Industrial Development in the Inland Region of China: A Case Study of the Motorcycle Industry

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Abstract

Although the inland region of China has generally been left behind in economic development compared with the coastal region, the motorcycle industry in Chongqing has recorded remarkable growth due to the meteoric rise of private enterprises over the last decade. Based on panel data of enterprises, we attempt to identify the factors behind the dynamic development of this industry. We conclude that the success of the motorcycle industry in Chongqing is attributable to a combination of positive features from the Wenzhou model in the 1990s, in which industrial development is based on clustering of private enterprises, and the Sunan model in the 1980s, in which industrial development is based on the effective use of human resources recruited from existing state-owned enterprises (SOEs). Learning by collective enterprises from SOEs in Chongqing coupled with the growth of the private enterprise sector fostered cluster-based industrial development.

JEL Classification: O14, O53, L62

Key words: Industrial development, Scale economies, Industrial cluster, Chinese economy

1. Introduction

For the last three decades, the center of the considerable economic growth in China has been the coastal region. In the 1980s, industrial development in this region was led by collective township and village enterprises (TVEs), as Chen *et al*. (1992), Jefferson *et al*. (1996), and Otsuka *et al*. (1998) attest. According to Murakami, Liu, and Otsuka (1994, 1996) and Xu and Tan (2001), collective TVEs south of the Yangtze River in Jiangsu Province grew rapidly partly because they learned technical and managerial expertise from state-owned enterprises (SOEs), especially those in Shanghai.[1] When privatization began in China in the early 1990s, nationwide attention was attracted to a strategy of private-enterprise-led development in Wenzhou City and its vicinity in Zhejiang Province. According to Zhang (1989), Nolan and Dong (1990), Wang (1996), Zhang (1999), and Sonobe, Hu, and Otsuka (2004), the hallmark of industrial development in Wenzhou was the industrial cluster, i.e., the geographical concentration or localization of enterprises producing similar or closely related goods in a small area.[2] Such clusters were formed in almost every township in the Wenzhou area by a myriad of fake-collectives or small-scale red-cap private enterprises.[3]

In the inland economy, the SOEs remained predominant in the industrial sector, which was biased toward the munitions industry and related heavy industries built up for the purpose of the Third Front Construction in the 1960s and 1970s.[4] However, entry of private enterprises is vitalizing the local industries in several inland cities, especially in Chongqing and its vicinity.[5] Thus, the recent GDP growth in Chongqing, which has been faster than the growth of the national economy, cannot be attributed solely to increased central funding associated with the promotion of Chongqing to a Municipality directly under the central government in March 1997 and the campaign to Open Up the West. Such new developments should mitigate regional income inequality between the coastal and inland regions, which is pronounced and even widening according to Kanbur and Zhang (1999), Hare and West (1999), and Fu (2004).

However, to date, the process of industrial development in the inland region has not been analyzed rigorously.[6]

This paper attempts to characterize the process of industrial development in the inland economy from a comparative perspective using primary data collected from motorcycle enterprises in Chongqing. The motorcycle industry in China dates back to the 1950s; China is now the largest producer in the world, accounting for nearly half of total world production. In Chongqing, this industry began around 1980 when two SOEs diverted production from ammunitions to motorcycles and were allowed to import technology and equipment from Japan. These SOEs leapfrogged the incumbents in other cities and became the leading producers in the country. In the 1980s, collective TVEs were established to produce motorcycle parts, but they did not play an important role in the development of the motorcycle industry in Chongqing. By contrast, extensive entry of private enterprises, which began in the early 1990s, changed the industrial organization dramatically. New entrants formed motorcycle clusters in several cities including Chongqing. The flood of their low-quality products caused a drastic decline in the market prices of motorcycles. Since the price decline hit the SOEs particularly hard, Chongqing lost its primary position in the industry in the mid-1990s. However, the municipality recovered in only a few years because three of the small private enterprises grew considerably and formed large enterprise groups. This recovery occurred even though production by SOEs continued to decline and many private enterprises exited the industry. Currently, Chongqing accounts for almost 40% of total motorcycle production in China.[7]

Although many industrial clusters have been formed in developing countries, few have achieved the phenomenal growth attained by the motorcycle cluster in Chongqing.[8] The exit of many enterprises alongside of the spectacular growth of other enterprises in this cluster is reminiscent of a common pattern of industrial development that has been observed in developed countries in the past and in the coastal region of China recently.[9] The key to this successful transformation from the dominance of SOEs to the vigorous growth of private enterprises in the generally backward economy in the inland region is addressed in this paper using primary data.

Our main finding is that this success owes much to the massive recruitment of engineers by private firms from SOEs, both those in the motorcycle industry and other local enterprise. Learning relatively advanced technologies and management know-how from SOEs is also a characteristic of the Sunan model, which refers to the development strategy pursued in southern Jiangsu in the 1980s; however, the growing enterprises in this model were collective TVEs and they were not part of a cluster. Although private enterprises in Wenzhou were clustered, they had less opportunity to learn from SOEs than did their counterparts in Chongqing. Thus, the development process of the motorcycle industry in Chongqing combines positive features of the Sunan and Wenzhou models as it is based on learning from SOEs by cluster-based private enterprises. We argue that this combination is the key to the successful industrial development of the inland region.

The rest of the paper is organized as follows. Section 2 contains a review of the empirical literature on industrial development, paying particular attention to case studies from various parts of the world to provide a comparative perspective. In section 3, we describe our data-collection method and report basic statistics on production, R&D, and growth of the sample enterprises. In section 4, we present the testable hypotheses and the resulting econometric specifications. Section 5 contains the empirical results. Finally, section 6 offers a summary of the findings of the paper and a discussion of their policy implications.

2. A Comparative Perspective on Industrial Development

As Krugman (1991) emphasizes, the industrial cluster is historically and spatially ubiquitous. Schmitz and Nadvi (1999) compile case studies conducted in South Asia, Africa, and Latin America and show that agglomeration externalities arising from industrial clusters, e.g., information spillovers, the development of the division and specialization of labor among enterprises, and the development of skilled labor markets, play critical roles in industrial development. Although the industrial cluster was relatively uncommon in China under the planned economy regime,[10] an increasing number of clusters have been formed since the early 1990s after the privatization of enterprises afforded freer locational choice.

The expansion of a cluster reinforces the benefits of agglomeration economies so that new entry is easier even for novices with little technical and managerial expertise. Since such new entrants tend to be inefficient producers, the productivity growth of the industry is often negligible or even negative in the early stage of industrial development, as Sonobe, Kawakami, and Otsuka (2003) find in their study of the machine tool industry in Taiwan. The motorcycle industry in postwar Japan made no progress in the average quality of engines until the mid-1950s during which the number of producers increased dramatically from 5 to more than 120, according to Yamamura, Sonobe, and Otsuka (2004). Similarly, the motorcycle industry in China expanded in terms of the number of enterprises and total production in the early 1990s without developing attractive products, according to Ohara (2001) and Shi and Wang (2002).

