INCONSISTENCIES IN CHINA'S SOCIALIST DEVELOPMENT STRATEGIES

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ABSTRACT

China's struggle along the road to material prosperity has been long and arduous. Economic problems emerge from the leadership's desire to accommodate competing objectives, which leads to the implementation of inconsistent policies. These inconsistencies have arisen under both the Maoists and reformists, and form the basis of this thesis.

In his radical phase, Mao emphasised ideological objectives such as the moulding of a new, socialist human being. Given that people's preferences could not be changed quickly, partial concessions were made to tap material self-interest to maintain work incentives. Private plots were placed side-by-side with collectives, and, at other times, peasants received income rewards for displays of altruism and generosity to others. We suggest that Mao's development goals (such as transforming preferences) were inconsistent with the means implemented to realise other desired goals (such as using private plots and material rewards to increase output). For the Maoist experiment in preference transformation, in particular, the inconsistency of means and goals contributed to China's relative economic stagnation during this period.

The thesis tests this view by comparing China's agricultural performance in the Maoist and reform periods. An important difference between the two concerns the economic impact of collectives versus that of the household responsibility system. Our econometric evidence supports the view of economic stagnation under Maoism, where we attempt to demonstrate the benefit of realigning prevailing attitudes toward work and income with a reward system emphasising individual material self-interest.

These issues lead to the second major part of the thesis, concerning the nature of China's economic reforms. We again highlight an inconsistency in China's evolving development path, this time by showing how problems can arise if reform is incomplete. In particular, the thesis focuses on the interactions between agriculture, rural industry and state industry. We attempt to show that the goal of protecting elements of the "socialist" economy, such as state enterprises, imposes costs on other sectors, especially those in the non-state sector. These costs in turn reduce the growth rate of private sector activity and potentially compromise the rate of economic growth, including, paradoxically, that of the state industrial sector.

Statement of Authorship

This work contains no material which has been accepted for the award of any degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

Steven Lim

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CHAPTER ONE: INTRODUCTION

China's struggle along the road to socialism and material prosperity has been long and arduous. The struggle has taken many turns as opposing factions in the Party leadership have jockeyed for political supremacy and stamped their authority on economic policy. These policies have swung wildly, with Mao's reliance on ideology, mobilisation and limited market relations contrasting starkly with Deng's market-oriented economic reforms. In judging the economic success of the two development strategies, mainstream economists overwhelmingly favour the reformist approach. The Maoist experiment is deemed to be utopian, while Deng's emphasis on economic openness, accountability and individual responsibility accord much more with standard economic views of the use of the market mechanism and the institutions required to support it.

Despite the relative success of the reformist policies, neither faction has demonstrated an ability to solve China's economic problems in a fully consistent way. This problem arises principally because both groups seek or have sought to accommodate multiple objectives simultaneously, where these objectives tend to conflict with one another over time. With the Maoist approach the problems are well known. In his radical phase, Mao attempted to unleash the creative potential

of the masses by moulding a new, socialist human being; this would act as the catalyst in the drive for economic development. To change the way in which people think and act, Mao hastened to socialise the relations of production: private ownership of the means of production was negated, non-material incentives were introduced, and new organisational forms such as communes and a planned economy replaced more market-oriented institutions. The severe limits placed on markets retarded output growth overall, given that, among other things, the socialised relations of production were inconsistent with the prevailing attitudes and incentives of the Chinese people themselves.

In repudiating the policies of the Maoists, the reformists emphasised greater use of market forces. Yet even in the economic realm the reformist leadership has exhibited dictatorial and capricious behaviour, which has conflicted at times with the running of an increasingly market-oriented economy. The opposing economic, political and social objectives of the reformists currently inhibit the emergence of a fully liberalised economy, with reforms tending to be piecemeal. Inconsistent, piecemeal reforms in turn impose costs on the economy as economic behaviour is distorted and the growth process is retarded.

This thesis focuses on inconsistency in each of the Maoist and reformist development strategies. The first inconsistency relates to Mao's inability to induce changes in people's consciousness under the commune system. As discussed in Chapter Two, there is a reasonably well developed literature on the disincentive

effects of (Maoist) income-sharing work reward systems in collectives. This literature takes as its starting point the assumption of individual, material self-interest of Chinese economic agents. When such attitudes are coupled with egalitarian, ideologically driven reward systems, rational peasants are shown to reduce their labour contributions to the collective.

This literature fails to address the prior question of why economic models of peasant behaviour are based on individual material self-interest in the first place. We seek to fill this gap by analysing the formal conditions under which a transformation of consciousness might be possible, such that rational economic man becomes more altruistic and self-sacrificing, and ask if such a transformation is likely to be sustainable. We suggest that a short-run change in consciousness may be possible under special conditions, but that in the longer term heightened consciousness is not likely to be sustained.

This result stems from an inconsistency in the radical Maoist strategy. Mao emphasised ideological objectives, but partial concessions were made to tap material self-interest to prevent work incentives from declining precipitously. Private plots were placed side-by-side with collectives; at other times, peasants received income rewards for displays of altruism and generosity to others. We suggest that adverse outcomes arise when the development goals (such as a "new socialist man") are inconsistent with the means implemented to realise other desired goals (such as using private plots and material rewards to increase output).

For the Maoist experiment in heightening consciousness, in particular, the inconsistency of means and goals contributed to China's relatively lacklustre economic performance during this period. The contribution of this discussion then is twofold. Along with modelling in much more depth the inconsistencies in the radical Maoist model, we highlight how the failure to develop or sustain a heightened socialist consciousness can also lead to a stagnation in output.

Chapter Three tests the stagnation hypothesis by comparing China's agricultural performance in the Maoist and reform periods. An important difference between the two relates to the economic impact of collectives relative to that of the household responsibility system (HRS). The link between the responsibility system and increased agricultural output is well known, and a number of important studies have attempted to confirm this link using traditional econometric techniques.

The novelty of our quantitative investigation of the HRS-output link lies in the use of recently developed econometric techniques. Previous econometric work in this area might now be considered inadequate in view of the critique of the conventional time-series methodology. Our use of cointegration techniques seeks to redress this inadequacy. The cointegration results of Chapter Three support the stagnation hypothesis, suggesting that China would gain from realigning prevailing attitudes toward work and income with a system of individual, material rewards.

The theoretical and empirical work in this thesis regarding human preferences has important implications for the way in which economists view the results of economic models and their implications for policy. If preferences could be changed such that people became more selfless and hardworking, then our standard views on the use of markets, private property rights, principal-agent problems and individual incentives as mechanisms for economic growth would need to be re-evaluated. By studying why such changes in preferences are so difficult to generate and sustain, we gain more confidence in the relevance of the standard neoclassical assumptions of human behaviour underpinning mainstream economic theory and policy.

These issues and the resulting stagnation hypothesis lead to the second major part of the thesis: the nature of China's economic reforms. Chapter Four stresses the need for fundamental economic reform. We again highlight an inconsistency in China's evolving development path, this time by showing how problems can arise if the market reform is incomplete. In particular, Chapters Five and Six focus on the interactions between agriculture, rural industry and state industry. We attempt to show that the failure to reform elements of the "socialist" economy, such as state enterprises, imposes costs on other sectors. The protection of state industry imposes costs on the non-state sector. These costs in turn reduce the growth rate of private sector activity and potentially compromise the rate of economic growth, including, paradoxically, that of the state industrial sector.

Understanding these intersectoral interactions is vital from a policy perspective, but the interactions do not appear to have been modelled extensively in the literature of the Chinese economy. The dynamic models presented in this thesis seek to deepen our understanding of the positive and negative linkages between major sectors in the Chinese economy, and do this in a way that is simple and parsimonious. From the models we generate a number of important policy implications in reducing the inconsistencies and conflicts associated with China's piecemeal reforms. The models also suggest an extension of this area of research, particularly in the direction of further quantitative work to verify the propositions derived in the thesis. Chapter Seven concludes.

CHAPTER TWO: A PROBLEM WITH TRANSFORMING CONSCIOUSNESS

"Apart from their other characteristics, the outstanding thing about China's 600 million people is that they are 'poor and blank'. This may seem a bad thing, but in reality it is a good thing.... On a blank sheet of paper free from any mark, the freshest and most beautiful characters can be written, the freshest and most beautiful pictures can be painted."

- Mao Zedong, 1958.

2.1 Introduction

Economists have made significant contributions to explaining the poor performance of socialist economic systems. The performance problems mainly relate to the incompatible pairing of socialist institutions and incentives with people's materially self-interested behaviour. This incompatibility gives rise to inefficiencies in central planning, with poor incentives to work, innovate and take

responsibility for one's actions. Similarly, in collective farms the motivational problems involve principal-agent problems, egalitarianism in team income-sharing and adverse price distortions. The imposition of socialist organisation, property rights and reward structures leads rational, self-interested people to deliver outcomes that are suboptimal from the viewpoint of the state.

But what if people could be invested with socialist consciousness, such that altruism, hardwork and a moderation of wants become internalised norms? Many of the mainstream economic criticisms of socialism would disappear. In this respect a dynamic socialism, one that is consistent with an eventual transition to communism, stands or falls on its ability to transform consciousness; this explains why socialists have expended so much effort on moulding people's preferences. The objective of this chapter is to suggest, however, that even if people were capable of changing the way in which they think and act, an inconsistency in the path of socialist development can emerge to hinder or preclude the long-term heightening of consciousness. If correct, such a view might represent a sufficient condition for rejecting socialism's historical role in the transition to communism. This approach seeks to complement the existing mainstream economic analysis of the failure of socialism and extends the literature by highlighting the problems of transforming preferences in a "dynamic" socialism.

The radical Maoist development strategy is adopted as a case study, since its failure highlights a potential inconsistency inherent in socialism. The high tide of radical

Maoism was arguably one of history's most intense and protracted attempts at social engineering at a national level. Two distinct lines of enquiry have explored the nature of the strategy. The first line, popularised in the 1960s and 1970s, adopted a reasonably sympathetic view of the Maoist experiment. A number of Western commentators have suggested that some Chinese during the Maoist period underwent an identity transformation, with the heightening of socialist consciousness (eg., Chan 1985:1, Gurley 1975:458, Kraar 1974:60, Maxwell 1975:488, Robinson 1970:34, Robinson 1974:58, Schurmann 1968:50).

By the early 1980s, an opposing research line became much more evident. In the growing literature on the output effects of the economic reforms, the contributors implicitly assumed that Chinese economic agents were driven by individual, material self-interest and that work effort would fall in the absence of a reward system tailored to exploit such self-interest (papers by Lin (1987, 1990, 1992), Putterman (1988, 1991), McMillan, Whalley and Zhu (1989) and Dong and Dow (1993) are notable examples). Principal-agent problems (such as those associated with the high monitoring costs of collective farming) and ideology-based egalitarianism in team income-sharing became central in explaining China's relatively poor agricultural performance as the relations of production became more socialised. Given the spatial dispersion of collective farming activities, monitoring costs were high and difficulties emerged in measuring each individual's contribution to output; for this and other reasons interworker income payment differentials became compressed. Productive workers recognised that they were

being short changed and partially withdrew from collective labour activities. In this view, declining output was the result of an incompatibility between the socially advanced work incentives, ownership system and organisation of the collectives on the one hand and the capitalist nature of the Chinese peasants on the other.

It would be tempting to accept this mainstream economic view of individual self-interest; the reports of Chinese internalising socialist norms could then be discarded as Maoist propaganda or wishful thinking on the part of sympathetic Western scholars. However, biologists have proposed how dimensions of heightened consciousness such as altruism may arise (eg., Boorman and Levitt 1980, Cohen and Eshel 1976, Eshel and Motro 1981, Hamilton 1964), as have philosophers such as Schmidtz (1993).

Some psychologists and sociologists have suggested that altruism is in part learned. Masters (1978:71) contends that cultural norms are very important in reinforcing appropriate behaviours in human societies, including altruism. The interaction between learned expectations of social norms and personal experience in the socialisation process generates personal norms. By influencing the sense of responsibility for undertaking an altruistic act, such norms help determine the extent of altruistic behaviour (Bar-Tal 1976:46; s.a. Grusec 1991, Kaufmann 1970); conforming to (internalised) altruistic norms can also elicit pride and enhanced self-esteem on the part of the altruist.

Economists have contributed to the discussion as well, with Bergstrom and Stark (1993), Simon (1993) and Sugden (1993) suggesting that altruistic preferences can prevail in a supportive group or organisational environment; Singh (1995) suggests that even unilateral altruism may be beneficial. Becker's economic model explains the survival of altruism towards unrelated neighbours or co-workers (Becker 1976:826), while Bergstrom (1995) explains altruism in terms of individuals copying successful altruistic role models. Casson contends that preferences and beliefs are malleable, with individuals subjected to common influences (or culture) tending to adopt similar attitudes. The efficiency payoff from encouraging altruism and honesty relates to the reduction in transactions costs, compensation for missing property rights and improvement in the coordination of different individuals' decisions (Casson 1993:420). Buchanan (1995) and Ruttan (1988) also acknowledge the cultural determinants of economic performance, with Ruttan suggesting that cultural endowments, including ideology, influence the supply of institutional innovation (Ruttan 1988:250).

Basu echoes this view, suggesting that the survival or demise of social norms can contribute to the success or failure of economies (Basu 1995:20). Norms that promote economic growth may be stable from an evolutionary perspective. For example, people may be taught to be honest in business dealings with others. This norm is immune from invasion by individuals with other norms, since people refrain from transacting with someone identified as being dishonest. Honesty

becomes a useful norm, since society benefits in the long run (Basu 1995:31). In a similar way, altruistic norms might evolve and be evolutionary stable.

Sen (1994:387) suggests that individual beliefs of work responsibility can vary widely across societies, and even within a given society people can be both self-interested and altruistic (Becker 1981). Bikhchandani, Hirshleifer and Welch (1992:993) outline mechanisms to induce uniform social behaviour, such as sanctions on deviants, conformity preference and communication (to explain the benefits of alternative behaviours). Communication and education serve to mould behaviour: "One of the functions of education seems to be to reduce people's mental and emotional dependence on the continuation of the status quo, or in economic terms to increase the elasticity of substitution of their preferences" (von Weizsacker 1971:371). All these methods were employed during the high tide of radical Maoism. Such views invite a reconsideration of our mainstream economic beliefs; perhaps a successful transformation of consciousness in China may have been possible after all.

If so, an immediate question arises: why was it that, after almost three decades of socialism and at times unrelenting political education, the Chinese people responded so enthusiastically to "capitalist" incentives with the introduction of economic reform? Our proposed answer involves a synthesis of the above two lines of enquiry and emphasises the problems in raising and maintaining socialist consciousness. The problems arise from fundamental inconsistencies within

socialism as it seeks to bridge capitalism and communism. Under radical Maoism (see White 1993:23), peasants were given material rewards to induce selflessness and other manifestations of socialist consciousness (Breth and Ward 1982:129). The application of material rewards had the potential to reinforce existing capitalist tendencies in the peasantry. Such inconsistencies may drive the level of socialist consciousness to zero over time.

As a corollary of the proposition that there is a low level of socialist consciousness, advanced socialisation of the relations of production becomes inappropriate, leading to slower output growth. Thus, the chapter contributes to explaining the failure of Mao's radical socialism as follows. The Maoist strategy fails to raise and maintain the level of socialist consciousness due to an inherent inconsistency in the strategy. By pushing forward more socialised relations of production, the relations become incompatible with the prevailing low level of consciousness, leading to economic stagnation. Stagnation in turn causes disillusionment with socialism and compounds the difficulties in raising consciousness above a capitalistic level. The subsequent introduction of economic reform meets with success because it realigns market-oriented economic institutions and incentives with the prevailing capitalist consciousness.

By investigating the problems associated with the Maoist strategy, the chapter seeks to gain insights into, and lend support to, the material self-interest assumption adopted by authors such as Lin, Putterman, and Dong and Dow. With

the exceptions of Sen (1966) and Chinn (1979), there appears to have been little formal analysis of preference formation under Maoism (see also Putterman 1989). It is this gap in the literature that the discussion attempts to fill. The modelling generates some interesting results, suggesting that even if an increase in the socialist consciousness of economic agents is observed, it does not necessarily follow that such consciousness will prevail over time. The reported observations of heightened consciousness in the 1960s and 1970s need not foreshadow a future prevailing socialist consciousness; behaviour may eventually "regress" to the material self-interest assumed by Lin and others.

The failure to raise consciousness is linked to the failure to realise adequate economic growth - the model developed below thus complements the vast literature on the deficiencies of command economies. The forced introduction of planning mechanisms in the national economy was justified by Mao on economic and ideological grounds. The ideological rationale involved the apparent incompatibility of markets with the heightening of consciousness; markets were associated with private property rights and individual, material self-interest, both of which were deemed to be inimical to a dynamic socialism. But to the extent that the evolution of the market is a spontaneous outcome of a society's need to allocate resources efficiently, the limiting of market relations had severe effects on China's economic growth. The model seeks to demonstrate that this in turn reduced the propensity of the Chinese to engage in altruistic behaviour. By negating markets

on ideological grounds, Mao indirectly sowed the seeds for the collapse of his strategy to build a new socialist human being.

2.2 The goal of communism

An ideal communist society is characterised by true freedom. In its Marxist-Leninist conception, such freedom includes the abolition of property, the elimination of class oppression and all social distinction, and the "withering away" of the state (Nove 1986:3,4). Markets, money and prices are negated under communism, such that the distribution of output is on a need basis at zero price (Breth and Ward 1982:18). In the economic realm the purported freedom manifests itself as the negation of scarcity, which in turn is predicated upon two factors: *a rising material-technical base (economic development) and the heightening of consciousness.*

Changes in the material-technical base directly influence the production frontiers bounding an economic system. The Maoists, however, in contrast to economists of a "mainstream" persuasion, have been obliged to incorporate and move beyond the technical and physical relationships embodied in the production function, for the elimination of scarcity also requires the transformation of man. Rather than accepting egoistic behaviour as given and immutable, Mao proceeded from the

Marxist notion that the social matrix determines consciousness. Changes in property, organisational and motivational relations were implemented to elicit heightened consciousness - that is, to produce a moderation of wants, so as not to outstrip the capacity of the economic system to meet those wants; to motivate economic agents not by an appeal to egoism, but to altruism; and to foster enthusiasm for work and the spirit of cooperation and self-sacrifice.

It is within the context of creating of a "new socialist man" that the rural people's communes assume importance. Mao argued that the implementation of the commune system was necessary in terms of the dialectical process between the forces and the relations of production. The relations of production refer to the way in which individuals relate to each other in the process of material production and include the set of property, organisational and motivational relations. Changes in the relations of production would form a decisive, independent variable in the development process. Such changes, together with the inspirational leadership of the Party, would spur rural economic development by destroying any remnants of the bourgeois superstructure, raising the ideological consciousness of the masses and unleashing the latent energy and creative potential of China's peasants (eg., see Anon. 1975, Gurley 1976:133).

The commune would act as the ladder to communism. Cooperation would start to replace competition as peasants would no longer labour individualistically, but would work within and identify with the wider group. With the abolition of private

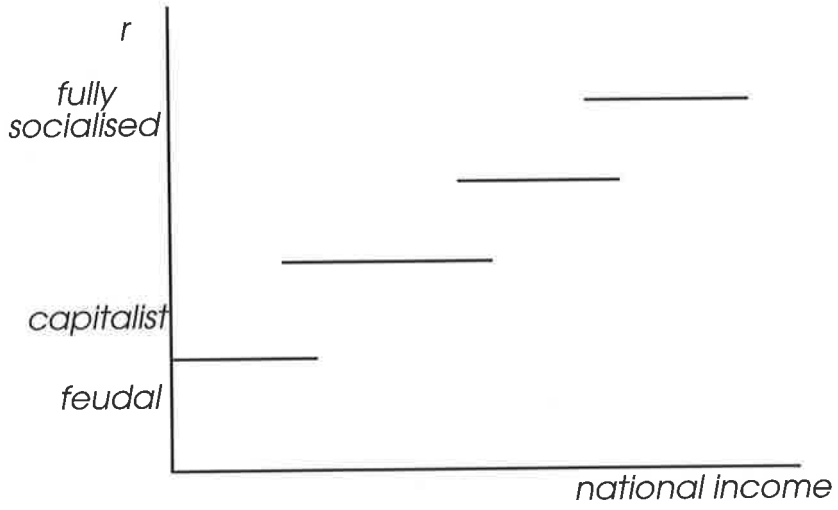
ownership of the non-labour means of production, it was hoped that peasants would work for the good of the collective, since individual reward depended not solely on individual effort, but also on team performance. Egalitarianism in income distribution would act to check capitalist restoration and to establish the foundations for comradeship and generosity. Political awareness, self-sacrifice and altruism would become internalised norms with the receding of individual self-interest. Thus, advances in the relations of production, from individual family farms to cooperatives and then to the commune, together with the changes in motivational and property relations that this entailed, would serve to both heighten consciousness and raise output. Mao's version of socialism would serve in this way as a transitional phase in realising the eventual goal of communism.

2.3 The Maoist model

Mao's idealised development strategy was to follow a wave-like pattern of revolutionary upsurge, consolidation and upsurge. Upsurge, or advances in the relations of production, would raise the consciousness of economic agents, who would work harder and increase output during the consolidation phase. Subsequently, a new round of revolutionary activity would be unleashed, socialist consciousness and output would again increase, and so on. Approaching the goal of communism, the economic system would be characterised by fully socialised relations of production, heightened consciousness and a highly developed material-

technical base. Van Ness and Raichur (1983) summarise this wave-like strategy in Figure 2.1, where *r* stands for the relations of production.

Figure 2.1 The Maoist path to communism



The specific changes in the relations of production to be considered relate to the organisation of an economic unit, such as a village, engaging in agricultural production. Given that the relations of production encompass organisational, property and motivational relations, let the village subject to *"capitalist"* relations of production comprise a system of individual family farming, where ownership of the means of production is private and the work reward system is based on individual, material incentives.

At the other extreme, let the same village characterised by *"fully socialised"* relations of production engage in collective farming, with group ownership of the

non-labour means of production and a work motivation system promoting internal, non-material incentives. Points between capitalist and fully socialised relations of production correspond to a mixture of capitalist and socialist relations of production, such as the coexistence of team farming and private plots or the use of material and non-material rewards within the collectivised village. Table 2.1 summarises the discussion of the relations of production.

Table 2.1 *The relations of production*

	Relations of production		
	capitalist		**fully socialised**
organisation	family farm	collective, private plot	collective
ownership	private	group, private	group
incentives	individual, material	group material/non-material, individual material	group, non-material

The discussion here initially focuses on an *idealised* Maoist system, where the relations of production augment the productivity of labour through heightened consciousness. From a Maoist perspective, the efficiency gains accrue from two sources. The first relates to the reaping of scale economies, such as in the

provision of irrigation and other infrastructural facilities as agricultural production becomes increasingly collectivised (eg., see Sicular 1992:346). According to Mao (quoted in Chung 1980:14):

> "Once the old relations of production were wiped out, new relations of production were set up. This paved the way for the development of the productive forces of the new society. At this point, we were able to organize a technical revolution vigorously so as to develop society's productive forces on a big scale."

Let the output increase promote socialist consciousness. For example, Unger cites the example of formerly poor villagers who were lifted from their poverty and oppression. A sense of gratitude for the revolution induced them to become more selfless and to work harder for the collective as cadres (Unger 1978:597), presumably to raise the output of the group.

The second source of efficiency gain relates to the heightened consciousness associated with ideological indoctrination, as more advanced relations of production are brought to bear. Political education and other forms of indoctrination raise consciousness directly. In their desire to build socialism, economic agents become more diligent, self-sacrificing and hardworking. Lin considers ideology to be the most important institutional arrangement in generating pro-social behaviour (Lin 1989:20). A person may well adopt prescribed social

norms more readily if the new institutional arrangements conform more closely with that person's ideology, if his or her group is more closely-knit or tightly structured, and if his or her ability to leave the group is low. These factors apply to the collectives of the Maoist period: ideological education and the politicisation of daily life were salient features of the commune system, mobility was low, and the (sub-)village formed the basic unit of production.

Within this basic unit of production, heightened consciousness might be induced by direct income payments to individuals displaying socialist consciousness or by offering non-material rewards. When individuals have very low material living standards or live close to subsistence, they may place greater weight on material rewards relative to external moral incentives. In such cases the frequency of genuinely socialist behaviour tends to be low, either because increased feelings of self- or family preservation associated with living close to the margin preclude the development of an altruistic consciousness, or because income-poor peasants are constrained from making altruistic income transfers even if they do care for others.

In countering these difficulties, political education might be intensified to increase the response to non-material incentives. If the desire for current consumption can be made to fall by reducing a person's marginal rate of time preference, the individual can become more altruistic. A number of policies introduced by Mao helped to meet this end, including limiting the exposure to non-socialist values and lifestyles, the suppression of intra-village income differences to reduce

materialistic demonstration effects, and indoctrination to emphasise the acceptance of hardship and deprivation in the process of building socialist character.

