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Abstract

In this paper, we estimate the investment and depreciation rates of 37 industrial sectors in China from 2001 to 2016. The average depreciation rate is 0.074, which is close to the US depreciation rate of 0.077, estimated by Hulten and Wykoff (1979, 1981), even though it fluctuates significantly with respect to industrial sector and time. We found that governmental tax policy and enterprise profit have a significant effect on the depreciation rate by analyzing the ratio of depreciation expense to the book value of fixed assets, which we use as a proxy for tax policy, and carrying out panel regression.

JEL classification: O14, D92, E22, L6

Keywords: China, depreciation rate, depreciation expense, investment, 37 industrial sectors

1 Introduction

1.1 Depreciation rate by industrial sector

The depreciation rate is an indispensable and important indicator of enterprise investment efficiency and must be taken into account when estimating capital stock. However, efforts to estimate China's depreciation rate are ongoing, and consensus has not yet been reached. For example, estimates of the depreciation rate range from 5% to 24%, at 5.7% by Chen (2014), 5%-7% by Tian (2016), 9.6% by Zhang et al. (2004), and 24% by Bai et al. (2006). There are significant differences between both the figures of the estimated depreciation rates and the estimation methods used.

Furthermore, existing studies have not made detailed estimates of the depreciation rate by industrial sector. Currently in China, as reported by Qiu and Wan (2018), there are inefficiencies in housing-related investment, such as steel or coal. This is an emerging issue for China and the rest of the world. Thus, economists and policy makers have shown much interest in the efficiency of investments in specific industrial sectors.[3] It is necessary, therefore, to evaluate depreciation rates separately for each industry, which can be achieved by estimating the marginal q by industrial sector.

In this paper, we estimate the depreciation rate of 37 industrial sectors in China for the first time. As the estimated marginal q value is sensitive to the depreciation rate, accuracy in the estimated depreciation rate is necessary to obtain reliable measurements of investment efficiency.

[3] Underinvestment in service sectors such as education and medical care in China are reported by Wan and Yin (2019). Investments in these sectors are crowded out by overinvestment in housing-related sectors, which is caused by housing bubbles.

We also analyze factors determining the depreciation rate by industrial sector in China for the first time, taking into account governmental tax policies and enterprise profit. To test the potential impact of this work, we will develop two hypotheses and carry out formal tests using panel data from 37 industrial sectors during the period 2001 to 2016.

1.2 Related studies and current research

1.2.1 Estimation of investment

Before estimating the depreciation rate, we need to estimate investment, because the value of investment appears in the formula for the depreciation rate. Investment is one of the most important variables determining the depreciation rate; therefore, reliably estimating investment is very important to economists. To provide current data for this purpose, the National Bureau of Statistics of China has published the annual fixed asset investment of the whole economy and the fixed asset investment by sub-industry. After careful comparison and analysis of the data, we did not find the data on investment by industry released by the National Bureau of Statistics to be reliable, because they are not of the caliber required for this study. Hence, we cannot use the statistics provided by the National Bureau of Statistics directly to estimate the depreciation rate.

In the existing literature on the derivation of investment indicators, investment is always assessed in terms of gross fixed capital formation (Zhang et al, 2004 ; Bai et al, 2007), but there are no detailed data on gross fixed capital formation by industrial

sector. Therefore, our first task was to estimate investment based on existing data. Luckily enough, we obtained data on the book values of capital stock of 37 industries by industrial sector from the National Bureau of Statistics.

1.2.2 Estimation of depreciation rate[4]

The following methods have been used to estimate depreciation rates in previous studies. The first method was proposed by Jorgenson et al. (1994), which strictly separates capital stock from input. Using the perpetual inventory method, the life span and relative efficiency of diminishing models of capital can be analyzed and estimated in detail. However, the current data available for China cannot be used to make such detailed estimates using this method.

The second method is to directly estimate the depreciation of fixed assets based on the accounting formula. For example, Li et al. (2003) use the accounting formula of the national income to estimate depreciation expenses. This method is an operational method at the macroeconomic level. They reported detailed statistics, but this method does not allow us to estimate the depreciation rates of sub-industries by industrial sector, which is required for estimating marginal *q*, which was used by Qiu and Wan (2018).

The third method was proposed by Tian (2016), who introduced investment transforming rate parameters and estimated the depreciation rate of China's

[4] Some studies, such as He (1992), Chow (1993) and Zhang et al. (2003), adopt cumulative indicators to estimate capital stock, thus avoiding the problem to estimate the depreciation rate. However, currently, China has not released accumulated data since 1993; thus, this method cannot be applied.

sub-sectors by industrial sector, and then discussed the relationship between depreciation expense and investment. However, Tian (2016) did not estimate the depreciation rates of the 37 industrial sectors in China using different qualities of statistics or data sources. Hence, we cannot use the results estimated by Tian (2016) in our study.

The fourth method is to use foreign depreciation rates directly, such as the results from the U.S. For example, Hayashi and Inoue (1991) and Ogawa et al. (1994) use the U.S. depreciation rate reported by Hulten and Wykoff (1981) to estimate the marginal q for Japan. This method is suitable for a developed country such as Japan because capital goods are freely traded between these two countries. However, it is unlikely that the depreciation rate of a developing country like China is similar to that of a developed country. There are two reasons for this. One is that capital goods cannot be freely traded between developing countries like China and developed countries like the U.S. The other is the significant differences between the fixed asset structures of developing and developed countries. Even within a developing country, such as Indonesia, it is reported by Schündeln (2013) that depreciation rates differ significantly between new and old firms due to the different capital goods structures. Hence, it would be controversy that depreciation rate reported by OECD is used to estimate capital stock for China in Holz and Sun (2018).

The fifth method is proposed by Zhang et al. (2004) and is based on using the residual values of capital goods to estimate the geometric depreciation rate, which can avoid the straight-line depreciation method used to estimate the depreciation of fixed

assets based on enterprise accounts. Although this method takes the problem of enterprise accounting into consideration when calculating depreciation, due to the restricted availability of data, this method requires information that has not been released for all 37 industries. Hence, we cannot apply this method to the available data set.

The sixth method was first applied by Chou (1991), followed by Wu (2000) and Chen (2014). They estimate the initial value of capital stock and the depreciation rate simultaneously, but the depreciation rate was not estimated by industrial sector. Hence, we cannot use this method to calculate the depreciation rates of sub-industries by sector.

