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## Research Article

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# Assessing the effects of the Environmental Protection Tax Law on heavily polluting firms in China

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## **ABSTRACT**

In 2016, China enacted a law on environmental protection tax (EPTL2016) to promote the transformation and upgrading of heavily polluting industries through tax leverage. Using the panel data of China's listed companies, this study assesses the treatment effects of environmental protection tax law on the transformation and upgrading of heavily polluting firms by incorporating the intermediary role of the financial market. Empirical evidence shows that the EPTL2016 has significantly reduced the innovation investment and productivity of heavily polluting firms but has no significant effect on fixed-asset investment. We also find that the EPTL2016 reduces the supply of bank loans to heavily polluting firms and increases the value of growth options for private enterprises and the efficiency of the supply of long-term loans to heavily polluting firms. Although the environmental policy of EPTL2016 benefits the transformation and upgrading of heavily polluting industries in many aspects, it generally hinders the industrial upgrading because of the reduction of bank loans.

**KEYWORDS:** Environmental protection tax, firm upgrading, heavily polluting industries, financial market

## 1. Introduction

China is under increasing pressure to conserve resources and protect the environment because of the size of its population and its rapidly growing economy. Hence, to restrain the excessive consumption of environmental resources and meet the increasing environmental demands for the residents, China has adopted various instruments of environment regulations to promote the transformation and upgrading of heavily polluting industries (Wen and Lee, 2020a). Tax policy in environmental protection, which is the market incentive instrument, is widely used to push micro-enterprises to invest in environment and improve environmental performance. In 2016, China promulgated its first law on the environmental protection tax to promote the development of an ecological civilization, the “Environmental Protection Tax Law of the People's Republic of China”. This tax policy, which is binding legally on the environmental behavior of micro-enterprises, aims at internalizing the costs of polluting emissions and developing a green economy in the long-term.

According to the principle of environmental protection tax law, heavily polluting firms would have to pay more environmental tax. The environmental protection tax is more stringent than the pollutant discharge fee, and polluters cannot negotiate with local governments to reduce their payments (Damania et al., 2020). Although the EPTL2016 presents an adverse shock, it may compel the heavily polluting industry to upgrade its equipment and technology. On the one hand, polluters have a stronger incentive to invest in green technologies to comply with the requirements of environmental regulations, which is the Porter hypothesis (Porter and Van der Linde, 1995). On the other hand, it also affects the decisions and behaviors of enterprise stakeholders, especially commercial banks and investors in capital markets (Hamilton, 1995; Viard and Fu, 2015; Ren et al., 2018). That is, heavily polluting firms may face severe financial constraints after policy intervention, leading to a lack of innovation capital for transformation and upgrading activities. Thus, the key questions we explore are the following: How does the EPTL2016 affect the transformation and upgrading of heavily polluting firms through financial markets? Does this policy affect the credit allocation of banks to enterprises and the equity value of heavily polluting firms?

The double dividend effect of environmental taxes, which was first mentioned by the British welfare economist Pigou (1932), has been mentioned constantly in literature. The double dividend effect has two meanings. The first meaning is the environmental dividend effect, which indicates that environmental tax can reduce environmental pollution (Symons and Proops, 1994). The second meaning is the social dividend effect, which consists of the efficiency dividend (Goulder, 1995; Komen and Peerlings, 1999), the income distribution dividend (Budzinski, 2002; Van Heerden et al., 2006), and the employment dividend (Carraro et al., 1996; Strand, 1999; Fæhn et al., 2009). A consistent conclusion on the environmental dividend effect of environmental tax can be found in the literature. However, no consensus has been reached on the social dividend effect. Some studies hold opposite opinions that environmental tax may bring a redundant cost for firms (Parry, 1995), increase the unemployment rate (Bovenberg and De Mooij, 1994), and lead to unequal income distribution (Brännlund and Nordström, 2004).

Environmental regulation is the general term for related policies and measures formulated by the

government for environmental protection. The instruments of environmental regulation can be summarized into three categories, namely, the command-and-control instruments, the market-incentive instruments, and the voluntary environment instruments. Two opposing viewpoints on the relationship between environmental regulation and enterprise competitiveness can be found in the literature, namely, the theory of Compliance Cost and the theory of Innovation Compensation. Neoclassical economics believes that environmental regulations can internalize the externality of pollution while increasing pollution costs, thereby reducing enterprise productivity and enterprise competitiveness. The theory of Innovation Compensation or the Porter hypothesis, holds that environmental regulations promote firms to carry out innovation activities, apply green technologies, and improve the productivity of related firms.

The transformation and upgrading of heavily polluting firms can be realized through innovation activities that require financial support. However, obtaining innovation funds only through internal financing channels is far from enough for these firms. As the most extensive and largest financing market, the financial market provides financial support for innovation activities and plays a vital role in the transformation and upgrading of enterprises. The bank credit market and the stock market respectively represent the main debt financing channels and equity financing channels of listed enterprises (Zhang and Du, 2020). In developing countries, capital markets are always imperfect, and enterprises are more dependent on the indirect financing of bank lending for long-term investment activities and risky investment activities (Atanassov, 2016). Moreover, the financial market responds quickly to macroeconomic policies and is an important channel that influences the effect of environmental policy or EPTL2016 in this study.

Although a considerable number of works that investigate the effects of environmental taxes can be found in the literature, further discussion on this topic is still necessary. First, existing literature focuses mainly on the macroeconomic effects, such as the efficiency effect, the employment effect, and the distribution effects. However, these studies focus less attention on the effects on enterprise behavior, especially for the heavily polluting firms. Environmental tax, as a micro-level policy, has a profound effect on the investment and financing behaviors of enterprises. Second, previous studies measure environmental tax mainly by using alternative indicators, such as emission charges or taxes related to the environment, which are highly subjective and endogenous. Third, most of the existing literature discusses the effect on enterprise behaviors while ignoring the role of the financial market. The EPTL2016 serves as a signal of enterprise operation pressure for heavily polluting firms, and the relevant stakeholders in the financial market respond quickly. Therefore, the financial market may affect the investment and financing behavior of heavily polluting firms.

