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# Nonperforming Debts in Chinese Enterprises: Patterns, Causes, and Implications for Banking Reform\*

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## Abstract

Given the domination of bank financing, nonperforming debts (NPDs) in large Chinese enterprises are a proxy for nonperforming loans (NPLs) in China's major banks. Using a firm-level survey of more than 20,000 large and medium-sized industrial enterprises conducted by the National Bureau of Statistics of China, this paper estimates both the level and ratio of NPDs across ownership type, industry, and region for the period 1995–2002. The results show that NPD ratios have been falling since 2000 as a result of the rapid expansion of better-performing non-state enterprises (NSEs), the improved performance of state-owned enterprises (SOEs), and the exit of poor-performing enterprises (which has been facilitated by asset management companies and other merger and acquisition activities). SOEs, however, are still much more likely than NSEs to generate NPDs. This paper provides useful tools and sector information for assessing enterprise debt risks and draws lessons for banking reform in China.

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## I. Introduction

Since early 2004, the newly established China Banking Regulatory Commission (CBRC) has announced quarterly

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statistics on the ratio of nonperforming loans (NPLs) for China's major banking institutions. It reported a sharp decline in the NPL ratio from above 24 percent in 2002 to 19.6 percent in June 2003, 17.8 percent in December 2003, 13.3 percent in June and December 2004, and only 8.7 percent in June 2005. During the 2-year period between June 2003 and June 2005, the outstanding amount of NPLs in China dropped from RMB2.538 trillion to RMB1.276 trillion, a decrease of RMB1.262 trillion. This is clearly a dramatic turnaround in terms of banking sector performance. Are the official statistics reliable? What happened to the quality of bank loans and debt in China's enterprises? These questions motivate this paper. Outside observers interpreted the official reports cautiously because they did not understand how China's banks calculated their NPL ratios. Most analysts and commentators would still estimate China's NPL ratio to be at a much higher level than the official figure—usually two to three times that of the official NPL ratio. For example, UBS, an investment bank and global asset management firm (Anderson 2005), estimates that China's NPLs fell from about 50–55 percent in 1997–98 to about 25–30 percent by the end of 2004. These market estimations of NPL ratios are usually based on macroeconomic data because it is difficult to get reliable and representative microeconomic data from Chinese banks.

This paper attempts to develop an alternative approach to the study of NPLs in China using firm-level microeconomic data. As a result of the limited development of stock markets and enterprise bond markets in China, banks are still the major holders of enterprises' long-term and short-term debt. In recent years, Chinese banks have expanded rapidly in the business of consumer loans, especially mortgage loans. The outstanding amounts of consumer loans rose from below 1 percent in 1998 to above 10 percent in 2004. Because the quality of consumer loans is generally much better than that of enterprise loans, the quality of bank loans depends largely on the quality of the bank lending to enterprises. The quality of enterprise debt is directly linked to the profitability of the enterprises. The ability to pay the interest and principal of loans derives ultimately from profitability and cash income flows of the enterprises. This is especially true if we are examining a large group of enterprises, in which the variations in the enterprise-specific timing of cash income flows and the structures of financing within the group will be averaged out statistically through the law of large numbers, making the profitability of each enterprise

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the single most important contribution to the quality of the enterprise group's portfolio of debts.

This paper uses the profitability conditions of each enterprise to measure and characterize the quality of the enterprise group's portfolio of debts. It uses both reported profitability and imputed profitability (the latter is derived from the components of value-added) to give two alternative estimates of the quality of debt portfolios for different groups of enterprises classified by ownership, industry, and region. The method is applied to a comprehensive annual survey of all the large and medium-sized industrial enterprises in China conducted by the National Bureau of Statistics of China. Information about the survey data can be found in tables A.1–A.6 in the appendix. The survey sample includes more than 20,000 enterprises and covers the period from 1995 to 2002 (see table A.6). In 2002, the sample enterprises had 26 million employees in total, which is about 16.7 percent of China's total industrial employment. These enterprises incurred RMB5.7 trillion in debt, an amount equal to 43.6 percent of the total loans in China's financial institutions. The sample enterprises contributed about 19.2 percent of China's GDP. Clearly these enterprises are the most important leaders in the Chinese industrial sector. Aggregate financial information about the sample enterprises has been regularly reported in the *Statistical Yearbook of China*.

The contribution of this paper is the methodology of using the disaggregated firm-level data to study the enterprise profitability of the enterprises and the quality of their debts. The paper derives both the level and ratio of NPD across enterprise groups by ownership, industry, and region for the period 1995–2002. The results show that NPDs have indeed been falling as a result of both the rapid expansion of better-performing non-state enterprises (NSEs) and improvements in the performance of state-owned enterprises (SOEs), as well as rapid exit of poor-performing state-owned enterprises, which has been facilitated by newly established asset management companies that specialize in dealing with NPLs. The micro-level evidence uncovered here is largely consistent with the CBRC reports on falling NPLs and NPL ratios in China's banking sector. This study, however, provides a more transparent, simpler, and more objective method of estimating NPDs and allows outsiders to examine the detailed causes and dynamics of the changing patterns of NPDs in Chinese enterprises. In particular, it was found that the SOEs had consistently generated higher NPD ratios than the NSEs, providing a challenge as well as an opportunity for future banking reform.

Section 2 defines our concepts of NPDs; section 3 shows the patterns of NPD and NPD ratios across enterprises' ownership type, industry, and region; and section 4

examines the trend of NPD ratios during the period 1995–2002 and provides scenarios of the future of NPD ratios in China. Section 5 uses panel data regressions to identify the impacts of various factors on the profitability and debt quality of the enterprises. Section 6 addresses the sample-selection bias in the measure of NPD ratios resulting from the exit of poor-performing enterprises from the sample over the study period. Section 7 discusses the implications of the empirical results for banking reform in China.

## 2. Defining and estimating NPDs

In recent years, the CBRC has been trying hard to monitor and supervise the NPLs in China's banking institutions. It developed detailed rules on the reporting of the amount of NPLs and the NPL ratios. The purpose is to manage and reduce financial risk by monitoring both the changing distribution of NPLs and the changing NPL ratios of individual banks and bank branches. This is clearly necessary and useful. Poor governance of banks is a sufficient condition for creating NPLs, even when the enterprise sector is doing well.

The efforts of the CBRC and the individual banks to reduce NPLs, however, are only necessary conditions. Ultimately, the quality of China's banking assets and enterprise debts depends directly on the profitability of China's enterprises. For example, in the short run it is easy for banks to reduce NPL ratios, or even the amount of NPLs, by simply expanding the total amount of loans. New loans are much less likely to have repayment problems in the short run, but they could create more bad loans in the future if they are extended to potentially loss-making enterprises. New loans can help existing loss-making enterprises continue to pay their interest on old loans, thereby also shifting the underlying risks to the future. The problem is especially serious when the economy is booming. These are the main reasons why the reliability of NPL statistics as reported by China's banks can vary considerably, depending on how they are calculated. Outsiders are unable to completely understand how the NPLs and NPL ratios in China's banks are actually calculated because the decisions in each individual case require judgments that are too complex for outsiders to assess. This is why analysts and commentators rely more on the study of China's macroeconomic conditions, such as business cycles and sector performance, to gauge the level of NPLs in China. Based on their personal impressions and understandings about the Chinese economy, they report NPL ratios that are usually two to three times larger than the official ratio.

This paper attempts to develop an objective measure of the quality of enterprise debts in China. Profitability is the only criterion used in measuring the quality of these debts. The concept and its implementation are straightforward. If the enter-

prises are making profits, the quality of their debts (more specifically their total liabilities) are termed "performing." If they are making losses, their debts are regarded as "nonperforming." The amount of NPD for a specific enterprise group is then the sum of the total liabilities in the loss-making enterprises for that group. The NPD ratio for the group is simply the ratio of the sum of total liabilities in the loss-making enterprises divided by the sum of total liabilities in both the loss-making and profit-making enterprises in the group. These simple definitions of NPD and the NPD ratio make our NPD statistics objective, easy to measure, and easy to understand.

Our concept of the NPD ratio, however, is not applicable to an individual enterprise, because according to our definition, an enterprise cannot have part of its total debt be performing and the other part be nonperforming: all the debts in any given enterprise have the same quality. For instance, one enterprise cannot have 70 percent of its debts performing and 30 percent nonperforming. For an individual enterprise, losses might occur in the first few years, but the firm would make profits in the future. After a close examination by its creditors, such a firm would be considered to have high-quality debt. Our definition of NPD would not be fair to this particular enterprise. On the other hand, a currently profitable enterprise might become a loss maker. Then its debt quality would be bad upon close examination. Our assessment, based only on current profitability, might not do justice to this particular enterprise. The difference between current profitability and longer-term profitability, however, could be seen as a random distribution for a large group of enterprises, such as groups in our sample separated by time, ownership, industry, and region. With a sizable group, the variability in the timing of cash flows, profit streams, payments to creditors, and other profitability-related variables for enterprises within the group would offset each other, leaving the average NPD ratio for the group a much more reliable and accurate measure of the quality of the group's portfolio of debts. This is why our concept of the NPD ratio is useful only for measuring debt quality for groups of enterprises. This study would be very useful as complementary research to the traditional method of estimating NPLs.

For our method to be useful, it needs to be applied to a representative sample with sizable groups of enterprises. The annual survey of large and medium-sized industrial enterprises conducted by China's National Bureau of Statistics (NBS) is a suitable data set for our method. The NBS data are in fact census data, not really sample data, because the survey covers all large and medium-sized industrial enterprises in China. In 2002, China had more than 180,000 industrial enterprises with sales above RMB5 million. The NBS sample includes only about 21,000–23,000 large and medium-sized industrial enterprises out of a total of 180,000 firms. Many small industrial enterprises are not included in our study, but most of them have limited access to bank finance under the current financial system in China.

One major weakness of using our method for the NBS data is sample selection bias. The group of enterprises included in the NBS survey each year is not always the same. About 20 percent of the group consists of enterprises that enter and exit the survey sample each year as a result of changes in their size classification or organizational changes such as mergers and acquisition, privatization, reorganization, and bankruptcy. The profitability of exiting firms is not necessarily the same as that of the new entries. This means that we are studying only the largest and most dynamic frontier industrial enterprises in China and leaving out the poor-performing ones. We will address this issue in section 6 and show the impact of this sample selection bias on the estimated ratio of NPD.

Our sample covers not only SOEs but also other types of enterprises in all industries and regions, including rural and urban collectives, private enterprises, domestic mixed-ownership corporations, foreign-invested enterprises, and enterprises with investment from Hong Kong, Macau, and Taiwan. Our sample does not include nonindustrial enterprises, however, such as China Telecom, a big service sector firm. It is entirely possible that the enterprises not included in our sample have worse performance records than the enterprises in the NBS sample. If that is the case, the NPD ratios for the entire Chinese enterprise sector would be higher than the ratios reported in this study. Also, if the banking institutions in China are performing worse than the enterprises in the NBS sample, as a consequence of their own weak governance, the overall NPL situation of the Chinese economy as a whole would be worse than that for the sample enterprises used in this study. In addition, we cannot directly compare the NPL ratios reported by the CBRC with the NPD ratios estimated in our study because they are defined differently. The NPD ratios here are designed to examine the trend and the cross-sectional patterns of the quality of Chinese enterprise debts.

During the period from 1995 to 2002, the sample enterprises created about 16–25 percent of China's industrial employment and 33–43 percent of China's industrial value added (see table A.6). Most significantly, the sample enterprises contributed about 14–19 percent of China's GDP. Their total liabilities, one of the key variables we examine in this paper, amount to about 43–65 percent of China's total banking loans during the 1995–2002 period. Of course, not all of the total liabilities in the sample enterprises correspond to loans from banks. But even assuming that 60 percent of the total liabilities in the sample are related to various bank loans, the statistical analysis in the paper provides an in-depth study of the quality of about 27–29 percent of China's total loans. In summary, although the members of the sample enterprises group are changing each year, as a whole they form a stable club of China's elite industrial enterprises. The performance of this elite group of enter-

prises is much more representative of the performance of China's industrial economy than, for example, the performance of China's listed companies or any small sample of Chinese enterprises. Given the growing importance of China's industrial sector for both the domestic and global economy, our analysis in this paper fills a crucial gap in understanding the dynamics of China's industrial reform and development.

Tables 1, 2, and 3 show the distribution of the total liabilities for the sample enterprises by ownership, industry, and region. The objective is to find out how much of these debts are located in profit-making and loss-making enterprises and then calculate the amounts and ratios of the NPD. There are two underlying forces affecting the NPD ratios: the shifting distribution of debts across enterprise groups with different profitability and the changing profitability of each group.

Table 1 shows the distribution of total liabilities (or total debts) across ownership types. The share of total debts by SOEs fell sharply, from 76.4 percent in 1995 to 48.2 percent in 2002, to the benefit of domestic mixed-ownership corporations and private enterprises. The total debt for SOEs increased from RMB2.5 trillion in 1995 to RMB3.2 trillion in 1998, immediately before the Asian financial crisis, and then fell to RMB2.8 trillion in 2002. The total debt for collectives followed the same pattern as that for SOEs, rising from RMB227 billion in 1995 to RMB287 billion in 1998 and then falling to RMB219 billion in 2002. The shifting of debt toward private, mixed, foreign, or overseas Chinese enterprises was steady and rapid throughout the 1995–2002 period, without any interruption resulting from the Asian financial crisis in 1998–99. For the 8 years from 1995 to 2002, total debt in the sample enterprises increased by RMB2,436 billion. Of this net increase, RMB246 billion ended up in the SOEs, RMB1,411 billion went to mixed-ownership enterprises, RMB467 billion to foreign enterprises, and RMB95 billion to private enterprises. The drastic changes in the distribution of total debt are strong evidence of the rapid but quiet privatization and opening up of the most dynamic part of China's industrial sector. In the next section, we will show that the redistribution of total debt from SOEs toward the better-performing NSEs contributed to the larger part of the observed fall in average NPD ratios for the sample enterprises.

How were financial resources allocated among the Chinese industrial enterprises during 1995–2002, which can be characterized as a period of high growth and steady reform? Which industries and regions were getting more financial resources for their elite industrial enterprises? Tables 2 and 3 provide the answer. The two tables give us detailed information about credit allocation among China's large and medium-sized industrial enterprises and illustrate the changing landscape of Chinese enter-

Table 1. Distribution of total liabilities by ownership, 1995–2002 (RMB billion)

	1995	1996	1997	1998	1999	2000	2001	2002	Change in total liabilities during 1995–2002	Change in total liabilities during 1995–2002 as percentage of total in 1996
Amount of debt for										
Private	0	1	2	11	18	31	61	95	95	9,500.0%
Collective	227	268	285	287	284	254	221	219	-8	-3.0%
Mixed	231	279	380	514	690	1,033	1,424	1,642	1,411	505.7%
Foreign	152	232	285	329	371	400	561	619	467	201.3%
Hong Kong, Macau, and Taiwan	164	190	214	276	297	305	359	389	225	118.4%
State-owned	2,512	2,737	3,035	3,193	3,145	2,940	2,703	2,758	246	9.0%
Total	3,286	3,707	4,201	4,610	4,805	4,963	5,329	5,722	2,436	65.7%
Share of debt for										
Private	0.0%	0.0%	0.0%	0.2%	0.4%	0.6%	1.1%	1.7%	1.7%	1.7%
Collective	6.9%	7.2%	6.8%	6.2%	5.9%	5.1%	4.1%	3.8%	-3.1%	-3.1%
Mixed	7.0%	7.5%	9.0%	11.1%	14.4%	20.8%	26.7%	28.7%	21.7%	21.7%
Foreign	4.6%	6.3%	6.8%	7.1%	7.7%	8.1%	10.5%	10.8%	6.2%	6.2%
Hong Kong, Macau, and Taiwan	5.0%	5.1%	5.1%	6.0%	6.2%	6.1%	6.7%	6.8%	1.8%	1.8%
State-owned	76.4%	73.8%	72.2%	69.3%	65.5%	59.2%	50.7%	48.2%	-28.2%	-28.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



prise financing. In tables 2 and 3 the total debt for each industry or region are sorted by their amount in 2002, to make it easy to look for the winners and losers. The last two columns show the amount of change and the growth rate for total debts during the 1995–2002 period.

As shown in table 2, the top five industries in 2002, ranked by the level of their total debts, were electric power, steam, and hot water; transport equipment manufacturing; smelting and pressing of ferrous metals; electronic and telecommunications equipment; and raw chemical materials and chemicals. The top five industries together attracted RMB2.692 trillion in debt, or 47 percent of the total debt for the whole sample. The net gains in debt for the top five industries during 1995–2002 amounted to RMB1.465 trillion, or 60 percent of the gains by the whole sample. China's financial risks are heavily influenced by the performance of the above five sectors.

From the last column of table 2, the top five industries ranked by the growth of their total debts during 1995–2002 were tap water production and supply; electric power, steam, and hot water; electronic and telecommunications equipment; papermaking and paper products; and gas production and supply.

Clearly, the above leading industries, which have attracted investment in the last decade, are largely related to industrial infrastructure, intermediate inputs, raw materials, production equipment, and utilities. Rapid development of these industries would lay a solid foundation for China's further industrialization. In this sense, China's enterprise finance looks increasingly driven by market forces. Of course, a risk-based regulation strategy would require extra attention to be paid to the sectors with heavy concentrations of investment. As we will see in the next section, some of the above sectors with rapid growth in enterprise debts do have high NPD ratios, especially the SOE-dominated utilities sector.

From table 3 we see that the top five regions ranked by the level of their total enterprise debts in 2002 are Guangdong, Jiangsu, Shandong, Shanghai, and Liaoning. These regions are clearly becoming China's new industrial centers. In section 5, we will examine region-specific enterprise performance, which is relevant for assessing debt risks across regions. Xiao (2005) examines enterprise performance in the north-east region of China in detail, and Xiao and Tu (2005) study China's industrial productivity growth using the same set of data.