Such quantitative expansion without qualitative change saturates the local market with low-quality standard products. In developing countries, the resultant decline in product prices and profitability often halted the growth of the industry, as in the cases of a shoe cluster in the Philippines (Lamberte and Jose, 1988), a tile cluster in Indonesia (Weijland, 1999), and a garment cluster in Peru (Visser, 1999). In many industries in both developed and developing countries, such crises were overcome by the improvements in product quality by innovative enterprises.[11] In the motorcycle industry in interwar Germany and Britain and postwar Japan, drastic declines in product prices triggered not only quality competition but also innovations in marketing, financial, and organization that accelerated the growth of the industry, as Braun and Panzer (2003) and Yamamura, Sonobe, and Otsuka (2004) discuss.

Based on historical data on the development of industries in the U.S. and U.K., Gort and Klepper (1982) establish the propensity for the number of enterprises to increase rapidly in the early stage of an industry's development, to reach a peak, and then to decline in the later stage.[12] The motorcycle industry in Germany, Britain, and Japan followed this evolutionary process leading to an oligopolistic market structure. Interestingly, quality competition tends to be accompanied by exits and mergers of enterprises. Such shakeouts take place presumably because qualitative upgrading leads to some type of scale advantage. As Romer (1990a, 1990b) argues, the results of R&D, e.g., improved product design and better production processes, are non-rival inputs in the sense that they can be used repeatedly without additional cost. If qualitative upgrading requires the large mechanization of production processes, the result will be an increase in the minimum efficient size of the plant. This shift to large-scale production by upgrading enterprises will force other enterprises out of the market.

Qualitative upgrading and shakeouts following quantitative expansion are observed in industries in the coastal region of China. According to Sonobe, Hu, and Otsuka (2004), some producers of electric switches and ampere meters in Wenzhou found that the demand for their improved products increased dramatically with the increase in consumer recognition of their brand names so that the expanded scale of their marketing activities increased sales more than proportionately. Importantly, brand names or the results of R&D can be shared within the same enterprise group, i.e., a parent enterprise and its subsidiaries. Thus, the formation of enterprise groups allows firms to take full advantage of these non-rival inputs. Since the mid-1990s, group formation has been pervasive in the coastal region of China.[13]

The existing case studies suggest that the development process of the motorcycle industry in Chonging after the emergence of private enterprises is not unique but rather similar to the evolutionary processes observed in developed countries and in the coastal region of China. However, the slow growth of the inland economy in general makes the reasons for this successful transition from quantitative expansion to qualitative upgrading interesting to investigate. According to the recent literature on industrial clusters and global value chains, the upgrading of local industries in developing countries is facilitated by their transactions with global buyers, e.g., large manufacturers and retailers with well-known brand names.[14] Such favorable opportunities were not available to the private motorcycle enterprises in Chongqing according to Hu (2003). We hypothesize that enterprises in this municipality took advantage of the large pool of engineers employed and trained by SOEs in the motorcycle industries as well as in other machinery and munitions industries in the inland region. In fact, we will show that successful enterprises recruited many engineers from SOEs. However, this fact does not necessarily imply that the recruitment of engineers is the main cause of superior enterprise performance. Rather, the causality may work in the opposite direction. Moreover, the issue of stagnant production of motorcycles by SOEs during the period requires exploration. To address these issues, we begin with an in-depth analysis of the data in the next section.

3. The Data

The *China Automotive Industry Yearbook* (Automobile Department of Mechanical Industry, various years) provides statistical data on production, revenues, and other information for enterprises that are producing finished motorcycles and are operating by permission of the government. Figure 1 depicts the number of such motorcycle makers in China and the total value of their production from 1980 to 2003. Production grew rapidly in the early 1990s and, by 1995, it exceeded the production peak in 1981 in Japan, which had been the largest producer in the world. The export of motorcycles, mainly to Asia and Africa, began when the growth of domestic consumption stagnanted in the late 1990s. Exports have increased rapidly since 2000 reaching three million in 2003, which accounts for 20.6% of the total number of motorcycles produced. However, these data do not cover small producers operating without government permission. Such enterprises proliferated in the 1990s, mainly in rural areas, due to the large demand for cheap motorcycles from rural consumers, as Ohara (2005) documents.

We conducted preliminary surveys of motorcycle enterprises in Chongqing, which is the largest production base for the industry in China, in August and December of 2001. Subsequently, a census of all the enterprises producing motorcycles or motorcycle engines was attempted from November to December 2002. We visited enterprises, including their subsidiary enterprises but not subsidiaries of subsidiaries, to interview managers using questionnaires and to obtain financial records. As a result, we collected data from 44 enterprises, i.e., about 80 percent of all such enterprises in the area, concerning the backgrounds of top managers and information about the enterprises, e.g., production, costs, marketing channels, and employment. We have data for 1995 and every year from 1997 to 2001 .[15]

Table 1 reports the number of sample enterprises by year, ownership type, and specialization. Three SOEs in our sample were munitions factories previously. Two of these three, namely, Jialing and Jianshe, began producing motorcycles around 1980 using technology and equipment imported from Japanese makers, i.e., Honda and Yamaha, and soon became the largest producers of motorcycles in China.[16] Jianshe and Yamaha formed a joint venture (JV), namely, Jianshe-Yamaha, in 1992, which is included in our sample separately from Jianshe. Although our sample does not include a JV founded by Jialing and Honda in 1993, it includes Wangjiang-Suzuki, which was founded by a military SOE and a Japanese maker, namely, Suzuki, in 1993.

All the other observations in the sample are private enterprises.[17] According to the managers of some long-established enterprises, numerous small-scale private enterprises entered the motorcycle industry in Chongqing as assemblers, engine makers, or parts suppliers, in the early 1990s. These new entrants formed an industrial cluster with an active division of labor among enterprises; however, many enterprises had exited by the time we conducted our survey. Of the private enterprises that began producing either finished motorcycles or engines by 1995, 10 enterprises survived and are included in our sample. Although the SOEs absorbed Japanese technology through formal agreements of technical cooperation and guidance as well as by the establishment of JVs, the private enterprises copied the original models of the Japanese makers without any formal relationships involving capital investment and technical cooperation.

Of the 20 enterprises that are private and operating in 1997, four are subsidiaries and 16 are independent enterprises, including three parent enterprises of the subsidiaries, namely, Lifan, Zongshen, and Loncin. The three enterprise groups led by these parent enterprises achieved remarkable growth during this period so that we refer to them as the Big 3. Nonetheless, Jialing and Jianshe remained among the largest producers in China throughout this period.[18] In 1999, another independent enterprise became a parent with an assembly subsidiary and an engine subsidiary, but this group remained much smaller than the Big 3. The number of independent enterprises in the sample increased by three per year until 1999, reached a peak in 2000, and then decreased by two because t two formerly independent enterprises became subsidiaries of two of the

Big 3. Taking the incidence of exits into account, we conclude that the consolidation of the industry began in Chongqing around the end of the 1990s.