The reported observations of heightened consciousness during the Maoist period (eg., Chan 1985) are perhaps then not surprising. Nor is it surprising that young people in China were particularly receptive to ideological indoctrination. Ideology may be defined as a set of beliefs about the world, which "helps an individual make a moral judgment about his and others' roles in the division of labour, the distribution of income, and the existing institutional structure" (Lin 1989:11). According to Lin (1989:11):

> "If a permanent (institutional) change does occur, young people are more apt to invest in acquiring a new ideology than old people, even if the young have the same preferences. This result stems from the fact that, in general, old people have more ideological capital to divest, which takes time and effort. Moreover, old people have less incentive to invest in a new ideology because they have fewer remaining years to collect the returns."

It is difficult to ascertain how widespread or significant the transformation of consciousness actually was. The remarkable point, however, is that Mao may have succeeded in realising a transformation of at least some members of the population. Let such individuals fall into one of two categories: Type I individuals, whose socialist consciousness tends toward an upper limit as capitalist consciousness

recedes, and Type II individuals who initially exhibit a combination of growing socialist and capitalist consciousness, but for whom socialist consciousness eventually falls to zero over time (Becker's work on altruism in the family and selfishness in the market (Becker 1981:10) supports the idea that an individual may exhibit a combination of *both* socialist and capitalist consciousness at some point in time). Other individuals are those for whom socialist consciousness is zero for all time periods (Type III). The success of the post-1978 economic reforms, which appealed to individual material incentives, is consistent with the prevalence of Type II and Type III individuals. Analysis of Type II individuals is particularly interesting, since they represent "lapsed" socialist economic agents whose regression might somehow be linked to the problems and inconsistencies of a socialist development strategy.

2.4 A potential inconsistency in socialist transition

The work incentives of capitalism and full communism clearly represent opposing extremes, and the transition from one set of incentives to the other is of crucial importance in socialism. In emerging from a capitalist society, Marx and Lenin recognised that the distribution of income under socialism would be made according to work done - the "bourgeois right of distribution" (or payment according to labour) would hold in the presence of poorly developed socialist consciousness. Under communism, however, distribution would be according to

need. But neither Marx nor Lenin attempted to describe the transition from a labour-based distribution system to a needs-based one (Riskin 1975:433).

Mao had to devise his own transition path. On the one hand, market socialism was to be vigorously opposed (White 1993:24). A heavy reliance on material incentives was incompatible with Mao's view of a dynamic socialism. On the other hand, when he sought to negate material incentives in the Great Leap Forward by introducing free supply, the resulting work disincentives caused output to fall precipitously (Whyte 1969:12). In response, even though non-material incentives would be instrumental in the transition to communism, the necessity of employing limited material incentives during the socialist phase was conceded. A hybrid form of motivational relations was developed - the Dazhai system, where peasants exhibiting heightened consciousness or "moral" behaviour were rewarded among other things with individual income payments. Yet as the model in this section will suggest, this and other approaches were internally inconsistent since material rewards are much more likely to appeal to acquisitive or selfish behaviour, rather than altruism.

The Dazhai system was not the only way in which individual, material incentives were coupled with attempts to heighten peasant consciousness. Collectivised agriculture sought in part to reinforce group or cooperative behaviour, but at the same time private plots were retained; work-grade payment systems were implemented, with the awarding of grades ostensibly linked to physical output

criteria, but income differentials were nonetheless compressed in order to prevent capitalist restoration. In attempting to reach the ultimate goal of developing a fully socialised human being, the incompatibility of the means employed had the potential to reinforce bourgeois attitudes and behaviour at the expense of socialist consciousness. Contributors to the literature have hinted at this inconsistency (eg., Breth and Ward 1982:130; Riskin 1975:440; Whyte 1969:6), but the implications do not appear to have been developed or formalised.

2.5 A model of consciousness

In examining this inconsistency, the model developed in this section seeks to determine the factors which contribute to or detract from socialist consciousness. The emphasis is on the way in which capitalist and socialist consciousness compete against or inhibit one another. On the basis of such competition, and given the likely values of the relevant parameters, the model seeks to show how difficult it is for socialist consciousness to survive over time. Models of competition are well-developed in the biology literature (Rescigno and Richardson 1967; Roughgarden 1979; Beltrami 1987; Renshaw 1991) and they are applied to the problem at hand.

Recall from the Maoist model in Figure 2.1 that advances in the relations of production act as the catalyst in economic development. With an upsurge to a higher, fixed level of r, consciousness would hopefully rise over time to generate

increases in output during the consolidation phase. The crucial issue, then, is whether the intended increase in socialist consciousness actually takes place for the given relations of production. As noted, this issue becomes especially acute when the set of property rights, institutions and incentive systems contains elements which promote both socialist and capitalist consciousness.

We begin with the following definition.

Definition. An economic agent who is altruistic and self-sacrificing is said to exhibit socialist consciousness. An economic agent who is materially self-interested is said to exhibit capitalist consciousness.

Assuming that an individual can have a combination of capitalist and socialist consciousness (cf. Becker 1981), consider the following system:

$$\dot{S} = g(S,C)S,$$

$$\dot{C} = h(S,C)C. \qquad (2.1)$$

S(t) and *C(t)* represent the respective amounts of socialist and capitalist consciousness of an individual, and functions g and h represent their respective growth rates. Assume that the initial values of S and C are positive and that r is constant. While properties may be assigned to g and h to indicate the inhibiting

effect of one on the other (ie., $\partial g / \partial C < 0$, $\partial h / \partial S < 0$), greater expositional clarity and analytical insight may be gained by offering an explicit expression for g and h. The growth rates of S and C are given a linear representation in (2.2); linear models are justified on the grounds that that they approximate the general equations of (2.1) close to their equilibria (eg., see Goh 1980:66). Such an approximation provides a simple and useful basis for gaining insights into the inconsistency problem. Let:

$$\dot{S} = (\gamma_s - \gamma_s \frac{S}{\overline{S}} - \varepsilon C)S, \text{ and}$$

$$\dot{C} = (\gamma_c - \gamma_c \frac{C}{\overline{C}} - \eta S)C. \qquad (2.2)$$

The bracketed terms of (2.2) correspond to g and h. γ_s and γ_c are the intrinsic growth rates of socialist and capitalist consciousness. $\overline{S}$ and $\overline{C}$ are the upper limits of S and C. The coefficients ε and η represent the inhibiting effects of C on S and S on C. Let γ_s, γ_c, ε and η be strictly positive constants.

Several assumptions have been made in the model. Given fixed values of the relevant parameters, neither consciousness is able to increase above a certain size, irrespective of the size of the other consciousness. For example, let $\overline{S}$ be income dependent, such that there exists an upper limit to socialist consciousness (in the extreme, altruism and self-sacrifice may lead to an individual's own death through excessive income transfers to others). In the absence of inhibiting effects (ie., ε, η

=0), both S and C grow *logistically* - the growth rates of S and C fall with increases in S and C. If $S = \bar{S}$, the logistic growth rate is zero, for example. If both C and S are very small, both are able to increase; ie., the bracketed terms in (2.2) are strictly positive.

In general the system of simultaneous differential equations in (2.2) cannot be solved explicitly. However, the fixed points can be determined and the paths of C and S described in phase diagrams. There are four possible (C,S) fixed points:

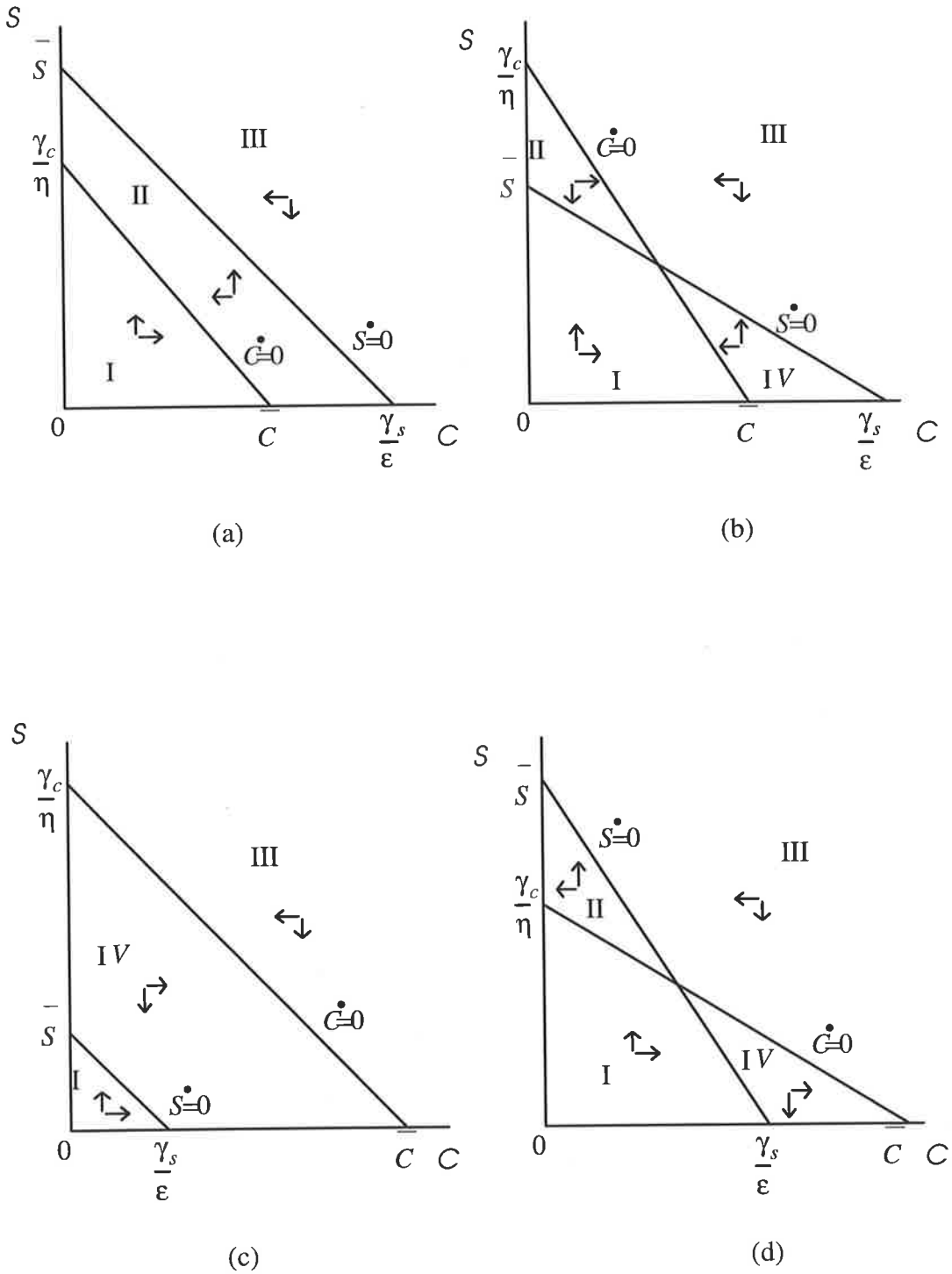
$$(0,0),\ (0,\bar{S}),\ (\bar{C},0),\ (a,b),$$

where $a = (\frac{1}{\bar{S}} - \frac{\eta}{\gamma_c}) / (\frac{1}{\bar{C}\bar{S}} - \frac{\eta\varepsilon}{\gamma_c\gamma_s})$, and

$$b = (\frac{1}{\bar{C}} - \frac{\varepsilon}{\gamma_s}) / (\frac{1}{\bar{C}\bar{S}} - \frac{\varepsilon\eta}{\gamma_s\gamma_c}).$$

The equilibria can be represented in the following diagrams:

Figure 2.2 *Phase planes of capitalist and socialist consciousness*



Lines are drawn for $\dot{S} = \dot{C} = 0$, with the arrows indicating the path orientation of C and S in the regions bounded by the isoclines. We have the following structurally stable cases from the figures:

Case (a). There are three fixed points in the first quadrant, all on the boundary. The origin is a source, $(0,\overline{S})$ is a sink and $(\overline{C},0)$ is a saddle.

Case (b). There is a fixed point in the interior of the first quadrant which is a sink, the origin is a source and the two semipositive fixed points on the boundary are saddles with stable manifolds given by the appropriate axes.

Case (c). There are three fixed points in the first quadrant, all on the boundary. The origin is a source, $(0,\overline{S})$ is a saddle and $(\overline{C},0)$ is a sink.

Case (d). There is a fixed point in the interior of the first quadrant which is a saddle, the origin is a source and the two semipositive fixed points on the boundary are sinks.

In no case can there be a closed orbit.

An *idealised* Maoist outcome could be represented by the fixed point $(0,\overline{S})$ in Fig. 2.2(a), assuming that $\overline{S}$ represents an acceptable or desired consciousness level. Case (a) corresponds to a Type I individual, with capitalist consciousness being totally replaced by socialist consciousness as time becomes sufficiently large. A number of special conditions would need to hold for this to happen: the upper limit to capitalist consciousness, the growth rate of capitalist consciousness and the

inhibiting effect of capitalist consciousness on socialist consciousness would all have to be relatively low, while the upper limit to socialist consciousness, the growth rate of socialist consciousness and the inhibiting effect of socialist consciousness would be relatively large.

The population frequency of such people is likely to be extremely low, even during the Maoist period. After all, Mao considered it necessary to maintain some material incentives to keep the population working. Perhaps the best that Mao could have hoped for in the short to medium term is given by Fig. 2.2(b). Consider Figs. 2.2(b), (c) and (d), and let the initial point lie in zone I. Socialist consciousness is able to increase from its initial level, but only in case (b) is there no possibility of the "degenerate" outcome $(\overline{C},0)$. Case (b) exhibits weak inhibiting effects (ie., $\gamma_c > \eta\overline{S}$ and $\gamma_s > \varepsilon\overline{C}$), such that there is a stable coexistence at (a,b). The stability conditions are given in Appendix A.

Depending on the magnitudes of S and C, their stable coexistence in case (b) could be desirable for Mao. With sufficient S, the negative effects of egalitarianism and monitoring problems in collectives would diminish, as peasants' socialist consciousness inhibited them from shirking and free-riding. (Such people were assigned role model status in Mao's China and were to be emulated.)

The consolidation of some socialist consciousness might also permit case (a) to be eventually realised. With the associated increase in output and further

indoctrination, the upper limit of S might gradually increase over time, sufficiently so for case (a) to hold (the essential difference between (a) and (b) lying in the position of the intercept $\overline{S}$.)

Problems emerge, however, from the possibility that socialist consciousness might be negated altogether.

PROPOSITION 2.1 *If* $\overline{C} > \gamma_s / \varepsilon$ *and* $\overline{S} < \gamma_c / \eta$, *and given certain restrictions on the parameters, the system described by (2.2) is consistent with an equilibrium S=0 when time is large.*

Proof. The growth rates of C and S in (2.2) each contain two negative terms relating to both S and C, which combine to offset the intrinsic growth rates, γ_c and γ_s. Assume that the combined size of S and C in these negative terms is identical in the growth rate expression for both capitalist and socialist consciousness. Denote this size Z, such that $Z = C + \tau S$, where τ allows S and C to vary in their inhibitory effects. The system (2.2) becomes:

$$\dot{C} = (\gamma_c - \nu_1 Z)C,$$

$$\dot{S} = (\gamma_s - \nu_2 Z)S. \qquad (2.3)$$

It follows from (2.2) and (2.3) that $\nu_1 = \gamma_c / \bar{C}$, $\nu_1 \tau = \eta$, $\nu_2 = \varepsilon$, $\nu_2 \tau = \gamma_s / \bar{S}$. (2.3) becomes:

$$\dot{C}/C = \frac{d}{dt}\ln C = \gamma_c - \nu_1 Z,$$

$$\dot{S}/S = \frac{d}{dt}\ln S = \gamma_s - \nu_2 Z. \tag{2.4}$$

(2.4) implies that:

$$\frac{d}{dt}\ln\left(\frac{C^{\nu_2}}{S^{\nu_1}}\right) = \gamma_c \nu_2 - \gamma_s \nu_1$$

$$\Rightarrow \quad \frac{C^{\nu_2}}{S^{\nu_1}} = A\exp[(\gamma_c \nu_2 - \gamma_s \nu_1)t,$$

where A is a constant of integration. If $\gamma_c \nu_2 > \gamma_s \nu_1$, S→0 as t→∞. This completes the proof of the proposition.

A $(\bar{C}, 0)$ outcome can also be generated which does not require that $\bar{S} < \gamma_c / \eta$, as in Fig. 2.2(d). Trajectories in the *CS*-plane are indicated in the phase diagram. We use the following assumption:

ASSUMPTION 2.1 *The initial value of C is high relative to initial S.*

Assumption 2.1 results from the thousands of years of private farming in China, such that initial C is likely to be much higher than initial S. This is supported by the view that the masses of Chinese peasants supported the Communists in their struggle against the Guomindang because of an expectation of income gains and an improvement in their economic livelihood, rather than as a result of a commitment to the ideology of Marxism-Leninism.

PROPOSITION 2.2 *If* $\overline{C} > \gamma_s / \varepsilon$, *S may rise initially, but degenerates into a* $(\overline{C}, 0)$ *equilibrium.*

Proof. Applying Assumption 2.1, Proposition 2.2 is self-evident in case (d). The initial high value of C relative to S generates a trajectory where S can rise, but the rise cannot be sustained over time; ie., the trajectory eventually leads into region IV.

The equilibrium is asymptotically stable. To determine the stability of the fixed point (C^*, S^*) at $(\overline{C}, 0)$, let $C = C^* + c$ and $S = S^* + s$, where c and s are small. Linearise the system of (2.2) in the neighbourhood of the fixed point, taking the first two terms of a Taylor series:

$$\dot{c} = a_1 c + a_2 s,$$

$$\dot{s} = b_1 c + b_2 s.$$

The coefficients are the respective partial derivatives evaluated at the fixed point:

$$a_1 = -\gamma_c, \quad a_2 = \eta\overline{C}, \quad b_1 = 0, \quad b_2 = \gamma_s - \varepsilon\overline{C}.$$

$$\therefore \begin{pmatrix} \dot{c} \\ \dot{s} \end{pmatrix} = \begin{pmatrix} -\gamma_c & \eta\overline{C} \\ 0 & \gamma_s - \varepsilon\overline{C} \end{pmatrix} \begin{pmatrix} c \\ s \end{pmatrix}.$$

It is necessary to find eigenvalues ξ satisfying:

$$\det \begin{pmatrix} -\gamma_c - \xi & \eta\overline{C} \\ 0 & \gamma_s - \varepsilon\overline{C} - \xi \end{pmatrix} = 0$$

$$\Rightarrow \xi = -\gamma_c, \quad \xi = \gamma_s - \varepsilon\overline{C}$$

Inspection of Fig. 2.2(d) reveals that $\gamma_s < \varepsilon\overline{C}$; thus, both eigenvalues are negative and the fixed point is asymptotically stable.

Remark (i). The difference between Figures 2.2(c) and (d) relates to the relative sizes of $\overline{S}$ and γ_c / η. If the upper limit, $\overline{S}$, is relatively high, an equilibrium $S>0$, $C=0$ is possible, as in region II of (d). But the upper limit is likely to be low in poor countries like China, where selflessness and altruism might well be considered luxury goods. Peasants living close to subsistence income levels are not as likely to be altruistic to non-family members of the village, since the opportunity cost of such behaviour to them and their families is very high. Chan,

Madsen and Unger hint at an income dependent socialist consciousness: peasants did not mind egalitarian team income distribution when team income was growing year by year; in harsher economic times, however, the same peasants resented sharing their income with others who did not work as hard (Chan, Madsen and Unger 1984:248). The low value of $\overline{S}$ implies that the logistic growth is low, and eventually this is overtaken by the negative effect associated with capitalist consciousness to generate a $(\overline{C},0)$ outcome.

The role of $\overline{S}$ as modelled here supports aspects of the Liu-Dengist "theory of the productive forces". In contrast with Mao's emphasis on advances in the relations of production as the catalyst in China's economic development, the Liu-Deng reformists consider the level of economic development to be the decisive factor in *permitting* advances in the relations of production. In his official pronouncements, at least, Deng has considered an eventual transition to more advanced relations of production and higher forms of socialism, but only when income levels are higher might this be attempted. This view is consistent with an income dependence in the upper limit of socialist consciousness, $\overline{S}$. As income grows, peasants will have attained a margin of comfort and, in this view, may be more receptive to attempts to increase their levels of altruism and ideological consciousness in general. In the absence of material prosperity, however, a low value of $\overline{S}$ will contribute to the realisation of a $(\overline{C},0)$ outcome.

Remark (ii). The increase in consciousness may have been that observed during periods of political mobilisation in the 1960s and 1970s. Note that the increase is temporary; observation of rising socialist consciousness in the initial stages of socialist development may have little bearing on the final result over time.

Even if case (b) were initially realised, other factors leading to disillusionment with socialism emerged in China to render case (b) untenable over time. These factors refer to the crises of faith in Mao and the political leadership experienced by the masses (Chan, Madsen and Unger 1984:282, Chan 1985:224). White (1993:98) mentions dissatisfaction with national policies and the lack of economic freedom, for example, which dampened morale. Exposure of the corruption and intrigues of formerly-revered leaders, such as Lin Biao and the Gang of Four, could be added to the list.

These factors are included in the following generalised model of (2.2):

$$\begin{aligned} \dot{C} &= h_1(C,S) = g_1(C,S)C \\ \dot{S} &= h_2(C,S) = g_2(C,S;\delta)S \end{aligned} \qquad (2.5)$$

(2.5) states that the per unit growth rates, g_1 and g_2, depend on the level of C and S and, in the case of g_2, δ. δ is the effect on S of disillusionment with socialism, where disillusionment impairs the growth of socialist consciousness.

Disillusionment with Maoist policies can generate an adverse outcome for socialist consciousness, as Proposition 2.3 suggests:

PROPOSITION 2.3 Consider the model given by (2.5), with derivatives satisfying:

$$\frac{\partial g_1}{\partial C} < 0, \frac{\partial g_1}{\partial S} < 0, \frac{\partial g_2}{\partial C} < 0, \frac{\partial g_2}{\partial S} < 0, \frac{\partial g_2}{\partial \delta} < 0.$$

Assume that for each $\delta \geq 0$ both of the equations:

$$g_1(0,S) = 0, \qquad g_2(0,S,\delta) = 0$$

have solutions for S. Let S_δ be the solution to $g_2(0,S,\delta) = 0$. If:

$$\frac{\partial g_2}{\partial \delta} \Big/ \frac{\partial g_2}{\partial S} > c$$

for some positive $c \in R$, then there exists δ_1 such that the equilibrium $(0, S_{\delta_1})$ is unstable.

Proof. See Appendix C.

The propositions have been obtained for a fixed value of r. A Maoist response to these problems would be to advance the relations of production (possibly including further cultural revolutions), in the hope that the growth rate of socialist consciousness would rise and that of capitalist consciousness would fall. A higher γ_s and η, together with a lower γ_c and ε of sufficient magnitude, could reverse the "non-socialist" outcomes in Fig. 2.2 by changing the position of the isoclines, generating an equilibrium $(0,\overline{S})$. This was Mao's approach when he and the leadership immediately after him popularised the Dazhai system as a national emulation model. The Dazhai system focused much more on political education, and the wellsprings of capitalist consciousness, such as private plots, were abolished.

However, should the requisite parameter changes fail to materialise, the result would be the superimposition of advanced relations of production against a backdrop of capitalist consciousness. The likelihood of realising full communism would then be low. From a Marxist-Leninist concept of communism, a fully communist system is free from economic scarcity, such that distribution of the final output would be based on the dictum: "From each according to ability, to each according to need". But the need principle requires heightened consciousness and a rising material-technical base. A failure to raise consciousness would be problematic not just in its own right, but also in terms of its adverse impact upon the level of output.

