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The Effect of the Policy of Accelerated Depreciation of Fixed Assets

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Abstract

This paper utilizes the difference-in-differences model to explore the effect of the policy of Accelerated Depreciation of Fixed Assets through whether it can quantitively promote enterprise investment and qualitatively improve labor productivity. The sample is taken from the panel data of 2,257 listed companies from 2010 to 2017. The study found that the policy is not only conducive to promoting investment in fixed assets, but improves the labor productivity of enterprises. It is in line with the goals of policy design, promotes high-quality economic development, and provides evidence for further policy expansion.

Keywords

Accelerated depreciation; investment in fixed assets; labor productivity; difference-in-differences method.

1. INTRODUCTION

Since China's economic growth has slowed down, the manufacturing industry has entered a "new normal" situation. The problems caused by the rapid growth in the early stages gradually shows. Within the enterprise, the low-end products have excess manufacturing capacity, insufficient effective demand, mismatched resources, products with low added-value, and are lack of independent innovation capabilities and awareness. From the external aspect, the market competition is intensifying, demographic dividends are disappearing, financing is more difficult and its costs are increasing. These internal and external factors jointly restrict companies' investment to improve competitiveness and transformation and upgrading. Investment as one of the "troikas" driving economic growth is also declining. Therefore, it is especially important to promote enterprises to update equipment and tools in a timely manner, change the company's factor input structure, meet new consumer demand from the perspective of supply, promote technological upgrades, improve social productivity, and form new growth drivers.

In the context of the current supply-side reform, fiscal and tax policies have also been adjusted. In the past, the focus of demand-side management in the field of fiscal and taxation was to increase companies' after-tax income. The main measures taken were direct financial subsidies, tax reductions or reductions in tax rates. Under the current background of declining fiscal revenue, however, they should not be continued. While the focus of supply-side management is to reduce the marginal tax raterate so that it avoids the "heavy flood" of strong stimulus. The main measures taken are indirect investment credits, accelerated depreciation, etc. Among them, the accelerated depreciation policy has clear policy directions. First, it supports specifically for investment in research and development equipment for traditional industries, accelerates technological transformation and upgrading of traditional industries, and eliminates excess capacity. Second, it provides support for investment in fixed assets and

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equipment in emerging industries, and promotes the formation of new momentum in the manufacturing industry to accelerate their transformation and upgrading. Third, it supports the fixed asset investment of small and micro enterprises, reduces the cost burden on small and micro enterprises, and stimulates the vitality of small and micro enterprises. Through promoting enterprises to update production equipment, the policy effectively guides the behavior of micro-enterprises, which is consistent with the report of the 19th Party Congress. This report points out that China should accelerate the construction of a manufacturing power, accelerate the development of advanced manufacturing, support the optimization and upgrading of traditional industries, and promote China's industry to move into a higher level of the global value chain, and cultivate world-class advanced manufacturing clusters.

Since 2014, the accelerated depreciation tax policy have been continuously expanded, reflecting China's determination to give full play to tax incentives to encourage enterprises to update fixed assets. This article attempts to analyze and evaluate whether accelerated depreciation of fixed assets incentives can promote fixed-asset investment in terms of quantity, and whether it can promote labor productivity in manufacturing enterprises.

2. LITERATURE REVIEW

Most developed countries have introduced accelerated depreciation policies to encourage enterprises to upgrade equipment and adopt new technologies to face market competition. In order to encourage small and medium-sized enterprises to increase investment in emerging industries, Japan first implemented accelerated depreciation, and the United States also made provisions for accelerated depreciation in the Financial and Tax Law of 1954. Australia and Germany have corresponding regulations. Among the G20 countries, only Argentina, Brazil, China, Germany, and Mexico have a fixed asset depreciation of a period of 10 years. In contrast, Canada, France, the United States, and South Africa have fixed asset depreciation periods within 3 years. In addition, most countries along the “Belt and Road” have also issued accelerated depreciation tax policies, including Thailand, Romania, Lithuania and so on.

With the continuous promulgation of China's accelerated depreciation tax policy, many scholars have in-depth understanding of enterprises' feedback and evaluation of this policy through surveys, forums, and questionnaires. For example, the State Administration of Taxation of Hebei Province, Xia (2019), Tang (2017), etc., find that the breadth and depth of the use of the policy are significantly different from the government's expectations after the policy was introduced. They also find that there exists shortcomings such as lack of attractiveness and small industry scope. In addition, scholars also conduct substantive analysis from the direct and indirect effects of the policy to analyze its effects. In terms of direct effects, Zhuang et al. (2019) concludes that the policy can quickly reduce the actual tax burden of enterprises; Liu et al. (2017), Chen et al. (2018), Cao et al. (2017), Liu et al. (2018), Shen (2019) and Liu (2019) analyzes the impact of accelerated depreciation on corporate investment. In terms of indirect effects, Li et al. (2017), Han et al. (2019), Wang et al. (2019), Wu et al. (2019), Chen et al. (2018), Tang et al. (2018), Lu (2018) analyze the policy effect from different dimensions, including the company's research and development, enterprise value and overall productivity. However, their empirical results are different and fail to form a unified conclusion.

