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**Pre-commitment vs. Flexibility:
Uncertainty and Distribution Reform
in P.R. China**

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*Forthcoming in the *Journal of Socio-Economics*

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Pre-commitment vs. Flexibility: Uncertainty and Distribution Reform in P. R. China

Abstract

The Chinese economic reform is remarkably different from the East European reforms in which the Chinese model emphasizes competition over privatization. This paper explains why the Chinese distribution reform is successful, although the Chinese government has made no attempt in privatizing her inefficient state-owned enterprises. By extending Coughlan's (1985) price competition model to endogenize the pre-commitment versus flexibility decision, it is shown that reducing uncertainty can encourage enterprises to pre-commit their investment which allows further development of the retail sectors. This results supports the gradual pace of distribution reform policy of China. By contrast, the 'revolutionary' East European model inevitably creates high uncertainty in the society and enterprises are unwilling to pre-commit their investment.

Introduction

Economic reform aims at shifting away from central planning toward largely market-based resource allocation. Such a process involves strengthening incentives that link material rewards to economic performance by moving toward private ownership and reforming management incentives within systems that maintain extensive social ownership (Gelb, Jefferson and Singh 1993). There are two basic reform models: (1) the 'revolutionary' model or called the East European model, (2) the 'evolutionary' model or called the Chinese model (McMillan and Naughton 1992, Weitzman 1993). The East European model contains the so-called 'reform troika': marketization, privatization and democratization. In addition, it involves making a transition to the 'West European market economy' as quickly as possible, with a focus of an aggressive establishment of well-defined private property rights. To achieve this goal, massive privatization is the major tool used by the East European governments.

On the other hand, the Chinese model emphasizes competition over privatization. The Chinese government did not attempt to privatize the state-owned enterprises. Instead, it allowed or encouraged the non-state sector to compete with and outgrow the state sector gradually. Although the performance of the state sector also improves under the competitive pressure, it may not be enough to save them in the long run. The majority of this non-state enterprises is the collective enterprises which are basically a communal organization or a 'vaguely defined cooperative' (Weitzman 1993). In contrast to the East European model, the Chinese model stresses more on the design of competitive market structure which, in turn, exerts pressure gradually on the inefficient state enterprises to improve their productivity so as to survive in the market. Such an approach is not supported by western academics and businesspeople as they have all preferred privatization to any other means for shifting an economy from central planning to market-based resource allocation. However, the success of the Chinese model seems to have puzzled the academics and policy-makers. McMillan and Naughton (1992) summarize the Chinese reform process into the following three stages: (1) massive entry of non-state enterprises; (2) a dramatic increase in competition; (3) improvements in the performance of state-owned enterprises resulting from state-imposed market-like incentives. China has demonstrated how she has successfully used the fundamental market forces of entry and competition in moving her centrally-planned economy toward a market economy.

Economic reform involves coordinated changes in different parts of the economy. Among them, distribution reform plays a very crucial role. A healthy and efficient distribution system is important for enterprises in making correct decisions on resource allocation. The failure of Gorbachev's *perestroika* was primarily due to a breakdown in the

economy's distribution system (empty store shelves, widespread hoarding of goods, etc.). Such a breakdown in the distribution was actually both cause and effect of a general loss of public confidence in the former Soviet Union's economy which finally contributed to the fall of Gorbachev and the collapse of the Soviet Union (Holtzman 1991). Contrary to the former Soviet's failure, China's success is partly due to her successful liberalization of distribution system mentioned by Gelb, Jefferson and Singh (1993). An important issue involved here is why the Chinese model based on vaguely-defined cooperatives seems to be significantly outperforming the East European model based on well-defined private property.

The Chinese distribution reform has been very successful. Its total retail sales (deflated by the national retail price index) has been growing at an annual rate of 6.4% from 1978 to 1992. This paper attempts to explain why the distribution reform in China is successful by pointing out that privatization, albeit important, may not be the necessary and sufficient way in reforming a centrally-planned economy. MacDonald (1993) also suggests that the East European state-owned enterprises require more than just privatization. They need the support from strong and capable shareholders and managers. These free market skills and tenacity can only be acquired through active training and learning from competing in the marketplace. China's successful use of the market forces of entry and competition provides valuable insight for the East European governments in designing a competitive environment for their newly privatized or state-owned enterprises.

This paper does not study the vertical relationship between retailers and manufacturers in a marketing channel (Choi 1991, Shugan and Jeuland 1988, and McGuire and Staelin 1983a,b). Instead, it attempts to construct a simple game-theoretic model to analyse the investment decisions under price competition and exogenous uncertainty in the retail sector. In order to highlight the competition among manufacturing enterprises and their marketers, this model is built on a simplified version of Coughlan's (1985) price competition model. In addition, it further endogenizes the choice of pre-commitment vs. flexibility and the following results are obtained: (1) Reforming the distribution sector at a gradual pace has an advantage of reducing uncertainty in the transition process. Reduction in uncertainty can encourage enterprises to commit more investment which is crucial for the further development of manufacturing enterprises and their marketers. On the other hand, the rapid transition proposed under the East European model may create higher uncertainty which may damage the incentive to commit investment by enterprises. As a result, less growth will be observed and consumers have to face higher prices and less provision of goods.