Therefore, in the following subsections, we will apply a different method to those discussed above to estimate the investment and depreciation rate by industrial sector.

1.3 Contribution and organization of this research

In this research, we estimate the investments and depreciation rates of China's 37 industrial sectors between 2001 and 2016 and find that the depreciation rate is significantly affected by governmental tax policy and enterprise profit. As far as we know, there are no accurate estimates of investment and depreciation rate by industry for China. It is necessary to estimate these values to measure the marginal q so that we can analyze investment efficiency by industry according to Qiu and Wan (2018).

The remainder of the paper is organized as follows. Our research hypotheses are

presented in Section 2. In Section 3, we describe the data source, empirical specifications, and analysis. We present our estimation results in Section 4. In Section 5, we outline our conclusions and discuss their implications.

2 Research question and hypothesis

2.1 Government policies and depreciation rates

The government's tax policy can influence the choice of depreciation estimation method used for enterprise accounting, because the government always has some preferential tax reduction and exemption policies for start-up enterprises and some special firms. Accordingly, enterprise accounting will select a depreciation method that estimates low depreciation expenses during the tax preferential period.

The government will also impose accelerated depreciation on some enterprises or industries. For example, in 2003, 2009, 2014, 2015, the Chinese central government issued four notices and two announcements to regulate the accelerated depreciation of fixed assets (State Administration of Taxation, 2003).[5] Enterprise income tax should be calculated based on the new regulations, which are beneficial for reducing the burden of enterprises. Hence, governmental tax policies and depreciation expenses are closely related.

Therefore, we predict that government taxation policies affect depreciation rates by influencing the timing and volume of investment, as well as the depreciation expense. We summarize this point as the following hypothesis.

[5] See details from the official website of State Administration of Taxation. http://www.chinatax.gov.cn/n810341/n810765/n812198/n813051/c1205333/content.html

***Hypothesis* 1:** The depreciation rate is affected by government tax policies.

We will use the ratio of depreciation expenses to the book values of fixed assets as a proxy for government tax policy.

2.2 Enterprise profits and depreciation rate

Enterprise profit is also closely related to the depreciation rate. We predict that depreciation rates are affected by enterprise profits, because profit both determines the expected return of, and provides resources for, new investment. Hence, we propose the following hypothesis.

***Hypothesis* 2:** The depreciation rate is affected by enterprise profit.

To empirically test these two hypotheses, we carry out regression analysis on panel data from 37 industrial sectors.

3 Data and empirical analysis

3.1 Data source of 37 industrial sectors

We collected data from National data, provided by the China National Bureau of Statistics (http://data.stats.gov.cn/). We downloaded data on the main economic indicators of Industrial Enterprises above the designated size by industry sector, for 37 sectors in total. Because the aggregation and statistical methods used differ before and after 2000, we only use data for the period 2000–2016. We also use both the total book value of fixed assets and total market value of fixed assets to estimate the investment and depreciation rate.

3.2 Estimation of investment and depreciation rate

Our data source does not provide information on the investment or depreciation rate. Thus, we estimated these variables based on the book and market values of fixed assets by industry.

Inflation and depreciation rate

We consider the effect of inflation of investment prices before estimating the depreciation rate, because inflation may cause the values of assets to be higher than their purchase prices, as noted by Hulten and Wykoff (1981). To avoid this issue, we use the price index for investment in fixed assets from 2000 to 2016, obtained through the official website of the National Bureau of Statistics. The price indices for every year between 2000 and 2016, are 1.011, 1.004, 1.002, 1.022, 1.056, 1.016, 1.015, 1.039, 1.089, 0.976, 1.036, 1.066, 1.011, 1.003, 1.005, 0.982, and 0.994, where the index for the last year is equal to 1. We can see that the price index for investment in fixed assets changed very little during the sample period. We do not consider inflation to have a significant impact on the estimates of the depreciation rate. Hence, we did not take it into account for our estimation of the depreciation rate.

Estimation of investment

Due to the fact that we cannot use the investment estimates reported in previous studies, we use a method to estimate investment based on the definition of the book

value of fixed assets, published by the National Bureau of Statistics. The investment and book values of the fixed assets of industry *m* at time *t* are denoted I_{mt} and BV_{mt}, respectively; thus, we have

$$I_{mt} = BV_{mt} - BV_{mt-1}. \tag{1}$$

This approach is based on the sum of the new fixed assets purchased each year, according to a company's accounts. Eq. (1) subtracts the asset value at the beginning of the year from that at the end of the year. Thus, we obtain the investment for that year. Noticeably, the investment can take a negative value because a company or industrial sector may have suffered losses or sold some fixed assets during the year.

Estimation of depreciation rate

We estimate the depreciation rates based on the perpetual inventory method, which was pioneered by Goldsmith (1951). The basic formula is

$$K_t = (1 - \delta_t)K_{t-1} + I_t, \tag{2}$$

where the capital stock, depreciation rate and investment at time *t* are represented by K_t, δ_t, I_t, respectively. We can obtain the depreciation rate by industry from Eq. (2) by transforming it as follows, as proposed by Hulten and Wykoff (1981):

$$\delta_t = \frac{K_{t-1} + I_t - K_t}{K_{t-1}}. \tag{3}$$

According to Eq. (3), we obtain the depreciation rate by applying the perpetual inventory method to the market values of fixed assets and investments. The depreciation rate of industry *m* at time *t* is expressed by δ_{mt}, as follows:

$$\delta_{mt} = \frac{FA_{mt-1} + I_{mt} - FA_{mt}}{FA_{mt-1}}, \quad (4)$$

where the market value of the fixed assets at $t - 1$ is represented by FA_{mt-1}.

3.3 Depreciation expense

Depreciation Expense as Accounting Item

We will calculate the depreciation expense according to the method developed by Feletham and Ohlson (1996, p.215), which is called accounting depreciation in Hayashi and Inoue (1991). Enterprise accounting departments will adjust the depreciation calculation method used based on current tax policy, adjusting depreciation expenses to increase input costs, thus reducing profit before tax and saving on tax. Hence, the depreciation expense can reflect the impact of governmental tax policy adjustment and can thus act as a proxy variable for tax change.