COROLLARY 2.1 (Stagnation Hypothesis) *Given the tendency toward the* $(\overline{C},0)$ *outcome of Proposition 2.2, advanced socialisation of the relations of production (of the Maoist type) retards output levels.*

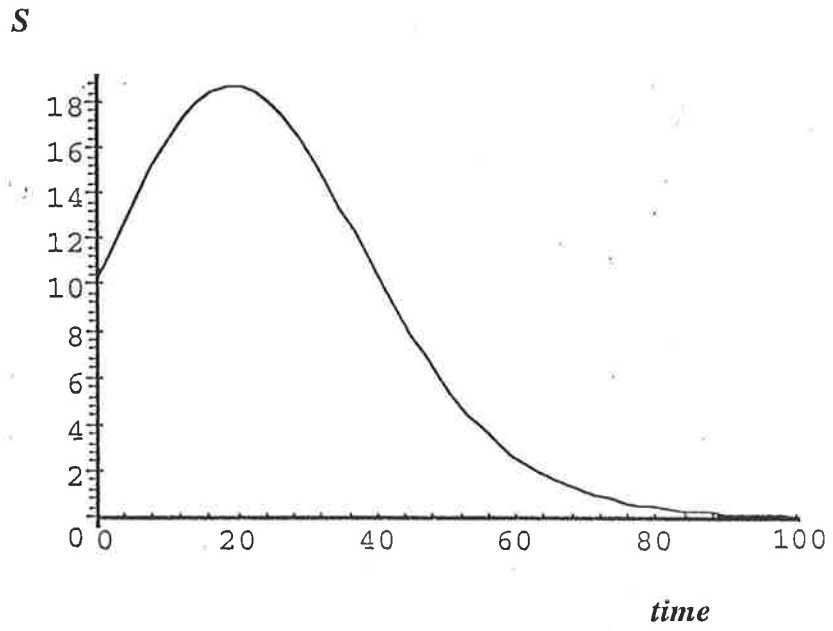
A numerical example relates the path of socialist consciousness as given in case (c) to an output function to derive the time path of output. We use the model:

$$\dot{C} = \gamma_c(1-\frac{C}{\overline{C}}-\alpha_1 S)C$$

$$\dot{S} = \gamma_s(1-\frac{S}{\overline{S}}-\alpha_2 C)S \qquad (2.6)$$

where $\alpha_1 = \eta/\gamma_c = 0.01$, $\alpha_2 = \varepsilon/\gamma_s = 0.02$, $\gamma_c = \gamma_s = 0.1$, $\overline{S} = 60$ and $\overline{C} = 100$. With $S(0) = 10$ and $C(0) = 10$, the time path of socialist consciousness is modelled (using MAPLE V) in Figure 2.3.

Figure 2.3 *The path of socialist consciousness*



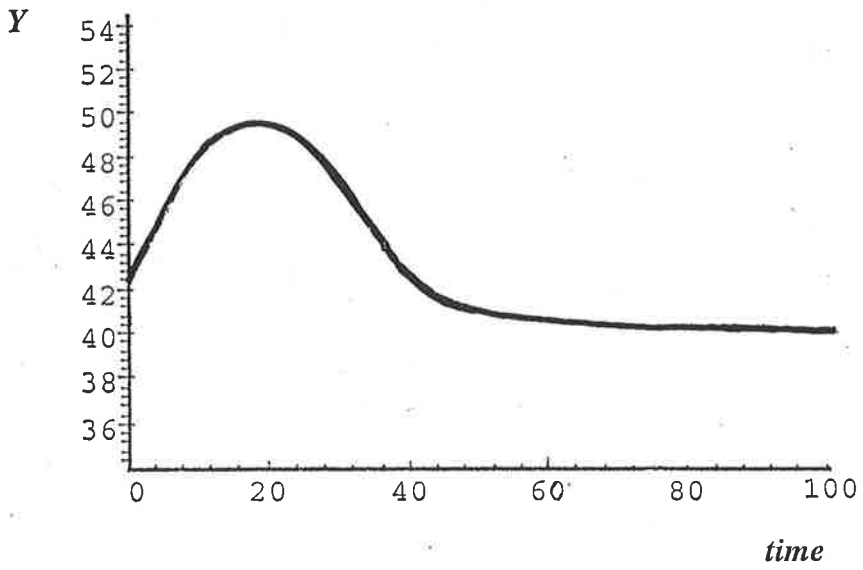
Associated with this path of socialist consciousness is a simple output function:

$$Y = Y_0 + \left(\frac{S}{\overline{S}}\right)^2 \overline{Y}, \tag{2.7}$$

where $\overline{Y}$ is a fixed, maximum level of output and Y_0 is a constant. The equation (2.7) seeks to capture the effect of consciousness on output. In the numerical example, $Y_0 = 40$ and $\overline{Y} = 100$. If socialist consciousness could rise to equal $\overline{S}$, then output would be maximised at 140. On the other hand, if Proposition 2.2 holds, then output eventually falls over time. The implementation of "advanced"

socialist organisation and incentive systems in the presence of an incompatible non-socialist consciousness causes output to fall for the reasons suggested by Putterman, Lin and others. The graph is given in Figure 2.4.

Figure 2.4 *The path of output*



Although not incorporated in the above numerical simulation, $\overline{S}$ would fall in turn, making socialist transition even more difficult. In the face of this unintended outcome, the Maoist response was typically to increase the amount of repressive control imposed over economic agents, substituting coercion for socialist consciousness.

In response, the Liu-Dengist "theory of the productive forces" would suggest that a retreat be made from the advanced socialisation of *r* in order to realign the relations of production with the lower, prevailing level of consciousness. In this view, income would then increase. Such changes are seen to be crucial, as is evident in the current leadership's attempts to muster support and renew the masses' sense of political purpose by offering rapid economic development and higher living standards, a response precipitated by Mao's unfulfilled promise of a better life and the past political turmoil which led to economic stagnation. Nevertheless, the Liu-Deng model offers little hope for significant socialist transition, since it reinforces capitalist consciousness and thus renders the outcome in either Fig. 2.2(c) or (d) more likely.

2.6 A wider perspective

The analysis so far has skirted discussion of the "standard" problems of China's socialist development, such as the costs of central planning, the incompatibility of market and plan, distortions generated by the procurement system, the apathy and alienation caused by commandism, and the lack of private property rights. These issues and others have been analysed extensively in the economics literature. For example, Yang and Borland (1991) have established that the division of labour enlarges the extent of the market and increases the growth rate of per capita income over time. Yet Mao's emphasis on reducing the differences between "town and

country, industry and agriculture, and mental and manual labour" rejected specialisation of economic activity. To the extent that this approach retarded the level of economic development, it is captured in the analysis of the previous section by instilling disillusionment with socialism or by directly reducing the size of $\overline{S}$.

2.7 Conclusions

The formal model has sought to reconcile a number of observations associated with China's struggle along the path of socialism. First, there is evidence of heightened consciousness among some sectors of the population at certain times. For example, Unger's investigation of Chinese village life in Guangdong reveals that, to an extent, some peasants shared "a strong sense of moral certainty in the higher rightness of collective endeavour" (Unger 1978:586). A second observation is that some Maoist policies caused national output to stagnate, generating significant disillusionment with the Maoist strategy. The upheaval resulting from waves of political campaigns and permanent revolution, together with the imposition of unworkable and unpopular economic policies such as the Dazhai system, undermined support for Mao's revolutionary approach to economic development. Third, the positive response to the economic reforms suggests that Chinese economic agents are primarily driven by material self-interest. The

decollectivisation of the rural sector and the strengthening of the work-reward link produced spectacular output growth rates in the first half-decade of reform.

The model offers economic explanations to reconcile these observations. The explanations revolve around a potential inconsistency in socialist transition. The gap between the old society and the future communist economic system cannot be bridged by appealing to non-material incentives alone. In general, socialist relations of production must retain elements of capitalism if the economic system is not to collapse. Given that the post-1949 China was still affected by behaviours and attitudes inherited from the old semi-capitalist society, material incentives and private plots had to be maintained to motivate peasants to work. Kornai summarises this point nicely in suggesting that socialist systems require an active private sector to achieve material prosperity: "Socialism arrived at a stage in history when it was unable to survive in its pure, strictly non-capitalist fashion and had to coexist with its self-acknowledged archenemy not only worldwide but within its own borders as well" (Kornai 1990:138,139). This has profound implications for socialism, since the elements of capitalism retained in organisational, property and motivational relations serve to undermine the transformation of consciousness.

The significance of this point has seemingly been lost on some observers: "Peasants are taught to feel that they are working for the nation, for the revolution and for all the oppressed people of the world, but they are clearly and obviously

doing good for themselves at the same time" (Robinson 1974:55). The apparent implication is that individuals were motivated by a sense of altruism *and* individual gain. It can be shown that with appropriate parameterisation such a result is theoretically possible, as in the case of Figure 2.2(b). However, given the prevailing initial condition of high capitalist consciousness relative to socialist consciousness and the likely values of the relevant parameters, the dynamic analysis in this chapter suggests that the possibility of socialist consciousness surviving over time is remote. Monetary incentives indeed erode socialist morality (Robinson 1974:49), but observers sympathetic to socialism apparently fail to note that this is a likely outcome of the inconsistencies inherent in socialist development strategies such as Mao's. Indeed, as Woo suggests, "a planned economy produces degenerative moral qualities that ultimately defeat the system itself" (as quoted in Prime 1994:870).

The difficulties in transforming economic agents into "new socialist human beings" strongly complements the literature on the failure of command economies. Central planning, collectivisation and other manifestations of the socialist economy collapsed in large part from the coupling of these organisational forms with the self-interested behaviour of economic agents. Had these agents been sufficiently imbued with socialist consciousness, the problems associated with shirking and narrow individual material interest may not have arisen, and elements of the command economy, such as the egalitarian collectives, would not have had to be dismantled. By inducing team members to care for each other, an individual might

have preferred to work for him or herself *and* for others in the team, a situation in which egalitarian income distribution could be consistent with increased motivation to work. Principal-agent problems associated with monitoring difficulties would also have been avoided. The internalisation of Maoist norms would have precluded free-riding and shirking problems had peasants been fully committed to socialist construction and working for the common good, rather than for individual self-gain.

The inability to heighten and sustain such consciousness over time, however, meant that an unworkable mix of institutions and incentives arose, with a resulting economic stagnation. This in turn made it even more difficult to raise the altruism of agents, as the low income levels inhibited individuals from becoming more altruistic and self-sacrificing.

CHAPTER THREE: EMPIRICAL EVALUATION

3.1 Introduction

An important proposition from the last chapter related to the *stagnation hypothesis*. This was the view that if the economic behaviour of the Chinese people was based on individual, material self-interest, then socialised relations of production of the Maoist type would cause output to stagnate (alternatively, output would increase under the household responsibility system, a reward system which emphasises material self-gain). For example, the egalitarian income-sharing reward systems of the collectives compressed intra-collective earnings differentials. In the reformist view, had peasant consciousness been more advanced, this compression may not have done so much damage; as it transpired, however, materialistic and self-interested peasants were induced to shirk team labour, resulting in the relatively poor economic performance of the rural collective sector.

This chapter seeks to confirm this view of materially self-interested peasants. The proposition is testable by studying Chinese grain output for the period 1961-92. A positive output response to the household responsibility system (HRS) would imply material self-interest. One might argue that this output response is almost self-

evident - all that is required to confirm the view of material self-interest is to casually observe the time series for agricultural output in the pre- and post reform periods. We consider that such an approach is too simplistic, and that a fuller consideration of the stagnation hypothesis requires rigorous econometric testing. This is because the impact of the HRS is entangled with other factors such as price changes and market liberalisation, which also may have contributed to the observed output changes. Accounting for these and other effects requires econometric analysis.

Nguyen and Wu (1993), Lin (1992) and McMillan, Whalley and Zhu (1989) have attempted to measure the relative importance of the HRS for improved agricultural performance in post-1978 China. Lin and Nguyen and Wu undertake econometric studies using province-level panel data and time series data respectively, while McMillan et al. use a growth accounting technique. The studies suggest that the implementation of the HRS is a significant contributor to output growth in agriculture. Our study seeks to confirm this result, but differs by employing recently developed cointegration techniques. The issues of non-stationary time-series data, cointegration and error correction are integral parts of the profound reassessment of the statistical basis of econometric modelling undertaken in the 1980s (Banerjee, Dolado, Galbraith and Hendry 1993:1) and prompt our re-evaluation of the type of econometric studies cited above.

The data set and the reasons for adopting a cointegration approach are discussed in Sections 3.2 and 3.3. We derive a long-run estimate of the impact of the HRS on

grain output, using the Johansen vector autoregressive method. The econometric analysis of this chapter suggests that the large grain output response associated with the post-1978 reforms, which introduced ostensibly *capitalist* relations of production, is consistent with the behaviour of materially self-interested economic agents. Thus, Mao's focus on rapid socialisation of the relations of production appears to have been inconsistent with, and to have outpaced, the prevailing level of consciousness.

3.2 The data

The stagnation hypothesis relates outputs to inputs, especially labour in efficiency units (where efficiency units are related to motivation and therefore consciousness). To evaluate the relationship econometrically, an *ideal* data set might embody a number of important characteristics. First, the data would directly relate output changes to peasant work motivation, picking up the impact of the HRS relative to the pre-reform system. In doing so, it would avoid other influences on output associated with the reforms. It might be argued that it is not just adjustments in peasant work motivation which have contributed to the post-1978 growth in agriculture, but other factors as well. These include the encouragement of greater commercialisation and specialisation, the widening of private activity, price increases, and the greater leeway for local production units to determine cropping and management according to comparative advantage. We seek a dependent variable which minimises the

impact of these added effects and highlights the relationship between and output and the HRS itself.

The ideal data would be highly disaggregated, say at the household level, in order to capture nuances in people's motivation to work. The data would be collected over a long period, beginning from the early stages of collectivisation to the present. Apart from its desirable statistical properties, a long time series is valuable because we are investigating the problem of induced preference change on the part of Chinese peasants. Such changes may take a fairly long time to be realised, and a longer time series increases the likelihood of tracking such changes if they occur.

The collection of a data set with these characteristics should in principle be attainable. Unfortunately, such an undertaking lies outside the funding and time constraints of this thesis, and we compromise on the ideal. The compromise relates to our use of national rather than micro-level data, a choice which stems from our desire for a long time series. It appears that the only readily accessible data to span the full length of the collective and reform periods is provided in various editions of the *Statistical Yearbook of China*, which cite only national data for the range of variables we are interested in. In defence of this compromise, we recognise that national data have been used in other studies of the HRS, notably those of McMillan et al. (1989) and Nguyen and Wu (1993).

We use national grain output as the dependent variable in our data set. In contrast to a broader aggregate, such as total agricultural output, the use of grain has the advantage of isolating the relationship between output and the HRS. It separates the impact of the HRS from the other policy changes associated with the agricultural reforms, such as market liberalisation, because these changes have worked *against* grain in favour of other (higher-priced) crops and activities as the policy of local grain self-sufficiency has been relaxed. (This approach is more direct than Lin's, who uses proxies for the extent of market reforms (Lin 1992:41).) If all other things were equal, then, if we observe a significant positive relationship between the HRS and grain output, it is likely to be due to the effect on work incentives themselves.

Other variables to explain grain output besides the HRS might include grain sown area, farm labour, non-labour inputs, draught animals, weather, technology and relative prices facing peasant farmers. Labour input to grain is proxied following a procedure similar to Lin (1992:49). Data are available for total agricultural labour, but not labour allocated specifically to grain. Total grain labour is estimated by dividing the value of grain output (grain output times the mixed average purchasing price of grain) by the value of agricultural output, and multiplying this ratio by the number of workers employed in agriculture. While this is a rather crude proxy, it appears to be the best available.

This variable does not take into account the diligence or effort with which the labourers work. This is proxied by the HRS variable, which seeks to capture the

change in work incentives as the egalitarian, income-sharing collectives were replaced by the HRS. The proportion of teams engaged in family farming is tracked over time, taking values of zero during collectivisation, 0.05 in 1980, rising to 1 by 1985, and 1 thereafter (see McMillan, Whalley and Zhu 1989). Lin (1992:38) provides different estimates of the percentages of teams converted to the HRS, but the differences appear only to be slight.

Grain price is another important variable in determining work effort, since changes in price alter the income-leisure choice and the diligence with which farmers work. The price series used is the mixed average purchasing price of trade grain. To obtain the price ratio of grain to farm inputs, P, the series is divided by the retail price index of agricultural producer goods. Lin (1992) uses two relative price series (market and above-quota prices) in his regression equations. In both of his production functions the coefficients of relative prices are statistically insignificant, and the above-quota relative price index has the opposite sign to that hypothesized. This result may be due to multicollinearity and prompts our choice of the mixed average purchasing price series. In this series, above-quota and negotiated prices are combined in a single aggregate. Negotiated prices are close to market prices, so the series captures elements of Lin's two price series. (To sharpen the impact of negotiated or "marginal" prices in this series, we also consider a relative price series where mixed average purchasing prices are squared.)

New technology, including new seed varieties, might account for variations in grain output over time. Despite success with high-yielding wheat and rice varieties in the 1960s and 1970s, research into new varieties of crops with higher potential yields has not advanced much (Kharbanda and Qureshi 1984:33; for a more mixed assessment, see Stone 1988). Lardy (1986b:98) also discounts biological technology in accounting for the growth in post-reform crop yields. Given that statistical data relating to technological advancement are extremely inadequate in China (Yang 1994:100), we omit this as a variable in the model.

As for state investment, Lardy (1986a:452-453) considers that this factor can be ruled out as a contributor to agricultural growth in the post-reform period. Even though the Central Committee in 1978 adopted a resolution to increase the share of state investment expenditure from the then current 11 percent to 18 percent within two to three years, this planned increase was not realised. Investment levels actually fell, and this was reflected largely in decreased water conservancy and irrigation investment.

Supplies of current inputs have risen dramatically in the post-reform period. In capturing the influence of current inputs on grain output, the value of retail sales of the means of agricultural production is employed. The means of agricultural production in the data series comprise chemical fertilisers and pesticides, tractors, walking tractors, motor-driven agricultural machinery, and pesticide sprinklers. The value of the retail sales of the means of agricultural production is then deflated by the

retail price index of agricultural producer goods. The use of the single aggregate of the means of agricultural production, *MAP*, has the advantage that problems of multicollinearity are avoided, given that, in the agricultural modernisation process, inputs such as chemical fertiliser, machinery and pesticides come together as a package.

The last input considered are draught animals, *DA*. Following Nguyen and Wu (1993), draught animals are measured by number of head. Note that the national data are insufficiently disaggregated to distinguish the different types of draught animals in the series.

Another major influence on grain production is the weather (Zhang and Carter 1994). Kueh (1984) has shown that a weather index (comprising the weighted average of farm areas "covered" *(shouzai)* and "affected" *(chengzai)* by natural disasters) is an important determinant of output. It may also be important to include this variable to ensure that the rise in post-1978 grain output is not principally the result of a favourable weather cycle, rather than the HRS.

Grain production grew very slowly during the 1960's and early 1970's, despite an increase in the use of mechanised equipment and fertilisers, for example. In the early reform period, especially, there is a large increase in grain output. It might therefore be expected that much of this increase in production is attributable to the reform package. In particular, the purpose of the subsequent statistical analysis is to try to

show that there was a significant relationship between grain output and the introduction of the HRS in the sample period.

3.3 The model and results

The empirical analysis is partially based on Lim and Harris (1993), in which it was suggested that evidence of a strong positive relationship between grain output and the implementation of the "capitalist" work incentives of the HRS called into question the whole of the Maoist 20-year experiment in economic development.

We follow the approach of Lin (1992:41), who postulates a Cobb-Douglas production function with conventional agricultural inputs and terms which affect the efficiency of the inputs. For example, the switch from collective income-sharing arrangements to family farms may affect the income-leisure choice of agricultural workers, as might changes in relative prices. Our production function becomes:

$$G_t = f(S_t, MAP_t, N_t, DA_t, W_t, HRS_t, P_t, T, \varepsilon_t) \qquad (3.1)$$

Three dummy variables were introduced to account for significant outliers in the data: *D61* adjusts for the relatively low grain output following the Great Leap Forward, *D72* picks up the bad harvest of 1972, and *D86* accounts for the state's post-1985 grain purchasing activities. *D86* takes values of 1 for the period 1986-1989 and

0 otherwise. The dummy reflects the return to administrative intervention in production (Lin 1992:36,39) and possibly also the adverse effect of the booming rural enterprise sector on agriculture in the latter half of the 1980s (eg., see Putterman 1992:476). All the variables are expressed in natural logarithms, except for *HRS*, *T* and the dummies.

At least two potential econometric problems would need to be considered when estimating an appropriate functional form of this equation. The residuals of regressions involving non-stationary variables in levels can have variances increasing over time, such that tests of significance are invalid. Differencing may solve this problem, with least squares estimation providing consistent estimates. However, differencing results in a loss of "long run information", and the cointegration approach has been suggested as a solution to this problem (Maddala 1992:262).

Secondly, with the variables in levels, rather than differenced, there is the possibility of spurious results indicated by good model fit without any actual economic causation. In the case of non-cointegration where there is no long run or equilibrium relationship between the variables, a unit root in the error process could lead to a low DW statistic, a high R^2 and highly significant coefficients (see Granger and Newbold 1974,1977). The problem occurs because most economic series are non-stationary and are therefore highly correlated with each other over time, even if there are no relationships between them. If a set of variables has no cointegration relationship, these variables cannot have a long run equilibrium relationship.

We attempt to overcome this problem by modelling a cointegrated system. (If the elements of a time series vector x_t are stationary only after differencing, while a linear combination $a'x_t$ is stationary, these elements are said to be cointegrated with $a' = (a_1 \ldots . a_k)$ being the cointegration vector.) There are a number of approaches to modelling cointegrated systems, including the Engle-Granger two-step method, ADL models and the Johansen procedure. The Johansen method may be preferred to the residual-based ADF procedure for testing for cointegration when there are more than two first difference stationary variables in the model.

Using MICROFIT 3.0, the Johansen (1988) approach allows the estimation and testing of cointegrating relationships within the framework of VAR(p) error-correction models with Gaussian errors. The general model is given by:

$$\Delta x_t = \mu + \Gamma_1 \Delta x_{t-1} + \Gamma_2 \Delta x_{t-2} + \ldots + \Gamma_{p-1} \Delta x_{t-p+1} + \Pi x_{t-p} + B z_t + u_t , \qquad (3.2)$$

where x_t is an $m \times 1$ vector of $I(1)$ variables, ie., variables which are covariance stationary in first differences. z_t, an $s \times 1$ vector of $I(0)$ variables, represents stationary variables included in the model to render the disturbances u_t as close to being Gaussian as possible. The Γ and Π are $m \times m$ matrices of unknown parameters, B is an $m \times s$ matrix and $u_t \sim N(0, \Sigma)$. Johansen's ML method estimates (3.2) subject to the hypothesis that Π has a reduced rank, $r < m$:

$$H(r): \Pi = \alpha\beta' \qquad (3.3)$$

where α and β are $m \times r$ matrices. The reduced rank condition (3.3) implies that under certain conditions Δx_t is stationary, x_t is non-stationary and βx_t (the cointegrating relations) is stationary (Pesaran and Pesaran 1991:85). The number of cointegrating vectors among x_t is given by r.

To apply the Johansen procedure, we firstly determine the order of integration of each variable in the multivariate model using augmented Dickey-Fuller (ADF) tests. The results are shown in Table 3.1, with the term "d" representing first differences. The results of the ADF tests indicate that the variables in levels are non-stationary, ie., we cannot reject the hypothesis of a unit root. Stationarity for all variables is achieved upon first differencing (except for *HRS* in the "with trend" case). Note that *HRS* is not treated as a dummy variable. The temporal conversion of teams to the HRS reflected the (spontaneous) choice of agricultural institution by the peasants themselves, given the increased economic freedoms of the post-1978 reforms. In fact, the unit root test without trend for *HRS* suggests that the series is I(1).

Table 3.1 *ADF tests on the variables*

VARIABLE	Without Trend	With Trend
Ln *G*	-1.9472	-3.1959
dLn *G*	-66.1823 *	-60.6494 *
Ln *S*	-0.6835	-1.8275
dLn *S*	-4.4164 *	-4.3683 *
Ln *MAP*	-1.2628	-1.2112
dLn *MAP*	-34.5169 *	-32.4702 *
Ln *N*	-2.1852	-1.8014
dLn *N*	-113.9139 *	-106.6125 *
Ln *DA*	-0.3512	-1.1623
dLn *DA*	-203.9088 *	-182.4486 *
HRS	-1.2465	-2.7722
d *HRS*	-3.0810 *	-3.1106
Ln *P*	-1.7727	-1.6296
dLn *P*	-4.7051 *	-4.9032 *

* reject null of unit root at 5% level

In formulating the dynamic model, three dummies are incorporated in the term z_t of (3.2). They are included to take account of short run shocks to the system, such as from policy interventions and other setbacks to grain output.

We set the lag length of the vector error-correction model equal to one. The data are annual, so the choice of a one-period lag seems reasonable. This choice is supported by the requirement that the residuals be Gaussian: tests for serial correlation and non-normality suggest that a one-period lag length is sufficient. On the basis of F-tests (F(6,17)), the null hypothesis that each of the lagged variables is zero is rejected at the one percent level for all the variables except grain output.

Diagnostic vector (system) tests suggest that there are no problems with serial correlation or normality in the multivariate model ($F_{ar}(72,33)=1.6514$ [0.0565]; $\chi^2(12)=17.792$ [0.1222]).

The Johansen (1989) cointegration log-likelihood ratio test based on the maximal eigenvalue procedure and on the trace of the stochastic matrix are used to test for reduced rank. Johansen's trace statistic is used to test the null hypothesis that there are at most r cointegration vectors. The maximum eigenvalue statistic is for testing the hypothesis $H(r\text{-}1)$ against the alternative $H(r)$ (Pesaran and Pesaran 1991:223), ie., there are no fewer than r cointegration vectors. Additional statistics are provided by replacing T (the sample size) in the maximal eigenvalue and trace statistics with

T-nm, where *n* is the number of variables in the model and *m* is the lag length. The results in Table 3.2 suggest that there are as many as four cointegrating vectors.