Interestingly, specialization in motorcycle assembly and engine production occurs mostly within the four enterprise groups. This division of labor among enterprises would be more efficient than a vertically integrated production system if production size is large enough and if the parts and components used by the assembler are simple and standard. However, as the Big 3 improve the quality of their motorcycles and increase the use of specially designed high-quality parts and components, the cost of transacting for these intermediate input increases for them.[19] However, division and specialization within enterprise groups reduces such transaction costs.

Table 2 reports the declining real prices of motorcycles and engines. The data for this table are obtained by dividing the real value of the production of motorcycles or engines by the number of motorcycles or engines produced, and then by averaging such prices over the sample enterprises. The deflator used is the machinery price index aggregated at the national level from *China State Statistical Bureau* (various years). Admittedly, such price data reflect not only the product quality but also the size and type of products, an issue we consider below. Throughout the period, JVs commanded the highest price because they enjoyed a reputation for producing high-quality motorcycles that were comparable to those imported from Japan. The products of the SOEs were much more expensive than those of the private enterprises in 1995, partly because their product lines were oriented toward larger products and partly because they were less efficient than private enterprises.

Jefferson, Rawski, and Zheng (1996) and Hsiao *et al*. (1998) point to the inefficiency of SOEs relative to collective TVEs and private enterprises in the industrial sector of the Chinese economy. Based on their case studies of the iron and steel, garment, and machine-tool industries in China, Otsuka, Liu, and Murakami (1998) ascribe the inefficiency of SOEs partly to their vertically integrated production system, in which many parts and intermediate inputs are manufactured within an enterprise. In our sample, SOEs procured only 51 percent of the engine parts from outside sources in 1995 and 67 percent of these inputs from outside sources in 2001. In contrast, private enterprises procured 97 percent and 93 percent from outside sources in these same two years.[20] Thus, private enterprises depend heavily on outsourcing to produce copies of Japanese motorcycles at low cost, even though the Big 3 tend to procure important parts from within their own groups.

Table 3 provides further information about motorcycle prices. In our survey, we asked the manager of each sample enterprise about prices, horsepower, and engine sizes in terms of the displacement of its two best-selling motorcycles as of 2001. The unit price shown in Table 3 corresponds to the price divided by displacement. Since the price of a motorcycle tends to increase with its displacement, this unit price is a better price index than the average price shown in Table 2. Table 3 also reports the engine quality index, which was computed following the formula in Taylor (1960).[21] The sample size of the data on engine quality is small because many respondents did not answer our question about horsepower. This table does not distinguish parent enterprises from subsidiaries because a parent and its subsidiaries share the same brand name, the same unit prices, and the same levels of engine quality. Table 3 indicates, that, despite the small sample size, the difference in engine quality between the SOEs and the Big 3 is statistically significant at the 5 percent level. However, their unit prices are almost identical indicating that SOEs could not be producing high-quality motorcycles efficiently. Between the Big 3 and the other private independent enterprises, the difference in engine quality is statistically insignificant. However, the difference in unit price is highly significant, which suggests that the Big 3 enjoy an advantage due to their established brand names.[22]

Table 4 presents the average numbers of motorcycles and engines produced along with the average value added by enterprise type. For the Big 3 and another enterprise group, these variables measure the production size of the whole group not only the parent enterprise. The drastic decline in production by SOEs and the extraordinarily fast growth of the Big 3 are evident in this table. The value added of SOEs decreases considerably not only because prices decline most drastically for them but also because their production volumes decrease. By contrast, the number of motorcycles produced by the Big 3 increases more than five fold and the production of engines increases almost four fold from 1998 to 2001 so that value added almost triples for the Big 3 despite the severe decline in product prices. Moreover, their subsidiaries are much larger than other independent enterprises.[23] The JVs experience somewhat more moderate growth in output that that of the Big 3 and they maintain their value added relatively constant during this period. Although the products of JVs enjoy a good reputation and command high prices, these enterprises could not grow as rapidly as the Big 3 because of intense competition with private enterprises producing low-price copies of their products. Indeed, many private enterprises in Chongqing increased their sales of low-quality products rapidly in rural areas, where the demand for such motorcycles increased.[24]

The fact that the Big 3 continue to grow faster than all other enterprises even after 1998, when their production sizes had already become much larger, suggests that they were benefiting from scale advantages. When the Big 3 were founded in the early 1990s, they were also small. Moreover, the educational and occupational backgrounds of their founders are not systematically different from those of other independent enterprises. Thus, the success of the Big 3 is attributable largely to unobservable entrepreneurial characteristics of their founders. The core of their successful strategies involves improving the quality of their products, establishing a good reputation among consumers, and shifting to mass production of relatively high-quality products at low cost.

To improve products and introduce mass production, engineers are required. The top portion of Table 5 shows that, as early as 1995, the Big 3 employed more engineers than the other independent enterprises. Moreover, they increased the employment of engineers at faster rates than other enterprises in the subsequent years. In the early years, most of these engineers came from SOEs. Some were from the SOEs producing motorcycle but many came from SOEs in other heavy industries, which were abundant in Chongqing. In the later years, the proportion of new graduates from technical schools and universities increased. As the middle portion of the table indicates, the Big 3 also increased R&D expenditure per engineer rapidly.

The bottom portion of the table reports the percentage of enterprises that recruited their general managers from SOEs. The percentage of private enterprises having such managers increased faster in the later years than in the earlier years, probably because increased size prompted the Big 3 to upgrade management and because the other independent enterprises were seeking survival strategies. Thus, the development in Jiangsu province, in which collective TVEs learn technologies and management know-how from SOEs, was adopted by private enterprises in Chongqing. Although Table 5 indicates that SOEs allocated considerable amounts of human and material resources to R&D, the engine quality of their motorcycles was significantly lower than that of the Big 3, as reported in Table 2. As a possible explanation, we suggest that the work of engineers is more difficult to monitor than the work of line workers. The theory of efficiency wages advanced by Shapiro and Stiglitz (1984) argues that poor motivation is aggravated as the outside opportunity of employment improves. Hence, the growth of the private sector should have induced SOEs to reduce the number of engineers and increase their salaries.

4. The Testable Hypotheses and Empirical Specifications

To test the hypotheses that the recruitment of engineers by the Big 3 is a major reason for their superior performance and that scale advantages stem from product improvement, we consider the determinants of enterprise growth, average labor productivity, and unit price, in that order, in this section. According to Nelson and Winter (1982), the growth of an enterprise is a function of its initial size, its age in terms of the number of years in operation, and variables that represent the development and learning of new technology and management practices. Following Evans (1987), we use the following logarithmic form as a specification of this theory:

$$\ln V_{it} = \alpha_0 + \alpha_1 \ln V_{it-1} + \alpha_2 \ln E_{it-1} + \alpha_3 \ln R_{it-1} + \alpha_4 M_{it-1} + \alpha_5 \ln Y_{it} + u_i + v_t + e_{it}, \qquad (1)$$

where V_{it} is the value added of enterprise i in year t to represent the size of the enterprise, V_{it-1} is the initial enterprise size, E is the number of engineers employed, R is the R&D expenditure per engineer, M is a dummy variable representing a general manager coming from an SOE, Y is the number of years for which the enterprise produced motorcycles or engines to represent its age, u consists of unobservable time-invariant characteristics, v is a set of year dummies, and e is a disturbance term.