Ratio of Depreciation Expense to Book Value of Fixed Assets

We will derive the ratio of depreciation expense to book value of fixed assets so that we can compare depreciation expenses in terms of both sector and time. This ratio for industry *m* at time *t* is represented by de_{mt}, as follows：

$$de_{mt} = \frac{depreciation\ expense}{book\ value\ of\ fixed\ assets_{t-1}}. \quad (5)$$

We use this ratio as an independent variable for regression analysis, to identify the potential impact of government tax policy on the estimated depreciation rate.

3.4 Empirical specification

To analyze the factors that determine the depreciation rate, we consider the following empirical expression:

$$\delta_{mt} = \alpha_0 + \alpha_1 rpf_{mt} + \alpha_2 de_{mt} + \alpha_3 rpc_{mt} + \alpha_4 scr_{mt} + \alpha_5 tak_{mt} + \tau_m + \rho_t + \varepsilon_{it}, \quad (6)$$

where,

δ_{mt}: depreciation rate calculated by the perpetual inventory method, for industrial sector *m* at time *t*;

rpf_{mt}: total profit (before tax) / total value of fixed assets $_{(t-1)}$ of industry *m* at time *t*;

de_{mt}: depreciation expense / book value of fixed assets $_{(t-1)}$ of industry *m* at time *t*;

rpc_{mt}: personal capital / actual receipt capital $_{(t-1)}$ of industry *m* at time *t*;

scr_{mt}: state capital / actual receipt capital $_{(t-1)}$ of industry *m* at time *t*;

tak_{mt}: total assets / total value of fixed assets $_{(t-1)}$ of industry *m* at time *t*;

α_1, α_2, α_3, α_4, α_5, are coefficients, and α_0 is a constant, while τ_m, ρ_t, and ε_{it}, are error terms. We will use the panel estimation method with fixed effects and robust standard errors to obtain the values of these parameters.

4 Estimation and empirical results

4.1 Investment in the 37 industrial sectors

We estimated investment in China's 37 industrial sectors from 2001 to 2016, as shown in Figure 1. We found that investment in China's 37 industrial sectors is generally on the rise, except for declines in some years. This rising trend of investment comes from overinvestment in housing-related industrial sectors, as argued by Qiu and Wan (2018). The sudden decrease in investment in 2009 was due to the Lehman Shock, while the decrease in 2014 was caused by the policy of restricting speculative housing purchases, and was analyzed by Wan (2018) and Niu and Wan (2019).

4.2 Depreciation rate of 37 industrial sectors

We include the estimated investment in Eq. (4) and estimate the depreciation rates of China's 37 industrial sectors from 2001 to 2016, as shown in Tables 1*a*-*d*. Based on the estimated depreciation rate, we plotted Figs. 2-4. Through Figs. 3-4, we can see that the depreciation rate varies significantly between different industrial sectors. Furthermore, the national average depreciation rate is approximately 7.4%, which is close to the U.S. depreciation rate of 7.7%, estimated by Hulten and Wykoff (1979, 1981). This value was also used by Ogawa et al. (1994) for a study of Japan. These results are surprising because the trade of capital goods between China and U.S. is not as free as the trade between Japan and U.S., and, as a developing country, China has different fixed asset structures to developed countries such as the U.S. We can see volatility in the depreciation rate over time in Fig. 2. This appears to correspond to the transition in investment shown in Fig. 1. The change in the depreciation rate is

influenced by many factors, such as governmental policies and enterprise profit. We will analyze these effects in detail in the following subsection.

4.3 Effect of government tax policy and enterprise profit on the depreciation rate

The descriptive statistics of the main variables are summarized in Table 2, and the empirical results are summarized in Tables 3a, b, c. We can see that the depreciation rate is significantly affected by governmental tax policy and enterprise profit. This result is in line with our conjecture that enterprise accounting will select the most suitable depreciation estimation method based on current tax policy, with a view to increasing net profit after tax. To explain the impact of enterprise profit on the depreciation rate, we consider the following mechanism. As a tax accounting rule, enterprise income tax is based on enterprise profit. The depreciation expenses of fixed assets are included in the current expenses. When the depreciation expense increases, the current expenses will increase, so profits will decrease, and the enterprise income tax bill will decrease accordingly. In the case of profitable enterprises, the larger the depreciation expense, the higher the profit after tax. This is because replacing old equipment with new requires new investment to generate higher expected returns, and there should be sufficient financial resources for this investment.

5 Conclusions and implications

We have presented an approach for estimating investment in terms of the book value of fixed assets and use it to estimate investment in 37 industrial sectors, because direct information on investment is not available publicly in China. We also use the

estimated investments to calculate the depreciation rates for 37 industrial sectors from 2001 to 2016. Then, we regress the depreciation rates using an industrial panel data set and find that depreciation rates are determined by depreciation-expense oriented governmental policies, such as tax policies, and enterprise profits.

The depreciation rate mainly arises due to technological innovation during the life spans of capital goods. Furthermore, our results show that they are also affected by governmental intervention and accounting treatment. Hence, we provide new insights into the factors that determine depreciation rates. From the point of view of policy, the fact that the depreciation rate is affected by governmental policy impacts the evaluation of capital stock and its marginal *q* at both the micro or macro level. This influences all aspects of the economy.

In future research, we will use the approach presented here to estimate investment and identify the factors that determine the depreciation rate using data at the household, firm, industrial sector or national level for other economies.