Table 3.2 *λ-max and trace statistics*

H_0:r	λ-max	(using *T-nm*)	λ-trace	(using *T-nm*)
0	57.54 **	46.75 **	156.10 **	126.80 **
1	34.94 *	28.39	98.57 **	80.09 **
2	29.59 *	24.04	63.63 **	51.70 *
3	21.53 *	17.49	34.04 *	27.66
4	10.89	8.85	12.52	10.17
5	1.63	1.32	1.63	1.32

** reject at the 1% level * reject at the 5% level

The normalised eigenvectors are presented in Table 3.3. LR tests reject the hypothesis of weak exogeneity in the system.

Table 3.3 *Estimated cointegrated vectors in Johansen estimation*

	Vector 1	Vector 2	Vector 3	Vector 4
Ln *G*	-1.0000	- 1.0000	-1.0000	-1.0000
Ln *S*	0.2973	40.0103	46.6441	-1.4133
Ln *N*	0.2345	-0.3700	19.6003	0.1090
Ln *MAP*	0.2843	-0.4250	-3.6067	0.2335
Ln *DA*	0.0861	5.1988	20.9755	1.3607
HRS	0.2205	1.6851	3.2011	-0.5562

Additional I(0) variables: *D61*, *D72*, *D86*.

Figure 3.1 plots the residuals of each of the cointegrating vectors to check for stationarity (eg., see Harris Chapter 5). Vector 1 seems to be the most stationary relation in the model. This is supported by inspection of Figure 3.2, which shows the residuals adjusted for short run dynamics.

Figure 3.1 *Residuals of cointegrating vectors*

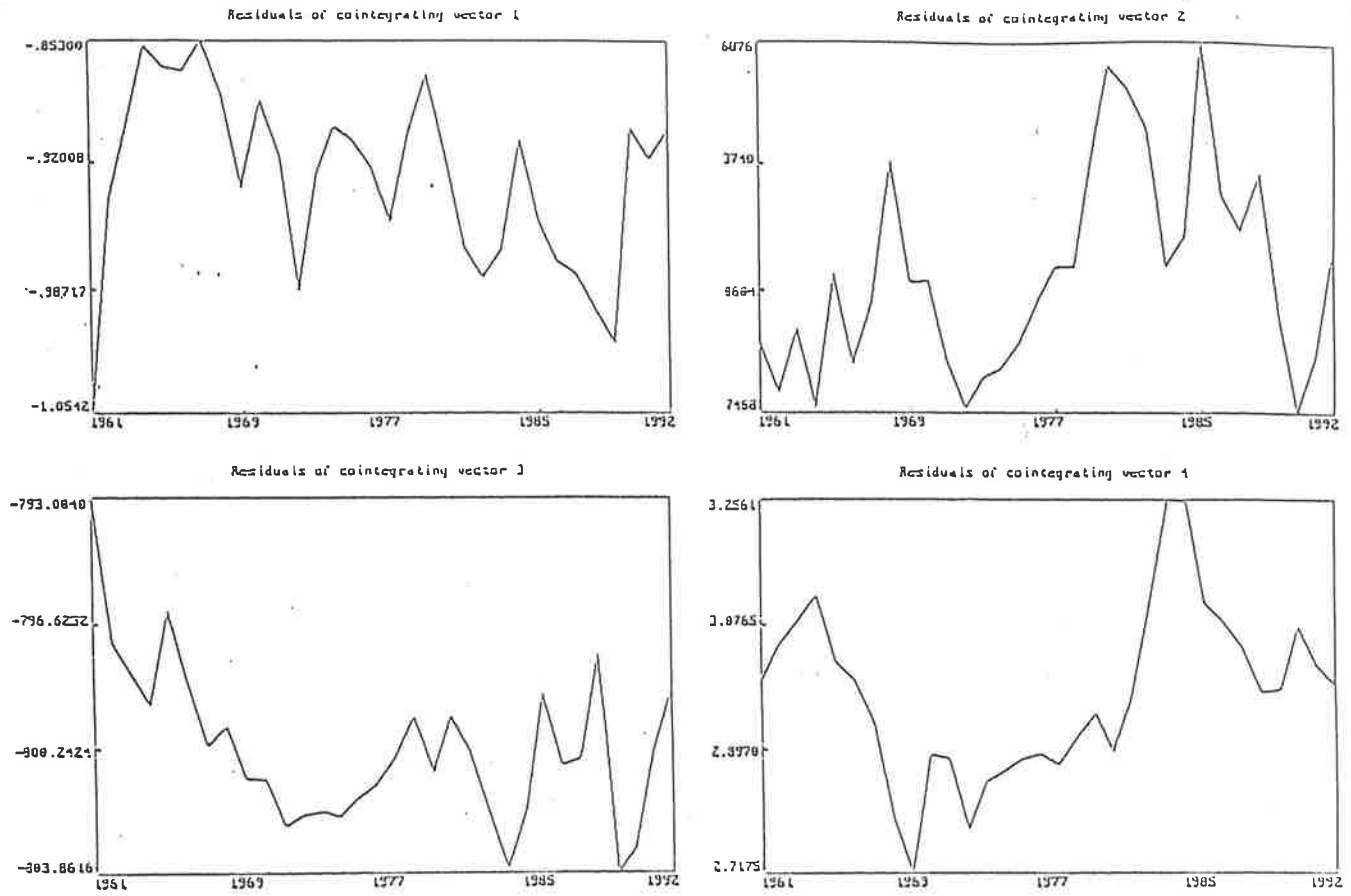
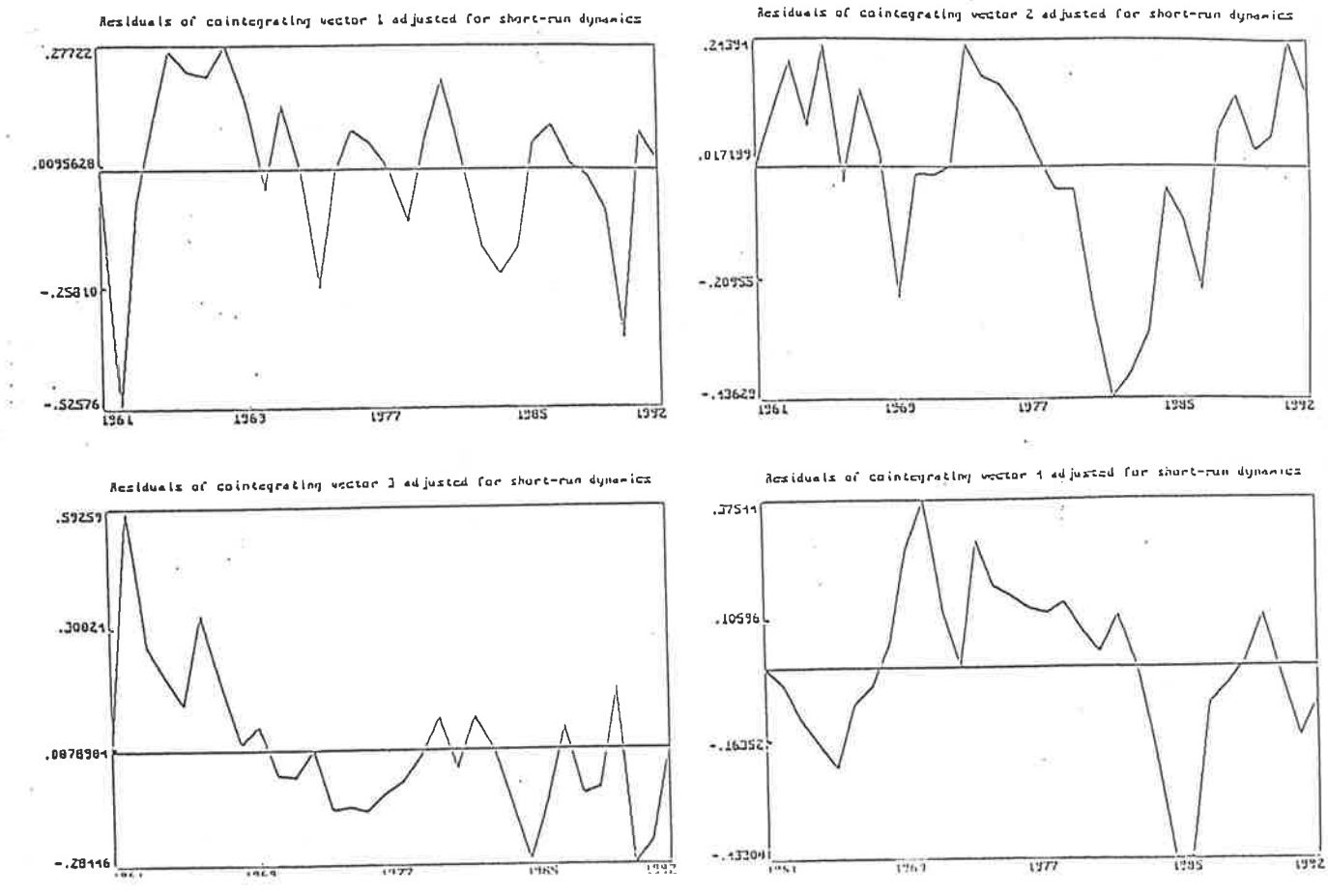


Figure 3.2 *Residuals of the cointegrating vectors adjusted for short run dynamics*



As a further check of the adequacy of the model, we inspect the plots of the recursive estimates of the eigenvalues. These plots correspond to the standard plot of parameter estimates, where non-constancy of the long run coefficients is reflected in non-constancy of the estimated eigenvalues (Harris Chapter 5). The model does not appear to suffer from parameter instability.

Maddala suggests that even though there may be *r* distinct cointegrating vectors, they may not all have meaningful economic interpretations; it is necessary to choose the linear combinations that make economic sense (Maddala 1992:594). Of our four cointegrating vectors, only one has a sensible economic interpretation in terms of the signs and magnitudes of the coefficients. These normalised elements may be interpreted as long run parameters (Charemza and Deadman 1993:200), and, in this case, as elasticities. Since economic theory predicts diminishing returns to each of the factors of production, only vector 1 offers a reasonable set of parameter estimates.

This point becomes more apparent by comparing vector 1 with estimates from a conventional approach. The conventional model is specified as in equation 3.1, generating OLS estimates of the logged variables. (An ADF unit root test of the OLS residuals confirms that this equation also represents a cointegration relationship.) The trend, relative price and weather variables were dropped on the basis of low statistical significance or to generate a model which conformed to plausible economic expectations (which was also the case in the Johansen model). The results are reported in Table 3.4.

Table 3.4 *OLS estimates of the "conventional" model*

(Dependent variable=Ln *G*)

Regressor	Coefficient	T-Ratio	[Prob]
Constant	-2.8198	- 0.7695	[.449]
Ln *S*	0.6631	1.5127	[.144]
Ln *MAP*	0.2782	12.6274	[.000]
Ln *N*	0.1183	1.6867	[.105]
Ln *DA*	0.1844	1.7013	[.102]
HRS	0.1780	4.6014	[.000]
D61	-0.1773	-2.8693	[.009]
D72	-0.0887	-3.2952	[.003]
D86	-0.0618	-4.5433	[.000]

Diagnostics: $\bar{R}^2$=0.99, n=32, DW=1.85, Godfrey LM statistic $\chi^2(1)$=0.27 [.602], Ramsey RESET LM statistic $\chi^2(1)$=0.03 [.852], Jarque-Bera LM statistic $\chi^2(2)$=0.04 [.982].

The theoretical results of Chapter Two highlighted the difficulties of the radical Maoists in altering or sustaining a revolutionary change in people's consciousness. This failure underpinned our stagnation hypothesis, where a fundamental incompatibility between socialised institutions and egoistic consciousness would cause output growth to stagnate. The results from both vector 1 and the conventional model, which indicate that the variable *HRS* is positive, provide strong econometric support for the stagnation hypothesis. The coefficient of *HRS* in both models is very close to that of Lin (1992:43). Thus, our empirical modelling also confirms important existing work related to this area, with our models grounded firmly in the modern econometric methodology of cointegration.

3.4 Conclusions

Had the Maoists succeeded in transforming human consciousness to generate a new socialist man, output growth in agriculture might have been truly impressive with collectivisation. Yet the data for the Maoist period suggest that the economic performance was relatively lacklustre. Grain output growth barely kept up with population growth, for example, despite a policy of assigning priority to grain production. The spectacular growth rates in the early post-reform period suggests that the collectivised sector was operating at reasonably high levels of inefficiency. Under Maoism, socialised relations of production reduced work incentives, implying the failure of Mao's historical experiment in transforming consciousness. Thus, the

point at which socialist institutions could possibly give rise to high levels of material abundance is likely to be in the very distant future, if at all, and to lie outside the bounds of tolerance, given the relatively high time preference of the Chinese people and their current leaders. As far as the post-1978 leadership is concerned, the only sensible alternative was to abandon the utopian Maoist policies and embark on economic reform.

CHAPTER FOUR: THE OPTIMALITY AND NATURE OF ECONOMIC REFORM

4.1 Introduction

With the passing of Mao, Deng Xiaoping's eventual political rehabilitation and subsequent repudiation of much of Mao's economic and ideological legacies came as little surprise. The repudiation was not necessarily a rejection of socialism, but rather a response to Mao's singularly inappropriate form of socialist development. On the surface, China still adheres to a socialist ideology and continues to exhibit a number of important features which define it as a socialist system: the Communist Party retains its leading role and social ownership of the non-labour means of production predominates. The Party leadership has publicly contended that China's development trajectory is also socialist in a dynamic sense, with the economic reforms deemed to be consistent with the eventual realisation of communism.

Given that the leadership under Deng is ostensibly committed to the socialist path, this chapter attempts to investigate the nature of the reformist struggle to maintain and develop socialism in China. Chapters Two and Three suggested the need for the

reformers to raise income. This point is now taken up to examine a reform path of raising output and reducing the emphasis on ideological matters. A dynamic model is developed in which it is optimal for the Party leadership to undertake economic reform and depoliticise daily life.

This model assumes that a socialist leadership (whether Maoist or Dengist) wishes to maximise a simple functional, whose arguments are national income and the cost of generating the income. Given its monopoly over political power, the state subordinates the institutions of society to itself and seeks to manipulate the relations of production. The manipulation focuses on the mounting of ideological campaigns and the promotion of socialist education in order to raise work effort and income. Both Maoists and Dengists are intensely concerned with economic growth and both have engaged in nationwide policies of political education. The difference between the two development strategies resides in the relative weights applied to current income versus ideological purity. In this context, the size of the income gains relative to the costs of political education determines which of the two strategies is to be followed. As the next section seeks to demonstrate, the current leadership's focus on raising income by expanding market relations is optimal.

4.2 The need for economic reform

The following optimal control model highlights pressures for limiting political education and for raising national income. The rejection of radical Maoist policies

implies the need for economic reform. The model is taken from Lim (1993). Assume that the Maoist leadership seeks to maximise the following functional:

$$\int_0^{\infty} \exp(-\sigma t)(y(L) - c(E))dt, \tag{4.1}$$

subject to:

$$\dot{L}(t) = E(t)L(t)$$

$$L(0) = L_0,$$

$$0 \leq E \leq \bar{E}, \tag{4.2}$$

where y denotes income. Income is a function of labour effort, *L(t)*, and this effort rises over time with political education, *E(t)*. Political education raises the efficiency of labourers, with the Party seeking to raise income by controlling this education. The cost function, *c(E)*, relates to the income losses associated with political education. The income losses result from the exhaustion and apathy associated with political mobilisation campaigns, from the economic dislocations and inefficiencies associated with excessive attempts at political education, such as the Cultural Revolution, and from the severe limiting of market relations, which at times have been deemed incompatible with the fostering of socialist consciousness. (A wider definition of costs might readily have included the human dimension as well. These include the costs of the violent suppression of "counter-revolutionary" activity, such

as the labour camps and purging of "bad elements", and the everyday costs imposed on the citizenry, such as attending political study meetings.) $c(E)$ is an increasing function of E, with $c' > 0$, c'' = constant, and $c''' = 0$. The discount rate is given by σ.

The problem has been set up with a bounded control, with zero and $\bar{E}$ as the lower and upper bounds of the control, $E(t)$. The aim is to determine the conditions under which it is optimal to set the control variable at or near to its lower bound. The current value Lagrangian, H, is:

$$H = y(L) - c(E) + mEL + \mu_1 E + \mu_2(\bar{E} - E), \tag{4.3}$$

where m is the current value multiplier and the bounds in (4.2) have been appended with multipliers μ_1 and μ_2 to the Hamiltonian. An optimal solution requires:

$$\frac{\partial H}{\partial E} = -c'(E) + mL + \mu_1 - \mu_2 = 0, \tag{4.4}$$

$$m' = \sigma m - H_L = \sigma m - y'(L) - mE, \text{ and} \tag{4.5}$$

$$\mu_1 \geq 0,\ \mu_2 \geq 0,\ \mu_1 E = \mu_2(E - \bar{E}) = 0. \tag{4.6}$$

Under what circumstances would it be optimal to abandon political education, ie., to set E=0? Begin by assuming that E=0. (4.5) now becomes:

$$m' - \sigma m = -y'(L) \tag{4.7}$$

$$\Rightarrow m(t) = \frac{y'(L)}{\sigma} + K\exp(\sigma t), \tag{4.8}$$

where K is a constant of integration. For (4.8) to be consistent with (4.4) and hold for all t greater than or equal to zero, K must equal zero. An E equal to zero also implies that $\bar{E} - E > 0$, and from (4.6) $\mu_2 = 0$. Hence, from (4.4):

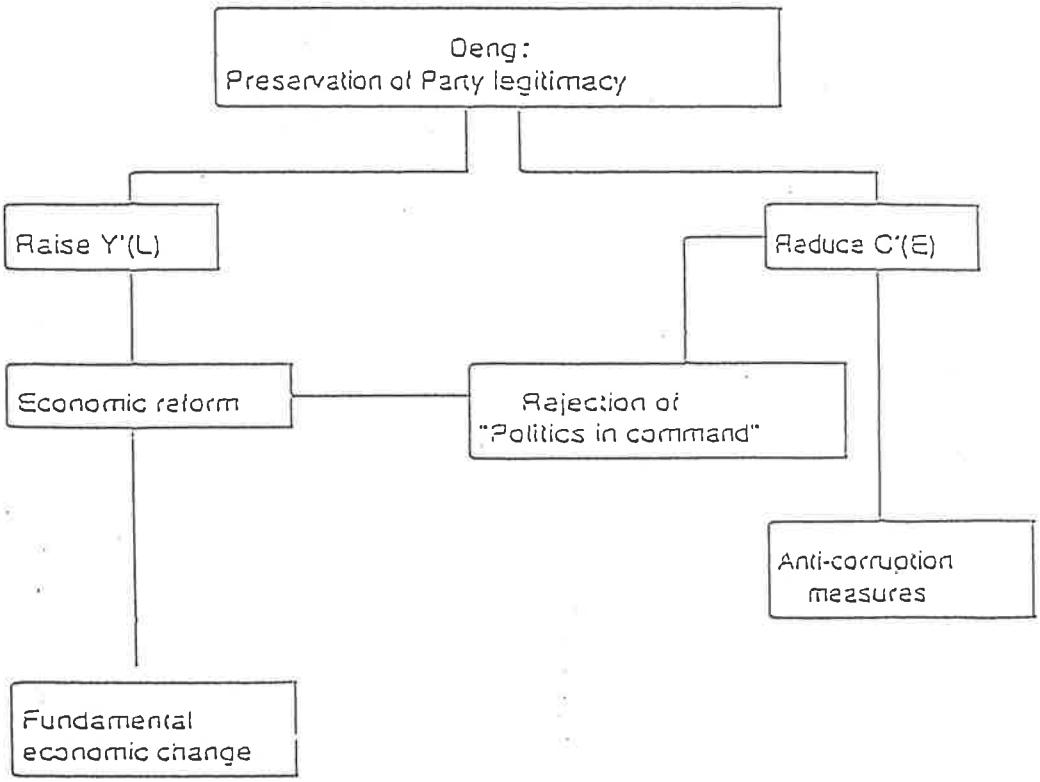
$$c'(E) \geq \frac{y'(L)L}{\sigma} \quad \text{(for } E\text{=0)}. \tag{4.9}$$

Equation (4.9) is central in the need for economic reform. Should China have relatively high values of $c'(E)$ and σ (the marginal rate of time preference) and a low value of $y'(L)$, which arguably was the situation by the end of the Maoist period, it is optimal that E fall to zero. The costs of generating higher income by political education are too high relative to the (low) benefits, $y'(L)$. The marginal costs, $c'(E)$, of the Maoist strategy are well documented (eg., see Chan, Madsen and Unger (1984) for a description of the Maoist political campaigns), as are the economic losses that China suffered during the high tide of Maoism, ie., the low values of $y'(L)$. The marginal rate of time preference of the reformist leadership was also likely to be high, given the speed with which it reduced the role of political education and embarked on economic reform.

4.3 The reformist leadership's response

The role of the Party leadership in initiating reform processes is pivotal in the discussion of China's economic reform. Reform takes place in China only at the acquiescence of the Party elite. For Deng, the response to the pressures of equation (4.9) primarily requires economic reform and the relative depoliticisation of daily life. A stylised view of Deng's response to the reform pressures is given in Figure 4.1.

Figure 4.1 *Deng's response*



By 1978, when Deng resumed political power, China was in dire straits economically. Problems with economic coordination and frequent mobilisation campaigns had driven China to the point of bankruptcy. Deng's approach to development since 1978 has focused on the economy, since he appears to believe that, in the view of the masses, the legitimacy of the Party can only be maintained by delivering economic prosperity (Ch'i 1991:257). A prerequisite for economic growth is stability, both economically and politically. The proponents of reform were quick to defend their policies as being consistent with the need for economic stability and growth, and hence also consistent with Marxist orthodoxy. Mao's policies were condemned as utopian, and he was even accused of never being a Marxist (Van Ness and Raichur 1983:13). The retreat from "advanced" relations of production was seen to be necessary in view of China's economic backwardness, while the socialist nature of the Chinese economy was deemed to be upheld - two basic tenets of socialism continued to be maintained: public ownership of the means of production and distribution according to work (Riskin 1981:39). For Deng, even though economic prosperity would lead to political stability, such stability would also involve the reassertion of Party prestige. Thus, in reducing $c'(E)$, the Maoist experience was discredited and a promise was made to end campaigns like the Cultural Revolution (Cheng 1989:ix), and more recently some attempts have been made to restore Party discipline and to reduce corruption and abuse of Party privileges.

In mid-June 1989, Deng predicted that the Party would have the wide support of the people if it could maintain a 6-7 percent annual growth rate for the rest of the century (Ch'i 1991:272). However, Ch'i rejects this optimistic assessment by suggesting that the Tiananmen Square tragedy occurred despite a decade of economic growth rates in excess of 10 percent (Ch'i 1991:275). Ch'i's dismissal of Deng's view of the role of economic growth in pacifying the populace is perhaps rather harsh. First, the issue of concern in the student-worker protest in Tiananmen Square was not economic growth rates (which contrasted dramatically with the Eastern European and Soviet protest movements, where appeals for a more market economy were much more pronounced). Rather, the issues of discontent concerned official corruption, inflation and human rights violations. Secondly, the protest movement was essentially confined to the cities. The countryside, which since the late 1970s witnessed rapid increases in material living standards due to Deng's rural economic reforms, seemed less affected by the events in the major cities. It may be argued then that Deng has been relatively successful in raising national income and that his past efforts have paid dividends in preempting widespread popular discontent from poor economic performance.

4.4 Longer term perspectives: The need for full economic reform

Institutions only survive in the long run if they are perceived to be fair or of (material) benefit to a sufficiently large sector of society. If the essential goal is to

deliver material growth, then the rationale for China's pursuit of a socialist development path is severely weakened. Economic reform requires extensive liberalisation of markets; communist parties stand in the way and create economic distortions (Scobie and Lim 1992:4). The impact of the distortions can be very large and involve several sectors simultaneously. Consider the combined problem of rural unemployment, declining grain production and inefficient state enterprises, a problem which results in part from the coexistence of state planning (in setting some agricultural prices) with liberalised markets (allowing labour mobility). The burden of subsidies and wages required for the state enterprises increases the state budget deficit, thus fuelling inflation. A partial solution to this problem is to keep total wages low by maintaining low grain prices for urban workers. Artificially low state purchase prices for grain reduce farmers' incentives to engage in grain production and grain output falls. The displaced farm labourers give rise to the problems of unemployment and rural labour transformation.

A long run solution might instead involve the transition to a full market economy. State firms would be privatised, such that the imposition of a "hard" budget constraint would restrain excessive wage demands and facilitate the realisation of static efficiency gains; grain prices would be totally freed to induce peasants to return to grain production; this, in turn, would eventually put some downward pressure on grain prices over the longer term as supply increased, so allowing urban wages to fall.