In the next section, we will show how much of the total debt shown in tables 1–3 is located in loss-making enterprises. Profitability of enterprises becomes the crucial

Table 2. Distribution of total liabilities by industry, 1995–2002, by total liability in 2002 (RMB billion)

	1995	1996	1997	1998	1999	2000	2001	2002	Change in total liabilities during 1995–2002	Change in total liabilities during 2002 as percentage of total in 1995
[44] Electric power	296	317	361	521	614	719	802	934	638	215.5%
[37] Transport equipment	229	276	324	360	385	400	440	491	262	114.4%
[32] Pressing ferrous	331	356	396	416	440	407	443	443	112	33.8%
[41] Electronic and telecommunications	145	167	198	229	251	286	366	424	279	192.4%
[26] Raw chemicals	226	264	326	365	369	388	380	400	174	77.0%
[17] Textile	258	274	287	275	244	234	230	234	-24	-9.3%
[40] Electric equipment	136	164	185	195	194	195	218	226	90	66.2%
[35] Ordinary machinery	157	180	194	207	202	205	209	222	65	41.4%
[06] Coal mining	129	147	168	182	206	209	217	215	86	66.7%
[31] Nonmetal products	138	166	186	195	201	195	209	215	77	55.8%
[36] Special equipment	148	161	176	187	186	191	184	192	44	29.7%
[25] Petroleum processing	101	113	163	180	180	184	178	173	72	71.3%
[33] Pressing nonferrous	95	101	116	132	140	140	153	162	67	70.5%
[07] Petroleum extract	151	157	164	170	160	158	149	153	2	1.3%
[27] Medical	59	73	81	91	97	105	121	133	74	125.4%
[22] Papermaking	53	65	72	73	80	88	121	125	72	135.8%
[15] Beverage	73	83	99	103	108	111	111	114	41	56.2%
[13] Food processing	87	107	112	114	106	101	103	111	24	27.6%
[16] Tobacco	70	76	82	72	71	74	109	108	38	54.3%
[28] Chemical fiber	62	71	76	83	91	83	75	73	11	17.7%
[34] Metal products	46	53	59	62	63	59	65	68	22	47.8%
[14] Food production	37	41	42	46	48	48	56	65	28	75.7%
[30] Plastic	31	38	43	46	48	49	55	61	30	96.8%
[29] Rubber	36	43	48	50	51	49	52	51	15	41.7%
[46] Tap water	14	15	23	27	30	34	39	46	32	228.6%
[42] Instruments	29	32	37	34	35	34	40	40	11	37.9%
[18] Garments	18	23	24	26	29	33	38	39	21	116.7%
[10] Nonmetal mining	16	16	18	19	23	28	23	23	13	81.3%
[23] Printing	14	17	19	20	22	23	27	27	13	92.9%
[19] Leather	16	19	21	21	21	21	23	24	8	50.0%
[45] Gas production	10	13	13	16	18	20	19	23	13	130.0%
[12] Timber logging	19	20	22	23	22	22	22	22	3	15.8%
[20] Timber	10	12	16	16	18	19	21	22	12	120.0%
[09] Nonferrous mining	18	18	19	19	19	19	20	21	3	16.7%
[43] Other manufacturing	9	11	11	10	12	11	13	13	4	44.4%
[08] Ferrous mining	6	7	8	11	9	8	8	10	4	66.7%
[24] Cultural	5	8	8	9	9	9	8	10	5	100.0%
[21] Furniture	4	4	5	5	5	5	6	6	2	50.0%
Total	3,282	3,708	4,202	4,610	4,807	4,964	5,327	5,725	2,443	74.4%

Note: See appendix 2 for full industry names corresponding to industry codes.

Table 3. Distribution of total liabilities by region, 1995–2002, by total liability in 2002 (RMB billion)

	1995	1996	1997	1998	1999	2000	2001	2002	Change of total liabilities during 1995–2002	Change of total liabilities during 1995–2002 as percentage of total in 1995
[44] Guangdong	299	348	414	436	434	468	509	559	260	87.0%
[32] Jiangsu	226	269	300	320	328	369	456	503	277	122.6%
[37] Shandong	262	295	336	354	416	436	455	490	228	87.0%
[31] Shanghai	231	273	323	337	347	334	349	376	145	62.8%
[21] Liaoning	293	310	346	362	320	323	335	354	61	20.8%
[50] Sichuan + Chongqing	183	199	233	240	319	295	303	325	142	77.6%
[13] Hebei	143	166	184	199	213	224	249	257	114	79.7%
[41] Henan	133	156	165	204	210	219	234	254	121	91.0%
[42] Hubei	135	164	182	217	219	233	229	253	118	87.4%
[23] Heilongjiang	149	149	167	190	183	191	189	195	46	30.9%
[33] Zhejiang	121	143	153	157	159	166	170	187	66	54.5%
[12] Tianjin	108	110	119	156	155	144	153	175	67	62.0%
[22] Jilin	115	136	153	155	159	170	163	173	58	50.4%
[11] Beijing	98	113	132	166	154	157	187	169	71	72.4%
[61] Shaanxi	78	89	99	101	134	133	142	156	78	100.0%
[35] Fujian	47	55	54	55	62	66	135	149	102	217.0%
[43] Hunan	78	86	99	112	119	124	140	149	71	91.0%
[34] Anhui	81	92	108	108	113	131	129	145	64	79.0%
[14] Shanxi	78	89	100	129	129	135	126	133	55	70.5%
[53] Yunnan	58	64	68	75	76	75	103	114	56	96.6%
[62] Gansu	54	59	79	93	83	84	88	94	40	74.1%
[45] Guangxi	60	62	71	80	85	90	89	90	30	50.0%
[36] Jiangxi	58	68	72	78	87	88	90	88	30	51.7%
[54] Inner Mongolia	51	55	63	71	78	72	83	87	36	70.6%
[51] Tibet + Qinghai + Ningxia	34	34	43	56	57	63	55	79	45	132.4%
[52] Guizhou	44	40	47	59	63	74	72	78	34	77.3%
[65] Xinjiang	58	68	75	79	79	80	80	78	20	34.5%
[46] Hainan	12	15	19	20	23	20	15	16	4	33.3%
Total	3,287	3,707	4,204	4,609	4,804	4,964	5,328	5,726	2,439	74.2%

variable for our study. Reported profits, however, present several problems. First, it is difficult to check the consistency of reported profits with enterprises' other financial variables because of China's complicated accounting regulations. In other words, we do not know how reported profits are calculated from other financial variables reported in the NBS survey. Second, it is widely reported that enterprises sometimes manage their profit numbers for many purposes, including legal or illegal tax evasion. For this paper, it seems useful to develop an alternative measure of profitability, one that is based on a consistent set of financial variables available from the NBS survey. Because the main purpose of the NBS survey is to calculate the value-added of industrial enterprises, it is possible to develop a measure of an enterprise's profitability or potential profitability based on the reconstructed components of its value-added.

We use the following variables available from the NBS survey to define the imputed profitability of the sample enterprises:

$VA$  = value-added, including value-added taxes and financial changes

$W$  = wages and other employee compensation expenses

$FC$  = financial charges, mainly interest payments

$D$  = current depreciations

$T$  = all tax payments, including those for value-added taxes

$TA$  = total assets

We can classify enterprises into eight profitability groups:

[-4]: if  $VA \leq 0$

[-3]: if  $VA - W \leq 0$  and  $VA > 0$

[-2]: if  $VA - W - FC \leq 0$  and  $VA - W > 0$

[-1]: if  $VA - W - FC - D \leq 0$  and  $VA - W - FC > 0$

[+1]: if  $VA - W - FC - D - T \leq 0$  and  $VA - W - FC - D > 0$

[+2]: if  $VA - W - FC - D - T > 0$  and  $(VA - W - FC - D - T)/TA \leq 0.05$

[+3]: if  $(VA - W - FC - D - T)/TA > 0.05$  and  $(VA - W - FC - D - T)/TA \leq 0.15$

[+4]: if  $(VA - W - FC - D - T)/TA > 0.15$

Table 4 shows the number of enterprises in each of the eight profitability groups over the period from 1995 to 2002. This imputed profitability by group allows us to separate the NPDs into more disaggregated groups according to the qualitative and quantitative extent of loss making. Chinese banks are in the process of changing from four loan classification categories (normal, overdue, doubtful, and poor) to the international standard of five categories (normal, special mention, substandard,

Table 4. Number of enterprises and share of total enterprises, by profitability, 1995–2002

Profitability	1995	1996	1997	1998	1999	2000	2001	2002	Average 1995–2002
[-4]: if VA ≤ 0	867	1,006	969	901	569	458	450	602	728
[-3]: if VA - W ≤ 0 and VA > 0	2,995	2,977	3,102	3,085	2,503	2,260	1,963	1,928	2,602
[-2]: if VA - W - FC ≤ 0 and VA - W > 0	2,152	2,199	1,988	1,749	1,307	955	811	698	1,482
[-1]: if VA - W - FC - D ≤ 0 and VA - W - FC > 0	1,815	1,757	1,839	1,943	1,841	1,684	1,740	1,724	1,793
[+1]: if VA - W - FC - D - T ≤ 0 and VA - W - FC - D > 0	3,059	2,644	2,705	2,579	2,399	2,396	2,396	2,138	2,540
[+2]: if VA - W - FC - D - T > 0 and (VA - W - FC - D - T) / TA ≤ 0.05	5,095	5,106	5,336	5,284	5,292	5,129	5,225	4,985	5,182
[+3]: if (VA - W - FC - D - T) / TA > 0.05 and (VA - W - FC - D - T) / TA ≤ 0.15	4,371	4,327	4,297	4,253	4,490	4,579	5,208	5,365	4,611
[+4]: if (VA - W - FC - D - T) / TA > 0.15	2,189	2,958	2,721	2,499	3,062	3,277	4,105	4,780	3,199
Total	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	22,136
[-4]: if VA ≤ 0	3.8%	4.4%	4.2%	4.0%	2.7%	2.2%	2.1%	2.7%	3.3%
[-3]: if VA - W ≤ 0 and VA > 0	13.3%	13.0%	13.5%	13.8%	11.7%	10.9%	9.0%	8.7%	11.8%
[-2]: if VA - W - FC ≤ 0 and VA - W > 0	9.5%	9.6%	8.7%	7.8%	6.1%	4.6%	3.7%	3.1%	6.7%
[-1]: if VA - W - FC - D ≤ 0 and VA - W - FC > 0	8.1%	7.6%	8.0%	8.7%	8.6%	8.1%	7.9%	7.8%	8.1%
[+1]: if VA - W - FC - D - T ≤ 0 and VA - W - FC - D > 0	13.6%	11.5%	11.8%	11.6%	11.2%	11.6%	10.9%	9.6%	11.5%
[+2]: if (VA - W - FC - D - T) / TA > 0.05 and (VA - W - FC - D - T) / TA ≤ 0.05	22.6%	22.2%	23.2%	23.7%	24.7%	24.7%	23.9%	22.4%	23.4%
[+3]: if (VA - W - FC - D - T) / TA > 0.05 and (VA - W - FC - D - T) / TA ≤ 0.15	19.4%	18.8%	18.7%	19.1%	20.9%	22.1%	23.8%	24.1%	20.8%
[+4]: if (VA - W - FC - D - T) / TA > 0.15	9.7%	12.9%	11.9%	11.2%	14.3%	15.8%	18.7%	21.5%	14.5%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: VA = value-added, including value-added taxes and financial changes; W = wages and other employee compensation expenses; FC = financial charges, mainly interest payments; D = current depreciations; T = all tax payments including value-added taxes; TA = total assets.

doubtful, and loss). Unlike the classification of bank loans, the profitability classification proposed here reveals the underlying economic conditions, for example:

- Enterprises in profitability group [-4] create negative value-added. They should be closed immediately according to economic principles. The quality of their debts is the worst among the eight groups by profitability.
- Enterprises in group [-3] have positive value-added but cannot pay all of their wage bills. In economics, they cannot even cover their variable costs. They should also be closed as soon as possible to avoid incurring new losses. The quality of their debts will worsen every day as the losses accumulate.
- Enterprises in group [-2] can pay their wage bills but cannot pay all of their financial charges. The quality of their debts is poor, but because their investment is sunk, such firms may have reasons to continue operations in the short run to maintain employment while waiting for a turnaround after reorganization.
- Enterprises in group [-1] can pay their wage bills and financial charges but cannot cover all of their depreciation charges. The quality of their debts will fall as capital is depleted.

We will leave the more detailed analysis of NPDs based on the above profitability classifications for a separate paper. Here we focus on the big picture first and classify enterprises in the first four groups as loss making and the last four groups as profit making, based on imputed profitability.

Table 5 shows the number of enterprises making profits or losses based on both reported and imputed profits over the period from 1995 to 2002. The number of loss-making enterprises by imputed profitability was stable at about 8,000 (34–35 percent) during 1995–98 and fell rapidly afterward to 4,952 (22.3 percent) in 2002. The number of loss-making enterprises by reported profitability was 6,937 (30.8 percent) in 1995 and rose sharply to 8,987 (40.3 percent) in 1998, then dropped to 6,295 (or 28.3 percent) in 2002. In the next section, we will use both imputed and reported profitability to estimate the amount and ratio of NPD. Although the two profitability measurements are different in concept and measurement, both are useful for assessing the quality of enterprise debt. Imputed profitability is more useful for comparing enterprise performance across groups because it is based on a consistent set of reported financial variables, but it is different from actually reported profitability. Imputed profits can be larger than reported profits for several reasons. First, when output is not sold or is still in inventory, some of the value-added might not turn into actual profits. Second, reported profits are likely to be lower than imputed profits as a result of tax avoidance, tax evasion, or profit hiding. In other re-

**Table 5. Number and share of enterprises making profits or losses, 1995–2002**

	1995	1996	1997	1998	1999	2000	2001	2002	Average 1995–2002
<b>Based on imputed profits</b>									
Number of enterprises									
Making profits	14,714	15,035	15,059	14,615	15,243	15,381	16,934	17,268	15,531
Making losses	7,829	7,939	7,898	7,678	6,220	5,357	4,964	4,952	6,605
Total	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	22,136
Share									
Making profits	65.3%	65.4%	65.6%	65.6%	71.0%	74.2%	77.3%	77.7%	70.2%
Making losses	34.7%	34.6%	34.4%	34.4%	29.0%	25.8%	22.7%	22.3%	29.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Based on reported profits</b>									
Number of enterprises									
Making profits	15,606	15,088	14,476	13,306	14,328	15,144	15,510	15,925	14,923
Making losses	6,937	7,886	8,481	8,987	7,135	5,594	6,388	6,295	7,213
Total	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	22,136
Share									
Making profits	69.2%	65.7%	63.1%	59.7%	66.8%	73.0%	70.8%	71.7%	67.4%
Making losses	30.8%	34.3%	36.9%	40.3%	33.2%	27.0%	29.2%	28.3%	32.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

lated papers (Liu and Xiao 2004; Cai, Liu, and Xiao 2005), we examine the issue of profit disguising in detail.

### 3. Estimated level and ratio of NPD

Using the method developed in section 2, we report the main NPD statistics for the whole sample as well as for groups classified by ownership, industry, and region. Table 6 shows the amount of NPD as well as the NPD ratio for the whole sample during the 1995–2002 period. There are two sets of NPD statistics in the table: the upper part is derived from imputed profits and the lower part from reported profits. The amount and ratio of NPD are calculated separately for three categories of debts: total liabilities, long-term liabilities, and short-term liabilities. They are similar in size and trend, with the NPD ratio for short-term liabilities declining slightly faster than the ratio for long-term liabilities.

According to imputed profitability, the NPD ratio for the whole sample was stable at around 27–30 percent during 1995–99 but declined rapidly afterward to only 18.4 percent in 2002, with the amount of NPD at about RMB1 trillion.

According to reported profitability, the NPD ratio for the whole sample was 24.1 percent in 1995, rising to 34.3 percent in 1998 and then falling to 22.9 percent in 2002, with the amount of NPDs at about RMB1.3 trillion. According to the CBRC, China's NPL ratio fell sharply to 19.6 percent, with the amount of NPLs at RMB2.5 trillion by the middle of 2003. Given the different definitions of NPL and

Table 6. Amount of nonperforming debt and nonperforming debt ratio for whole sample, 1995-2002

	1995	1996	1997	1998	1999	2000	2001	2002	Change in 1995-2002	Change in 1998-2002
<b>Based on imputed profits</b>										
Amount of nonperforming debt (RMB billion)										
Within total liabilities	914	1,095	1,204	1,371	1,315	1,128	1,091	1,051	137	-320
Within long-term liabilities	308	370	389	470	472	395	365	343	35	-127
Within short-term liabilities	605	724	812	895	836	727	716	709	104	-186
Nonperforming debt ratio (percent)										
Within total liabilities	27.8	29.5	28.7	29.7	27.4	22.7	20.5	18.4	-9.5	-11.4
Within long-term liabilities	26.6	29.5	28.2	30.3	29.2	24.2	21.9	19.9	-6.7	-10.4
Within short-term liabilities	28.5	29.6	29.1	29.5	26.5	22.2	19.8	17.9	-10.6	-11.6
<b>Based on reported profits</b>										
Amount of nonperforming debt (RMB billion)										
Within total liabilities	792	1,002	1,167	1,580	1,427	1,185	1,392	1,311	519	-269
Within long-term liabilities	282	327	368	556	504	411	441	408	126	-148
Within short-term liabilities	509	674	793	1,014	916	759	930	891	382	-123
Nonperforming debt ratio (percent)										
Within total liabilities	24.1	27.0	27.8	34.3	29.7	23.9	26.1	22.9	-1.2	-11.4
Within long-term liabilities	24.4	26.1	26.7	35.9	31.1	25.1	26.5	23.7	-0.7	-12.3
Within short-term liabilities	24.0	27.5	28.4	33.4	29.0	23.2	25.8	22.5	-1.5	-11.0



**Table 7. Amount of nonperforming debt and nonperforming debt ratio, estimated from imputed profitability, by ownership, 1995–2002**

	1995	1996	1997	1998	1999	2000	2001	2002
Amount of nonperforming debt estimated from imputed profitability (RMB billion)								
Private	0	0	0	2	2	4	5	7
Collective	53	55	60	50	47	32	25	22
Mixed	39	63	90	107	165	191	207	178
Foreign	36	69	77	94	74	63	98	94
Hong Kong, Macau, and Taiwan	26	32	37	68	54	53	53	49
State-owned	761	876	938	1,049	972	786	702	701
Total	915	1,095	1,202	1,370	1,314	1,129	1,090	1,051
Nonperforming ratio estimated from imputed profitability (percent)								
Private	0.0	0.0	0.0	18.2	11.8	12.9	8.2	7.4
Collective	23.3	20.6	21.1	17.4	16.5	12.6	11.3	10.0
Mixed	16.9	22.5	23.7	20.8	23.9	18.5	14.5	10.8
Foreign	23.7	29.7	27.0	28.7	20.0	15.8	17.5	15.2
Hong Kong, Macau, and Taiwan	15.9	16.8	17.3	24.6	18.2	17.4	14.8	12.6
State-owned	30.3	32.0	30.9	32.9	30.9	26.7	26.0	25.4
Total	27.8	29.5	28.6	29.7	27.4	22.7	20.5	18.4
Share of nonperforming debt estimated from imputed profitability (percent)								
Private	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.7
Collective	5.8	5.0	5.0	3.6	3.6	2.8	2.3	2.1
Mixed	4.3	5.8	7.5	7.8	12.6	16.9	19.0	16.9
Foreign	3.9	6.3	6.4	6.9	5.6	5.6	9.0	8.9
Hong Kong, Macau, and Taiwan	2.8	2.9	3.1	5.0	4.1	4.7	4.9	4.7
State-owned	83.2	80.0	78.0	76.6	74.0	69.6	64.4	66.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NPD, the results for the NPD statistics look consistent with the CBRC statistics for NPLs. In the next section, we will further examine the trend of NPD ratios for the whole sample.

