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The Impact of Government Promotion Policies on Technological Innovation in New Energy Vehicle Enterprises: Ten Cities, One Thousand Cars Policy as an Example

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Abstract. In the face of the world's trend towards green development and sustainable energy, China started the "Ten Cities, Thousand Cars" project in 2009, which was one of its major plans to cut down emissions and encourage green technology. To speed up the industrialization of NEVs via demonstration and promotion, it began with 10 cities and 1000 cars. This paper uses a difference-in-differences approach to assess the impact of the program on technological innovation using panel data on automotive companies listed on the Shanghai and Shenzhen A-share market from 2007 to 2014. The sample contains both pilot and non-pilot city firms, making it possible to make a clean comparison. The results show that joining the pilot cities greatly improves the number of innovations measured by patents filed and increases the R&D intensity of NEV companies. Evidence shows that the policy works mainly by easing firms' financing problems, probably because of subsidies and better chances to get money for loans, so they can put more money into being innovative. Heterogeneity tests show that the innovation effect is stronger for bigger firms, which fits with them having more power to use policy help. In general, this program does succeed at spurring technological progress among individual companies and helping spread green car tech. These findings give some ideas about how to make industrial policies that help create sustainable innovation in growing countries.

Keywords: Double difference model, new energy vehicle makers, emerging industries.

1. Introduction

In the context of the world's energy transformation and green development, the new energy vehicle industry has become an important force driving China's high-quality economic growth and achieving its dual carbon objectives. Following the launch of the "Ten Cities, Thousand Vehicles Energy Saving and New Energy Vehicle Demonstration and Promotion Project" in 2009, the sector has moved away from its exploratory R&D phase and entered a new era of demonstration, promotion, and industrialization, setting the foundation for its subsequent strong growth.

Academic research has extensively examined new energy vehicle promotion policies. Existing literature indicates that industrial policies should incorporate "new governance" concepts to optimise the allocation of market-oriented and social policy instruments, thereby enhancing policy precision

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and effectiveness [1]. Concurrently, studies categorise policies into "supportive" and "access-related" types, emphasising that dynamic alignment between these two approaches—combining restraint and encouragement—is essential across different industrial development stages to maximise innovation incentives [2].Concerning policy effectiveness evaluation, prior research has found that government subsidies during the industry's nascent phase can confer profitability advantages, yet their impact on incentivising corporate R&D becomes limited after industrial expansion [3]. Subsequent studies, adopting a demand-side perspective, have revealed the intrinsic mechanism through which subsidy policies empower new productive forces via two pathways:Resource Allocation Optimization and Corporate Innovation Stimulation [4]. Also, some studies use the Catalogue of Recommended Models for New Energy Vehicle Promotion as a case study and apply the difference-in-difference approach to examine how policy promotion has positively influenced corporate technological innovation, but they also point out that there are regional differences [5].

The above-mentioned research provides us with the necessary theoretical basis and methods for evaluating whether the "Ten Cities, Thousand Vehicles Project" policy can work together with the company's technological inventions in this paper. Here we study listed car companies on China's Shanghai and Shenzhen A-share markets from 2007 to 2014, using a difference-in-differences method to see how the policy affects business tech innovation.

2. Theoretical analysis and research hypotheses

New energy vehicles are a strategic emerging industry, so it's closely related to what the government does. A lot of talks going around right now about choosing the right tools to make rules, checking if those rules work well, and making sure they're the best ones possible.

Regarding policy instruments, existing literature primarily focuses on categorising policy types and optimising their combinations. Some studies classify new energy vehicle policy instruments into three categories:Regulatory, market-based, socialized, pointing out that there are problems with the current policy system such as too much emphasis on regulation and lack of internal tools [1]. Then some other studies split them up into supporting and access restricting kinds of policies; the supporting kind makes companies want to create new things by giving them money and cutting taxes, while the restricting kind tells companies what they can and can't do using special rules about machines and nature. Results show big changes over time and place for how these two kinds of policies work as rewards [2]. Dual credit policy research produced a corporate green transformation institution reaction matrix showing varied company actions based on differing policy designs [6].

Regarding policy effectiveness evaluation, research findings exhibit distinct phased characteristics. Early studies indicate that government subsidies during an industry's nascent stage confer significant profitability advantages to new energy enterprises. However, as the sector expands, reliance solely on supportive policies struggles to sustainably incentivise increased R&D investment, potentially even inducing homogenised overcapacity [3].Research from the demand-side perspective indicates that subsidy policies can jointly advance industrial development through two pathways:Improving industrial resources and promoting corporate technology innovation [4]. License plate restriction studies show that regulatory measures can significantly boost the number of new energy vehicles in regions implementing such rules, and they produce positive spatial spillover effects [7]. Dual Credit Policy study provides a framework for improving policies with three options available to traditional fuel car makers: buy credits, team up, or start producing [8].