Based on the panel data of China's listed companies, this paper attempts to investigate the effects of EPTL2016 on the transformation and upgrading of heavily polluting firms by incorporating the intermediary role of the financial market. Specifically, this study focuses on the mechanism of bank loans, their allocation efficiency, and the equity value of enterprises. This study treats the introduction of EPTL2016 as a quasi-experiment and uses the differences-in-differences (DID) method to assess the treatment effects of environmental protection tax law on the heavily polluting firms. The DID method can effectively avoid the endogenous problem of the measurement of

environmental taxes and identify the causality. This study enriches the relevant literature on environmental regulation theory. This study attaches importance to the bank credit and equity value of enterprises and examines the heterogeneity of policy intervention effects for different enterprises. It provides an empirical basis for the reform of the environmental protection tax system. More importantly, it enriches the literature on the role of the financial market in the intervention effects of environmental policy.

## **2. Environmental tax law and its effect on firm upgrading in theory**

### **2.1. Reform of environmental tax in China.**

China has introduced a series of laws on environmental protection, including the Environmental Protection Law, the Radioactive Pollution Prevention Law, the Environmental Impact Assessment Law, the Clean Production Promotion Law, and so on. These laws cover almost all aspects of environmental pollution, but the environmental performance of heavily polluting firms has not been improved enough to meet residents' expectations. In the "Comprehensive Work Plan for Energy Conservation and Emission Reduction" issued by the State Council in May 2007, China first proposed to levy an environmental tax with the aim of correcting the shortcomings of pollution charge fees and fulfilling the task of energy conservation and emission reduction. In 2014, the draft of the environmental protection tax law was submitted to the State Council, and public opinions were solicited from 2015 to 2016. In 2016, China's first green tax law was passed and promulgated officially by the National People's Congress.

Environmental protection tax, also known as green tax, is a policy on resource conservation and environmental protection. It is formulated based on the original system of pollution discharge fees and embodies the legislative principle of the tax shift. From this point of view, the object of the environmental tax is similar to that of the original pollutant discharge fee, mainly for air and water pollutants. The producers that discharge taxable pollutants are the taxpayers of environmental protection tax. Compared with the pollution discharge fee, the environmental protection tax also increased the levy of excessive discharge from the centralized treatment site of waste. The environmental protection tax expanded the scope of taxable objects, strengthened the control of pollutant emissions, and made the tax plan more specific and targeted. Overall, the environmental protection tax is a means of economic control over pollution.

### **2.2. Theoretical effect of environmental protection tax law on firm upgrading**

The environmental policy may have an indirect effect on the decisions and behaviors of enterprise stakeholders. This study believes the promulgation of EPTL2016 serves as a signal for commercial banks and other financial institutions, which affect the financing and investment of heavily polluting firms. Bank loans are generally regarded as the most extensive external financing channel used by enterprises (Atanassov, 2016). This study intends to examine the effects of EPTL2016 on bank loans within heavily polluting industries. Heavily polluting firms are faced with higher cleaning costs, which probably results in lower credit guarantees and higher default rates. Commercial banks are

likely to reduce loans to heavily polluting firms after the EPTL2016, and banks must pay more attention to environmental and social risks in heavily polluting industries. Consequently, banks may reduce the lending quota to heavily polluting firms. Hence, this study proposes the following hypothesis.

**Hypothesis 1.** The introduction of environmental protection tax law significantly reduces the bank credit of heavily polluting firms.

Capital flows mainly to more productive firms in a perfect capital market, and credit capital is no exception. Banks face the challenge of allocating credit capital to efficient enterprises in heavily polluting industries because of asymmetric information. Thus, banks may choose to lend to companies with better financial performance. The EPTL2016 makes environment performance a strong constraint for enterprises, and the financial performance gained from enterprises through pollution would be squeezed out. As a result, banks may refuse to lend to companies with high pollution and low productivity after the EPTL2016. In addition, commercial banks can obtain detailed environmental information of enterprises through the other stakeholders after the policy, and the information asymmetry between banks and enterprises can be mitigated. Hence, this study proposes the following hypothesis.

**Hypothesis 2.** The EPTL2016 has a positive effect on the efficiency of the supply of bank loans within heavily polluting industries.

Enterprises have the value of options in the face of an uncertain future, including the value of growth options and the value of the abandonment option (Burgstahler and Dichev, 1997). According to the capital profit-seeking law and real options theory (Zhang, 2000), investment is the main source of equity value. The timely expansion of fixed assets increases the value of growth options when firms are faced with better investment opportunities. When firms are faced with poor investment opportunities, the disposal of fixed assets increases the value of the abandonment option. Government policies have important external effects on the financing and investment activities of enterprises (Zhang and Du, 2020). The EPTL2016 releases a political signal, which helps to reduce information asymmetry in the investment activities. Heavily polluting firms are also confronted with the pressure of upgrade after the promulgation of EPTL2016, which motivates executives to strengthen their self-discipline and exert more efforts in risky investment activities. Therefore, the EPTL2016 may enhance investment flexibility and investment efficiency through the information and competition effects. When faced with better investment opportunities, executives can quickly identify investment opportunities through the information effectively and quickly grasp investment opportunities to execute growth options through the competition effect. Nevertheless, when faced with poor investment opportunities, the information and competition effects cannot help enterprises reduce their investment quickly. Hence, this study proposes the following hypothesis.

**Hypothesis 3.** The EPTL2016 significantly increases the value of growth options of heavily polluting firms but it does not affect the value of the abandonment option.

Firm upgrading is quite extensive and an obscure concept, and this study defines firm upgrading

as the enterprise growth triggered by investment or innovation activities. Although innovation is the fuse for firm upgrading, the increase in profits comes from the growth of the enterprise. Specifically, enterprises obtain above-average productivity through innovation investment and technology updating. The environmental protection tax law could reduce the bank credit of heavily polluting industries, which may lead to a lack of funds for innovation and upgrading of enterprises. Although the information and competition effects can improve the efficiency of credit allocation and increase the equity value, this study holds that the effects of credit supply reduction may be greater. Therefore, this paper proposes the following hypothesis.

**Hypothesis 4.** The introduction of environmental protection tax law has a negative effect on the upgrade of heavily polluting firms.

