From Inferior to Superior Products: An Inquiry into the Wenzhou Model of Industrial Development in China[1]

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Abstract

While it is widely recognized that the vitality of small private enterprises has been the prime mover of the miraculous economic growth in Wenzhou, solid empirical research has seldom been attempted to inquire into the development process of such private enterprises. We found, based on our own survey of enterprises producing low-voltage electric appliances, that the entry of a swarm of new enterprises producing poor-quality products was followed by the upgrading of product quality as well as the introduction of new marketing strategies. This study attempts to identify statistically the mechanisms underlying such an evolutionary process of industrial development.

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1. Introduction

China's miraculous economic growth in the 1980s was led by township- and village-run enterprises (TVREs), as argued by Chen et al. (1992), Jefferson et al. (1996), and Otsuka et al. (1998), among others. In the 1990s, however, the private sector has emerged to be the new engine of Chinese economic growth. The heartland of rapid economic growth led by the private sector is found in Zhejiang Province, particularly in Wenzhou City (see e.g., Zhang, 1989; Nolan, 1990; Dong, 1990; Wang, 1996; Li, 1997; Zhang, 1999; Sonobe et al. 2002). Although Wenzhou used to be a poor rural area, it now ranks among the most prosperous cities in China, as a result of its relatively rapid economic growth in the 1980s and explosive growth in the 1990s.

While the development strategy pursued in Wenzhou is broadly known as the Wenzhou Model of Industrial Development, few solid empirical inquiries have been attempted to examine how small and medium scale enterprises in Wenzhou have achieved such dramatic industrial growth. Initially poor farmers in Wenzhou began to produce poor-quality consumer goods such as apparel and footwear items and peddle them in major cities throughout China. "Made in Wenzhou" became a synonym for inferior products. As consumers in China became increasingly fastidious about the quality of products in the 1990s with the rise in their income levels, however, enterprises in Wenzhou have attempted

to improve the quality of their products. How these enterprises could have achieved this quality upgrading, allowing them to overcome their bad reputation and capture the national market, and how they could have played an important role in the accelerated economic growth in Wenzhou in the 1990s is worth investigating.

This study attempts to analyze the process of innovation and imitation in the industrial development in Wenzhou by using primary data collected from private enterprises in the low-voltage electric appliance industry. Low-voltage electric appliances refer to switches, wall outlets, ammeters, and so on, which are used mainly in houses, apartments, and office buildings. Under the planned economy, these items were rationed, and it was difficult to obtain replacements and parts. Before the economic reform began in 1978, this industry in Wenzhou was initiated when a farmer produced simple parts using scraps from factories of state owned enterprises and sold them to factories and offices in Shanghai illegally. This attempt was nothing but a “new combination” in the sense of Schumpeter (1912) and, hence, this farmer should be considered an innovator. In the mid-1980s, when a number of enterprises produced and marketed low-quality products despite customers’ increasing complaints, a few enterprises began to improve the quality of their products. Another enterprise went further by introducing new marketing strategies such as the establishment of a brand name and the development of a network of own sales

throughout China, to overcome the bad reputation of Wenzhou as the homeland of inferior products. The introduction of these new strategies can be regarded as another innovation, which had pervasive impacts on the growth of the industry by stimulating imitation by many other enterprises.

Recently, there has been increasing interest in the evolutionary process of innovation and imitation in the economic literature (e.g., Filson, 2002; Gort and Klepper, 1982; Jovanovic and MacDonald, 1994a; 1994b; Klepper, 1996, 2002; Klepper and Simons, 2000). Empirical studies in less developed economies, however, have seldom been attempted. In this study on the development of an industry in China, we attempt to investigate how the improvement of product quality began, how the marketing strategies for overcoming the bad reputation worked, and how such strategies were diffused through imitation by followers. We also attempt to explore the consequences of this innovation and imitation for the growth performance of the industry as a whole, with a view to enhancing our understanding of the substance of the Wenzhou Model of Industrial Development.

The organization of this paper is as follows. Section 2 sketches the conceptual framework for this empirical study. After the pattern of economic growth in Wenzhou is briefly described, Section 3 provides details of the history of the industry under study,

especially the process of improvements in the quality of products. Section 4 formulates the hypotheses and specifies the regression functions for empirical testing, which is followed by the regression analyses in Section 5. Finally, we summarize our major findings and implications for future studies in Section 6.

2. Conceptual Framework

Until the mid-1980s, the quality of manufactured products would not have been a major concern of consumers as goods in general were in short supply in China. Under the planned economy regime, economic planners had little interest in the quality of building materials and components as long as the structures built did not topple, and builders used cheap materials and components, including low-voltage electric appliances. As the transition from a planned economy to a market economy proceeded and as the income level of consumers rose, however, poor quality products became increasingly difficult to sell, and the improvement of product quality became profitable. In fact, an increasing number of low-voltage electric appliance enterprises in Wenzhou began improving the quality of their products in the late 1980s, according to our interviews. Subsequently, they introduced a mass production system, in order to meet the rapidly growing demand thanks to the booming construction of houses and office buildings as well as the rapid electrification in

the vast areas of poor rural villages in the 1990s.

According to the literature regarding imperfect information on product quality pioneered by Akerlof (1970), however, an enterprise's effort to improve quality can be fruitless and instead create the problem of adverse selection if the products with improved quality are intermingled with poor-quality products of other enterprises. As suggested by this literature, there are several strategies to escape from this problem, including the establishment of brand names, direct transactions with customers, and the use of own sales agencies that deal only in the enterprise's products. When the brand name is virtually unknown to consumers, however, the producer who has just improved the quality of his product may not be able to "command those high prices associated with high quality items until his reputation is established," as assumed by Shapiro (1983, p. 660) in his theoretical model. In other words, price p of a product may be an increasing function of the level of quality θ_P *perceived* by consumers whereas production cost C is an increasing function of actual quality θ_A as well as output Q, so that profits is given by $\pi = p(\theta_P)Q - C(Q, \theta_A)$. Immediately after quality improvement, perceived quality θ_P remains low whereas the production cost has increased with the increase in the actual quality θ_A, and, hence the profit margin becomes thin. Shapiro (1983) shows that it is optimum to keep selling the improved product with thin profit margins for a certain period, which can be interpreted as

an investment in reputation. Klein and Leffler (1981) demonstrate that the high profit margins of enterprises with good reputations encourage them to maintain their reputations for the high quality of products.

Figure 1 illustrates schematically the conceptual framework we adopt to examine the process of quality improvement in the low-voltage electric appliance industry in Wenzhou. Suppose that initially the products of all enterprises were equally poor, but that some enterprises have just succeeded in improving the quality of their products. For these forerunners, there will emerge a perception gap between θ_P and θ_A, which will lead to low profit margins, even though they may introduce such signaling devices as brand names and own retail networks. As a result, their performances in terms of, say, sales volume, will remain average in spite of the improved quality of their products in the short run. Consumers who have purchased the products of these enterprises, however, will revise their perceptions if the high quality is maintained, and such information may be communicated to other potential buyers. The rapidity with which the perception gaps are narrowed will depend on the sales volume, which will in turn depend on the price of the product with improved quality. As Shapiro (1983) indicates, these enterprises may intentionally reduce the price and, hence, profit margins to build their reputations in the future. As the perception gap is narrowed, the enterprises will begin earning high profits and their

enterprise sizes will be enlarged. This process is described in the middle portion of Figure 1.

Observing the success of such enterprises, an increasing number of other enterprises will sooner or later follow suit. They will imitate both the high quality products and the marketing strategies of the leading enterprises. They may also imitate the production processes that the leaders have improved in order to meet the increasing demand for high quality products. In this way, the successful followers will follow the paths described in Figure 1 with time lags. In addition to these leaders and followers in the Schumpeterian sense, there may also be enterprises which fail to imitate products and/or marketing strategies and are consequently left behind. However, since the range of the Chinese markets served by producers of electric components is huge, some enterprises may specialize intentionally in the low-quality segment of the market, targeting rural households with very low incomes. Thus, we conjecture that there were three types of enterprises: leaders, followers, and laggards.