We compare the NPD statistics for different types of enterprises by ownership, where NPD is derived from both imputed profitability (table 7) and reported profitability (table 8). These tables show that NPD ratios vary significantly across types of enterprises by ownership and that SOEs have much higher NPD ratios than NSEs. In 2002, the NPD ratio for SOEs was 25.4 percent by imputed profitability and 25.8 percent by reported profitability. The NPD ratio for private enterprises was 7.4 percent by imputed profitability and 15.8 percent by reported profitability. The NPD ratio for domestic mixed-ownership enterprises was 10.8 percent by imputed profitability and 20.2 percent by reported profitability.

From the NPD statistics in tables 7 and 8, it is possible to decompose the fall of the average NPD ratio for the whole sample into two parts: one resulting from improvement in NPD ratios in each type of enterprise and the other resulting from the redistribution of debts from SOEs to the better-performing NSEs.

**Table 8. Amount of nonperforming debt and nonperforming debt ratio, estimated from reported profitability, by ownership 1995–2002**

	1995	1996	1997	1998	1999	2000	2001	2002
Amount of nonperforming debt estimated from reported profitability (RMB billion)								
Private	0	0	0	4	4	7	12	15
Collective	53	67	74	84	69	52	48	42
Mixed	28	37	69	136	172	214	296	332
Foreign	44	82	102	136	107	98	177	139
Hong Kong, Macau, and Taiwan	29	45	52	89	74	63	77	71
State-owned	638	770	869	1,131	999	752	782	712
Total	792	1,001	1,166	1,580	1,425	1,186	1,392	1,311
Nonperforming debt ratio estimated from reported profitability (percent)								
Private	0.0	0.0	0.0	36.4	23.5	22.6	19.4	15.8
Collective	23.3	25.0	26.1	29.3	24.3	20.5	21.7	19.2
Mixed	12.2	13.3	18.2	26.5	24.9	20.7	20.8	20.2
Foreign	28.9	35.3	35.8	41.3	28.9	24.5	31.6	22.4
Hong Kong, Macau, and Taiwan	17.7	23.7	24.3	32.4	24.9	20.7	21.4	18.2
State-owned	25.4	28.1	28.6	35.4	31.8	25.6	28.9	25.8
Total	24.1	27.0	27.8	34.3	29.7	23.9	26.1	22.9
Share of nonperforming debt estimated from reported profitability (percent)								
Private	0.0	0.0	0.0	0.3	0.3	0.6	0.9	1.1
Collective	6.7	6.7	6.3	5.3	4.8	4.4	3.4	3.2
Mixed	3.5	3.7	5.9	8.6	12.1	18.0	21.3	25.3
Foreign	5.6	8.2	8.7	8.6	7.5	8.3	12.7	10.6
Hong Kong, Macau, and Taiwan	3.7	4.5	4.5	5.6	5.2	5.3	5.5	5.4
State-owned	80.6	76.9	74.5	71.6	70.1	63.4	56.2	54.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Let us assume that  $R_i^t$  is the NPD ratio in year  $t$  for enterprise group  $i$  and  $S_i^t$  is the share of debts for group  $i$  in year  $t$ . Then the NPD ratio for the whole sample in year  $t$  can be calculated from the following formula:

$$\text{NPD ratio} = \sum_i 0.5 \cdot (R_i^{2002} + R_i^{1995}) \cdot (S_i^{2002} - S_i^{1995}) + \sum_i 0.5 \cdot \sum_i (R_i^{2002} - R_i^{1995}) \cdot (S_i^{2002} + S_i^{1995}),$$

where  $i$  = private enterprises, collective enterprises, mixed enterprises, foreign enterprises, Hong Kong, Macau, or Taiwanese enterprises (HK-M-Taiwan), or SOEs.

The change in NPD for the whole sample from 1995 to 2002 can be presented equivalently in the following formats:

$$R^{2002} - R^{1995} = \sum_i (R_i^{2002} * S_i^{2002}) - \sum_i (R_i^{1995} * S_i^{1995}) + \sum_i 0.5 * (R_i^{2002} + R_i^{1995}) * (S_i^{2002} - S_i^{1995}) + \sum_i 0.5 * (R_i^{2002} - R_i^{1995}) * (S_i^{1995} + S_i^{2002}).$$

The first term in the above equation is the first component of the change in the NPD ratio for the whole sample during 1995–2002 that can be attributed to the shift of the

total liabilities across ownership groups while holding the individual ownership group's NPD ratio at its average level for 1995 and 2002. Using statistics from tables 1, 7, and 8, this first component is  $-3.86$  percent for the imputed-profitability method and  $-2.33$  percent for the reported-profitability method.

The second term in the NPD equation is the component of change in the NPD ratio for the whole sample during 1995–2002 that can be attributed to the fall in individual ownership groups' NPD ratio while holding constant the distribution of total liabilities across ownership groups at its average level for 1995 and 2002. This second component is  $-4.74$  percent for the imputed-profitability method and  $1.13$  percent for the reported-profitability method.

Hence, according to the imputed-profitability method, the NPD ratio for the whole sample fell from  $27.8$  percent in 1995 to  $18.4$  percent in 2002, a drop of  $9.4$  percentage points. Out of these  $9.4$  percentage points,  $3.86$  percentage points can be attributed to the shift of financial resources from SOEs to the better-performing NSEs, which have lower NPD ratios than SOEs.

According to the reported-profitability method, the NPD ratio for the whole sample fell only slightly, from  $24.1$  percent in 1995 to  $22.9$  percent in 2002, a drop of only  $1.2$  percentage points. The decomposing of this  $1.2$  percentage points shows that the shift of financial resources from SOEs to the better-performing NSEs led to a  $2.33$ -percentage-point drop in the NPD ratio for the whole sample, whereas the changes in the NPD ratios for individual ownership groups led to an increase of  $1.13$  percentage points in the NPD ratio for the whole sample.

Clearly, the decline in the NPD ratio is more significant according to the imputed-profitability method, compared with the reported-profitability method. As previously noted, we are not clear how reported profits are calculated because of large variations in accounting and profit-reporting practices across types of enterprises, but we know exactly how imputed profits are calculated from the financial variables that are used for measuring GDP. We think both measures are useful. The NPD statistics derived from imputed profitability can be used for comparing the underlying performance of different groups of enterprises, and the NPD statistics from reported profitability better reflect the actual outcomes that creditors are going to face when they deal with enterprises.

Tables 9–12 present NPD statistics by industry for 1995–2002. The results shown in tables 9 and 10 are derived using imputed profitability, and the results in tables 11 and 12 are derived from reported profitability. Tables 13–16 present NPD statistics

**Table 9. Amount of nonperforming debt by industry, estimated from imputed profitability, 1995–2002, by nonperforming debt in 2002 (RMB billion)**

	1995	1996	1997	1998	1999	2000	2001	2002
[44] Electric power	52	86	80	143	188	169	174	177
[26] Raw chemicals	52	65	92	127	108	88	97	89
[06] Coal mining	63	76	77	81	112	102	67	77
[36] Special equipment	69	74	86	103	98	93	83	76
[37] Transport equipment	63	81	90	101	96	93	103	72
[41] Electronic and telecommunications	47	52	60	64	54	56	52	60
[31] Nonmetal products	42	56	72	65	59	49	48	51
[35] Ordinary machinery	52	71	74	81	74	65	62	51
[17] Textile	113	124	106	105	72	47	44	44
[40] Electric equipment	39	51	58	53	52	45	48	40
[22] Papermaking	13	13	22	28	21	19	25	27
[28] Chemical fiber	17	22	21	33	26	22	24	24
[32] Pressing ferrous	75	70	85	81	85	62	35	23
[27] Medical	13	20	19	20	15	11	13	19
[46] Tap water	7	7	12	9	10	12	13	19
[13] Food processing	32	42	41	42	32	21	17	18
[33] Pressing nonferrous	28	35	36	47	28	22	22	16
[42] Instruments	15	17	19	17	14	13	14	16
[14] Food production	13	13	16	14	11	8	12	14
[34] Metal products	16	19	23	27	22	18	13	14
[45] Gas production	9	12	11	10	10	13	13	14
[15] Beverage	11	12	13	14	12	13	9	13
[07] Petroleum extract	3	4	13	0	13	11	18	12
[25] Petroleum processing	3	9	7	15	18	8	17	10
[10] Nonmetal mining	7	5	7	7	6	6	7	9
[29] Rubber	9	9	9	11	18	9	9	9
[30] Plastic	12	12	14	16	14	10	7	9
[09] Nonferrous mining	5	6	6	9	6	5	6	7
[12] Timber logging	4	4	6	7	9	8	7	7
[20] Timber	5	4	6	8	7	6	5	6
[18] Garments	4	5	4	7	5	4	6	5
[23] Printing	4	4	6	5	6	6	6	5
[08] Ferrous mining	5	4	1	5	2	2	1	3
[19] Leather	6	5	5	7	4	5	3	3
[43] Other manufacturing	3	2	3	3	3	3	3	3
[24] Cultural	1	2	1	3	2	3	2	2
[16] Tobacco	1	1	1	3	1	2	3	1
[21] Furniture	2	1	1	1	2	2	2	1
Total	915	1,095	1,203	1,372	1,315	1,131	1,090	1,046

Note: See appendix 2 for full industry names corresponding to industry codes.

by region during 1995–2002. Tables 13 and 14 are derived from imputed profitability, and tables 15 and 16 are derived from reported profitability. Tables 9–16 are sorted by the results in the last column (for 2002) so that readers can easily see the best and worst performers in the quality of enterprise debts by region.

The information here shows the big picture on the quality of enterprise debts across industry and region and can be used by policymakers, as well as by banks, investors, and enterprises as a benchmark against which to check the performance of their own debt portfolios. This information is a public good and contributes to more scientific management of debt risks in China. Bankers from Shanghai and Guangdong might want to know the NPD statistics in their regions. Officials in charge of utilities might want to know how bad that sector's enterprise debts are

**Table 10. Nonperforming debt ratios by industry, estimated from imputed profitability, 1995–2002, by nonperforming debt ratio in 2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[45] Gas production	90.0	92.3	84.6	58.8	58.8	68.4	72.2	60.9
[46] Tap water	50.0	43.8	50.0	34.6	32.3	34.3	33.3	41.3
[36] Special equipment	46.3	46.0	48.9	55.1	52.7	48.9	45.1	39.6
[42] Instruments	51.7	53.1	51.4	50.0	40.0	38.2	35.0	39.0
[06] Coal mining	49.2	51.7	45.8	44.5	54.6	48.8	30.9	35.8
[09] Nonferrous mining	27.8	35.3	31.6	47.4	33.3	26.3	30.0	35.0
[28] Chemical fiber	27.4	31.0	28.0	39.8	28.9	26.5	32.0	32.9
[12] Timber logging	21.1	20.0	27.3	30.4	40.9	34.8	33.3	31.8
[10] Nonmetal mining	41.2	33.3	38.9	36.8	27.3	21.4	30.4	31.0
[08] Ferrous mining	83.3	57.1	12.5	45.5	25.0	22.2	12.5	30.0
[20] Timber	55.6	33.3	37.5	50.0	38.9	31.6	23.8	28.6
[31] Nonmetal products	30.4	33.7	38.7	33.3	29.5	25.1	23.0	23.8
[43] Other manufacturing	30.0	20.0	27.3	30.0	25.0	27.3	25.0	23.1
[35] Ordinary machinery	33.1	39.7	38.1	39.1	36.6	31.7	29.5	23.0
[26] Raw chemicals	23.0	24.6	28.3	34.8	29.3	22.7	25.5	22.3
[22] Papermaking	24.5	20.3	30.6	38.4	26.3	21.6	20.7	21.6
[14] Food production	35.1	31.7	38.1	29.8	22.9	16.7	21.1	21.5
[34] Metal products	34.8	35.8	39.0	43.5	34.9	30.5	20.0	20.6
[24] Cultural	20.0	25.0	12.5	33.3	22.2	33.3	25.0	20.0
[44] Electric power	17.6	27.1	22.2	27.4	30.6	23.5	21.7	19.0
[17] Textile	44.0	45.3	36.9	38.2	29.5	20.0	19.1	18.8
[23] Printing	28.6	25.0	31.6	25.0	26.1	26.1	22.2	18.5
[29] Rubber	25.0	21.4	18.8	22.0	35.3	18.4	17.3	18.0
[40] Electric equipment	28.5	31.1	31.4	27.2	26.8	23.1	22.0	17.7
[21] Furniture	50.0	25.0	20.0	20.0	40.0	40.0	33.3	16.7
[13] Food processing	36.4	39.3	36.6	36.5	30.2	20.8	16.5	16.2
[30] Plastic	38.7	31.6	32.6	34.8	29.2	20.4	12.7	15.0
[37] Transport equipment	27.5	29.3	27.7	28.1	24.9	23.3	23.4	14.7
[27] Medical	22.0	27.4	23.5	22.2	15.5	10.5	10.7	14.3
[41] Electronic and telecommunications	32.2	31.1	30.3	27.9	21.5	19.6	14.2	14.2
[18] Garments	23.5	21.7	16.7	25.9	16.7	12.5	16.2	13.2
[19] Leather	37.5	26.3	23.8	33.3	19.0	23.8	13.0	12.5
[15] Beverage	15.1	14.5	13.1	13.7	11.1	11.7	8.1	11.4
[33] Pressing nonferrous	29.5	34.7	30.8	35.6	20.0	15.7	14.4	9.9
[07] Petroleum extract	2.0	2.5	7.9	0.0	8.1	7.0	12.1	7.8
[25] Petroleum processing	3.0	7.9	4.3	8.3	10.0	4.3	9.6	5.8
[32] Pressing ferrous	22.7	19.7	21.5	19.5	19.3	15.2	8.4	5.2
[16] Tobacco	1.4	1.3	1.2	4.2	1.4	2.7	2.8	0.9
Total	27.9	29.6	28.6	29.8	27.4	22.8	20.5	18.3

Note: See appendix 2 for full industry names corresponding to industry codes.

compared with those of other industries. These patterns of NPD ratios at the aggregate levels by ownership, industry and region are useful for illustrating the overall quality and distribution of enterprise debts in China as well as for contributing to informed policy debates.

#### 4. Patterns of NPDs

By applying a simple regression method to the disaggregated NPD ratios, we can summarize the variability in NPD ratios for two relevant dimensions: one is the declining trend in NPD ratios and the other is the gap in NPD ratios across ownership type, industry, and region. Tables 17–19 show the results of six regressions using the group NPD ratios reported in tables 7 and 8, 9 and 11, and 13 and 15, respectively. In

**Table 11. Amount of nonperforming debt by industry, estimated from reported profitability, 1995–2002, by nonperforming debt in 2002 (RMB billion)**

	1995	1996	1997	1998	1999	2000	2001	2002
[44] Electric power	83	39	76	119	161	147	173	183
[26] Raw chemicals	39	51	103	174	158	123	134	140
[37] Transport equipment	57	68	89	106	114	117	108	117
[25] Petroleum processing	4	22	16	76	39	86	98	76
[41] Electronic and telecommunications	31	41	53	60	54	35	59	73
[31] Nonmetal products	43	64	83	88	74	54	70	72
[17] Textile	104	135	128	135	88	51	74	69
[35] Ordinary machinery	36	52	58	72	64	59	68	65
[36] Special equipment	50	57	68	88	81	76	86	65
[40] Electric equipment	30	41	52	61	52	42	62	45
[28] Chemical fiber	11	20	16	34	27	17	32	32
[33] Pressing nonferrous	18	35	35	68	46	21	33	32
[13] Food processing	29	52	53	68	51	28	29	31
[22] Papermaking	13	17	26	32	27	23	40	30
[15] Beverage	18	21	22	29	27	25	27	29
[32] Pressing ferrous	45	61	69	68	81	41	43	25
[06] Coal mining	29	33	31	79	99	78	67	23
[27] Medical	12	17	24	23	15	14	17	20
[34] Metal products	15	21	26	30	27	21	19	19
[14] Food production	12	15	17	18	13	12	17	18
[30] Plastic	11	12	14	17	14	13	13	15
[46] Tap water	4	5	10	12	9	9	11	15
[16] Tobacco	5	6	7	6	5	8	25	14
[42] Instruments	10	12	15	17	14	9	11	13
[10] Nonmetal mining	7	6	6	7	6	7	5	11
[29] Rubber	11	11	10	13	19	18	15	11
[45] Gas production	4	10	9	8	8	10	8	10
[07] Petroleum extract	28	40	6	22	7	2	3	9
[18] Garments	3	5	7	8	6	5	9	8
[20] Timber	4	5	7	8	7	6	8	8
[19] Leather	5	6	6	6	5	5	5	7
[09] Nonferrous mining	7	8	6	9	6	3	5	6
[12] Timber logging	3	5	8	7	7	8	7	6
[23] Printing	3	3	5	5	4	3	4	4
[08] Ferrous mining	5	3	2	2	3	3	2	3
[43] Other manufacturing	2	3	3	3	4	3	3	3
[21] Furniture	1	1	2	1	1	1	2	1
[24] Cultural	1	1	1	2	1	1	1	1
Total	793	1,004	1,169	1,581	1,424	1,184	1,393	1,309

Note: See appendix 2 for full industry names corresponding to industry codes.