Despite hints of privatising "small" state enterprises (Kaye 1993:13), central planning still has a major influence in the Chinese economy. State-owned firms account for a substantial proportion of industrial output and employment, and they still continue to receive substantial subsidies. Propping up loss-making firms to avoid the short-run costs of urban unemployment generates further welfare losses, as consumers and workers on fixed incomes are penalised by inflation. These distortions also hurt entrepreneurs, on whom the leadership relies to deliver economic prosperity. The inefficient state enterprises divert resources that could have been more gainfully employed by the private sector, and shortages result from the central planning of vital industries, such as energy and raw materials, which stifle other sectors.

The problem of internal inconsistencies in a partial reform becomes more apparent when the general conditions that must hold for an efficient working of a market system are compared with the principles of socialist ethics. Prybyla (1990:117) suggests that a market system must meet a number of conditions: all markets must be free, including freedom of entry and exit and voluntariness of transactions; prices must not be distorted; workable competition must prevail; economic agents must be rational maximisers; private property rights must be established; and macroeconomic stability must be maintained. The incentive system, degree of entrepreneurship and personal responsibility embodied in Prybyla's conditions often conflict with the ethical principles of a socialist economy. The socialist principles include the principle of solidarity, where the weak in an economic system are to be helped; the

principle of security, such as the security of full employment; and the priority of social interest over partial interest (Kornai 1980:149).

Attempts to mesh the market conditions with the ethical principles generates a less efficient outcome in which the intended benefits of both are reduced. The priority of social over partial interest clashes with the promotion of entrepreneurship, initiative and risk-taking in a market environment, and distorts naturally-evolving patterns of economic activity. A prime example of this is China's rural industrialisation. The emergence of a mutually supportive relationship between agriculture and rural industry accords with standard economic precepts of the structural transformation process in economic development. Yet the Chinese leadership has intervened at times to obstruct this relationship. For example, the objective of national food self-sufficiency, coupled with the reported downturn in grain output in 1985, precipitated the closure of many rural industries as the government attempted to divert rural resources back to grain. At a wider level, the tension and competition between urban state industry and the rural sector also results from the primacy of non-economic objectives over economic relationships. Political objectives intercede to subsidise and maintain urban state enterprises and employment. The costs are borne by agricultural producers, who are hurt by adverse agricultural-industrial price scissors, and by rural industries which are taxed and sometimes even closed down when their activities are deemed to be inconsistent with the interests of state enterprises. The implications of such interventions form the basis of the next chapter, which examines

how the time paths of rural industrialisation and agriculture are distorted by state intervention designed to protect the urban state industrial sector.

4.5 The Party's resistance to full reform

If a solution to China's economic ills possibly lies in the transition to a full market economy, why is it that the Chinese leadership has not completed its market reforms? Three obstacles to the transition to full market relations have been proposed. The first relates to the possibility that the Chinese leadership misunderstands the workings of the market mechanism, such that economic policy mistakes are introduced. In this view, the problems that have arisen in the implementation of reform result from a fundamental ignorance of the market system, whereby internally inconsistent reforms are implemented. The ignorance comes from a variety of sources, including China's earlier closed-door policies, the suppressing of intellectual debate over "bourgeois" economics, and the concentration of economic research on central planning (Tinari and Lam 1991:84).

A second source of resistance to full economic reform stems from vested interest groups in the state sector, who stand to lose the economic and political privileges derived from their positions in the state bureaucracy (eg, see Jefferson and Rawski 1992). State workers face the prospect of losing their tenured positions, together with the other benefits accorded them by their work units. State bureaucrats are also

potential losers in the reform stakes, forfeiting material benefits and the economic and political power associated with their positions in the state bureaucracy.

Third, full reform itself may be inconsistent with non-economic goals set by the Party leadership, which in turn constrain the extent to which economic reform can be implemented. Political leaders decide the trajectory of reform (Hewitt 1989:17) and determine the boundaries within which the reform parameters must lie. The Party leadership is acutely aware of these boundaries and focuses on avoiding widespread urban unemployment and social unrest. Such issues underpin the Party's maintenance of power, both on ideological and political grounds. To the extent that the reforms attempt to remove the controls and administrative restrictions impeding economic development (Dernberger 1989:22, Tinari and Lam 1991:84), the non-economic boundaries limit the extent of these institutional changes.

The three factors constraining full reform are interrelated. For example, workers in state enterprises who fear the loss of their economic status resist the reforms. The resistance may involve exaggerating the difficulties and economic costs of reform; if the political leadership lacks a full understanding of how the market mechanism works, such advice is more readily accepted. The Party leadership, as defender of the working class, may also feel compelled to support and maintain state enterprises, including those which are inefficient and making losses, in order to protect state workers from the prospect of unemployment. Whether as a result of ignorance of the market, vested interests or an appeal to ideology, the outcome is the same: an

unwillingness to undertake full economic reform and the imposition of an internally inconsistent reform package.

4.6 Conclusions

As China emerged from the Maoist era, the Party leadership recognised that China faced severe economic problems as a result of the failed Maoist strategy. Given the waning confidence of the masses in the Party, Deng's solution to the problem operated primarily on the economic front. The emphasis has been on economic reform and growth, and the successes have been impressive. It does not appear likely that China will follow the Soviet and Eastern European experience in rejecting socialism, at least in the short run. The CCP seems to have forged a social contract, especially in the rural areas, whereby progressive extension of material benefits is the *quid pro quo* for tolerance of Party control; China has no equivalent of Yeltsin around whom an effective political opposition might be mounted; the CCP leadership, while not monolithic, displays more public unity than did its Soviet counterpart (Ferdinand 1992:286) and has demonstrated its willingness to suppress dissent by military action; and significant advances have been attained in the people's material livelihood since the reforms were introduced.

Yet the economic reforms are far from complete. An obstacle to full reform has been the inability of the Party leadership to come to grips with the problems posed by the

state industrial sector. State industry has been favoured in China's intersectoral resource flows since the early 1950s, and reforms in the 1980s were even slowed down or abandoned when they threatened urban living standards and investment (Keidel 1992:128). Protecting the urban sector imposes costs on other sectors of the economy, however. Agricultural development has suffered from adverse procurement prices and high prices for state industrial output, while rural industrial growth is retarded by taxes and bureaucratic restrictions to support urban state industry. Until the state sector is satisfactorily reformed, agriculture and rural industry may fail to reach their potential growth rates and the structural transformation of China's national economy will be retarded. An investigation of this internally inconsistent reform path forms the basis of the next two chapters of the thesis.

CHAPTER FIVE: THE EMERGENCE OF RURAL INDUSTRY

5.1 Introduction

In mediating the interactions between agriculture, rural industry and state industry to achieve multiple objectives, the Party has created serious economic distortions and structural dislocations. When the social and economic objective of protecting state industry conflicts with the desire for economic growth in rural industry, the Chinese leadership has shown itself at times willing to intervene in favour of state industry. The result has been an uneven pattern of growth within the rural sector since the mid-1980s.

The objective of this and the following chapter is to examine the sectoral interactions that generate such tensions and relate them to the structural transformation of China's rural economy. Section 5.2 outlines the phases of sectoral linkage in an economy undergoing structural transformation. The formal modelling of sectoral linkage and structural transformation begins in Section 5.3, in which we develop one-, two- and three-sector models of the Chinese economy. Section 5.4 discusses an early phase of

the transformation, where rural industry emerges and becomes a net recipient of resource transfers from agriculture. The growth of rural industry is discussed in terms of exploiting an appropriate resource niche between agriculture and state industry. The niche arises when the state imposes adverse distortions on agriculture by artificially reducing the relative profitability of farming. In the mid-1980s, for example, restrictions on rural industry were removed. Agriculture found itself at a competitive disadvantage, and labour and other resources flowed to rural industry to provide a resource niche upon which rural enterprises would grow. (The implications of the growth of rural industry for agriculture and state industry form the basis of Chapter Six, in which the beneficial and competitive interactions between the three sectors are examined.)

5.2 Phases of sectoral interaction

Economic development over time involves the interaction of various sectors. Sectoral articulation has been studied extensively in the development economics literature (eg., Chowdhury and Chowdhury (1993), Ranis and Stewart (1993), Anderson (1992), Timmer (1989), Mellor (1986), Ghatak and Ingersent (1984), Mellor (1984), Asian Development Bank (1977), Jorgenson (1970), Johnston (1970), Ruttan (1970), Hirschman (1958)) and also in the Chinese economy literature (eg., B. Lin (1995a), Findlay, Watson and Wu (1994a), Ratha, Singh and Xiao (1994), Islam and Jin (1994), Woo, Hsueh, Shi and Zhang (1993), Zweig (1992), Sicular (1992),

Wu (1992), Findlay and Watson (1992), Islam (1991), and Byrd and Lin (1990)). The novelty of our contribution concerns the application of sectoral linkage theories to the structural transformation of the Chinese rural economy and the way in which the maintenance of opposing objectives generates distortions which inhibit the structural transformation. (In these chapters, we use the term structural transformation to mean a temporal increase in the ratio of the number of rural industrial firms to agricultural firms. Firms within a given sector are assumed to be identical, and their size is assumed to be invariant with time.)

It is useful to distinguish three phases of sectoral linkage between agriculture, rural industry and state industry. *Phase I* relates to the resource transfers from agriculture to the growing sectors. Agriculture is initially the largest sector in GDP share and is required to make a net resource contribution to the growth of emerging sectors. The resource transfers are competitive in the sense that agriculture loses from the growth of the other sectors, such as rural industry. The emergence of rural industry in the context of Phase I is the focus of this chapter. *Phase II* emphasises the development of sectoral linkages. Intersectoral competition eventually gives way to positive growth linkages between sectors. This is discussed in the next chapter, which considers the positive feedback between agriculture and rural industry; the two sectors provide markets and resources for one another's growth. In *Phase III* the sectors grow independently of each other.

Phases I and II have been evident in China, although the temporal demarcation between them is not clear due to phase overlap. The rapid flow of labour from agriculture to rural industry in the mid-1980s is an example of Phase I. Phase II corresponds to the Central Committee and State Council's March 1984 view of the role of rural enterprises in an integrated rural economy, an economy in which agricultural and rural industrial growth would be mutually supportive (eg., see Findlay and Watson 1992:64). The transition to Phase II includes greater reliance on market forces and a reduction in the bias against agriculture to facilitate its development on an equal basis with rural industry.

5.3 The basic models

This section develops models of sectoral growth and interaction. These models trace their origins to the population ecology models of theoretical biology. Mathematical treatments of species growth and inter-species linkages are well developed in the biology literature, and such approaches have immediate application to the analysis of sectoral dynamics in economics. In particular the growth of a biological species exhibits similarities with the growth of an industry or sector, where both species and sectors grow and compete for resources. For example, the growth of biological populations is often modelled logistically, as have been the growth profiles of industry (Sengupta 1987:127). An additional appeal of our models relative to other approaches, such as some CGE models (eg., Findlay, Martin and Watson (1993)),

input-output analysis (eg., Vogel (1994); Woo, Hsueh, Shi and Zhang (1993)) or large-scale econometric models (eg., Shi, Yao, Zhang, Hsueh and Woo (1993)), is that our models are much more dynamic and can in principle be simulated. They thus provide a simple and useful framework for thinking about how sectors in the Chinese economy emerge, interact with others and respond to policy interventions over time.

We begin with a one-sector model. Consider a simple logistic model describing the growth of a single sector, *i*, such as agriculture or rural industry, without intersectoral interactions. Denote the number of firms in this single sector by X_i, where all firms in a sector are assumed to be identical. Let the sector grow at an intrinsic rate r_i, which reflects the rate at which the sector would grow without the inhibiting effects of resource scarcity. This rate may depend on factors such as the macro- or microeconomic environment and is assumed to be constant.

As economic activity consumes available resources, a physical limit to the number of firms that may exist and compete in this sector is approached. Refer to this physical limit as the *carrying capacity*, K_i (defined as the number of firms that resources may support indefinitely). Defined in this way, the carrying capacity has useful economic interpretations: property rights and governance, hard or soft budget constraints, operational autonomy and intersectoral competitive pressures, for example, may influence the efficiency with which resources are used and determine the carrying capacity of a given sector.

The logistic growth of the sector is given by:

$$\dot{X}_i = (r_i - (r_i / K_i) X_i) X_i. \qquad (5.1)$$

Equation (5.1) models growth as depending on the intrinsic growth rate, r_i, and on intrasectoral competition, ie., the competition for resources between firms in the same sector. The effect of this density-dependent competition is given by the term $-r_i / K_i$. As the number of incumbent firms, X_i, approaches the carrying capacity, K_i, the logistic growth rate falls. As time continues, the number of firms tends to the carrying capacity (see Appendix D).

Now suppose that another sector exists as well, and that this sector partially competes for resources. The growth of each sector will be inhibited by the competitive presence of the other; refer to this as intersectoral competition (or negative interaction). Competition for resources may be either exploitative or interfering. Exploitative resource competition occurs when at least two sectors exploit the same limiting resources, such as state and rural industry competing for labour. Interfering resource competition refers to actions undertaken by one sector to inhibit another sector's ability to survive or exploit resources. An example is the request by state industry for the state to close down rural industries. Note that in this expository section competition is confined to exploitative competition.

A model of competition between the two sectors is given by:

$$\begin{aligned}\dot{X}_1 &= (r_1 - (r_1 / K_1) X_1 - (r_1 / K_1) b_{12} X_2) X_1 \\ \dot{X}_2 &= (r_2 - (r_2 / K_2) X_2 - (r_2 / K_2) b_{21} X_1) X_2 .\end{aligned} \tag{5.2}$$

The difference between (5.1) and the first equation in (5.2), for example, is the addition of the term $-(r_1 / K_1) b_{12} X_2$. This represents the effect on sector one of competition for resources by firms in sector two; ie., the effect of intersectoral competition. The way in which this is denoted allows a comparison of the relative effects of inter- and intrasectoral competition. If $b_{12} = 1$, then the dampening effect on sector one of firms in sector two is the same as if they were in sector one. If $b_{12} > 1$, then firms in sector two inhibit growth in sector one more than they would if they belonged to sector one (conversely for $b_{12} < 1$).

In the model for n sectors, the system becomes:

$$\dot{X}_i = r_i \frac{(K_i - \sum_{j=1}^{n} b_{ij} X_j)}{K_i} X_i . \tag{5.3}$$

b_{ij} is the competition coefficient, with b_{ij}=1 for all i=j. This term reflects the competitive effect of sector j on sector i relative to the competition in sector i itself.

Let there be three sectors in our model: agriculture (X_1), rural industry (X_2) and state industry (X_3). (Three sector models of the Chinese economy have been used elsewhere; eg., see Shi and others 1993, Putterman 1992.) This model highlights intersectoral competition for resources whose supply is fixed. The resources are assumed to be potentially mobile within China, but not internationally (with the implications of an open economy discussed in Chapter Six). In particular, assume that all three sectors draw upon a fixed quantity of labour as a prime resource in their production. The emphasis on labour is important, given that China's post-reform transfer of labour from traditional agriculture to rural industry has been described as the largest in recent world history (Kalirajan and Wang 1994:66).

We further assume that all labour can be differentiated on the basis of quality. Let labour quality refer to the technical skill level of the worker. Denote labour quality by q, with q=0 representing the highest quality available and progressively higher values of q representing lower labour quality. Due to the differing characteristics of the sectors, each sector has a different preference for the labour quality it uses. The resource niche of each sector depends on each sector's needs: labour quality tends to be higher in rural industry than agriculture, and lower than in state industry (Wu 1994, Islam and Jin 1994:1657).

Consider any sector i. Define $u_i(q)$ to be a probability distribution function on the interval $[0,\infty)$ and refer to it as the labour utilisation function of sector i. The function represents the probability of sector i choosing to use a worker of quality q,

and thus the preferences for labour quality within the sector. That is, the position of u_i represents the quality of labour sector i prefers to employ, with the niche position of sector i given by the mean of u_i, $\bar{q}_i = \int q u_i(q) dq$.

Recall that b_{ij} reflects the competitive effect of sector j on sector i relative to the competition in sector i itself. Given labour utilisation functions, u_i, from MacArthur and Levins (1967:380) this may be written as:

$$b_{ij} = \frac{\int u_i(q) u_j(q) dq}{\int u_i^2(q) dq}.$$

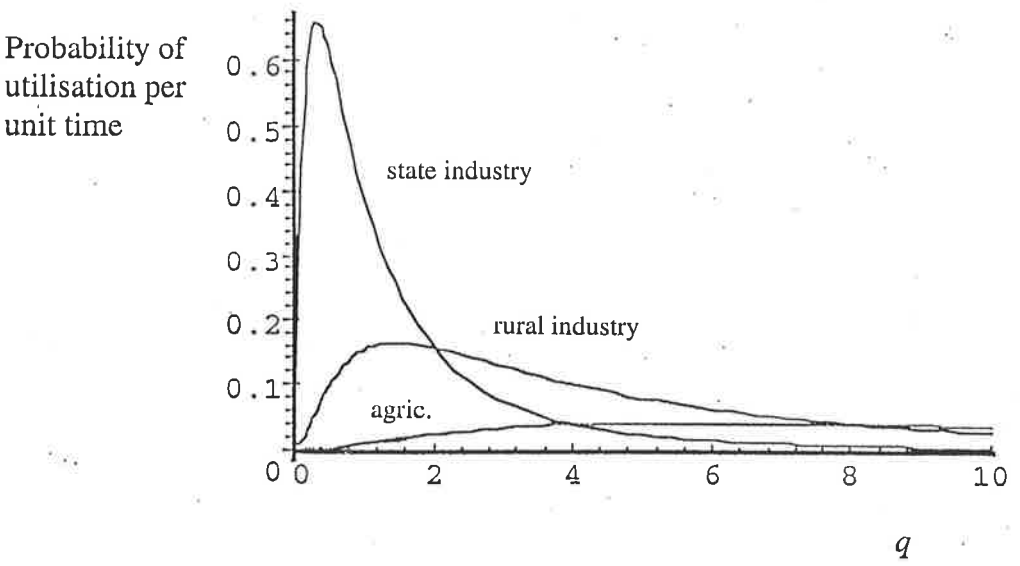
The numerator represents the overall chance that a firm in sector j will be competing with a firm in sector i for the same quality labour (ie., intersectoral competition), while the denominator shows the overall chance that two firms in sector i will be competing for common labour quality (ie., intrasectoral competition).

The utilisation functions may be used to characterise the three sectors of the Chinese economy (agriculture, rural industry and state industry). Consider a subset of the log-normal distribution functions. These take the form:

$$u(q / q_i) = \frac{\exp(\frac{-1}{2}(\log(q) - \log(q_i))^2)}{q\sqrt{2\Pi}},$$

where q_i is some positive constant, and examples are depicted below. Consider the graph corresponding to q_3=1 in the following figure; this describes state industry's demand for labour quality. In our numerical example (using MAPLE V), state industry requires highly skilled workers and is reluctant to hire labour outside the range $q \in [0,3]$. Agriculture is illustrated as fairly indifferent to labour quality and has a more uniform utilisation function (as represented by the curve corresponding to q_1=16). As noted earlier, rural industry is likely to fall between these two extremes, and an example of its utilisation function is the curve corresponding to q_2=4.

Figure 5.1 *Examples of resource utilisation functions*



The niche position of each sector is given by:

$$\bar{q}_i = q_i \exp(1/2).$$

Given these utilisation functions, Roughgarden (1979) demonstrates that the competitive coefficient b_{ij} depends only on the value $d = \log(q_i) - \log(q_j)$. How may we interpret this? As the niche positions are $\bar{q}_i = q_i \exp(1/2)$, then:

$$\begin{aligned}\log(\bar{q}_i) - \log(\bar{q}_j) &= (\log(q_i) + 1/2) - (\log(q_j) + 1/2) \\ &= \log(q_i) - \log(q_j) = d.\end{aligned}$$

The niche distance, d, represents the distance between niche positions on the labour quality spectrum. Denote the competition coefficient between sectors at a niche distance of d by $b(d)$, with $b'(d) < 0$. This simplification means that the effects of sectoral competition depend only on the distances between sectors and not on the location of their particular niches.

5.4 The growth of rural industry

The intersectoral competition model can be used to investigate the conditions under which rural industry will emerge. This emergence has been spectacular, with non-state industrial output rising from 26.7 percent of total output in 1983 to 58.6 percent

in 1993 (Wong 1995:19). The mid-1980s boom in rural industrialisation shall be treated as a distinct new phenomenon (see Chang 1993:241), with only agriculture (X_1) and state industry (X_3) assumed to exist before this period. Again, the sectors are sustained on a one-dimensional continuum of labour quality. The focus on labour links the emergence of this new phase of rural industrialisation to one of its intended goals (namely, the absorption of underemployed or displaced farm labour) and facilitates discussion of rural structural transformation, a process in which labour transfer is a major component.

Let agriculture and state industry initially be at their equilibrium sizes in the approximate absence of rural industry. As rural industry just begins to be established in very low numbers, $X_1 = X_1^{(2)}$, $X_3 = X_3^{(2)}$ and $X_2 \approx 0$, where $X_1^{(2)}$ and $X_3^{(2)}$ are the equilibrium values of the sectors when rural enterprises are rare. Growth in rural industry (X_2) at these points requires that $dX_2 / dt > 0$.

Assume that the intersectoral competition coefficients are identical and that the interactions of rural industry with agriculture and with state industry are the same. For the purposes of this section, let the intersectoral competition coefficients between adjacent sectors on the resource axis be $b(d)$ and that between agriculture and state industry be $b(2d)$, where d is the average difference between the sectors in terms of the type of resource used.

A result from Roughgarden (1974:165) forms the basis of the following proposition.

PROPOSITION 5.1. *The condition for the successful entry of rural industry into the two-sector economy is*:

$$b(2d) - \frac{b(d)(K_1 + K_3)}{K_2} + 1 > 0. \tag{5.4}$$

Proof. See Appendix E.

Competition against rural industry by the incumbent sectors is reflected in $-b(d)$. It is difficult to determine how strong these competition effects are. Distinct resource niches appear to exist for each sector, with agricultural workers being of lower quality than those in rural enterprises, who in turn are less skilled than state industrial workers. The presence of these niches tends to reduce the strength of intersectoral competition for labour resources.

An important factor in the growth of rural industry relates to the expression $(K_1 + K_3)/K_2$. The greater the amount of resources available to rural industry relative to the other sectors, the more likely is a successful entry into the economy. This was the case in the mid-1980s, when farm labour displacement due to agricultural productivity gains, together with unfavourable relative prices for agriculture and restrictions on rural-urban migration, left a large pool of surplus labour in the countryside. State industry did not step in to absorb the labour because

of rigidities in central planning; thus, the carrying capacity of rural industry rose. (Other important resource continua besides labour would include financial and physical inputs. Financial resources for rural enterprises became more readily available as a result of fiscal contracting (Findlay, Watson and Wu 1993:9), the unwillingness of peasants to invest their savings in urban enterprises (Findlay and Watson 1992:66) and the mandating of rural credit cooperatives to provide credit for rural enterprises (Sicular 1992:360), while declining state control over the allocation of producer goods meant that rural enterprises could expand. These results have been treated elsewhere; for example, see Anderson (1992)).

5.5 Conclusions

This chapter discussed Phase I of structural transformation, where one sector grows at the expense of another. We introduced a three-sector model of the economy. Each sector was initially assumed to exhibit logistic growth, which was then extended to take account of competition for resources between sectors. Under the assumption of only one prime resource, labour, the three sectors overlapped in their demand for this resource. This overlap was only partial, given the differing niche positions of the sectors on the resource continuum. The greater the niche distance, the lower was the intersectoral competition. Lower competition against rural industry by the existing sectors, agriculture and state industry, facilitated the emergence and growth of the "third sector", rural industry. Over time, the relationship between rural industry and

the other two sectors will develop and undergo change. These changes and the resulting intersectoral interactions are the focus of the next chapter.

CHAPTER SIX: RURAL INDUSTRIAL INTERACTIONS WITH AGRICULTURE AND STATE INDUSTRY

6.1 Introduction

The growth of rural industry described in the previous chapter relates to Phase I of structural transformation, with a one-way flow of resources from agriculture to rural industry. As structural transformation proceeds, some intersectoral resource competition eventually makes way for mutually beneficial interaction. This leads to Phase II, where the two sectors support one another in net terms.

Section 6.2 looks at an integrated two-sector development process in which rural industry and agriculture support one another to provide positive feedback. In this scenario, market linkages transcend competition to establish complementary intersectoral growth.