The relationship between investment and uncertainty has been extensively studied

by financial economists (Dixit and Pyndick 1994, Ingersoll and Ross 1992 and MacDonald and Siegel 1986). But, they have ignored the strategic aspects of investment decision. Investment decision is sensitive to the magnitude of uncertainty faced by investors. The value of retaining flexibility and waiting for the uncertainty to be resolved is generally increasing in the magnitude of uncertainty. When enterprises are facing high uncertainty, they would like to wait until the uncertainty is resolved in order to avoid pre-committing too early. However, the role of pre-commitment is especially important for enterprises to maintain or even increase their market shares by deterring any entries. In addition, the enterprise which is the first to pre-commit will naturally be the market leader. As a result, there is a trade-off between pre-commitment and flexibility (Appelbaum and Lim 1985, Spencer and Brander 1992). If enterprises are willing to pre-commit their investment so as to build a larger selling capacity, these enterprises can later be benefited by selling their goods at a lower cost and supplying more goods in the market. Furthermore, the distribution sector can grow faster and operate more efficiently when more enterprises pre-commit their productive investment. Consequently, encouraging enterprises to pre-commit their investment is a welfare-improving policy.

(2) The entries of non-state enterprises make the competition keener. Competition gradually reduces the equilibrium market prices of goods and the market share of the state-owned enterprises. In addition, in response to the pressure of competition, state enterprises have to improve their own efficiency in order to survive in the market. All these changes are likely to improve the welfare of the society.

Section 2 presents a brief review of the distribution reform of the People's Republic of China. Section 3 contains a simple game-theoretic model which describes and analyses the changes in the retail sector of China. Finally, section 4 presents the conclusion of this study.

Distribution Reform in China

Before the economic reform, China like other communist countries was a shortage economy. Production and distribution of commodities were all planned by the central planning bureau. Nearly all the existing marketing channels at that time were state-owned. The distribution system was established not according to the economic functions, but according to political and administrative functions (Mun 1988 and Qiang and Harris 1990). After the economic reform was introduced to the rural areas in 1978, the original distribution system showed difficulty in coping with the pace of reform in agricultural production. From 1983 to 1984, the central government finally undertook serious measures to resolve the

problems¹. The reform involved the following: (1) The government re-organised the supply and marketing cooperatives and other state distribution enterprises to provide better link between urban and rural economies by introducing a performance-related reward system into state enterprises. (2) Using the established state-owned distribution system as the backbone, the government introduced secondary channels operated by other enterprises to achieve a multi-form, multi-layer system. It allowed other enterprises like collective, individual and joint enterprises to compete with and complement the state marketing channel². The government hoped that the new measures would overhaul the existing system and that the targeted system would provide various services like distribution, storage, processing and transportation to the economy.

The introduction of these measures saw rapid changes in the retail sector as observed by Wortzel and Wortzel (1987), Chow (1995a,b, 1996), and Chow and Tsang (1994). Small and primitive secondary marketing channels, like numerous free markets which developed initially in rural areas and later spread to urban areas, were established autonomously by individual traders and other small private enterprises. Figure 1a,b,c shows the relative performance of different enterprises during the economic reform.

{Insert Figure 1a, 1b, 1c}

In Figure 1a, market shares of state enterprises (SE), collective enterprises (CE), individual enterprises (IE) and joint enterprises (JE) are reported. The steady declines of state and collective enterprises are in contrast to the rapid growth of the individual enterprises. The market share of joint enterprises is negligibly small; therefore, the joint enterprises are skipped in this study. Although the market share of state enterprises is slightly increasing after 1987, it does not imply that the efficiency of state enterprises is improving. In Figure 1b, the profit per 100 yuan of sales (SPF/S) of state enterprises is steadily declining. After 1989, they have been suffering losses despite their rapid increase of investment per 100 yuan of sales (SI/S) which doubles the amount of investment (CI/S) (measured by investment per 100 yuan of sales) made by the collective enterprises! In addition, Figure 1c suggests that the collective enterprises are generally performing better in the return of their investment as the labour productivity (measured by the sales per worker) per one

¹The vice-premier, Tian Jiyun ordered to re-structure the distribution system in the national economic meeting held on Feb 17, 1984.

²Collective enterprises are basically communal organizations with a vaguely defined property rights. Most of them are located in townships or villages. Therefore, they are also known as township-village enterprises (TVE). Individual enterprises are small manufacturers and retailers run by individual or a family. They are allowed to employ only one to two helpers and no more than five apprentices. Typical examples of individual enterprises are hawkers, neighbourhood stores, small traders, etc. Joint enterprises are basically joint ventures of state and collectives, state and individuals, Chinese and overseas investors, etc.

dollar of investment (CLP/I) of the collective enterprises is more than twice of the labour productivity per investment (SLP/I) made by state enterprises. Unfortunately, there is no detailed investment data of the individual enterprises; therefore, it is impossible to compare the investment performance of individual enterprises with those of state and collective enterprises.

