

Identifying the Patterns of Profitability Across China's State-owned Industrial Enterprises

A sharp decline in the aggregate profitability of industrial state-owned enterprises (SOEs) during the reform period has prompted a number of inquiries into the causes of the decline. The patterns of profitability among industrial SOEs, on the other hand, have received little attention. This paper focuses on four dimensions in explaining differences in aggregate industrial SOE profitability, namely enterprise size, ownership level, sector-specific characteristics and location. Size and sector-specific characteristics turn out to be important in explaining differences in aggregate SOE profitability, but ownership level and locational factors are not. China is fortunate in that relatively profitable sectors are large both in terms of output and employment, and contribute much to aggregate SOE profit. In order to raise aggregate SOE profit, two specific low-profitability sectors which contribute much of the losses should be targeted for reform, but otherwise SOE profitability across all sectors needs to improve. This can in part be achieved by closing the least profitable SOEs which persist across all sectors.

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The past two decades have seen a continuous decline in the profitability of industrial state-owned enterprises (SOEs). A number of current economic, historical and systemic reasons have been explored. Thus the impact of growing competition and of excessive labor remuneration has been tested and confirmed statistically. Excessive capital intensity, heavy pension and other social welfare obligations, as well as distorted output prices are part of the historical legacy. SOEs' intrinsic governance structure with poor incentives for management and workers, and all too often a soft budget constraint, are seen as a major systemic reason for poor profitability.¹

While much attention has gone to the *causes* of low profitability across industrial SOEs in general, the *patterns* of low profitability within the SOE category have been largely neglected. Data on all industrial SOEs in China allow the identification of profitability patterns according to (i) industrial sector, (ii) province, (iii) size and (iv) ownership level. Each of these four dimensions may have a specific impact on profitability. Thus different industries may face different policies, such as restrictions on entry. Different provinces could be endowed with different regional characteristics, such as a particular quality of the labor force or the transportation system. A large size could imply larger returns to scale or preferred treatment by planners. Central rather than local ownership may come with a particular administrative rank and thus access to resources.

In a perfectly competitive economy, none of these dimensions should matter for enterprise profitability. Yet dominant patterns explaining SOE profitability levels in China persist. Earlier literature has noted that large industrial SOEs tend to be more profitable than medium-sized ("medium") or small SOEs (Cao, Qian and Weingast 1999; or Ash and He 1998). Similarly, centrally owned ("central") SOEs have a higher profit rate than locally owned ("local") SOEs (Ash and He 1998). Song et al. (1992) tried to qualitatively identify the loss patterns in 1987 through price changes, size, sectoral, and regional characteristics. The purpose of this paper is to systematically use extensive data to identify any patterns along the four dimensions (sector, location, size, and ownership level), in particular during the 1990s, and to understand their underlying logic. Ideally, this helps recognize where the playing field is

uneven and suggests corrections to policy and the regulatory environment, or facilitates the choice of SOEs which the state should abandon.

After a section on the data and indicators used, the third section looks at each dimension in turn, providing a theoretical argument as to why the particular dimension could matter and some bivariate data. The fourth section uses multivariate analysis to incorporate all four dimensions. Sector-specific characteristics are examined in more detail in the fifth section. The sixth section looks at SOE profitability within individual industrial sectors. The last section concludes.

Data

For most variables, sectoral and provincial data on industrial SOEs are available since 1986.² In 1993, the State Statistical Bureau adopted the System of National Accounts which led to a corresponding revision of the accounting systems; value-added replaced net material product as output measure, and balance sheets replaced earlier source and use of funds measures. In the following, this necessitates a switch in some variables and indicators in 1993, and leads to a focus on the years since 1993.

A further statistical break occurred in 1998. Since 1998, the category SOEs also includes a proportion of the formerly separate category shareholding companies. Shareholding companies are now split according to their ownership and proportionally classified with SOEs and other ownership forms. The statistical break between 1997 and 1998 is complete in that it affects all ownership categories across all economic variables. Much of the quantitative analysis in this paper therefore ends in 1997.

The profitability indicator often used in the literature is profit and taxes per working capital and net fixed assets (see, for example, Naughton 1992, Jefferson and Rawski 1995, Fan and Woo 1996). This indicator may have been highly appropriate for the socialist economy in which (i) all funds for investment

in fixed assets and fixed-quota working capital (as part of current assets) are provided by the government, and (ii) the SOE pays for these funds by handing over its annual surplus to the government as a combined taxes and profit transfer. But since the beginning of the reform period, both assumptions are no longer met. The switch from budget appropriations to bank loans was formalized in 1983, and the tax reform of 1983/85 began to distinguish clearly between profit and taxes. Profit now constitutes the return to equity holders, not the return on debt (liabilities). But the sum of working capital (or current assets) and net fixed assets is an approximation of total assets, i.e., equity *plus* debt. If the denominator is total assets, then the numerator must include the return on debt, namely interest payments. Second, any change in circulating taxes, such as value-added taxes, changes the value of this profitability indicator. Yet a meaningful measure of profitability should not be a function of taxes.

Profitability in the following therefore is measured as profit per equity. It is the return obtained by the owners of the firm. Profit in the aggregate for SOEs in one sector or province is defined as the profit of profitable SOEs, in the following labeled “gross profit,” minus the losses of loss-making SOEs. Equity data are available for the years since 1993. A second indicator, for earlier years when equity data are not available, is losses (of loss-making SOEs) relative to gross profit (of profitable SOEs). While profit per equity focuses on the return to the corresponding source of funds, losses per gross profit splits aggregate profit into its two sub-categories and standardizes one by the other. It is an extremely sensitive measure of aggregate profitability; if profitability deteriorates across loss-making as well as profitable SOEs, the numerator rises and the denominator falls, yielding a sharp increase in the indicator.

All data are from the national statistical yearbooks (ZGTJNJ), the 1995 industrial census (Industrial Census 1995), and provincial statistical yearbooks of all those provinces for which data on both different SOE ownership levels and different SOE size categories are available. For these province-specific data the analysis is limited to the years since 1993 when the current accounting systems came into effect (equity and value-added data became available). 1998 data available in some provincial

statistical yearbooks were included if they follow the old statistical system, i.e., do not exhibit a statistical break between 1997 and 1998. Table 1 provides an overview over the available data.

Table 1 about here

Individual Profitability Patterns

With an increasing degree of marketization, profitability should not differ much across the four dimensions (sectors, provinces, size, and ownership level). Capital flows should equalize returns. But China is not yet a market economy. In the following, for each of the four dimensions a theoretical argument is made as to why it might matter for SOE profitability. Some bivariate statistics are included to show basic correlations. Once all four dimensions have been explored, the next section proceeds with multivariate analysis of their joint impact on SOE profitability.

Industrial sectors

Profitability may vary across sectors to the extent to which remnants of central planning still prevail. The spectrum ranges from guaranteed inputs at fixed prices to output quotas at fixed prices, or general price controls on all or parts of the output. Production and price controls may be accompanied by a concentration of production in very few enterprises, which may all be subordinate to a central line ministry. Petroleum and natural gas extraction, and also the tobacco industry, are prime examples of central state monopolies, except that prices are set administratively and need not reflect the profit-maximizing rule of marginal cost equals marginal revenue. Other sectors, such as the furniture industry, have been largely liberalized with prices determined in close to perfectly competitive markets. Lacking an accurate indicator of state control across sectors, the best approximation available is the share of

SOEs in total sectoral value-added. The more value-added is produced by enterprises in other ownership forms, the less likely it is that state price controls are in effect.