To sum up, due to the short introduction and rapid change of the New Accelerated Depreciation policy in the country, many scholars in China tend to use system analysis or case analysis to explore the accelerated depreciation tax benefits for corporate cash flow, corporate income tax burden, accounting profit, and tax differences, etc., so as to give enterprises the appropriate suggestions for the correct use of the policy. However, there are few studies on the quantitative analysis of the effect of this tax policy. Existing empirical studies due to the selection of different policies and the lack of comprehensive samples and short data periods

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have led to large differences in empirical conclusions from different literatures. Therefore, it is necessary to select micro-data of enterprises to conduct a comprehensive study on the economic effects of accelerated depreciation policies. This paper conducts empirical analysis from both qualitative and quantitative aspects, and comprehensively verifies the effect of accelerated depreciation policy.

3. INSTITUTIONAL BACKGROUND AND THEORETICAL ANALYSIS

From a macroeconomic background, China has experienced rapid growth in the past 30 years with adverse effects, such as excessive resource consumption, environmental impact, ecological degradation, and industrial inefficiency. Some industries have overcapacity and missed the best time of structural adjustment. China today has entered a new stage of rapid growth, showing a "new normal" situation. On the one hand, it is necessary to reduce production capacity for traditional industries, otherwise it will only lead to higher leverage and more severe overcapacity; on the other hand, as for industries that can bring new economic growth, it is a must to encourage investment and expand production capacity. At the micro-enterprise level, China's demographic dividend is gradually declining, and resources are gradually becoming scarce. Industries cannot continue to rely on the traditional extensive enterprise development model. Instead, they must accelerate the comprehensive mechanization and modernization of the manufacturing industry through the upgrading of fixed assets, and complete technological innovation in enterprises. However, the investment has a certain degree of irreversibility. The initial investment in updating fixed assets of enterprises is large, and the return period is long, coupled with the narrowing of financing channels, rising financing costs and other realistic factors. These make enterprises do not easily upgrade capital investment and fixed assets even if they have more advanced fixed assets. As a result, this greatly suppressed new economic momentum and achieved new growth.

In this context, the State issued the "Notice of the Ministry of Finance and the State Administration of Taxation on Improving the Enterprise Income Tax Policies for the Accelerated Depreciation of Fixed Assets" (Caishui [2014] No. 75), which was mainly targeted at biopharmaceutical manufacturing, special equipment manufacturing, railways, shipping, the aerospace and other transportation equipment manufacturing industry, computer, communications and other electronic equipment manufacturing industry, instrumentation manufacturing industry, information transmission, software and information technology service industry (referred to as "six major industries"). These industries can accelerate depreciation. The small and micro enterprises with a unit value of less than 1 million in the six major industries can be deducted at one time. The instruments and equipment developed by all enterprises with a unit value not exceeding 1 million can be deducted at one time. These decisions reflected the government's support for transformation of traditional industries to research and development industry, support for emerging industries, and special support for small and micro enterprises. Accelerated depreciation taxation on fixed assets has become an important part of China's structural reform. Later, the“Notice of the Ministry of Finance and the State Administration of Taxation on Further Improving the Enterprise Income Tax Policies for the Accelerated Depreciation of Fixed Assets” (Caishui [2015] No. 106) promulgated in 2015 strengthened the former policy. It reflected China's compliance with the trend of new technological revolution. Industrial, textile, machinery, automobile (referred to as the "four major areas") were given the same accelerated depreciation tax concessions. Then, can the policy promote enterprises to invest in fixed assets, and promote the high-quality development of the economy in essence? This article analyzes from the two aspects of quantitative asset investment and qualitative labor productivity improvement.

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3.1. Accelerated Depreciation of Fixed Assets Policy and Investment in Fixed Assets

The direct purpose of the accelerated depreciation policy is to promote enterprises' investment in fixed assets. There is currently no consensus in the academic community on the relationship between accelerated depreciation policy and fixed asset investment.