Pre-commitment vs. Flexibility Pricing Game Model

In this section, a simple game-theoretic model is constructed to capture what is going on in the retail sector of China during the economic reform. Since the Chinese model emphasizes the market forces of entry and competition, this model focuses on the market structure instead of the internal organizational structure of enterprises. From this model, some predictions are generated in order to explain why the Chinese distribution reform works. There are three players, namely, one state enterprise, one collective enterprise and a competitive fringe of numerous tiny individual enterprises in this model. Each enterprise is selling a differentiated product in the retail market. The demands for these products are assumed to be linear; without loss of generality, the slope of each demand curve is assumed to equal one.

$$x = a - p_x + \alpha(p_y + p_z) + u_x, \quad y = a - p_y + \alpha(p_x + p_z) + u_y, \quad z = a - p_z + \alpha(p_x + p_y) + u_z. \quad (1)$$

where $a > 0$, and $0 < \alpha < 1$ measures the substitutability among x , y and z . x , p_x are the sales volume and product price of the state enterprise, y , p_y are the sales volume and product price of collective enterprise, z , p_z are the aggregate sales volume and product price of individual enterprises. For simplicity, $u_x = u_y = u_z = u$ is random variables with mean zero and variance σ^2 . The density function $f(u)$ is defined on support $[\underline{u}, \bar{u}]$ where $\underline{u}$ is assumed to be sufficiently large so that enterprises can have positive sales volume. This random variable u captures all the uncertainty of the macroeconomic and political environment. If the macroeconomic or political situation is unstable, it will be reflected in an increase of the variance σ^2 . The aggregate marginal cost function of individual enterprises which are all price takers is simply assumed to be linear in z

$$MC_I = b + z \quad (2)$$

Since investment is the major element that determines the sustainability of growth and future successes of enterprises, the aim of this paper is to consider the investment decision of manufacturing enterprises and their marketers in a price competition environment. As a result, a simple game theoretic model of pre-commitment versus flexibility

like Spencer and Brander (1992) is considered. For simplicity, it focuses on the integrated non-cooperative situation in which manufacturers and their marketers are merged into one firm. Briefly, this model can be described as follows: For state and collective enterprises, there are two major decisions: (1) a pre-commitment decision which determines whether enterprises should pre-commit their selling capacity and (2) a pricing decision which determines the selling prices of their goods. Both state and collective enterprises have the option of pre-committing their capacity of selling before uncertainty is resolved. If only one enterprise pre-commits, it will naturally be the (Stackelberg) market leader. The capacity is linearly related to capital investment. A commitment to build a new selling capacity or expanding the existing one involves plenty of investment capital. A larger capacity implies that a larger floor space and more equipment are needed to provide a larger output. Individual enterprises which are all small price takers always act or react after uncertainty is resolved.

There are three stages in this game. In stage one, the state or collective enterprise decides whether to commit its capacity before uncertainty is resolved, or to retain the flexibility to make its selling decision after observing the realization of u . The outcome of this timing decision is observed by other enterprises. In stage two, if either enterprise has decided to pre-commit, it can decide how to set the selling prices at this stage. Uncertainty is resolved in the final stage, individual enterprises and the enterprise which has chosen to retain its flexibility can decide how to set their selling prices. If both state and collective enterprises have chosen to pre-commit their selling capacity, only individual enterprises will set their price at their aggregate marginal cost in this stage.

In order to illustrate the effects of competition in the market structure, the complicated internal structure of state and collective enterprises and the within channel relationship between manufacturers and retailers are ignored. Only the competition among retailers is modelled since the major characteristic of the Chinese model is the keen competition that forces enterprises to improve their productivity and profitability³. To simplify the analysis, marginal costs of all enterprises are assumed to be affected only by their investment decision. If both state and collective enterprises do not pre-commit, their marginal costs will be c^h . If both enterprises pre-commit, both can achieve a lower marginal costs, c with $c < c^h$. This is a reasonable assumption because workers' productivity can be raised when they are working with more machines and equipment. Therefore, the operational efficiency of enterprises is improved. If only one enterprise pre-commits

³The organizational structure and ownership of state and collective enterprises usually induce complicated incentive structure in these enterprises and their objectives may not simply be profit-maximizing. To simplify our analysis, both state and collective enterprises are still assumed to have profit-maximization behaviour.

(it acts as a leader), it will also operate at the lower marginal cost, c .

In this three stage game, there are three possible cases: (1) If both state and collective enterprises pre-commit their selling capacity before uncertainty is resolved, a Cournot-Nash equilibrium is resulted. It is called "committed Cournot-Nash" equilibrium. (2) If only one enterprise pre-commits its selling capacity, then a Stackelberg equilibrium is resulted. The enterprise which has pre-committed its selling capacity is called "committed leader". The enterprise which has chosen to wait until uncertainty is resolved is called "flexible follower". (3) If both enterprises choose not to pre-commit their selling capacity, another Cournot-Nash equilibrium is resulted. It is called "flexible Cournot-Nash" equilibrium. For all Cournot-Nash equilibria, only the symmetric equilibrium case is considered.