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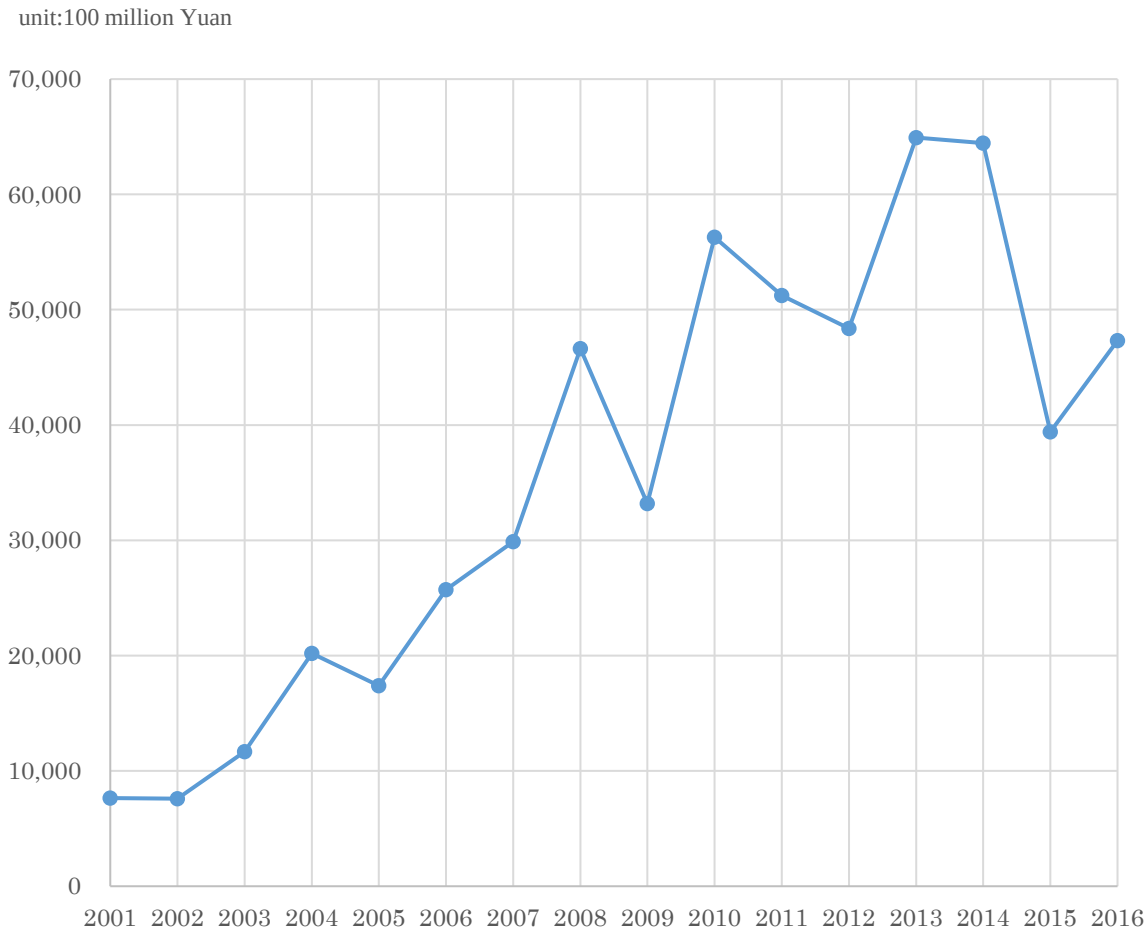
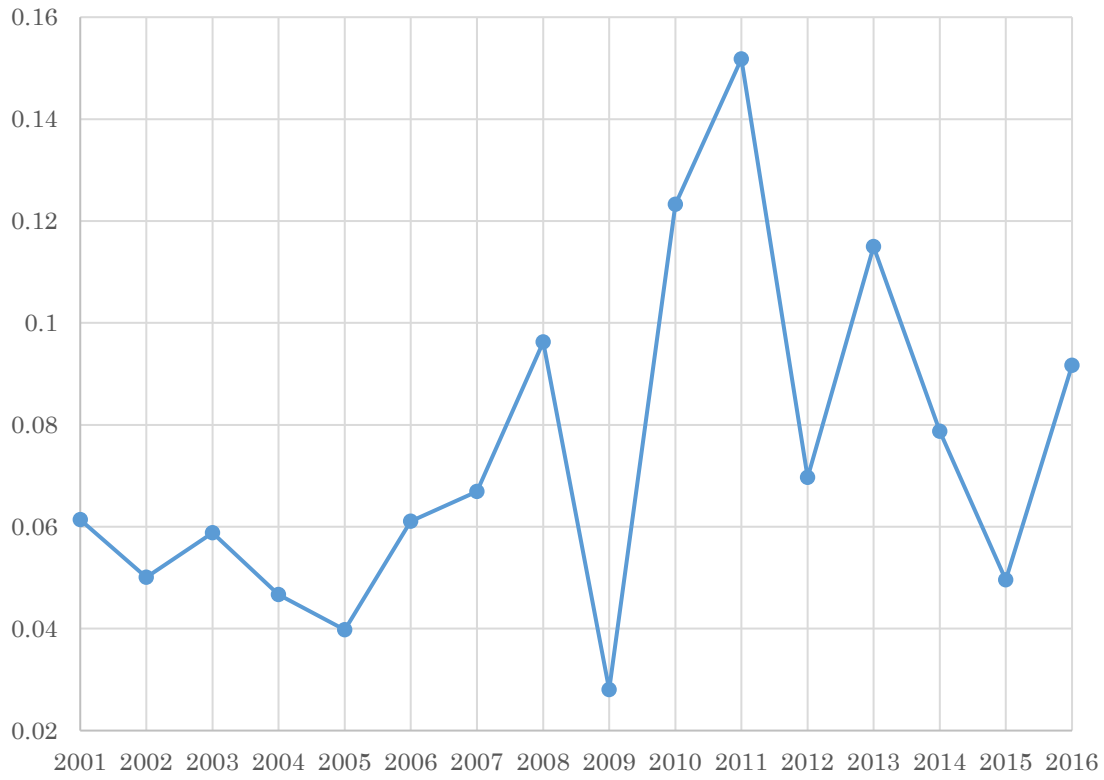
Figure 1: Investment in the 37 industrial sectors (national total) from 2001 to 2016