### 3. Methodology and data

#### 3.1. Model specification

Referring to Wen and Lee (2020b), this study adopts the DID method to assess the treatment effects of EPTL2016 on bank loans and firm upgrading. Specifically, this study divides enterprises into two groups and compares the grouping differences in the growth of firm upgrading before and after the policy. The model can be expressed as follows:

$$Y_{it} = \alpha_i + \beta_1 Treat_i \times After_t + X_{it} \zeta + \lambda_t + \varepsilon_{it}, \quad (1)$$

where  $Y_{it}$  represents the dependent variable, and it refers to firm upgrading and bank loans in our study. The variable  $Treat_i$  refers to the grouping dummy, which equals one if the firm belongs to heavily polluting industries and zero otherwise. The variable  $After_t$  refers to the year dummy of policy intervention, and it equals one after the year of 2016 and zero otherwise.  $X_{it}$  is a series of control variables that may affect the dependent variable. This study is interested mainly in the regression-based DID estimator,  $\beta_1$ , which is the treatment effect of policy intervention.

This study also employs the quasi-experiment design and investigates how the EPTL2016 affects the long-term loans of heavily polluting firms. Specifically, this study uses the following econometric model:

$$LongLoans_{it} = \alpha_i + \beta_2 After_t \times FDummy_{it} + \beta_3 FDummy_{it} + X_{it} \zeta + \lambda_t + \varepsilon_{it}, \quad (2)$$

where  $LongLoans_{it}$  refers to the long-term loans of firm  $i$ .  $FDummy_{it}$  refers to the grouping dummy variables of firms in heavily polluting industries, which are grouped using performance indicators. This study focuses on the coefficient of the interaction term,  $\beta_2$ , which indicates the intervention effect of EPTL2016 on the efficiency of the supply of long-term loans in heavily polluting industries.

Referring to the method of Burgstahler and Dichev (1997), this study uses the following empirical econometric model to examine the effects of EPTL2016 on the value of growth options of heavily polluting firms:

$$\begin{aligned}
Ln(MV / BV) = & \alpha_0 + \alpha_1 Gm + \alpha_2 Gh + \alpha_3 (E / BV) + \alpha_4 Gm \times (E / BV) \\
& + \alpha_5 Gh \times (E / BV) + \alpha_6 After + \alpha_7 After \times Gm + \alpha_8 After \times Gh \\
& + \alpha_9 After \times (E / BV) + \alpha_{10} After \times Gm \times (E / BV) \\
& + \alpha_{11} After \times Gh \times (E / BV) + Control'_{it} \gamma + \sum Firm + \sum Year + \varepsilon_{it}
\end{aligned} \tag{3}$$

where  $MV$  is the market value of the company's equity.  $BV$  refers to the net assets and  $E$  is the net profits of firms. Samples are divided into three groups according to  $E/BV$ , which refers to the return on equity ( $ROE$ ).  $Gm$  equals one if  $E/BV$  is in the middle group and otherwise zero.  $Gh$  equals one if  $E/BV$  is in the highest group and otherwise zero. When  $Gh$  equals one, it indicates that the firm has high profitability.  $Control'_{it}$  refers to a series of control variables that may affect the equity value of enterprises. The coefficient of the interaction term ( $After \times (E/BV) \times Gh$ ) will be tested. If  $\alpha_{11}$  is significantly positive, it indicates that the EPTL2016 can significantly increase the value of growth options of heavily polluting firms.

This study employs the following model to study the effect of EPTL2016 on the value of the abandonment option.

$$\begin{aligned}
Ln(MV / E) = & \delta_0 + \delta_1 Dm + \delta_2 Dh + \delta_3 (BV / E) + \delta_4 Dm \times (BV / E) \\
& + \delta_5 Dh \times (BV / E) + \delta_6 After + \delta_7 After \times Dm + \delta_8 After \times Dh \\
& + \delta_9 After \times (BV / E) + \delta_{10} After \times Dm \times (BV / E) \\
& + \delta_{11} After \times Dh \times (BV / E) + Control'_{it} \gamma + \sum Firm + \sum Year + \varepsilon_{it}
\end{aligned} \tag{4}$$

We divide the sample into three groups according to  $BV/E$ , which refers to the reciprocal of  $ROE$ .  $Dm$  equals one if  $BV/E$  is in the middle group and otherwise zero.  $Dh$  equals one if  $BV/E$  is in the highest group otherwise zero. If  $Dh$  equals one, it indicates that the company's profitability is poor. According to Hypothesis 3, the environment policy of EPTL2016 has no significant effect on the value of the abandonment option of firms with poor investment opportunities, hence  $\delta_{11}$  should be insignificant.

### 3.2. Sample and data

This study adopts the panel data of China's A-share industrial listed firms, including 37 industries and a total of 2786 enterprises. Heavily polluting industries are defined by the "Guidelines for Industry Classification of Listed Companies" (revised in 2012) and "Guidelines for the Disclosure of Listed Companies Environmental Information" (draft for comments), including coal mining and washing, oil and gas extraction, etc. The data set used in this paper includes 996 heavily polluting firms in the treatment group and 1820 other enterprises in the control group. This study also investigates the effects of EPTL2016 on the efficiency of the supply of long-term loans and the equity value of enterprises using the 996 heavily polluting firms. Given the environmental protection tax law was introduced in 2016, the sample period is set from 2012 to 2019, including four years before and after the policy intervention. The financial data of firms in this study are collected from the Database of China Stock Market and Accounting Research. Some observations are lost during the regression analysis because of missing values.

Firm upgrading is defined as the enterprise growth triggered by investment or innovation activities in this study. Although choosing the appropriate measure variables can be difficult, this study adopts the variables of *Innovation Input*, *Fixed-asset Investment*, and *Productivity* to reflect the transformation and upgrading of enterprises. *Innovation Input* refers to the natural logarithm of

the firm's R&D expense plus one, which is the best proxy variable that reflects the enterprise's investment in upgrading. *Productivity* is the logarithm of the total factor productivity and is measured using the method of Levinsohn and Petrin (2003). It is the proxy variable that reflects the performance of the upgrading of the enterprise. We also use the variable of *Fixed-asset Investment* to show the progress of enterprise upgrading, which is defined as the cash payments for investing in the fixed, intangible, and other long-term assets.

Other dependent variables are also used in the empirical analysis, including the bank credit and the equity value. Bank credit is the ratio of bank loans to total assets, which is the most important external financing source for enterprise upgrading. The equity value consists of the value of growth options and the value of the abandonment option, all treated by logarithm. Various control variables are defined in our study and shown in Table 1. The descriptive statistical results of related variables are reported in Table A1. To eliminate the interference of extreme outliers to the empirical results, we winsorized some variables at the 1% level.