In 1997, the three sectors with the highest level of SOE profitability were tobacco (with a SOE market share of 97.87%, also see notes to Table 2), petroleum and natural gas extraction (96.13%), and beverages (48.70%). The three sectors with the lowest level of profitability were food processing (34.50%), textiles (30.48%), and other manufacturing (4.75%). This suggests that the larger the market share, the higher profitability. Indeed, across all sectors, SOE profitability is positively correlated with the SOE market share in all industrial enterprises, at the 0.1% significance level. If a large SOE market share reflects a low degree of competition and a high degree of state regulation of output and prices, this is exactly what one would expect; the larger the SOE market share, the lower SOE profitability. The pattern also holds for non-SOEs; the larger the SOE market share, the higher the profitability of non-SOEs (at the 5% significance level).

Nationwide industrial SOE profitability has declined almost continuously between 1986 and 1997. (See Table 2.) Average sectoral profitability of industrial SOEs is always below aggregate nationwide industrial SOE profitability, which indicates that profitability in smaller sectors (in terms of gross profit or equity) has deteriorated particularly strongly. In the second half of the 1980s the coefficient of variation of profitability decreased gradually across sectors, possibly as individual sectors became deregulated and those sectoral profitability levels that were relatively market-determined converged. For the in terms of price liberalization crucial years 1991 through 1993 (Chai 1997), no consistent measure of profitability is available. In 1993 through 1997, the range and standard deviation of profitability remained remarkably stable. (The coefficient of variation is not a useful measure of dispersion for the profitability indicator “profit per equity” because mean profitability became extremely small at a value close to zero.) This suggests that a particular degree of liberalization might have been achieved in 1993 and was then held constant over the following years. It did not, however, prevent aggregate SOE profitability from slipping further.

Table 2 about here

Provinces

Numerous reasons suggest that profitability levels could differ between coastal and interior provinces. Interior provinces tend to be less developed and more firmly anchored in the traditional planning system. This could imply a higher degree of government control over the economy and thus government-determined, relatively high profitability levels. Government control would ensure that, in the case of tradeables, these profitability levels through restrictions on market access are protected from inter-provincial trade. In contrast, in coastal provinces fierce competition in a more market-oriented environment could drive profit margins down.

On the other hand, governments in interior provinces could be willing to keep loss-making SOEs alive simply to avoid sharp rises in unemployment when one of (only) a few firms goes bankrupt; a situation of low, perhaps even negative profitability could then prevail over a long period of time. Furthermore, due to the lower level of economic development, interior governments are likely to be more strapped for revenues than the governments of coastal provinces. They could attempt to make up for the shortfall by levying fees and profit remittance obligations on their SOEs. SOEs then may have few incentives to strive for profit, again leading to lower interior profitability levels.

Explaining differences in provincial profitability by the location of the particular province is not convincingly born out by the data. In 1997, the three provinces with the highest level of profitability were Heilongjiang, Yunnan, and Fujian; the three provinces with the lowest level of profitability were Jilin, Guangxi, and Shaanxi. Only one of the high-profitability provinces is a coastal province (Fujian); none of the low-profitability provinces is. Analysis of variance shows that the mean profitability of each of the three regions (coastal, central and Western) does not differ significantly in any of the years 1993 through 1997.

Industrial SOE profitability across provinces declined almost continuously between 1986 and 1997 (Table 2). As in the sectoral analysis, average profitability across provinces is below the nationwide profitability level, which suggests that small provinces (in terms of gross profit or equity) are on average less profitable than large provinces. The coefficient of variation of profitability also decreased in the second half of the 1980s, again a sign of convergence, but in the 1990s the standard deviation remained stable. Throughout all years the dispersion across provinces is much smaller than across sectors, suggesting that sectoral factors may have larger explanatory power for SOE profitability levels than locational factors.

Profitability data from the selected provinces (the provinces for which both size and ownership-level data are available) in 1997 allow significance tests as to whether provinces are performing consistently well (or badly) across sectors. A Friedman test shows at the 1% significance level that this is not the case.³ Similarly, at the 0.1% significance level, sectors do not have a consistently high (or low) level of profitability across all provinces.

Size

Industrial enterprises come in three sizes: large, medium and small. In the early reform period, the enterprise size classification followed the capital construction (investment) categorization of 1978. A product-specific enterprise size classification scheme was only adopted in 1988 and then revised in 1992. Size categories were established for each industrial sector (or sub-sector) separately, in most cases focusing on the original value of fixed assets and/ or the physical production volume (SEC 5 April 1988 and 8 July 1988). The Chinese press in 1999 reported as imminent a new classification system, based on sales volume and total assets, but an official ministerial announcement or new regulation as of early 2001 has not yet been issued (China Infobank 19 April 1999).

Being classified as a large or medium industrial SOE comes with a number of privileges. Large joint enterprises in 1987 were granted extra-plan status under the central plan. Large and medium enterprises

were the first candidates for import-export licenses in 1992. They were the main beneficiaries of attempts to resolve the triangular debt problem in the early 1990s and enjoyed preferential low interest rates on working capital loans. Two special support measures in 1991 and 1995 embraced numerous items of preferential treatment. In 1997 they were listed as the main recipients of medium-term working capital loans and syndicated loans. Bad loans of large and medium enterprises heading for bankruptcy were preferentially written off between 1998 and 2000. (*China Infobank* 2 April 1987, 26 March 1990, 18 April 1990, 16 May 1991, 11 May 1992, 6 March 1995, 6 Oct. 1997, 7 Oct. 1997, 17 Jan. 2001)

These privileges enjoyed by large and medium SOEs should boost their profitability. Furthermore, if large size facilitates access to restricted sectors, and prices in this restricted sector are state-determined and high, then large size implies high levels of profitability. If large size facilitates access to rationed funding, then large size could imply the ability to maintain regular production, and the ability to achieve economies of scale or scope through the choice of optimal size. On the other hand, if size is the result of over-investment in a socialist system, large size may imply low profitability. The ever helping hand of the state may also lead to moral hazard problems in that enterprises, knowing that the state will always come to their rescue, do not need to be concerned with their profitability.

The data suggest that size is favorable to profitability. The 1995 industrial census shows that large SOEs outperform all other SOEs in a number of respects. The share of loss-making enterprises is smallest in the category of large SOEs at 28.20%, compared to 34.87% and 33.94% for medium and small SOEs. (See Table 3.) The distinction is even sharper for profitability. Losses among large SOEs are equivalent to only one quarter of the gross profit of large SOEs, but losses among medium and small SOEs exceed the gross profit in their respective categories. This implies that the 4685 large SOEs, accounting for two-thirds of SOE value-added, are the only SOEs that yield an overall positive profit in 1995; the aggregate profit in the 72,237 small SOEs and the 10,983 medium SOEs is negative. Similarly, in 1995 profit per equity in large SOEs stood at 6.42%, compared to a small negative return

on equity in medium and small enterprises. The same patterns of size and profitability hold for the selected provinces in each of the years 1993 through 1997 (not reported in the table).

Table 3 about here

Ownership

The major ownership distinction is between central SOEs (SOEs owned by the central government) and local SOEs (SOEs owned by the provincial, municipal/ prefectural, or county government). Central SOEs are directly subordinate to either a central line ministry or the State Council itself. They all report to the Chinese Communist Party Central Committee's Central Work Committee for Enterprises (in Chinese: *zhongyang qiye gongwei*), since 1998 headed by Wu Bangguo, a Politburo member and Vice-Premier. The central government is the sole recipient of central SOEs' income taxes and profit remittances. (*China Infobank* 15 Dec. 1993 and 11 Feb. 1995.)