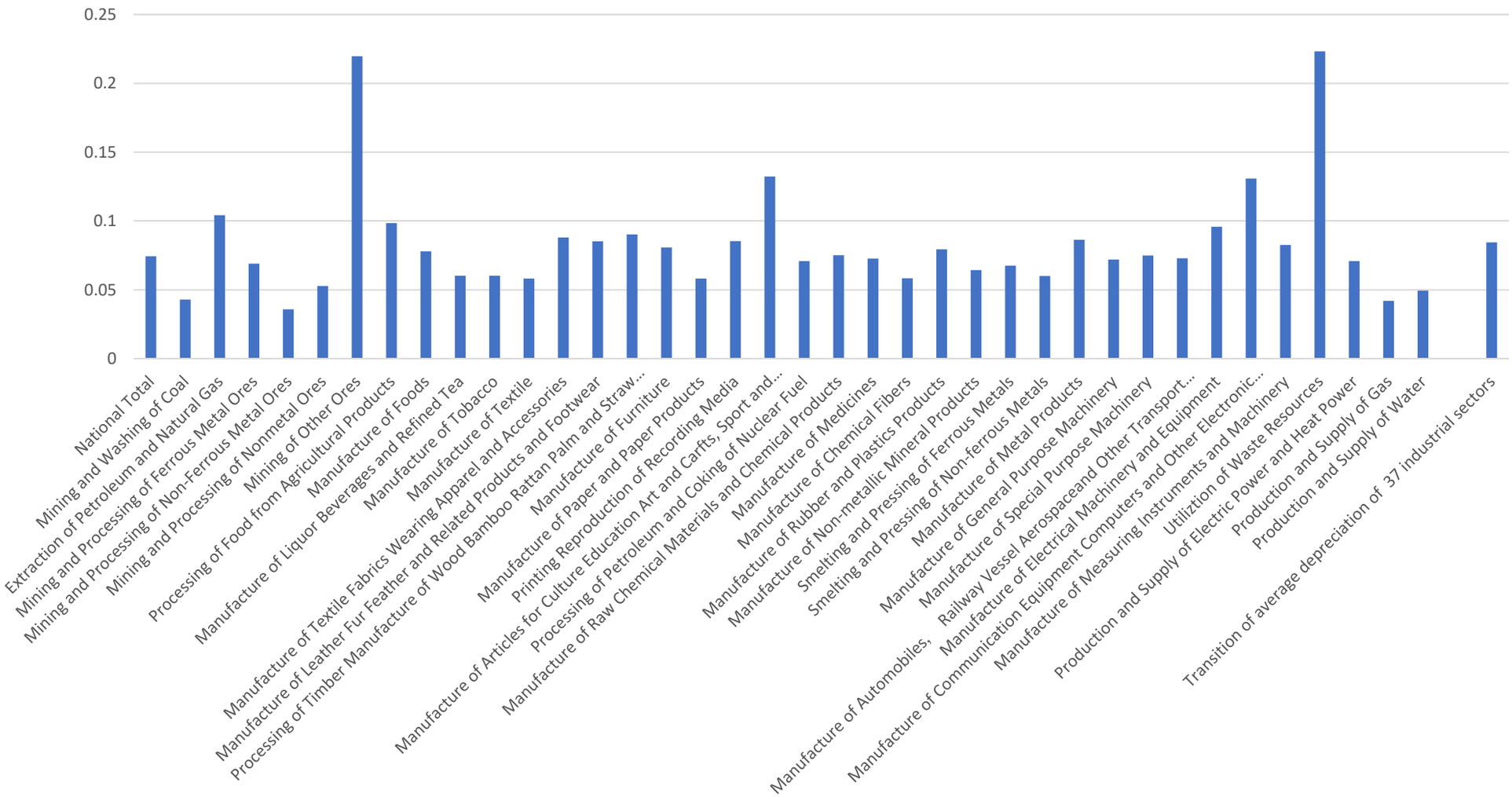
Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Figure 2: Deprecation rates in the 37 industrial sectors (national total) from 2001 to 2016



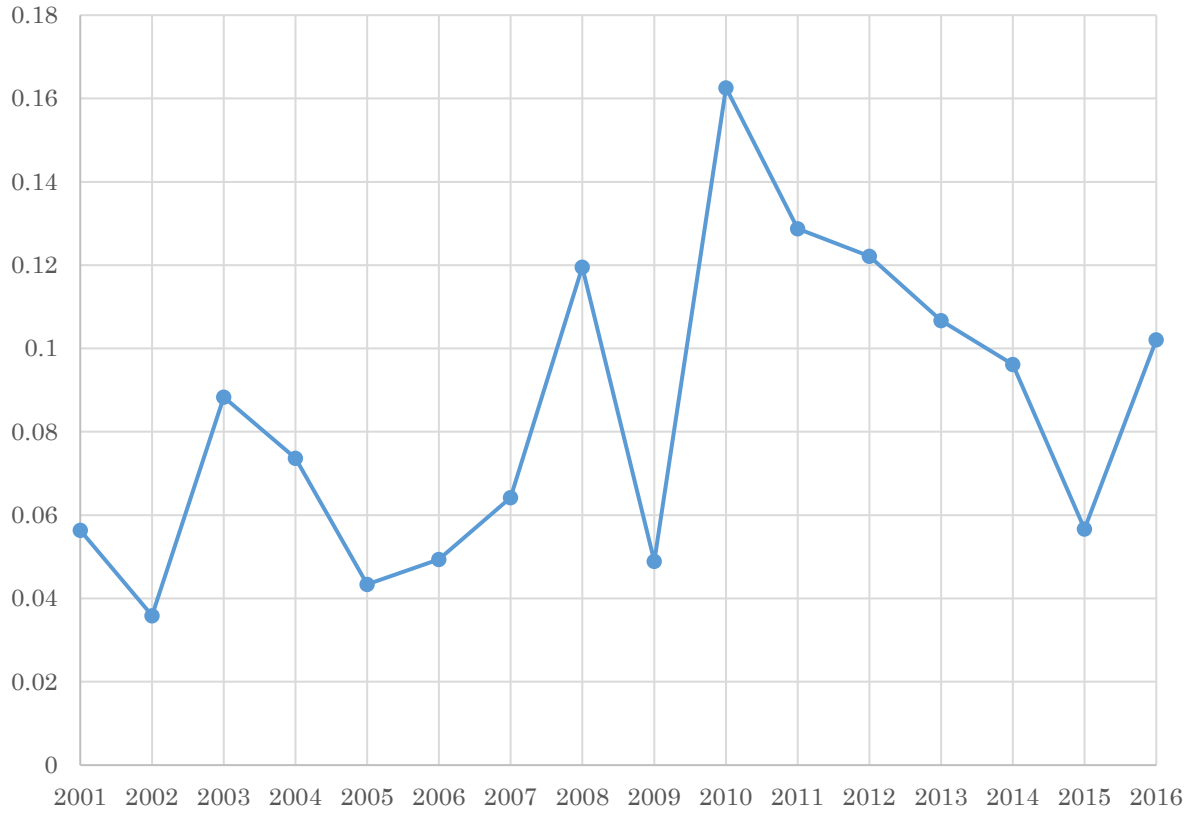
Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Figure 3: Average deprecation rate by industrial sector from 2001 to 2016



Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn

Figure 4: The transition of average depreciation rate of 37 industrial sectors from 2001 to 2016



Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 1a: Depreciation rates of the 37 industrial sectors, 2001-2016

Year	National Total	Mining and Washing of Coal	Extraction of Petroleum and Natural Gas	Mining and Processing of Ferrous Metal Ores	Mining and Processing of Non-Ferrous Metal Ores	Mining and Processing of Non-metal Ores	Mining of Other Ores	Processing of Food from Agricultural Products	Manufacture of Foods	Manufacture of Liquor Beverages and Refined Tea
2001	0.0614	0.0557	0.1910	0.0215	0.0799	0.0239	0.1607	0.0228	0.0246	0.0410
2002	0.0500	0.0559	0.0634	0.0970	-0.0144	0.0046	-0.4219	0.0164	0.0535	0.0495
2003	0.0588	0.0251	0.1866	0.0962	0.0077	0.0101	1.5398	0.0171	0.0145	0.0467
2004	0.0467	-0.0052	0.1486	0.1593	0.0376	-0.0058	-0.0175	0.0394	0.0796	0.0496
2005	0.0398	0.0061	0.0358	-0.0530	-0.0116	-0.0752	0.1044	0.0319	0.0341	0.0373
2006	0.0610	0.0266	0.0930	-0.0020	0.0086	0.1491	-0.4780	0.0512	0.0664	0.0457
2007	0.0669	0.0080	0.2179	0.1640	0.0300	0.0516	0.3786	0.0562	0.0695	0.0664
2008	0.0963	0.0766	0.0316	0.0387	0.0674	0.1530	-0.0729	0.1322	0.0754	0.0326
2009	0.0280	0.0597	-0.2185	-0.0910	-0.0235	-0.0706	0.7555	0.1726	0.0459	0.0818
2010	0.1232	0.0408	0.1626	0.0693	0.0516	0.1552	1.9393	0.2318	0.1388	0.0825
2011	0.1518	0.0807	0.2602	0.2112	0.0557	0.2837	-0.6779	0.2506	0.1449	0.1056
2012	0.0696	0.0481	-0.0208	0.1013	0.0504	-0.0220	0.6187	0.1701	0.0483	0.0550
2013	0.1150	0.0848	0.1246	0.0874	0.0957	0.0751	-0.7776	0.2849	0.1309	0.0676
2014	0.0787	0.0286	0.2385	0.1569	0.0517	0.2200	-0.1098	0.0257	0.0853	0.0746
2015	0.0496	0.0035	-0.0591	0.0462	0.0224	-0.1026	0.0174	0.0178	0.1376	0.0631
2016	0.0917	0.0920	0.2104	0.0018	0.0628	-0.0049	0.5557	0.0532	0.0956	0.0641
Avg.	0.0743	0.0429	0.1041	0.0690	0.0358	0.0528	0.2197	0.0984	0.0778	0.0602

Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 1b: Depreciation rates of the 37 industrial sectors，2001-2016 (cont.)

Year	Manufacture of Tobacco	Manufacture of Textile	Manufacture of Textile Fabrics Wearing Apparel and Accessories	Manufacture of Leather Fur Feather and Related Products and Footwear	Processing of Timber Manufacture of Wood Bamboo Rattan Palm and Straw Products	Manufacture of Furniture	Manufacture of Paper and Paper Products	Printing Reproduction of Recording Media	Manufacture of Articles for Culture Education Art and Carfts, Sport and Entertainment Activities
2001	0.0630	0.0356	0.0472	0.0681	0.0379	0.0639	0.0402	0.0617	0.0658
2002	0.0882	0.0235	0.0245	0.0140	0.0523	0.0599	0.0337	0.0614	0.0850
2003	0.0929	0.0141	0.0209	0.0266	0.0337	0.0392	0.0493	0.0852	0.0833
2004	0.0870	0.0423	0.0515	0.0877	0.0209	0.0442	0.0375	0.0867	0.0956
2005	0.0789	0.0410	0.0455	0.0415	0.0448	0.0841	0.0504	0.0599	0.0358
2006	0.0807	0.0549	0.0779	0.0506	0.0594	0.0579	0.0379	0.0925	0.0542
2007	-0.2429	0.0438	0.0433	0.0489	0.0609	0.0493	0.0776	0.0521	0.0677
2008	0.2572	0.0912	0.1452	0.0975	0.1470	0.1221	0.0918	0.1243	0.1371
2009	0.0425	0.0316	0.0292	0.0440	0.0401	0.0516	0.0067	0.0553	0.0338
2010	-0.1234	0.0929	0.0765	0.1111	0.1468	0.1337	0.0888	0.0929	0.0157
2011	-0.0258	0.1080	0.1292	0.1119	0.2133	0.0671	0.2331	0.0270	0.0561
2012	0.2913	0.0385	0.2325	0.2325	0.0982	0.1298	0.0662	0.0951	0.8978
2013	0.1045	0.1004	0.1589	0.0757	0.1972	0.2698	-0.0144	0.1988	0.1500
2014	0.1260	0.0750	0.1018	0.1525	0.1703	0.0485	0.0519	0.1157	0.1508
2015	-0.0299	0.0846	0.1008	0.0926	0.0221	0.0457	0.0325	0.0729	0.0957
2016	0.0733	0.0525	0.1222	0.1082	0.0979	0.0258	0.0461	0.0843	0.0923
Avg.	0.0602	0.0581	0.0879	0.0852	0.0902	0.0808	0.0581	0.0854	0.1323

Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 1c: Depreciation rates of the 37 industrial sectors，2001-2016 (cont.)