We expect higher values for E, M and Y to increase development and learning of new technology and management practices and R represents investment spending on such activities. Since the employment of engineers and R&D expenditures per engineer may have lagged effects on the growth of value added, we also estimate a version of equation (1) that includes E_{it-2} and $\ln R_{it-2}$.[26] We include time-invariant characteristics of enterprises, e.g., the educational and occupational backgrounds of the head of enterprise, and specialization in either motorcycle assembly or engine production on the right-hand side of specification (1). An obvious advantage of the fixed-effects model over the pooled-regression model, which takes the sum of *u* and *e* as the disturbance term, is its ability to resolve the endogeneity problem arising from correlation between unobservable components of *u* and the explanatory variables. Such correlations are likely to exist because the unobservable entrepreneurial characteristics of the founders of the Big 3 enabled them to employ more engineers than other private enterprises so that they could take advantage of the resulting scale effects. Our regression analysis is intended to examine the effectiveness of these efforts to improve product quality.

Applying the within estimator to a dynamic panel model of the type specified by equation (1) in which the lagged dependent variable appears on the right-hand side results in biased and inconsistent estimators. To avoid this problem, we use the generalized method of moment estimator developed by Arellano and Bond (1991). Fortunately, this estimator also deals with the endogeneity of *E*, *R*, and *M*, which is likely because R&D investment, the upgrading of management, and the expansion of production are components of the same strategy. With this estimator, the first three years in the period under study are eliminated due to lags and differencing in addition to the small size of the complete sample. Although we apply this estimator to the latter half of the period, we also run Ordinary Least Squares (OLS) regressions using the pooled data for the entire period.

Our basic hypothesis is that both the employment of engineers and R&D investment have positive effects on growth. However, SOEs failed to give adequate incentives to engineers and supervisors so that this effect is weaker for them. For subsidiaries, the growth effect is also weaker because the results of R&D are shared within the enterprise group rather than appropriated by the subsidiary that employs the engineers and bears the R&D expenditure. Hence, we state the following hypothesis:

Hypothesis 1: Increases in the employment of engineers and R&D expenditure enhance enterprise growth but the effects are weaker for SOEs and subsidiaries.

From Table 1, almost all of the subsidiaries specialized in either motorcycle assembly or engine production. As suggested by the transaction cost model of division and specialization of labor between enterprises found in Becker and Murphy (1992), this behavior is attributable to the efficiency of specialization and low transaction costs between enterprises belonging to the same group. To capture the growth effect of such specialization, we state the following hypothesis:

Hypothesis 2: Specialized enterprises grow faster than non-specialized enterprises.

Since few enterprises changed their strategies regarding specialization, the dummy variables for engine producer and motorcycle assembler are virtually time-invariant so that these variables are eliminated in the fixed-effects model. Hence, to test hypothesis 2, we use an OLS regression.

To confirm the robustness of these two hypotheses, we estimate a specification using average labor productivity, denoted θ, as an alternative measure of enterprise performance for the dependent variable. We use the same set of explanatory variables as in specification (1) so that we have:

$$\ln\theta_{it} = \beta_0 + \beta_1\ln V_{it-1} + \beta_2\ln E_{it-1} + \beta_3\ln R_{it-1} + \beta_4 M_{it-1} + \beta_5\ln Y_{it} + w_i + \eta_t + \varepsilon_{it}, \quad (2)$$

where w is a fixed effect, η is a time effect, and ε is a disturbance term. First, we estimate equation (2) using the within estimator for entire period. However, $\ln V_{it-1}$ is closely correlated with the lagged dependent variable, i.e., ln $\ln\theta_{it-1}$, so that the within estimator may be problematic. To apply the Arellano-Bond estimator, we rearrange equation (2) to obtain:

$$\ln\theta_{it} = \beta_0 + \beta_1\ln\theta_{it-1} + \beta_1\ln L_{it-1} + \beta_2\ln E_{it-1} + \beta_3\ln R_{it-1} + \beta_4 M_{it-1} + \beta_5\ln Y_{it} + w_i + \eta_t + \varepsilon_{it}, \qquad (2')$$

where L is the number of workers and $\ln\theta_{it-1} = \ln V_{it-1} - \ln L_{it-1}$. The Arellano-Bond estimation of (2') allows us to obtain an estimate for the size effect, i.e., β_1 , without concern for any bias due to the inclusion of the lagged dependent variable.

Finally, we investigate the determinants of the unit price, denoted *UP*, for which data are available for the two best-selling motorcycles for each enterprise in 2001. The specification is given by:

$$\ln UP_i = \gamma_0 + \gamma_1\, Enterprise\ type_i + \gamma_2\ln D_i + \gamma_3\ln V_i + \gamma_4\ln VG_i + \gamma_5\ln Y_i + \gamma_6\ln YG_i + \gamma_7\ln E_i + \gamma_8\ln EG_i + \gamma_9\ln R_i + \gamma_{10}\ln RG_i + \omega_i, \qquad (3)$$

where *Enterprise type* is a vector of dummy variables consisting of SOEs, JVs, Big 3, and subsidiaries, D is the displacement, VG is the value added of the enterprise group to which enterprise i belongs, Y is the number of years for which the enterprise has produced motorcycles, YG is the number of years for which the enterprise group has produced motorcycles, EG is the number of engineers employed by the enterprise group, and RG is the R&D expenditure per engineer of the enterprise group. All explanatory variables, except D, Y, and YG, are lagged by one year. For enterprises that do not belong to a group, VG, YG, EG, and RG are equal to V, Y, E, and R, respectively.

The assumption behind specification (3) is that the unit price of a motorcycle depends on the size of the engine, the quality of the motorcycle, and the reputation of the producer. We assume that the quality of the motorcycle depends on past R&D and that reputation depends on how widely the enterprise or enterprise group is known, which would depend in turn on past production size and the length of time producing motorcycles. However, the good reputation that JVs enjoy will not be captured by these factors because it relates to the fact that they are not copiers. Thus, we introduce enterprise type dummies, of which only the JV dummy and possibly the SOE dummy are expected to have significant effects on unit price. By contrast, the reputation effect for the Big 3 and their subsidiaries will be captured by production size and the years of operation of the entire group. Based on these considerations, we state the following hypothesis:

Hypothesis 3: The unit price of a motorcycle depends on *VG*, *YG*, *EG*, and *RG* as well as on the JV dummy rather than on *V*, *Y*, *E*, and *R*.

Finally, we emphasize that we do not intend to support the hypothesis that the formation of the industrial cluster leads immediately to the development of the motorcycle industry in Chongqing. Rather, we aim to provide evidence that the efforts to improve technology and management, to strengthen specialization in the production process, and to establish brand names are an integral part of the development of the industrial cluster.