In a large-scale decentralization of economic authority between 1970 and 1973, almost all enterprises previously controlled by central ministries were transferred to local governments. On 12 April 1978, in a complete reversal of this policy, the Chinese Communist Party Central Committee re-centralized key enterprises of importance for the national economy. These enterprises from now on were to be under dual central-local leadership, but with the main leadership exerted by the center (*yi zhongyang bumen wei zhu*). There is no evidence of any other major adjustment during the reform period so far.⁴ More changes could be coming up in the future as the state is set to focus on three types of enterprises, namely those related to state security, those in natural monopoly industries, and those that provide important public goods and services (Wu 1999). But future reforms are less likely to lead to changes in central vs. local subordination than to changes in state- vs. non-state ownership.

Central ownership matters for an SOE in that the direct subordination to a central line ministry or the central government, as well as the direct link to the Chinese Communist Party Central Committee, may be of advantage in overcoming physical and financial constraints. In the planned economy, a central

SOE's input requirements took priority over those of local SOEs; in the reform period the number of materials under central control have dwindled but central control has not yet disappeared altogether. Similarly, with the banking system under central control, central SOEs are likely to have easier access to external funding than local SOEs. This preferential access to resources may advance profitability if the resources allow the maintenance of profitable production processes if not their expansion.

On the other hand, as central SOEs in the course of economic reform lose much of their previous supply of planned, cheap inputs, costs rise and profitability may fall. Unrestricted access to bank funds may allow SOEs to neglect cash flow and profit. The fact that all central SOEs must be located in some locality and that this always requires some form of co-operation with the local government, which may only add complications to enterprise management, could also negatively affect SOE profitability.

The data suggest that for an SOE to be owned by the central government has a positive effect on its profitability. In 1995, the 4,738 central industrial SOEs accounted for 46.12% of total industrial SOE value-added. (See Table 3.) A very similar share of enterprises in both categories was loss-making, 32.55% of the central SOEs, and 33.82% of the local ones. But the discrepancy in profitability is striking. In central SOEs, losses were equivalent to only one quarter of gross profit, while in local SOEs this ratio was three-fourths. Central SOEs earned a 7% return on equity, while local SOEs managed just below 2%. The same pattern of size and profitability holds for the selected provinces in each of the years 1993 through 1997 (not reported in the table).

That high profitability is associated with central as well as large SOEs appears plausible. Many central SOEs are likely to be large SOEs (a cross-tabulation is not available). Across the selected provinces, the provinces for which both size and ownership data are available, profit per equity of central SOEs is highly correlated with profit per equity of large SOEs in each of the years 1993 through 1997. (See Table 4.) The profitability level of local SOEs, on the other hand, is highly correlated with that of medium or small SOEs. For losses per gross profit the results are slightly less sharp, perhaps due to a smaller number of observations, but overall still follow the same pattern.

Table 4 about here

Multivariate Analysis

If all four dimensions, sector, province, size, and ownership are analyzed together, some of the bivariate results disappear. The first data column in Table 5 reports the results of a OLS regression of annual provincial profitability (for the selected provinces) in the years 1993-1997/98 on the four dimensions. Size still has a positive impact on profitability. But the level of ownership is no longer relevant. Inter-provincial differences play almost no role in explaining the differences in provincial profitability patterns. Coastal Fujian performs significantly better than Shanxi, but so does the central province Jiangxi; none of the other provinces carries a significant coefficient. Similarly, the larger the shares of sectors 8 through 10 and sectors 30 through 32 in provincial value-added, the lower provincial profitability; yet none of the other eight groups of sectors has an impact on province-wide profitability different from the omitted sectors 26 through 29. (For a legend of sectoral groups, see notes to table; sectors have to be aggregated due to the small number of observations.) The coefficient signs of the year dummies document a continuous decline in profitability.

Table 5 about here

The bivariate statistics suggested that the group of large industrial SOEs is significantly more profitable than medium and small industrial SOEs. This also holds in the multivariate analysis. If the share of large industrial SOEs in provincial industrial value-added is replaced by the share of large and medium industrial SOEs together, the coefficient turns insignificant; the share of small (or medium) industrial SOEs by itself carries a negative but insignificant coefficient. These results suggest that while numerous regulations grant privileges to both large and medium enterprises, only the large enterprises

end up with high profitability. Perhaps medium SOEs lack the ability to translate these privileges into higher profitability, or other effects cancel out the positive effects of the privileges.

Another explanation would be that privileges may have no significant effect on profitability and large SOEs enjoy higher profitability due to other advantages, such as economies of scale and scope. This appears particularly plausible because a continuous size indicator “value-added per enterprise” to replace the official size categories has an equally positive and significant coefficient. But if it is possible to reap economies of scale and scope, then bureaucratic constraints to entry and enterprise expansion, or financial constraints, must currently be binding.

A third explanation of the positive and significant coefficient of large size only could be that large enterprises are predominantly located in sectors that are strictly state-controlled and highly profitable due to the government’s choice of prices. The government could choose to organize production in these sectors in a small number of enterprises in order to facilitate bureaucratic oversight. No accurate measure of state control across sectors is available; the share of large enterprises in a province’s value-added is positively correlated (at the 0.1% significance level) with the market share of SOEs in this province, suggesting that this explanation is also plausible.

Size is a potentially endogenous variable in that the highly profitable enterprises may be the ones that expand production. Yet a separate regression (not reported in the table) reveals that the relative change in profitability in a particular year has no impact on the relative change in size (measured by the share of large SOEs in provincial industrial SOE value-added, or as value-added per enterprise); this holds even if ownership, provinces, sectors, and years are controlled for. Similarly, lagged profitability has no impact on the change in size. Size thus does not depend on profitability.

While central ownership does not matter in the first regression reported, the coefficient turns significantly negative as soon as the provincial dummies are omitted from the regression. The largely insignificant ten provincial dummies thus disturb any impact of central ownership (but not vice-versa, as regression results show if the share of central industrial SOEs in provincial industrial value-added is

omitted). The negative coefficient sign suggests that central SOEs' privileged access to physical and financial resources may well not be a blessing after all. A hard budget constraint could have a positive effect on profitability.⁵

Due to the historical development of SOE subordination, ownership cannot be an endogenous variable. Today's distribution of SOEs in central vs. local ownership was determined in 1978 based on the choice of products then perceived to be of national importance. I.e., the decision was made under a completely different economic regime in which the indicator profitability measured as profit per equity did not exist and could not be calculated. No major adjustment to the pattern of subordination was made during the reform period.

Various reasons why provincial characteristics could matter for profitability were introduced above. One variable that could to some degree capture the government's influence on the economy is the degree of price liberalization within a province. In the second regression reported in Table 5, provincial dummies are replaced by the share of retail sales, agricultural procurement, and producer goods purchases that were conducted in a particular province in a particular year at market prices. Only the coefficient of agricultural procurement is significant, with the positive sign suggesting that the larger the share of agricultural procurement conducted at market prices, the higher profitability in industry. The fact that government-decreed agricultural procurement prices in recent years tended to be above market prices may explain the positive coefficient sign—if agricultural procurement prices are not fixed at an artificially high level, the lower input prices translate into higher profitability for industrial SOEs.

The share of large industrial SOEs in provincial industrial value-added in this second regression has the same positive and significant sign as before, but the share of central SOEs now has a highly significant negative sign (which appears as soon as provincial dummies are omitted from the regression, regardless of whether price indices, sectoral measures or year dummies are included or not). The relative size of several more industries has a distinct impact on profitability, while the annual pattern is unchanged.