Committed Cournot-Nash Case

In this case, both state and collective enterprises pre-commit their selling capacity before uncertainty is resolved. In stage 3, only tiny individual enterprises are making decision. These tiny individual enterprises are all competitive firms which take prices given. They will continue to enter the market until they make no profit at equilibrium,

$$p_z = MC_z \implies p_z = \frac{a + b + u + \alpha(p_x + p_y)}{2}$$

In stage 2, the state enterprise solves the following problem

$$\max_{p_x} E(\Pi_x) = E[a - p_x + u + \alpha(p_y + p_z)](p_x - c) + \theta \quad s.t. \ p_y, p_z, c, u \text{ given.}$$

where θ is the government subsidy with the property that $\theta = 0(> 0)$ if $p_x - c \geq 0(< 0)$. It means that the government subsidy is positive/zero as long as the *ex post* profit is negative/positive. However, this model does not assume the presence of bankruptcy; therefore, θ can be dropped in all cases. The state enterprise solves the following problem

$$\max_{p_x} E(\Pi_x) = E[a - p_x + u + \alpha(p_y + p_z)](p_x - c) \quad s.t. \ p_y, p_z, c, u \text{ given.}$$

The first order condition is

$$p_x = p_x(p_y, p_z) = \frac{a + c + \alpha(p_y + E(p_z))}{2}$$

Similarly, the collective enterprise also solves this problem

$$\max_{p_y} E(\Pi_y) = E[a - p_y + u + \alpha(p_x + p_z)](p_y - c) \quad s.t. \ p_x, p_z, c, u \text{ given.}$$

The first order condition is

$$p_y = p_y(p_x, p_z) = \frac{(a + c + \alpha(p_x + E(p_z)))}{2}$$

The committed Cournot-Nash equilibrium is defined as follows: $\{p_x^{cc}, p_y^{cc}, p_z^{cc}\}$ solves both enterprises' problems and p_z^{cc} satisfies

$$p_z(p_x^{cc}, p_y^{cc}, u) = b + z^{cc} \quad \text{if } z^{cc} > 0 \quad (\leq b + z^{cc} \quad \text{if } z^{cc} = 0) \quad (3)$$

The equation above suggests that individual enterprises will stop moving into the market when the equilibrium price equals the marginal cost of the marginal individual enterprise, i.e. zero profit condition. All individual enterprises with marginal costs larger than the equilibrium price are forced out of the retail market.

By choosing a sufficiently small b , z^{cc} can always be positive. Consequently, it is impossible to completely drive out all individual enterprises by pre-committing a sufficiently large selling capacity. The committed Cournot-Nash equilibrium in this model is

$$p_x^{cc} = p_y^{cc} = \frac{(2 + \alpha)a + 2c + \alpha b}{2(2 + \alpha)(1 - \alpha)}, \quad E(\Pi_x^{cc}) = E(\Pi_y^{cc}) = \left[\frac{[(2 + \alpha)a + \alpha b + 2(\alpha^2 + \alpha - 1)c]}{2(2 + \alpha)(1 - \alpha)} \right]^2. \quad (4)$$

The equilibrium price p_z set by individual enterprises:

$$p_z = \frac{2\alpha(a + c) + (2 - \alpha)(a + b)}{2(2 + \alpha)(1 - \alpha)} + \frac{u}{2} \quad (5)$$

Flexible Cournot-Nash Case

In this case, both state and collective enterprises have chosen to wait until the uncertainty is resolved. In stage 3, the state enterprise solves the following problem

$$\max_{p_x} \Pi_x = [a - p_x + u + \alpha(p_y + p_z)](p_x - c^h) \quad \text{s.t. } p_y, p_z, c^h, u \text{ given.}$$

The first order condition is

$$p_x = p_x(p_y, p_z, u) = \frac{(a + c^h) + u + \alpha(p_y + p_z)}{2}$$

The collective enterprise also solves a similar problem

$$\max_y \Pi_y = [a - p_y + u + \alpha(p_x + p_z)](p_y - c^h) \quad \text{s.t. } p_x, p_z, c^h, u \text{ given.}$$

The first order condition is

$$p_y = p_y(p_x, p_z, u) = \frac{(a + c^h) + u + \alpha(p_x + p_y)}{2}$$

Those tiny individual enterprises enter the market until they make no profit at equilibrium,

$$p_z(p_x, p_y, u) = \frac{a + b + u + \alpha(p_x + p_y)}{2}$$

The flexible Cournot-Nash equilibrium is defined as follows: $\{x^{fc}, y^{fc}, z^{fc}\}$ solves both enterprises' problems and z^{fc} satisfies

$$p_z(p_x^{fc}, p_y^{fc}, u) = b + z^{fc} \quad \text{if } z^{fc} > 0 \quad (\leq b + z^{fc} \quad \text{if } z^{fc} = 0)$$

At flexible Cournot-Nash equilibrium, the sales of state and collective enterprise are

$$p_x^{fc} = p_y^{fc} = \frac{(2 + \alpha)a + 2c^h + \alpha b + (2 + \alpha)u}{2(2 + \alpha)(1 - \alpha)}. \quad (6)$$

The expected profits of state and collective enterprises:

$$E(\Pi_y^{fc}) = E(\Pi_x^{fc}) = \left[\frac{(2 + \alpha)a + \alpha b + 2(\alpha^2 + \alpha - 1)c^h}{2(2 + \alpha)(1 - \alpha)} \right]^2 + \frac{\sigma^2}{4(1 - \alpha)^2}. \quad (7)$$

At flexible Cournot-Nash equilibrium, the profits of both enterprises are influenced by the uncertainty parameter σ^2 . The higher the uncertainty, the larger their profits are. $\Pi^{fc} = \Pi^{cc} + \sigma^2/4(1 - \alpha)^2 \geq \Pi^{cc}$ for most of the cases. However, under low uncertainty and low substitutability among x , y and z , $\Pi^{cc} \geq \Pi^{fc}$. For example, when $\sigma^2 = \alpha = 0$, $\Pi^{cc} > \Pi^{fc}$ given $c^h > c$.