Efforts to improve the product quality represent partly a response to the declining profitability of producing simple, low-quality products and partly a response to the increasing demand of consumers for high-quality products associated with income growth. Although statistical evidence on the quality improvements of low-voltage electric

appliances in the entire Chinese market is difficult to obtain, our informal interviews with enterprise managers clearly indicated the increasing intensity of quality competition since the late 1980s. Such a growing demand for high-quality products, however, is exogenous for the enterprises in Wenzhou under study, as it is basically determined by the speed of economic growth in the Chinese economy as a whole. An interesting point is that while the potential demand for high-quality products would have grown gradually with income growth, the quality competition began suddenly after the profitability of producing low quality products declined in the early 1990s, indicating that internal economic forces directly stimulated the efforts to improve the quality of products.

We also conjecture that managers of leading enterprises tended to be more educated than those of followers or laggards and that their prior experience in marketing also had a bearing on whether or not they became leaders. Such a link between innovation and experience is suggested by both historical and recent case studies of industrial development. Landes (1969) argues that the internal contradictions of the putting-out system in the proto-industrialization in England in the seventeenth century, such as the embezzlement of cloth and other material by domestic weavers, were overcome by merchants through the introduction of the factory production system, because their experiences in selling and manufacturing alerted them to the possibility of the new profitable production system.

Recent case studies of garment clusters in Hiroshima Prefecture in Japan after World War II and in Zhejiang Province in China for the last two decades report that new marketing and production systems were introduced to these clusters by former local merchants with relatively high education when inferior products were replaced with superior products (Sonobe et al. 2002; Yamamura et al. 2003). A case study of the machine tool industry in Taiwan reports that the new methods of production and marketing of numerically controlled machines were first introduced by the two new enterprises with highly educated managers, and that these new methods were quickly imitated by the experienced manufacturers of machine tools (Sonobe et al. 2003). In the following sections, we characterize the innovators and imitators in Wenzhou in terms of their educational and occupational backgrounds.

3. The Process of Economic Development in Wenzhou

Development in Wenzhou

The initial condition of Wenzhou as of 1978, when the economic reform started in China, was unfavorable; the area was densely populated but endowed with meager arable land. Poor people, particularly farmers, peddled miscellaneous low-quality, hand-made goods, such as leather goods, apparel, and footwear, to major cities. Some of them settled there to sell products shipped from Wenzhou. Within Wenzhou, the number of

state-owned enterprises was small for a geopolitical reason; Wenzhou is close to Taiwan. The financially weak local governments could not afford to establish TVREs. However, a large number of small-scale “red cap” enterprises emerged which were essentially private but disguised themselves as TVREs in the early 1980s. As Nolan (1990) rightly points out, in poor areas where the non-farm economy was weak as in Wenzhou, private enterprises were important in the non-farm sector. Such enterprises increased rapidly thereafter.

The local governments in Wenzhou, however, did not just passively permit free economic activities; they facilitated them by constructing several local marketplaces from the early 1980s. According to our interviews with the managers of long-established enterprises producing low-voltage electric appliances, the establishment of the marketplace for various metal products in Yueqing city, Wenzhou, drastically reduced the difficulties in procuring raw materials and finding buyers for their products. In the marketplace, the producers could learn the ideas and designs of other producers and obtain information brought in by outside traders on what products were sellable in large cities. The drastic reduction in search costs and the spillovers of valuable market information not only helped incumbents but also attracted new entrants, who were farmers, factory workers, and traders. Thus, the entry of new enterprises increased significantly after the construction of the marketplace in the early 1980s. As a result, a cluster of enterprises producing similar

products was formed in Yueqing, which is a lower-level city within Wenzhou city. Similar development processes took place in other cities within Wenzhou specializing in other products, such as garments, footwear, and cigarette lighters. Thus, Dong (1990), Wang (1996), and Li (1997) among others argue that while the major characteristic of the Wenzhou model of development is the growth of private household enterprises, the role of specialized markets in facilitating transactions of parts and final products is no less important.[2]

It is true, as argued forcefully by Friedman (2003), that to interpret accurately what is happening in China today calls for a knowledge of history and, particularly, a history of cities. Wenzhou is no exception: It has a long tradition of handicrafts and commerce since the Sung period, even though it was not as prosperous as Ningbo, a center of long-distance as well as foreign trade, from which it was separated by a chain of high mountains (Shiba, 1968, 1977; Skinner, 1977). Because of this tradition, this city was endowed with large human capital in the form of latent mercantile skills when the reform began and, consequently, it might have had high social potential for growth. Indeed, this tradition has led to active outmigration of Wenzhou people during the reform period, which has contributed to the formation of Wenzhou markets in various large Chinese cities and commercial networks between Wenzhou and those cities, including Beijing (Zhang, 2001).

Thus, the Wenzhou model of development, which is built upon a network of Wenzhou traders working throughout China, may be an exceptional case. Nonetheless, it is also important to realize that the rural-urban information and marketing networks created through migration play a key role in the development of rural industries not only in other parts of China (Murphy, 2002) but also in other East Asian countries (Otsuka, 1998).

Figure 2 shows the trend of GDP per capita in China, Wenzhou, and Yueqing, since 1978, on semi-log scale. From this figure, we observe that while GDP per capita in Yueqing as well as Wenzhou was 60 percent of the average in China as a whole in 1978, the former reached the same level as the latter in 1992 and became twice as high as the latter in 1998. It is also noteworthy that the economic growth of Yueqing as well as Wenzhou accelerated in the 1990s. Thus, it seems legitimate to describe the economic growth in the 1980s as relatively rapid growth and that in the 1990s as explosive growth. With a view to elucidating the factors behind this acceleration, we now turn to the result of our enterprise survey.

Basic Characteristics of Sample Enterprises

In May 2000, we conducted informal interviews with managers of the two largest enterprises producing low-voltage electric appliances as well as nine other enterprises

producing garments, footwear, and cigarette lighters in Wenzhou. Later, we decided to focus on the low-voltage electric appliance industry,[3] and conducted a second wave of personal interviews with eight enterprise managers, including the initiator of this industry, in December 2000. Based on these interviews, we specified questionnaires, pretested them, and finally conducted a formal survey of 117 enterprises producing finished products and 90 enterprises producing parts in Yueqing city from May to December 2001. In this paper, we analyze the data of enterprises producing finished products and defer the analysis of parts suppliers for future study.[4] We obtained data on production and costs in 1990, 1995, and 2000, as well as various characteristics of enterprises, their founders, and current managers. We eliminated five enterprises from the analysis because their production and cost data were either incomplete or highly suspicious. Thus, the sample actually used in the analysis below consists of 112 enterprises, which were active at the time of our survey.

Table 1 shows the number of sample enterprises, the average years of schooling of the founders, and the percentage composition of their occupational backgrounds by the timing of their entry into the industry. The earliest entry, i.e., the initiation of the industry, took place in 1973. The number of new entrants increased suddenly in the early 1980s, when the first marketplace was constructed, and the sizable entry continued until the mid-1990s. The years of schooling of the founders increased gradually along with the

increase in the average education level in Wenzhou. The occupational backgrounds of the entrants, however, changed more drastically. The proportion of farmers as a former occupation was high among the early entrants in the 1970s and that of factory workers was high in the early 1980s. These observations suggest that prior knowledge of marketing and engineering was not required for entry into this industry in the early stage of development.[5] In the later periods, however, the proportion of these occupations declined,[6] whereas the majority of new entrants were salesmen and traders, which suggests that the development of this industry is one of "merchant-led industrial development," in which merchants play the role of entrepreneurs.

Table 2 reports the changes in the number of sample enterprises and the average size of production. In the late 1990s, enterprise groups were formed through mergers as in many other industries in China.[7] Of the 112 sample enterprises, 28 enterprises were registered as groups by 2000, and the largest group had about 70 subsidiaries in 2000. Reflecting the formation of groups, an increasing number of sample enterprises became subsidiaries; the number of subsidiaries in the sample was zero in 1990, six in 1995, and 39 in 2000.[8] At the same time, a large number of enterprises exited from the industry in the late 1990s since their management was too inefficient to be reformed, according to our interviews with managers of large enterprise groups. As a result, the number of

independent enterprises in the sample, excluding subsidiaries, increased from 66 to 94 in the early 1990s and then decreased to 73 in the late 1990s.