The 39 sectors were aggregated into eleven groups in order to preserve degrees of freedom. (The regression includes observations on all provinces in 1993 through 1997/98 for which both ownership and size data are available.) Sectors were grouped according to the similarity of their products. One of the eleven groups, the one comprising sectors processing metals and non-metal minerals (26 through 29), was omitted to avoid singularity; two extremely small sectors were also omitted. The regression was run in a number of further variations. First, sectors were also grouped following a cluster analysis of all sectors' profitability across provinces (conducted for each year individually, with groups then formed uniformly for all years).⁶ Second, only the shares in industrial SOE value-added of ten individual sectors were included, namely of the five sectors in which SOEs (nationwide) in 1997 had the largest market share plus the five sectors in which they had the smallest market share. Third, all sectoral measures were replaced by the share of industrial SOEs' value-added in a province's total industrial value-added. Overall, the results are very similar to those reported in the first regression in Table 5. One specific difference is that a focus on the ten sectors in which SOEs have an extremely high or extremely low market share yields no clear-cut sectoral results. The industrial SOE market share in the third version also has no impact on profitability, which implies that a large market share does not necessarily lead to a high level of profitability once the share of large SOEs, the share of central SOEs, years, and provinces are controlled for.

The year dummies always carry significant explanatory power, documenting a gradual decline in profitability. The corresponding change in the size of the coefficients (not reported) is almost perfectly consistent over time. This raises the question as to how far other factors that are highly correlated with time could affect profitability. Thus changes in accounting rules in 1993 may have made it more difficult for SOEs to hide losses. Asset stripping has become more prominent in the course of the various SOE reform measures introduced throughout the 1990s, beginning with SOE re-structuring and the establishment of the company system in 1993; asset stripping could indirectly lead to higher losses. Debt

forgiveness measures and other special treatment available to loss-making SOEs since the mid-1990s have created incentives to under-report profit.

Switching to the profitability indicator losses per gross profit results in a severe degree of freedom problem. The overall regression with only two degrees of freedom has largely insignificant coefficients. In the second type of regression reported in Table 5, with seven degrees of freedom, the size effect is significant with a negative sign (implying that the larger the size, the lower the losses relative to gross profit), the ownership effect is insignificant, the year effects are the same as before except for 1993 (insignificant), and most sectoral coefficients are insignificant. The market price index of retail sales has a significant negative sign, and that of producer goods a significant positive sign. Thus the larger the share of retail sales conducted at market prices, the smaller the losses relative to gross profit. The positive sign for the price index of producer goods indicates that controlled prices of producer goods may be set artificially high.

Sectoral Profitability Patterns

In the regression analysis, sectors had to be aggregated into a few groups due to the small number of degrees of freedom, and provincial dummies appeared to be confounding sectoral effects. This section focuses solely on sectoral profitability over time. A cluster analysis reveals historical patterns. And a closer look at the individual sectors shows that a small number of high- and low-profitability sectors exert an disproportionately large influence on aggregate sectoral profit, value-added and employment.

Cluster analysis

A cluster analysis of SOE sectoral profitability across the years 1993 through 1997 identifies which sectors share a common profitability pattern over time. Table 6 presents the different groups and identifies each group by its profitability pattern. Between 1993 and 1997, half of all sectors were on a low, sometimes negative, but relatively stable profitability level. Another one third experienced a gradual decline.

Table 6 about here

Six sectors, apart from a residual sector, each followed its own distinct path: (i) the tobacco industry enjoyed high profitability throughout; (ii) petroleum and natural gas extraction saw a gradual improvement from a negative to a high positive profitability level; (iii and iv) profitability in the food processing industry deteriorated rapidly, and profitability in the leather, fur, down and related products industry gradually, both to a highly negative level; (v) the textile industry was unprofitable in all years, and increasingly so; and (vi) the non-metal mineral products industry saw a rapid drop in profitability to a medium negative level. Profitability in the first two industries is clearly the outcome of state-determined prices. Although no sector-specific data are available on the extent to which prices are state-determined, the China Price Yearbook contains numerous regulations on pricing in the petroleum industry (ZGWJNJ 1998).

Prices in the other four sectors should be largely market-determined following the wide-ranging price liberalization in 1993. Perhaps an increase in competition was driving down prices and thereby profitability. Industrial SOEs in these four sectors experienced a rapid fall in their market share by 25-60 percentage points—compared to a 18 percentage point drop across the aggregate of all sectors. (The bivariate statistics above showed a correlation, but in the multivariate analysis the market share did not have a significant impact on province-wide industrial SOE profitability.)

Competition comes not only from enterprises in non-state ownership, but also from other SOEs in the same sector. In 1997 the number of SOEs exceeded 200 in every sector except in petroleum and natural gas extraction, and in other mineral mining and dressing; there were 8000 SOEs in the food

processing sector. As long as their products are tradeable and not subject to state output planning, once prices are freed, competition between SOEs could be fierce. The exact extent to which prices in a particular sector are market-determined, however, is not known. Enterprises in many sectors still suffer from numerous minor price administration measures. One example is the paper industry, where the price of paper sold to central news organs is centrally determined; central news organs presumably purchase from state-determined suppliers.

The instances of tobacco and petroleum and natural gas extraction show that if the state wishes to maintain high profitability levels in sectors in which it still controls prices, it can easily do so. On the other hand, it appears that as soon as prices are liberalized and the output planning system has been dismantled, profitability quickly deteriorates. SOEs in some sectors clearly fare worse than in others, for example the textile sector. But textile enterprises in other ownership forms also fare poorly, worse than the nationwide average of all enterprises in other ownership forms. Sectoral profitability of SOEs is significantly and positively correlated with sectoral profitability of non-SOEs at the 1% significance level. The difference is only in the profitability levels; SOE profitability across all sectors tends to be below the profitability levels of the non-SOEs.

Best- and worst-performing sectors

With average profitability declining in recent years, the worst-performing sectors reduce aggregate SOE profit by an ever larger amount. Whereas the five sectors with the lowest profitability levels in 1993 accumulated losses equivalent to only 5.55% of aggregate SOE profit (of all industrial SOEs across all sectors), by 1997 that share had risen to 30.78%. (See Table 7.) Yet the contribution of these five sectors to aggregate value-added remained stable between 1993 and 1997 at approximately 7%. In other words, if enterprises in these five out of the thirty-nine sectors (i.e., 12.82% of all sectors) were closed, aggregate SOE profit would rise by about 30%, while aggregate SOE value-added would only fall by about 7%. It is in terms of employment that closing SOEs in these sectors appears most

difficult; the share in total industrial SOE employment at almost 13% is double the output share. (Employment shares are for 1998, the first year for which a sectoral breakdown is available; except for the one-year time difference, the 1998 employment data are consistent with all other 1997 SOE variables.) Within the five worst-performing sectors, two sectors, food processing and textiles, with a profitability level of -18.47% and -15.40%, account for the bulk of all losses (in absolute terms equal to 28.36% of total profit), value-added (6.63%), and employment (about 11%). (For the individual sectoral data, see Table 8.)

Table 7 and Table 8 about here

In contrast, the five sectors with the highest profitability levels in 1997 contributed more than a quarter of aggregate value-added and 88.23% of total profit, but employed only about 10% of all SOE laborers. Among these five sectors, also two sectors stand out, namely petroleum and natural gas extraction, and the tobacco industry, with profitability levels of 13.28% and 9.84%. Together they accounted for 69.77% of total profit, 20.85% of value-added, but only about 5% of employment (corresponding to their share in the total number of sectors, two out of thirty-nine). As noted earlier, these two sectors are state monopolies with state-determined prices. Provincial-level sectoral data in 1997 for 19 provinces for which sectoral data are available reveal that two provinces are highly affected by the sectoral concentration of profit: petroleum and natural gas extraction accounted for 123.72% of aggregate industrial SOE profit in Heilongjiang, and tobacco for 98.92% of aggregate industrial SOE profit in Yunnan.