Some scholars believe that the policy will promote enterprise's purchase of fixed assets and increase the scale of fixed asset investment. the reasons are as follows:

First, the policy eases the financing pressure. The interest-free loan effect indicates that companies in four areas in six industries have obtained tax deferral effects, which has eased capital pressure. In terms of endogenous financing (Cao et al., 2017), accelerated depreciation of fixed assets is used, and depreciation costs are shifted forward. In the first tax year when it is put into use, the depreciation income of fixed asset depreciation is strong, and policy dividends can be realized. It also contributes to the release of cash flow, making up for the shortage of cash flow for the purchase of fixed assets, and as a result, eases the current tension of the corporate capital chain. In terms of external financing, the support information released by the policy on key national industries further eased the pressure on financing.

Second, the policy meets the cost compensation requirements. Traditional depreciation can not reflect the real depletion of fixed assets, and cannot promote the rapid recovery of initial investment for a new round of investment either. However, accelerated depreciation reflects the loss of asset use, including value depreciation due to external inflation and internal technological progress and physical loss. It also accelerates the pace of recovery of investment by enterprises, so that the cost of fixed asset investment is compensated as soon as possible, in line with the shortening of economic cycles today. Enterprises have the ability to purchase new and more advanced and efficient fixed assets. Even if they need to pay less taxes to the government at a later stage, they can purchase new fixed assets to accelerate depreciation to offset the tax burden, reduce corporate tax burden, and form a virtuous circle.

Third, the policy threshold is low. In the past, most tax preferences have high entry barriers, and often they need to meet stricter conditions, and the tax department must also review and approve them. The threshold for accelerated depreciation policy is relatively low, so enterprises can make their choices and weigh independently (Tang, 2017).

However, some scholars believe that accelerated depreciation policy will not promote the scale of investment in fixed assets. the reasons are as follows:

First, the incentives are tiny. Accelerated depreciation has no substantial tax reduction effect (Hebei Provincial Bureau of Taxation, Fixed Assets Accelerated Depreciation Task Force, 2015; Tang, 2017). The interest-free loan effect of accelerated depreciation has not changed the total taxable income of the enterprise, but only changed the tax payment time distribution so as to obtain the time value of money. The resulting income is not enough to motivate enterprises to invest in fixed assets. In addition, tax delays may cause funding difficulties in subsequent tax years, which in turn may lead to tax-related risks.

Second, the willingness of enterprises is not strong. According to the interpretation of the preferential depreciation taxation policy, it is stipulated that the tax treatment and accounting treatment of fixed assets can adopt inconsistent methods. From the perspective of management, according to the principal-agent theory, managers do not aim at maximizing corporate value. For enterprises, the accelerated depreciation policy will only affect the current taxable income and cash flow of the enterprise, and will not affect the current accounting profit. When the enterprise only focuses on accounting profit, the accelerated depreciation policy of fixed assets may lead to increased depreciation. It will reduce the company's accounting profits, which often do not match the management's concerns. For financial personnel, the accelerating policy will cause tax differences and increase the difficulty of accounting. If accounting is still based on the

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straight-line method of depreciation, which is inconsistent with the tax law treatment, tax adjustments need to be made to generate deferred income tax liabilities. This increases the difficulty of accounting, increases the workload of corporate financial staff, and generates a challenge of professionalism for corporate financial staff.

Third, the cost of taking the benefits from the policy is high. According to the announcement on issues related to the accelerated depreciation policy of fixed assets, if an enterprise chooses to adopt the accelerated depreciation policy, it should provide relevant documents such as invoices for purchase of fixed assets, accounting vouchers, etc. for reference, and a ledger should be established. In the prepayment declaration, it is necessary to submit the prepayment statistics table at the same time. In the annual declaration, post-mortem filing management is performed and relevant information is submitted as required, which will undoubtedly reduce the willingness of the enterprise to apply for accelerated depreciation policy.

Based on theoretical analysis, it is believed that accelerated depreciation can promote enterprises' investment in fixed assets in terms of quantity. Based on this, the hypotheses proposed in this article are as follows:

H1: Accelerated depreciation of fixed assets have an incentive effect on manufacturing enterprises' investment in fixed assets.

3.2. Accelerating Depreciation Tax Benefits and High-Quality Development

The direct effect of accelerated depreciation policy is to promote the purchase of fixed assets by enterprises, but policy makers and enterprises are more concerned about completing industrial upgrading and improving resource allocation efficiency through the updating of fixed assets. The ultimate goal is to promote high-quality economic development. At present, China's economic external demand is weak, leverage is too high, and the demographic dividend is gradually disappearing. The endogenous recovery of the Chinese economy must rely on technological progress and institutional reforms to improve production efficiency. The accelerated depreciation taxation of fixed assets directly encourages enterprises to eliminate old equipment, introduce new equipment and new processes, and directly bring technological progress. Further analysis of the role of policies in promoting the high-quality development of manufacturing enterprises lies in the following three points.