Most conspicuous in Table 2 is the explosive expansion of the average size of enterprise in the late 1990s, which is in a sharp contrast to the moderate growth during the early 1990s. Note that the data on production used in this table cover only the production of the core or parent enterprises in the case of enterprise groups. If the subsidiaries of the sample enterprises are included and the total sizes are measured by the sum of real value added, then the average size of the sample enterprises in 2000 is about 1.6 times as large as that shown in Table 1. Thus, the late 1990s is a period of drastic expansion of enterprise size. According to our interviews with enterprise managers, however, there was no significant change in production technology in favor of mass production. Thus, the rapid expansion in enterprise size, including the formation of huge groups, in the late 1990s would be attributable primarily to factors other than technical changes.

Table 3 classifies the sample enterprises into five categories according to the timing of forming an enterprise group. By the term “enterprise group,” we mean a group consisting of a parent enterprise and subsidiaries that produce finished goods under the same brand name, whether or not they are officially registered as an enterprise group. We based our identification of when a group was formed in this sense on whether the

production of subsidiaries was zero or positive in the three sample years, i.e., 1990, 1995, and 2000.[9] Those enterprise which formed groups before 1995 tend to be long-established ones and operated by managers with relatively high education.

Process of Quality Upgrading

Since poor-quality products were sellable under the planned economy, and thanks to the increasingly thriving marketplace, a number of new enterprises entered the industry with little prior knowledge of manufacturing or marketing. Even in those days, however, consumers would not hesitate to complain about faulty appliances that did not function well. Although numerical data on the quality of products are unavailable, it is safe to say that consumers bought such faulty products with considerable frequency since, according to the managers of long-established enterprises, none of the enterprises had even the simplest instrument for testing their products before shipping. Since the apparel and footwear products made in Wenzhou were notorious for their poor quality, consumers would likely have had a very low opinion of electric appliances made in Wenzhou as well.

In our view, the key to understanding the rapid growth of this industry in the 1990s lies in the upgrading of product quality, which began in the mid-1980s, when two partners founded a new enterprise with the novel idea of shipping after quality inspection.

According to Table 4, the number of engineers as a proportion of workers increased steadily in the 1990s. The employment of engineers would be important for the sample enterprises for two purposes: one is to improve the quality of their products, and the other is to organize production that was rapidly expanding to meet the increasing demand for their products with improved quality. The average number of subcontractors also increased rapidly in the late 1990s. Although there were parts suppliers even in the 1980s, their relationship with finished goods producers consisted of mainly arm's length transactions. It was not until the 1990s that the two parties built up the much more intimate and longer-term relationship of subcontracting. Having accumulated experience, these subcontractors were ready to produce high-quality parts.

As discussed in the previous section, however, the introduction of quality inspection was just the beginning of the innovation leading to the quality upgrading of the industry as a whole. To avoid the situation of having one's inspected products being intermingled with defective products, enterprises began to use brand names and then developed new marketing channels through own retail shops and sales agencies which dealt only in their products. As shown in Table 4, the importance of these new marketing channels increased steadily in the 1990s whereas that of the marketplace and local traders declined especially in the late 1990s. By using local sales agencies, even a small enterprise could distribute

its products to distant large cities. Thus, the proportion of sales agencies increased more rapidly than that of own retail shops over the 1990s. The largest enterprises had as many as 800 sales agencies throughout China in the late 1990s, even though they tend to give higher priority to the development of own retail networks recently. A major drawback of using sales agencies is the familiar agency problem. Interestingly, the enterprises under study have solved this problem by means of local community ties; almost all of their sales agencies are merchants from Wenzhou who settled in large cities earlier. The use of migrant merchants as sales agencies is common also in garment, footwear, and many other industries in Wenzhou (Wang 1996), but such an arrangement does not seem to be practiced by garment enterprises in other areas, such as Wuhan, Hubei Province.[10] Thus, the enterprises in Wenzhou took advantage of the tradition of out-migration to lower transaction costs associated with the use of sales agencies.

Table 5 shows the increasing proportions of the sample enterprises that adopted new marketing strategies. The establishment of brand names was required for the marketing strategies to use sales agencies because they would be meaningless without a brand name. A certificate of “national standard” or “international standard” is granted by the central government body to an individual product, if it satisfies the quality standard. Therefore, this may add prestige as a quality product. It was in the late 1980s that all of these new

strategies were adopted by an innovative enterprise. Interestingly, this enterprise was also the first to form an enterprise group. We may regard it as the innovator, even though it was not the first enterprise that began quality inspection. Consistent with our view of "merchant-led" industrial development, this innovator was formerly a salesman before he started manufacturing. The new strategies were then adopted by five relatively long-established enterprises, which, following the lead of the innovator, formed enterprise groups in the early 1990s. Among these five enterprises was the first enterprise that introduced quality inspection.[11] Thus, we regard these five enterprises plus the innovator as the leaders.

There is a simple reason why the leaders formed enterprise groups earlier than others, according to some of the managers of the leaders. While a number of enterprises were still producing poor quality products, the leaders were selling high quality products under brand names through networks of sales agencies or own retail outlets and found the demand for their products increasing tremendously with the increase in consumers' recognition of their brand names. Further, they noticed that the effect of marketing activities on total sales was increasing with the expanded scale of marketing activities using the same brand name. To exploit such a size effect, these leaders began to form enterprise groups through mergers. A manager of a large group told us that among small enterprises, the relatively

high-performing ones were the first to recognize the importance of size and, hence, they became subsidiaries soon, whereas many other small enterprises resisted being merged but eventually became subsidiaries after suffering large losses.

Table 6 classifies the sample enterprises other than leaders into followers, laggards, and converts. Some of these enterprises invented certain original strategies regarding labor management, recruitment and factory operation as well as quality improvement and marketing. Some other enterprises chose to stay in the low-quality segment of the market. The majority of the enterprises, however, adopted the leaders' strategies, at least partially. In particular, the followers simply imitated them. Converts are defined as those enterprises which became subsidiaries of other enterprises by 2000. Both the followers and the laggards were independent enterprises as of 2000, but they differ in that the followers formed enterprise groups in the late 1990s, whereas the laggards did not have subsidiaries as of 2000. Thus, the classification in this table is identical to that in Table 3, where enterprises were classified according to the timing of group formation. As we saw in Table 3, leaders tended to have greater years of operation and be founded and operated by more educated managers than the rest, which is consistent with the results of the case studies of quality upgrading discussed in Section 2.

According to Table 6, the leaders except the innovator had a remarkably high

proportion of workers that were engineers, especially in 1990, which would help these enterprises improve the quality of their products as well as their production processes more than the innovator. Consistent with our conceptual framework shown in Figure 1, these enterprises had the lowest average of profit margin rates in 1990, which is defined as the ratio of operating profit to sales revenue, and the highest averages in 1995 and 2000. In the early 1990s, they increased the share of sales revenue earned through agencies and own retail network, as well as the variety of product specifications, much more rapidly than any other enterprise type. The number of specifications was increased, presumably to attract a larger number of sales agencies, which had to satisfy a variety of preferences of the consumers. Although the data on the number of specifications may be inaccurate since the method of counting specifications is likely to be different for different enterprises, its drastic increase is indicative of fierce competition for market share. In the late 1990s, it was the followers' turn to increase the share of the new marketing channels and the number of specifications drastically.

Figure 3 shows the growth in the average enterprise size of the leaders except the innovator, the followers, the laggards, and the converts, relative to the innovator. The enterprise size is measured here by value added, including that of subsidiaries in the case of enterprise groups.[12] Because of the log spacing of the vertical axis, the slope of a line

represents the growth rate of the enterprise size. Interestingly, all the sample enterprises besides the innovator had similar enterprise sizes in 1990, despite the fact that the leaders other than the innovator had much higher proportions of workers that were engineers. Probably because of their great efforts to improve product quality and production processes, however, they grew most rapidly in the early 1990s and surpassed the innovator. It is also important to note that the followers grew rapidly from 1995 to 2000.

4. Testable Hypotheses and the Specification of Regressions

In our schematic view of the process of quality improvement shown in Figure 1, the profit margin rate assumes the role of a strategic variable to promote sales right after an enterprise has improved the quality of its product. Later, the enterprise's high performance is supposed to be reinforced by the size effect of reputation. We now attempt to elaborate this view further and postulate testable hypotheses. Our measure of performance is valued added, and if the enterprise is the principal of an enterprise group, it is the total value added of the group. In addition to profit margins and value added, we also consider causes and effects of an increase in the share of the new marketing channels. This variable is a strategic variable like the intentionally reduced profit margins since it reflects an enterprise's efforts to expand the marketing network. However, it may also be a measure of

performance to the extent that potential sales agencies choose suppliers based on suppliers' reputations.