5. The Emprical Results

Table 6 contains the results estimating equation (1). In the upper portion of the table, we indicate the sample period, the types of enterprises included in the sample, and the estimator used. By Pooled OLS, we mean that the fixed effect, u_i, is treated as a component of disturbance. Of the two versions of the Arellano-Bond estimator, i.e., one-step and two-step, we used the one-step estimator because it is recommended for inference by Arellano and Bond (1991). Although the presence of second-order autocorrelation in the differenced residuals would imply that the Arellano-Bond estimates are inconsistent, we confirm that this is not the case for columns (iv), (v), and (vi) of the table

In the OLS regression in column (i), two interaction terms, i.e., SOE*lnV_{t-1} and SOE*lnE_{t-1}, are included to investigate whether the effects of enterprise size and engineer employment are different between SOEs and private enterprises. The estimated coefficient of SOE*lnV_{t-1} is positive and significant because, among the three SOEs in the sample, Jialing and Jianshe performed much better than the smaller SOE especially toward the end of the period. For private enterprises, the growth effect from employing engineers is positive and highly significant as the coefficient on lnE_{t-1} indicates. However, for SOEs, this estimated effect is small and statistically insignificant as indicated by the sum of the coefficients for lnE_{t-1} and SOE* lnE_{t-1}. The strong positive impact of employing more engineers on the growth of private enterprises is also observable in columns (ii), (iii), and (iv) in which SOEs are excluded. Although the OLS estimate of the effect of R&D expenditure is not significant, the Arellano-Bond estimate in column (iv) is positive and highly significant. If the SOEs are included in the sample, as in column (v), neither the employment of engineers nor R&D expenditure has a significant effect on growth. These results are highly consistent with Hypothesis 1. Moreover, the growth effects of engineers and R&D are much stronger when the sample of the independent enterprises is used in columns (ii) and (iv) than when subsidiaries are included in columns (iii) and (vi).[27] These results offer empirical support for Hypothesis 1.

The dummy variables used to identify enterprises that specialize in motorcycle assembly and those that specialize in engine production do not have significant effects in columns (i) and (ii), presumably because most of the independent enterprises produce both engines and motorcycles especially in the later period. If the subsidiaries are included in the sample in column (iii), these dummy variables have positive and significant effects, which is consistent with Hypothesis 2. In addition, the JV dummy variable has a positive and significant effect on growth in column (iii) in which the Big 3 and SOEs are excluded. Overall, the results shown in Table 6 confirm the effectiveness of the strategies undertaken by the Big 3. Employing more engineers, spending more on R&D, and forming enterprise groups that allow the specialization and division of labor within the group contribute positively to growth. This conclusion would not be altered if we were to take account of exits. If data on exits were available so that we could incorporate this phenomenon into the analysis, the estimated effects of these strategies would be stronger because enterprises that exited did not adopt these strategies according to our respondents.[28]

Table 7 presents the estimation results using average labor productivity as the dependent variable. In the first two columns, the within estimator is used to estimate specification (2). In the other columns, the Arellano-Bond estimator is applied to estimate specification (2’). The estimated effects of employing more engineers are quite similar to those in Table 6. Specifically, its positive impact on growth is much stronger if the sample consists of the independent private enterprises, as in columns (i) and (iii), than if SOEs are included as in column (iv) or if subsidiaries are included as in columns (ii) and (v). Although the estimated effects of R&D expenditure are significant in columns (ii) and (i), they are insignificant for the Arellano-Bond estimation in columns (iii), (iv) and (v). These results are consistent with Hypothesis 1, even though we now use average labor productivity rather than growth to measure enterprise performance.

In column (ii) of Table 7, the effect of $\ln V_{t-1}$ on average labor productivity is positive and highly significant even when subsidiaries are included. These results reflect the fact that larger enterprises tend to use more capital-intensive production methods. Although the effect of recruiting the general manager from SOEs on growth tends to be insignificant in Table 6, the effect of this strategy on labor productivity is positive and significant in columns (iii) and (iv) of Table 7. This result suggests that SOE managers may be talented and capable in promoting efficiency but that their skills are constrained by the rigidities of the organization of the SOE.

Table 8 presents the estimation results for the determinants of the unit price of motorcycles. As the table indicates, unit price tends to increase with increases in displacement, ln*D*, even though this effect is not significant in some specifications. As shown in the second row, specialization in motorcycle assembly does not have any significant impact on price. Since Column (i) does not include production size, years of operation, or R&D variables, the coefficients have an interpretation similar to that of the observations in Table 3. Specifically, JVs charge the highest price while SOEs along with the Big 3 and their subsidiaries charge higher prices than do other independent enterprises. However, if ln*V* and ln*Y* are included, the coefficient on the JV dummy becomes smaller and the coefficients on the dummy variables for SOE and Big 3 lose their significance, as shown in column (ii). Thus, the higher prices for products sold by SOEs and the Big 3 are explained by the larger sizes and the longer histories of motorcycle production of these enterprises. In contrast, the coefficient for the subsidiary dummy variable remains positive and significant, presumably because the relatively high prices for their products are supported by the reputation of the groups to which they belong. To investigate this issue further, we replace ln*V* and ln*Y* with ln*VG* and ln*YG* in column (iii). As expected, the effect of the subsidiary dummy is no longer significant.

In columns (iv) and (v) in Table 8, we examine the effects of R&D on unit price with the value added variables, i.e., ln$V$ and lnVG, and the years of motorcycle production, i.e., ln$Y$ and lnYG, excluded to avoid multicolinearity arising from including these variables along with the R&D variables, i.e., ln$E$, lnEG, ln$R$, and lnRG. In column (iv), R&D variables for individual enterprises are used and the subsidiary dummy variable is significant whereas the SOE dummy and the Big 3 dummy are insignificant. However, in column (v), the subsidiary dummy variable loses its significance if the R&D variables for the group are included in the estimation. These empirical results provide strong support for Hypothesis 3.

6. Conclusion

In the motorcycle industry in Chongqing, considerable entry of new enterprises occurred in the 1990s allowing the formation of industrial clusters by relatively early entrants. A drastic decline in product prices resulted and had an important impact on the industry's development. During this period, the decline of the dominant SOEs accelerated and, as in many industries in other countries as well as in the coastal regions of China, the improvement of product quality led to the industry shakeout and the birth of large private enterprise groups. To achieve quality upgrading, private enterprises in Chongqing obtained technical and managerial expertise by recruiting engineers and managers from SOEs. Thus, the success of this industry is attributable to a combination of the positive features of the Wenzhou model, in which industrial development is based on the clustering of private enterprises, and the Sunan model, in which industrial development is based on the effective use of human resources recruited from existing SOEs. However, without the benefits of external economies arising from an industrial cluster, these initially tiny private enterprises would have had a difficult time competing with the large existing SOEs. The formation of industrial clusters has been prevalent in China since the beginning of privatization in the early 1990s so that we consider it to be an important outcome of the privatization process. Thus, we think that this complementary effect of privatization deserves more attention than it has received in the existing literature.

Such cluster-based industrial development led by private enterprises learning from SOEs should be replicable in other parts of the inland region of China. Considering the positive externalities arising from industrial clusters, the government should support the formation of industrial clusters, particularly in the inland region. To promote wide-ranging industrialization in the inland region, including the development of labor intensive, processing-type industries, our empirical analysis demonstrates the benefits of inducing engineers and managers from SOEs in a variety of industries in the coastal region to join private enterprises in the inland region. Such a policy could go a long way to closing the significant regional income gap in China today.