each of the six regressions, the independent variables include a time trend (year) and a categorical variable (ownership, industry, or region). Each categorical variable has the “whole sample” dummy to match the NPD ratio for the whole sample. The regression equations can be written as

$$NPD\ ratio = f(year, categorical\ variable) .$$

We use weighted regressions to discount the impact of the NPD ratios in the early years. (The weights used are listed in the footnotes of tables 17, 18, and 19.) The regression coefficients for the time trend variable (year) indicate how fast the NPD ratio would fall every year based on the variability of the NPD ratios reported for each group in the relevant tables. In principle, the declining trend of NPD ratios for all

**Table 12. Nonperforming debt ratios by industry, estimated from reported profitability, 1995–2002, by nonperforming debt ratio in 2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[25] Petroleum processing	4.0	19.3	9.8	42.2	21.7	46.7	54.7	43.9
[28] Chemical fiber	17.7	28.2	21.1	41.0	29.7	20.5	42.1	43.8
[45] Gas production	40.0	76.9	69.2	50.0	44.4	50.0	44.4	41.7
[10] Nonmetal mining	43.8	37.5	33.3	35.0	27.3	25.9	21.7	37.9
[20] Timber	40.0	41.7	43.8	50.0	41.2	31.6	38.1	36.4
[26] Raw chemicals	17.3	19.3	31.6	47.7	42.8	31.7	35.3	34.9
[36] Special equipment	33.8	35.6	38.6	47.1	43.5	39.8	46.7	33.9
[31] Nonmetal products	31.2	38.3	44.9	45.4	37.0	27.7	33.5	33.6
[46] Tap water	26.7	31.3	43.5	44.4	29.0	26.5	28.2	32.6
[42] Instruments	34.5	37.5	40.5	51.5	40.0	26.5	27.5	31.7
[08] Ferrous mining	71.4	37.5	25.0	18.2	33.3	37.5	25.0	30.0
[17] Textile	40.3	49.3	44.6	49.1	35.9	21.8	32.0	29.5
[35] Ordinary machinery	22.8	28.9	29.9	34.8	31.7	28.8	32.5	29.4
[19] Leather	31.3	31.6	28.6	28.6	23.8	22.7	21.7	29.2
[09] Nonferrous mining	38.9	47.1	31.6	47.4	33.3	15.8	25.0	28.6
[34] Metal products	31.9	38.9	44.1	48.4	42.9	35.6	29.2	28.4
[13] Food processing	33.3	48.6	47.7	59.1	48.1	28.0	28.2	27.9
[14] Food production	32.4	36.6	40.5	39.1	27.1	24.5	30.4	27.7
[12] Timber logging	15.8	25.0	36.4	30.4	31.8	34.8	31.8	26.1
[15] Beverage	24.7	25.3	22.2	28.4	25.2	22.5	24.5	25.4
[30] Plastic	35.5	31.6	32.6	37.0	29.2	26.5	23.6	24.6
[22] Papermaking	24.5	26.2	36.1	43.8	33.8	26.4	33.1	24.0
[37] Transport equipment	24.9	24.6	27.4	29.4	29.6	29.2	24.5	23.8
[29] Rubber	30.6	25.6	20.8	25.5	37.3	36.7	28.8	21.6
[43] Other manufacturing	22.2	27.3	27.3	33.3	33.3	27.3	23.1	21.4
[18] Garments	17.6	21.7	29.2	29.6	20.7	15.2	23.7	20.5
[40] Electric equipment	22.1	25.0	28.1	31.3	26.8	21.5	28.4	19.9
[33] Pressing nonferrous	18.9	34.7	30.2	51.5	32.9	15.1	21.4	19.8
[44] Electric power	28.0	12.3	21.1	22.8	26.2	20.5	21.6	19.6
[41] Electronic and telecommunications	21.4	24.6	26.6	26.2	21.5	12.2	16.1	17.2
[21] Furniture	25.0	33.3	40.0	20.0	20.0	20.0	33.3	16.7
[27] Medical	20.3	23.6	29.3	25.3	15.5	13.3	14.0	15.0
[23] Printing	21.4	17.6	25.0	23.8	18.2	13.0	14.8	14.8
[16] Tobacco	7.0	7.9	8.5	8.3	7.0	10.8	22.9	13.0
[24] Cultural	16.7	12.5	12.5	22.2	11.1	11.1	12.5	11.1
[06] Coal mining	22.5	22.3	18.5	43.4	48.1	37.3	30.9	10.7
[07] Petroleum extract	18.5	25.5	3.7	12.9	4.4	1.3	2.0	5.9
[32] Pressing ferrous	13.6	17.1	17.5	16.3	18.4	10.1	10.3	5.6
Total	24.1	27.1	27.8	34.3	29.6	23.9	26.1	22.9

Note: See appendix 2 for full industry names corresponding to industry codes.

the groups is related to the improvement of the general market environment of the Chinese economy as a result of reform and opening. The regression coefficients for the categorical variable indicate the average gap between the NPD ratio of that particular category and the NPD ratio of the base category (which is indicated by a zero value for the coefficient and a blank value for the t-statistics in the tables) after removing the influence of the declining trend in NPD ratio. The negative sign means “lower than” the NPD ratio of the base category.

For example, table 17 shows that based on the NPD ratios estimated from imputed profitability (reported in table 7), the NPD ratio for a particular group is likely to decline on average by 1.5 percentage points each year. For private enterprises, NPD ratios in a given year are likely to be 21.3 percentage points lower than those for SOEs

**Table 13. Amount of nonperforming debt by region, estimated from imputed profitability, 1995–2002, by nonperforming debt in 2002 (RMB billion)**

	1995	1996	1997	1998	1999	2000	2001	2002
[31] Shanghai	70	94	95	98	92	78	69	81
[44] Guangdong	64	90	113	131	106	90	86	80
[41] Henan	23	39	37	63	61	64	69	72
[23] Heilongjiang	60	58	56	69	71	62	56	58
[21] Liaoning	105	117	115	110	87	63	75	57
[50] Sichuan + Chongqing	71	71	109	88	127	124	104	57
[12] Tianjin	52	32	38	61	53	24	39	56
[42] Hubei	27	53	39	36	34	36	35	46
[13] Hebei	33	45	41	42	47	45	49	45
[37] Shandong	47	48	50	64	69	58	44	45
[11] Beijing	27	45	67	99	68	64	55	42
[22] Jilin	36	35	38	39	35	32	39	41
[32] Jiangsu	39	49	57	57	59	51	49	40
[61] Shaanxi	37	49	49	46	48	38	46	38
[14] Shanxi	24	33	29	50	44	33	24	35
[54] Tibet + Qinghai + Ningxia	12	18	23	18	14	11	11	34
[43] Hunan	29	28	33	37	35	34	30	32
[52] Guizhou	16	15	15	28	25	28	26	31
[34] Anhui	26	27	26	35	31	44	14	23
[45] Guangxi	18	18	23	20	21	17	16	22
[15] Inner Mongolia	17	16	14	27	46	25	34	21
[53] Yunnan	9	11	20	24	23	17	20	21
[35] Fujian	7	10	11	11	6	8	34	20
[62] Gansu	12	22	29	30	28	26	15	15
[36] Jiangxi	20	26	29	30	32	19	18	12
[33] Zhejiang	19	25	24	37	25	18	17	11
[65] Xinjiang	9	13	14	16	21	17	15	11
[46] Hainan	4	7	9	5	8	2	4	3
Total	913	1,094	1,203	1,371	1,316	1,128	1,093	1,049

**Table 14. Nonperforming debt ratios by region, estimated from imputed profitability, 1995–2002, by nonperforming debt ratio in 2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[54] Tibet + Qinghai + Ningxia	35.3	52.9	53.5	31.6	24.6	17.7	20.0	42.5
[52] Guizhou	36.4	37.5	31.9	47.5	39.7	37.8	36.1	40.3
[12] Tianjin	48.1	29.4	32.2	39.1	34.2	16.6	25.5	32.0
[23] Heilongjiang	40.0	38.9	33.7	36.3	38.8	32.6	29.5	29.7
[41] Henan	17.3	25.0	22.3	30.9	29.0	29.2	29.5	28.3
[14] Shanxi	30.4	37.1	29.0	38.5	34.1	24.4	19.0	26.5
[11] Beijing	27.6	39.8	51.1	59.6	44.2	40.8	29.6	24.9
[45] Guangxi	30.5	29.5	32.9	24.7	24.7	18.9	18.0	24.4
[61] Shaanxi	47.4	55.7	50.0	45.1	35.8	28.6	32.4	24.2
[15] Inner Mongolia	33.3	28.6	22.2	38.6	59.0	34.7	41.0	24.1
[22] Jilin	31.3	25.5	24.8	25.2	22.0	18.8	23.9	23.7
[31] Shanghai	30.3	34.3	29.4	29.1	26.5	23.4	19.8	21.6
[43] Hunan	36.7	32.6	33.3	33.0	29.4	27.4	21.3	21.5
[46] Hainan	33.3	43.8	50.0	25.0	34.8	10.5	25.0	18.8
[53] Yunnan	15.5	17.5	29.4	32.4	30.3	22.7	19.2	18.4
[42] Hubei	20.0	32.3	21.4	16.7	15.5	15.5	15.3	18.2
[13] Hebei	23.1	27.1	22.2	21.1	22.1	20.0	19.7	17.6
[50] Sichuan + Chongqing	38.8	35.7	46.8	36.7	39.8	42.0	34.3	17.5
[21] Liaoning	35.8	37.7	33.3	30.5	27.2	19.5	22.3	16.1
[34] Anhui	32.1	29.7	24.1	32.4	27.4	33.8	10.9	16.0
[62] Gansu	22.2	37.3	37.2	32.6	33.3	31.0	16.9	16.0
[44] Guangdong	21.4	25.9	27.3	30.0	24.4	19.3	16.9	14.3
[65] Xinjiang	15.8	19.1	18.9	20.3	26.3	21.3	18.5	13.9
[36] Jiangxi	34.5	38.2	40.3	38.5	36.8	21.3	20.0	13.6
[35] Fujian	14.9	18.2	20.0	20.0	9.7	12.1	25.2	13.3
[37] Shandong	17.9	16.3	14.8	18.1	16.6	13.3	9.7	9.2
[32] Jiangsu	17.3	18.2	19.1	17.8	18.0	13.8	10.7	8.0
[33] Zhejiang	15.8	17.5	15.7	23.6	15.6	10.8	10.0	5.9
Total	27.8	29.5	28.7	29.8	27.4	22.7	20.5	18.3



**Table 15. Amount of nonperforming debt by region, estimated from reported profitability, 1995–2002, by nonperforming debt in 2002 (RMB billion)**

	1995	1996	1997	1998	1999	2000	2001	2002
[21] Liaoning	89	87	95	117	77	46	94	114
[44] Guangdong	68	121	137	170	151	118	131	111
[50] Sichuan + Chongqing	61	60	71	94	129	101	91	88
[32] Jiangsu	41	54	63	83	74	64	96	73
[31] Shanghai	34	50	63	82	72	47	63	69
[12] Tianjin	28	33	41	66	55	57	55	67
[37] Shandong	46	45	51	68	67	56	72	63
[22] Jilin	35	42	64	78	57	46	52	62
[42] Hubei	33	54	60	77	73	79	65	62
[23] Heilongjiang	47	59	58	104	69	74	74	56
[43] Hunan	24	31	45	54	37	48	41	55
[13] Hebei	28	30	40	54	47	48	64	53
[61] Shaanxi	31	34	38	49	53	46	48	45
[41] Henan	34	44	45	51	51	55	69	43
[62] Gansu	16	16	17	41	36	11	31	40
[35] Fujian	9	10	8	11	9	10	38	36
[36] Jiangxi	19	24	26	35	36	32	32	31
[54] Tibet + Qinghai + Ningxia	14	17	21	26	21	25	10	30
[45] Guangxi	14	27	31	35	30	23	25	29
[14] Shanxi	15	20	24	54	53	38	35	28
[15] Inner Mongolia	18	16	16	30	36	24	30	28
[34] Anhui	21	22	25	52	49	25	33	26
[53] Yunnan	8	9	15	21	25	19	24	26
[65] Xinjiang	10	36	16	21	25	22	28	26
[11] Beijing	11	18	37	40	39	37	51	22
[33] Zhejiang	19	22	28	38	26	20	23	14
[52] Guizhou	15	13	20	18	16	11	11	11
[46] Hainan	4	8	11	8	12	4	6	4
Total	792	1,002	1,166	1,577	1,425	1,186	1,392	1,312

**Table 16. Nonperforming debt ratios by region, estimated from reported profitability, 1995–2002, by nonperforming debt ratio in 2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[62] Gansu	29.1	27.1	21.5	44.6	42.9	13.1	35.2	43.0
[12] Tianjin	25.9	30.0	34.5	42.6	35.5	39.6	35.9	38.5
[54] Tibet + Qinghai + Ningxia	41.2	50.0	48.8	45.6	36.8	39.7	18.2	38.0
[43] Hunan	30.8	36.0	45.5	48.6	31.1	38.7	29.1	37.2
[22] Jilin	30.2	30.7	41.8	50.3	35.8	27.1	31.9	35.8
[36] Jiangxi	32.8	35.3	36.1	44.3	41.4	36.0	35.6	35.2
[65] Xinjiang	17.5	52.2	21.3	26.9	31.6	27.5	35.0	32.9
[45] Guangxi	23.7	43.5	44.3	43.2	35.3	25.3	27.8	32.2
[21] Liaoning	30.4	28.0	27.5	32.3	24.1	14.3	28.1	32.2
[15] Inner Mongolia	34.6	28.6	25.4	42.9	45.6	32.9	36.1	31.8
[61] Shaanxi	39.7	38.6	38.4	48.5	39.6	34.6	33.8	28.8
[23] Heilongjiang	31.3	39.6	34.9	54.7	37.7	38.7	38.9	28.6
[50] Sichuan + Chongqing	33.3	30.2	30.5	39.0	40.4	34.2	30.0	27.1
[46] Hainan	36.4	53.3	61.1	40.0	50.0	20.0	37.5	25.0
[42] Hubei	24.4	32.9	33.0	35.5	33.5	34.1	28.5	24.5
[35] Fujian	19.1	18.2	14.8	20.4	14.5	15.2	28.1	24.0
[53] Yunnan	13.8	14.1	22.1	28.0	33.3	25.3	23.3	22.8
[14] Shanxi	19.0	22.7	24.0	41.9	41.4	27.9	27.8	21.2
[13] Hebei	19.6	18.1	21.7	27.1	22.1	21.4	25.8	20.6
[44] Guangdong	22.8	34.8	33.1	39.0	34.8	25.2	25.7	19.9
[31] Shanghai	14.7	18.2	19.5	24.4	20.7	14.1	18.1	18.4
[34] Anhui	25.9	24.2	23.1	48.1	43.0	19.2	25.8	17.9
[41] Henan	25.6	28.0	27.3	25.1	24.3	25.1	29.5	16.9
[32] Jiangsu	18.1	20.1	21.1	25.9	22.6	17.3	21.1	14.5
[52] Guizhou	34.1	32.5	41.7	30.5	25.0	14.9	15.3	14.3
[11] Beijing	11.2	16.1	28.2	24.1	25.3	23.4	27.3	13.0
[37] Shandong	17.6	15.3	15.2	19.2	16.1	12.8	15.8	12.9
[33] Zhejiang	15.7	15.4	18.3	24.2	16.4	12.0	13.5	7.5
Total	24.1	27.0	27.8	34.2	29.7	23.9	26.1	22.9

Table 17. Regression summarizing trend and cross-ownership patterns of nonperforming debt ratios (dependent variable = nonperforming debt ratio)

Independent variables	Nonperforming debt ratio estimated from imputed profitability as shown in table 7		Nonperforming debt ratio estimated from reported profitability as shown in table 8	
	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	2,996.8	10.9	1,092.6	2.0
Year	-1.5	-10.7	-0.5	-1.9
Ownership = private enterprises	-21.3	-18.2	-13.9	-5.9
Ownership = collective enterprises	-18.2	-15.5	-10.7	-4.6
Ownership = mixed-ownership domestic enterprises	-18.3	-15.7	-16.3	-7.0
Ownership = foreign-invested enterprises	-13.3	-11.4	-5.1	-2.2
Ownership = enterprises with investment from Hong Kong, Macau, and Taiwan	-13.6	-11.7	-6.9	-3.0
Ownership = whole sample	-12.4	-10.6	-11.0	-4.7
Ownership = state-owned enterprises	0		0	
Number of observations	56		56	
Adjusted R <sup>2</sup>	0.906		0.538	

Note: Regression equation:  $NPD\ ratio = f(\text{year, ownership})$ . Weighted least-squares regression with weights of 100 to 2002, 95 to 2001, 90 to 2000, 85 to 1999, 80 to 1998, 75 to 1997, 70 to 1996, and 65 to 1995.

**Table 18. Regression summarizing trend and cross-industry patterns of nonperforming debt ratios (dependent variable = nonperforming debt ratio)**

Independent variables	Nonperforming debt ratio based on imputed profitability as shown in table 9		Nonperforming debt ratio based on reported profitability as shown in table 11	
	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	3,571.4	15.7	1,754.7	6.4
Year	-1.8	-15.6	-0.9	-6.3
[07] Petroleum extract	-25.3	-11.1	-17.3	-6.3
[44] Electric power	-13.9	-6.1	-13.1	-4.8
[16] Tobacco	-26.6	-11.7	-13.0	-4.7
[24] Cultural	-7.1	-3.1	-8.5	-3.1
[27] Medical	-15.6	-6.9	-7.8	-2.9
[23] Printing	-1.2	-0.5	-7.5	-2.7
[18] Garments	-9.5	-4.2	-5.3	-1.9
[21] Furniture	-7.3	-3.2	-4.6	-1.7
[43] Other manufacturing	-8.2	-3.6	-4.0	-1.5
<b>Industry = whole sample</b>	<b>-8.4</b>	<b>-3.7</b>	<b>-4.0</b>	<b>-1.5</b>
[26] Raw chemicals	-8.4	-3.7	-3.0	-1.1
[10] Nonmetal mining	-3.2	-1.4	-2.1	-0.8
[15] Beverage	-18.0	-7.9	-1.4	-0.5
[40] Electric equipment	-5.4	-2.4	-1.0	-0.4
[41] Electronic and telecommunications	1.0	0.4	-0.6	-0.2
[25] Petroleum processing	-15.5	-6.8	-0.5	-0.2
[22] Papermaking	-11.3	-5.0	-0.1	0.0
[46] Tap water	0.0		0.0	
[19] Leather	-5.9	-2.6	0.0	0.0
[06] Coal mining	8.6	3.8	0.2	0.1
[33] Pressing nonferrous	-6.9	-3.0	0.6	0.2
[09] Nonferrous mining	7.3	3.2	0.7	0.3
[08] Ferrous mining	-1.3	-0.6	1.4	0.5
[29] Rubber	-7.2	-3.2	1.8	0.6
[37] Transport equipment	-0.3	-0.1	2.1	0.8
[35] Ordinary machinery	1.0	0.4	3.3	1.2
[30] Plastic	-4.9	-2.1	3.8	1.4
[34] Metal products	-1.2	-0.5	4.2	1.5
[32] Pressing ferrous	-4.9	-2.1	4.4	1.6
[31] Nonmetal products	-6.8	-3.0	4.6	1.7
[28] Chemical fiber	-3.5	-1.5	4.6	1.7
[12] Timber logging	4.7	2.1	4.6	1.7
[14] Food production	-4.8	-2.1	5.1	1.8
[17] Textile	-5.0	-2.2	5.4	2.0
[42] Instruments	9.5	4.2	5.5	2.0
[36] Special equipment	6.9	3.0	6.9	2.5
[13] Food processing	-4.9	-2.2	8.7	3.1
[20] Timber	2.6	1.1	8.7	3.2
[45] Gas production	35.0	15.4	22.1	8.0
Number of observations	312		312	
Adjusted R <sup>2</sup>	0.850		0.610	

*Note:* Regression equation: NPD ratio =  $f(\text{year}, \text{industry})$ . Weighted least-squares regression with weights of 100 to 2002, 95 to 2001, 90 to 2000, 85 to 1999, 80 to 1998, 75 to 1997, 70 to 1996, and 65 to 1995. See appendix 2 for full industry names corresponding to industry codes.

in that year. The NPD ratio for the whole sample for a given year is likely to be 12.4 percent lower than the NPD ratio for SOEs in that year.