Reduced-form regressions for these three variables may be specified as follows:

$$V'_i = \alpha_0 + \alpha_V V_i + \alpha_C C_i + \alpha_M M_i + \alpha_E E_i + X_i \alpha_X + u_i \,, \quad (1)$$

$$C'_i = \beta_0 + \beta_V V_i + \beta_C C_i + \beta_M M_i + \beta_E E_i + X_i \beta_X + v_i \,, \quad (2)$$

$$M'_i = \gamma_0 + \gamma_V V_i + \gamma_C C_i + \gamma_M M_i + \gamma_E E_i + X_i \gamma_X + w_i \,, \quad (3)$$

where V is the logarithm of value added, C is the percentage share of the new marketing channels, M is the profit margin rate in percentage term, and these variable with primes on the left-hand side take the values five years later. E is the proportion of workers who were engineers, X is a vector of characteristics of the manager, such as the occupational background and schooling years, and u, v, and w are disturbance terms. These functions will be estimated for the two periods separately, since coefficients are expected to change over time. In the Appendix, we report the results of regressions that combine the two periods and control for the unobserved heterogeneity among enterprises.

Table 7 shows the expected directions of the effects of the lagged dependent variables (i.e., V, C, and M) and the employment of engineers E, separately for the leaders and the others and for the 1990-95 and the 1995-2000 periods. The leaders increased E to improve the quality of products and production processes by 1990 (see Table 6), which

would promote sales and contribute to profits. Thus, for the leaders, *E* would have positive effects on *V'*, *C'*, and *M'* and, hence, coefficients α_E, β_E, and γ_E are expected to be positive, as shown in column (i). Since the leaders reduced profit margins *M* in order to increase *V'*, *C'*, and *M'*, it is expected that α_M, β_M, and γ_M are negative. An increase in the share of the new marketing channels *C* would also be intended to increase *V'*, as reflected in the positive sign of α_C in column (i). Since the relative sizes of the leaders in 1995 would reflect those in 1990, α_V is expected to be positive. Similarly, we expect that β_C is positive. Unlike the leaders, the non-leaders did not take strategic action in this period. Their relative sizes would remain unchanged, new marketing channels were not explored intentionally, and the profit margin rate would reflect productivity rather than strategic pricing. Thus, the expected signs of α_V, β_C, and γ_M are all positive as shown in column (ii). Other than these positive effects, *V*, *C*, *M*, and *E* of the non-leaders would not have any significant effects.

By 1995, the gap between the perceived quality and the actual quality would have been narrowed for the leaders. Thus, in the 1995-2000 period, they would be in a position to be able to reap the profits from the size effect of reputation and, hence, the effects of *V* and *C* on *V'*, *C'*, and *M'* are expected to be positive and intensified relative to the earlier period (see column (iii)). The effects of *M* and *E*, however, are ambiguous for the leaders

since the aggressively low-pricing policy and the employment of engineers would not be as important as before. The followers and some of the laggards imitated the leaders' improved products and production processes as well as new marketing strategies. The effects of *V*, *C*, and *M* in 1995 on *V'*, *C'*, and *M'* in 2000 for the non-leaders would be the same as those in the 1990-95 period for the leaders. The non-leaders, however, could improve product quality and production process through imitation in the late 1990s without increasing *E* as much as the leader did in the early 1990s. Thus, the same signs can be transferred from column (i) to column (iv), even though the significance of α_E, β_E, and γ_E will be lower.

Unfortunately, it is practically impossible to test the expected differences in the effects of the key variables between the leaders and the non-leaders, since the number of the leaders is as small as six. It is possible, however, to compare the effects between the two periods. In this comparison, the effects that can be examined are the combined effects for the leaders and the others. Since the expected signs of γ_M are opposite for the leaders and the others, we leave it as ambiguous. For the other coefficients, the expected signs should be clear.

Now we may summarize the above arguments in three testable hypotheses as follows:

Hypothesis 1: Value added and the share of the new marketing channels increased with the initial employment of engineers in the early 1990s, but these effects became weaker in the late 1990s because imitation reduced the importance of engineers in quality upgrading and process improvement.

Hypothesis 2: An initially thin profit margin contributed to growth in value added and increases in the share of new marketing channels in both periods, and its contribution to the future profit margin became stronger in the later period.

Hypothesis 3: Positive effects of value added are intensified over time because of the increased size effect of reputation.

Equations (1) to (3) are specified as reduced-form equations, with all explanatory variables being predetermined or exogenous, so that the problem of endogeneity is mitigated if not completely solved. While the OLS method is appropriate for the estimation of equations (1) and (3), it is not so for equation (2) since the dependent variable (*C'*) is censored at 0% in the 1990 data and both at 0% and 100% in the 1995 data. Instead we use the one-limit tobit method for the early 1990s and the two-limit tobit

method for the late 1990s to estimate equation (2). In the tobit estimation, attention should also be paid to the possibility of heteroskedasticity since it biases estimates in the presence of censoring. Indeed, the variance of the disturbance v_i is likely to be greater for smaller enterprises, of which *C*' can more easily be affected by even a slight change in the number of sales agencies and own retail outlets. To cope with this problem, we adopt the multiplicative tobit method by assuming that the variance of v_i takes the form, $\sigma^2_i = \exp(\delta_0 + \delta_1 V_{it})$, where coefficient δ_1 is expected to be negative. [13]

5. Estimation Results

The estimates of the three functions (1) – (3) for the 1990-95 period are shown in Table 8 and those for the 1995-2000 period are shown in Table 9.[14] In columns (i), (iii), and (v) in Table 8, the employment of engineers has positive and highly significant effects on the three dependent variables, which is consistent with Hypothesis 1. Profit margins do not have the expected negative effects on either value added or the share of the new marketing channels if the employment of engineers is included as an independent variable in the regressions. Without the engineer variable, however, profit margins have negative and significant effects, as shown in columns (ii) and (iv). These changes in estimates may be attributable to the intercorrelation between the employment of engineers and profit

margins, which arise because low profit margin rates among the leaders tended to be associated with particularly high engineer ratios in 1990.

The effect of the profit margin rate on itself is positive and marginally significant if the engineer variable is included in the regression, and it is insignificant otherwise. These results are consistent with the expected directions of the effect for the leaders and the others as specified in Table 7; if the leaders' behavior is controlled for by the employment of engineers, the effect of profit margins tends to be positive, reflecting the behaviors of the non-leaders. Also as expected, the share of the new marketing channels had a positive and significant effect on value added in column (ii). The effects of the dummy variables representing the managers' former occupations (with former merchants as default) were generally insignificant with a few exceptions, which indicates that prior experience in commerce was not particularly advantageous, with other things being equal, even though the majority of new entrants to the industry were former merchants in the early 1990s. The positive and significant effect of the years of schooling on value added, as shown in columns (i) and (ii), indicates the importance of education in organizing production efficiently.

The effects of value added and the share of the new marketing channels in 1990 on the corresponding variables in 1995 are positive and significant as expected. The

coefficients of value added in columns (i) and (ii) would have been unity if all the enterprises had grown at the same rates regardless of their initial sizes. Actually, these coefficients are significantly smaller than unity, which suggests that smaller enterprises tended to have higher growth rates than larger ones.

In Figure 3, we saw that the innovator was by far the largest enterprise in 1990, but it was surpassed by the other leaders and caught up with to some extent by the followers by 1995. Table 8 offers three explanations for the leaders' high performances during this period: the first is their distinctively large employment of engineers relative to their enterprise sizes, the second is their low-price policy, and the third is their managers' relatively high education.

For the regressions shown in columns (i), (iii), and (v) in Table 9, the full sample was used. Since, however, the converts were not on equal footing with other enterprises in that they sold products through the distribution channels of their principal enterprises, this table also reports the results of regressions in which the converts are excluded from the sample, in columns (ii), (iv), and (vi). In the absence of the converts, the *t*- (or *z*-) values are generally smaller because of the reduction in the sample size, but the qualitative results are not much different.

The estimates shown in Table 9 are considerably different from those in Table 8.