The data suggest a classification of industrial SOEs by sectors into three categories. Two fully state-controlled sectors account for the bulk of all profit, a fair share of value-added, but relatively little employment. The state is dependent on these two sectors to support aggregate SOE profit and may well have chosen prices in these sectors correspondingly. Petroleum and natural gas prices affect virtually all other industrial sectors, while tobacco prices directly affect consumers.

Two highly unprofitable sectors account for a severe amount of losses, an average share of value-added, but a relatively large share of employment. These two sectors, food processing and textiles, would be prime candidates for enterprise closures were it not for the employment problem. If the employment problem can be resolved, the state may best withdraw from these sectors.

Apart from these two best- and two worst-performing sectors, no other sectors stand out as major contributors to overall profit (or losses), value-added or employment. Aggregate profit of the residual thirty-five sectors divided by their aggregate equity yields a meagerly 1.41% return. Although sectoral profitability levels in this group of thirty-five residual sectors may still differ widely, there are no easy targets for reform that would immediately improve aggregate profit. For example, the sector “other manufacturing” has a profitability level of -11.53%, but its contribution to profit (in absolute terms), value-added and employment is below half a percentage point. Similar cases are the four sectors (i) leather, fur, down and related products, (ii) timber, bamboo, cane, palm fiber and straw products, (iii) metal products, and (iv) instruments, meters, cultural and office machinery. Only one other sector, non-metal mineral products, has a below-average profitability level (of -6.22%) together with a relatively large contribution to aggregate profit (of -9.57%); its share in value-added is 3.02%, and in employment about 6%.

While drastic reform of two (perhaps three) low profitability sectors would yield an immediate and significant improvement in overall profitability, reform of all other low-profitability sectors would not advance aggregate profit much. If the objective were to improve aggregate SOE profitability, this suggests two parallel reform measures. The food processing and textile industry (and perhaps the non-metal mineral products industry) should be handled as specific reform cases. At the same time, all sectors need to raise their profitability levels, even the relatively well performing ones, which may require systemic changes.

It appears that the situation could be much worse. In 1997, sectoral profitability across the thirty-five residual sectors is positively correlated with (i) the sectoral share in aggregate profit (at the 1%

significance level), (ii) the sectoral share in value-added (5%), and (iii) the sectoral share in employment (5%). For all thirty-nine sectors the first two correlations become even more significant (at the 0.1% and 1% level), while the correlation with employment disappears. This implies that relatively profitable sectors tend to be large both in terms of output as well as employment (except the two top-profitability sectors), and contribute much to overall profit. Similarly, low-profitability sectors contribute much to the losses but relatively little to value-added and employment (except the two sectors with the lowest profitability levels). The situation would be much worse if relatively profitable sectors were small in terms of equity (leading to a small profit), value-added and employment, and if the sectors with the lowest profitability levels were large.

Profitability Patterns Within Sectors

Not only was the decline in profitability during the reform period not uniform across sectors, but profitability furthermore differs significantly between SOEs within one and the same sector. Nationwide sectoral data from the 1995 industrial census show that losses in a particular sector are positively correlated with gross profit in the same sector, at a 5% significance level. (The same pattern holds across provinces, at the 1% significance level.) In other words, sectors with a relatively large volume of gross profit at the same time incurred relatively large losses; sectors with a relatively small volume of profit also had relatively small losses. The same pattern holds per enterprise (at the 5% significance level across sectors and the 1% level across provinces).⁷ The higher the losses per loss-making SOE in a particular sector (province), the higher the (gross) profit per profitable SOE.

This polarization within each sector suggests a severe lack of exit. Apparently some SOEs, after the extensive industrial price liberalization in the early 1990s no longer protected through sectoral average-cost price calculations, could not face the competition and gradually sank into the red, but at least as of

1995 were not allowed to exit. These relatively few loss-making enterprises in a large number of sectors could be prime targets for reform.

With no output and profitability data on loss-making vs. profitable enterprises available except for 1995, it is difficult to check whether loss-making enterprises are already being closed. Using the available aggregate profit data suggests that perhaps since 1996 loss-making enterprises are indeed being systematically closed. In the sectors or provinces with the lowest profitability levels the worst performing enterprises should close, thus reducing (i) the share of this sector's (province's) SOE value-added in the nationwide SOE value-added, (ii) the market share of SOEs in the value-added of this sector (province), and (iii) the number of SOEs in the particular sector (province) itself. (On the other hand, profitable SOEs in a sector or province could expand production, or new SOEs could be established.) The profitability level in 1996 across sectors is as expected positively correlated with the relative change in all three indicators in 1997 over 1996 (at the 1%, 5%, and 5% significance level), i.e., the worst SOEs across all sectors may indeed be gradually closed. In no other year is there any significant correlation, and across provinces only the 1993 profitability level is significantly (positively) correlated with the 1994 over 1993 relative change in the market share.

Conclusions

The multivariate analysis showed that of the four dimensions considered, only size and sector-specific characteristics mattered for SOE profitability in the years 1993-1997/98. Being categorized as a 'large' industrial SOE comes with a significant positive impact on profitability. Economies of scale and scope, as noted by Nolan (1996), thus may play an important role in the determination of an enterprise's profitability. But this would imply that barriers to entry across most of China's industry are

still severe, perhaps in form of direct bureaucratic restrictions on the establishment of enterprises, as the industrial policy guidelines regularly issued by the State (Development and) Planning Commission indicate, or through the lack of well-functioning capital markets. Another potential explanation is that large SOEs are concentrated in sectors where prices tend to be state-controlled at a level that yields a high rate of profitability; SOEs could be large in order to facilitate government control. While the regression results at first sight justify the Chinese government's attempt to form numerous large conglomerates, if size implies profitability solely due to administrative decisions such as on prices or entry rules, the rationale for forming conglomerates will disappear as (if) the economy is liberalized further.

Whether a SOE is owned by the central rather than a local government has no significant impact on its profitability; if the provincial dummies are dropped, central ownership even has a negative impact on profitability. The privileges accorded to central SOEs, for example as regards access to physical and financial resources, thus appear to be balanced by if not outweighed by disadvantages, perhaps poor management in the face of a soft budget constraint.

The particular location of a SOE does not affect its profitability. Patterns of excessively high province-wide industrial SOE profitability are easily explained by sector-specific factors. Thus Heilongjiang's high level of profitability is solely due to the formidable size of its petroleum and natural gas extraction industry, by government-choice a high-profitability sector; similarly, the second important state monopoly sector, tobacco, explains Yunnan's high profitability level.

Petroleum and natural gas extraction together with the tobacco industry are high-profitability sectors thanks to government price policies, accumulating an immense volume of profit. The until today high profitability levels (with a large volume of profit) reflects a clever choice. High prices in the petroleum and natural gas extraction industry affect all industrial sectors, high prices in the tobacco industry affect a large number of consumers. This indirect 'tax' on the economy is collected by a very few SOEs directly under central government control. The central government thereby secures a stable source of income

not subject to central-provincial bargaining; thanks to the concentration of production in these two sectors in very few enterprises, the potential for leakage is minimal.

On the other hand, food processing and the textile industry are highly liberalized sectors with an abysmal profitability record throughout the 1990s, thus constituting prime targets for reform. Since 1998 the central government in its three-year SOE reform program indeed focused in particular on the textile industry, and recent reports suggest that drastic layoffs and capacity reductions have allowed the state-owned textile industry to turn the corner. While there may be further scope for sector-specific measures in a number of other low-profitability sectors, in 1997 (and similarly in earlier years) no other sector except food processing contributed significantly to aggregate SOE losses. But overall, the situation could be far worse than it is. China is fortunate in that relatively profitable sectors tend to be large both in terms of output and employment, and contribute much to overall profit.