The regression results shown in tables 17–19 can be used to make rough predictions about NPD ratios for a particular group in the future. But these rough predictions are based only on the pattern of NPD ratios during 1995–2002. Figures 1 and 2 show

**Table 19. Regression summarizing trend and cross-region patterns of nonperforming debt ratios (dependent variable = nonperforming debt ratio)**

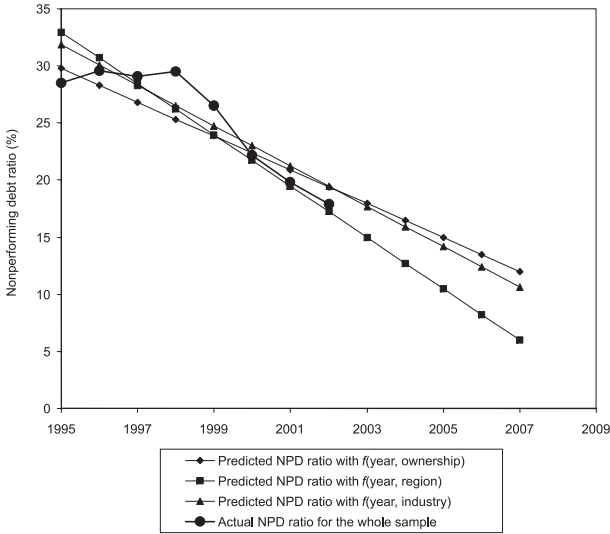
Independent variables	Nonperforming debt ratio based on imputed profitabil- ity as shown in table 13		Nonperforming debt ratio based on reported profitabil- ity as shown in table 15	
	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	4,537.3	16.1	2,022.1	5.5
Year	-2.2	-16.0	-1.0	-5.4
[37] Shandong	-24.9	-10.2	-28.2	-8.9
[33] Zhejiang	-24.1	-9.9	-25.1	-8.0
[35] Fujian	-18.5	-7.6	-22.3	-7.0
[32] Jiangsu	-24.0	-9.9	-21.1	-6.7
[11] Beijing	5.4	2.2	-20.6	-6.5
[31] Shanghai	-10.8	-4.4	-19.3	-6.1
<b>Region = whole sample</b>	<b>-17.6</b>	<b>-7.2</b>	<b>-19.3</b>	<b>-6.1</b>
[13] Hebei	-15.7	-6.5	-18.8	-5.9
[15] Inner Mongolia	-16.5	-6.8	-14.4	-4.6
[41] Henan	-17.6	-7.2	-14.0	-4.4
[14] Shanxi	-7.8	-3.2	-12.5	-3.9
[53] Yunnan	-6.0	-2.5	-10.4	-3.3
[34] Anhui	-19.1	-7.8	-9.5	-3.0
[44] Guangdong	-13.2	-5.4	-9.3	-2.9
[50] Sichuan + Chongqing	-7.3	-3.0	-9.1	-2.9
[42] Hubei	-14.8	-6.1	-7.2	-2.3
[21] Liaoning	-4.3	-1.8	-6.1	-1.9
[12] Tianjin	-4.0	-1.7	-5.0	-1.6
[54] Tibet + Qinghai + Ningxia	-4.5	-1.9	-4.9	-1.6
[22] Jilin	-4.3	-1.8	-4.0	-1.3
[23] Heilongjiang	-4.9	-2.0	-3.5	-1.1
[45] Guangxi	-14.0	-5.8	-3.3	-1.0
[36] Jiangxi	-8.1	-3.3	-2.7	-0.8
[46] Hainan	-7.7	-3.2	-2.1	-0.7
[62] Gansu	-3.4	-1.4	-2.1	-0.7
[52] Guizhou	2.4	1.0	-1.5	-0.5
[43] Hunan	-3.7	-1.5	-1.0	-0.3
[61] Shaanxi	1.4	0.6	-0.6	-0.2
[65] Xinjiang	0.0		0.0	
Number of observations	232		232	
Adjusted R <sup>2</sup>	0.790		0.629	

*Note:* Regression equation: NPD ratio =  $f(\text{year}, \text{region})$ . Weighted least-squares regression with weights of 100 to 2002, 95 to 2001, 90 to 2000, 85 to 1999, 80 to 1998, 75 to 1997, 70 to 1996, and 65 to 1995.

the actual and predicted value of NPD ratios using the regression coefficients in tables 17–19 when the categorical variable is set to the whole sample. Figure 1 is based on imputed profitability and shows a much faster rate of decline in NPD ratios than figure 2, which is based on reported profitability.

A more sophisticated method for assessing likely NPD ratios in future years for the whole sample is to build a few likely scenarios based on alternative assumptions about the possible NPD ratios for individual groups and the possible distribution of total liabilities. Table 20 outlines nine scenarios for the NPD ratios for the whole sample by the year 2007 by providing specific alternative assumptions about the possible NPD ratios for each group of enterprises and about the possible distribution of total liabilities across groups. These simulated scenarios can facilitate policy

**Figure 1. Predicting nonperforming debt ratios: Imputed profitability and weighted regression**



**Figure 2. Predicting nonperforming debt ratios: Reported profitability and weighted regression**

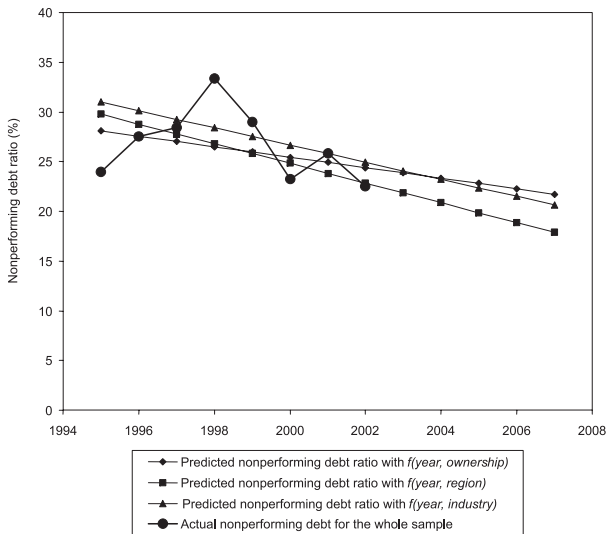


Table 20. Scenarios for nonperforming debt ratio of the whole sample by 2007 (percent)

	Alternative assumptions about distribution of total liabilities	Pessimistic case: Two years slower than predicted by trend	Likely case: As predicted by trend	Optimistic case: Two years faster than predicted by trend
Alternative assumptions about value of nonperforming debt ratios				
Private		2.9	3.7	4.5
Collective		2.6	1.8	1.0
Mixed		38.0	44.2	50.4
Foreign		13.5	15.3	17.1
Hong Kong, Macau, and Taiwan		7.7	8.3	8.9
State-owned		36.2	28.2	20.2
Optimistic case: 2002 nonperforming debt ratios estimated from imputed profitability				
Private	7.4		15.8	14.7
Collective	10.0	16.8		
Mixed	10.8			
Foreign	15.2			
Hong Kong, Macau, and Taiwan	12.6			
State-owned	25.4			
Weighted average for all	18.4			
Likely case: 2002 average nonperforming debt ratio (average over nonperforming debt statistics from both imputed and reported profitability)				
Private	11.6	19.6	18.9	18.3
Collective	14.6			
Mixed	15.5			
Foreign	18.8			
Hong Kong, Macau, and Taiwan	15.4			
State-owned	25.6			
Weighted average for all	20.6			
Pessimistic case: 2002 nonperforming debt ratio estimated from reported profitability				
Private	15.8	22.4	22.1	21.8
Collective	19.2			
Mixed	20.2			
Foreign	22.4			
Hong Kong, Macau, and Taiwan	18.2			
State-owned	25.8			
Weighted average for all	22.9			

debates by showing the magnitude of reforms necessary to achieve various specific objectives. For example, table 20 shows that to lower the overall NPD ratio to 14.7 percent by the year 2007, it is necessary for individual groups to achieve NPD ratios in the optimistic case (e.g., 2002 NPD ratios estimated from imputed profitability) and for the distribution of total liabilities also to achieve the optimistic case, in which the SOE sector share of total liabilities falls to 20.2 percent. The nine scenarios in table 20 are built for illustrative purposes. The alternative assumptions are subjective and debatable but are all based on the patterns of NPD statistics estimated in this paper.

## 5. Explaining profitability and quality of debts

The NPD statistics for each group of enterprises reflect the total effects from all factors that might cause NPD. For example, a major factor that might contribute to a high NPD ratio for SOEs is that many enterprises in the utilities industry are SOEs and the utilities industry as a whole is not profitable because of heavy price regulation by the government. In this case, the high NPD ratio for the group of SOEs actually reflects both ownership and industry risks. The purpose of this section is to use regression analysis to isolate different sources of bad debt risks. Because we have classified enterprise debts by their profitability, we need to explain what factors are driving enterprise profitability and returns on assets.

Tables 21 and 22 summarize the characteristics of the key variables used in the profitability regressions. Table 23 reports the results of four panel data regressions: two logistic regressions explaining the imputed and reported profitability and two linear regressions explaining the imputed and reported return on total assets. The explanatory variables for the four regressions are the same:  $\log(\text{capital/labor ratio})$ ; ratio of liability to total assets;  $\log(\text{employees})$ ; market share; industry concentration; and dummy variables for ownership, year, industry, and region. The coefficients and their standard errors indicate the size and the statistical significance of the impact of the explanatory variables on profitability.

Some common patterns emerge in all four regressions:

- The ratio of liability to total assets has a significantly negative impact on profitability, implying that the more the enterprise borrows, the less the profits or the lower the returns on assets.
- Market share has a positive impact on profitability.
- State ownership has a negative impact on profitability.
- Profitability improves significantly during 2000–02.

Table 21. Summary statistics for key variables in profitability regressions, 1995–2002

	1995	1996	1997	1998	1999	2000	2001	2002	Total
Number of observations for									
Return on total assets with reported profit	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	177,086
Return on total assets with imputed profit	22,393	22,815	22,813	22,129	21,296	20,555	21,730	21,999	175,730
Capital/labor ratio (RMB thousand per person)	22,295	22,724	22,708	22,046	21,440	20,505	21,641	21,972	175,131
Asset/liability ratio	22,479	22,904	22,848	22,187	21,354	20,633	21,792	22,069	176,266
Employment	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	177,086
Market share (percentage of three-digit industry sales total)	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	177,086
Industry concentration (percentage by top four enterprises in two-digit industry sales total)	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220	177,086
Median for									
Return on total assets with reported profit (percent)	0.27	0.14	0.09	0.04	0.18	0.38	0.53	0.82	0.23
Return on total assets with imputed profit (percent)	3.42	3.56	3.40	3.22	4.51	5.38	6.59	7.31	4.58
Capital/labor ratio (RMB thousand per person)	27.4	36.5	41.6	49.4	57.9	63.6	70.0	75.5	49.2
Asset/liability ratio	0.713	0.711	0.711	0.711	0.690	0.682	0.651	0.635	0.690
Employment	877	823	793	715	654	620	560	701	701
Market share (percentage of three-digit industry sales total)	0.207	0.192	0.182	0.185	0.199	0.201	0.192	0.185	0.193
Industry concentration (percentage by top four enterprises in two-digit industry sales total)	10.4	11.1	11.6	12.1	12.4	13.1	11.7	12.3	11.6
Mean for									
Return on total assets with reported profit (percent)	0.16	-0.54	-0.64	-0.89	0.34	1.29	1.69	2.03	0.41
Return on total assets with imputed profit (percent)	5.04	6.07	5.74	5.58	7.72	8.91	10.65	11.61	7.63
Capital/labor ratio (RMB thousand per person)	51.4	65.9	74.1	95.0	118.3	130.0	152.4	165.6	105.8
Asset/liability ratio	0.706	0.709	0.711	0.714	0.694	0.687	0.657	0.642	0.690
Employment	1,696	1,633	1,593	1,502	1,428	1,361	1,237	1,189	1,458
Market share (percentage of three-digit industry sales total)	0.838	0.831	0.823	0.839	0.867	0.907	0.881	0.869	0.856
Industry concentration (percentage by top four enterprises in two-digit industry sales total)	11.4	12.0	13.0	13.4	13.5	13.8	13.9	14.1	13.1
Standard deviation for									
Return on total assets with reported profit (percent)	8.30	9.24	8.36	8.53	8.42	8.46	9.99	8.97	8.86
Return on total assets with imputed profit (percent)	13.73	16.25	15.16	14.27	15.27	16.06	17.99	19.51	16.29
Capital/labor ratio (RMB thousand per person)	123.6	162.6	154.9	202.8	358.3	346.6	430.6	447.8	308.4
Asset/liability ratio	0.23828	0.25137	0.26388	0.28025	0.27605	0.28080	0.28693	0.28883	0.27218
Employment	5,215	4,908	4,719	4,482	4,401	3,947	3,599	3,560	4,404
Market share (percentage of three-digit industry sales total)	3.2	3.2	3.2	3.1	3.1	3.4	3.4	3.4	3.3
Industry concentration (percentage by top four enterprises in two-digit industry sales total)	7.5	7.5	7.6	7.1	6.9	7.1	6.2	6.1	7.1



Table 22. Median of key variables for profitability regressions by ownership, 1995–2002

	1995	1996	1997	1998	1999	2000	2001	2002	Total
Percentage return on total assets with reported profit for									
Private	1.78	4.84	0.36	0.03	1.00	1.03	1.38	1.72	1.34
Collective	0.69	0.50	0.34	0.28	0.51	0.67	0.72	0.91	0.52
Mixed	2.07	1.46	0.89	0.52	0.88	1.10	1.24	1.33	1.11
Foreign	1.70	0.83	0.77	0.54	1.65	2.93	2.99	3.61	2.08
Hong Kong, Macau, and Taiwan	1.31	1.01	0.89	0.43	0.87	1.35	1.55	1.95	1.26
State-owned	0.14	0.05	0.02	0.00	0.03	0.09	0.06	0.09	0.05
Total	0.27	0.14	0.09	0.04	0.18	0.38	0.53	0.82	0.23
Percentage return on total assets with imputed profit for									
Private	11.25	17.44	9.65	7.39	12.01	11.34	12.93	13.98	12.67
Collective	7.44	8.24	7.17	7.52	8.60	9.46	10.57	10.97	8.41
Mixed	7.13	6.78	6.36	6.06	7.11	7.83	8.83	9.43	7.85
Foreign	5.80	6.31	6.09	5.49	8.15	9.93	11.01	11.24	8.66
Hong Kong, Macau, and Taiwan	6.57	6.75	6.23	5.41	6.99	8.19	8.86	9.69	7.61
State-owned	2.14	2.01	1.86	1.34	2.18	2.53	2.80	2.87	2.14
Total	3.42	3.56	3.40	3.22	4.51	5.38	6.59	7.31	4.58
Capital/labor ratio (RMB thousand per person) for									
Private	26	54	49	48	52	51	52	56	52
Collective	25	30	33	40	44	45	49	52	37
Mixed	33	39	42	46	52	57	62	67	54
Foreign	71	91	114	134	144	145	149	145	129
Hong Kong, Macau, and Taiwan	63	79	82	98	109	108	107	103	96
State-owned	26	35	40	47	55	62	68	74	44
Total	27	36	42	49	58	64	70	75	49
Liability/total assets ratio for									
Private	0.531	0.653	0.722	0.724	0.686	0.693	0.667	0.654	0.671
Collective	0.708	0.718	0.723	0.717	0.707	0.712	0.690	0.686	0.711
Mixed	0.646	0.636	0.650	0.672	0.664	0.660	0.653	0.644	0.654
Foreign	0.574	0.553	0.554	0.538	0.534	0.516	0.479	0.472	0.517
Hong Kong, Macau, and Taiwan	0.638	0.622	0.625	0.614	0.603	0.589	0.544	0.520	0.583
State-owned	0.731	0.733	0.737	0.747	0.732	0.732	0.718	0.704	0.732
Total	0.713	0.711	0.711	0.711	0.690	0.682	0.651	0.635	0.690
Median employment per firm for									
Private	500	453	718	429	391	394	383	367	384
Collective	643	599	565	511	490	461	437	408	528
Mixed	1,010	972	897	820	748	711	645	606	725
Foreign	408	387	376	350	321	332	320	320	341
Hong Kong, Macau, and Taiwan	446	390	387	360	364	360	343	340	363
State-owned	1,014	975	946	873	829	793	753	729	894
Total	877	823	793	715	654	620	560	520	701
Market share (percentage of three-digit industry sales total) for									
Private	0.159	0.285	0.283	0.118	0.147	0.148	0.148	0.141	0.146
Collective	0.206	0.190	0.175	0.193	0.192	0.185	0.161	0.146	0.185
Mixed	0.361	0.310	0.253	0.212	0.221	0.213	0.198	0.183	0.214
Foreign	0.450	0.402	0.399	0.419	0.406	0.396	0.355	0.318	0.381
Hong Kong, Macau, and Taiwan	0.339	0.331	0.341	0.341	0.329	0.343	0.312	0.277	0.318
State-owned	0.185	0.169	0.156	0.149	0.158	0.155	0.145	0.143	0.160
Total	0.207	0.192	0.182	0.185	0.199	0.201	0.192	0.185	0.193
Industry concentration (percentage by top four enterprises in two-digit industry sales total) for									
Private	12.6	9.5	8.6	10.8	11.7	11.0	11.6	11.1	11.6
Collective	9.9	8.5	9.7	10.8	10.6	11.3	11.6	11.1	10.5
Mixed	10.5	11.3	11.6	11.7	12.4	12.9	11.7	12.3	11.8
Foreign	10.5	11.3	13.3	12.5	13.8	13.1	14.0	12.3	12.4
Hong Kong, Macau, and Taiwan	9.9	10.6	11.6	12.1	12.4	12.1	13.1	12.3	11.7
State-owned	10.4	11.1	11.6	12.1	12.4	13.4	13.1	12.5	11.7
Total	10.4	11.1	11.6	12.1	12.4	13.1	11.7	12.3	11.6