The coefficient for value added in the value added function in Table 9 is equal to unity. The positive effects of initial value added on both the share of the new market channels and profit margins are now highly significant, and the effect of the new marketing channels on value added is also significant. These results support Hypothesis 3, even though the new marketing channel share does not have a significant effect on profit margins. The negative effects of initial profit margins on the three dependent variables are also generally significant, which supports Hypothesis 2. On the other hand, the effects of the employment of engineers are no longer significant, which is consistent with Hypothesis 1. Thus, although there is no question that the employment of engineers contributes to the improvement of product quality in the long run, their contribution was limited in the late 1990s, when the imitation of high-quality products became easier than in the early 1990s.

Other results in Table 9 which may be worth mentioning are the positive effect of the former engineer dummy and the negative effect of the years of top management on value added. These effects were not significant in the earlier period, which suggests that with other things being equal, engineering expertise and new management leadership assumed greater importance as the industry developed. Except for these effects, the managers' characteristics do not have any significant effects.

To sum up, the employment of engineers lost its significance and the contribution of

initially thin profit margins to growth performance became clearer over time. These results suggest that the imitation of product quality and process as well as strategic pricing took place. On the other hand, as the leaders' reputations were increasingly established, the size effect of reputation became stronger. Then, those enterprises which failed to imitate high quality products or marketing strategies were forced to abandon their own brand names and to become subsidiaries of large enterprises. By absorbing such small enterprises, the enterprise groups grew rapidly and reaped the returns on their past investment in their reputation. The estimation results in Tables 8 and 9 substantiate considerably such a view of the explosive expansion of the industry in the late 1990s.

6. Conclusions

Despite the prominence of the Wenzhou Model of Industrial Development among researchers, businessmen, and policy makers interested in China, little has been known as to how Wenzhou has achieved the high economic growth, except that small- and medium-scale private enterprises have played important roles. Like any other area, Wenzhou had a unique set of initial conditions, and, hence, one might wonder whether the industrial development in Wenzhou is replicable in other poor rural areas as a useful "model." In order to provide an answer to such a question, this study attempted to explore

the essence of the Wenzhou Model by examining closely the evolutionary development process of the low-voltage electric appliance industry in Wenzhou.

In general, the evolutionary process of industrial development in late-follower countries tends to begin with the search for a market for imitated simple products rather than beginning with product innovation. It is technologically easy to produce such products. Thus, it is no wonder that the new entry of a large number of small enterprises easily took place just after the construction of a local marketplace in Wenzhou. However, as they tried to expand their market beyond the local marketplace, the importance of marketing expertise increased because of high transaction costs, which is an inherent characteristic of less developed economies in general and transition economies in particular. In fact, our study found that the ratio of former merchants among new entrants increased consistently. Hence, it seems clear that the roles of marketplaces and merchants are critical in the early stage of industrial development.

As the number of enterprises producing poor-quality products increases, their market will sooner or later be saturated and the improvement of the quality of products will become profitable and, hence, inevitable. Whether the major innovation in this stage depends on engineering knowledge or marketing expertise will hinge on the nature of the product of the industry. In technologically backward, remote areas producing simple

products, such as in Wenzhou, however, the innovation is likely to be a new combination of marketing expertise and production system since the improvement in the product quality tends to be easy relative to the marketing of the improved product. Moreover, in less developed areas, where poor-quality products prevail in the market, the problem of asymmetric information will be particularly serious, and, accordingly, investment in reputation and other marketing strategies will be indispensable. In fact, our study demonstrated that the new marketing strategies, such as the use of brand names and the use of exclusive sales agencies, introduced by a former merchant and imitated by a number of followers, were truly effective for the growth of the industry. It seems reasonable to conclude that the term, "merchant-led industrial development," accurately reflects the essence of the Wenzhou Model. This same pattern of growth seems to be replicable and will probably characterize industrial growth in other parts of the world, to the extent that the area has a long tradition of commerce. Before generalizing the critical roles played by merchants, however, further compilation of empirical evidence is called for.

Appendix

Panel Data Regressions

To check the robustness of the estimation results reported in Tables 8 and 9, this appendix examines the panel data regressions, which makes it possible to control for all of the *unobserved* heterogeneity among enterprises. For this purpose, we modified equations (1) to (3) as follows:

$$Y'_{it} = \theta_0 + \theta_1 V_{it} + \theta_2 S_t V_{it} + \theta_3 C_{it} + \theta_4 M_{it} + \theta_5 S_t M_{it} + \theta_6 E_{it} + \theta_7 S_t E_{it} + \lambda_i + \theta S_t + \varepsilon_{it}, \qquad \text{(A1)}$$

where Y'_{it} is a dependent variable, i.e., V'_{it}, C'_{it}, or M'_{it}, subscript t indicates year 1990 or 1995, S_t is the second period dummy which is 0 for the first period (t = 1990) and 1 for the second period (t = 1995), λ_i is the enterprise effect which captures the effects of both observed and unobserved characteristics of enterprises, and ε_{it} is an error term. Interaction terms *SV*, *SM*, and *SE* are intended to capture the changes in the effects of value added, profit margin, and engineer employment, which were predicted by Hypotheses 1 to 3 and confirmed in Tables 8 and 9. We employ the fixed effects estimator and the random effects GLS estimator. Although consistent estimators for dynamic panel data models like (A1) have been developed recently (e.g., Baltagi 1995, ch. 8), these techniques are not applicable to our data because the number of time-series observations is too small. Moreover, the limited nature of the dependent variable in the new marketing channel

equation has to be ignored because of the small size of the sample.

The estimation results are reported in Table A1. While the full sample was used for the first two columns for each dependent variable, the sub-sample that excludes converts was used for the third column. The effects of lagged value added on the three dependent variables are positive and generally significant, and the interaction term between value added and the second period dummy has positive effects except for one case. These results support Hypothesis 3. Consistent with Hypothesis 2, the profit margin rate and its interaction term have negative effects on value added and the new marketing channel share. Moreover, the effect of the interaction term on the profit margin rate is negative and highly significant, which strongly support the second part of Hypothesis 2. According to Hypothesis 1, the employment of engineers should have positive effects on value added and the new marketing channel share, whereas its interaction term should have negative effects. Although the fixed-effects estimates of these effects were not statistically significant, the random effect estimates, shown in columns 1 and 4, provide highly supportive evidence for this hypothesis.

Notes

1. We thank Yujiro Hayami, Michiki Kikuchi, Justin Y. Lin, Scott Rozelle, Deqiang Liu, Michael Kevane, John Bonin and four anonymous referees for very helpful comments. We also thank Paul Kandasamy for his editorial advice.

2. According to Li (1997), Wenzhou had as many as 528 specialized markets at the time of his writing, of which 114 markets specialized in different parts, materials, and machines for industrial production and construction and the rest dealt in consumption goods.

3. The cases of the garment and footwear industries looked equally interesting. Moreover, the qualitative pattern of their development did not seem to differ substantially from the case of the low-voltage electric appliance industry.

4. Thus, this paper neglects the inter-enterprise division of labor, even though we believe that it plays an important role in the development of the industry under study.

5 Sonobe, Hu, and Otsuka (2002) find a similar tendency in a cluster of garment enterprises in the northern part of Zhejiang Province.

6. According to the description of twelve successful entrepreneurs in Wenzhou in the 1980s by Zhang (1989), many of them had worked for other factories in the past.

7. See Smyth and Lu (2000) for the discussion of the formulation of large enterprise groups in the late 1990s.

8. In the sample, there is no enterprise that was established as a subsidiary from the beginning.

9. The year of group formation in this sense is, in most cases, earlier than the year when the enterprise was officially registered as a group.

10. The source of information on the Wuhan case is our interview with the sales manager of a garment enterprise there.

11. By 1990, this enterprise was separated into two enterprises. Both are classified as "leaders."

12. Since some of the subsidiaries supplied parts to their parent enterprises, it is inappropriate to add sales revenues in order to measure the size of a group. Thus, we use value added to measure the total size of an enterprise group.

13. For details of this method, see Greene (2000, Ch. 19).

14. The condition number of the moment matrix $\boldsymbol{X'X}$, where $\boldsymbol{X}$ is the matrix of the explanatory variables, is far less than 20 for each period and each set of explanatory variables used in the regressions reported Tables 8 and 9, which suggests there is no serious problem of multicollinearity in the data.