Stackelberg Case

In stage 3, the state enterprise which is assumed to be the follower (collective enterprise is now assumed to be the follower) solves the following problem⁴

$$\max_{p_x} \Pi_x = [a - p_x + u + \alpha(p_y + p_z)] \quad \text{s.t. } p_y, p_z, u \text{ given.}$$

The first order condition is

$$p_x = p_x(p_y, p_z, u) = \frac{(a + c^h + u) + \alpha(p_y + p_z)}{2}.$$

Those tiny individual enterprises enter the market until they make no profit at equilibrium,

$$p_z(p_x, p_y, u) = \frac{a + b + u + \alpha(p_x + p_y)}{2}.$$

In stage 2, the collective enterprise which is assumed to be the leader solves the following problem

$$\max_{p_y} E[\Pi_y] = E[a - p_y + u + \alpha p_x(p_y, p_z, u) + p_z](p_y - c) \quad \text{s.t. } c, u \text{ given.}$$

The first order condition is

$$p_y = p_y(p_x, p_z, u) = \frac{(2 + \alpha)(a + \alpha E(p_z)) + \alpha c^h + (2 - \alpha^2)c}{2(2 - \alpha^2)}. \quad (8)$$

⁴Obviously, a similar result will be obtained if collective enterprise is the leader.

By putting p_x in p_z , the following equation is obtained,

$$p_z = \frac{(2 + \alpha)(a + \alpha p_y + u) + \alpha c^h + 2b}{(2 + \alpha)(2 - \alpha)} \quad (9)$$

Similarly, p_x is further simplified as

$$p_x = \frac{(2 + \alpha)(a + \alpha p_y + u) + \alpha b + 2c^h}{(2 + \alpha)(2 - \alpha)} \quad (10)$$

The Stackelberg equilibrium of this model is defined as follows: $\{p_x^{se}, p_y^{se}, p_z^{se}\}$ solves the leader's and follow's problem and p_z^{se} satisfies

$$p_z(p_x^{se}, p_y^{se}, u) = MC_z = b + z^{se} \quad \text{if } z^{se} > 0 \quad (\leq b + z^{se} \quad \text{if } z^{se} = 0)$$

Equation (8), (9) and (10) determine the Stackelberg equilibrium of this system. By putting $E(p_z)$ in p_y , the leader's (collective enterprise) price at the Stackelberg equilibrium is

$$p_y = \frac{2[(2 + \alpha)a + \alpha(c^h + b)] + (2 - \alpha)(2 - \alpha^2)c}{2(2 - \alpha)(2 - \alpha^2) - \alpha^2(2 + \alpha)} \quad (11)$$

and its profit is

$$\Pi^L = \left[\frac{2[(2 + \alpha)a + \alpha(c^h + b)] - [(2 - \alpha)(2 - \alpha^2) - \alpha^2(2 + \alpha)]c}{2(2 - \alpha)(2 - \alpha^2) - \alpha^2(2 + \alpha)} \right]^2 \quad (12)$$

However, the formulae for the follower's equilibrium price, p_x , and profit, Π^F , are long and tedious. They are presented in the appendix I. Because the objective is to rank the equilibrium profits of enterprises at all equilibria, this problem is handled by using computer simulation. The details are also presented in the appendix II.

In the first stage, the timing decision of whether to pre-commit or to wait is based on the expected profits made in different equilibrium situations. The selection of equilibria depends on the cost differential $c^h - c$, especially, the magnitude of uncertainty σ^2 and the substitutability parameter α .

Proposition 1 *There are three equilibria which existence depends on the values of α and σ^2 : (1) Under low uncertainty (small σ) and low substitutability among x , y and z (small α), committed Cournot-Nash equilibrium is the unique equilibrium which is also the dominant strategy equilibrium. (2) Under either the case of medium uncertainty and low substitutability or the case of low uncertainty and high substitutability, there are two Stackelberg equilibria: Either the state enterprise is the leader or the collective enterprise is the leader. (3) Under either high uncertainty or high substitutability, flexible Cournot-Nash equilibrium is the unique equilibrium which is also the dominant strategy equilibrium.*

Proof: See appendix II.