Table 23. Profitability regressions

Dependent variable	Imputed profitability (1 = profit, 0 = loss)			Reported profitability (1 = profit, 0 = loss)			Return on total assets by imputed profitability			Return on total assets by reported profitability		
	B	SE	Exp(B)	B	SE	Exp(B)	B	SE	Exp(B)	B	SE	Exp(B)
Constant	2.174***	0.120	8.797	2.430**	0.118	11.353	0.142***	0.008	11.353	0.014***	0.004	11.353
Log(capital/labor ratio)	0.005	0.007	1.005	-0.063***	0.007	0.939	-0.012***	0.000	0.939	0.001***	0.000	0.939
Liability/assets ratio	-1.730***	0.023	0.177	-3.156***	0.026	0.043	-0.116***	0.001	0.043	-0.115***	0.001	0.043
Log(employees)	0.029***	0.007	1.029	0.080***	0.007	1.084	-0.003***	0.000	1.084	0.003***	0.000	1.084
Market share	0.109***	0.005	1.115	0.175***	0.006	1.191	0.004***	0.000	1.191	0.002***	0.000	1.191
Industry concentration	-0.001	0.003	0.999	0.005	0.003	1.005	-0.001***	0.000	1.005	0.000***	0.000	1.005
Private	-0.450***	0.059	0.637	-0.215**	0.049	0.806	0.106***	0.003	0.806	0.029***	0.001	0.806
Collective	-0.534***	0.059	0.586	-0.094***	0.048	0.910	0.070***	0.001	0.910	0.022***	0.001	0.910
Mixed	-0.763***	0.061	0.466	-0.940***	0.051	0.391	0.047***	0.001	0.391	0.017***	0.001	0.391
Foreign	-0.757***	0.061	0.469	-0.658***	0.051	0.518	0.065***	0.002	0.518	0.017***	0.001	0.518
Hong Kong, Macau, and Taiwan	-1.235***	0.057	0.291	-0.585***	0.047	0.557	0	0	0.557	0	0	0.557
State-owned	-0.390***	0.025	0.677	0.061***	0.025	1.062	-0.049***	0.002	1.062	-0.005***	0.001	1.062
1995	-0.397***	0.024	0.673	-0.118***	0.024	0.889	-0.038***	0.001	0.889	-0.012***	0.001	0.889
1996	-0.394***	0.024	0.674	-0.236***	0.024	0.790	-0.040***	0.001	0.790	-0.014***	0.001	0.790
1997	-0.412***	0.024	0.662	-0.393***	0.023	0.675	-0.041***	0.001	0.675	-0.016***	0.001	0.675
1998	-0.231***	0.024	0.794	-0.111***	0.024	0.895	-0.027***	0.001	0.895	-0.008***	0.001	0.895
1999	-0.093***	0.025	0.911	0.225***	0.025	1.252	-0.018***	0.001	1.252	-0.001***	0.001	1.252
2000	0.016	0.025	1.016	-0.005	0.024	0.995	-0.007***	0.001	0.995	-0.001***	0.001	0.995
2001	0.016	0.025	1.016	-0.005	0.024	0.995	-0.007***	0.001	0.995	-0.001***	0.001	0.995
2002	0.016	0.025	1.016	-0.005	0.024	0.995	-0.007***	0.001	0.995	-0.001***	0.001	0.995
Regression method	Logistic			Logistic						General linear model		
Nagelkerke R <sup>2</sup>	0.189			0.251			0.181			0.218		
Adjusted R <sup>2</sup>	177,086			177,086			172,985			174,317		
Number of observations	177,086			177,086			172,985			174,317		

Note: Coefficients for industry and region dummies are omitted in this table but are used to calculate pure industry and region profitability index in next table.  
 \*\*\*Estimated coefficient is significant at level of 1 percent.

Table 24. Industry-specific profitability indexes for large and medium-sized industrial enterprises, by ISPI5, 1995–2002

Industry	ISPI1 (estimated from reported profitability)	ISPI2 (estimated from imputed profitability)	ISPI3 (estimated from reported return on total assets)	ISPI4 (estimated from imputed return on total assets)	ISPI5 (ISPI1 + ISPI2/2)	ISPI6 (ISPI3 + ISPI4/2)
[16] Tobacco	3.196	8.018	1.030	1.301	5.607	1.166
[07] Petroleum extract	1.314	3.714	1.060	1.142	2.514	1.101
[44] Electric power	2.451	1.764	1.019	1.021	2.107	1.020
[15] Beverage	1.548	2.654	1.006	1.065	2.101	1.036
[27] Medical	1.903	2.064	1.021	1.039	1.984	1.030
[22] Papermaking	1.353	1.508	1.007	1.008	1.431	1.008
[26] Raw chemicals	1.510	1.333	1.007	1.001	1.422	1.004
[25] Petroleum processing	0.833	1.783	0.999	1.052	1.308	1.026
[23] Printing	1.628	0.942	1.003	0.974	1.285	0.989
[33] Pressing nonferrous	1.230	1.174	1.002	1.001	1.202	1.002
[13] Food processing	1.095	1.277	0.999	1.039	1.186	1.019
[40] Electric equipment	1.283	1.021	1.004	0.996	1.152	1.000
[41] Electronic and telecommunications	1.396	0.851	1.008	0.986	1.124	0.997
[18] Garments	1.173	0.960	0.999	1.006	1.066	1.003
[31] Nonmetal products	1.007	1.122	0.993	0.971	1.065	0.982
[12] Timber logging	1.034	1.048	1.005	0.974	1.041	0.990
[37] Transport equipment	1.119	0.943	1.001	0.985	1.031	0.983
[17] Textile	1.044	1.016	0.992	0.978	1.030	0.985
[19] Leather	1.061	0.897	0.995	1.004	0.979	0.999
[14] Food production	0.935	1.007	0.995	1.005	0.971	1.000
[32] Pressing ferrous	0.858	1.061	0.994	0.998	0.960	0.996
[35] Ordinary machinery	1.088	0.832	0.997	0.961	0.960	0.979
[29] Rubber	0.780	0.984	0.992	0.990	0.882	0.991
[43] Other manufacturing	0.927	0.838	0.996	0.999	0.882	0.998
[30] Plastic	0.913	0.812	0.995	0.967	0.862	0.981
[24] Cultural	0.937	0.777	0.998	0.974	0.857	0.986
[10] Nonmetal mining	0.882	0.829	0.995	0.968	0.856	0.982
[28] Chemical fiber	0.856	0.852	0.996	0.996	0.854	0.996
[34] Metal products	0.887	0.748	0.993	0.972	0.816	0.982
[20] Timber	0.823	0.990	0.992	0.990	0.810	0.991
[36] Special equipment	0.853	0.651	0.995	0.960	0.752	0.978
[09] Nonferrous mining	0.898	0.602	1.010	0.964	0.750	0.987
[21] Furniture	0.768	0.688	0.990	0.977	0.728	0.984
[06] Coal mining	0.797	0.551	0.996	0.953	0.674	0.974
[42] Instruments	0.748	0.554	0.997	0.957	0.651	0.977
[08] Ferrous mining	0.430	0.676	0.991	0.973	0.553	0.982
[46] Tap water	0.454	0.571	0.966	0.942	0.513	0.954
[45] Gas production	0.159	0.132	0.962	0.907	0.146	0.935

Note: ISPI = industry-specific profitability index. The indexes in this table are derived from the coefficients of industry dummies in the profitability regressions reported in table 23. For easy comparison, each profitability index is normalized by the sample average. An index value that is greater than one indicates profitability that is better than the sample average. See appendix 2 for full industry names corresponding to industry codes.

It should be noted that the above are independent impacts by each explanatory variable after the impacts of other explanatory variables, including the impact of industry and region variables, are controlled for.

The impacts of ownership on profitability revealed by each of the four regressions are the following:

- The logistic regression on imputed profitability implies that, compared with private enterprises, the odds that collective, mixed, foreign, HK-M-Taiwan, and SOEs will be profitable are 0.637, 0.586, 0.466, 0.469, and 0.291, respectively. In other words, the SOEs have the lowest probability of making profits compared with the other groups.
- The logistic regression on reported profitability shows similar results but with less dramatic quantitative impacts except for the foreign-invested and HK-M-Taiwan-invested enterprises. As compared with private enterprises, the odds that collective, mixed, foreign, HK-M-Taiwan, and SOEs will be profitable are 0.806, 0.910, 0.391, 0.518, and 0.557, respectively. The foreign-invested and HK-M-Taiwan-invested enterprises seem less profitable than the SOEs when measured by reported profits. This is likely attributable to the different tax and accounting system for the externally invested enterprises. For example, the multinational corporations are likely to use various accounting practices to transfer profits to their overseas entities. The imputed profits would be more useful when comparing enterprise performance across ownership in China because they are derived from the consistent framework of calculating value-added and would not be affected by differences in tax and accounting systems across ownership sectors.
- The linear regression on imputed profitability shows that the return on total assets for private, collective, mixed, foreign, and HK-M-Taiwan enterprises will be 10.6, 7, 4.7, 6.5, and 5.3 percentage points higher, respectively, than that for SOEs.
- The linear regression on reported profitability shows that the return on total assets for private, collective, mixed, foreign, and HK-M-Taiwan enterprises will be 2.9, 2.2, 1.7, 1.7, and 1.5 percentage points higher, respectively, than that for SOEs.

Tables 24 and 25 use the industry and region dummies in the four profitability regressions to construct industry- and region-specific profitability indexes (ISPI and RSPI, respectively). These tables can be used as benchmarks for assessing the pure industry-specific or region-specific risks of enterprise debts in China. They summarize the independent impacts of industry and location on the quality of industrial enterprise debts averaged over 1995–2002.

Table 25. Region-specific profitability indexes for large and medium-sized industrial enterprises, by RSP15, 1996–2002

Region	RSP11 (estimated from reported profits)	RSP12 (estimated from imputed profits)	RSP13 (estimated from reported return on total assets)	RSP14 (estimated from imputed return on total assets)	RSP15 (RSP11 + RSP12)/2	RSP16 (RSP13 + RSP14)/2
[37] Shandong	2.829	2.105	1.023	1.047	2.467	1.035
[32] Jiangsu	1.532	1.799	1.009	1.040	1.666	1.024
[13] Hebei	1.746	1.445	1.014	1.030	1.595	1.022
[33] Zhejiang	1.622	1.496	1.014	1.005	1.559	1.010
[41] Henan	1.346	1.700	1.009	1.032	1.523	1.021
[34] Anhui	1.035	1.623	1.001	1.030	1.329	1.016
[15] Inner Mongolia	1.103	1.316	1.002	1.014	1.210	1.008
[31] Shanghai	1.432	0.858	1.007	0.989	1.145	0.998
[35] Fujian	1.253	1.011	1.007	1.015	1.132	1.011
[14] Shanxi	1.082	1.028	1.002	1.001	1.055	1.002
[42] Hubei	0.827	1.279	1.004	1.032	1.053	1.018
[45] Guangxi	0.764	1.327	0.996	1.009	1.045	1.003
[36] Jiangxi	0.901	1.140	1.000	1.003	1.021	1.001
[44] Guangdong	0.913	0.969	0.998	1.006	0.941	1.002
[23] Heilongjiang	0.905	0.939	0.998	0.997	0.922	0.997
[50] Sichuan + Chongqing	0.908	0.886	0.993	0.994	0.897	0.993
[11] Beijing	1.341	0.445	0.996	0.961	0.893	0.979
[54] Tibet + Qinghai + Ningxia	0.825	0.833	0.990	0.983	0.829	0.987
[53] Yunnan	0.885	0.764	0.997	0.978	0.824	0.988
[22] Jilin	0.809	0.816	0.994	0.994	0.812	0.994
[12] Tianjin	0.815	0.738	1.004	0.970	0.776	0.987
[46] Hainan	0.721	0.812	0.996	0.975	0.766	0.985
[61] Shaanxi	0.766	0.760	0.992	0.990	0.763	0.991
[43] Hunan	0.660	0.857	0.989	0.989	0.758	0.989
[62] Gansu	0.686	0.794	0.984	0.982	0.740	0.983
[52] Guizhou	0.727	0.735	0.994	0.986	0.731	0.990
[21] Liaoning	0.774	0.662	0.993	0.974	0.718	0.983
[65] Xinjiang	0.705	0.695	0.992	0.973	0.700	0.983

Note: RSP1 = region-specific profitability index. The indexes in this table are derived from the coefficients of region dummies in the profitability regressions reported in table 23. For easy comparison, each profitability index is normalized by the sample average. An index value that is greater than one indicates profitability better than the sample average.

ISPI1, ISPI2, ISPI5, RSPI1, RSPI2, and RSPI5 (see tables 24 and 25) are derived from the industry or region dummies in the logistic regressions but are normalized by the sample average. Compared with the sample average, the odds that a specific industry or region will be profitable can be calculated by multiplying the sample average by the index value. For example, the index value of ISPI5 given in table 24 for the tobacco industry is 5.607. Thus the odds that the tobacco industry will be profitable are 5.607 times those that the average industry will be profitable, when other factors influencing profitability are held constant.

ISPI3, ISPI4, ISPI6, RSPI3, RSPI4, and RSPI6 are derived from the industry or region dummies in the linear regressions but are also normalized by first subtracting the average return of all industries or regions and then adding one. This makes the index value equal to one for the average of all industries or regions. The index value minus one is the additional return a specific industry or region has over the average return on total assets. For example, the index value of ISPI6 in table 24 is 1.166 for the tobacco industry. This means that the tobacco industry's return on total assets is likely to be higher than the average return on total assets for all industries by a ratio of 0.166 ( $1.166 - 1$ ), or 16.6 percent.

Hence, tables 24 and 25 help us determine which industries and regions are more profitable for the large and medium-sized industrial enterprises when the influences of other factors such as types of ownership and capital intensity are removed. The two tables are sorted by ISPI5 and RSPI5 from high to low profitability. The top five industries by industry-specific profitability are tobacco processing; petroleum and natural gas extraction; electric power, steam, and hot water; beverage production; and medical and pharmaceutical products. The top five regions by region-specific profitability are Shandong, Jiangsu, Hebei, Zhejiang, and Henan.

The profitability regressions in table 23 can also be used to assess the profitability or debt quality of a particular enterprise if we know the value for that enterprise of the explanatory variable. The predicted value from the logistic regressions is the probability of making profits. Of course, the prediction using the regression equation only helps to assess non-enterprise-specific risks that are summarized by the explanatory variables in the regressions. In the real world and for a specific enterprise, the enterprise-specific risks are clearly most important and cannot be analyzed using the statistical results presented here. It is usually the case, however, that practitioners know the firm-specific risks very well but find it difficult to assess non-firm-specific risks. Our study helps reveal non-firm-specific information and thus can contribute to better policy and more effective business strategy.

## 6. Exit of poor-performing enterprises and its impact on the NPD ratio

The analysis in the previous sections is affected by a sample selection bias that results from the way the National Bureau of Statistics in China defines the sample of large and medium-sized industrial enterprises. As pointed out earlier, about 20 percent of firms enter and exit this sample every year, and the enterprises in the sample make up a very dynamic group that accurately reflects the current state of China's large industrial enterprise sector. Such change in the sample, however, creates a problem for measuring the NPD ratio: it is possible that the exiting enterprises have higher NPD ratios than the new entries.

Table 26 shows the number of enterprises by profitability and entry-exit status for the 1995–2002 period. The entry-exit status of a sample enterprise for a particular period  $t$  is defined as one of the following four exclusive groups:<sup>1</sup>

- “exit” group: the enterprise was in the sample at  $t - 1$  and  $t$ , but not at  $t + 1$
- “new” group: the enterprise was in the sample at  $t$  and  $t + 1$ , but not at  $t - 1$
- “stay” group: the enterprise was in the sample at  $t - 1$ ,  $t$ , and  $t + 1$
- “once” group: the enterprise was in the sample at  $t$ , but not at  $t - 1$  and  $t + 1$

As shown in table 26, among the profit-making enterprises in 1996, 1,177 enterprises appeared in the sample of 1995 and 1996 but did not show up in the sample of 1997, and hence they belong to the “exit” group; 2,802 enterprises did not appear in the sample of 1995 but appeared in the sample of 1996 and 1997, and hence they fall into the “new” group; 10,540 enterprises appeared in the sample of 1995, 1996, and 1997, and hence they are in the “stay” group; 516 enterprises did not appear in 1995 and 1997 but showed up in 1996, and hence they are put into the “once” group.

Table 26 tells us that both profit-making and loss-making enterprises are actively entering and exiting the sample every year. The dynamics of this life-death process reflect how lively China's enterprise reform and restructuring has been. But we would expect that the “exit” group would have more loss-making enterprises than the “new” or “stay” group. The bottom part of table 26 presents information to

<sup>1</sup> Because we do not have data for 1995 and 2003, the entry-exit status for 1995 and 2003 may differ slightly from the definition here. For 1995, we have information on firms that exited or stayed in 1996, but we do not have information on firms that were new in 1995 or appeared only in 1995. For 2002, we have information on firms that were new or stayed in 2002, but we have no information on firms that exited or appeared only in 2002. The unavailable information is indicated by blank entries in the table.