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Table 1. Years of Schooling and Previous Occupation of Founders by the Timing of Entry

	Before 1980	1981-85	1986-90	1991-95	1995-2000
No. of enterprises	4	32	30	36	10
Years of schooling	8.0	9.8	10.0	10.5	10.9
Occupation (%)					
Farmers	50	12.5	6.7	2.8	0
Factory workers	0	25	16.7	16.7	10
Salesmen or traders	25	25	43.3	63.9	50
Engineers	0	3.1	13.3	5.6	0
Managers	0	9.4	10	5.6	10
Others	25	25	10	5.6	30

Table 2. Changes in the Number of the Sample Enterprises, and Average Size of Operation [a]

	1990	1995	2000
Number of enterprises	66	102	112
Number of independent Enterprises[b]	66	96	73
Sales revenue[c]	320.4	964.1	9525.7
Value added[c]	123.7	375.8	3671.4
Number of employees	46.7	104.1	338.3
Capital stock [c]	372.0	983.9	7922.1

Notes:

[a] Production and employment sizes reported in this table are the averages of the then existing sample enterprises in each year. Although some of the sample enterprises had subsidiaries, the numbers shown here do not include subsidiaries'.

[b] Excluding subsidiaries.

[c] Real value in terms of the 2000 constant prices, 10,000 yuan. The deflator is the ex-factory price index for the electric machinery and equipment industry compiled by the Statistical Bureau of Zhejiang Province (*Zhejiang Statisitical Yearbook*, various years).

Table 3. Characteristics of Enterprises by the Timing of Forming Enterprise Group

	Before 1990	Early 1990s	Late 1990s	Not until 2000*	Merged by 2000
No. of enterprises	1	5	20	47	39
Established year	1986	1982	1987	1990	1990
Years of schooling of managers	13	13.0	10.9	10.4	10.4

* These enterprises were independent at least until 2000 and did not form enterprise groups.

Table 4. Changes in Number of Engineers as a Proportion to the Total Workers, Average Number of Parts-Supplying Subcontractors, and Composition of Marketing Channels

	1990	1995	2000
Proportion of workers that were engineers [a] (%)	1.5	2.7	4.2
Number of parts supplying subcontractors	0	2.8	34.8
Composition of marketing channels [b] (%)			
Local wholesale market	23.5	20.4	3.6
Wenzhou traders	26.5	23.8	5.7
Sales agencies	22.0	30.7	50.6
Own retail outlets	9.5	12.6	27.1
Other channels	18.5	12.5	13.0

Notes:

[a] Weighted average with weights being the share of each enterprise's employment in the total employment of the independent enterprises.

[b] Weighted average with weights being the ratios of each enterprise's sale to the total sales of the independent enterprises.

Table 5. Changes in Proportion of Sample Enterprises that Adopted New Marketing Strategies (%)

	1990	1995	2000
Use of brand name	50.0	72.9	98.6
Certification of the national standard	43.5	72.9	91.8
Full-scale use of sales agencies	12.9	42.7	56.0
Certification of the international standard	4.8	15.6	54.8

Note:

The sample used for this table does not include subsidiaries.

Table 6. Changes in the Employment of Engineer, Marketing Channel, Product Variety, and Profit Margin by Enterprise Types*

	Leaders		Followers	Laggards	Converts
	Innovator	Others			
Proportion of workers that were engineers (%)					
1990	2.4	7.2	1.9	0.9	0
1995	2.7	5.7	2.1	2.1	1.6
2000	2.5	5.7	3.6	2.6	2.7
Profit margin (%)					
1990	15.9	-0.02*	0.05	11.9	13.4
1995	16.1	18.9	10.3*	14.9	14.5
2000	16.1	20.2	16.6	11.9*	14.0
Number of product specifications					
1990	50	25	79	22	70
1995	900	1424	405	48	84
2000	1500	7960	2840	156	182
Share of the new marketing channels (%)					
1990	60	8	3.9	3.5	1.1
1995	55	58	16.4	6.2	5.5[b]
2000	70	79	60	18.9	NA[c]

Notes:

[a] Enterprises are classified according to the timing of forming an enterprise group.

[b] The average is taken over the converts that were independent in 1995.

[c] The converts did not have sales networks since they were subsidiaries in 2000 by definition.

* indicates that the enterprise type had the lowest average in the specified year.

Table 7. Expected Effects of Increase in Specified Independent Variables on Dependent Variables, with All Others Held Constant, 1990 – 1995, 1995 - 2000

Eq.	Dependent Variable	Coefficient	1990 - 1995		1995 - 2000	
			Leaders (i)	Others (ii)	Leaders (iii)	Others (iv)
(1)	*V'*	α_V	+	+	+	+
		α_C	+		+	+
		α_M	–			–
		α_E	+			(+)
(2)	*C'*	β_V			+	
		β_C	+	+	+	+
		β_M	–			–
		β_E	+			(+)
(3)	*M'*	γ_V			+	
		γ_C			+	
		γ_M	–	+		–
		γ_E	+			(+)

Note: + and – signs indicate significantly positive and negative effects, respectively, whereas (+) sign indicates positive but weakly significant or insignificant effect.

Table 8. Determinants of Value Added, Share of the New Marketing Channels, and Margin Rate, 1990 - 1995

	ln(value added) $_{1995}$		New marketing channel share $_{1995}$ (%)		Margin rate $_{1995}$ (%)	
	OLS		Multiplicative tobit		OLS	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
ln(value added) $_{1990}$	0.555**	0.639**	- 2.800	0.033	- 0.826	- 0.469
	(3.98)	(4.52)	(- 0.64)	(0.00)	(- 1.16)	(- 0.66)
New marketing channel share $_{1990}$ (%)	0.019	0.027*	1.103**	1.172**	0.053	0.091
	(1.46)	(1.95)	(4.55)	(3.14)	(1.11)	(1.47)
Margin rate $_{1990}$ (%)	- 0.013	- 0.036**	- 0.130	- 0.627*	0.149*	0.031
	(- 1.02)	(- 3.18)	(- 0.54)	(- 1.74)	(1.76)	(0.32)
Employment of engineers $_{1990}$ (%)	0.183**		3.797**		0.935**	
	(3.30)		(4.01)		(3.01)	
Farmer dummy	0.359	0.624	6.414	18.05	- 2.227	- 0.889
	(0.76)	(1.22)	(0.57)	(1.11)	(- 0.59)	(- 0.25)
Factory worker dummy	- 0.112	- 0.259	6.391	- 6.916	- 2.656	- 3.349
	(- 0.26)	(- 0.58)	(0.59)	(- 0.39)	(- 0.92)	(- 1.09)
Engineer dummy	- 0.307	0.044	- 27.01	13.81	- 3.526	- 1.821
	(- 0.52)	(0.07)	(- 0.71)	(0.35)	(- 1.01)	(- 0.51)
Manager dummy	- 0.034	0.123	31.60**	36.17*	- 5.455	- 4.702
	(- 0.06)	(0.21)	(2.85)	(2.09)	(- 1.12)	(- 1.12)
Other occupations Dummy	0.036	0.147	11.04	30.97*	- 1.790	- 0.709
	(0.09)	(0.34)	(1.39)	(2.11)	(- 0.68)	(- 0.29)
Years of schooling	0.153**	0.120*	1.820	1.826	0.272	0.125
	(3.09)	(2.24)	(1.63)	(1.06)	(0.71)	(0.30)
Years of top Management	- 0.048	0.016	- 0.382	1.193	- 0.331	- 0.005
	(- 1.20)	(0.40)	(- 0.44)	(0.86)	(- 0.94)	(- 0.02)
Constant	1.777*	1.532*	- 11.22	- 36.63	16.18**	15.04**
	(2.11)	(1.68)	(- 0.40)	(- 0.83)	(2.66)	(2.43)
Correction for heteroskedasticity						
ln(value added) in 1990	NA	NA	- 1.044**	- 0.381	NA	NA
			(- 3.32)	(- 0.88)		
R-squared	0.66	0.57	NA	NA	0.20	0.11

Notes:

The sample size = 55. In tobit regressions (iii) and (iv), 27 observations are left-censored at "the share of new marketing channels in 1995" = 0%. Numbers in parentheses are *t*- (or *z*-) values. * and ** indicate statistical significance at the 5% and 1% levels, respectively (one-sided test).