Most of the cases observed in our numerical experiments presented in the appendix are Stackelberg equilibrium and flexible Cournot-Nash equilibrium. Committed Cournot-Nash equilibrium exists only in the case of very low uncertainty and low substitutability among x , y and z . In the numerical examples presented in the appendix, committed Cournot-Nash equilibrium disappears when $\alpha \geq 0.50$. However, Stackelberg equilibrium and flexible Cournot-Nash equilibrium are more robust to the choice of α and cost differential $c^h - c$. This proposition suggests the following picture: Under low uncertainty, equilibria in which one (Stackelberg leader) or both (committed Cournot-Nash) enterprises are willing to pre-commit are more likely to emerge. Nevertheless, under high uncertainty, flexible Cournot-Nash equilibrium in which none is willing to invest is the dominant outcome. As the Chinese government adopted a gradual pace in reforming its distribution system, it can achieve its target of minimizing the shocks inevitably created in the reform process. Under such a low uncertainty environment, enterprises were motivated to pre-commit their investment which, in the end, sustained a robust and healthy growth of the distribution sector. Its total retail sales (deflated by the national retail price index) has been growing at an annual rate of 6.4% from 1978 to 1992.

In this model, the presence of a competitive fringe of small individual enterprises is crucial in affecting the market structure. The improvement in their efficiency by reducing the parameter b of their aggregate marginal cost over time can have the follow impacts.

Proposition 2 *When the small individual enterprises improve their operating efficiency by a reduction of marginal costs (represented by a reduction in b), as long as $\alpha > 0$, it will (1) reduce the retail prices (p_x , p_y and p_z), profits of the state and collective enterprises ($E\pi_x$, $E\pi_y$) and (2) increase their own aggregate sales (z) and the total provision of goods (Q) at all equilibria.*

The proof of this proposition is obvious by observing the solutions at each equilibrium. Intuitively, the price reduction of individual enterprises forces the other two enterprises to follow suit and results in reductions of their profits. Nevertheless, in the end, price reduction of individual enterprises benefits the whole society by delivering lower retail prices and more goods to consumers at all equilibria. The presence of individual enterprises simply makes the retail market more competitive and pressurizes the state and collective enterprises to match the increases in the productivity of individual enterprises in order to keep their market shares.

Proposition 2 explains how these individual enterprises have achieved a spectacular growth since the implementation of the economic reform in 1978. In Figure 1a, the market

share of individual enterprises was close to zero in 1978 and it has grown, at the expense of the state and collective enterprises, rapidly to more than 20% in 1992! Since the individual enterprises did not receive any aid from the government, such an autonomous development was achieved mainly by their own efforts in improving their productivity in providing better services to consumers. Moreover, this development is improving the social welfare not only by reducing retail prices and by increasing product provision but also by forcing the state and collective enterprises to improve their efficiency in order to survive in a more competitive retail market. The Chinese government policy of encouraging the growth of these individual enterprises distinguishes its reform policy from its East European counterparts because this reform policy successfully develops a healthy and competitive retail sector. Moreover, the presence of individual enterprises continually adds flexibility and competitiveness to the distribution system because these small enterprises have higher adaptability to the changing market conditions (Chow 1995a, 1996). Competition caused by entry and exit of enterprises is the largest factor that determine the performance of all retailing enterprises in China (Chow 1995b).

In contrast to the Chinese model, the East European reform model has created big changes in the political and economic environment and created high uncertainty in the retail market. Such an approach is highly unfavourable for investors or enterprises to commit their investment. Moving hastily from a centrally-planned economy to a market economy may sound like a good idea but it may create problems of under-investment. High uncertainty may further delay or even damage the development of the retail sector due to the lack of productive investment which is capable of sustaining its growth. With a depressing distribution sector, it can jeopardize the whole economic reform. The failure of Gorbachev's *perestroika* is a typical example of this problem.

Conclusion

The economic reform pursued by the Chinese government is remarkably different from what the East European countries have implemented. The Chinese model emphasizes competition over privatization. The loss-making state enterprises are replaced not by extensive privatization in the short run, but by being gradually outcompeted and outgrown by other non-state enterprises in the long run. Such a reform strategy has been working well in China although it is not advocated by many western economists and businesspeople. The purpose of this paper is to explain why the Chinese reform model is working well in her retail sector.

This paper suggests that the success of the Chinese distribution reform is due to at least two factors: (1) a successful use of market forces of entry and competition by intro-

ducing non-state enterprises like collective and individual enterprises into the retail sector, and (2) a gradual pace of reform. The first factor create a competitive environment. A keener competition forces all enterprises to lower their selling prices which reduce their profits but deliver more goods and services to consumers. At the same time, competitive pressure forces inefficient enterprises to work hard to improve their efficiency in order to survive in the market. The second factor encourages enterprises to commit more investment which is important for the rapid development of the retail sector. The model of this paper predicts that the 'big bang' approach may create more uncertainty which keeps enterprises from committing their investment. However, a gradual reform can minimize the inevitable shocks created in the reform process so as to stimulate enterprises to commit their investment.

Since a system of well-defined property rights gives proper incentives to managers and workers to operate within an organization, the absence of well-defined property rights may sooner or later harm the development process when the Chinese economy advances to a more developed stage in which all available sources of growth have been exhausted. Further efficiency gains and growth may have to be resulted from a better definition of property rights. The Chinese government can hardly ignore this problem and should plan to carry out this reform of property rights in the near future.