**Table 1. Variable Definition**

	Variables	Definition
Dependent variables	<i>Innovation Input</i>	Natural logarithm of the R&D expense plus one
	<i>Fixed-asset Investment</i>	Fixed-asset Investment/total assets
	<i>Productivity</i>	Natural logarithm of the total factor productivity
	<i>Bank credit</i>	100×Bank loans /total assets
	<i>LN(MV/BV)</i>	Natural logarithm of the ratio of corporate equity value to net assets
	<i>LN(MV/E)</i>	Natural logarithm of the ratio of corporate equity value to net profits
Independent variables	<i>lnAge</i>	Natural logarithm of the years that a firm has survived
	<i>lnSize</i>	Natural logarithm of the total assets
	<i>Education</i>	Proportion of undergraduates or above in total employees
	<i>Larst</i>	Percentage of shares owned by the largest shareholder
	<i>Cash</i>	Cash monetary assets /total assets
	<i>Lev</i>	Total debt/total assets
	<i>ROA</i>	Net income/total assets
	<i>State</i>	Equal one for state-owned enterprise and zero otherwise
	<i>Sep</i>	The difference between control and ownership of the listed company

	owned by the actual controller
<i>Duality</i>	Equal one if the chairman and the general manager are not currently held by the same person and zero otherwise
<i>KL</i>	Fixed assets/number of employees
<i>Growth</i>	Growth rate of operating income

#### 4. Empirical results and analysis

##### 4.1. Effect of EPTL2016 on the bank credit

Table 2 shows the effects of environmental protection tax law on bank credit. Columns (1), (3), and (5) report the results of the regression-based DID estimation, while the other columns are the results for comparison. The coefficients of control variables mostly meet the theoretical expectations or are not contradictory, thereby indicating that the empirical results of this study are robust and relatively reliable. Although some interesting conclusions on the control variables can be found, we focus on the treatment effects of the EPTL2016 or the coefficients of the interaction term.

**Table 2. Effects of environmental protection tax law on bank credit.**

Variables	<i>Long-term loan</i>		<i>Short-term loan</i>		<i>Total loans</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Treat × After</i>	-0.497* [-1.92]	-0.867*** [-3.80]	-0.544 [-1.47]	-1.445*** [-4.35]	-1.044** [-2.22]	-2.339*** [-5.58]
<i>lnAge</i>	2.504** [2.39]	0.735 [1.38]	3.994** [2.41]	-2.622*** [-3.29]	6.725*** [3.21]	-1.869* [-1.83]
<i>lnSize</i>	0.546*** [3.08]	0.439** [2.53]	0.181 [0.72]	-0.054 [-0.22]	0.746** [2.37]	0.399 [1.29]
<i>Lev</i>	0.002	0.002	0.017**	0.019***	0.019**	0.022**

	[0.32]	[0.39]	[2.37]	[2.60]	[2.09]	[2.32]
<i>Growth</i>	-0.237*** [-19.05]	-0.230*** [-18.63]	-0.197*** [-10.07]	-0.199*** [-10.26]	-0.435*** [-16.77]	-0.430*** [-16.66]
<i>Education</i>	-0.005 [-1.02]	-0.006 [-1.11]	0.004 [0.54]	0.002 [0.27]	0.0001 [-0.01]	-0.003 [-0.27]
<i>Larst</i>	0.002 [0.25]	0.004 [0.67]	-0.017 [-1.53]	-0.017 [-1.63]	-0.014 [-0.99]	-0.011 [-0.88]
<i>State</i>	-0.383 [-0.94]	-0.315 [-0.78]	-0.156 [-0.26]	0.1 [0.17]	-0.44 [-0.59]	-0.105 [-0.14]
<i>Duality</i>	-0.305 [-1.49]	-0.314 [-1.53]	-0.442 [-1.42]	-0.448 [-1.43]	-0.808** [-2.14]	-0.822** [-2.17]
<i>ROA</i>	0.0001 [-0.03]	-0.001 [-0.04]	-0.101*** [-3.76]	-0.104*** [-3.90]	-0.107*** [-3.10]	-0.111*** [-3.23]
<i>Sep</i>	-0.024 [-1.53]	-0.024 [-1.50]	-0.032 [-1.23]	-0.028 [-1.06]	-0.059* [-1.84]	-0.054* [-1.69]
<i>Constant</i>	-14.415*** [-3.00]	-6.671** [-2.02]	-6.386 [-0.89]	18.813*** [3.93]	-21.906** [-2.44]	11.809** [1.99]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	NO	Yes	No	Yes	No
N	15828	15828	15828	15828	15828	15828
Adj. R-sq	0.026	0.023	0.017	0.015	0.032	0.029

Notes: The numbers in bracket is T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%).

The results show that EPTL2016 has significantly reduced bank loans to heavily polluting firms. When the dependent variables are the long-term loan or total loans, the coefficients of *Treat*×*After* are significantly negative but is insignificant in Column (3) for the dependent variable of short-term loans. Above results indicate that the EPTL2016 has significantly reduced the long-term loans of

heavily polluting firms but its effect on short-term loans is unclear. Overall, the availability of bank loans for heavily polluting enterprises has declined and these enterprises may suffer financing constraints for upgrading activities. The long-term loan is the most important financing channels for innovation activities, the policy of EPTL2016 may hinder the innovation investment of these firms and impede industrial upgrading.

#### 4.2. Effects of EPTL2016 on the allocation efficiency of the long-term loans

We use a sample of 996 firms in heavily polluting industries and investigate the effects of EPTL2016 on the allocation efficiency of the long-term loan in this section. Specifically, we regress the variable of long-term loan on the interaction terms between time dummy variables (*After*) and grouping variables for the different enterprises (*FDummy*). It is intended to clarify the characteristics of companies to which long-term credit prefers to flow. The empirical results are shown in Table 3.