Table 9. Determinants of Value Added, Share of the New Marketing Channels, and Margin Rate, 1995 - 2000

	ln(value added) $_{2000}$		New marketing channel share $_{2000}$ (%)		Margin rate $_{2000}$ (%)	
	OLS		Multiplicative tobit		OLS	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
ln(value added) $_{1995}$	1.062**	1.105**	21.73**	10.49*	1.079**	1.362**
	(13.38)	(8.82)	(3.86)	(1.96)	(3.37)	(3.10)
New marketing channel share $_{1995}$ (%)	0.014**	0.014*	0.665*	0.725**	0.009	0.006
	(2.38)	(1.73)	(1.91)	(2.40)	(0.37)	(0.21)
Margin rate $_{1995}$ (%)	- 0.059**	- 0.059**	- 2.062**	- 1.520*	- 0.066	- 0.118*
	(- 4.11)	(- 3.00)	(- 2.41)	(- 2.00)	(- 1.13)	(- 1.69)
Employment of engineers $_{1995}$ (%)	0.019	0.016	- 0.120	- 0.269	0.036	0.081
	(0.77)	(0.45)	(0.08)	(- 0.18)	(0.37)	(0.66)
Farmer dummy	0.364	0.563	10.97	5.200	0.553	1.374
	(1.08)	(1.27)	(0.61)	(0.35)	(0.41)	(0.88)
Factory worker dummy	- 0.075	- 0.267	- 10.64	- 8.071	0.122	- 0.954
	(- 0.29)	(- 0.74)	(- 0.73)	(- 0.65)	(0.12)	(- 0.75)
Engineer dummy	0.698*	0.951	9.636	20.47	2.631	1.278
	(1.76)	(1.51)	(0.39)	(0.89)	(1.65)	(0.58)
Manager dummy	0.352	0.616	24.32	13.33	- 0.247	0.996
	(0.97)	(1.29)	(1.44)	(0.98)	(- 0.17)	(0.59)
Other occupations Dummy	0.575*	0.757*	2.279	- 2.823	1.276	0.920
	(1.91)	(1.75)	(0.14)	(- 0.19)	(1.05)	(0.61)
Years of schooling	0.021	0.063	- 1.844	0.035	- 0.069	0.022
	(0.57)	(1.21)	(- 1.04)	(0.02)	(- 0.47)	(0.12)
Years of top Management	- 0.043*	- 0.045	- 1.781	- 1.094	0.016	- 0.043
	(- 2.01)	(- 1.51)	(- 1.50)	(- 1.07)	(0.18)	(- 0.41)
Constant	1.869**	1.155	- 49.41*	- 3.462	9.563**	8.200**
	(3.32)	(1.40)	(- 1.79)	(- 0.14)	(4.21)	(2.82)
Correction for heteroskedasticity						
ln(value added) in 1995	NA	NA	- 0.252*	- 0.409*	NA	NA
			(- 1.73)	(- 2.08)		
R-squared	0.82	0.81	NA	NA	0.24	0.35
Number of observations	95	62	95	62	95	62

Notes:

The sample size = 95. For regressions (ii), (iv), and (vi), only the 62 observations which were independent enterprises in 2000 were used. In tobit regression (iii), 51 observations are left-censored at "the share of new channels in 2000" = 0% and 5 observations are right-censored at 100%. In tobit regression (iv), 18 observations are left-censored and 5 observations are right-censored. Numbers in parentheses are *t*- (or *z*-) values. * and ** indicate statistical significance at the 5% and 1% levels, respectively (one-sided test).

Table A1. Panel Data Estimation of the Determinants of Value Added, Share of the New Marketing Channels, and Margin Rate, 1990-2000

	ln(value added)			New marketing channel share (%)			Margin rate (%)		
	Random effect 1	Fixed effect 2	Fixed effect 3	Random effect 4	Fixed effect 5	Fixed effect 6	Random effect 7	Fixed effect 8	Fixed effect 9
ln(value added) $_{-5}$	0.703**	0.417**	0.500**	0.128	13.15**	18.88**	0.299	1.798**	1.735**
	(6.62)	(3.18)	(2.99)	(0.05)	(3.14)	(3.90)	(0.51)	(3.46)	(3.44)
ln(value added)$_{-5}$	0.150	-0.022	0.038	8.617**	3.934	2.933	0.669	0.436	0.812
× Second period dummy	(1.43)	(-0.21)	(0.23)	(2.78)	(1.19)	(0.60)	(1.14)	(1.06)	(1.61)
New marketing	0.018**	0.014*	0.011	0.615**	-0.476*	-0.397	0.031	0.009	-0.013
channel share $_{-5}$	(3.52)	(2.24)	(1.33)	(4.93)	(-2.33)	(-1.64)	(1.11)	(0.36)	(-0.52)
Margin rate $_{-5}$	-0.026**	-0.014	-0.015	-0.058	-0.599*	-0.698*	0.079*	-0.090*	-0.051
	(-2.99)	(-1.50)	(-1.31)	(-0.25)	(-1.93)	(-2.09)	(1.66)	(-2.35)	(-1.46)
Margin rate $_{-5}$	-0.040**	-0.059**	-0.072**	-0.726*	-1.403**	-0.795	-0.591**	-1.051**	-1.141**
× Second period dummy	(-2.71)	(-3.67)	(-3.48)	(-1.76)	(-2.72)	(-1.32)	(-7.14)	(-16.44)	(-18.25)
Employment of	0.108**	0.030	0.043	3.287**	-2.157	-1.935	0.448*	-0.008	0.038
engineers $_{-5}$	(2.81)	(0.64)	(0.79)	(3.23)	(-1.43)	(-1.23)	(2.10)	(-0.05)	(0.23)
Engineer employment$_{-5}$	-0.079*	0.041	0.045	-3.339**	-0.297	-2.329	-0.306	0.216	0.292
× Second period dummy	(-1.86)	(0.73)	(0.64)	(-2.89)	(-0.17)	(-1.13)	(-1.29)	(0.98)	(1.37)
Second period dummy	0.292	1.635**	1.380	-22.03	4.781	38.33	4.874*	10.60**	9.327**
	(0.60)	(3.27)	(1.66)	(-1.56)	(0.30)	(1.59)	(1.81)	(5.34)	(3.72)
Constant	2.257**	3.604**	3.581**	8.218	-25.60	-51.07**	11.04**	7.848**	6.832**
	(6.02)	(7.39)	(5.14)	(0.73)	(-1.64)	(-2.53)	(4.65)	(4.06)	(3.25)
R-squared	0.77	0.83	0.85	0.20	0.53	0.68	0.74	0.88	0.93
p-value for F test that all enterprise effect = 0		0.00	0.00		0.02	0.01		0.00	0.00
Number of enterprises	95	95	62	95	95	62	95	95	62
Number of observations	150	150	100	150	150	100	150	150	100

Notes: Numbers in parentheses are *t*- (or *z*-) values. * and ** indicate statistical significance at the 5% and 1% levels, respectively (one-sided test).