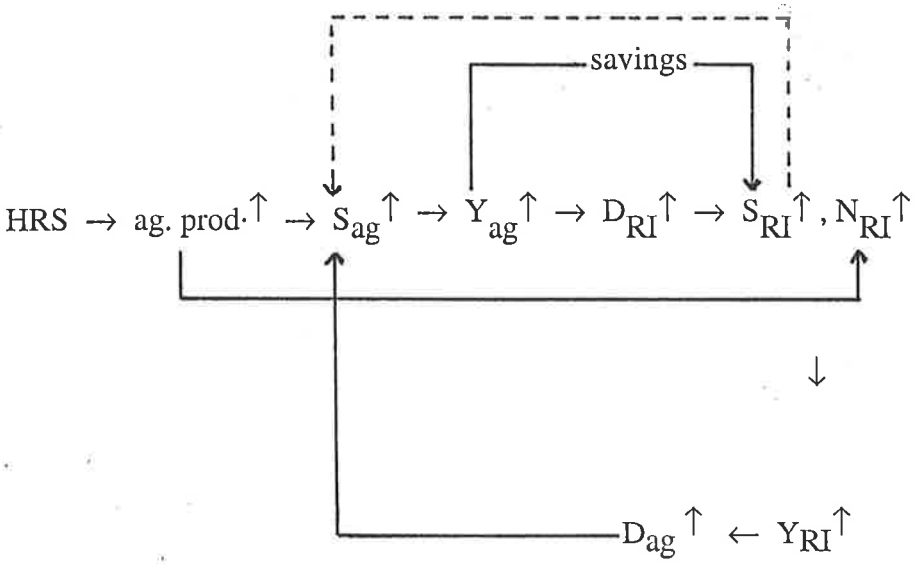
The growth in rural industry can adversely affect state industry, however. Competition between rural and state industry is the focus of Section 6.3, where a three-sector model is developed. Beneficial and competitive interactions arise in this model between agriculture, rural industry and state industry. Given the prospect of state industry succumbing to competitive pressures from rural industry, one response by the Chinese leadership has been to protect state industry by restricting rural industry. But as Section 6.4 attempts to show, direct suppression of rural industry may indirectly harm state industry. This stems from the positive interaction between rural industry and agriculture: when rural industry declines, so does agriculture. Since agriculture helps to support state industry by providing inputs and establishing market linkages, state industry is potentially disadvantaged by the restrictions imposed on rural industry.

The severity of the choice facing the leadership becomes clear. The Party must either allow rural industry to prosper and compete with state industry, or, in suppressing rural industry to release resources for state industry, suffer the adverse economic consequences of indirectly harming agriculture (and possibly even state industry itself), while at the same time retarding the structural transformation of the rural economy. Section 6.5 discusses the policy options, including reform of the state industrial sector as an alternative to suppressing rural industry.

6.2 Linkages between rural industry and agriculture

A representation of the links between agriculture and rural industry since the mid-1980s is given in Figure 6.1. The figure concentrates on the agricultural-rural industrial articulation and does not include other factors influencing the growth of rural industry, such as foreign or urban markets.

Figure 6.1 *Agricultural-rural industrial linkages*



HRS, S, D, Y, N, RI stand for the household responsibility system, supply, demand, income, employment and rural industry. The top part of the figure reflects the one-way intersectoral flows of Phase I of structural transformation. The HRS promoted

increases in agricultural productivity, which released labour, and farm savings rose to provide investment in rural industry.

Phase I overlaps with Phase II as agriculture and rural industry begin their economic integration. Rural industries have been important in helping agriculture to grow (Islam and Jin (1994:1644). A mutualistic relationship develops as rural industry grows, generates more employment and raises off-farm incomes. Part of the rising incomes are spent on or remitted to the agricultural sector (eg., see Islam and Jin (1994:1651-1655) for a discussion of financial flows from rural industry in support of agriculture). Farm incomes rise and farmers are able to increase their expenditures on inputs, such as transport services and farm equipment, and on consumer goods, such as electrical appliances and housing, much of which is provided by rural industry. The increased availability of consumer goods, for example, in turn provides more incentives for farmers to produce more in order to buy consumer goods. (This is represented in the previous figure by the dotted line linking rural industrial output with agricultural supply.) A virtuous circle emerges in which rural industry and agriculture expand in tandem. Recent changes such as the greater freeing of agricultural prices contribute to these developments.

The beneficial intersectoral relations are readily modelled. Consider the mutually supportive agriculture-rural industry articulation:

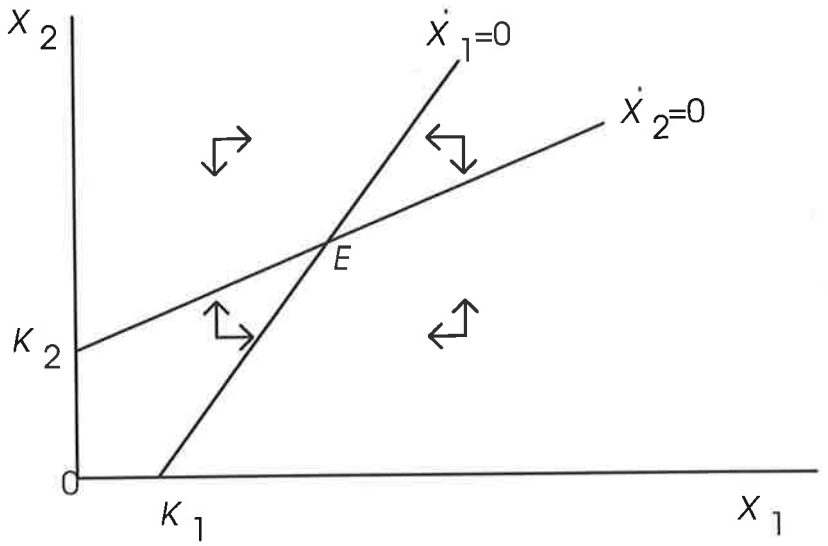
$$\dot{X}_i = (r_i - a_{ii} X_i + a_{ij} X_j) X_i. \qquad (6.1)$$

The notation has been simplified, with the intrasectoral competition coefficient denoted by $a_{ii} = r_i / K_i$ and the a_{ij} terms representing the intersectoral interaction coefficients, such that $a_{ij} > 0$, $i = 1,2$, $i \neq j$. In the case at hand the interactions are beneficial, so that a_{ij} shows the positive effect of a production unit from sector j on a unit from sector i. The equilibria are given by:

$$X_i^* = \frac{K_i + \alpha_{ij} K_j}{1 - \alpha_{ij}\alpha_{ji}}, \tag{6.2}$$

where $\alpha_{ij} = a_{ij} / a_{ii}$. It is easy to show that the X_i^* are strictly positive if $r_i a_{ji} > -r_j a_{ii}$. Assuming both sectors can persist in the absence of interaction, the phase diagram for the stable mutualistic system is presented in Figure 6.2.

Figure 6.2 *Phase diagram*



The equilibrium point is $E = (X_1^*, X_2^*)$. The slope of the $\dot{X}_1 = 0$ isocline is a_{11} / a_{12} and that of $\dot{X}_2 = 0$ is a_{21} / a_{22}. The larger the beneficial interaction and the weaker the intrasectoral competition, the larger is the equilibrium size of the benefiting sector. Note that $X_i^* > r_i / a_{ii} = K_i$; ie., both sectors are larger than they would be in the absence of mutually beneficial interactions. The stability of the equilibrium is discussed in Appendix F.

PROPOSITION 6.1 *An increase in intrasectoral competition in agriculture, an increase in the beneficial effect of agriculture on rural industry, a fall in intrasectoral competition in rural industry, or a fall in the beneficial effect of rural industry on agriculture is sufficient for structural transformation on the basis of agricultural-rural industrial articulation (Phase II).*

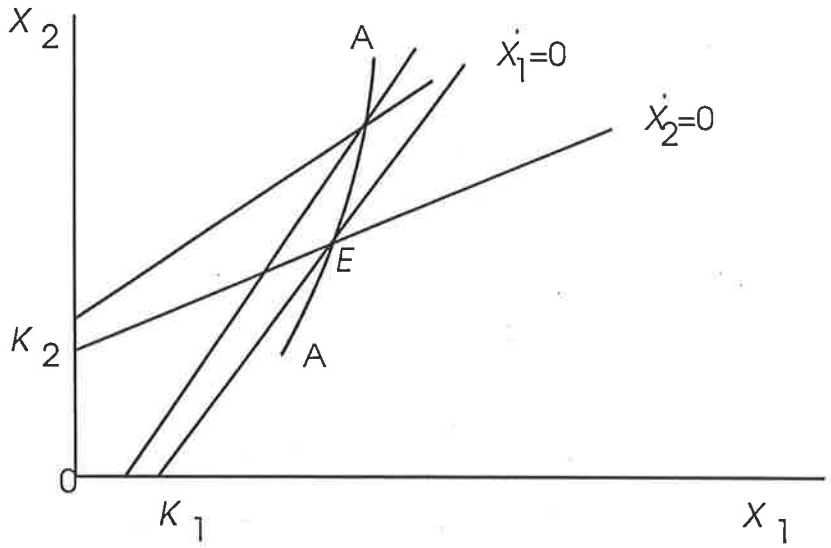
Proof. Structural transformation implies that the ratio of agricultural to rural industrial output falls over time. Define $\overline{X}$ as the ratio of the equilibrium values of agriculture to rural industry:

$$\overline{X} = \frac{X_1^*}{X_2^*} = \frac{K_1 + \alpha_{12} K_2}{K_2 + \alpha_{21} K_1}. \tag{6.3}$$

$\partial \overline{X} / \partial a_{21} < 0$. A fall in $\overline{X}$ over time is consistent with increases in a_{11} and a_{21}, and decreases in a_{12} and a_{22} over time.

The changes are depicted in Figure 6.3, with both isoclines shifting upwards. Note the change in the intercepts to reflect the new carrying capacities of each sector as intersectoral resource flows take place. A locus of equilibrium points (AA) is drawn to indicate the fall in the agricultural-rural industrial output ratio.

Figure 6.3 *Structural transformation*

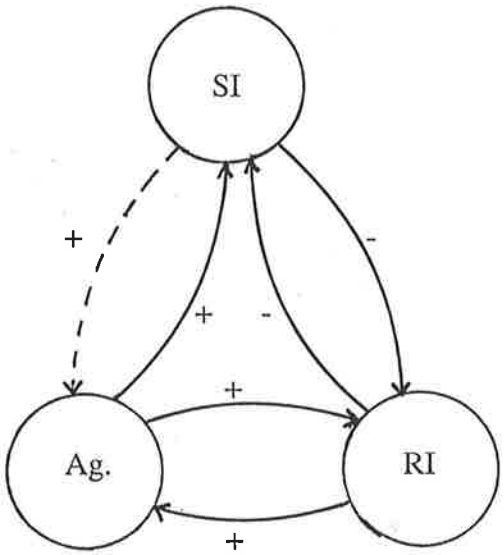


Remark. The intrasectoral competition coefficient in agriculture, a_{11}, is likely to rise as fewer resources become available to agriculture with the resource flow to rural

Remark. The intrasectoral competition coefficient in agriculture, a_{11}, is likely to rise as fewer resources become available to agriculture with the resource flow to rural industry. As rural industry purchases fewer agricultural products or as it changes the composition of its output to supply fewer inputs to agriculture, the positive feedback coefficient from rural industry to agriculture, a_{12}, is likely to fall. An increase in the carrying capacity of rural industry, K_2, decreases a_{22}, the intrasectoral competition coefficient. This could result from the flow of resources from agriculture to industry with the easing of restrictions on rural enterprises. As agriculture expands in output value, the beneficial effect of agriculture on rural industry, a_{21}, may rise as increasingly wealthier farmers purchase inputs and consumer goods from rural industry. (Note that an increase in a_{21} is consistent with a rising a_{11}, since agricultural output value could increase in absolute terms even with a labour outflow if agricultural productivity rises enough.) The effect of these changes is to decrease the per unit growth rate of the agricultural sector and raise that of rural industry, a change which is consistent with the structural transformation of the Chinese rural economy as agriculture decreases in sectoral importance (see Islam and Jin (1994:1647) for a description of the structural transformation of rural China between 1980-92).

industry). This section focuses on the interactions between rural and state industry, where it is assumed that the two industrial sectors compete with one another in net terms. (See Figure 6.4.) The concept of intersectoral competition is now widened to include competition in output markets as well as for resources. The (+) and (-) signs denote intersectoral benefit or competition.

Figure 6.4 *Intersectoral interactions*



Determining whether the relationship between rural and state industry is one of overall competition is clouded by a number of issues. On the one hand, output produced by rural enterprises is sold to urban producers (Wu 1992:22), and in some areas state enterprises assist rural industry in a number of ways, including the provision of specialist training (Zweig 1992:425), technology, funds and marketing

Determining whether the relationship between rural and state industry is one of overall competition is clouded by a number of issues. On the one hand, output produced by rural enterprises is sold to urban producers (Wu 1992:22), and in some areas state enterprises assist rural industry in a number of ways, including the provision of specialist training (Zweig 1992:425), technology, funds and marketing opportunities (Jefferson and Rawski 1995:133). State enterprises in turn expand their sales by subcontracting or establishing rural subsidiaries to take advantage of cheaper labour, avoid problems of planning targets (Christiansen 1992:82) and gain access to vital inputs, including land, whose supply may be restricted in the state sector.

On the other hand, the geographical distribution of rural industries and strong community identities associated with them reduce the extent of beneficial rural-state industrial linkages (Findlay and Watson 1992:76). The two sectors also compete for resources such as energy and other inputs (Putterman 1992:480). Raw material prices increase with the expansion of rural industry, inducing localities to retain resources in their own region to the detriment of state industry (Zweig 1992:431). The greater market prices received by some rural industries for their output have allowed them to outbid state enterprises in markets for inputs (Ody 1992:19). J. Lin (1995:12) suggests that as investment demand rises in an economic boom, strong competition arises between state and non-state enterprises for credit, foreign exchange and raw materials. When government regulations are not effectively enforced, bureaucrats and managers have incentives to divert resources from the state

to the non-state enterprises under their control, where the rates of return are higher (Wong 1995:21, s.a. Woo, Hsueh, Shi and Zhang 1993:255).

On the output side, rural and state industry compete for (monopoly) profits (Naughton, 1994:474; Naughton 1992) and in the supply of light industrial goods (Zweig 1992:419); such direct competitive effects have precipitated state intervention in restricting the scope of rural industrial activity. Singh and Jefferson suggest that 1982-90 provincial data show that the fall in state industry profits was greatest in provinces where rural industry grew the most rapidly (Singh and Jefferson 1994:7), while national data suggest rapid rural industrial output growth at the expense of state industry (Jefferson and Rawski 1995:142). Naughton (1994:479) also presents evidence of a consistent decline in the profits of state industry resulting from the rapid entry of and competition from rural industries (for a counter view, see Woo 1994:285).

The intersectoral competitive effects arise indirectly as well. Failure to reform state industry and come to grips with the soft budget constraint potentially imposes tax burdens (indirectly) on non-state sectors and perpetuates cycles of inflation and macroeconomic retrenchment, all of which inhibit the growth of rural industry (eg., see Islam (1991)). In 1993, industrial investment increased by 71 percent; to the extent that state industry accounted for 62 percent of these investments, much investment credit failed to be channelled to rural industry (Singh and Jefferson 1994:8). In sum, then, it is assumed that rural and state industry are net competitors.

From Figure 6.4, the interrelationships between the three sectors can be modelled in terms of the familiar linear growth equations:

$$\begin{aligned}
\dot{X}_1 &= (r_1 - a_{11}X_1 + a_{12}X_2 + a_{13}X_3)X_1 \\
\dot{X}_2 &= (r_2 + a_{21}X_1 - a_{22}X_2 - a_{23}X_3)X_2 \qquad (6.4) \\
\dot{X}_3 &= (r_3 + a_{31}X_1 - a_{32}X_2 - a_{33}X_3)X_3 .
\end{aligned}$$

As reflected in the signs of the coefficients, a_{ij} (i,j=1,2,3), the system (6.4) models beneficial interactions between agriculture and rural industry and between agriculture and state industry, while rural and state industry compete with one another.

The agriculture-rural industry and rural industry-state industry interactions have already been discussed, while the positive links between agriculture and state industry are well-known, at least in terms of the flow from agriculture to state industry. These resource flows were pronounced during China's period of heavy industrial development. With the current emphasis on a socialist market economy, agriculture can again be expected to contribute to state industrial growth. For example, agriculture provides raw materials and foodstuffs to state industry. All other things being equal, as grain output increases, the price of food in the cities tends to fall, putting downward pressure on wages in state industry. The reverse flow, from state industry to agriculture is more difficult to determine. Naughton

(1992:18) mentions the flow of financial resources from state industry in support of agriculture, for example. On the other hand, the econometric evidence from Yao (1994) finds no causal supportive link from state industry to agriculture, although he finds unidirectional causality from agriculture to state industry; Chowdhury and Chowdhury (1993) also provide partial support of this view.

The system (6.4) may now be used to derive the following proposition:

PROPOSITION 6.2 *Given the system (6.4), a necessary condition for state industry to decline is that* $\frac{r_2}{r_3} - \frac{a_{22}}{a_{32}} > 0$ *and* $\frac{a_{21}}{a_{31}} - \frac{a_{22}}{a_{32}} > 0$.

Proof. See Appendix G.

Remark. The first condition in Proposition 6.2 is more likely to be satisfied the higher the intrinsic growth rate of rural industry (r_2) relative to that of state industry (r_3), the lower the intrasectoral competition in rural industry (a_{22}) and the higher the intersectoral competition from rural industry on state industry (a_{32}). The coefficient a_{32} is likely to be high given the intense rivalry between the two sectors, while a_{22} is probably relatively low due to the large flow of resources to rural industry, which increases rural industry's carrying capacity.

Remark. The second condition is more likely to be satisfied the higher the beneficial impact of agriculture on rural industry (a_{21}) relative to agriculture's impact on state industry (a_{31}). Coefficient a_{21} is likely to be relatively high as farmers purchase the producer and consumer goods offered by rural enterprises.

Proposition 6.2 presents the Chinese leadership with a dilemma. A growing and prospering rural industrial sector puts competitive pressure on state industry. State industry faces the prospect of a decline, with the attendant urban unrest and "betrayal" of proletarian interests high on the leadership's mind. Support of the urban sector may be a true test of the Party leadership's commitment to socialism (Keidel 1992:130), social justice (Chou and Xu 1993:213) and job security (Putterman 1992:479), and state industry serves as an instrument of state power. Yuan Mu has recently claimed that state-owned enterprises "still represent our country's general economic power and are the chief source of the state budget and the main force for social stability" (Cottrell 1995:16). Over 100m workers are employed in the state owned enterprises, and the enterprises themselves fulfil a welfare function by providing their workers and families with housing, medical benefits, education and pensions. For a variety of reasons, then, the Party has been reluctant to allow state industry to suffer from the growth of the rural industrial sector. (Although the desire to protect state industry is presented here as a non-economic objective, economic considerations might also be considered, especially with regard to important areas such as energy provision by state industries. Nevertheless, to the extent that approximately one-third of state enterprises are estimated to be making explicit

losses and one-third implicit losses (J. Lin 1995:11), non-economic objectives must account for some of the leadership's aversion to a decline in state industry.)

The other side of the dilemma is that rural industry is a very dynamic and important sector in China's modernisation drive in terms of output, employment and tax revenues (rural industries have supplied over fifty percent of new state taxes since 1980 (Zweig 1992:422), although the ability of the state to tax rural industry is currently less clear). The suppression of rural industry in 1989 by the then dominant planning faction of the Party leadership and the back peddling from this policy in 1990 highlight the anxiety that this dilemma has caused. Either the social objective of protecting an inefficient state sector must be downgraded or rural industry must face the potential for further suppression by the state.

6.4 Suppression of rural industry

In seeking to avoid widespread unemployment and urban unrest, the leadership has demonstrated sufficient political resolve to retrench rural industry; in fact this was one of the goals of the 1989 austerity program (Sicular 1992:362, Putterman 1992:480), although state industry also suffered as a result. Two million rural enterprises were closed or taken over by other firms (Zweig 1992:422). The state has implemented a raft of policies to restrict rural industries directly or to place them at a competitive disadvantage versus state industry. Non-state enterprises have been the

victims of forced plant closures, taxes and other financial pressures. The state has been able to stop rural enterprises from withdrawing their own funds from the bank and has bankrupted them by having banks call in all outstanding loans (Zweig 1992:427). Conversely, state industries have been favoured by subsidised inputs, including capital, raw materials and energy, soft budget constraints and purchases of stocks unable to be sold on the market (Jefferson and Rawski 1992:55).

This section seeks to show that such a strategy has the potential to harm state industry: given the positive feedback between rural industry and agriculture, the restrictions placed on rural enterprises hurt agriculture, which in turn indirectly hurts state industry, given the mutualism between state industry and agriculture.

In the following model, the size of the state industrial sector is fixed and the focus is solely on the mutualistic relationship between agriculture and rural industry. The model of agricultural and rural industrial growth is given in the generalised form:

$$\begin{aligned} \dot{X}_1 &= h_1(X_1, X_2)X_1 \\ \dot{X}_2 &= h_2(X_1, X_2, \beta)X_2. \end{aligned} \tag{6.5}$$

β is a measure of government suppression of rural industry, with higher values of β reflecting increasing suppression.

The effect of a change in β on the equilibrium values of X_1 and X_2 is given in the following proposition:

PROPOSITION 6.3 *Let the model of agriculture and rural industry be given by (6.5), in which the derivatives satisfy:*

$$\frac{\partial h_1}{\partial X_1} < 0, \quad \frac{\partial h_2}{\partial X_2} < 0, \quad \frac{\partial h_1}{\partial X_2} > 0, \quad \frac{\partial h_2}{\partial X_1} > 0, \quad \frac{\partial h_2}{\partial \beta} < 0$$

for all X_1, X_2, β. *For* $\beta \geq 0$, *let* (X_1^β, X_2^β) *represent the intersection of the curves:*

$$h_1(X_1, X_2) = 0, \quad h_2(X_1, X_2, \beta) = 0.$$

If:

$$\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial X_2} - \frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial X_1} > 0$$

for all β, *then* (X_1^β, X_2^β) *is a stable equilibrium of the dynamic system (6.5). Further, both* X_1^β *and* X_2^β *are decreasing functions of* β.

Proof. See Appendix H.

Thus, assuming a mutualistic relationship between agriculture and rural industry, and intrasectoral competition in both, it follows that suppression of rural industry by the government is damaging. The effect of the suppression is to lower both rural industrial and agricultural output.

Remark. All other things being equal, the decline in agriculture in turn reduces the size of the state industrial sector, due to the positive linkage effects between the two sectors. On the other hand, the suppression of rural industry releases resources to state industry, increases state industry's carrying capacity and, all other things being equal, raises the growth rate of state industry. Thus, whether the policy of protecting state industry by suppressing rural enterprises harms state industry overall depends on the relative sizes of the two opposing effects.

A corollary of Proposition 6.3 is given in the following proposition, such that decreases in rural industrial and agricultural output may inhibit the structural transformation of the rural economy.

PROPOSITION 6.4 *Consider the system (6.5) and the assumptions concerning the signs of the derivatives. Let* (X_1^e, X_2^e) *represent the stable equilibrium when* $\beta = 0$. *Assuming that* $X_1^e > X_2^e$ *and that* $\partial h_1 / \partial X_1 < 0, \partial h_1 / \partial X_2 > 0$, *then for* $\beta > 0$:

$$\frac{X_1^\beta}{X_2^\beta} > \frac{X_1^e}{X_2^e}.$$

That is, government suppression of rural industry leads to a rise in the ratio of agriculture to rural industry.

Proof. See Appendix I.

Note the assumptions needed in this proof. The proof assumes that the initial size of agriculture is higher than that of rural industry. This is the case for China, as it is for many other developing economies, especially if we consider the total number of workers in each sector. The assumption that:

$$\frac{-\partial h_1}{\partial X_2} \Big/ \frac{\partial h_1}{\partial X_1} < 1$$

demands that the positive impact of rural industry on agriculture be lower than the effects of intrasectoral competition in agriculture.

Proposition 6.4 has important implications for the growth of the rural sector as a whole. Assume that structural transformation arising from an initial intersectoral disequilibrium increases economic growth. The increase results from the reallocation of inputs from less productive to more productive sectors of the economy (B. Lin 1995b:2; s.a. Putterman 1992:467 for a related view). That is, given an initial intersectoral disequilibrium where the marginal product of a resource is lower in one sector than another, the reallocation of resources to the intersectoral equilibrium maximises aggregate output.

This could correspond, for example, to the rural situation in the mid-1980s as resources shifted from agriculture to rural industry in response to the initial disequilibrium (excess agricultural labour supply) and subsequent rural economic liberalisation. An impact of the HRS was to save farm labour, which was then released to more productive uses in rural industry. Woo and others provide evidence that by 1986 the per capita output of rural industries was nearly five times as great as that of agriculture, leading them to conclude that raising the share of non-agriculture in total rural labour should have increased the rural social output value (Woo, Hsueh, Shi and Zhang 1993:244).