First, the resource allocation of factor markets has been improved. Accelerated depreciation policy provides corresponding tax benefits for fixed assets in the "six major industries and four major areas", but for other traditional industries only tax incentives are available for research and development equipment. The reason for the policy requirement is that the factor market in traditional industries has been distorted for a long time, and excess capacity has emerged. However, the lack of factor input in emerging industries makes it difficult for enterprises to reach the optimal production scale. One of the policy goals of accelerating depreciation is to "adjust the structure". By improving the allocation of factor market resources, it promotes the upgrading of traditional industries and the development of strategic emerging industries to improve the production efficiency.

Second, the policy eases financing constraints. When enterprises face higher financing costs, the high financial risks will restrict their ability to improve production efficiency. Investment in fixed assets often needs to occupy a large amount of capital. Enterprises usually update their equipment after the assets are overworked during the production process. As mentioned above, accelerated depreciation eases the financing constraints of enterprises from both internal and external financing. It reduces the tax burden of enterprises, increases net income after tax and liquidity, provides funding for enterprises to expand reproduction, completes internal accumulation in a short period of time, reduces the cost of capital, and improves the company's

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expectations for the future. The policy also encourages corporate investment on profitable projects, which improves production efficiency and achieves high-quality development.

Third, the policy encourages enterprises to invest in research and development. Accelerated depreciation policy encourages companies to purchase research and development equipment. Meanwhile the increase in research and development efficiency has played an important role in promoting the growth of production efficiency. At present, global integration is accelerating, emerging technologies are developing vigorously, and the cycle of technological progress has been shortened due to knowledge diffusion and technology spillovers. The improvement of enterprises' independent research and development capabilities is conducive to reducing enterprise production costs and dependence on labor, and promoting technological progress. In addition, when companies purchase assets for research and development, the two policies, accelerated depreciation policy along with China's policy on additional deductions for research and development costs, further reduce the current taxable income tax, alleviate the cash pressure of the enterprise. As a result, there are more funds used for research and development investment to enhance the ability and willingness of enterprises to invest in the research and development.

Based on the above analysis, the following hypothesis is proposed:

H2: Accelerated depreciation tax of fixed assets has an incentive effect on high-quality development.

4. RESEARCH DESIGN

4.1. Sample Selection and Data Collection

This paper selects listed companies in China from 2010 to 2017 as initial research samples. The reason for selecting the sample interval in this way is that the accelerated depreciation tax policy was introduced in 2014 and 2015, so 2014-2017 is regarded as the post-policy period. Year 2018 is not selected to avoid the interference caused by the further expansion of the policy. As a comparison, this article selects 2010-2013 as the period before the policy was introduced. The sample was screened as follows: (1) The paper stipulates that the fixed assets newly purchased by enterprises in six industries and four areas can adopt the accelerated depreciation policy. Since the biopharmaceutical manufacturing industry is a small category in the C27 pharmaceutical manufacturing industry, and daily use chemical product manufacturing is a small class of C26 chemical raw materials and chemicals, they cannot be directly selected from the CSMAR database. Therefore, this paper selects listed companies that belong to the biopharmaceutical manufacturing industry and companies that belong to the six major industries according to the specific industry and main products information in the WIND database. In addition, although there are other preferential tax policies, they affects small, medium and micro enterprises or all enterprises in the six major industries. The data selected in this article are listed companies, so other policies will not affect the sample selection and conclusion parameters. (2) The paper deletes listed companies in the financial and insurance industry; (3) The paper deletes companies with a sample interval of ST or * ST status; (4) The paper deletes companies whose listing time was later than 2014; (6) The paper deletes listed companies with incomplete data. In order to avoid the influence of extreme values on the results, this paper performs a 1% bilateral tailing treatment on all continuous variables. The industry screening comes from WIND database, and the rest of the corporate data comes from the CSMAR database. Data processing and analysis were performed using Stata 13.1.

4.2. Variable Definition and Data Description

Regarding the effect of the "quantity" of accelerated depreciation policy, this paper measures this effect by the size of the company's investment. Most of the existing research using new fixed

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assets has several methods. Method 1: According to the balance sheet measurement (Tong et al., 2005; Cao et al., 2017; Liu, 2017; Liu et al., 2018), this measurement can be further subdivided into the ratio of investment to capital stock (I / K) or taking the logarithm of the new fixed assets (InI). The investment (I) is the annual value of the fixed asset investment, that is, the net value of the fixed assets in the current year less the net value of the fixed assets in the previous period and plus the depreciation amount of the current fixed assets. Total assets (K) is the total assets at the beginning of the year. Method two measures according to the cash flow statement (Chen et al., 2017), specifically the ratio of cash outflows to assets for the purchase of fixed assets, intangible assets and other long-term assets. This article further subdivides the scale of fixed asset investment, specifically to measure the company's investment scale by adding new fixed assets in the current period disclosed in the notes to the financial statements, and removing newly added houses and buildings, so that the investment scale authentically reflects the new impact of fixed assets such as machinery and equipment. In the robustness test, the ratio of the cash flow of purchasing fixed assets, intangible assets, and other long-term assets to total assets will be used as a substitute variable.