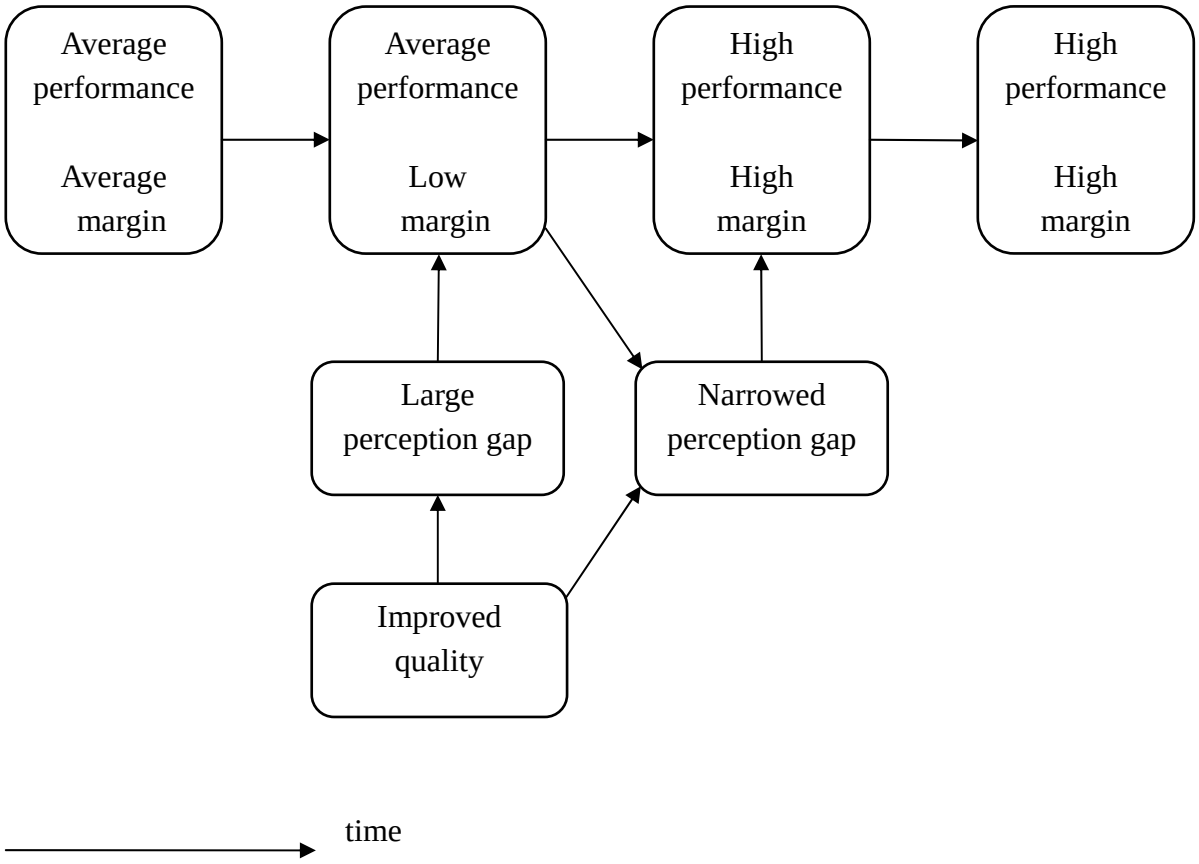

Figure 1

Effects of Improved Product Quality on

Perception Gap, Profit Margin, and Performance

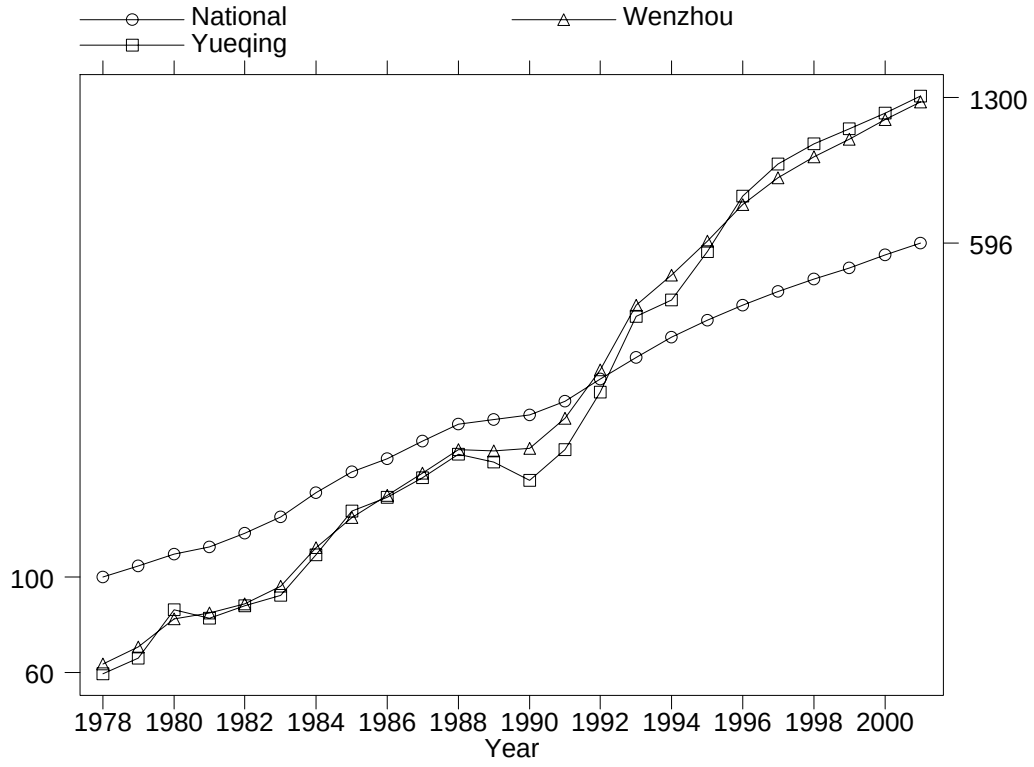

Figure 2

Changes in Real GDP per Capita in the Yueqing Cluster, Wenzhou City, and China as a Whole, 1978 - 2001

(Semi-log scale, China in 1978 = 100)

Sources: *China Statistical Yearbook 2002* (State Statistical Bureau, 2002), *Comprehensive Statistical Data and Materials on 50 Years of New Zhejiang* (Statistical Bureau of Zhejiang Province, 2000), and *Zhejiang Statistical Yearbook* (Statistical Bureau of Zhejiang Province, 2000, 2001, and 2002).

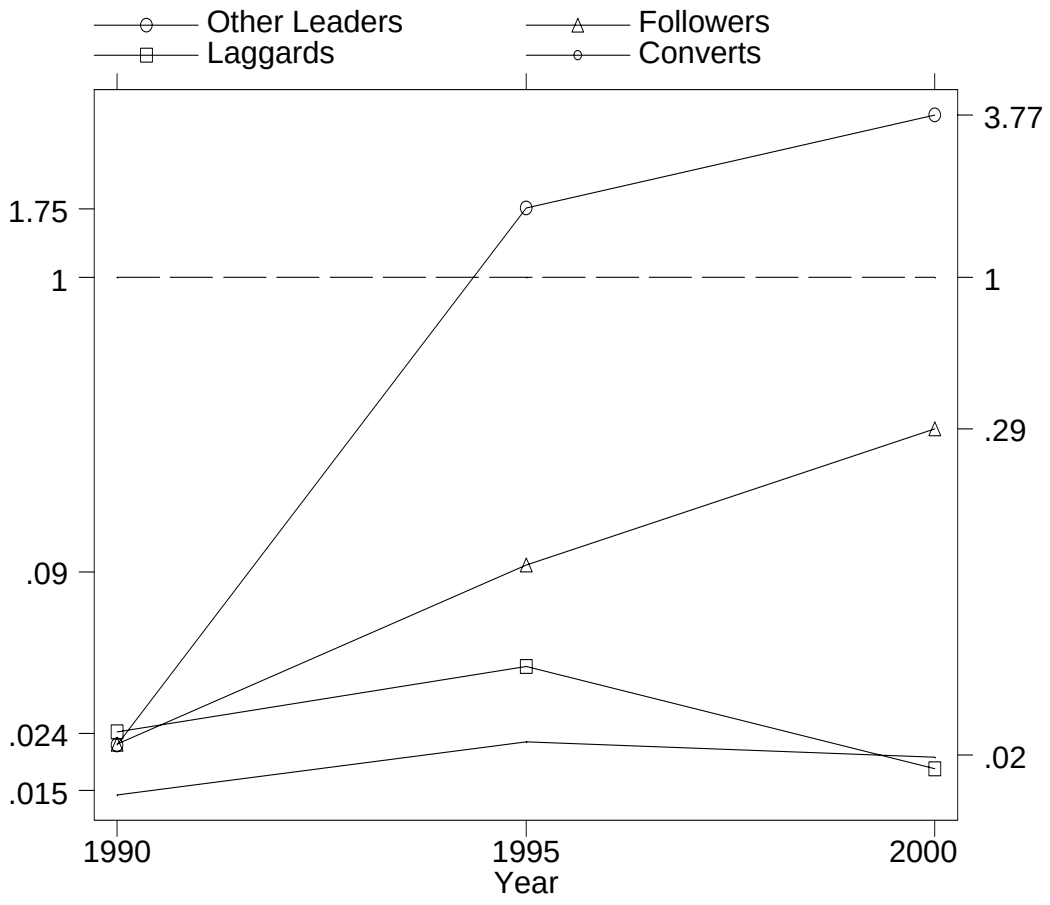

Figure 3

Average Value Added by the Type of Enterprise

Relative to the Innovator

(Semi-log scale; Innovator = 1)

Note: For those enterprises with subsidiaries, this figure shows the total value added of the enterprise group as a whole.