Due to the severe statistical break in 1998, much of the quantitative analysis in this paper ends in 1997 (1998 for some provinces which still adhered to the original enterprise classification in 1998). All SOE data since 1998 include a share of shareholding company data corresponding to the state's share in these companies' paid-in capital. In 1998, this re-defined SOE category had a nationwide ratio of profit to equity of 1.96%, down from the 2.09% of the old SOE category in 1997 (ZGTJNJ 1999: 434f, Table 8). The rate of profitability of the re-defined SOE category then improved to 3.26% in 1999, the most recent year for which any systematic data are available (ZGTJNJ 2000: 426f). Sectoral SOE data available for 1999 (but not for 1998) show a significant improvement in the rate of profitability of SOEs in the textile sector from -15.40% in 1997 to -3.55% in 1999 (ZGTJNJ 2000: 426f, Table 8), which, however, can also be due to the re-definition of the SOE category. The negative profitability level of SOEs in the food processing sector, which in the late 1990s was not a direct target of reform, improved less, from -18.47% in 1997 to -13.03% in 1999. Petroleum and natural gas extraction, and also the tobacco industry remained highly profitable. The relative rates of SOE profitability across sectors changed little (apart from the case of the textile sector), with a tendency towards an improvement in

sectoral profitability rates, suggesting that the patterns identified in this paper are likely to continue to hold after 1997/98. (SOE profitability levels across sectors in 1997 are positively correlated with those for the re-defined SOE category in 1999 at the 0.1% significance level; the same holds across provinces.)

The improvement in nationwide SOE profitability between 1998 and 1999 (in both years following the new SOE definition) shows that reforms can be effective. Targeting all SOEs in the worst performing sectors, such as the textile sector, are likely to be successful in raising aggregate profitability, albeit at a cost to the state in the form of unemployment and other social security benefits. But SOE reform need not focus solely on particular sectors, nor necessarily on all SOEs. Instead, allowing a small number of the very worst performing SOEs across all sectors to exit has the potential to significantly improve aggregate profitability.

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Table 1. Availability of Data on SOE Profitability^a

	China Statistical Yearbook (ZGTJNJ)		Industrial Census 1995		Provincial statistical yearbooks 1993-97/98 ^b	
	Losses / gross profit, only 1986-91	Profit / equity, only 1993-97	Losses / gross profit	Profit / equity	Losses/ gross profit	Profit / equity
Nationwide	4	4	4	4	—	—
Sectors ^c						
Nationwide	30 sectors	39 sectors	37 sectors	37 sectors	—	—
Provincial-level	—	—	—	—	40 sectors	40 sectors
Provinces	29 provinces ^d	30 provinces ^d	30 prov.	30 prov.	4	4
Size						
Nationwide	—	4	4	4	—	—
Provincial-level	—	—	—	—	4	4
Ownership						
Nationwide	—	—	4	4	—	—
Provincial-level	—	—	—	—	4	4

a The data cover all SOEs with independent accounting systems.

b Only those provinces are included for which data both according to size and ownership level are available. Hainan in the year 1994 would meet this criterion but is such an outlier that it was ignored. This leaves the following provincial observations for profit per equity (those provinces for which losses per gross profit data are available are marked with a *).

1993: Beijing*, Shanxi*, Liaoning, Jiangxi*, Shandong;

1994: Beijing*, Shanxi*, Liaoning*, Heilongjiang*, Fujian*, Jiangxi*, Shandong, Shaanxi*;

1995: Beijing, Shanxi, Liaoning, Heilongjiang, Anhui, Jiangxi, Shandong, Shaanxi*;

1996 and 1997: Beijing*, Shanxi (* 1996 only), Liaoning, Heilongjiang*, Anhui, Fujian*, Jiangxi*, Shandong*, Guizhou*, Xinjiang*, Shaanxi*.

Coastal provinces comprise Liaoning, Fujian and Shandong; Beijing, although not located at the coast, is also included. (No size and ownership level data are available for the coastal provinces Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Guangdong, Guangxi and Hainan.) Central provinces comprise Shanxi, Heilongjiang, Anhui, and Jiangxi. (No size and ownership level data are available for Neimenggu, Jilin, Henan, Hubei and Hunan.) Western provinces comprise Guizhou, Xinjiang and Shaanxi. (No size and ownership data are available for Sichuan, Yunnan, Tibet, Gansu, Qinghai and Ningxia.) Central and Western provinces together constitute the 'interior' provinces.

c Up through 1992, SOE data on 30 industrial sectors are available, since 1993 on 39 industrial sectors, and in the 1995 industrial census (for 1995) on 37 industrial sectors; the sectoral classification prior to 1992 only partially matches later data. The 37 industrial sectors covered in the 1995 industrial census in terms of value-added accounted for 99.26% of nationwide industrial SOE value-added. The 39 industrial sectors covered in the statistical yearbooks for the years 1993 through 1997, in 1995 in terms of value-added accounted for 99.40% of the total. (The two additional industrial sectors are "other mineral mining and processing" and "other manufacturing.") If the 1995 sectoral classification is reduced to the 1986 sectoral classification, in 1995 the sectors included in the old classification scheme accounted for 95.44% of total industrial SOE value-added. Some provincial statistical yearbooks provide data on 40 industries. The fortieth sector is "weapons and ammunition."

d In 1988 Hainan was newly included in the reported statistics as a separate province, raising the number of provinces to 30. Chongqing first appeared as a separate province in the reported statistics on 1997, and in the following was folded back into Sichuan.

Table 2. Profitability Across Sectors and Provinces

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Losses per gross profit	0.0732	0.0720	0.0841	0.1952	0.4733	0.4771	0.4083	0.3564	0.3679	0.4900	0.6571	0.6601
Sectors												
Mean across sectors	0.1615	0.1632	0.1858	0.3877	0.7843	0.8138						
Coefficient of variation	3.0210	3.1530	2.5215	2.0412	1.5931	1.4493						
Range	2.6479	2.8857	2.4737	3.7419	6.6242	5.7925						
Provinces												
Mean across provinces	0.1502	0.1174	0.1167	0.2096	0.5007	0.5518						
Coefficient of variation	1.6518	0.9445	0.7002	0.5115	0.4237	0.4771						
Range	1.4087	0.5881	0.4177	0.4848	0.8036	1.0578						
Profit per equity								0.0770	0.0672	0.0410	0.0224	0.0209
Sectors												
Mean across sectors								0.0534	0.0220	0.0185	-0.0106	-0.0126
Standard deviation								0.0737	0.0823	0.0688	0.0769	0.0740
Range								0.3415	0.5372	0.4167	0.4459	0.3867
Provinces												
Mean across provinces								0.0705	0.0581	0.0312	0.0111	0.0109
Standard deviation								0.0540	0.0578	0.0539	0.0506	0.0497
Range								0.2454	0.2716	0.3093	0.2641	0.2228

Range denotes the maximum value minus the minimum value.

