 1% significance level. It implies that industrial promotion from China's Five-Year Plan plays a more substantial role in enhancing firms' innovation performance in high-competition industries.

7.3. Heterogeneity of marketization degree

The marketization index reflects the economic freedom and market environment of a region. A higher marketization index implies a more perfected market mechanism, more rational resource allocation, and more transparent information within the region. Additionally, regions with a higher marketization index usually possess a more standardized, transparent, and fair legal system, enabling industrial promotion to better fulfil their utility and achieve the expected outcomes. Additionally, the lower the level of marketization in a region, the lower its market operational efficiency, resulting in more significant constraints on economic activities and a higher likelihood of rent-seeking behavior among enterprises (Han et al., 2017). These negative factors can hinder the smooth initiation and implementation of corporate innovation activities. Lin and Rosenblatt (2012) also demonstrated that the successful implementation of many government policies is predicated on market efficiency. Hence, we anticipate that the industrial promotion from China's Five-Year Plan would have a significant impact on enterprises in regions with a higher degree of marketization.

Using the mean value of the marketization Index in the report by Fan et al. (2003) as the classification criterion, this study categorizes the samples into groups with high and low degrees of marketization for subgroup regression analysis. The regression results are presented in columns (5) and (6) of Table 6. The coefficient of *IPDID* in column (5) is 0.1444 with a significance level of 1% in the samples with higher marketization index, whereas the coefficient of *IPDID* has a magnitude of 0.1059 and a significance level of 10% in the samples with lower marketization index in column (6). The magnitude and significance level of the coefficient of *IPDID* in column (5) are greater than those in column (6), suggesting that the policy effect of industrial promotion is more pronounced among firms in more market-oriented regions.

8. Conclusions and implications

Utilizing data from China's A-share listed firms from 2011 to 2020, we study whether China's Five-Year Plan for industrial promotion influences enterprises' innovation performance and study its influence mechanisms. The findings indicate that industrial promotion from China's Five-Year Plans substantially enhances firms' innovation performance, and after a string of robustness tests, this conclusion still holds. The robustness tests include variable substitutions, the elimination of policy interference, PSM-DID estimation and more. The mechanism analysis reveals that the industrial promotion encourages firms' innovation through three key channels: tax incentives, government subsidies, and credit support. The heterogeneity tests find that China's Five-Year Plan for industrial promotion has a more pronounced promotion on innovation levels among large-scale firms and firms operating in highly competitive industries and regions with high marketization.

Our research provides the following implications. First, the Chinese government should bolster the enforcement of intellectual property laws to protect companies' research and development achievements. It will encourage firms to engage in more innovation, as they can have confidence in the legal safeguarding of their intellectual property. Additionally, the government could establish more specialized innovation funds to provide loans and subsidies to enterprises actively involved in innovative activities. Furthermore, simplifying the loan application process and reducing the barriers to innovation project financing will encourage businesses' innovation initiatives. Moreover, the government could incentivize businesses to form more partnerships with research institutions and universities. It will promote technological innovation and the transformation of theoretical knowledge into practical applications. Encouraging cross-sector and cross-industry collaboration will also stimulate more innovation.

Second, the government should fully leverage the comparative advantages of different industries and regions to implement industrial promotion policies tailored to specific enterprises and local conditions. It could strengthen innovation support for small enterprises to stimulate their innovation capabilities. Additionally, the government could relax market entry barriers for encouraged industries to enhance competition and further drive corporate innovation. Finally, the government could avoid excessive intervention in market mechanisms to ensure the market's core role in resource allocation and help regions with lower marketization levels improve their marketization.

9. Limitations and reforms

Although this study demonstrates the positive impact of industrial promotion policy on corporate innovation, there are limitations when such policies are improperly implemented. First, China's industrial promotion policies are predominantly selective, characterized by picking winners and discriminatory practices that may distort business decisions and create opportunities for rent-seeking behavior (Pack and Saggi, 2006). Second, the government often lacks sufficient information and capabilities when formulating industrial promotion policies. Compared to entrepreneurs, the government generally has weaker information advantages, expertise, and market sensitivity, which may result in unscientific policy settings and "good intentions with bad outcomes" (Han et al., 2017). Third, industrial promotion policy can impact the functioning of market mechanisms, potentially leading to resource misallocation. An excessive pursuit of "catch-up" may also result in overcapacity (Wu et al., 2019).

There are several ways to address these potential limitations. First, research based on regional and industry data reveals that the effectiveness of China's industrial promotion policies is closely related to government capacity, government objectives, regional marketization levels, and regional economic development levels (Dai and Cheng, 2019). Therefore, each region should establish support for industries based on local characteristics, such as spatial layout, industrial structure, and resource endowment. The establishment of supporting industries should also be flexible, with adjustments and improvements made in response to regional development changes. Second, the market's core role in resource allocation should always be emphasized. It is essential to continuously promote the complementarity between industrial promotion policy and market regulation. Market enhancement theory suggests that government policy guidance should not replace market mechanisms. Instead, the government should coordinate external financial, legal, and regulatory frameworks to foster the complementarity between market and policy mechanisms (Han et al., 2017). Therefore, rational industrial promotion policies should promote competition rather than weaken it. In the future, the government can reduce its reliance on selective industrial policies and shift towards market-friendly and inclusive industrial policies, such as functional industrial policies (Dai and Cheng, 2019). Additionally, strengthening legal frameworks and promoting integrity education within government departments can help mitigate rent-seeking and corruption.

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Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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