Acknowledgement Note

We are grateful for the comments and suggestions of Ken Ariga and the other participants in the 2004 FASID Hakone Conference, the Editor, and two anonymous referees.

Endnotes

1. Another important feature of industrial development in this region is that transactions of TVEs with SOEs were supported by the township or village governments, as Li, (1996), Hsiao *et al*. (1998), and Chen and Rozelle (1999) discuss. Oi (1999) and Kung (1999) emphasize that local leaders played active strategic roles in industrial development in southern Jiangsu.
2. This definition of industrial clusters is consistent with the definitions adopted in the literature of business economics, innovation studies, and development economics. For example, Porter (1998, p.18) defines clusters as "geographic concentrations of interconnected companies and institutions in a particular field." Swann, Prevezer, and Stout (1998, p. 1) define a cluster as "a large group of firms in related industries at a particular location." In a special issue of *World Development* on clustering and industrialization, Schmitz and Nadvi (1999) use both sectoral and spatial concentrations of firms to define industrial clusters.
3. Fake collectives or red-cap enterprises are essentially private firms that disguise themselves as TVEs, as Nolan and Dong (1990) and Oi (1999) discuss. The formation of industrial clusters in Wenzhou in the early 1980s was facilitated by the establishment of specialized local markets for products and materials by local governments. When these clusters made inroads into national and international

markets, Whiting (1999) and Xiu and Tan (2001) argue that traders who migrated from Wenzhou played important roles in this expansion.

4. The Third Front consists of Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Ningxia, and the western parts of Henan, Hubei, and Hunan. The Chinese government began Third Front Construction in 1964 to build military industries ranging from ammunitions to atomic bombs in addition to the complementary industries producing steel, chemicals, and other materials in the Third Front region, as Li (2002) and Chen (2002) discuss. This project was continued until 1979. In 1995, SOEs accounted for 81.5 % of the total production value of all industrial enterprises having independent accounting systems in these provinces, whereas the corresponding national figure was 56.8 % according to State Statistical Bureau (1996). In the same year, the share of the munitions industry in the total production value of all industrial enterprises having independent accounting systems was 21.8 % in Chongqing according to Chongqing Municipality Statistical Bureau (1996); however, the corresponding data at the national level are not available.
5. In Chongqing, the private sector increased manufacturing employment at 11.5% annually from 2000 to 2003, while this employment grew at 9.4% in China according to State Statistical Bureau (various years).
6. The case studies of the color TV and automobile industries by Xie (2001) and by Xie and Wu (2003) cover part of the inland region. Sun (2001), Jin (2004), and Hong (2004) argue that industrial development in this region is hindered by the limited inflow of foreign direct investment, less favorable access to world trade relative to the coastal region, and the sluggish reform of the SOE sector.
7. Chongqing accounted for 20.8%, 29.3%, and 38.2% of the total production value of

the Chinese motorcycle industry in 1997, 2000, and 2003, respectively, according to China Automobile Department of Mechanical Industry (various years).

8. Schmitz and Nadvi (1999) and the papers cited therein provide information about the experiences of industrial clusters in South Asia, Latin America, and Africa.
9. Gort and Klepper (1982) and Klepper (1996) discuss the regularity of the process of industrial development in the U.S. and the U.K. The experiences of industrial clusters in Japan, Taiwan, and the coastal region of China are presented in Yamamura, Sonobe, and Otsuka (2003, 2004), Sonobe, Kawakami, and Otsuka (2003), and Sonobe, Hu, and Otsuka (2002, 2004).
10. We do not suggest that industrial clusters did not exist before privatization began in the early 1990s. For example, Changchun has been the site of one of the largest Chinese car makers for fifty years and nine large SOEs producing machine tools were located in Shenyang. In Wuxi and Suzhou in Jiangsu province, diverse and large industrial agglomerations were formed before privatization.
11. Examples from developing countries include a shoe cluster in Brazil (Schmitz, 1995), a woolen knitwear cluster in India (Tewari, 1999), and a surgical instrument cluster in Pakistan (Nadvi, 1999).
12. The empirical work on the evolutionary process of industrial development includes Klepper and Graddy (1990) and Klepper and Simons (2000). Jovanovic and MacDonald (1994) and Klepper (1996) present theoretical models.
13. An alternative account of the proliferation of enterprise groups in China is given by Smyth and Lu (2000), who argue that this process began in the late 1990s as a response by collective TVEs to competition from private enterprises.
14. Gereffi (1999) is probably the first to discuss the effect of global value chains on

industrial upgrading in developing countries. Giuliani, Pietrobelli, and Rabellotti (2005) and the compilation of case studies in Schmitz (2004) also address this issue.

15. We did not to ask about 1996 so as to reduce the burden on the respondents.
16. The motorcycle industry in China dates from the 1950s but no major producers were located in Chongqing until 1979.
17. Four former red-cap enterprises or fake collectives are included as private enterprises. Although these enterprises originated before 1995, they produced only parts until the late 1990s. Table 1 includes only enterprises that had begun producing either motorcycles or engines by the specified year.
18. According to a newspaper article in Jingji Ribao (February 3, 2005), Lifan, Zongshen, and Loncin ranked among the seven largest producers and the four largest exporters in 2004. . Although Jialing and Jianshe had declined in the late 1990s, they regained competitiveness and ranked as the second and third largest producers and the fifth and tenth largest exporters, respectively, in 2004.
19. This account of increasing transaction costs was given by some managers of the sample enterprises. They suggested that increasing transaction costs were due to quality improvement. According to Becker and Murphy (1992), the division of labor is limited by transaction or coordination costs.
20. The percentage of engine parts purchased from outside was assessed by the accounting section of each enterprise in the sample.
21. Taylor (1960) shows that (horsepower)/(displacement)$^{2/3}$ approximates engine quality.
22. The price difference may also be attributable to other possible differences in the quality of motorcycles in addition to engine quality.

23. The growth of the other independent enterprises and subsidiaries is somewhat non-comparable to that of SOEs and the Big 3 because new entrants are smaller than incumbents; these *de novo* firms are included in the former two categories and affect their average sizes. However, the two categories are comparable with each other.
24. According to our recent interviews with Japanese motorcycle makers, their JVs in Chongqing have grown much faster than the other enterprises in Chongqing in recent years. They attribute this phenomenon to a higher income level and to a strengthening of the regulations regarding exhaust gas and noise by the government.
25. These hypotheses could be tested by estimating a production function. Although not reported in this paper, we find that estimates using a production function are highly consistent with the estimation results presented. The estimation methods and results usinga production function are available upon request from the authors.
26. Although the growth of value added may be affected not only by R&D investment in the recent past but also by the stock of R&D, the data do not allow us to construct stocks of R&D for enterprises established before 1995.
27. Although not reported in the table, we estimated a version of specification (1) in which $E_{t\text{-}1}$ and $R_{t\text{-}1}$ are replaced by $E_{t\text{-}2}$ and $R_{t\text{-}2}$, respectively. For this specification, the sample size is too small to perform an Arellano-Bond test for first-order and second-order autocorrelation. However, the coefficient estimates are similar to the results shown in columns (iv) through (vi) of Table 6. Specifically, the effects of $E_{t\text{-}2}$ and $R_{t\text{-}2}$ are positive and significant if the SOEs and the subsidiaries are not included whereas they are insignificant otherwise.
28. Dunne, Roberts, and Samuelson (1989) and subsequent studies of enterprise survival and growth discuss the correction of such sample selection bias.