The forty sectors listed in descending order according to the 1997 nationwide market share of SOE value-added in the value-added of all industrial enterprises with independent accounting systems on township tier and above are: Tobacco (97.87%), Petroleum and Natural Gas Extraction (96.13%), Logging and Transport of Timber and Bamboo (95.28%), Tap Water Production and Supply (85.65%), Petroleum Processing and Coking (81.59%), Coal Mining and Dressing (78.34%), Smelting and Pressing of Ferrous Metals (75.01%), Electric Power, Steam and Hot Water Production and Supply (73.87%), Gas Production and Supply (63.76%), Smelting and Pressing of Nonferrous Metals (54.86%), Nonferrous Metals Mining and Dressing (51.65%), Beverages (48.70%), Communication and Transport Equipment (44.57%), Raw Chemical Materials and Chemicals (43.88%), Special Purpose Equipment (41.11%), Printing and Record Media (40.52%), Ferrous Metals Mining and Dressing (39.83%), Medical and Pharmaceutical Products (36.57%), Food Processing (34.50%), Ordinary Machinery (33.78%), Textiles (30.48%), Rubber (29.25%), Non-metal Minerals Mining and Dressing (28.60%), Instruments, Meters, Cultural and Office Machinery (28.15%), Paper (25.88%), Non-metal Mineral Products (25.07%), Electronic and Telecommunications Equipment (23.80%), Food Production (23.26%), Other Minerals Mining and Dressing (20.62%), Chemical Fibers (19.95%), Electric Equipment and Machinery (18.47%), Timber, Bamboo, Cane, Palm Fiber and Straw products (12.55%), Metal products (11.88%), Plastics (8.86%), Cultural, Educational and Sports Goods (7.55%), Furniture (6.19%), Leather, Fur,

Down and Related Products (6.05%), Garments and Other Fiber Products (5.27%), Other Manufacturing (4.75%), Weapons and Ammunition (n.a.).

Sources: ZGTJNJ 1987 through ZGTJNJ 1998.

Table 3. Profitability, Size, and Ownership Level of SOEs

	Total	Large	Medium	Small	Central	Local
Number of enterprises	87,905	4,685	10,983	72,237	4,738	83,167
Share of loss-making enterprises	0.3375	0.2820	0.3487	0.3394	0.3255	0.3382
Share in total SOE value-added	1.0000	0.6885	0.1688	0.1427	0.4612	0.5387
Losses per gross profit	0.4900	0.2550	1.1023	1.2464	0.2432	0.7248
Profit per equity	0.0410	0.0642	-0.0067	-0.0170	0.0700	0.0197
Losses per loss-making ent. (mio. yuan)	2.1558	18.7260	5.0410	0.8122	10.0331	1.7239
Gross profit per profit. ent. (mio. yuan)	2.2412	28.8424	2.4486	0.3348	19.9068	1.2154
Profit per enterprise (mio. yuan)	0.7572	15.4299	-0.1632	-0.0545	10.1627	0.2214

Sources: Industrial Census 1995, Vol. II: 16f, 20, 22.

Table 4. Correlation in Profitability Between Ownership and Size Across Selected Provinces

Ownership	Size	1993	1994	1995	1996	1997
<i>Profit per equity</i>						
Observations		5	8	8	11	11
Central	Large	***0.9866	***0.9163	***0.9667	***0.9318	***0.9518
Central	Medium	**0.8751	-0.1063	-0.0985	0.1178	0.1042
Central	Small	0.5700	-0.3968	0.0277	0.2224	0.2286
Local	Large	0.6336	-0.2597	-0.0884	0.2156	-0.0624
Local	Medium	0.7546	***0.8367	***0.8215	***0.8873	***0.9028
Local	Small	**0.8911	***0.8321	**0.7483	0.3318	0.5052
<i>Losses per gross profit</i>						
Observations		3	7	1	8	9
Central	Large	***1.0000	***0.9129	n.a.	*0.6286	**0.6628
Central	Medium	***0.9942	0.0143	n.a.	*0.6655	0.2547
Central	Small	***0.9930	-0.2947	n.a.	0.4300	0.5489
Local	Large	**0.9782	0.0666	n.a.	*0.6609	0.5217
Local	Medium	***0.9944	***0.8846	n.a.	0.5585	**0.6720
Local	Small	**0.9450	***0.8613	n.a.	*0.6371	***0.8398

Significance levels: *** 1%, ** 5%, * 10%.

For details on the provinces included, see notes to Table 1.

Sources: Provincial statistical yearbooks.

Table 5. Determinants of Province-wide Industrial SOE Profitability (Profit per Equity), 1993-98

Number of observations R ²	37 0.9911	37 0.9571
Intercept	0.2652 (1.3345)	-0.1242 (-0.6918)
Share of large SOEs in provincial industrial value-added	*0.3178 (2.1665)	**0.2323 (2.8935)
Share of central SOEs in provincial ind. value-added	0.0096 (0.0614)	***-0.3696 (-4.4574)
Year dummies (except for 1997)	**+ 1993 ***+ 1994 + 1995 + 1996 - 1998	***+ 1993 ***+ 1994 **+ 1995 - 1996 - 1998
Provincial dummies for all eleven provinces except Shanxi	**+ Fujian *+ Jiangxi	
Share of each of ten groups of sectors in provincial industrial value-added	*- 8-10 *- 30-32	***+ 1-6 *+ 8-10 ***+ 11 ***- 12-14 ***+15, 16 **+ 20-25 *+ 33-35 ***+ 37-39
Share of prices determined on market:		
Retail sales		-
Agricultural procurement		** +
Means of production (producer goods) purchases		-

Significance levels: *** 1%, ** 5%, * 10%.

The eleven provinces are Beijing, Shanxi (omitted), Liaoning, Heilongjiang, Anhui, Fujian, Jiangxi, Shandong, Guizhou, Shaanxi, and Xinjiang.

The eleven sectoral groups are 1-6, 8-10, 11, 12-14, 15 and 16, 17-19, 20-25, 26-29, 30-32, 33-35, and 37-39. Sectors 26-29 were omitted to avoid singularity; the two very small sectors 7 and 36 were also omitted. (On the individual sector names, see Table 8.) No data are available on the weapons and ammunition sector.

Sources: Provincial yearbooks; ZGWJNJ 1994: 64-67, ZGWJNJ 1995: 18-20, ZGWJNJ 1996: 385-7, ZGWJNJ 1997: 479-81, ZGWJNJ 1998: 414-6, ZGWJNJ 1999: 574-6.

Table 6. SOE Sectoral Profitability Clusters, 1993 through 1997

Cluster 1: low and stable level of profitability (positive or negative)

coal mining and dressing; ferrous metals mining and dressing; non-metal minerals mining and dressing; other minerals mining and dressing; foods; garments and other fiber products; timber, bamboo, cane, palm fiber and straw products; furniture; paper; cultural, educational and sports goods; raw chemical materials and chemicals; chemical fibers; rubber; plastics; metals; ordinary machinery; special purpose equipment; electric equipment and machinery; instruments, meters, cultural and office machinery; gas production and supply.

Cluster 2: gradual improvement from negative to high positive level

petroleum and natural gas extraction.

Cluster 3: low-level profitability with gradual decrease

nonferrous metals mining and dressing; logging and transport of timber and bamboo; beverages; printing and record media; petroleum processing and coking; medical and pharmaceutical products; smelting and pressing of ferrous metals; smelting and pressing of nonferrous metals; communication and transport equipment; electronic and telecommunications equipment; electric power, steam and hot water production and supply; tap water production and supply.

Cluster 4: rapid deterioration to high negative level

food processing.

Cluster 5: high profitability throughout

tobacco.

Cluster 6: gradual decrease in always negative profitability

textiles.

Cluster 7: gradual decrease in always very negative profitability

leather, fur, down and related products.

Cluster 8: rapid decrease from high profitability to medium negative level

non-metal mineral products.

Cluster 9: gradual decrease to high negative level, with recovery in 1994 only

other manufacturing.