In the tax policy area, the main focus is on designing and improving tax incentive tools. One study analyzed the shortcoming of vehicle purchase tax reduction policies on the coverage scope, discount amount, and tax rate setting, and gave specific improvement suggestions [9]. Another effort developed a theory framework at three levels:Tax System, Tax Policy, Tax Administration to analyze practical issues such as core technical bottleneck, industry chain deficiency, and sectoral over-competition [10].

As for corporate innovation and financing constraints, the literature mentions complicated outcomes that may result from policy inducements. Research shows that companies can fiddle with their R&D spending to hit the numbers that policies want them to, and this happens more often with private firms, profitable ones, and places where the government doesn't watch taxes too closely. It makes their R&D do worse [11]. Credit rent seeking research shows that both finance restrictions and rent seeking activities greatly hinder company innovation, and there is a mutual influence between the two, especially in small and medium-sized enterprises and privately owned companies [12]. More studies show that financing constraints affect not just whether to hire people, but also how many and what kind of jobs they get, which then affects how well they innovate and grow [13]. The study from an equity pledge perspective gives us some new ideas about how companies react to money worries [14]. Market structure studies show that due to local protectionism, market structures can be obstructive for industrial development according to literature. From the empirical data, we can see that there are obvious local preferences in the new energy vehicle market, and local governments adopt different policy measures to carry out protective actions. It reduces the efficiency of using fiscal resources and hinders the creation of a single nationwide market [15].

The "Ten Cities, Thousand Vehicles Project" employs a combination of policies—including fiscal subsidies, government procurement, and infrastructure development—aimed at reducing corporate R&D costs and stimulating innovation. Theoretically, this policy can alleviate financing constraints on corporate innovation activities through direct financial support and signalling effects, thereby increasing R&D resource allocation and enhancing innovation outputs. Based on this, this paper proposes:

H1:"Ten Cities, Thousand Vehicles Project" greatly encourages new energy vehicle companies' tech advancement.

Significant disparities exist in resource endowments and risk-bearing capacity between enterprises of different scales. Large-scale enterprises typically possess more substantial capital reserves, more sophisticated R&D platforms, and more mature technological accumulation, enabling them to better convert policy dividends into innovation outputs. Conversely, small-scale enterprises, constrained by resource limitations, struggle to substantially increase R&D investment in the short term. Based on this, this paper proposes:

H2:"Ten Cities, Thousand Vehicles Project" policy stimulates innovation more strongly for large enterprises than for small ones.

3. Empirical analysis

3.1. Variable selection and data description

This study looks at auto companies that are listed on the Shanghai and Shenzhen A-share markets in China between 2007 and 2014, using 214 listed firms as a base for the study. All data is from CSMAR. To reduce the impact of outliers on the regression results, all continuous variables were trimmed at the 1st and 99th percentiles.

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3.1.1. Variable selection

Dependent Variable:Corporate Innovation (Patent): Patent information is easier to show a company's innovative achievements and quality, so this paper follows the method in [5] and the overall direction. Technological innovation output is calculated as the natural logarithm of the total number of independent invention patents filed by the company in the current year plus one. Invention patent applications better represent a company's true technological innovation capabilities than do design and utility model patents.

Explanatory Variable:"Ten Cities, Thousand Vehicles Project" Policy Variable (Treat×Post): This study applies a difference-in-differences model to evaluate the impact of the policy, with the main explanatory variable being the interaction term between Treat and Post. Here, treat is a group dummy variable: new energy vehicle companies in the 13 pilot cities (including Beijing, Shanghai, and Chongqing) are treated as the experimental group and given a value of 1, while those in other cities form the control group with a value of 0. Post refers to the time dummy variable, which is set to 1 for years after 2009 and 0 for years before 2009, indicating that the program began officially in 2009. Coefficient β1 of the interaction term Treat×Post shows the net effect of the policy on corporate innovation.

Control variables:To address the issue of omitted variable bias and enhance the precision of the model's estimation, this study chooses the following variables that may affect corporate innovation as controls:

Variable names, symbols and some definitions are provided in Table 1.