**Table 26. Number of enterprises by profitability and entry-exit status, 1995–2002**

	1995	1996	1997	1998	1999	2000	2001	2002
Number of profit-making enterprises								
Exit	2,485	1,177	2,434	1,648	1,335	2,608	1,258	
New		2,802	1,533	2,408	2,523	1,160	3,890	2,300
Stay	12,229	10,540	10,493	9,849	11,017	11,235	11,221	14,968
Once		516	599	710	368	378	565	
Whole sample	14,714	15,035	15,059	14,615	15,243	15,381	16,934	17,268
Number of loss-making enterprises								
Exit	1,651	1,048	1,745	1,722	943	1,182	649	
New		981	574	838	642	360	864	687
Stay	6,178	5,642	5,293	4,674	4,474	3,631	3,258	4,265
Once		268	286	444	161	184	193	
Whole sample	7,829	7,939	7,898	7,678	6,220	5,357	4,964	4,952
Number of enterprises								
Exit	4,136	2,225	4,179	3,370	2,278	3,790	1,907	
New		3,783	2,107	3,246	3,165	1,520	4,754	2,987
Stay	18,407	16,182	15,786	14,523	15,491	14,866	14,479	19,233
Once		784	885	1,154	529	562	758	
Whole sample	22,543	22,974	22,957	22,293	21,463	20,738	21,898	22,220
Share of loss-making enterprises (percent)								
Exit	39.9	47.1	41.8	51.1	41.4	31.2	34.0	
New		25.9	27.2	25.8	20.3	23.7	18.2	23.0
Stay	33.6	34.9	33.5	32.2	28.9	24.4	22.5	22.2
Once		34.2	32.3	38.5	30.4	32.7	25.5	
Whole sample	34.7	34.6	34.4	34.4	29.0	25.8	22.7	22.3

*Note:* "Exit" group = enterprise was in sample at  $t - 1$  and  $t$  but not at  $t + 1$ ; "new" group = enterprise was in sample at  $t$  and  $t + 1$  but not at  $t - 1$ ; "stay" group = enterprise was in sample at  $t - 1$ ,  $t$ , and  $t + 1$ ; "once" group = enterprise was in sample at  $t$ , but not at  $t - 1$  and  $t + 1$ .

allow us to assess this expectation. The share of loss-making enterprises in the "exit" group is much higher than their share in the other groups, particularly during 1998–99. In 1998, the share of loss-making firms is 51.1 percent for the "exit" group, 25.8 percent for the "new" group, 32.2 percent for the "stay" group, and 38.5 percent for the "once" group. Clearly the group that is exiting the sample has a much higher share of poor-performing firms than the group that is entering the sample. This is a good trend for the economy, but it creates biased estimates of NPD ratios, because the NPDs of the exiting enterprises are entirely ignored in the analysis of the previous sections.

Unlike table 26, which shows the distribution in the number of enterprises by entry-exit status, table 27 shows the distribution of the amounts of performing and nonperforming debts by entry-exit status. For example, table 27 shows that the amount of NPDs that exited the sample with the exit of enterprises rose from RMB157 billion in 1995 to RMB200 billion in 1998, and then fell to RMB92 billion in 2001. On the other hand, the amount of performing debt that entered the sample with the entry of new enterprises rose steadily from RMB311 billion in 1996 to RMB400–800 billion after 1997. The exit of bad firms and the entry of good firms are clearly driving forces in improving the debt quality of the Chinese enterprise sector.



**Table 27. Liabilities/debts by profitability and entry-exit status, 1995–2002**

	1995	1996	1997	1998	1999	2000	2001	2002
Amount of performing debt based on imputed profits (RMB billion)								
Exit	327	204	384	272	396	512	298	
New		311	248	503	429	418	780	483
Stay	2,043	2,044	2,295	2,335	2,587	2,812	3,088	4,190
Once		52	70	129	78	92	71	
Whole sample	2,370	2,611	2,997	3,239	3,490	3,834	4,237	4,673
Amount of nonperforming debt based on imputed profits (RMB billion)								
Exit	157	116	193	200	154	174	92	
New		130	96	145	151	81	168	115
Stay	757	826	881	971	990	848	803	936
Once		23	34	54	20	25	27	
Whole sample	914	1,095	1,204	1,370	1,315	1,128	1,090	1,051
Total liabilities (RMB billion)								
Exit	484	320	577	472	550	686	390	
New		441	344	648	580	499	948	598
Stay	2,800	2,870	3,176	3,306	3,577	3,660	3,891	5,126
Once		75	104	183	98	117	98	
Whole sample	3,284	3,706	4,201	4,609	4,805	4,962	5,327	5,724
Nonperforming debt ratio based on imputed profits (percent)								
Exit	32.4	36.3	33.4	42.4	28.0	25.4	23.6	
New		29.5	27.9	22.4	26.0	16.2	17.7	19.2
Stay	27.0	28.8	27.7	29.4	27.7	23.2	20.6	18.3
Once		30.7	32.7	29.5	20.4	21.4	27.6	
Whole sample	27.8	29.5	28.7	29.7	27.4	22.7	20.5	18.4

*Note:* "Exit" group = enterprise was in sample at  $t - 1$  and  $t$  but not at  $t + 1$ ; "new" group = enterprise was in sample at  $t$  and  $t + 1$  but not at  $t - 1$ ; "stay" group = enterprise was in sample at  $t - 1$ ,  $t$ , and  $t + 1$ ; "once" group = enterprise was in sample at  $t$ , but not at  $t - 1$  and  $t + 1$ .

From table 27 it is clear that the NPD ratio for the "exit" group is much higher than that for the "new," "stay," and "once" groups. For example, in 1998 the NPD ratio for the "exit" group was 42.4 percent, close to twice the NPD ratio for the "new" group (22.4 percent) and much higher than that for the "stay" group (29.4 percent).

The implication of the above evidence is that the dynamics of entry and exit are contributing significantly to the fall in the NPD ratio for the sample. Clearly, the analysis in the previous sections underestimated the level of the NPD ratios. The number of bad firms exiting the sample, however, is more than the number of bad firms entering the sample for every one of the eight years. This means that the *trend* of declining NPD, as revealed in the previous sections, is still valid, although some bias and distortions exist in the *level* of estimated NPD. The rest of this section attempts to identify the size of the NPD ratio bias that resulted from the entry-exit dynamics of the sample enterprises.

If the "exit" group of enterprises had remained in the sample while the same NPD ratio and the same amount of total debts were maintained, then the NPD ratio of the enlarged hypothetical sample would certainly have been pushed higher. Table 28

attempts to estimate how much higher the NPD ratio of the enlarged hypothetical sample would have been if the “exit” group had stayed in the sample for one, two, or three years. The variables in table 28 are defined as follows:

$R(t)$  = NPD ratio for the original sample for period  $t$ , from row 4 of table 6.

$L(t)$  = total liabilities or debts of the original sample for period  $t$ , from row 7 of table 1.

$Rx(t)$  = NPD ratio for the “exit” group for period  $t$ , from row 16 of table 27.

$Lx(t)$  = total liabilities/debts for the “exit” group for period  $t$ , from row 11 of table 27.

$R(t, T)$  = NPD ratio for the hypothetically enlarged sample, with the original “exit” group remaining in the sample for  $T$  periods:

$$R(t, T) = [R(t) * L(t) + \sum_j Rx(t - j) * Lx(t - j)] / [L(t) + \sum_j Lx(t - j)],$$

where  $j = 1, 2, \dots, T$ .  $dR(t, T) = R(t, T) - R(t)$ , the difference, in percentage points, in the estimated NPD ratios between the enlarged hypothetical sample and the original sample.

In table 28, rows 1–4 simply replicate results we have from previous tables, as noted above. Rows 5–10 construct the NPD ratio and the total debts of the “exit” group for the periods  $t - 1$ ,  $t - 2$ , and  $t - 3$ . These 10 rows of data are used to calculate the NPD ratio for the enlarged hypothetical sample in which the “exit” group of enterprises are retained for one, two, or three periods. The results of these calculations are shown in rows 11–13. The longer the “exit” group is retained in the enlarged sample, the higher the NPD ratio for the enlarged sample. Rows 14–16 show the percentage-point difference in the NPD ratio between the enlarged hypothetical sample (i.e., including the “exit” group) and the original sample. This is the estimated sample selection bias. As shown in table 28, on average, over 1998–2002, the NPD ratio would have increased about two percentage points if the “exit” group of enterprises had remained in the sample for three more years.

As shown in row 16 of table 28, the increase in the NPD ratio in this counterfactual experiment is particularly significant for the years 1999 to 2001, largely as a result of more active restructuring of SOEs during this period. We know that during the period from 1999 to 2000, Chinese authorities transferred RMB1.4 trillion in bad loans from the four big state-owned banks to four asset management companies to facilitate the bankruptcies and restructuring of SOEs. The exit of poor-performing enterprises and their debts from our sample was also very significant around 1998. In fact, as shown in row 6 of table 27, from 1995 to 2000, RMB0.994 trillion in NPDs (based on the imputed-profits method of this paper) exited from our sample,

**Table 28. Reduction of nonperforming debt ratio resulting from exit of poor-performing enterprises, 1995–2002**

Row	Variable	Definition of variable	1995	1996	1997	1998	1999	2000	2001	2002	Average during 1998–2002
1	$R(t)$	Nonperforming debt ratio for original sample in $t$	27.8%	29.5%	28.7%	29.7%	27.4%	22.7%	20.5%	18.4%	23.7%
2	$L(t)$	Total debts for original sample	3,286	3,707	4,201	4,610	4,805	4,963	5,329	5,722	
3	$R_x(t)$	Nonperforming debt ratio for “exit” group in $t$	32.4%	36.3%	33.4%	42.4%	28.0%	25.4%	23.6%		
4	$L_x(t)$	Total liabilities/debts for “exit” group in $t$	484	320	577	472	550	686	390		
5	$R_x(t-1)$	Nonperforming debt ratio for “exit” group in $t-1$		32.4%	36.3%	33.4%	42.4%	28.0%	25.4%	23.6%	30.6%
6	$L_x(t-1)$	Total debts for “exit” group in $t-1$		484	320	577	472	550	686	390	
7	$R_x(t-2)$	Nonperforming debt ratio for “exit” group in $t-2$			32.4%	36.3%	33.4%	42.4%	28.0%	25.4%	33.1%
8	$L_x(t-2)$	Total debts for “exit” group in $t-2$			484	320	577	472	550	686	
9	$R_x(t-3)$	Nonperforming debt ratio for “exit” group in $t-3$				32.4%	36.3%	33.4%	42.4%	28.0%	34.5%
10	$L_x(t-3)$	Total debts for “exit” group in $t-3$				484	320	577	472	550	
11	$R(t, 1)$	Nonperforming debt ratio of enlarged sample with “exit” group staying hypothetically for one period		29.9%	29.2%	30.1%	28.7%	23.3%	21.0%	18.7%	24.4%
12	$R(t, 2)$	Nonperforming debt ratio of enlarged sample with “exit” group staying hypothetically for two periods			29.5%	30.5%	29.2%	24.8%	21.6%	19.4%	25.1%
13	$R(t, 3)$	Nonperforming debt ratio of enlarged sample with “exit” group staying hypothetically for three periods				30.7%	29.5%	25.5%	23.0%	20.0%	25.7%
14	$dR(t, 1)$	$= dR(t, 1) - R(t)$		0.3%	0.5%	0.4%	1.3%	0.5%	0.6%	0.3%	0.6%
15	$dR(t, 2)$	$= dR(t, 2) - R(t)$			0.9%	0.8%	1.8%	2.0%	1.1%	1.0%	1.4%
16	$dR(t, 3)$	$= dR(t, 3) - R(t)$				0.9%	2.2%	2.8%	2.5%	1.7%	2.0%

Note: Exit group = enterprise was in sample at  $t-1$  and  $t$  but not at  $t+1$ .

amounting to about 70 percent of the bad loans carved out by the four asset management companies. The declining trend of NPD ratios observed in the sample during 1995–2002 is clearly helped by the exit of these poor-performing enterprises and their NPDs. But as shown in row 13 of table 28, even if the “exit” group of enterprises had been included in the sample, the estimated NPD ratio for the hypothetically enlarged sample would still have declined very significantly, from 30.7 percent in 1998 to 20.0 percent in 2002, consistent with the trend we discovered in the previous sections.

The NPDs of “exiting” enterprises will continue to burden China’s banks unless the banks can transfer the NPLs to China’s asset management companies (which have been established to manage NPLs). So it is important to examine the impact of exiting poor-performing firms on estimated NPD ratios. It is also important, however,

to keep in mind that past NPDs are sunk costs, and what matters the most for economic growth in China is the future trend of NPD ratios. Our NPD estimation method is more meaningful for projecting the future NPD trend because our sample consists of a truly dynamic group of the more active Chinese industrial enterprises, and these firms more accurately represent the current state of the Chinese industrial sector.

## **7. Implications for banking reform**

This paper investigates empirically the quality of debts in the most dynamic group of enterprises in China. We uncover a large amount of independent, consistent, and statistically significant micro-level evidence that shows that the quality of enterprise debts in China improved during 1995–2002, especially after 1998. Because of the transparency and scientific methods used in this research, the evidence looks much more convincing than the macroeconomic statistics announced by China's financial authorities.

The fall in NPD ratios for our sample enterprises is brought about by the shift of financial resources from SOEs to NSEs, improvement in the profitability of SOEs and NSEs, and the exit of poor-performing enterprises from the sample of the large and medium-sized industrial enterprises. Both enterprise restructuring and the timing of business cycles have contributed to the recent improvement in enterprise profitability in China and the fall in NPD ratios. But the benefits of reform dividends and business cycle timing could be uncertain in the future.

China can continue, however, to benefit from the shift of financial resources from SOEs to better-performing NSEs, because the gaps in performance between the two are still very large. The gaps in profitability across industries and regions in China are also large, showing the need for better risk management and more efficient allocation of financial resources. The analysis in this paper could contribute to better assessment of various risks relating to ownership, industry, and region.

The rising share of financial resources allocated to NSEs and the declining NPD ratios for all types of enterprises provide excellent opportunities for pushing banking reforms in China now. If China's banks can establish good corporate governance and risk management, there seem to be enough good NSEs to lend to.

Most of the major banks in China, however, are still state-owned. In light of the strong evidence that SOEs are performing much worse than NSEs, priorities for banking reform would seem to be the development of good private banks, the pri-

vatization of state-owned banks, and the encouragement of more foreign or joint-venture banks to establish themselves in China. If China fails to develop non-state banks, there is a high risk that it will continue to have high NPL ratios, even when its NPD ratio is falling as a result of the privatization of enterprises. This is because SOEs could create NPLs in spite of the good performance of China's enterprise sector.

## Appendix I. Data cleaning

The NBS survey covers more than 20,000 large and medium-sized industrial enterprises in China. It contains some observations that are unusable because of incomplete data reporting or the classification of small enterprises that were considered large and medium-sized historically on the basis of their design production capacity. The classification standard for the size of industrial enterprises was first issued in April 1988 by several government agencies, including the State Planning Commission, National Bureau of Statistics, Ministry of Finance, Ministry of Labor, and State Economic Commission. The standard includes detailed specifications based on measurements of output quantity or capacity in technical-quantity terms instead of value terms. The standard is clearly a legacy of the centrally planned economy and is being phased out at present. It now only applies to state-owned industrial enterprises. For private enterprises, the National Bureau of Statistics is using sales as the sole variable in determining enterprise size.

In this study, observations that satisfy one or more of the following screening conditions for industrial enterprises are regarded as unusable, and consequently such enterprises are deleted from the usable sample:

1. Net value of fixed assets < RMB100,000
2. Intermediate inputs < RMB100,000
3. Number of employees < 30
4. Gross value of industrial inputs at current price < RMB100,000
5. Sales < RMB100,000
6. Total assets < RMB100,000
7. Total assets – liquid assets < 0
8. Total assets – gross fixed assets < 0
9. Total assets – net value of fixed assets < 0
10. Accumulated depreciation – current depreciation < 0
11. Missing data for total assets, number of employees, gross value of industrial output at current price, net value of fixed assets, or sales

After the unusable observations are deleted, only about 5 percent or less of the sample enterprises have sales values less than RMB5 million. Tables A.1, A.2, and A.3 show the distribution of usable and unusable observations in the sample by ownership, industry, and region, respectively. Because the unusable observations are evenly distributed across ownership, industry, and region, we believe that excluding them from the usable sample does not create much bias in our analysis.

Table A.4 shows summary statistics for key size variables (i.e., sales, output, assets, liabilities, labor, and value-added) for the sample with the unusable observations removed. Table A.5 shows the same set of size variables at selected percentiles. Table A.6 examines the weight of the sample within the context of the Chinese economy. Clearly, the sample represents an important part of the Chinese economy, and this makes statistical analysis of the sample important and valuable for both policy-makers and practitioners.