The number of clusters was determined by a visual inspection of the dendrogram of sectoral profitability (profit per equity) across time. The choice of the number of clusters was made such that a decrease in the number of clusters would not be accompanied by merging two clusters with a large "distance," i.e., merging clusters would end before two groups with relatively different levels of profitability or relatively different profitability trends were merged. (Sectors were number-coded and the number of clusters thus not influenced by any knowledge of which sectors were being merged at any one point of time.) After the number of clusters had been determined, the characteristics of each cluster were ascertained by looking at the profitability data of all members of a cluster.

Sources: ZGTJNJ 1994 through ZGTJNJ 1998.

Table 7. Highest and Lowest Profitability Sectors

	Share in SOE profit (in %)	Share in SOE value-added (in %)	Share in SOE employment (in %, 1998)
5 sectors with highest SOE profitability			
1993	65.08	31.44	
1994	79.68	38.99	
1995	52.81	27.13	
1996	121.49	35.86	
1997	88.23	26.89	9.92
5 sectors with lowest SOE profitability			
1993	-5.55	7.31	
1994	-4.41	8.26	
1995	-10.84	5.17	
1996	-40.02	7.68	
1997	-30.78	7.19	12.75

Sources: ZGTJNJ 1994 through ZGTJNJ 1998; ZGLDTJNJ 1999: 280-90.

Table 8. Sector-specific Industrial SOE Performance, 1997

	Profit / equity (in %)	Share in SOE value-added (in %)	Share in SOE employment (in %, 1998)
Nationwide industrial SOE average	2.09		
1 Coal Mining and Dressing	2.90	6.07	12.04
2 Petroleum and Natural Gas Extraction	13.28	12.09	4.07
3 Ferrous Metals Mining and Dressing	-0.20	0.25	0.47
4 Nonferrous Metals Mining and Dressing	5.58	0.75	1.25
5 Non-metal Minerals Mining and Dressing	-1.47	0.56	1.15
6 Other Minerals Mining and Dressing	-2.44	0.00	0.05
7 Logging and Transport of Timber and Bamboo	0.46	0.91	3.20
8 Food Processing	-18.47	2.93	3.61
9 Food Production	-2.13	0.89	1.40
10 Beverages	10.51	2.95	1.89
11 Tobacco	18.16	8.76	1.00
12 Textiles	-15.40	3.70	7.84
13 Garments and Other Fiber Products	-3.39	0.27	0.62
14 Leather, Fur, Down and Related Products	-20.51	0.19	0.32
15 Timber, Bamboo, Cane, Palm Fiber & Straw Prod.	-8.13	0.23	0.49
16 Furniture	-3.29	0.06	0.13
17 Paper	-4.44	0.95	1.44
18 Printing and Record Media	3.76	0.83	1.28
19 Cultural, Educational and Sports Goods	-1.65	0.11	0.15
20 Petroleum Processing and Coking	4.71	5.35	1.88
21 Raw Chemical Materials and Chemical Products	-0.48	5.68	6.61
22 Medical and Pharmaceutical Products	4.33	1.64	1.63
23 Chemical Fibers	-2.58	0.45	0.71
24 Rubber	-0.34	0.67	0.64
25 Plastics	-2.81	0.35	0.54
26 Non-metal Mineral Products	-5.47	3.02	5.53
27 Smelting and Pressing of Ferrous Metals	0.59	8.37	6.14
28 Smelting and Pressing of Nonferrous Metals	-0.95	1.86	2.22
29 Metal Products	-6.22	0.67	1.16
30 Ordinary Machinery	-2.43	2.92	5.19
31 Special Purpose Equipment	-3.10	2.44	4.26
32 Communication and Transport Equipment	0.88	4.88	6.57
33 Electric Equipment and Machinery	-1.61	1.65	2.38
34 Electronic and Telecommunications Equipment	7.36	2.34	1.71
35 Instruments, Meters, Cultural and Office Machinery	-6.56	0.46	0.96
36 Other Manufacturing	-11.53	0.13	0.49
37 Electric Power, Steam and Hot Water Prod. & Supply	4.71	13.07	6.87
38 Gas Production and Supply	-2.60	0.07	0.66
39 Tap Water Production and Supply	1.82	1.05	1.47
40 Weapons and ammunition	n.a.	n.a.	n.a.

Sources: ZGTJNJ 1994 through ZGTJNJ 1998; ZGLDTJNJ 1999: 280-90.

Notes

¹ Naughton (1992), Jefferson and Rawski (1994), Rawski (1994) explain the decline in profitability with increasing competition. Fan and Woo (1996), Sachs and Woo (1997), and Huang and Duncan (1999) argue against the competition hypothesis; the first two favor excessive labor remuneration as explanation. Jefferson (1998) makes a theoretical argument for “overconsumption” (i.e., excessive labor remuneration). Holz (2000) shows that the two hypotheses, competition vs. labor remuneration, are not mutually exclusive. Lin, Cai and Li (1998 and 1999) elaborate on the historical disadvantages of SOEs, while Huang and Duncan (1997a and 1997b) explore a large number of (partly historical) enterprise-specific variables and find several of them of significant importance in explaining profitability. The issue of government structure and softness of the budget constraint are raised, for example, by Qian (1996), Steinfeld (1998), Zhu (1999), or also Lin, Cai and Li (1998 and 1999).

² The data cover the industrial SOEs with independent accounting systems, i.e., industrial activities in non-industrial SOEs, such as in construction enterprises, are excluded because no independent profit and loss account data on these industrial activities are available. Similarly, “all industrial enterprises” refers to all industrial enterprises with independent accounting systems on township tier and above, the only aggregation of industrial enterprises on which profit and loss account data are available. The SOEs with independent accounting systems constitute a sub-category in the statistics on all industrial enterprises with independent accounting systems on township tier and above; SOEs by definition are registered on township tier and above. The focus on industrial enterprises with independent accounting systems on township tier and above is common practice in the literature, see, for example, Jefferson and Rawski (1994), or Lardy (1998).

³ The Friedman test takes one sector at a time and compares the profitability of this sector across the provinces. The province with the highest profitability level in this sector receives the highest rank, the province with the second-highest profitability level in this particular sector the second-highest rank, and so on. This is repeated for all sectors. The ranks a province achieves in the various sectors are added up to yield an overall provincial rank. The Friedman test compares these overall provincial ranks.

⁴ See Riskin (1991: 197f, 343) and Wu (1994: 88). On the dual leadership structure also see Lyons (1990). Since not all ministerial-level documents are published, minor adjustments in the subordination of SOEs are possible. The only evidence of a change in subordination that could be found in *China Infobank*, which includes a database on Chinese laws and regulations, concerns engineering design units in 2001—presumably these are not part of industry (*China Infobank* 10 Jan. 2001).

⁵ Steinfeld (1998) notes the exceptional arrangements for Shougang (Capital Iron and Steel Company) which for many years faced a hard budget constraint in exchange for management autonomy. In these years, profit was used to finance investment and thereby rapid growth. Profitability and expansion collapsed once the hard budget constraint disappeared.

⁶ All sectors whose share in provincial value-added in no province exceeded 1% were not included in the regression; sector 25 falls into this category but was retained as it formed part of sectors 21-28. Since the groups, due to the cluster analysis, were formed thus that within-group differences in profitability are minimized, this selection of groups is likely to yield artificially high coefficient significance levels in the regression.

⁷ In the sectoral case the two outliers ‘petroleum and natural gas extraction’ and ‘tobacco’ were omitted; if they are included, the positive correlation is even more significant. In the provincial case one outlier, Yunnan, was removed; if it is included, the correlation coefficient changes sign.