Table 1. Variable list

Variable category	Variable name	Variable symbol	Measurement method
Dependent variable	Corporate innovation	Patent	Ln(Number of independent invention patent applications in year t + 1)
Explanatory variable	"10 cities, 1000 vehicles" policy variable	Treat×Post	Treat variable indicates that the new energy vehicle companies in 13 cities including Beijing are the experimental group (value = 1), and the rest are the control group. Post variable is 1 for the year 2009 and after, 0 for before.
Control variables	Return on Assets	Roa	Net profit / Total assets
	Revenue Growth Rate	Growth	(Current year revenue - Prior year revenue) / Prior year revenue
	Enterprise Scale	Size	Ln(Total assets)
	Duration of Enterprise Operation	Age	Subtract the year when it was founded from the current year, add one, and then take the logarithm.
	Leverage Ratio	Lev	Total Liabilities / Total Assets
	Cash Flow Ratio	Cashflow	Net cash flow from operating activities / Current liabilities at period end
	Equity Nature	Soe	If it's a state-owned property right company, then the number is 1, otherwise 0.
	Dual Role	Dual	Is chairman and general manager the same person?

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Table 1. (continued)

Majority Shareholder's Holding Ratio	Top1	Largest Shareholder's Shareholding Ratio to Total Shares
Board size	Board	Natural log of the number of board members
Current ratio	Cr	Corporate solvency
Inventory turnover ratio	Ito	Corporate operational capacity

3.2. Model construction

A double difference model is employed to evaluate the impact of inclusion in the recommended catalogue on technological innovation within new energy vehicle enterprises. The baseline model is specified as follows:

$$Yit = \beta 0 + \beta 1 Postt \times Treati + \Sigma \beta 2 Xit + Companyi + Yeart + \varepsilon it \quad (1)$$

i is the firm, t is the year. Dependent variable Yit is the technological innovation output of firm i in year t, refer to Table 1.

Core explanatory variable:interaction term Treati×Postt. Treati is a group dummy variable, which takes the value of 1 if company i is a new energy vehicle enterprise among the ten cities participating in the "Ten Cities, Thousand Vehicles" project (experimental group), and 0 otherwise. Postt is the policy implementation time dummy variable. Since the "Ten Cities, Thousand Vehicles Project" began officially in 2009, this research gives a score of 1 for the year 2009 and every year after that, and 0 for all previous years. The coefficient β_1 of the interaction term is the main parameter of this study, it represents the net impact effect of the "Ten Cities, Thousand Vehicles Project" policy on technological innovation in the experimental group companies. β_1 is pretty positive shows that the policy significantly improved the tech innovation level of those companies.

Xit stands for the group of control variables that affect a firm's technological innovation, Companyi refers to the fixed effect of every company, Yeart represents the year fixed effect, and εit is the random error term.

3.3. Benchmark regression

Table 2 reports the double difference estimation results with the number of independently applied invention patents as the dependent variable.

Table 2. Benchmark regression results

	(1)	(2)
	PT2	Rn
did	0.541^{**}	0.695^{**}
	(0.210)	(0.340)
Size	0.0797	0.402^{*}
	(0.0701)	(0.218)
Lev	0.00423	0.318
	(0.00479)	(0.259)

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Table 2. (continued)

Cashflow	0.119	-0.441
	(0.295)	(0.605)
Roa	0.00307	-0.719
	(0.00792)	(1.094)
Dual	0.182	0.121
	(0.113)	(0.154)
Top1	-0.387	0.313
	(0.417)	(0.992)
Board	0.255	0.946**
	(0.399)	(0.401)
Cr	-0.0101	0.0152**
	(0.0109)	(0.00663)
Ito	0.000185**	0.0155
	(0.0000832)	(0.0167)
_cons	-1.041	6.053
	(1.497)	(4.867)
N	884	614
R^2	0.853	0.911
adj. R^2	0.807	0.877

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Regarding the main explanatory variable, the coefficient of the interaction term Treat x Post (did) is 0.541, which is significantly greater than zero at the 5% significance level. That is, after the "Ten Cities, Thousand Vehicles Project" policy was implemented, the number of patents held by firms in the experimental group increased much more than that in the control group. So this policy did encourage the tech innovation output of new energy car firms, so we know our research hypothesis H1 for this study is right – that new energy car promotion policies do have a big good effect on firm tech innovation actions.

3.4. Robustness tests

In order to improve the reliability of the benchmark regression results and reduce the possible bias of the dependent variable measurement, this paper replaced the explained variable to conduct a robustness test. Innovation indicators for enterprises have been modified from PT2 (number of patents) to Rn (R&D expenditure), and model (1) was re-estimated. R&D expenditure means how much money a company puts into new things they want to create, it's another way to show if a company wants to try new ideas and can do so. This study uses the natural logarithm of enterprise R&D expenditure amount + 1 as a substitute variable, and the data from the CSMAR database is used.