**Table 3. Effects of EPTL2016 on the efficiency of the supply of long-term loans**

Variables	Dependent Variable: <i>long-term loan</i>					
	(1) TFP	(2) Innovation	(3) ROA	(4) Size	(5) State	(6) Political
<i>FDummy</i>	-0.715* [-1.84]	0.435 [0.28]	-0.384 [-0.79]	4.831*** [13.03]		-0.229 [-0.49]
<i>After</i> × <i>FDummy</i>	0.413 [0.86]	0.329 [0.59]	1.147** [2.51]	-1.229*** [-2.62]	-1.213*** [-2.60]	0.79 [1.27]
<i>lnAge</i>	5.642** [2.55]	5.237** [2.39]	4.957** [2.28]	3.235 [1.50]	4.035* [1.82]	5.402** [2.47]
<i>lnSize</i>	0.842*** [2.68]	0.830*** [2.85]	0.689** [2.34]	0.487* [1.66]	0.708** [2.39]	0.831*** [2.88]
<i>Lev</i>	0.0001 [-0.03]	-0.005 [-0.75]	-0.005 [-0.78]	-0.007 [-1.14]	-0.005 [-0.74]	-0.005 [-0.76]
<i>Growth</i>	-0.249*** [-12.32]	-0.252*** [-13.80]	-0.253*** [-13.73]	-0.083*** [-5.03]	-0.251*** [-13.70]	-0.252*** [-13.79]
<i>Education</i>	-0.006 [-0.91]	-0.007 [-1.06]	-0.008 [-1.10]	-0.008 [-1.16]	-0.007 [-1.06]	-0.007 [-1.05]
	0.002	0.006	0.005	0.007	0.01	0.007

<i>Larst</i>	[0.15]	[0.49]	[0.40]	[0.57]	[0.73]	[0.51]
<i>State</i>	0.039 [0.06]	-0.374 [-0.60]	-0.466 [-0.74]	-0.632 [-1.08]	0.281 [0.42]	-0.406 [-0.65]
<i>Duality</i>	-0.658* [-1.68]	-0.523 [-1.42]	-0.532 [-1.44]	-0.403 [-1.14]	-0.508 [-1.38]	-0.509 [-1.39]
<i>ROA</i>	0.001 [0.02]	-0.016 [-0.50]	-0.027 [-0.64]	-0.015 [-0.49]	-0.01 [-0.32]	-0.015 [-0.49]
<i>Sep</i>	-0.012 [-0.40]	-0.039 [-1.43]	-0.04 [-1.45]	-0.044 [-1.64]	-0.029 [-1.07]	-0.039 [-1.42]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4550	5301	5301	5301	5301	5301
Adj. R-sq	0.032	0.034	0.035	0.099	0.035	0.034

Notes: The numbers in the bracket is the T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%). The variables of *TFP*, *Innovation*, *ROA*, *Size*, *Sate*, and *Political* are binary variables, which are equal to one for enterprises with high productivity, enterprises with continuous R&D investment, enterprises with a high return on assets, large-scale enterprises, state-owned enterprises, and politically connected enterprises, respectively.

The coefficients of the interaction term in Columns (1) and (2) are positive and insignificant, and no evidence indicates that banks prefer productive and innovative firms after the EPTL2016. In Column (3), the coefficient of *After*×*FDummy* is significantly positive at the 5% level, indicating that the introduction of EPTL2016 has led to a preference for lending to profitable companies. Credit discrimination for different ownership firms and different size firms continues to exist in the lending market and has led to some adverse effects on investment activities (Brandt and Li, 2003; Guariglia and Poncet, 2008; Brandt et al., 2013). In Columns (4) and (5), the coefficients of *After*×*FDummy* are significantly positive at the 1% level, thereby suggesting that the EPTL2016 alleviated the phenomenon of scale and ownership discrimination in credit allocation. In addition, Column (6) shows that banks did not lend more to politically connected companies when the supply of bank loans was falling.

The above results indicate that the promulgation of EPTL2016 has reduced the phenomenon of credit discrimination and improved the efficiency of credit allocation within heavily polluting industries, which has two aspects of effects on firm upgrading. Although banks have reduced the credit quota of heavily polluting firms, the improvement of allocation efficiency provides financing support for long-term innovation investment of highly profitable enterprises, thereby promoting the

updating of equipment and firm upgrading. In addition, smaller enterprises and private enterprises have better access to credit capital, which can be used to update fixed equipment and cleaning technology and promote firm upgrading. Under the policy intervention of EPTL2016, banks have reduced the long-term loan to heavily polluting industries, while they have improved the efficiency of the bank credit, thus causing two opposite effects on the firm upgrading.

### 4.3. Effects of EPTL2016 on the equity value

To examine how the policy of EPTL2016 affects the investors in the stock market response to corporate valuation, this study employs the growth options value model and the abandonment option value model to conduct the empirical analysis. We also divide the sample into two subsamples according to the different types of ownership of firms. Columns (1) to (3) in Table 4 show the empirical results of the growth options value model. The other columns report the empirical results of the abandonment option value model.

For the growth options value model, the coefficients of  $After \times (E/BV) \times Gh$  are significantly positive at the 5% level for the full sample and the subsample of non-state-owned enterprises (non-SOEs), while the coefficient for the state-owned enterprises (SOEs) is significantly negative at the 1% level. The results indicate that the value of growth options of non-SOEs has been improved through information effect and competition effect. Conversely, the value of growth options of SOEs decreases significantly, suggesting that EPTL2016 has not improved the investment efficiency of SOEs. For the abandonment option value model, the coefficients of  $After \times (BV/E) \times Dh$  are all insignificant, indicating that the policy did not cause an increase in the value of the abandonment option when firms are faced with poor investment opportunities. Overall, Hypothesis 3 is established.

The different effects of the EPTL2016 on the value of growth options between SOEs and non-SOEs are not contradictory. When firms are faced with better investment opportunities, market competition prompts the executives of non-SOEs to invest in a timely manner in projects with the positive net present value, thereby increasing the value of growth options. The weak management of SOEs leads to low investment efficiency and low investment flexibility, and EPTL2016 cannot improve or even worsen the investment efficiency of SOEs through information effect and competitive threat. Moreover, executives may choose to postpone some good investment opportunities, thereby reducing the value of growth options (Akdoğan and Mackay, 2009).