(Note that these authors seem to be talking about average revenue product - their point is clouded by the artificially suppressed price of farm products, for example, which also contributed to the structural transformation of the rural economy and reallocation of labour. If agricultural price suppression were the only cause of the reallocation, it would by no means be clear that the resulting structural transformation would be optimal, especially if the agricultural output were valued at its higher, shadow price (eg., see Putterman 1992:480).)

If Proposition 6.4 and the assumption that structural transformation contributes to aggregate economic growth hold, it follows that the suppression of rural industry must decrease the growth rate of the rural sector overall. (In our three-sector model, we define the rural sector to be the sum of the rural industrial and agricultural sectors.) The direct impact is that rural industrial output falls and drags down

agricultural output, given the complementary linkages between the two sectors. This effect is reinforced by the *reversal* of the path of structural transformation, as the number of agricultural to rural industrial firms rises.

6.5 Policy implications

The suppression of rural industry to protect state industry has two adverse consequences: state industry faces the possibility of being harmed indirectly through the rural industry-agriculture-state industry linkages, and the structural transformation of the rural economy is impeded. The harm done to rural industry may be reduced by the selective targeting of individual rural enterprises to be discriminated against, as opposed to a general sector-wide retrenchment. For example, rural enterprises with weak or non-existent linkages with agriculture could be targeted for close-down. The "39 Points" proposed at the 5th Plenum in November 1989 also suggested that product lines be shifted away from those of state industry and that rural enterprises be restricted to processing local materials (Zweig 1992:422).

Despite such policies, other aspects of the intersectoral competition problem remain difficult to resolve. There are resources which are used by almost all rural enterprises. Intersectoral competition exists for energy and transport (Findlay, Watson and Wu 1994b:15). Shifts in product line are not likely to have a large

impact on total use of such resources by a sector. The shifting of product lines entails producer and consumer welfare costs, as rural producers move against comparative advantage and market demand. Most importantly, the suppressing of rural industry diverts attention from the area most in need of overhaul - the inefficient state sector. A long term solution to the problem involves state sector industrial reform and greater privatisation. As Keidel suggests, in the absence of urban labour and management reforms, inefficient state enterprises will "hold the much more competitive non-state economy at bay by means of a hated taxing authority, restrictions on the scope of the non-state economy, and inflationary state finances" (Keidel 1992:121).

The impetus for these changes comes from competition with rural enterprises (Rawski 1993:4). Singh and Jefferson suggest that the growth of the non-state sector (ie., town and village enterprises) has led state industry to increase its productivity: "For every 10 percent increase in the non-state sector's share of industrial output, productivity in state industry - depending on the initial level of productivity - has risen by an average of 2.5 to 4.0 percent" (Singh and Jefferson 1994:7; see also Ratha, Singh and Xiao 1994). In terms of the state industry growth model in equation (5.2), these intersectoral competitive pressures raise the carrying capacity of state industry and therefore its growth rate. Removing the obligation of state enterprises to provide social services for its workers, greater input and output market flexibility, and the imposition of financial responsibility and accountability, would contribute significantly to easing the current problems of state industry.

To the extent that intersectoral competition is encountered in output markets, this competition might be reduced by redirecting sales to external markets. In this regard, the three-sector model of (6.4) implicitly incorporates the international trade sector as a vent for reduced intersectoral competition, since the competition coefficients (for outputs, at least) tend to decline with the introduction of new, overseas outlets for the outputs of state and rural industries. Rural industries, for example, have played an active role in this area in becoming an important vehicle for China's export-led growth (Lee 1994:190).

In the longer term, an increase in export markets for rural industrial output can contribute indirectly to the growth of state industry. Rural industry provides foreign exchange, with which more resources and technology may be imported to aid state industry. The short-run "zero-sum" scenario of rural-state industrial competition may partially give way to positive impacts provided by rural industry. As Rozelle (1994:385) suggests, policies that slow down rural industry impair the growth of the Chinese economy as a whole.

The growth of rural industry may even facilitate the transition to a privatised urban industrial sector. State industrial sector reform becomes more tenable politically when redundant state workers are able to find alternative employment. Given that the required educational levels of the workforce in rural enterprises are substantially above those in agriculture and are only slightly below the average levels in the state

industrial sector (Wu 1994:132), an expansion of rural industry may be a source of labour absorption as state industry is reformed and urban workers are displaced. Competitive pressure from state industry obliges rural enterprises to increase capital accumulation and technology (Findlay, Watson and Wu 1993:16), so that rural enterprises are likely to gain from the urban-rural migration of technically-trained urban workers.

6.6 Conclusions

The models used in this and the preceding chapter have attempted to characterise important elements of intersectoral interaction in the Chinese economy and highlight the implications of major policy interventions. The analysis began by deriving the conditions under which rural industry might emerge and occupy a resource niche between agriculture and state industry. With growth in rural industry, mutually supportive linkages with agriculture could develop, with the size of both sectors increasing relative to that in the absence of supportive linkages. It was shown that under certain conditions rural industry could grow more rapidly over time than agriculture, resulting in the structural transformation of the rural sector.

The growth of rural industry had potentially adverse implications for state industry due to intersectoral competition for resources and product markets; as a result, state industry could even decline. The Chinese leadership would then face an unpalatable

choice of either suppressing rural industry to protect state industry or compromising the social and political objective of protecting the urban proletariat. The choice reflects the problems associated with meshing multiple objectives, ie., protecting state industry coupled with the desire to make greater use of the market, including the forging of intersectoral links, on efficiency grounds. The suppression of rural industry and the protection of the state industrial sector could fail to achieve the twin objectives. Market outcomes, including structural transformation of the rural economy, could be compromised by a decline in the growth rates of agriculture and rural industry, and the protection of state industry might be undermined by the indirect adverse effects arising from the suppression of rural industry.

Depending on the magnitude of the relevant impacts, intervention to protect state industry may or may not be optimal; if the costs were low over some range of intervention, some protection might be desirable, given the objectives of the Party leadership.

These issues suggest that quantification of the trade-offs, perhaps with the aid of input-output or CGE models, may well be an important line of future research, especially if the prospects of thorough state sector reform remain as bleak as some have suggested (eg., J. Lin 1995:14) and if China wishes to extend its market reforms.

CHAPTER SEVEN: SUMMARY

The story we have told relates to the inconsistencies and conflicts attending China's struggle for economic development under socialism. The inconsistencies relate to important policies pursued by both Maoists and reformists. Under the radical Maoist strategy the intention was to transform China by altering human consciousness; this in turn would increase the material-technical base and herald the beginning of material prosperity. In emerging from a feudal-capitalist past, Mao recognised that the Chinese people still retained a tendency towards capitalist consciousness. By imposing changes in the relations of production, such consciousness might be altered and eventually replaced with a socialist consciousness, a consciousness which emphasised generosity, self-sacrifice and concern for others. But the relations of production could not become fully socialised overnight, and concessions had to be made to material incentives to prevent output falling in the early phases of socialism. Unfortunately for Mao, the concessions to a market economy tended to reinforce the existing capitalist consciousness.

Mao believed that if the market concessions could be limited, heightened consciousness might still be attained. But the Maoist strategy would run into an internal contradiction if self-sacrifice, altruism and generosity were income

dependent (such that people firstly had to establish a margin of material comfort for themselves and their families before they were able to help others). The assumption of an income dependent consciousness was crucial to our discussion of Mao's failure: given a prevailing capitalist consciousness at the beginning of the Maoist strategy, the replacing of markets with central plans, private plots with collectives, and egoistic incentive systems with income-sharing arrangements could dampen people's incomes, and this could ultimately retard the emergence of altruism and generosity.

Mao's solution was to attack the consciousness problem directly by promoting political study, role models and moral suasion. But the politicisation of daily life and unrelenting indoctrination campaigns during the high tide of radical Maoism turned out to be self-defeating. The campaigns left in their wake economic ruin, political upheaval and broken promises, leading to disillusionment with socialism in general and radical Maoism in particular.

The thesis has sought to model these issues formally and suggested that the goal of heightened consciousness was highly unlikely to be realised. This view was tested indirectly by investigating the stagnation hypothesis. The empirical analysis strongly supported the notion that, even after two decades of Maoist institutions, the prevailing consciousness of the Chinese peasantry was essentially capitalistic. In the face of such consciousness and the prospect of further economic stagnation, the only alternative to the Maoist path was economic reform.

The current reform path suffers from its own internal problems. In our discussion of the linkages between agriculture, rural industry and state industry, an inconsistency arose from the presence of conflicting objectives. The Party leadership under Deng recognises the benefits of a growing private economy, but political and social constraints require that inefficient sectors be shielded from the discipline of the market. Tensions emerge when the sectors interact, and the protection of state industry imposes costs on the private sector, especially rural industry. The Party leadership seems unable to reconcile the conflicts imposed by seeking to accommodate economic and political objectives simultaneously. By making concessions to political pressures and stopping short of full economic reform, the Party is forced to play a messy zero-sum game between the state and rural industry, constraining in the short run the more dynamic market-oriented sectors of the economy.

The two areas of inconsistency highlighted in the thesis are not the only areas of conflict. China's development path is littered with many such instances; our two cases are mere illustrations. Until the Chinese can deal effectively with these tensions, China's development will continue to fall short of its economic potential.

APPENDICES

Appendix A

Recall that case (b) results from the assumptions that $\gamma_c > \eta\bar{S}$ and $\gamma_s > \varepsilon\bar{C}$. We restrict the values of C and S to be non-negative. The four equilibria are:

$(0,0)$, $(0,\bar{S})$, $(\bar{C},0)$, (a,b),

where $a = (\frac{1}{\bar{S}} - \frac{\eta}{\gamma_c}) / (\frac{1}{\bar{C}\bar{S}} - \frac{\eta\varepsilon}{\gamma_c\gamma_s})$, $\quad b = (\frac{1}{\bar{C}} - \frac{\varepsilon}{\gamma_s}) / (\frac{1}{\bar{C}\bar{S}} - \frac{\varepsilon\eta}{\gamma_s\gamma_c})$.

The stability of each is examined. We follow Brock and Malliaris (1989), who discuss the Liapunov instability of an autonomous system:

THEOREM 1 (Brock and Malliaris 1989) *Consider an autonomous differential equation* $\dot{x} = f(x)$, $f: D \subset R^n$; *assume that* f *is continuously differentiable in an open, connected set D, which contains the origin. Let U be an open set which contains in its closure the 0-equilibrium solution. Suppose that V is continuously differentiable on D, that V and* $\dot{V}$ *are positive definite on* $D \cap U$, *and also that V=0 on* $\partial U \cap D$, *that is on that part of the boundary of U inside D. Then the 0-solution of* $\dot{x} = f(x)$ *is unstable.*

To determine the stability of the fixed point (0,0) in the problem under consideration, try a Liapunov function:

$$V(C,S) = (C^2 + S^2),$$

$$\dot{V}(C,S) = 2(C\dot{C} + S\dot{S}).$$

For sufficiently small (non-zero) values of C and S, both V and $\dot{V}$ are positive definite, since we have assumed that the growth rates of C and S are positive when C and S are small and that C,S are positive.

For the second fixed point, $(0,\bar{S})$, put $s = S - \bar{S}$, so that (C,s) are coordinates with reference to the fixed point $(0,\bar{S})$ as the centre. Thus:

$$\dot{C} = \gamma_c C(1 - \frac{C}{\bar{C}} - \frac{\eta}{\gamma_c} S)$$

$$= \gamma_c C[1 - \frac{C}{\bar{C}} - \frac{\eta}{\gamma_c}(s + \bar{S})]$$

$$= \gamma_c C - \eta C\bar{S} + \gamma_c C(h.o.t.)$$

$$= \gamma_c C(1 - \frac{\eta\bar{S}}{\gamma_c}) + O(R^2).$$

Hence, $\dot{C} > 0 \ \forall C, s$ sufficiently small. Let D be a neighbourhood of the origin, and try $V(C,s) = C$:

$$D = \{(C,s): \dot{C} > 0\} \cup \{(C,s): C = 0\} \text{ and } U = \{(C,s): C > 0\}.$$

Thus, the closure of U, $\overline{U} = \{(C,s): C \geq 0\}$, contains the origin. Since $V > 0$ when $(C,s) \in U$ and $\dot{V} > 0$ when $(C,s) \in D$, then V and $\dot{V} > 0$ when $(C,s) \in U \cap D$. $V(C,s) = C = 0$ on the part of the boundary of U that is inside D. Therefore, from Theorem 1, the fixed point is unstable. A similar treatment holds for the fixed point $(\overline{C},0)$. Lastly, for the fixed point (a,b), it is readily shown that it is asymptotically stable.

Appendix B

Lemma 1 An equilibrium of the system (2.5) is stable if:

$$\frac{\partial h_1}{\partial C}\frac{\partial h_2}{\partial S} - \frac{\partial h_1}{\partial S}\frac{\partial h_2}{\partial C} \geq 0$$

Proof. To determine the stability of the equilibrium, let $C = C^* + c$ and $S = S^* + s$, where c and s are small. Linearise the system (2.5) in the neighbourhood of the equilibrium, taking the first two terms of a Taylor series:

$$\dot{c} = a_1 c + a_2 s$$

$$\dot{s} = b_1 c + b_2 s.$$

The coefficients are the partial derivatives evaluated at the fixed point. It is necessary to find eigenvalues λ satisfying:

$$\begin{vmatrix} \frac{\partial h_1}{\partial C} - \lambda & \frac{\partial h_1}{\partial S} \\ \frac{\partial h_2}{\partial C} & \frac{\partial h_2}{\partial S} - \lambda \end{vmatrix} = 0.$$

$$\Rightarrow 2\lambda = (\frac{\partial h_1}{\partial C} + \frac{\partial h_2}{\partial S}) \pm \sqrt{(\frac{\partial h_1}{\partial C} + \frac{\partial h_2}{\partial S})^2 - 4(\frac{\partial h_1}{\partial C}\frac{\partial h_2}{\partial S} - \frac{\partial h_2}{\partial C}\frac{\partial h_1}{\partial S})}.$$

The stability requirement hence becomes:

$$\frac{\partial h_1}{\partial C}\frac{\partial h_2}{\partial S} - \frac{\partial h_2}{\partial C}\frac{\partial h_1}{\partial S} \geq 0.$$

Appendix C

Let S_δ be the solution to $g_2(0,S,\delta)$ for each δ and let S' be the solution of $g_1(0,S)=0$. By Lemma 1, Appendix B, the equilibrium point $(0,S_\delta)$ is stable if and only if:

$$\frac{\partial h_1}{\partial C}\frac{\partial h_2}{\partial S}-\frac{\partial h_2}{\partial C}\frac{\partial h_1}{\partial S}\geq 0 \quad \text{at } (0,S_\delta)$$

$$\Leftrightarrow \left(\frac{\partial g_1}{\partial C}C+g_1\right)\left(\frac{\partial g_2}{\partial S}S+g_2\right)-\frac{\partial g_1}{\partial S}\frac{\partial g_2}{\partial C}CS\geq 0 \quad \text{at } (0,S_\delta)$$

$$\Leftrightarrow g_1\frac{\partial g_2}{\partial S}\bigg|_{(0,S_\delta)}S_\delta \geq 0.$$

As $\frac{\partial g_2}{\partial S}<0$ and $S_\delta>0$, this is equivalent to the condition:

$$g_1(0,S_\delta)\leq 0.$$

The equation $g_2(0,S,\delta)=0$ defines S implicitly as a function of δ and:

$$\frac{\partial g_2}{\partial S}\frac{\partial S}{\partial \delta}+\frac{\partial g_2}{\partial \delta}=0$$

$$\Rightarrow \frac{\partial S}{\partial \delta} = \frac{-\partial g_2}{\partial \delta} \Big/ \frac{\partial g_2}{\partial S}.$$

By assumption, then, $\frac{\partial S}{\partial \delta} < -c$ on this curve. That is, S_δ is a steadily decreasing function of δ. As c is a positive constant, $S_{\delta_1} < S'$ for some value δ_1. But if $S_{\delta_1} < S'$, then $g_1(0, S_{\delta_1}) > 0$ as $g_1(0, S') = 0$ and $\frac{\partial g_1}{\partial S} < 0$. For this value of δ_1, as $g_1(0, S_{\delta_1}) > 0$ then the equilibrium $(0, S_{\delta_1})$ is unstable.

Appendix D

From (5.1) we have:

$$\dot{X}_i = (r_i - \frac{r_i}{K_i} X_i) X_i,$$

$$\Rightarrow \frac{dX_i}{X_i(1 - X_i / K_i)} = r_i dt.$$

To integrate the LHS, obtain the partial fractions:

$$\frac{1}{X_i(1 - X_i / K_i)} = \frac{1}{X_i(1 - 1/K_i)} + \frac{1}{K_i(1 - X_i / K_i)}.$$

Thus:

$$\int\left\{\frac{1}{X_i}+\frac{1}{K_i-X_i}\right\}dX_i=\int r_i dt$$

$\Rightarrow \ln|X_i|-\ln|K_i-X_i|=r_i t+C$, where C is a constant of integration.

Setting $C=\ln|c|$, with c having the same sign as $X_i/(K_i-X_i)$ yields:

$$\ln\left\{\frac{X_i}{c(K_i-X_i)}\right\}=r_i t$$

$$\Rightarrow \frac{X_i}{K_i-X_i}=c\exp(r_i t)$$

$$\Rightarrow X_i(t)=\frac{K_i}{[K_i/X_i(0)-1]\exp(-r_i t)+1}, \text{ by setting } X_i=X_i(0) \text{ for } t=0.$$

As $t\to\infty$, $X_i\to K_i$.

Appendix E

The condition for X_2 to be able to grow when rare is provided by Roughgarden (1979:543):

$$K_2 - b(d)X_1^{(2)} - b(d)X_3^{(2)} > 0.$$

Rural industry can only emerge if sufficient resources allow it to grow; ie., iff the carrying capacity of rural industry exceeds the combined inhibitory effects of the incumbent sectors.

$X_i^{(j)}$ represents the equilibrium size of sector X_i in the absence of sector X_j. That is:

$$X_1^{(2)} = \frac{K_1 - b(2d)K_3}{1 - b(2d)^2}, \qquad X_3^{(2)} = \frac{K_3 - b(2d)K_1}{1 - b(2d)^2}.$$

Substituting these equilibrium values into the growth expression above gives Proposition 5.1.

Appendix F (Stability analysis)

The equilibrium E is stable if $a_{11}a_{22} > a_{12}a_{21}$. To determine the stability of E, let $X_1 = X_1^* + x_1$ and $X_2 = X_2^* + x_2$, where x_1 and x_2 are small. Linearise the system (6.1) in the neighbourhood of the fixed point, taking the first two terms of a Taylor series:

$$\dot{x}_1 = ax_1 + bx_2$$

$$\dot{x}_2 = cx_1 + dx_2.$$

The coefficients are the partial derivatives evaluated at the fixed point. For example, $\partial \dot{X}_1 / \partial X_1 = r_1 - 2a_{11}X_1 + a_{12}X_2$. When evaluated at the fixed point, and recalling that $r_1 = a_{11}X_1 - a_{12}X_2$ in equilibrium:

$$\left(\frac{\partial \dot{X}_1}{\partial X_1}\right)^* = -a_{11}X_1^*.$$

Thus:

$$\begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} -a_{11}X_1^* & a_{12}X_1^* \\ a_{21}X_2^* & -a_{22}X_2^* \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}.$$

It is necessary to find eigenvalues λ satisfying:

$$\begin{vmatrix} -a_{11}X_1^* - \lambda & a_{12}X_1^* \\ a_{21}X_2^* & -a_{22}X_2^* - \lambda \end{vmatrix} = 0.$$

$$\Rightarrow 2\lambda = -(a_{11}X_1^* + a_{22}X_2^*) \pm \sqrt{(-a_{11}X_1^* - a_{22}X_2^*)^2 + 4(a_{12}a_{21}X_1^*X_2^* - a_{11}a_{22}X_1^*X_2^*)}.$$

The stability requirement hence becomes:

$$a_{11}a_{22} > a_{12}a_{21}.$$

Remark. The positive intersectoral interactions, a_{12} and a_{21}, are not stabilising. Stability derives from the self-regulatory effects, a_{11} and a_{22}.

Appendix G

The proof follows Hallam (1980). The proof by contradiction involves setting $a_{22}a_{31} - a_{21}a_{32} \geq 0$ and $a_{22}r_3 - r_2a_{32} \geq 0$. Consider the limiting (X_1, X_2) system, where X_3 is sufficiently close to zero. The X_2 and X_3 isoplanes are derived by setting the respective per unit growth rates equal to zero, and their slopes are a_{22} / a_{21} and a_{32} / a_{31}. Since the X_2 isoplane is at least as steep as the X_3 isoplane, then in R^3_+ above the X_3 isoplane and close to the X_1X_2-plane, X_3 must increase to keep the per unit growth rate of X_3 equal to zero. This contradicts the assumed decline in X_3.

To show that $r_2a_{32} - a_{22}r_3 > 0$, use the persistence function:

$$V(t) = V(X_2(t), X_3(t)) = [X_2(t)]^{-a32}[X_3(t)]^{a22}.$$

Along paths of (6.4),

$$\dot{V} = [(a_{22}r_3 - r_2a_{32}) + X_1(a_{22}a_{31} - a_{32}a_{21}) + X_3(a_{23}a_{32} - a_{22}a_{33})]V.$$

Recall that it is assumed that X_3 is close to zero, $a_{22}a_{31} - a_{21}a_{32} \geq 0$ and $a_{31}a_{22} - a_{21}a_{32} \geq 0$. For sufficiently small X_3, it is true that:

$$X_3(a_{23}a_{32} - a_{22}a_{33}) \geq -\frac{(a_{22}r_3 - r_2a_{32})}{2}.$$

$$\therefore \dot{V} \geq \frac{(a_{22}r_3 - r_2a_{32})V}{2} + X_1(a_{31}a_{22} - a_{21}a_{32})V \geq \frac{(a_{22}r_3 - r_2a_{32})V}{2}.$$

Since $\dot{V}$ is weakly positive, this contradicts $\lim_{t\to\infty} V(t) = 0$.

Appendix H

As noted in Appendix F, the intersection point of the curves $h_1 = 0$, $h_2 = 0$ is a stable equilibrium point of the dynamic system if:

$$\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial X_2}-\frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial X_1}>0.$$

As β varies, these stable equilibrium points $(X_1^{\beta}, X_2^{\beta})$ vary and are functions of β. Differentiate the system $h_1 = 0$, $h_2 = 0$ with respect to β:

$$\frac{\partial h_1}{\partial X_1}\frac{\partial X_1}{\partial \beta}+\frac{\partial h_1}{\partial X_2}\frac{\partial X_2}{\partial \beta}=0$$
$$\frac{\partial h_2}{\partial X_1}\frac{\partial X_1}{\partial \beta}+\frac{\partial h_2}{\partial X_2}\frac{\partial X_2}{\partial \beta}+\frac{\partial h_2}{\partial \beta}=0.$$

This is a linear system which may be solved for $\frac{\partial X_1}{\partial \beta}, \frac{\partial X_2}{\partial \beta}$:

$$\frac{\partial X_1}{\partial \beta}=\frac{\frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial \beta}}{\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial X_2}-\frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial X_1}}, \qquad \frac{\partial X_2}{\partial \beta}=\frac{-\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial \beta}}{\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial X_2}-\frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial X_1}}.$$

Given the assumptions on the signs of the derivatives, including that:

$$\frac{\partial h_1}{\partial X_1}\frac{\partial h_2}{\partial X_2}-\frac{\partial h_1}{\partial X_2}\frac{\partial h_2}{\partial X_1}>0,$$

it follows that $\frac{\partial X_1}{\partial \beta}<0, \frac{\partial X_2}{\partial \beta}<0.$

Appendix I

All equilibria (X_1^β, X_2^β) lie on the curve $h_1(X_1, X_2) = 0$. This equation implicitly defines X_1 as a function of X_2. The derivative $\partial X_1 / \partial X_2$ on this curve may be computed as follows. Differentiating with respect to X_2 and rearranging:

$$\frac{\partial X_1}{\partial X_2} = \frac{-\partial h_1}{\partial X_2} \Big/ \frac{\partial h_1}{\partial X_1}.$$

Let (X_1^β, X_2^β) be the equilibrium corresponding to some $\beta > 0$. Then, applying the mean-value theorem:

$$\frac{X_1^\beta}{X_2^\beta} = \frac{X_1^e + (X_2^\beta}{X_2^\beta} \frac{X_1^\beta}{} = \frac{X_1^e + (X_2^\beta - X_2^e)\dfrac{\partial X_1}{\partial X_2}\Big| c}{X_2^\beta}, \qquad X_2^\beta \le c \le X_2^e$$

$$= \frac{X_1^e - (X_1^e - X_2^\beta)\dfrac{\partial X_1}{\partial X_2}\Big| c}{X_2^e - (X_2^e - X_2^\beta)}.$$

By Proposition 6.3, $X_2^e - X_2^\beta \ge 0$. By assumption:

$$\frac{\partial X_1}{\partial X_2} = \frac{-\partial h_1}{\partial X_2} \Big/ \frac{\partial h_1}{\partial X_1} < 1$$

and thus $0 \le (X_1^e - X_2^\beta)\frac{\partial X_1}{\partial X_2}\Big|_c \le X_1^e - X_2^\beta$. That is, a larger value is being subtracted from the denominator than from the numerator. With the assumption that $X_1^e > X_2^e$, this is sufficient to give $\frac{X_1^\beta}{X_2^\beta} > \frac{X_1^e}{X_2^e}$.