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Table 1. Number of sample enterprises by ownership type and specialization

	SOEs	JVs	Private enterprises					
			Independent enterprises			Subsidiaries		
				specializing in			specializing in	
			Total	motor cycles	engines	Total	motor cycles	engines
1995	3	2	10	1	7	0	0	0
1997	3	2	16	5	4	4	2	2
1998	3	2	19	4	4	7	4	3
1999	3	2	22	5	1	12	8	4
2000	3	2	23	5	0	16	10	4
2001	3	2	21	2	0	18	11	4

Table 2. Declining average real prices of motorcycles and engines by enterprise type, 1995 to 2001 in thousands of yuan

	SOEs		JVs		Big 3		Other independent enterprises	
	motor cycle	engine	motor cycle	engine	motor cycle	engine	motor cycle	engine
1995	11.2	2.1	21.2	4.7	6.9	1.5	4.7	1.4
1997	7.4	1.8	20.0	4.5	7.3	1.3	4.3	1.2
1998	6.6	1.6	18.5	4.4	6.3	1.0	4.2	1.2
1999	5.5	1.5	16.7	4.4	4.9	1.0	3.9	1.1
2000	5.2	1.5	15.4	2.4	4.7	1.0	3.6	1.0
2001	4.6	1.3	15.1	2.2	4.5	1.0	3.4	0.9

Notes

i. The average real price is the average of the real value of production divided by the number of motorcycles or engines sold.

ii. The deflator applied to nominal production values to obtain real values is the price index for machinery compiled by the State Statistical Bureau (various years).

Table 3. Average unit price of motorcycle and engine quality by enterprise type in 2001

	SOEs	JVs	Big 3 and their subsidiaries	Other independent enterprises	Difference	
	(1)	(2)	(3)	(4)	(1) - (3)	(3) - (4)
Unit price (yuan)	41.5	82.5	41.9	31.9	-0.330 (-0.05)	9.96** (5.52)
Sample size	6	4	30	40		
Engine quality	0.269	n.a.	0.317	0.295	-0.048* (-3.39)	0.023 (0.12)
Sample size	3	0	14	11		

Notes

i. The symbols * and ** indicate that the difference in averages is statistically significant at the 5 and 1 percent levels, respectively. The numbers in parentheses are t-statistics.

ii. The unit price is defined as the price of motorcycle divided by engine displacement.

iii. The engine quality is defined as (horsepower)/(displacement)$^{2/3}$.

Table 4. Average production sizes in terms of the numbers of motorcycles and engines produced and value added by enterprise type in selected years

	SOEs	JVs	Independent enterprises		Subsidiaries
			Big 3	Others	
Motorcycles (1000 sets)					
1995	900	28	9	3	n.a.
1998	498	39	109	8.5	55
2001	433	101	595	30	95
Engines (1000 sets)					
1995	562	28	55	12	n.a.
1998	569	41	351	38	309
2001	481	135	1386	78	656
Value added (million yuan)					
1995	3410	282	57	8	n.a.
1998	1234	202	302	16	98
2001	503	242	894	26	118

Notes

i. The third column shows the average size of the entire group.

ii. In the fourth and fifth columns, the number of enterprises changes over time due to new entries and mergers.

iii. The value added is deflated using the machinery price index compiled by the State Statistics Bureau (various years).

Table 5. Average number of engineers, R&D expenditures per engineer, and the proportion of managers recruited from SOEs by enterprise type in selected years

	SOEs	JVs	Independent enterprises		Subsidiaries
			Big 3	Others	
Number of engineers					
1995	176	25	14 (12)	2 (2)	n.a.
1998	439	34	84 (65)	8 (7)	14 (11)
2001	748	45	296 (198)	18 (13)	29 (19)
R&D expenditure per engineer (1000 yuan)					
1995	142	18	6	4	n.a.
1998	105	49	28	25	12
2001	60	162	97	58	40
% of enterprises with general managers from SOEs					
1995	100	0	0	29	n.a.
1998	100	0	33	38	43
2001	100	100	100	67	67

Notes

i. The numbers in parentheses are the number of engineers recruited from SOEs. For JVs, this number are not available.

ii. The third column reports the average number of engineers employed by an entire group, R&D expenditures of the entire group, and the general managers of the parent enterprises.

iii. In the fourth and fifth columns, the number of enterprises included in other independent enterprises and subsidiaries changes over time due to new entry and mergers.

iv. The real value of R&D expenditure is obtained by deflating using the machinery price index (State Statistics Bureau, various years).

Table 6. Estimates of the growth function

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Period	'97-'01	'99-'01	'99-'01	'99-'01	'99-'01	'99-'01
Inclusion of						
SOEs	yes	no	no	no	yes	no
Big 3	yes	yes	no	yes	yes	no
other independent	yes	yes	yes	yes	yes	yes
subsidiaries	no	no	yes	no	no	yes
Estimator	Pooled OLS	Pooled OLS	Pooled OLS	Arellano-Bond	Arellano-Bond	Arellano-Bond
$\ln V_{t-1}$	0.800††	0.765††	0.787††	0.152††	0.539††	0.337††
	(0.091)	(0.108)	(0.054)	(0.200)	(0.261)	(0.143)
$SOE^* \ln V_{t-1}$	0.128*					
	(0.064)					
$\ln E_{t-1}$	0.268**	0.381**	0.226**	0.506**	0.340	0.020
	(0.112)	(0.135)	(0.077)	(0.169)	(0.206)	(0.162)
$SOE^* \ln E_{t-1}$	-0.192*					
	(0.104)					
$\ln R_{t-1}$	0.043	0.038	-0.035	0.208*	0.029	0.167*
	(0.051)	(0.060)	(0.040)	(0.093)	(0.156)	(0.097)
M_{t-1}	0.169*	0.007	0.100	0.582*	0.411	0.068
	(0.098)	(0.142)	(0.114)	(0.300)	(0.259)	(0.261)
$\ln Y_{t-1}$	-0.124	-0.384*	-0.358**	0.486	0.375	0.271
	(0.145)	(0.170)	(0.122)	(0.447)	(0.433)	(0.418)
Motorcycle	0.048	0.006	0.183*			
	(0.167)	(0.200)	(0.107)			
Engine	0.125		0.650**			
	(0.141)		(0.216)			
Years of	-0.012	-0.021	-0.011			
Schooling	(0.017)	(0.021)	(0.015)			
SOEs	-1.053					
	(0.739)					
JVs	-0.081	0.361	0.406*			
	(0.177)	(0.258)	(0.222)			
Number of obs.	102	64	90	55	64	70
R-squared	0.96	0.93	0.89			
p-value (H_0:no auto-correlation of order 1)				0.24	0.10	0.03
p-value (H_0:no auto-correlation of order 2)				0.35	0.40	0.70

Notes.

i. The dependent variable is $\ln V_t$. Each regression includes a constant term and a set of year dummies. The numbers in parentheses are robust standard errors.

ii. The symbol †† indicates that the coefficient is smaller than 1 at the 1 % significance level.

iii. The symbols * and ** represent statistical significance at 5 % and 1 % levels, respectively.