Regarding the "qualitative" effect of accelerating depreciation policy, companies generally use total factor productivity or labor productivity to measure whether it is conducive to high-quality development. Total factor productivity is more comprehensive and it contains more information at the enterprise level. However, the methods for measuring total factor productivity show a variety of characteristics. The measurement results of total factor productivity vary greatly between different methods. Even if using the same method, different parameter settings still leads to different results (Wang et al., 2019). Therefore, labor productivity that has a long-term stable co-growth relationship with total factor productivity (Li et al., 2018) has the characteristics of easy calculation and strong comparability, and is also used to measure whether it contributes to high-quality development. Labor productivity is calculated as the logarithm of the ratio of the number of employees with operating income.

Regarding explanatory variables, Post is a time dummy variable. Although Caishui [2014] No. 75 was promulgated in October 2014, it is stipulated that fixed assets purchased in six major industries on January 1, 2014 can use accelerated depreciation. Therefore, Post1 takes 1 when the sample interval is 2014-2017, which is after the implementation of the accelerated depreciation policy, and takes 0 when the sample interval is 2010-2013, that is, before the implementation of the accelerated depreciation policy. For the same reason, Caishui [2015] No. 106 stipulates that the fixed assets purchased by the four major areas on January 1, 2015 can use accelerated depreciation. Therefore, Post2 takes 1 when the sample period in Post2 is 2015-2017, which is after the implementation of the accelerated depreciation policy. It takes 0 when the sample interval is 2010-2014, which is before the implementation of accelerated depreciation policy. Treat is a group dummy variable. Treat1 takes the value of 1 when the sample belongs to the six industries, and takes 0 when the sample does not belong to the six industries. Treat2 takes a value of 1 when the sample belongs to the four major areas, and a value of 0 if it does not belong to the four major areas. DID is the crossover term of the above two variables and is a key variable of the model. It is used to measure the net effect of accelerated depreciation tax benefits on enterprises. Its coefficient indicates the utility coefficient of the accelerated depreciation policy, which is used to reflect the impact of accelerated depreciation tax preference on the enterprise after controlling other factors. If the accelerated depreciation tax incentives have a promoting effect on enterprises, the regression coefficient of DID is significantly positive.

This article refers to the practice of Liu et al. (2017), and selects the size of the enterprise, the asset-liability ratio (Lev), the Cashflow, the return on assets (Roa), and the age of the enterprise (Age) as the controlling variables in testing accelerated depreciation in enterprise's fixed assets. This article refers to the practice of Xue et al. (2019), and selects the enterprise size (Size),

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economic development level (PGDP), profitability (Roa), government subsidy (Sub), and capital intensity (Ppeat) as controlling variables. This article also controls the fixed effects of industry and year. The specific meanings of the variables are shown in Table 1.

Table 1. Variable definition

Variable name	Economic meaning	Measurement method	Variable type
Invest	fixed asset investment scale	Except for houses, take the logarithm of new fixed assets in this period; Cash outflow of the purchase of fixed assets, intangible assets and other long-term assets / total assets	Explained variable
TFP_LP	Total factor productivity	LP measurement method (see formula 1)	Explained variable
Labpro	Labor Productivity	In (income / employer number)	Explained variable
Post	annual dummy variable	Takes 1 in and after the year of policy promulgation, otherwise takes 0	explanatory variables
Treat	enterprise dummy variable	Takes 1 if it's in six industries or four areas, otherwise takes 0	explanatory variables
DID	dummy variable cross	Post1×Treat1+Post2×Treat2	explanatory variables
Size	Enterprise Size	In (total assets)	Control Variable
Lev	Asset-Liability Ratio Total Liability	total debts/ total assets	Control Variable
Cashflow	Cash holdings	opening balance of cash and cash equivalent/ total assets	Control Variable
Roa	Return on Assets	Net profit/total assets	Control Variable
Age	Corporate Age	In (current year to listing year)	Control Variable
Pgdp	Capital intensity	In (provincial gross domestic product)	Control Variable
Sub	Government subsidies	government grants / operating income	Control Variable
Ppeat	Capital Intensity	Net Fixed Assets / Total Assets	Control Variable

Table 2 gives descriptive statistics of the main variables. Descriptive statistics show that the mean and median of the explanatory variables are very close, and the standard deviation is relatively small, indicating that there is not much difference in growth between different enterprises. The mean of Treat is 0.50, indicating that companies affected by the policy account for about 50% of all companies. The mean of Soe is 0.41, indicating that approximately 41% of companies are state-owned enterprises. The characteristics of other variables are basically consistent with existing research.