BIBLIOGRAPHY

Anderson, K. (1992), "Intersectoral Changes in Transforming Socialist Economies: Distinguishing Initial from Longer Term Responses", *Seminar Paper 92-18*, Adelaide: Centre for International Economic Studies.

Anon. (1975), *Learning from Tachai in Rural China*, Peking: Foreign Languages Press.

Asian Development Bank (1977), *Rural Asia: Challenge and Opportunity*, Singapore: Federal Publications.

Banerjee, A., J. Dolado. J. Galbraith and D. Hendry (1993), *Co-Integration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, NY: Oxford University Press.

Bar-Tal, D. (1976), *Prosocial Behavior: Theory and Research*, Washington: Hemisphere Publishing Corporation.

Basu, K. (1995), "Civil Institutions and Evolution: Concepts, Critique and Models", *Journal of Development Economics*, 46(1):19-34.

Becker, G. (1976), "Altruism, Egoism, and Genetic Fitness: Economics and Sociobiology", *Journal of Economic Literature*, XIV(3):817-826.

Becker, G. (1981), "Altruism in the Family and Selfishness in the Market Place", *Economica*, 48(189):1-15.

Beltrami, E. (1987), *Mathematics for Dynamic Modelling*, San Diego: Academic Press.

Bergstrom, T. (1995), "On the Evolution of Altruistic Ethical Rules for Siblings", *American Economic Review*, 85(1):58-81.

Bergstrom, T. and O. Stark (1993), "How Altruism Can Prevail in an Evolutionary Environment", *American Economic Review, Papers and Proceedings*, 83(2):149-155.

Bettelheim, C. (1978), "The Great Leap Backward", *Monthly Review*, 30(3):37-130.

Bikhchandani, S., D. Hirshleifer and I. Welch (1992), "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades", *Journal of Political Economy*, 100(5):992-1026.

Boorman, S. and P. Levitt (1980), *The Genetics of Altruism*, N.Y.: Academic Press.

Breth, R. and I. Ward (1982), *Socialism: The Options*, Melbourne: Hargreen.

Brock, W. and A. Malliaris (1989), *Differential Equations, Stability and Chaos in Dynamic Economics*, Amsterdam: North-Holland.

Buchanan, J. (1995), "Economic Science and Cultural Diversity", *Kyklos*, 48(2):193-200.

Byrd, W. and Q. Lin (1990), *China's Rural Industry: Structure, Development and Reform*, NY: Oxford U.P.

Casson, M. (1993), "The Cultural Determinants of Economic Performance", *Journal of Comparative Economics*, 17:418-442.

Chan, A. (1985), *Children of Mao: Personality Development and Political Activism in the Red Guard Generation*, Seattle: University of Washington Press.

Chan, A., R. Madsen and J. Unger (1984), *Chen Village: A Recent History of a Peasant Community in Mao's China*, Berkeley: University of California Press.

Chang, K. (1993), "The Peasant Family in the Transition from Maoist to Lewisian Rural Industrialisation", *Journal of Development Studies*, 29(2):220-244.

Charemza, W. and D. Deadman (1993), *New Directions in Econometric Practice: General to Specific Modelling, Cointegration, and Vector Autoregression*, Aldershot: E. Elgar.

Chen, K., G. Jefferson and I. Singh (1992), "Lessons from China's Economic Reform", *Journal of Comparative Economics*, 16:201-225.

Cheng, J. (1989), "China's Modernization Programme in the 1980s", in J. Cheng (ed.), *China: Modernization in the 1980s*, Hong Kong: Chinese University Press.

Ch'i, H. (1991), *Politics of Disillusionment: The Chinese Communist Party Under Deng Xiaoping, 1978-1989*, Armonk: M.E. Sharpe.

Chinn, D.L. (1979), "Team Cohesion and Collective-Labour Supply in Chinese Agriculture", *Journal of Comparative Economics*, 3:375-394.

Chou, S. and D. Xu (1993), "A Comparative Study of China's State and Collective Enterprises in the 1980s", in G. Yu (ed.), *China in Transition: Economic, Political and Social Developments*, Lanham: University Press of America.

Chowdhury, K. and M. Chowdhury (1993), "Sectoral Linkages and Economic Growth in Asia: Evidence from Granger Causality Test", Paper Presented at the 1993 Conference of Economists, Murdoch University, Perth.

Chung, C. (1980), *Maoism and Development: The Politics of Industrial Management in China*, Seoul: Seoul National University Press.

Cohen, D. and I. Eshel (1976), "On the Founder Effect and the Evolution of Altruistic Traits", *Theoretical Population Biology*, 10:276-302.

Cottrell, R. (1995), "A Survey of China: A Vacancy Awaits", *The Economist*, 334(7906):5-24.

Dernberger, R. (1989), "Reforms in China: Implications for U.S. Policy", *American Economic Review*, 79(2):21-25.

Dong, X. and G. Dow (1993), "Monitoring Costs in Chinese Agricultural Teams", *Journal of Political Economy*, 101(3):539-553.

Engle, R. and C. Granger (1987), "Co-integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55(2):251-276.

Eshel, I. and U. Motro (1981), "Kin Selection and Strong Evolutionary Stability of Mutual Help", *Theoretical Population Biology*, 19:420-433.

Fan, S. (1991), "Effects of Technological Change and Institutional Reform on Production Growth in Chinese Agriculture", *American Journal of Agricultural Economics* , 73(2):266-275.

Ferdinand, P. (1992), "Russian and Soviet Shadows over China's Future?", *International Affairs*, 68(2):279-292.

Findlay, C., W. Martin and A. Watson (1993), *Policy Reform, Economic Growth and China's Agriculture*, Paris: Development Centre for the OECD.

Findlay, C. and A. Watson (1992), "Surrounding the Cities from the Countryside", in R. Garnaut and Liu Guoguang (eds.), *Economic Reform and Internationalisation: China and the Pacific Region*, St Leonard's, NSW: Allen and Unwin.

Findlay, C., A. Watson and H. Wu (1993), "Economic Liberalisation in China: The Impact of and Prospects for the 'Out-of-Plan' Sector", *Asian Studies Review*, 17(2):5-20.

Findlay, C., A. Watson and H. Wu (1994a), *Rural Enterprises in China*, manuscript version, London: Macmillan.

Findlay, C., A. Watson and H. Wu (1994b), "Rural Enterprises in China: Overview, Issues and Prospects", in C. Findlay, A. Watson and H. Wu (eds.), *Rural Enterprises in China*, manuscript version, London: Macmillan.

Ghatak, S. and K. Ingersent (1984), *Agriculture and Economic Development*, Brighton: Wheatsheaf Books.

Goh, B. (1980), *Management and Analysis of Biological Populations*, Amsterdam: Elsevier Scientific Publishing Co.

Granger, C. and P. Newbold (1974), "Spurious Regressions in Econometrics", *Journal of Econometrics*, 26:1045-1066.

Granger, C. and P. Newbold (1977), *Forecasting Economic Time Series*, N.Y.: Academic Press.

Gray, J. (1969), "The Economics of Maoism", *Bulletin of the Atomic Scientists*, 25(2):42-51.

Grusec, J. (1991), "The Socialization of Altruism" in M. Clark (ed.), *Prosocial Behavior*, Newbury Park: Sage Publications.

Gurley, J. (1975), "Rural Development in China 1949-72, and the Lessons to be Learned from it", *World Development*, 3(7&8):455-472.

Gurley, J. (1976), *Challengers to Capitalism: Marx, Lenin, and Mao*, San Francisco: San Francisco Book Co.

Hallam, T. (1980), "Effects of Cooperation on Competitive Systems", *Journal of Theoretical Biology*, 82:415-423.

Hamilton, W. (1964), "The Genetical Evolution of Social Behaviour", *Journal of Theoretical Biology*, 7:1-16.

Harris, R. (forthcoming), *Using Cointegration Analysis in Econometric Modelling*, Harvester Wheatsheaf.

Hewitt, E. (1989), "Economic Reform in the USSR, Eastern Europe, and China: The Politics of Economics", *American Economic Review*, 79(2):16-20.

Hirschman, A. (1958), *The Strategy of Economic Development*, New Haven: Yale University Press.

Islam, R. (1991), "Growth of Rural Industries in Post-Reform China: Patterns, Determinants and Consequences", *Development and Change*, 22(4):687-719.

Islam, R. and H. Jin (1994), "Rural Industrialization: An Engine of Prosperity in Postreform Rural China", *World Development*, 22(11):1643-1662.

Jefferson, G. and T. Rawski (1992), "Unemployment, Underemployment, and Employment in China's Cities", *Modern China*, 18(1):42-71.

Jefferson, G. and T. Rawski (1995), "How Industrial Reform Worked in China: The Role of Innovation, Competition, and Property Rights", *Proceedings of the World Bank Annual Conference on Development Economics 1994*.

Johansen, S. (1988), "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, 12:231-254.

Johnston, B. (1970), "Comment: Sectoral Interdependence, Structural Transformation, and Agricultural Growth", in C. Wharton (ed.), *Subsistence Agriculture and Economic Development*, London: Frank Cass and Co.

Jorgenson, D. (1970), "The Role of Agriculture in Economic Development: Classical Versus Neoclassical Models of Growth" in C. Wharton (ed.), *Subsistence Agriculture and Economic Development*, London: Frank Cass and Co.

Kalirajan, K. and X. Wang (1994), "Modelling Growth performance of China's Rural Industry" in G. Ma, X. Meng and S. Lin (eds.), *Chinese and East Asian Economies in the 1990s*, Canberra: National Centre for Development Studies.

Kaufmann, H. (1970), *Aggression and Altruism: A Psychological Analysis*, NY: Holt, Rinehart and Winston.

Kaye, L. (1993), "Bold Blueprint", *Far Eastern Economic Review* (25 March), p. 13.

Keidel, A. (1992), "The Cyclical Future of China's Economic Reforms", in Joint Economic Committee, Congress of the United States, *China's Economic Dilemmas in the 1990s: The Problems of Reforms, Modernization, and Interdependence*.

Kharbanda, V. and M. Qureshi (1984), "Agricultural Modernization in China", *China Report*, 20:29-38.

Kornai, J. (1980), "The Dilemmas of a Socialist Economy: The Hungarian Experience, *Cambridge Journal of Economics*, 4(2):147-158.

Kornai, J. (1990), "The Affinity Between Ownership Forms and Coordination Mechanisms: The Common Experience of Reform in Socialist Countries", *Journal of Economic Perspectives*, 4(3):131-147.

Kraar, L. (1974), "I Have Seen China - And They Work", in D. Milton, N. Milton and F. Schurmann, *4 The China Reader: People's China: Social Experimentation, Politics, Entry onto the World Scene 1966 through 1972*, N.Y.: Vintage Books.

Kueh, Y. (1984), "A Weather Index for Analysing Grain Yield Instability in China, 1952-81", *China Quarterly*, 97:68-83.

Lardy, N. (1986a), "Prospects and Some Policy Problems of Agricultural Development in China", *American Journal of Agricultural Economics*, 68:451-457.

Lardy, N. (1986b), "Agricultural Reforms in China", *Journal of International Affairs*, 39:91-104.

Lee, K. (1994), "Making Another East Asian Success in China", in C. Lee and H. Reisen (eds.), *From Reform to Growth: China and Other Countries in Transition in Asia and Central and Eastern Europe*, Paris: OECD.

Lim, S. (1993), "The Potential Demise of Socialism in China: Economic and Political Responses", in Y. Wu and X. Zhang (eds.), *Chinese Economy in Transition*, Canberra: NCDS.

Lim, S. and R. Harris (1993), "The Chinese Agricultural Reforms: An Empirical Investigation", in D. Bing *et al.*, *Modern China in Transformation*, Hamilton: Outrigger.

Lin, B. (1995a), "The Rapid Expansion of Townships and Village Enterprises and Its Impacts on Agricultural Production in China" (mimeo), Asian Development Bank.

Lin, B. (1995b), "Rural Reforms, Structural Change and Agricultural Growth in China" (mimeo), Asian Development Bank.

Lin, J. (1987), "The Household Responsibility Reform in China: A Peasant's Institutional Choice", *American Journal of Agricultural Economics*, 69:410-415.

Lin, J. (1989), "An Economic Theory of Institutional Change: Induced and Imposed Change", *Cato Journal*, 9(1):1-33.

Lin, J. (1990), "Collectivization and China's Agricultural Crisis in 1959-1961", *Journal of Political Economy*, 98(6):1228-1252.

Lin, J. (1992), "Rural Reforms and Agricultural Growth in China", *American Economic Review*, 82(1):34-51.

Lin, J. (1995), "Can China's 'Mini-Bang' Succeed?", *Contemporary Economic Policy*, XIII(1):10-14.

Liu, B. (1993), "Civilisation Grafting: No Culture is an Island", *Foreign Affairs*, 72(4).

MacArthur, R. and R. Levins (1967), "The Limiting Similarity, Convergence and Divergence of Coexisting Species", *American Naturalist*, 101(921):377-385.

McMillan, J., J. Whalley and L. Zhu (1989), "The Impact of China's Economic Reforms on Agricultural Productivity Growth", *Journal of Political Economy*, 97:781-807.

Maddala, G. (1992), *Introduction to Econometrics* (Second edition), NY: Macmillan.

Masters, R. (1978), "Of Marmots and Men: Animal Behavior and Human Altruism" in L. Wispe (ed.), *Altruism, Sympathy, and Helping: Psychological and Sociological Principles*, NY: Academic Press.

Maxwell, N. (1975), "Learning from Tachai", *World Development*, 3(7&8):473-496.

Mellor, J. (1984), "Agricultural Development and the Intersectoral Transfer of Resources", in C. Eicher and J. Staatz (eds.), *Agricultural Development in the Third World*, Baltimore: Johns Hopkins University Press.

Mellor, J. (1986), "Agriculture on the Road to Industrialization", in J. Lewis and V. Kallab (eds.), *Development Strategies Reconsidered*, New Brunswick: Transaction Books.

Naughton, B. (1992), "Implications of the State Monopoly over Industry and its Relaxation", *Modern China*, 18(1):14-41.

Naughton, B. (1994), "What is Distinctive about China's Economic Transition? State Enterprise Reform and Overall System Transformation", *Journal of Comparative Economics*, 18:470-490.

Nguyen, D. and H. Wu (1993), "The Impacts of Economic Reforms on Chinese Agricultural Performance", *Working Paper No. 93/9*, Chinese Economy Research Unit, University of Adelaide, Adelaide.

Nolan, P. and G. White (1982), "The Distributive Implications of China's New Agricultural Policies", in J. Gray and G. White (eds), *China's New Development Strategy*, London: Academic Press, pp. 175-210.

Nove, A. (1986), *Marxism and "Really Existing Socialism"*, Chur: Harwood Academic Publishers.

Ody, A. (1992), "Rural Enterprise Development in China, 1986-90", *World Bank Discussion Papers: China and Mongolia Department Series, No. 162*, Washington, D.C.: The World Bank.

Peck, J. (1975), "Revolution Versus Modernization and Revisionism", in V. Nee and J. Peck, *China's Uninterrupted Revolution: From 1840 to the Present*, N.Y.: Pantheon Books.

Pesaran, M. and B. Pesaran (1991), *MICROFIT 3.0 An Interactive Econometric Software Package: User Manual*, Oxford: Oxford University Press.

Prime, P. (1994), "Options for Market Reforms in China", *Economic Development and Cultural Change*, 42(4):869-878.

Prybyla, J. (1990), "Economic Reform of Socialism: The Dengist Course in China", *The Annals of the American Academy*, 507:113-122.

Prybyla, J. (1991), "A Systemic Analysis of Prospects for China's Economy", in Joint Economic Committee, *China's Economic Dilemmas in the 1990s: The*

Problems of Reforms, Modernization, and Interdependence, N.Y.: M.E. Sharpe.

Putterman, L. (1988), "Group Farming and Work Incentives in Collective-Era China", *Modern China*, 14(4):419-450.

Putterman, L. (1989), "Agricultural Producer's Cooperatives", in P. Bardhan (ed.), *The Economic Theory of Agrarian Institutions*, NY: Oxford University Press.

Putterman, L. (1991), "Does Poor Supervisability Undermine Teamwork? Evidence from an Unexpected Source", *American Economic Review*, 81(4):996-1001.

Putterman, L. (1992), "Dualism and Reform in China", *Economic Development and Cultural Change*, 40(3):467-494.

Ranis, G. and F. Stewart (1993), "Rural Nonagricultural Activities in Development: Theory and Application", *Journal of Development Economics*, 40:75-101.

Ratha, D., I. Singh and G. Xiao (1994), "Non-State Enterprises as an Engine of Growth: An Analysis of Provincial Industrial Growth in Post-Reform China", Transition Economics Division, The World Bank (mimeo).

Rawski, T. (1993), "Chinese Industrial reform: Accomplishments, Prospects, and Implications", *Working Paper No. 287*, Department of Economics, University of Pittsburgh.

Renshaw, E. (1991), *Modelling Biological Populations in Space and Time*, Cambridge: Cambridge University Press.

Rescigno, A. and I. Richardson (1967), "The Struggle for Life: I. Two Species", *Bulletin of Mathematical Biophysics*, 29(2):377-388.

Riskin, C. (1975), "Maoism and Motivation: Work Incentives in China", in V. Nee and J. Peck (eds), *China's Uninterrupted Revolution: From 1840 to the Present*, N.Y.: Pantheon Books.

Riskin, C. (1981), "Market, Maoism and Economic Reform in China", *Bulletin of Concerned Asian Scholars*, 13(3):31-41.

Robinson, J. (1970), *The Cultural Revolution in China*, Hammondsworth: Penguin Books.

Robinson, J. (1974), "For Use, Not for Profit: A Report on a Recent Visit to China", in D. Milton, N. Milton and F. Schurmann, *4 The China Reader: People's China: Social Experimentation, Politics, Entry onto the World Scene 1966 through 1972*, N.Y.: Vintage Books.

Roughgarden, J. (1974), "Species Packing and the Competition Function with Illustrations from Coral Reef Fish", *Theoretical Population Biology*, 5:163-186.

Roughgarden, J. (1979), *Theory of Population Genetics and Evolutionary Ecology: An Introduction*, N.Y.: Macmillan Publishing Co.

Rozelle, S. (1994), "Rural Industrialization and Increasing Inequality: Emerging Patterns in China's Reforming Economy", *Journal of Comparative Economics*, 19:362-391.

Ruttan, V. (1970), "Comment: Two Sector Models and Development Policy", in C. Wharton (ed.), *Subsistence Agriculture and Economic Development*, London: Frank Cass and Co.

Ruttan, V. (1988), "Cultural Endowments and Economic Development: What Can We Learn From Anthropology?", *Economic Development and Cultural Change*, 36(3):247-271, Supplement.

Schmidtz, D. (1993), "Reasons for Altruism", *Social Philosophy & Policy*, 10(1):52-68.

Schram, S. (1972), *The Political Thought of Mao Tse-tung*, N.Y.: Praeger Publishers.

Schurmann, F. (1968), *Ideology and Organization in Communist China (Second Edition)*, Berkeley: University of California Press.

Scobie, G. and S. Lim (1992), "Economic Reform: A Global Revolution", *Policy*, 8(3):2-7.

Sen, A. (1966), "Labour Allocation in a Cooperative Enterprise", *Review of Economic Studies*, 33:361-371.

Sen, A. (1994), "The Formulation of Rational Choice", *American Economic Review*, 84(2):385-390.

Sengupta, J. (1987), *Applied Mathematics for Economics*, Dordrecht: D. Reidel Publishing Co.

Shi, R., C. Yao, Y. Zhang, T. Hsueh and T. Woo (1993), "A Quantitative Analysis of Rural Non-Agricultural Development and Migration of Agricultural Labour Force in China", in T. Hsueh, Y. Sung and J. Yu (eds.), *Studies on Economic Reforms and Development in the People's Republic of China*, Hong Kong: The Chinese University Press.

Sicular, T. (1992), "China's Agricultural Policy During the Reform Period", in Joint Economic Committee (eds.), *China's Economic Dilemmas in the 1990s: The Problems of Reforms, Modernization, and Interdependence*, N.Y.: M.E. Sharpe.

Simon, H. (1993), "Altruism and Economics", *American Economic Review, Papers and Proceedings*, 83(2):156-161.

Singh, I. and G. Jefferson (1994), "China's State Industry: A Paradox of Rising Productivity and Declining Profitability", *Transition*, 5(2-3):7-8.

Singh, N. (1995), "Unilateral Altruism May be Beneficial: A Game-Theoretic Illustration", *Economics Letters*, 47:275-281.

State Statistical Bureau (various years), *Statistical Yearbook of China*, Beijing: China Statistical Publishing House.

Stone, B. (1988), "Developments in Agricultural Technology", *China Quarterly*, (116):767-822.

Sugden, R. (1993), "Thinking as a Team: Towards an Explanation of Non-Selfish Behavior", *Social Philosophy & Policy*, 10(1):69-89.

Timmer, P. (1989), "The Agricultural Transformation", in G. Meier, *Leading Issues in Economic Development* (Fifth Edition), NY: Oxford University Press.

Tinari, F. and D. Lam (1991), "China's Resistance to Economic Reforms", *Contemporary Policy Issues*, IX(3):82-92.

Travis, C. and W. Post (1979), "Dynamics and Comparative Statics of Mutualistic Communities", *Journal of Theoretical Biology*, 78(4):553-571.

Unger, J. (1978), "Collective Incentives in the Chinese Countryside: Lessons from Chen Village", *World Development*, 6(5):583-602.

Van Ness, P. and S. Raichur (1983), "Dilemmas of Socialist Development: An Analysis of Strategic Lines in China, 1949-1981", *Bulletin of Concerned Asian Scholars*, 15(1):2-15.

Vogel, S. (1994), "Structural Changes in Agriculture: Production Linkages and Agricultural Demand-Led Industrialization", *Oxford Economic Papers*, 46:136-156.

von Weizsacker, C. (1971), "Note on Endogenous Change of Tastes", *Journal of Economic Theory*, 3(4):345-372.

White, G. (1993), *Riding the Tiger: The Politics of Economic Reform in Post-Mao China*, Houndmills: Macmillan.

Whyte, M. (1969), "The Tachai Brigade and Incentives for the Peasant", *Current Scene*, VII(16):1-12.

Wong, Y. (1995), "China's Economic Reform: The Next Step", *Contemporary Economic Policy*, XIII(1):18-27.

Woo, T., T. Hsueh, R. Shi and Y. Zhang (1993), "Impact of the Development of China's Rural Non-Agricultural Sector on the National Economy", in T. Hsueh, Y. Sung and J. Wu (eds.), *Studies on Economic Reforms and Development in the People's Republic of China*, Hong Kong: The Chinese University Press.

Woo, W. (1994), "The Art of Reforming Centrally Planned Economies: Comparing China, Poland, and Russia", *Journal of Comparative Economics*, 18:276-308.

Wu, H. (1992), "The Industrialisation of China's Rural Labour Force since the Economic Reform", *CERU Working Paper* No. 92/6, Adelaide: Chinese Economic Research Unit, University of Adelaide.

Wu, H. (1994), "The Rural Industrial Enterprise Workforce", in C. Findlay. A. Watson and H. Wu (eds.), *Rural Enterprises in China*, London: Macmillan.

Wu, Y. (1990), "The Linkage Between Economic and Political Reform in the Socialist Countries: A Supply-Side Explanation", *Annals, MPSS*, 507:91-102.

Yang, H. (1994), *Grain Production in China: Productivity Changes and Provincial Disparities, 1978-1990*, PhD Dissertation, Adelaide: University of Adelaide.

Yang, X. and J. Borland (1991), "A Microeconomic Mechanism for Economic Growth", *Journal of Political Economy*, 99(3):460-482.

Yao, S. (1994), "Cointegration Analysis of Agriculture and Non-Agricultural Sectors in the Chinese Economy 1952-92", *Applied Economics Letters*, 1(12):227-229.

Zhang, B. and C. Carter (1994), "Rural Reforms, the Weather, and Productivity Growth in China's Grain Sector", *CERU Working Paper 94/2*, Adelaide: University of Adelaide.

Zweig, D. (1992), "Rural Industry: Constraining the Leading Growth Sector in China's Economy", in Joint Economic Committee, Congress of the United States (ed.), *China's Economic Dilemmas in the 1990s: The Problems of Reforms, Modernization, and Interdependence*, NY: M.E. Sharpe.