Further research should be undertaken to empirically test the validity of the hypothesis that uncertainty can have a significant and negative effect on investment. It may be difficult to quantify uncertainty and our suggestion is to use inflation rate to approximate this uncertainty. Since most of transition economies are suffering from high inflation which major impact is the uncertain changes in relative prices for retailers. As a result, higher inflation should lead to higher uncertainty to retailers. If such a proposition is valid, one should measure the impact of uncertainty on investment for each type of enterprises.

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APPENDIX

(I) Stackelberg's follower's price and profit

Putting the Stackelberg leader's price into the follower's pricing function, the follower's price and profits are obtained,

$$\begin{aligned}
 p_x &= \frac{(2-\alpha)(4+2\alpha-\alpha^2)a + \alpha(2+\alpha)(2-\alpha^2)(5-2\alpha)b + 4(2-\alpha)(2-\alpha^2)c^h + M}{(2+\alpha)(2-\alpha)[2(2-\alpha)(2-\alpha^2) - \alpha^2(2+\alpha)]} + \frac{u}{2-\alpha} \\
 p_z &= \frac{(2-\alpha)(4+2\alpha-\alpha^2)a + \alpha(2+\alpha)(2-\alpha^2)(5-2\alpha)c^h + 4(2-\alpha)(2-\alpha^2)b + M}{(2+\alpha)(2-\alpha)[2(2-\alpha)(2-\alpha^2) - \alpha^2(2+\alpha)]} + \frac{u}{2-\alpha} \\
 \Pi^F &= \left[\frac{(2-\alpha)(4+2\alpha-\alpha^2)a + \alpha(2+\alpha)(2-\alpha^2)(5-2\alpha)b + [\alpha^2(2+\alpha)^2 - 2(2-\alpha^2)]c^h + M}{(2+\alpha)(2-\alpha)[2(2-\alpha)(2-\alpha^2) - \alpha^2(2+\alpha)]} \right]^2 \\
 &\quad + \frac{u^2}{(2-\alpha)^2}
 \end{aligned}$$

where $M = (2+\alpha)(2-\alpha)(2-\alpha^2)c$.

(II) Ranking the Equilibria

The expected profits of state and collective enterprises derived from each equilibrium depend on an uncertainty parameter, σ^2 . This parameter directly affects the expected profits of the enterprises which take a 'wait and see' stand: the follower in the stackelberg equilibrium and the players in the flexible Cournot-Nash equilibrium. Although one can construct numerous cases by arbitrarily choosing different values for the parameters, what is important is to determine the ranking of each equilibrium profits. It substantially reduces the number of cases that are needed to be studied. It is found that the following cases appear repeatedly. Let us consider these examples: The values of a , b and c are fixed at 20, 10 and 2 respectively. The differences between c^h and c , $c^h - c$ are set to be 1, 0.1 and 0.01. In addition, three values of $\alpha = 0.25, 0.50, 0.75$ are also considered. σ^2 are allowed to vary so as to rank the equilibrium expected profits of state and collective enterprises case by case:

(1) Under $c = 2.0$, $c^h = 3.0$, $\alpha = 0.25$, the following rankings (σ^2 is increasing (from zero) as we are moving down the rows of inequalities) are obtained

- (i) $\Pi^L > \Pi^{cc} > \Pi^{fc} > \Pi^F$,
- (ii) $\Pi^L > \Pi^{fc} > \Pi^{cc} > \Pi^F$,
- (iii) $\Pi^L > \Pi^{fc} > \Pi^F > \Pi^{cc}$,
- (iv) $\Pi^{fc} > \Pi^L > \Pi^F > \Pi^{cc}$,
- (v) $\Pi^{fc} > \Pi^F > \Pi^L > \Pi^{cc}$.

The ranking of each equilibrium is reported in Table A1 from 1 (highest) to 4 (lowest). The first entry in each cell is the state enterprise's ranking of that cell, the second entry is the ranking of the collective enterprise.

[Insert Table A1]

Under (i) and (ii), there is only one committed Cournot Nash equilibrium which is also a dominant strategy equilibrium. Under (iii), there are two Stackelberg equilibria: state enterprise is the leader and collective enterprise is the leader. Under (iv) and (v), there is also only one flexible Cournot Nash equilibrium which is also a dominant strategy equilibrium.

(2) Under $c = 2.0$, $c^h = 3.0$, $\alpha = 0.50$, the following rankings (σ^2 is increasing (from zero) as we are moving down the rows of inequalities) are obtained

- (i) $\Pi^L > \Pi^F > \Pi^{cc} > \Pi^{fc}$,
- (ii) $\Pi^L > \Pi^F > \Pi^{fc} > \Pi^{cc}$,
- (iii) $\Pi^L > \Pi^{fc} > \Pi^F > \Pi^{cc}$,
- (iv) $\Pi^{fc} > \Pi^L > \Pi^F > \Pi^{cc}$,
- (v) $\Pi^{fc} > \Pi^F > \Pi^L > \Pi^{cc}$.

The ranking of each equilibrium is reported in Table A2.

[Insert Table A2]

Under (i), (ii) and (iii), there are two Stackelberg equilibria: state enterprise is the leader and collective enterprise is the leader. Under (iv) and (v), there is also only one flexible

Cournot Nash equilibrium which is also a dominant strategy equilibrium. The same ranking is achieved for the cases of $c = 2.0, c^h = 2.1, \alpha = 0.50$; $c = 2.0, c^h = 2.01, \alpha = 0.25$ and $c = 2.0, c^h = 2.01, \alpha = 0.50$.