## **Appendix 2. List of industry codes and the full industry names**

- [06] Coal mining and dressing
- [07] Petroleum and natural gas extraction
- [08] Ferrous metals mining and dressing
- [09] Nonferrous metals mining and dressing
- [10] Nonmetal minerals mining and dressing
- [12] Logging and transport of timber and bamboo
- [13] Food processing
- [14] Food production
- [15] Beverage production
- [16] Tobacco processing
- [17] Textile industry
- [18] Garments and other fiber products
- [19] Leather, furs, down, and related products
- [20] Timber, bamboo, cane, palm fiber and straw
- [21] Furniture manufacturing
- [22] Papermaking and paper products
- [23] Printing and record medium reproduction
- [24] Cultural, educational, and sports goods
- [25] Petroleum processing and coking
- [26] Raw chemical materials and chemicals
- [27] Medical and pharmaceutical products
- [28] Chemical fiber
- [29] Rubber products

- [30] Plastic products  
 [31] Nonmetal mineral products  
 [32] Smelting and pressing of ferrous metals  
 [33] Smelting and pressing of nonferrous metals  
 [34] Metal products  
 [35] Ordinary machinery manufacturing  
 [36] Special purposes equipment manufacturing  
 [37] Transport equipment manufacturing  
 [40] Electric equipment and machinery  
 [41] Electronic and telecom equipment  
 [42] Instruments, cultural, and office machinery  
 [43] Other manufacturing  
 [44] Electric power, steam, and hot water  
 [45] Gas production and supply  
 [46] Tap water production and supply

Table A.1 Distribution of usable and unusable observations by ownership, 1995–2002

	1995	1996	1997	1998	1999	2000	2001	2002
<b>Data quality</b>								
<b>Poor</b>								
Private	2	1	2	3	9	14	26	54
Collective	60	72	93	66	58	77	86	89
Mixed	23	24	39	73	82	145	178	158
Foreign	41	67	64	43	42	65	65	98
Hong Kong, Macau, and Taiwan	31	36	34	28	43	59	60	89
State-owned	307	525	583	901	538	626	674	615
Total	464	725	815	1,114	772	986	1,089	1,103
<b>Poor (percent)</b>								
Private	28.6	6.7	5.6	1.7	2.8	2.7	2.6	4.0
Collective	1.5	1.7	2.2	1.8	1.7	2.6	3.5	4.0
Mixed	1.8	1.7	1.9	2.4	2.2	3.2	3.1	2.5
Foreign	3.9	4.9	4.0	2.7	2.1	3.1	2.4	3.2
Hong Kong, Macau, and Taiwan	3.2	3.1	2.7	1.9	2.7	3.7	2.6	3.4
State-owned	2.0	3.4	3.9	6.7	4.8	6.3	7.7	7.9
Total	2.0	3.1	3.4	4.8	3.5	4.5	4.7	4.7
<b>Good</b>								
Private	5	14	34	176	307	498	958	1,302
Collective	4,008	4,199	4,116	3,577	3,350	2,899	2,394	2,138
Mixed	1,233	1,406	2,064	2,934	3,592	4,381	5,619	6,135
Foreign	1,000	1,305	1,525	1,579	1,924	2,048	2,610	2,935
Hong Kong, Macau, and Taiwan	936	1,115	1,222	1,454	1,524	1,552	2,211	2,495
State-owned	15,361	14,935	14,350	12,573	10,766	9,360	8,106	7,215
Total	22,543	22,974	23,311	22,293	21,463	20,738	21,898	22,220
<b>Total</b>								
Private	7	15	36	179	316	512	984	1,356
Collective	4,068	4,271	4,209	3,643	3,408	2,976	2,480	2,227
Mixed	1,256	1,430	2,103	3,007	3,674	4,526	5,797	6,293
Foreign	1,041	1,372	1,589	1,622	1,966	2,113	2,675	3,033
Hong Kong, Macau, and Taiwan	967	1,151	1,256	1,482	1,567	1,611	2,271	2,584
State-owned	15,668	15,460	14,933	13,474	11,304	9,986	8,780	7,830
Total	23,007	23,699	24,126	23,407	22,235	21,724	22,987	23,323

**Table A.2 Distribution of unusable observations by industry, 1995–2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[06] Coal mining	0.4	0.3	1.0	1.0	0.7	3.2	1.8	3.7
[07] Petroleum extract	0.0	0.0	4.0	7.1	3.0	2.6	2.6	0.0
[08] Ferrous mining	0.0	0.0	0.0	0.0	0.0	2.2	7.1	0.0
[09] Nonferrous mining	3.0	2.5	2.5	3.7	2.3	2.9	3.7	3.3
[10] Nonmetal mining	1.4	0.9	2.8	3.4	0.0	2.8	5.1	5.4
[12] Timber logging	0.0	0.0	0.0	0.0	1.0	4.0	4.3	5.4
[13] Food processing	2.3	2.7	3.7	5.0	3.6	5.4	6.9	6.5
[14] Food production	3.6	6.6	7.3	5.9	3.9	5.8	5.4	5.7
[15] Beverage	1.6	3.1	3.2	3.6	2.5	3.6	3.4	4.5
[16] Tobacco	0.7	4.2	0.0	0.0	0.0	1.4	1.4	1.4
[17] Textile	2.5	3.0	3.8	6.0	3.8	3.8	4.4	4.8
[18] Garments	2.8	1.5	1.8	1.6	1.3	2.0	2.0	3.1
[19] Leather	2.6	4.5	2.8	6.3	5.0	6.5	4.9	4.3
[20] Timber	7.4	1.5	1.3	5.2	5.3	4.9	4.1	5.4
[21] Furniture	3.1	5.6	1.3	3.1	2.7	1.4	2.3	2.3
[22] Papermaking	2.6	3.3	3.0	6.7	4.4	6.1	5.1	4.6
[23] Printing	1.1	1.3	2.5	1.3	2.3	1.6	2.3	1.6
[24] Cultural	9.4	8.9	0.9	2.7	2.7	7.1	3.7	3.2
[25] Petroleum processing	0.0	2.6	2.6	0.8	0.0	2.5	3.8	5.6
[26] Raw chemicals	2.4	2.7	2.2	4.2	2.5	4.3	4.9	5.1
[27] Medical	1.6	2.4	1.8	3.9	3.4	3.8	4.1	2.9
[28] Chemical fiber	2.4	1.1	4.7	3.7	2.4	4.6	3.4	5.3
[29] Rubber	4.7	3.4	3.4	4.4	3.2	3.1	4.2	6.1
[30] Plastic	2.6	3.6	2.9	2.1	2.8	4.4	4.6	5.1
[31] Nonmetal products	2.0	3.2	3.2	5.2	3.0	4.0	4.7	4.2
[32] Pressing ferrous	0.4	3.5	3.2	8.5	2.6	5.4	6.8	5.7
[33] Pressing nonferrous	1.1	2.3	1.4	2.2	3.2	1.9	3.0	2.8
[34] Metal products	0.9	1.9	3.1	4.2	2.0	4.4	3.8	4.4
[35] Ordinary machinery	0.5	1.0	1.9	2.2	1.8	2.6	2.4	2.6
[36] Special equipment	0.9	1.7	1.3	1.9	2.1	2.8	3.2	3.8
[37] Transport equipment	1.6	2.5	2.2	3.6	2.9	3.3	3.3	2.6
[40] Electric equipment	1.8	2.6	1.9	3.1	1.7	3.4	2.5	3.8
[41] Electronic and telecommunications	1.8	2.4	3.0	3.0	2.1	2.9	4.3	2.8
[42] Instruments	0.6	1.6	1.3	4.4	2.1	2.8	3.9	5.1
[43] Other manufacturing	3.0	4.2	3.8	2.8	2.1	3.7	3.8	5.9
[44] Electric power	4.7	14.2	18.6	22.8	19.5	20.3	18.4	16.8
[45] Gas production	2.9	2.9	7.6	4.7	7.1	6.2	9.8	4.8
[46] Tap water	1.1	1.5	1.0	1.9	1.9	1.4	2.6	1.7
Total	2.0	3.1	3.4	4.8	3.5	4.5	4.7	4.7

*Note:* See appendix 2 for full industry names corresponding to industry codes.



**Table A.3 Distribution of unusable observations by region, 1995–2002 (percent)**

	1995	1996	1997	1998	1999	2000	2001	2002
[11] Beijing	4.6	3.0	2.6	4.4	5.9	9.5	3.9	4.1
[12] Tianjin	4.4	5.9	13.9	13.1	9.3	18.2	18.5	22.3
[13] Hebei	1.5	2.1	2.1	4.2	3.4	4.7	7.9	8.9
[14] Shanxi	1.6	1.9	3.1	5.1	2.5	4.4	8.1	8.6
[15] Inner Mongolia	1.1	5.1	7.1	7.6	7.7	9.1	9.1	9.6
[21] Liaoning	2.3	3.2	2.9	8.1	2.0	2.6	4.4	4.3
[22] Jilin	2.2	6.1	7.8	11.2	12.5	10.6	11.3	10.2
[23] Heilongjiang	2.7	4.3	5.5	10.2	7.9	8.2	11.4	9.0
[31] Shanghai	5.4	5.5	5.4	3.6	1.1	1.2	0.4	1.2
[32] Jiangsu	0.6	0.6	1.3	0.9	0.8	1.0	0.8	1.0
[33] Zhejiang	0.5	1.7	1.5	1.9	4.3	4.7	4.5	3.1
[34] Anhui	0.8	1.2	0.4	3.7	1.8	2.7	3.5	3.6
[35] Fujian	2.1	1.7	2.5	4.2	1.9	3.3	2.5	2.5
[36] Jiangxi	1.6	1.9	1.7	5.6	4.8	8.2	4.4	5.3
[37] Shandong	1.5	2.3	2.7	2.6	2.1	2.4	2.6	2.6
[41] Henan	1.1	7.5	7.7	8.2	5.3	8.1	10.4	12.2
[42] Hubei	2.6	3.3	3.6	5.7	3.2	4.0	6.1	5.0
[43] Hunan	2.2	4.2	2.3	5.1	1.3	2.0	2.0	2.4
[44] Guangdong	2.8	2.5	2.2	2.7	2.7	2.9	2.5	3.2
[45] Guangxi	0.7	5.6	1.6	2.8	0.7	2.2	1.5	2.8
[46] Hainan	18.1	10.7	3.5	8.1	5.8	7.6	10.9	7.8
[50] Sichuan + Chongqing	1.7	2.7	1.8	5.1	4.9	6.4	5.8	3.6
[52] Guizhou	0.8	6.9	11.0	10.0	14.2	15.3	16.0	8.9
[53] Yunnan	0.9	0.0	1.2	2.9	1.1	2.6	1.5	2.3
[54] Tibet + Qinghai + Ningxia	0.0	0.6	2.7	6.2	2.4	0.6	4.4	2.8
[61] Shaanxi	1.5	1.3	0.6	4.7	2.1	2.5	2.3	1.4
[62] Gansu	1.4	1.0	6.9	7.4	8.7	9.2	8.8	10.3
[65] Xinjiang	1.5	1.6	1.4	3.7	0.6	4.0	2.2	1.8
Total	2.0	3.1	3.4	4.8	3.5	4.5	4.7	4.7

**Table A.4 Summary statistics for sales, output, assets, liabilities, labor, and value-added for the cleaned sample (RMB million)**

	Number of enterprises	Mean	Standard deviation	Median	Minimum	Maximum	Sum
<b>Sales</b>							
1995	22,543	136	630	45	0.109	39,930	3,071,530
1996	22,974	144	681	44	0.100	43,738	3,308,847
1997	22,957	155	761	44	0.103	50,760	3,560,393
1998	22,293	163	772	44	0.101	50,611	3,629,511
1999	21,463	188	871	50	0.107	61,211	4,032,923
2000	20,738	234	1,219	57	0.112	92,279	4,843,396
2001	21,898	257	1,213	63	0.109	78,984	5,624,020
2002	22,220	292	1,329	69	0.101	72,843	6,495,292
Total	177,086	195	966	51	0.100	92,279	34,565,913
<b>Gross value of industrial output</b>							
1995	22,543	136	616	46	0.101	40,214	3,073,253
1996	22,974	147	685	48	0.130	44,349	3,378,619
1997	22,957	157	762	48	0.113	51,693	3,607,608
1998	22,293	165	767	48	0.100	51,646	3,681,858
1999	21,463	190	874	54	0.106	63,918	4,068,673
2000	20,738	230	1,171	61	0.150	92,617	4,775,290
2001	21,898	255	1,177	67	0.140	79,422	5,573,291
2002	22,220	288	1,275	71	0.100	73,633	6,388,539
Total	177,086	195	943	54	0.100	92,617	34,547,132
<b>Total assets</b>							
1995	22,543	229	1,047	79	0.829	65,931	5,161,722
1996	22,974	256	1,199	85	0.831	75,366	5,872,942
1997	22,957	291	1,388	92	0.701	83,704	6,690,180
1998	22,293	329	1,522	99	0.701	90,322	7,323,630
1999	21,463	369	1,684	105	1.350	91,485	7,918,937
2000	20,738	397	1,763	111	1.770	85,791	8,239,931
2001	21,898	420	1,846	113	0.741	86,018	9,196,855
2002	22,220	446	1,882	115	0.835	85,809	9,909,926
Total	177,086	341	1,564	98	0.701	91,485	60,314,123
<b>Total liabilities</b>							
1995	22,543	146	595	56	0.028	29,785	3,285,112
1996	22,974	161	658	60	0.016	27,652	3,706,920
1997	22,957	183	788	64	0.016	31,269	4,201,084
1998	22,293	207	859	69	0.098	33,133	4,609,115
1999	21,463	224	895	71	0.022	32,958	4,804,740
2000	20,738	239	957	74	0.010	46,409	4,962,981
2001	21,898	243	908	72	0.001	33,647	5,328,350
2002	22,220	258	990	71	0.016	43,050	5,723,794
Total	177,086	207	840	66	0.001	46,409	36,622,096
<b>Number of employees</b>							
1995	22,543	1,696	5,215	877	30	254,078	38,223,099
1996	22,974	1,633	4,908	823	30	197,048	37,513,117
1997	22,957	1,593	4,719	793	30	193,076	36,581,069
1998	22,293	1,502	4,482	715	30	193,110	33,490,764
1999	21,463	1,428	4,401	654	30	194,410	30,656,548
2000	20,738	1,361	3,947	620	30	161,654	28,225,561
2001	21,898	1,237	3,599	560	30	147,722	27,079,491
2002	22,220	1,189	3,560	520	30	137,962	26,426,284
Total	177,086	1,458	4,404	701	30	254,078	258,195,933
<b>Reported value-added</b>							
1995	22,543	43	332	11	-424	32,912	958,256
1996	22,974	44	348	11	-3,241	34,809	1,016,728
1997	22,957	47	382	12	-6,738	39,565	1,080,121
1998	22,293	51	398	12	-5,939	41,525	1,131,106
1999	21,463	60	479	14	-1,954	53,645	1,288,589
2000	20,738	73	690	16	-12,140	79,063	1,520,978
2001	21,898	80	660	18	-1,796	78,355	1,741,547
2002	22,220	91	652	20	-2,339	72,057	2,012,908
Total	177,086	61	510	14	-12,140	79,063	10,750,232

**Table A.5 Size of sales, output, assets, liabilities, labor, and value-added at selected percentiles for the cleaned sample (RMB million)**

	Percentiles						
	5	10	25	50	75	90	95
<b>Sales</b>							
1995	6	10	20	45	101	233	418
1996	5	9	19	44	102	245	438
1997	4	8	19	44	105	264	488
1998	4	7	18	44	107	286	530
1999	6	9	21	50	125	325	614
2000	6	10	23	57	146	387	739
2001	6	11	25	63	162	444	838
2002	6	11	27	69	181	505	983
<b>Gross value of industrial output</b>							
1995	7	10	22	46	104	236	403
1996	6	10	21	48	110	250	440
1997	5	9	21	48	112	266	489
1998	5	9	20	48	115	288	536
1999	7	11	24	54	131	333	606
2000	6	11	25	61	151	388	730
2001	7	12	27	67	169	444	836
2002	7	12	29	71	186	505	956
<b>Total assets</b>							
1995	22	28	44	79	167	378	676
1996	23	29	46	85	180	414	745
1997	22	29	48	92	198	474	888
1998	23	30	50	99	218	538	1,007
1999	24	32	54	105	239	603	1,144
2000	23	31	54	111	259	672	1,304
2001	22	31	54	113	271	725	1,445
2002	21	30	54	115	282	775	1,589
<b>Total liabilities</b>							
1995	12	17	29	56	115	245	424
1996	12	18	31	60	125	268	471
1997	12	18	33	64	137	301	542
1998	12	19	34	69	151	345	641
1999	12	18	35	71	160	381	709
2000	11	18	35	74	169	412	784
2001	9	16	32	72	170	429	848
2002	9	15	31	71	176	459	910
<b>Number of employees</b>							
1995	211	306	520	877	1,515	2,858	4,631
1996	186	271	475	823	1,457	2,806	4,584
1997	168	248	445	793	1,429	2,767	4,595
1998	141	208	388	715	1,340	2,656	4,429
1999	126	187	348	654	1,257	2,566	4,258
2000	116	173	323	620	1,208	2,497	4,143
2001	103	150	288	560	1,129	2,332	3,815
2002	92	134	260	520	1,079	2,257	3,778
<b>Reported value-added</b>							
1995	-2	1	4	11	26	64	121
1996	-2	0	4	11	29	69	131
1997	-2	0	4	12	30	74	141
1998	-2	1	4	12	31	80	159
1999	0	2	5	14	37	95	183
2000	0	2	6	16	43	115	215
2001	1	2	7	18	49	131	247
2002	0	2	7	20	54	147	289

Table A.6 Weights of sample enterprises in Chinese economy

	1995	1996	1997	1998	1999	2000	2001	2002
(1) Number of enterprises in sample	22,543	22,974	23,311	22,293	21,463	20,738	21,898	22,220
(2) Number of all industrial state-owned enterprises plus non-state industrial enterprises with annual sales above RMB5 million				165,080	162,083	162,885	171,256	181,557
(3) Reported value-added for all enterprises in sample (RMB billion)	958	1,017	1,080	1,131	1,289	1,521	1,742	2,013
(4) Total industrial value-added in China (RMB billion)	2,472	2,908	3,241	3,339	3,509	3,905	4,238	4,654
(3)/(4) = Sample value-added/China's industrial value added	38.8%	35.0%	33.3%	33.9%	36.7%	39.0%	41.1%	43.3%
(5) China's GDP (RMB billion)	5,848	6,789	7,446	7,835	8,207	8,947	9,731	10,479
(3)/(5) = Sample value-added/China's GDP	16.4%	15.0%	14.5%	14.4%	15.7%	17.0%	17.9%	19.2%
(6) Number of employees for all enterprises in the sample (million)	38	38	37	34	31	28	27	26
(7) Number of employees in all industrial enterprises (million)	157	162	166	166	164	162	163	158
(6)/(7) = Sample employment/China's industrial employment	24.4%	23.1%	22.1%	20.2%	18.7%	17.4%	16.6%	16.7%
(8) Urban employees in China (million)	191	198	202	216	224	232	239	248
(6)/(8) = Sample employment/China's urban employment	20.0%	18.9%	18.1%	15.5%	13.7%	12.2%	11.3%	10.7%
(9) Total employment in China (million)	679	689	696	706	714	721	730	737
(6)/(9) = Sample employment/China's employment	5.6%	5.4%	5.3%	4.7%	4.3%	3.9%	3.7%	3.6%
(7)/(9) = China's industrial employment/China's employment	23.0%	23.5%	23.8%	23.5%	23.0%	22.5%	22.3%	21.4%
(10) Total liabilities for all enterprises in sample (RMB billion)	3,286	3,707	4,201	4,610	4,805	4,963	5,329	5,722
(11) Total loans in China (RMB billion)	5,054	6,116	7,491	8,652	9,373	9,937	11,231	13,129
(10)/(11) = Sample total liabilities/Total loans in China (%)	65.0%	60.6%	56.1%	53.3%	51.3%	49.9%	47.4%	43.6%

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