Year	Processing of Petroleum and Coking of Nuclear Fuel	Manufacture of Raw Chemical Materials and Chemical Products	Manufacture of Medicines	Manufacture of Chemical Fibers	Manufacture of Rubber and Plastics Products	Manufacture of Non-metallic Mineral Products	Smelting and Pressing of Ferrous Metals	Smelting and Pressing of Non-ferrous Metals	Manufacture of Metal Products	Manufacture of General Purpose Machinery
2001	0.0722	0.0714	0.0260	-0.0538	0.0718	0.0254	0.0658	0.0324	0.0469	0.0480
2002	0.0829	0.0611	0.0312	0.0745	0.0475	0.0460	0.0137	0.0307	0.0434	0.0495
2003	0.0374	0.0634	0.0111	-0.0301	0.0621	0.0362	0.0344	0.0133	-0.0219	0.0545
2004	0.0607	0.0498	0.0753	0.0225	0.0581	0.0516	0.0228	0.0478	0.0697	0.0571
2005	0.0851	0.0147	0.0474	0.0878	0.0508	0.0266	0.0341	0.0418	0.0473	0.0529
2006	0.0346	0.0650	0.0724	0.0679	0.0690	0.0603	0.0444	0.0436	0.0825	0.0487
2007	0.0135	0.0280	0.0995	0.0379	0.0600	0.0301	0.0859	0.0257	0.0897	0.0142
2008	0.1234	0.1111	0.0711	0.0329	0.1186	0.0973	0.0817	0.0984	0.1707	0.1915
2009	0.0712	0.0136	0.0286	-0.0013	0.0878	0.0171	0.0528	0.0344	0.0496	0.0077
2010	0.1345	0.1376	0.1097	0.0738	0.1189	0.0834	0.1717	0.1379	0.1066	0.1674
2011	0.1123	0.1685	0.1396	0.2202	0.1298	0.1343	0.1847	0.1376	0.1269	0.1284
2012	-0.0014	0.0940	0.0466	-0.0043	0.0418	0.1242	0.0888	0.0383	0.1930	0.0127
2013	0.1829	0.1404	0.1825	0.0671	0.1477	0.0789	0.1091	0.0747	0.1011	0.1351
2014	0.0724	0.0640	0.1045	0.0706	0.0869	0.0894	0.0400	0.0737	0.0695	0.1048
2015	0.0740	0.0431	0.0668	0.1039	0.0762	0.0400	-0.0126	0.0464	0.0822	0.0515
2016	-0.0223	0.0768	0.0507	0.1643	0.0437	0.0877	0.0630	0.0836	0.1221	0.0274
Avg.	0.0708	0.0752	0.0727	0.0584	0.0794	0.0643	0.0675	0.0600	0.0862	0.0720

Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 1d: Depreciation rates of the 37 industrial sectors，2001-2016 (cont.)

Year	Manufacture of Special Purpose Machinery	Manufacture of Automobiles, Railway Vessel Aerospaceand Other Transport Equipments	Manufacture of Electrical Machinery and Equipment	Manufacture of Communication Equipment Computers and Other Electronic Equipment	Manufacture of Measuring Instruments and Machinery	Utiliztion of Waste Resources	Production and Supply of Electric Power and Heat Power	Production and Supply of Gas	Production and Supply of Water	Transition of average depreciation of 37 industrial sectors
2001	0.0435	0.0513	0.0684	0.1051	0.0598		0.0675	0.0040	0.0588	0.0564
2002	0.0224	0.0558	0.0495	0.0722	0.0538		0.0630	0.0592	0.0393	0.0359
2003	0.0656	0.0478	0.0391	0.1256	0.0625		0.0971	0.0010	0.0331	0.0883
2004	0.0471	0.0169	0.0551	0.0814	0.1001	0.7015	0.0295	0.0819	0.0116	0.0737
2005	0.0009	0.0832	0.0335	0.1089	0.0295	0.1720	0.0306	0.0002	0.0261	0.0434
2006	0.0574	0.0319	0.0774	0.1163	0.0899	0.1248	0.0657	0.0168	0.0712	0.0494
2007	0.0350	0.0707	0.0701	0.1366	0.0594	0.1009	0.0794	0.0109	0.0179	0.0642
2008	0.1583	0.0607	0.1657	0.1529	0.0960	0.6419	0.0768	0.0431	0.0860	0.1195
2009	0.0257	0.0301	0.0481	0.1145	0.0848	0.0139	0.0249	0.0332	-0.0026	0.0489
2010	0.1322	0.1394	0.1182	0.1637	0.1095	0.1997	0.1113	0.0857	0.0844	0.1626
2011	0.1460	0.1387	0.4254	0.1693	0.1700	0.2747	0.1160	0.0184	0.0367	0.1287
2012	0.1536	0.0609	-0.0300	0.1408	-0.0631	0.2745	0.0489	0.0416	0.0583	0.1222
2013	0.1066	0.1218	0.1280	0.1698	0.1281	0.3407	0.0865	0.0644	0.0541	0.1067
2014	0.0973	0.0634	0.0632	0.1309	0.1211	0.2711	0.0608	0.0593	0.0729	0.0962
2015	0.0419	0.1057	0.1032	0.0363	0.0702	0.2157	0.0751	0.0855	0.0785	0.0567
2016	0.0638	0.0883	0.1171	0.2682	0.1496	0.2402	0.0994	0.0652	0.0631	0.1021
Avg.	0.0748	0.0729	0.0957	0.1308	0.0826	0.2232	0.0708	0.0419	0.0493	0.0844

Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 2: Summary statistics of the 37 industrial sectors, 2001-2016

Variable	Obs	Median	Mean	Std. Dev.	Min	Max
(level value)						
Depreciation Rate by Perpetual Inventory Method	589	0.0652	0.0828	0.1454	-0.7761	1.9393
Total Profits / Total Value of Fixed Assets $_{(t-1)}$	589	0.2412	0.2645	0.1950	-0.2340	1.2876
Depreciation Expense / Book Value of Fixed Assets $_{(t-1)}$	589	0.0552	0.0742	0.2175	-0.3937	4.8889
Personal Capital / Actual Receipt Capital $_{(t-1)}$	589	0.2078	0.2154	0.1411	0.0006	0.9378
State Capital / Actual Receipt Capital $_{(t-1)}$	589	0.1186	0.2039	0.2082	0.0000	0.9621
Total Assets / Total Value of Fixed Assets $_{(t-1)}$	589	2.7533	2.8627	0.2082	1.2734	6.8588
Year	589	2009	2008.533	0.2082	2001	2016

Source: Authors' estimations based on data from the National Data by National Bureau of Statistics of China. http://data.stats.gov.cn/