(3) Under $c = 2.0, c^h = 3.0, \alpha = 0.75$, the following rankings (σ^2 is increasing (from zero) as we are moving down the rows of inequalities) are obtained

- (i) $\Pi^L > \Pi^F > \Pi^{fc} > \Pi^{cc}$,
- (ii) $\Pi^L > \Pi^{fc} > \Pi^F > \Pi^{cc}$,
- (iii) $\Pi^{fc} > \Pi^L > \Pi^F > \Pi^{cc}$,
- (iv) $\Pi^{fc} > \Pi^F > \Pi^L > \Pi^{cc}$.

The ranking of each equilibrium is reported in Table A3.

[Insert Table A3]

Under (i) and (ii), there are two Stackelberg equilibria: state enterprise is the leader and collective enterprise is the leader. Under (iii) and (iv), there is also only one flexible Cournot Nash equilibrium which is also a dominant strategy equilibrium. The same ranking is achieved for the cases of $c = 2.0, c^h = 2.1, \alpha = 0.75$ and $c = 2.0, c^h = 2.01, \alpha = 0.75$.

(4) Under $c = 2.0, c^h = 3.0, \alpha = 0.25$, the following rankings (σ^2 is increasing (from zero) as we are moving down the rows of inequalities) are obtained

- (i) $\Pi^L > \Pi^{cc} > \Pi^F > \Pi^{fc}$,
- (ii) $\Pi^L > \Pi^F > \Pi^{fc} > \Pi^{cc}$,
- (iii) $\Pi^L > \Pi^F > \Pi^{fc} > \Pi^{cc}$,
- (iv) $\Pi^L > \Pi^{fc} > \Pi^F > \Pi^{cc}$,
- (v) $\Pi^{fc} > \Pi^L > \Pi^F > \Pi^{cc}$,
- (vi) $\Pi^{fc} > \Pi^F > \Pi^{cc} > \Pi^L$.

The ranking of each equilibrium is reported in Table A4.

[Insert Table A4]

Under (i), there is only one committed Cournot Nash equilibrium which is also a dominant strategy equilibrium. Under (ii) and (iii), there are two Stackelberg equilibria: state enterprise is the leader and collective enterprise is the leader. Under (iv) and (v), there is also only one flexible Cournot Nash equilibrium which is also a dominant strategy equilibrium. As a result, proposition one is easily obtained.

1a Market Shares

1b Profits and investment

1c Labour productivity

Table A1 Payoff matrices under $a = 20, b = 10, c = 2.0, c^h = 3.0, \alpha = 0.25$
('*' - Nash equilibrium)

(i)		Collective		(ii)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	2, 2*	1, 4		Commit	3, 3*	1, 4
State	Flexible	4, 1	3, 3		Flexible	4, 1	2, 2

(iii)		Collective		(iv)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4, 4	1, 3*		Commit	4, 4	2, 3
State	Flexible	3, 1*	2, 2		Flexible	3, 2	1, 1*

(v)		Collective	
		Commit	Flexible
State	Commit	4, 4	3, 2
State	Flexible	2, 3	1, 1*

Table A2 Payoff matrices under $a = 20, b = 10, c = 2.0, c^h = 3.0, \alpha = 0.50$
('*' - Nash equilibrium)

(i)		Collective		(ii)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	3, 3	1, 2*		Commit	4, 4	1, 2*
State	Flexible	2, 1*	4, 4		Flexible	2, 1*	3, 3

(iii)		Collective		(iv)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4, 4	1, 3*		Commit	4, 4	2, 3
State	Flexible	3, 1*	2, 2		Flexible	3, 2	1, 1*

(v)		Collective	
		Commit	Flexible
State	Commit	4, 4	3, 2
State	Flexible	2, 3	1, 1*

Table A3 Payoff matrices under $a = 20, b = 10, c = 2.0, c^h = 3.0, \alpha = 0.75$
('*' - Nash equilibrium)

(i)		Collective		(ii)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4,4	1, 2*		Commit	4,4	1, 3*
State	Flexible	2, 1*	3,3		Flexible	3, 1*	2,2

(iii)		Collective		(iv)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4,4	2,3		Commit	4,4	3,2
State	Flexible	3,2	1, 1*		Flexible	2,3	1, 1*

Table A4 Payoff matrices under $a = 20, b = 10, c = 2.0, c^h = 2.1, \alpha = 0.25$
('*' - Nash equilibrium)

(i)		Collective		(ii)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	2, 2*	1,3		Commit	3,3	1, 2*
State	Flexible	3,1	4,4		Flexible	2, 1*	4,4

(iii)		Collective		(iv)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4,4	1, 3*		Commit	4,4	2,3
State	Flexible	3, 1*	2,2		Flexible	3,2	1, 1*

(v)		Collective		(vi)		Collective	
		Commit	Flexible			Commit	Flexible
State	Commit	4,4	3,2		Commit	4,4	3,2
State	Flexible	2,3	1, 1*		Flexible	2,3	1, 1*