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Table 2. Descriptive statistics of main variables

Variable name	mean	standard deviation	minimum	median	maximum
Invest1	17.73	2.08	12.12	17.73	22.95
Invest2	0.05	0.05	0.00	0.04	0.24
TFP_LP	15.78	1.13	5.48	15.69	20.58
Labpro	13.75	0.92	11.84	13.64	16.58
Treat	0.50	0.50	0	1	1
Sizeinvest	22.08	1.34	16.12	21.91	28.51
lev	0.45	0.22	0.05	0.44	0.95
Cashflow	0.16	0.14	0.01	0.12	0.68
Roainvest	0.04	0.05	-0.18	0.03	0.19
Sizetfp	22.13	1.29	19.47	21.97	26.02
Pgdp	10.95	0.43	9.91	10.99	11.77
Roatfp	0.04	0.05	-0.18	0.04	0.20
Sub	0.01	0.02	0.00	0.01	0.12
Ppeta	0.22	0.17	0.00	0.19	0.72

4.3. Model Design

Accelerated depreciation policy can be regarded as an exogenous event and this feature provides a quasi-natural experimental scenario for the study in this paper. Based on the above analysis and basic assumptions, this paper constructs a difference-in-differences model as follows:

$$Invest_{i,t} = \alpha_0 + \alpha_1 DID_{i,t} + \alpha_2 Controls_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \quad \text{(Model 1)}$$

$$Labpro_{i,t} = \alpha_0 + \alpha_1 DID_{i,t} + \alpha_2 Controls_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \quad \text{(Model 2)}$$

The models also set the annual fixed effect and industry fixed effect. In order to reduce the effect of corporate individuals and of time on the identification effect in this paper, a two-way fixed effect model is used for empirical testing. ε is a random interference term.

4.4. Inspection of Applicable Methods for Difference-In-Differences Model

The difference-in-differences method generally requires to verify whether the parallel trend assumption is satisfied. In this paper, this is to observe whether the control group and the experimental group have a common change trend before the policy is implemented. This article introduces the values of Treat × Year2012 and Treat × Year2013 in the regression. The value of Year2012 is 1 in 2012 and the value in other years is 0. The value of Year2013 is 1 in 2013 and the value in other years is 0. The results are as follows: As shown in Table 3, the coefficients of Treat × Year2012 and Treat × Year2013 are not significant. This shows that before the introduction of accelerated depreciation policy the labor productivity and fixed asset investment of the experimental group and the control group did not change significantly, which indicates that the parallel trend test of the double difference method is satisfied.

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Table 3. Parallel Trend Test

	Scale of fixed asset investment			Labor productivity	
	(1)	(2)		(1)	(2)
DID	0.0708* (0.04)	0.0791** (0.04)	DID	0.0507*** (0.02)	0.0330** (0.02)
Treat×Year2012	-0.0059 (0.06)	0.0402 (0.05)	Treat×Year2012	-0.0158 (0.02)	0.0001 (0.02)
Treat×Year2013	-0.0821 (0.06)	-0.0124 (0.05)	Treat×Year2013	-0.0221 (0.02)	-0.0124 (0.02)
Size		1.2951*** (0.02)	Size		0.1932*** (0.01)
Lev		-0.3113*** (0.09)	Pgdp		0.0334 (0.07)
Cashflow		-0.5854*** (0.10)	Roa		2.2942*** (0.08)
Age		-0.2639*** (0.04)	Sub		-3.1450*** (0.23)
Roa		-0.1956 (0.22)	Ppeta		-0.5543*** (0.04)
Cons	17.4287*** (0.03)	-9.8486*** (0.45)	Cons	17.4287*** (0.01)	-9.8486*** (0.72)
Year FE	Yes	Yes	Year FE	Yes	Yes
Firm FE	Yes	Yes	Firm FE	Yes	Yes
N	16669	16669	N	17503	17503
R2(within)	0.0210	0.2445	R2(within)	0.0683	0.1783