Table 2 reports regression results with R&D expenditure (Rn) as the dependent variable. Column (2) shows that, after controlling for firm-specific fixed effects, time fixed effects, and a series of

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control variables, the coefficient for the interaction term Treat×Post (denoted as did) in the is 0.695, significantly positive at the 5% level.This indicates that the "Ten Cities, Thousand Vehicles Project" policy not only significantly increased patent output among experimental group firms but also substantially boosted their R&D expenditure. This finding aligns closely with the benchmark regression conclusions, further confirming the positive catalytic effect of new energy vehicle promotion policies on corporate technological innovation. It demonstrates the robust validity of this study's findings.

3.5. Heterogeneity analysis

Different scales of enterprises might show big differences in how they use their resources, how much risk they can take on, and what they decide about research and development, so it might lead to different policy outcomes for bigger and smaller companies. To study such a difference, we split all samples into two groups based on the median value of firm size:large firm and small firm. Then we run model (1) separately on each group. The grouped regression results are shown in Table 3.

Table 3. Heterogeneity analysis

	(1)	(2)
	PT2	PT2
did	0.926^{***}	0.0923
	(0.332)	(0.240)
Size	0.269	0.0497
	(0.282)	(0.164)
Lev	0.367	0.00299
	(0.695)	(0.00756)
Cashflow	0.712	-0.267
	(0.580)	(0.397)
Roa	0.0289	0.00121
	(1.597)	(0.0113)
Dual	0.375^{*}	0.0579
	(0.218)	(0.160)
Top1	0.0908	-1.157
	(1.047)	(0.730)
Board	-0.749	0.319
	(0.928)	(0.498)
Cr	-0.0144	-0.00496
	(0.0485)	(0.0143)

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Table 3. (continued)

Ito	0.0166	0.000147
	(0.0144)	(0.000130)
_cons	-3.499	-0.396
	(5.891)	(3.195)
N	412	424
R^2	0.917	0.672
adj. R^2	0.882	0.526

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3, column (1) gives the regression outcomes of the big business group, and column (2) provides those of the small business group. Important explanatory variables show that the coefficient of the interaction term "Treat × Post (did)" for the large enterprise sample is 0.926, which is strongly positive at the 1% significance level. Conversely, the coefficient of the interaction term in the small-scale enterprise sample is 0.0923, which is positive but does not reach the significance level. It means that the Ten Cities, Thousand Vehicles Project policy affects large companies more than small companies. Big companies usually have lots of money saved up and their money coming in stays about the same, so they can handle the risky and expensive work needed for research and development. So, they can react faster to policy initiatives and convert policy advantages into actual innovations.

3.6. Mediating variable test

This study employs a two-step approach for mechanism testing:Look at what the policy does to the financing limits first, then add some theory to see how those financing limits work with the policy and innovation. SA index is applied to assess the degree of financial constraint, taking into account the size and age of the company; the larger the value, the greater the constraint. We regress the SA index on the policy variable and controls, as specified in model (1). Results are shown in Table 4.

Table 4. Mediating variable test

	(1)
	Sa
did	-0.237^{***}
	(0.0839)
Size	-0.0859^{*}
	(0.0481)
Lev	-0.283
	(0.289)
Cashflow	-0.101
	(0.321)

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Table 4. (continued)

Roa	0.859
	(0.717)
Dual	-0.0516
	(0.0318)
Top1	0.198
	(0.382)
Board	0.000153
	(0.147)
Cr	0.00979
	(0.00701)
Ito	-0.000931
	(0.00531)
_cons	-1.693^{*}
	(0.979)
N	856
R^2	0.333
adj. R^2	0.115

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Column (1) of Table 4 shows that the coefficient of the interaction term is -0.237,significant at the 1% level. This indicates that following the implementation of the Ten Cities, Thousand Vehicles Project policy, financing constraints for firms in the treatment group were significantly reduced. Combined with the benchmark regression results showing the policy significantly promotes innovation, it can be inferred that this policy, by alleviating firms' financing constraints, increases the funds available for innovation, thereby driving an increase in technological innovation output.

4. Research conclusions and recommendations

4.1. Research findings

This study evaluates the impact of the "Ten Cities, Thousand Vehicles Project" policy on technological innovation within enterprises, employing a difference-in-differences approach to evaluate the effects of new energy vehicle promotion policies. Key findings are as follows:Firstly, the "Ten Cities, Thousand Vehicles Project" policy greatly promoted the technological advancement of new energy car companies. Policy lowered the company's R&D costs and market dangers via financial help, government purchases, and infrastructure building, thus promoting innovation activities and improving technological innovation results. Second, the policy has different levels of stimulating effects on innovation according to the size of the enterprise. Big companies react much better to the policy, changing policy benefits into creative accomplishments; little companies get less motivation effect because they don't have enough resources and R&D skills. Third, the finance constraint acts as a mediator for how the policy encourages companies to develop new technology.