Table 7. Estimates of the average labor productivity function

	(i)	(ii)	(iii)	(iv)	(v)
Period	'97-'01	'97-'01	'99-'01	'99-'01	'99-'01
Inclusion of					
SOEs	no	no	no	yes	no
Big 3	yes	no	yes	yes	no
other independe.	yes	yes	yes	yes	yes
subsidiaries	no	yes	no	no	yes
Estimator	Within	Within	Arellano-Bond	Arellano-Bond	Arellano-Bond
$\ln V_{t\text{-}1}$	0.154	0.304**			
	(0.130)	(0.098)			
$\ln \theta_{it\text{-}1}$			0.570*	0.747*	0.419**
			(0.278)	(0.346)	(0.153)
$\ln L_{t\text{-}1}$			0.395	0.568	0.597*
			(0.303)	(0.376)	(0.346)
$\ln E_{t\text{-}1}$	0.308*	0.104	0.396*	0.253	-0.029
	(0.162)	(0.134)	(0.215)	(0.247)	(0.203)
$\ln R_{t\text{-}1}$	0.167*	0.192**	-0.026	-0.138	0.124
	(0.099)	(0.077)	(0.167)	(0.209)	(0.100)
$M_{t\text{-}1}$	-0.064	0.055	0.667**	0.515*	0.215
	(0.183)	(0.162)	(0.244)	(0.230)	(0.221)
$\ln Y_{t\text{-}1}$	0.898*	0.019	0.205	0.010	-0.717
	(0.467)	(0.439)	(0.456)	(0.445)	(0.499)
Number of obs.	85	109	53	62	67
R-squared	0.40	0.39			
p-value (H_0:no auto-correlation of order 1)			0.18	0.20	0.19
p-value (H_0:no auto-correlation of order 2)			0.77	0.73	0.29

Notes

i. The dependent variable is $\ln\theta_t$. Each regression includes a constant term and a set of year dummies.

ii. The numbers in parentheses are robust standard errors.

iii. The symbols * and ** represent statistical significance at the 5 % and 1 % levels, respectively.

Table 8. Estimates of the unit price function

	(i)	(ii)	(iii)	(iv)	(v)
ln*D*	0.232	0.400*	0.371*	0.364*	0.324
	(0.184)	(0.183)	(0.179)	(0.195)	(0.199)
Motorcycle	-0.079	-0.085	-0.074	-0.078	-0.089
	(0.069)	(0.066)	(0.065)	(0.070)	(0.071)
SOEs	0.286**	0.030	-0.043	0.099	0.136
	(0.102)	(0.131)	(0.138)	(0.189)	(0.223)
JVs	0.820**	0.530**	0.478**	0.691*	0.724**
	(0.152)	(0.176)	(0.177)	(0.163)	(0.167)
Big 3	0.337**	0.046	0.108	0.114	0.170
	(0.102)	(0.131)	(0.137)	(0.162)	(0.185)
Subsidiaries	0.277**	0.205**	0.042	0.208**	0.130
	(0.072)	(0.073)	(0.119)	(0.078)	(0.167)
ln*V*		0.061**			
		(0.021)			
ln*Y*		0.068			
		(0.048)			
ln*VG*			0.023		
			(0.026)		
ln*YG*			0.179**		
			(0.063)		
ln*E*				0.061	
				(0.044)	
ln*R*				0.034*	
				(0.019)	
ln*EG*					0.048
					(0.054)
ln*RG*					0.022
					(0.017)
Intercept	2.352**	1.040	1.363	1.540	1.769*
	(0.880)	(0.925)	(0.904)	(0.949)	(0.968)
R-squared	0.53	0.59	0.59	0.56	0.54

Notes

i. The dependent variable is $\ln UP_i$. The number of observation is 76.

ii. The numbers in parentheses are standard errors.

iii. All explanatory variables, except ln*D* and the dummy variables, are lagged by one year.

iv. The symbols * and ** represent statistical significance at the 5 % and 1 % levels, respectively.

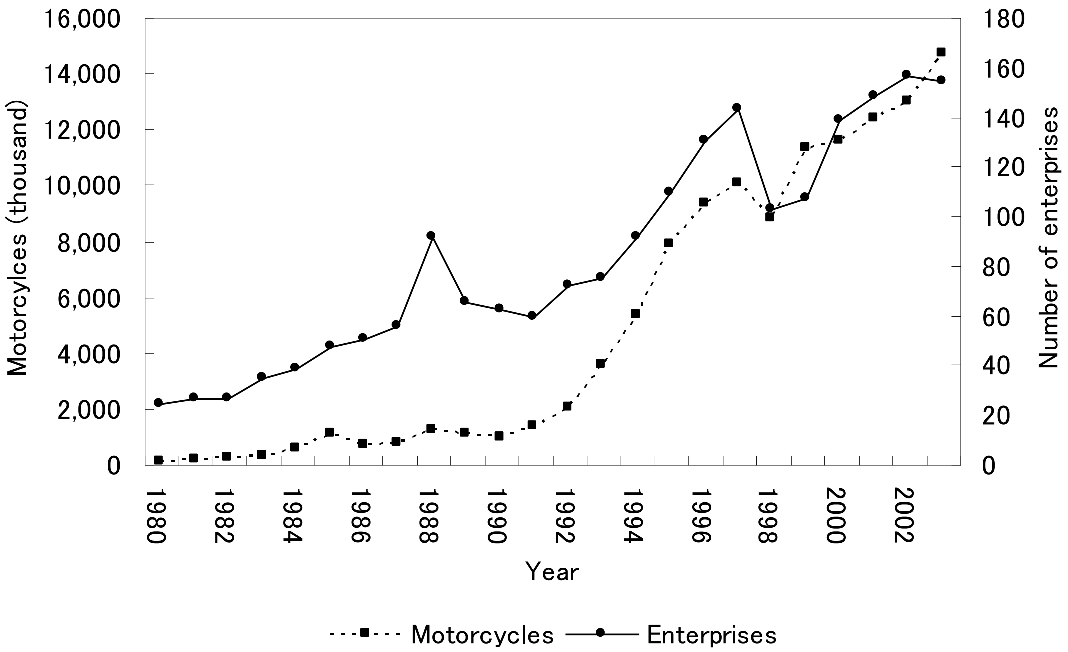

FIG. 1. The number of motorcycle enterprises and motorcycles produced in China, 1980 to 2003