Table 3a: Factors determining the depreciation rate, assessed by the perpetual inventory method, for 37 industrial sectors, 2001-2016 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent Variable = Depreciation Rate by Perpetual Inventory Method (t)							
Depreciation Expense / Book Value of Fixed Assets $_{(t-1)}$	0.4777***	0.494***	0.5025***	0.491***	0.4986***	0.4936***	0.4919***	0.4753***
	(0.0452)	(0.0377)	(0.0296)	(0.0343)	(0.0255)	(0.0320)	(0.0272)	(0.0409)
Personal Capital / Actual Receipt Capital $_{(t-1)}$		0.259***	0.2258***	0.2781**	0.2465***			
		(0.1014)	(0.0769)	(0.1044)	(0.0795)			
State Capital / Actual Receipt Capital $_{(t-1)}$			-0.0826		-0.0688	-0.1245	-0.1210	
			(0.0981)		(0.1145)	(0.1218)	(0.1361)	
Total Assets / Total Value of Fixed Assets $_{(t-1)}$				0.0230	0.0182		0.0065	0.0128
				(0.0159)	(0.0216)		(0.0257)	(0.0224)
Year	0.0037***	0.0005	-0.0001	-0.0007	-0.0009	0.0022**	0.0019***	0.0031**
	(0.0006)	(0.0010)	(0.0016)	(0.0011)	(0.0012)	(0.0010)	(0.0005)	(0.0015)
Constant	-7.2951***	-1.0384	0.1380	1.3624	1.8480	-4.3105**	-3.8474***	-6.2168**
	(1.1535)	(1.9529)	(3.1327)	(2.1324)	(2.4397)	(1.9965)	(1.0358)	(2.9923)
Observations	589	589	589	589	589	589	589	589
R-squared	0.5254	0.5380	0.5405	0.5402	0.5418	0.5317	0.5319	0.5261
Number of id	37	37	37	37	37	37	37	37

Note: Robust standard errors in parentheses (FE), *** p<0.01, ** p<0.05, * p<0.1.

Table 3b: Factors determining the depreciation rate, assessed by the perpetual inventory method, for 37 industrial sectors, 2001-2016 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent Variable = Depreciation Rate by Perpetual Inventory Method (t)							
Total Profits / Total Value of Fixed Assets $_{(t-1)}$	0.4529*	0.462**	0.5244**	0.4759*	0.5257**	0.5242**	0.5243**	0.4570*
	(0.2250)	(0.2202)	(0.2171)	(0.2434)	(0.2378)	(0.2182)	(0.2389)	(0.2416)
Personal Capital / Actual Receipt Capital $_{(t-1)}$		-0.1845**	-0.0237	-0.2021*	-0.0258			
		(0.0910)	(0.0687)	(0.1179)	(0.0570)			
State Capital / Actual Receipt Capital $_{(t-1)}$			0.3622*		0.3615**	0.3671**	0.3671**	
			(0.1794)		(0.1700)	(0.1718)	(0.1688)	
Total Assets / Total Value of Fixed Assets $_{(t-1)}$				-0.0162	-0.0017		-0.0002	-0.0051
				(0.0307)	(0.0282)		(0.0282)	(0.0226)
Year	-0.0026	-0.0005	0.0011	0.0003	0.0012	0.0009	0.0009	-0.0024
	(0.0031)	(0.0026)	(0.0021)	(0.0019)	(0.0018)	(0.0018)	(0.0016)	(0.0025)
Constant	5.1561	0.9181	-2.3160	-0.5153	-2.4620	-1.8665	-1.8802	4.8331
	(6.2677)	(5.1033)	(4.1110)	(3.7705)	(3.5136)	(3.4999)	(3.1816)	(5.1029)
Observations	589	589	589	589	589	589	589	589
R-squared	0.1652	0.1718	0.2212	0.1728	0.2212	0.2211	0.2211	0.1653
Number of id	37	37	37	37	37	37	37	37

Note: Robust standard errors in parentheses (FE), *** p<0.01, ** p<0.05, * p<0.1.

Table 3c: Factors determining the depreciation rate, assessed by the perpetual inventory method, for 37 industrial sectors, 2001-2016 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent Variable = Depreciation Rate by Perpetual Inventory Method (t)							
Total Profits / Total Value of Fixed Assets $_{(t-1)}$	0.1512**	0.1282*	0.121**	0.1224	0.1327**	0.1376*	0.1559**	0.1164*
	(0.0737)	(0.0675)	(0.0581)	(0.0815)	(0.0591)	(0.0681)	(0.0895)	(0.0671)
Depreciation Expense / Book Value of Fixed Assets $_{(t-1)}$	0.4435***	0.4621***	0.4664***	0.4627***	0.4549***	0.4551**	0.4435	0.4666***
	(0.0459)	(0.0372)	(0.0235)	(0.0388)	(0.0260)	(0.0256)	(0.0458)	(0.0239)
Personal Capital / Actual Receipt Capital $_{(t-1)}$		0.212*	0.205**	0.2193**				0.212**
		(0.1051)	(0.0872)	(0.0973)				(0.0831)
State Capital / Actual Receipt Capital $_{(t-1)}$			-0.0239		-0.0560	-0.0570		-0.0220
			(0.0901)		(0.1148)	(0.1176)		(0.0980)
Total Assets / Total Value of Fixed Assets $_{(t-1)}$				0.0062		-0.0066	-0.0058	0.0055
				(0.0208)		(0.0262)	(0.0256)	(0.0234)
Year	0.0017**	-0.0006	-0.0007	-0.0009	0.0012	0.0015**	0.0019**	-0.0010
	(0.0007)	(0.0016)	(0.0019)	(0.0013)	(0.0012)	(0.0007)	(0.0009)	(0.0014)
Constant	-3.324**	1.1911	1.4073	1.7387	-2.4694	-2.8733**	-3.6944*	1.8756
	(1.4284)	(3.1533)	(3.7682)	(2.5674)	(2.4124)	(1.3895)	(1.8507)	(2.8112)
Observations	589	589	589	589	589	589	589	589
R-squared	0.5398	0.5479	0.5481	0.5481	0.5409	0.5411	0.5400	0.5482
Number of id	37	37	37	37	37	37	37	37

Note: Robust standard errors in parentheses (FE), *** p<0.01, ** p<0.05, * p<0.1.