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Relieving the financing restrictions makes it simpler for firms to obtain the funds necessary for doing new sorts of tasks, hence causing more fresh discoveries to take place.

4.2. Policy recommendations

Based on the above conclusions, the following recommendations are proposed:First, keep the promotion policies continuous and stable to build a constant policy atmosphere. New energy vehicle industry's innovation activities have huge investment, long cycle, high risk, so they are quite sensitive to the stability of policies. Don't make changes to policies often and don't finish phases early because it could prevent companies from being creative. Second, give different support programs for small and medium-sized companies. Small companies with few resources need to set aside special innovation funds, offer R&D loan interest subsidies, and build industry-academia-research collaboration platforms. Large corporations will share their R&D resources with smaller ones so as to make up for the latter's lack of capacity for innovation; third, find every way possible to get money and make rules to deal with problems about having enough money. Promote the development of credit products by banks and other financial institutions for innovative businesses, and use interest subsidies and risk compensation methods to guide credit resources to these companies. At the same time, improve the multi-level capital market system to increase the channels of equity financing for enterprises.

References

[1] Wei Shuyan, Guo Suilei. Policy Instrument Selection for China's New Energy Vehicle Industry Development [J]. Science and Technology Progress and Policy, 2014, 31(21): 99-105.
[2] Wang Xi, Xiong Yongqing. The Characteristics of "Suppression and Promotion" in China's New Energy Vehicle Policies and Their Impact on Innovation Incentive Performance: Supportive and Access-related Policies Perspective [J]. Science of Science and Technology Management, 2021, 42(11): 39-55.
[3] Zhou Yahong, Pu Yulu, Chen Shiyi, et al. Government Support and New Industry Development: New Energy Case [J]. Economic Research Journal, 2015, 50(6): 147-161.
[4] Guo Xiaodan, Li Jiajun. Empowering New Quality Productivity Through Demand-Side Policies for Emerging Industries: Paths and results [J]. Finance and trade economics, 2025(7): 22-38.
[5] Huang Yadi. An Empirical Analysis of the Impact of New Energy Vehicle Promotion Policies on Corporate Technological Innovation: Difference-in-Differences Approach Evidence [J]. Contemporary Economy, 2025(4): 95-102.
[6] Gao Weihe, Wang Deyong, Yin Hua. Regulatory Institutional Responses to Corporate Green Transformation: China's dual credit policy on passenger cars evidence [J]. Management World, 2025(4): 91-112.
[7] Xing Weibo, Tian Kun, Huang Kun, et al. How Do Government Regulatory Policies Promote Emerging Industries? — The Case of New Energy Vehicles [J]. Journal of Quantitative Economics and Technical Economics, 2026(2): 1-26.
[8] Chai Qiangfei, Xiao Zhongdong, Zhou Guanghui. Strategic Choices of Traditional Energy Vehicle Manufacturers Under the Dual Credit Policy [J]. Journal of Management Engineering, 2022, 36(1): 124-133.
[9] Yin Xiaona, Xiao Xiang, Jin Dongsheng. Research on Vehicle Purchase Tax Reduction Policies for New Energy Vehicles [J]. Journal of Finance Science, 2024(7): 121-127.
[10] Xu Hangmin, Ding Liyun. Taxation as a Catalyst for High-Quality Development in the New Energy Vehicle Industry: Theoretical logic, practical difficulties, policy suggestions [J]. Journal of Local Finance, 2025(9): 12-21.
[11] Yang Guochao, Liu Jing, Lian Peng, et al. Tax Incentives, R&D Manipulation and R&D Performance [J]. Economic Research Journal, 2017, 52(8): 110-124.
[12] Zhang Xuan, Liu Beibei, Wang Ting, et al. Credit Rent-Seeking, Financing Constraints and Corporate Innovation [J]. Economic Research Journal, 2017, 52(5): 161-174.
[13] Wang Ling. Financing Constraints, Corporate Employment and Enterprise Development [J]. Business and Management, 2022(10): 16-23.

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[14] Hu Conghui, Zhu Feifei, Qiu Huimin. Share Pledging, Risk Management and Major Shareholder Buybacks [J]. Journal of Finance, 2020(9): 190-206.
[15] Chen, J. T., Xing, J. W., & Xiao, J. J. Local Preferences and Regional Protectionism in the New Energy Vehicle Market [J]. Journal of Quantitative Economics and Technical Economics, 2023, 40(11): 117-136.