**Table 4. Effects of environmental protection tax law on the equity value**

Variables	$Ln(MV/BV)$			Variables	$Ln(MV/E)$		
	(1) Full	(2) SOEs	(3) Non-SOEs		(4) Full	(5) SOEs	(6) Non-SOEs
$Gh$	0.381*** [9.87]	0.235*** [4.29]	0.460*** [9.27]	$Dh$	0.321*** [4.94]	0.595*** [7.46]	0.148 [1.56]
$Gm$	-0.073	-0.103	-0.019	$Dm$	-0.027	-0.157	0.006

	[-1.21]	[-1.11]	[-0.26]		[-0.38]	[-1.34]	[0.07]
<i>After</i>	-0.723*** [-16.19]	-0.704*** [-9.44]	-0.706*** [-12.34]	<i>After</i>	-0.702*** [-4.56]	-0.736** [-2.54]	-0.651*** [-4.23]
<i>E/BV</i>	-0.538*** [-4.80]	-1.149*** [-5.52]	-0.312*** [-2.97]	<i>BV/E</i>	0.009*** [36.57]	0.009*** [29.45]	0.009*** [20.11]
<i>Gm</i> ×( <i>E/BV</i> )	3.429*** [3.79]	4.132*** [2.78]	3.224*** [3.02]	<i>Dm</i> ×( <i>BV/E</i> )	0.007 [1.02]	0.028*** [2.77]	-0.003 [-0.31]
<i>Gh</i> ×( <i>E/BV</i> )	0.099*** [3.73]	0.474*** [3.11]	0.092*** [3.52]	<i>Dh</i> ×( <i>BV/E</i> )	0.000*** [4.30]	0.001*** [4.35]	0.000* [1.73]
<i>After</i> × <i>Gh</i>	-0.023 [-0.68]	0.093* [1.65]	-0.243*** [-4.40]	<i>After</i> × <i>Dh</i>	-0.019 [-0.12]	0.107 [0.37]	-0.078 [-0.54]
<i>After</i> × <i>Gm</i>	-0.003 [-0.04]	0.098 [0.88]	-0.102 [-1.11]	<i>After</i> × <i>Dm</i>	-0.068 [-0.41]	0.105 [0.36]	-0.183 [-1.05]
<i>After</i> ×( <i>E/BV</i> )	-0.148*** [-3.73]	0.214 [1.23]	-0.172*** [-4.14]	<i>After</i> ×( <i>BV/E</i> )	0.011 [0.48]	0.037 [0.82]	-0.005 [-0.23]
<i>After</i> ×( <i>E/BV</i> ) × <i>Gm</i>	-0.448 [-0.42]	-2.135 [-1.25]	0.357 [0.28]	<i>After</i> ×( <i>BV/E</i> ) × <i>Dm</i>	-0.009 [-0.39]	-0.036 [-0.81]	0.01 [0.42]
<i>After</i> ×( <i>E/BV</i> ) × <i>Gh</i>	0.122** [2.09]	-0.610*** [-2.74]	1.115*** [4.24]	<i>After</i> ×( <i>BV/E</i> ) × <i>Dh</i>	-0.011 [-0.49]	-0.037 [-0.82]	0.005 [0.23]
<i>Controls</i>	Yes	Yes	Yes	<i>Controls</i>	Yes	Yes	Yes
<i>Firm /Year FE</i>	Yes	Yes	Yes	<i>Firm/Year FE</i>	Yes	Yes	Yes
<i>N</i>	5237	1939	3298	<i>N</i>	4661	1690	2971
<i>Adj. R-sq</i>	0.5	0.493	0.565	<i>Adj. R-sq</i>	0.828	0.86	0.821

Notes: The numbers in the bracket is the T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%).

#### 4.4. Effects of EPTL2016 on firm upgrading

The desirable intervention effect of EPTL2016 is that it facilitates innovation or technological updating of heavily polluting firms, which ultimately improves the productivity of the enterprise. However, the policy has increased financial constraints for heavily polluting enterprises, which may

hinder long-term and risky investment activities. Hence, to examine whether the policy of EPTL2016 hinders the firm upgrading, we regress the proxy variables of firm upgrading on the interaction term between the grouping dummy (*Treat*) and the time dummy (*After*).

The coefficients of *Treat*×*After* for the innovation input and productivity are significantly negative at the 1% level, indicating that environmental protection tax law significantly reduces the innovation investment and productivity. Firms in heavily polluting industries lack funds for innovation activities and risky investment activities after the adverse shock of the EPTL2016, resulting in a drop in productivity. The regression coefficients of the interaction term (*Treat*×*After*) on fixed-asset investment are insignificant. The credit effect of environmental protection tax law may affect the investment activities in two aspects. Credit constraints prevent heavily polluting enterprises from blindly increasing the productive capital, thereby decreasing the investment rate and improving investment efficiency. In addition, credit constraints make it difficult for heavily polluting firms to upgrade the cleaner production facilities, thereby hindering the improvement of clean equipment and pollution-free technologies in production. The insignificant effects of EPTL2016 on fixed-asset investment indicate that two mechanisms may exist. Overall, although EPTL2016 has played an active role in limiting the expansion of inefficient capacity, achieve the goal of industrial upgrading for heavily polluting firms remains difficult.

**Table 5. Effect of environmental protection tax law on firm upgrading**

Variables	<i>Innovation Input</i>		<i>Productivity</i>		<i>Fixed-asset investment</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Treat</i> × <i>After</i>	-0.560*** [-6.60]	-0.384*** [-4.92]	-0.159*** [-5.42]	-0.133*** [-4.77]	0.105 [0.55]	-0.077 [-0.46]
<i>Lev</i>	0.005*** [3.62]	0.005*** [3.51]	0.009*** [12.60]	0.009*** [12.61]	-0.004 [-1.15]	-0.001 [-0.31]
<i>lnAge</i>	-0.778 [-1.58]	0.873*** [4.50]	0.11 [0.90]	0.124** [2.25]	-4.532*** [-5.03]	-6.955*** [-17.17]
<i>ROA</i>	0.006 [1.22]	0.005 [1.09]	0.019*** [9.81]	0.019*** [9.81]	0.100*** [8.06]	0.097*** [7.89]
<i>lnSize</i>	0.561*** [8.91]	0.616*** [9.26]	0.313*** [12.65]	0.318*** [13.19]	0.399*** [2.73]	0.306** [2.09]
<i>Education</i>	0.006***	0.006***	0.002***	0.002***	0.002	0.001