Note: *, **, *** indicate significance levels of 10%, 5%, and 1%, respectively

5. EMPIRICAL RESULTS AND ANALYSIS

5.1. Benchmark Regression Results and Analysis

To test hypothesis 1, the impact of accelerated depreciation policy on the size of fixed asset investment, the first column of Table 4 shows that the coefficient of DID is significantly positive at the level of 1% without adding any control variable; the second column shows that after adding all control variables, the coefficient of DID is significantly positive at the 5% level. The results reflects that accelerated policy have an incentive effect on corporate fixed asset investment, and Hypothesis 1 has been verified. In terms of control variables, the size of the enterprise (Size) and the fixed asset investment show a positive relationship at a significant level of 1%, indicating that the larger the enterprise size, the more it is necessary to invest in fixed assets. However, the asset-liability ratio (Lev), cash flow status (Cash), Age, and fixed asset

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investment show a significant negative correlation, indicating that the company's debt increases, it will not easily buy fixed assets. The longer the listing period is, the more stable the company's operating conditions will be, and the less fixed asset renewal they will have. More abundant company cash flow may result in that the company will more likely to invest funds in the financial industry to obtain higher returns, which has a certain connection with the current physical industry's "destabilization". Finally, the return on assets (Roa) has no significant impact on corporate fixed assets investment.

In order to test Hypothesis 2, the impact of accelerated depreciation policy on labor productivity, the third column of Table 4 shows that without any control variable, the DID coefficient is significantly positive at the level of 1%. The second column shows that after all control variables are added, the DID coefficient was significantly positive at the 5% level. The results indicates that accelerated depreciation policy has an incentive effect on high-quality development, and Hypothesis 2 has been verified. In terms of control variables, the size of the enterprise (Size) and return on assets (Roa) and the total factor productivity of the enterprise show a positive relationship at a significant level of 1%, indicating that the larger the enterprise scale and the higher the return on assets of the enterprise, the higher the total factor productivity. the government subsidy intensity (Sub) and capital intensiveness (Ppeta) have a negative relationship with the total factor productivity of the enterprise at a significant level of 1%, indicating that government subsidies enhance the inertia of the enterprise and affect the total factor productivity of the enterprise with a crowding-out effect. A high degree of capital intensiveness will reduce the capital liquidity of the enterprise, which is not conducive to the improvement of the total factor productivity of the enterprise. However, provincial GDP per capita (Pgdp) has no significant effect on the improvement of the total factor productivity of the enterprise.

Table 4. Benchmark regression results and analysis

Explained variable	Fixed asset investment size		Explained variable	Labor productivity	
	(1)	(2)		(1)	(2)
DID	0.0917*** (0.0059)	0.0736** (0.0137)	DID	0.0570*** (0.0003)	0.0351** (0.0169)
Size		1.2951*** (0.0000)	Size		0.1932*** (0.0000)
Lev		-0.3119*** (0.0005)	Pgdp		0.0344 (0.6019)
Cashflow		-0.5848*** (0.0000)	Roa		2.2947*** (0.0000)
Age		-0.2648*** (0.0000)	Sub		-3.1453*** (0.0000)
Roa		-0.1982 (0.3596)	Ppeta		-0.5543*** (0.0000)
Cons	17.4270*** (0.0000)	-9.8474*** (0.0000)	Cons	13.6111*** (0.0000)	9.1206*** (0.0000)
Year FE	Yes	Yes	Year FE	Yes	Yes
Firm FE	Yes	Yes	Firm FE	Yes	Yes
N	16669	16669	N	17503	17503
R2 (within)	0.0209	0.2444	R2 (within)	0.0677	0.1783

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5.2. Robustness Test

5.2.1 Placebo test

The placebo test is often used as a robustness test in the difference-in-differences method. It is to verify whether the increase in investment in fixed assets and the growth in the total factor growth rate reflect the impact of the accelerated depreciation policy. On one hand, if the growth is caused by other factors, the regression result will also be significant when the policy is implemented in the year when there is no policy implementation. On the other hand, if the regression result is significant only during the survey period, it is indeed a result of the hypothetical accelerated depreciation. Therefore, this article selects the period before the introduction of the accelerated depreciation policy as the research period (2010-2013), and constructs the time variables After_2012 and After_2013. After_2012 is set to 1 in 2012 and 2013, otherwise it is 0; After_2013 is set at the value of 1 in 2013, otherwise it is 0. The results of the difference-in-differences method are shown in Table 5-1. The coefficients of After_2012 and After_2013 are not significant, which indicates that before the policy was introduced, the fixed asset investment and labor productivity of the experimental group and the control group did not change significantly. Therefore, the possibility that the factors before the introduction of accelerated depreciation policy may lead to the above results is excluded.

Table 5. Placebo test

Explained variable	Fixed asset investment size		Explained variable	Labor productivity	
	(1)	(2)		(1)	(2)
Treat×After_2012	0.0264 (0.5535)		Treat×After_2012	-0.0161 (0.3054)	
Treat×After_2013		-0.0392 (0.4120)	Treat×After_2013		-0.0159 (0.2803)
Size	1.4140*** (0.0000)	1.4117*** (0.0000)	Size	0.1456*** (0.0000)	0.1461*** (0.0000)
Lev	-0.2089 (0.2439)	-0.2116 (0.2378)	Pgdp	-0.0580 (0.6472)	-0.0552 (0.6634)
Cashflow	-0.3444* (0.0520)	-0.3487* (0.0491)	Roa	1.8315*** (0.0000)	1.8342*** (0.0000)
Age	-0.0264 (0.7056)	-0.0110 (0.8747)	Sub	-2.2933*** (0.0000)	-2.2972*** (0.0000)
Roa	-0.0980 (0.7761)	-0.0989 (0.7740)	Ppeta	-0.2924*** (0.0000)	-0.2969*** (0.0000)
Cons	17.4270*** (0.0000)	-9.8474*** (0.0000)	Cons	11.0907*** (0.0000)	11.0492*** (0.0000)
Year FE	Yes	Yes	Year FE	Yes	Yes
Firm FE	Yes	Yes	Firm FE	Yes	Yes
N	7681	7681	N	8503	8503
R2 (within)	0.1696	0.1696	R2 (within)	0.0758	0.0756

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5.2.2 Transforming the explained variables

The cash flow statement is used to measure the fixed asset investment scale to transform the explained variable of the investment scale. Model 3 uses LP method to calculate the explained variable of total factor productivity. It is as follows:

$$Y_{i,t} = \beta_0 + \beta_k K_{i,t} + \beta_l L_{i,t} + \beta_m M_{i,t} + \omega_{i,t} + \varepsilon_{i,t} \quad \text{(Model 3)}$$

Among them, Y represents the total output of the enterprise, which is the logarithm of operating income; K represents the capital investment of the enterprise, which is the logarithm of the company's capital stock; L, which represents the manpower input of the enterprise, is the logarithm of the number of employees; M represents the intermediate input of the enterprise and is the logarithm of the cash paid by the enterprise for purchasing goods and receiving labor services; the subscripts i and t indicate the enterprise and the year respectively; and the logarithm of ω is used to calculate the TFP of the enterprise.

Table 6 shows the regression results. The coefficient of DID in the scale of investment in fixed assets is significantly positive at the level of 1%, and the coefficient of DID in total factor productivity is significantly positive at the level of 5%. This further validates the effect of the accelerated depreciation policy in terms of "quantity" and "quality".

Table 6. Transformed Explained Variable Test

Explained variable	Fixed asset investment size	Explained variable	Total factor productivity
DID	0.0030*** (0.0046)	DID	0.0334** (0.0055)
Size	0.0074*** (0.0000)	Size	0.5826*** (0.0000)
Lev	-0.0034*** (0.2817)	Pgdp	0.0437 (0.4174)
Cashflow	0.0277*** (0.0000)	Roa	2.3990*** (0.0000)
Age	-0.0202*** (0.0000)	Sub	-4.7142*** (0.0000)
Roa	0.0484*** (0.0000)	Ppeta	-0.7254*** (0.0000)
Cons	-0.0704*** (0.0000)	Cons	2.5710*** (0.0000)
Year FE	Yes	Year FE	Yes
Firm FE	Yes	Firm FE	Yes
N	16669	N	17503
R2 (within)	0.2444	R2 (within)	0.5323

6. CONCLUSION

This article considers the policy of accelerated depreciation of fixed assets in six industries and four major areas stipulated in Caishui [2014] No. 75 and [2015] No. 106 as a quasi-natural experiment. This paper utilizes the difference-in-differences model to explore the effect of the policy of Accelerated Depreciation of Fixed Assets through whether it can quantitively promote enterprise investment and qualitatively improve labor productivity. The sample is taken from

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the panel data of 2,257 listed companies from 2010 to 2017. The study found that the policy is conducive to promoting investment in fixed assets, improves the labor productivity of enterprises, and accelerates economic development. Caishui [2019] No. 66 further stipulates that the industry scope of fixed asset accelerated depreciation concessions is expanded to all manufacturing sectors. Based on the results of the study, this article believes that the accelerated depreciation policy of fixed assets is in line with the goals of supply-side reform, and has promoted the development of enterprises in terms of both qualitative and quantitative aspects. The expansion of the policy has its evidence, and further policy bonus can be achieved.

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