	[4.36]	[4.50]	[2.83]	[2.82]	[0.76]	[0.18]
<i>Larst</i>	-0.001 [-0.58]	-0.002 [-0.93]	-0.001 [-1.33]	0.0001 [-0.71]	0.018*** [4.07]	0.004 [1.10]
<i>State</i>	-0.1 [-0.87]	-0.163 [-1.44]	-0.01 [-0.27]	-0.003 [-0.08]	-0.938*** [-3.78]	-0.916*** [-3.72]
<i>Sep</i>	0.013** [2.33]	0.012** [2.18]	-0.003 [-1.61]	-0.003 [-1.60]	-0.014 [-1.37]	-0.011 [-1.11]
<i>Cash</i>	0.002 [1.54]	0.003* [1.72]	0.001 [1.15]	0.001 [1.28]	-0.038*** [-7.79]	-0.034*** [-7.02]
<i>Duality</i>	0.01 [0.15]	0.008 [0.13]	-0.02 [-0.96]	-0.02 [-0.97]	0.329** [2.29]	0.326** [2.26]
<i>Constant</i>	7.435*** [4.45]	1.223 [0.93]	0.564 [0.88]	0.407 [0.90]	9.022** [2.33]	18.086*** [6.46]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	No	Yes	No	Yes	No
N	15456	15456	14005	14005	15828	15828
Adj. R-sq	0.064	0.059	0.146	0.144	0.103	0.084

Notes: The numbers in the bracket is the T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%).

## 5. Further analysis and test

### 5.1. Heterogeneous analysis of the firm size

Generally, small-scale enterprises face stronger financing constraints in the process of upgrading and are more sensitive to the effects of external financing channels. It is generally believed that small-scale enterprises have more difficulty surviving under the constraints of environmental regulations. However, we find the EPTL2016 has reduced the phenomenon of credit discrimination in the previous analysis, thereby implying that the negative effect of the policy shock on the upgrading of small-scale enterprises is not larger than that of large-scale enterprises. Hence, this study divides the sample into large-scale, medium-sized, and small-scale enterprises according to

the quartile of the total assets of enterprises. Then, we examine whether a significantly heterogeneous effect of EPTL2016 on the firm upgrading exists with different scales. The results are shown in Table 6. All the coefficients of the interaction term,  $Treat \times After$ , are significantly negative, thereby indicating that EPTL2016 has significantly negative effects on the upgrading of different size enterprises. Moreover, no significant difference was observed in the treatment effect for these three groups of firms. These results are consistent with the conclusion that the EPTL2016 reduces the scale discrimination of long-term loan.

**Table 6. Heterogeneous effect of EPTL2016 on firm upgrading with different scale**

Variables	<i>Innovation Input</i>			<i>Productivity</i>		
	(1) Large	(2) Medium	(3) Small	(4) Large	(5) Medium	(6) Small
<i>Treat</i> × <i>After</i>	-0.678*** [-4.20]	-0.521*** [-3.49]	-0.503*** [-3.60]	-0.141** [-2.49]	-0.125** [-2.24]	-0.158*** [-2.83]
<i>Lev</i>	0.005 [1.36]	0.009*** [3.14]	0.003 [1.25]	0.009*** [6.87]	0.009*** [6.74]	0.009*** [7.08]
<i>lnAge</i>	-0.225 [-0.38]	-1.199 [-1.35]	-0.9 [-1.55]	0.288 [1.48]	0.235 [1.37]	-0.266 [-1.13]
<i>ROA</i>	0.006 [0.70]	-0.009 [-0.95]	0.011 [1.41]	0.019*** [4.66]	0.020*** [5.30]	0.017*** [4.63]
<i>lnSize</i>	0.593*** [5.14]	0.537*** [4.00]	0.587*** [4.96]	0.275*** [7.28]	0.290*** [6.04]	0.352*** [8.30]
<i>Education</i>	0.011*** [4.34]	0.0001 [-0.01]	0.009*** [3.88]	0.002 [1.49]	0.002** [2.03]	0.002 [1.54]
<i>Larst</i>	-0.005 [-1.31]	-0.006 [-1.17]	-0.001 [-0.27]	-0.003* [-1.71]	-0.001 [-1.05]	0.001 [0.60]
<i>State</i>	0.006 [0.04]	-0.036 [-0.17]	0.098 [0.49]	-0.018 [-0.26]	0.075 [1.11]	-0.002 [-0.03]
<i>Sep</i>	0.011* [0.04]	0.023** [0.04]	0.012 [0.04]	0.001 [0.04]	0.002 [0.04]	-0.005* [-0.03]

	[1.74]	[2.28]	[0.86]	[0.33]	[0.67]	[-1.95]
<i>Cash</i>	0.004 [1.32]	0.003 [0.78]	0.001 [0.32]	0.002 [1.26]	0.001 [0.95]	0.0001 [-0.32]
<i>Duality</i>	0.042 [0.33]	0.103 [0.91]	-0.019 [-0.19]	-0.036 [-0.84]	0.03 [0.75]	-0.017 [-0.44]
<i>Constant</i>	4.844* [1.78]	9.331*** [2.72]	7.193** [2.47]	0.841 [0.87]	0.597 [0.54]	0.8 [0.72]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	5144	5158	5154	4644	4691	4670
Adj. R-sq	0.071	0.055	0.084	0.15	0.14	0.157

Notes: The numbers in the bracket is the T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%).

## 5.2. Heterogeneous analysis of ownership

Studies also show that the upgrading activities are highly sensitive to changes in the external financing market, and it would be more difficult for private enterprises to operate under the constraints of environmental regulations. Hence, this study divides the sample into three groups, including state-owned, private, and foreign-owned enterprises. Then, we investigate whether significant heterogeneity of ownership can be observed for the treatment effect of EPTL2016.

The results in Table 7 show that all coefficients of interaction terms are significantly negative, while the coefficient for private enterprises is no less than that of state-owned enterprises, indicating the EPTL2016 has hindered the upgrading of all heavily polluting firms regardless of ownership. As the previous analysis shows, the EPTL2016 reduces the ownership discrimination of long-term loans, and thus, the adverse effect of the EPTL2016 on the private enterprises would not be greater than other enterprises. The results in Table 7 are also consistent with the conclusion that the policy increases the value of growth options of private enterprises but reduces the value of growth options of state-owned enterprises.

**Table 7. Heterogeneous effect of EPTL2016 on firm upgrading with different ownership**

Variables	<i>R&amp;D Investment</i>			<i>Total Factor Productivity</i>		
	(1) SOEs	(2) Private	(3) Foreign	(4) SOEs	(5) Private	(6) Foreign

<i>Treat×After</i>	-0.698*** [-4.14]	-0.497*** [-4.96]	-2.052** [-2.35]	-0.187*** [-4.07]	-0.162*** [-3.69]	-0.187* [-1.96]
<i>Lev</i>	0.008*** [2.64]	0.003 [1.42]	0.013* [1.86]	0.010*** [8.46]	0.008*** [8.26]	0.016*** [2.83]
<i>lnAge</i>	-0.249 [-0.14]	-0.477 [-1.12]	-8.175* [-1.68]	0.37 [1.00]	-0.045 [-0.30]	0.568 [1.29]
<i>ROA</i>	0.023*** [2.58]	0.002 [0.30]	0.005 [0.17]	0.013*** [4.12]	0.027*** [9.63]	0.011 [1.21]
<i>lnSize</i>	0.573*** [3.72]	0.575*** [7.88]	-0.086 [-0.16]	0.293*** [7.26]	0.322*** [10.17]	0.037 [0.24]
<i>Education</i>	0.009*** [3.90]	0.004** [2.23]	0.005 [0.33]	0.003*** [2.99]	0.001* [1.80]	0.002 [0.69]
<i>Larst</i>	0.002 [0.23]	0.007 [0.96]	-0.120** [-2.21]	-0.002 [-0.90]	-0.002 [-0.73]	-0.003 [-0.46]
<i>Sep</i>	0.012 [0.88]	0.009 [1.14]	0.07 [1.35]	0.001 [0.39]	-0.006* [-1.95]	-0.024** [-2.14]
<i>Cash</i>	0.003 [0.66]	0.003 [1.32]	0.021 [1.63]	0.001 [0.32]	0.001 [1.36]	-0.001 [-0.27]
<i>Duality</i>	0.119 [0.79]	-0.042 [-0.52]	-0.299 [-1.00]	0.017 [0.34]	-0.024 [-0.93]	-0.013 [-0.14]
<i>Constant</i>	4.987 [0.86]	6.155*** [3.95]	47.559** [2.49]	0.121 [0.08]	0.818 [0.99]	5.244 [1.57]
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

N	4440	8671	499	3779	8031	468
Adj. R-sq	0.049	0.075	0.197	0.112	0.163	0.168

Notes: The numbers in the bracket is the T value. The asterisk represents the significance level, \*\*\*(1%), \*\*(5%), and \*(10%).

## 6. Conclusion and enlightenment

Environmental pollution caused by heavily polluting industries has seriously limited the sustainable development of China's economy. How to motivate heavily polluting firms to improve environmental performance has been widely discussed by policy designers and scholars. Based on the panel data of China's A-share listed firms from 2012 to 2019, this paper adopts the Difference-in-Differences method to investigate the impact of environmental protection tax law on the firm upgrading from the perspective of intermediary role of the financial market.

Empirical evidence shows that although the policy of EPTL2016 may benefit the upgrading of heavily polluting firms in many aspects, it has also significantly reduced the innovation investment and the productivity of heavily polluting firms. Under the policy intervention, banking institutions have reduced the supply of loans to heavily polluting firms, which has led to a decline in innovation investment and productivity. Admittedly, the policy may limit the blind expansion of production scale and encourage the updating of production equipment. This study also finds that the supply of long-term loans is more efficient within heavily polluting industries and the value of growth options for private firms increased after the intervention of EPTL2016. It provides financial support for the development of high-quality private firms because of the increase in the value of growth options. Heterogeneity analysis shows that the EPTL2016 reduced innovation investment and productivity for all the heavy polluting enterprises, regardless of ownership and the asset size, and that the intervention effects are robust.

The main finding in our study is that as banks tend to reduce the supply of loans to these industries, heavy polluting firms may be unable to obtain funds for innovation activities, thereby inhibiting the green upgrading and development of heavily polluting firms in the long term. The findings of this study have some important implications. First, China should standardize and improve its green credit policy in case of blind expansion or lack of funds for innovation, thus promoting industry upgrading. Second, China should play the role of financial markets in allocating resources and avoid the excessive intervention of bank loans. Meanwhile, the government should guide the credit market and capital market to allocate capital more effectively, so that capital flows to efficient enterprises and promote the firm upgrading. Third, governments must design incentive policies that encourage heavy polluting firms to participate in innovation activities.

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## Appendix

**Table A1. Descriptive statistics: 2012-2019**

Variables	Obs	Mean	Std.Dev	Min	Max
<i>Long-term loan</i>	16918	4.064	7.200	0.000	35.445
<i>Short-term loan</i>	16918	9.326	10.320	0.000	44.613
<i>Total loans</i>	16918	13.497	13.295	0.000	54.740
<i>Ln (MV/BV)</i>	16616	1.161	0.752	-2.502	7.933
<i>Ln (MV/E)</i>	14871	3.897	1.056	-0.817	12.949
<i>Innovation Input</i>	16528	17.622	2.074	0.000	25.052
<i>Fixed-asset Investment</i>	16918	5.231	4.743	-0.002	64.186
<i>Productivity</i>	14088	8.184	0.972	3.551	12.578
<i>lnAge</i>	16913	2.770	0.355	1.609	3.434
<i>lnSize</i>	16899	22.004	1.241	19.619	25.827
<i>Education</i>	15846	42.390	20.830	0.000	100.000
<i>Larst</i>	16918	31.915	16.854	0.000	73.830
<i>Cash</i>	16918	17.375	12.372	1.175	60.743
<i>Lev</i>	16918	40.326	19.415	10.070	76.037
<i>ROA</i>	16899	3.995	4.716	-6.893	13.145
<i>State</i>	16918	0.290	0.454	0.000	1.000
<i>Sep</i>	16918	4.286	7.257	0.000	28.292
<i>Duality</i>	16918	0.298	0.457	0.000	1.000
<i>KL</i>	16641	12.706	1.723	8.048	17.668
<i>Growth</i>	16899	2.260	6.219	0.002	45.440
<i>E/BV</i>	16918	0.055	0.179	-1.113	0.493

*BV/E*

16918

23.286

45.474

-50.959

308.975

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