Land reform, household specialisation and rural development in China[1]

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Abstract: *Recent land reforms in China have sought to address fundamental problems with the Household Production Responsibility System such as land fragmentation. Primarily the reforms have targeted land productivity and grain output. However, the reforms have had a much broader effect on rural development as they have allowed a degree of household specialisation in non-grain activities both on and off the farm. Based on information collected from household surveys and fieldwork in Shandong and other provinces, this paper reports on some of the impacts of land reform on productivity, household specialisation and rural development.*

Introduction

Since the formation of the People's Republic, a key feature of the Chinese rural sector has been the various land reforms and collectivisation and decollectivisation of agricultural production. One of the oft-cited reforms was the decollectivisation of communal land under the Household Responsibility System (HRS) in the early 1980s. Reforms since that time have sought to modify the HRS to address some inherent flaws such as land fragmentation. Increasing land productivity and grain output have been the focus of these latter reforms.

Apart from any impact on grain production, however, the reforms have had a wider impact on farm households and rural development. Specifically, allowing some households to scale back their grain production has enabled them to specialise in other non-grain and non-farm activities, freeing up land for other specialist grain producers and thereby raising incomes and efficiency of both groups. This paper explores some of the specialisation that is occurring along with its impacts. Specific examples are taken from Shandong along with some of the specialisation that is occurring in the cattle and beef industry to highlight the issues raised.

Land and related institutional reforms

Pre-Household Responsibility System

Chen (1998) describes in detail the key institutional reforms that have occurred in the Chinese agricultural sector over the last 50 years. Table 1 and Figure 1 provide a brief overview of these reforms. The focus of this paper precludes re-visiting a discussion of the reforms that have occurred over the last half-century. However, some striking points to emerge from an overview such as that in Table 1 and Figure 1 are that:

- Chinese agriculture has gone through various periods of collectivisation and decollectivisation over the last 50 years.
- many of the problems associated with past collectivisation and decollectivisation have re-emerged or are part of more recent collectivisation and decollectivisation; and that
- the main problems with collectivisation have been the lack of incentive to work and management decisions too far removed from production activities. Conversely, decollectivisation has suffered from individual households or decision-making units having too small and or fragmented factors of production such as land.

For Chinese decision makers and policy analysts considering further land reforms or institutional changes, it is worth reviewing what has happened with previous reforms to avoid mistakes of the past being re-visited.

Household Responsibility System

Much has been written about the HRS introduced in the early 1980s, which brought about fundamental changes towards more decentralised decision-making. Farm households became the basic production units with shared land. Moreover, they were responsible for individual profits and losses, had full rights in decision-making, and were able

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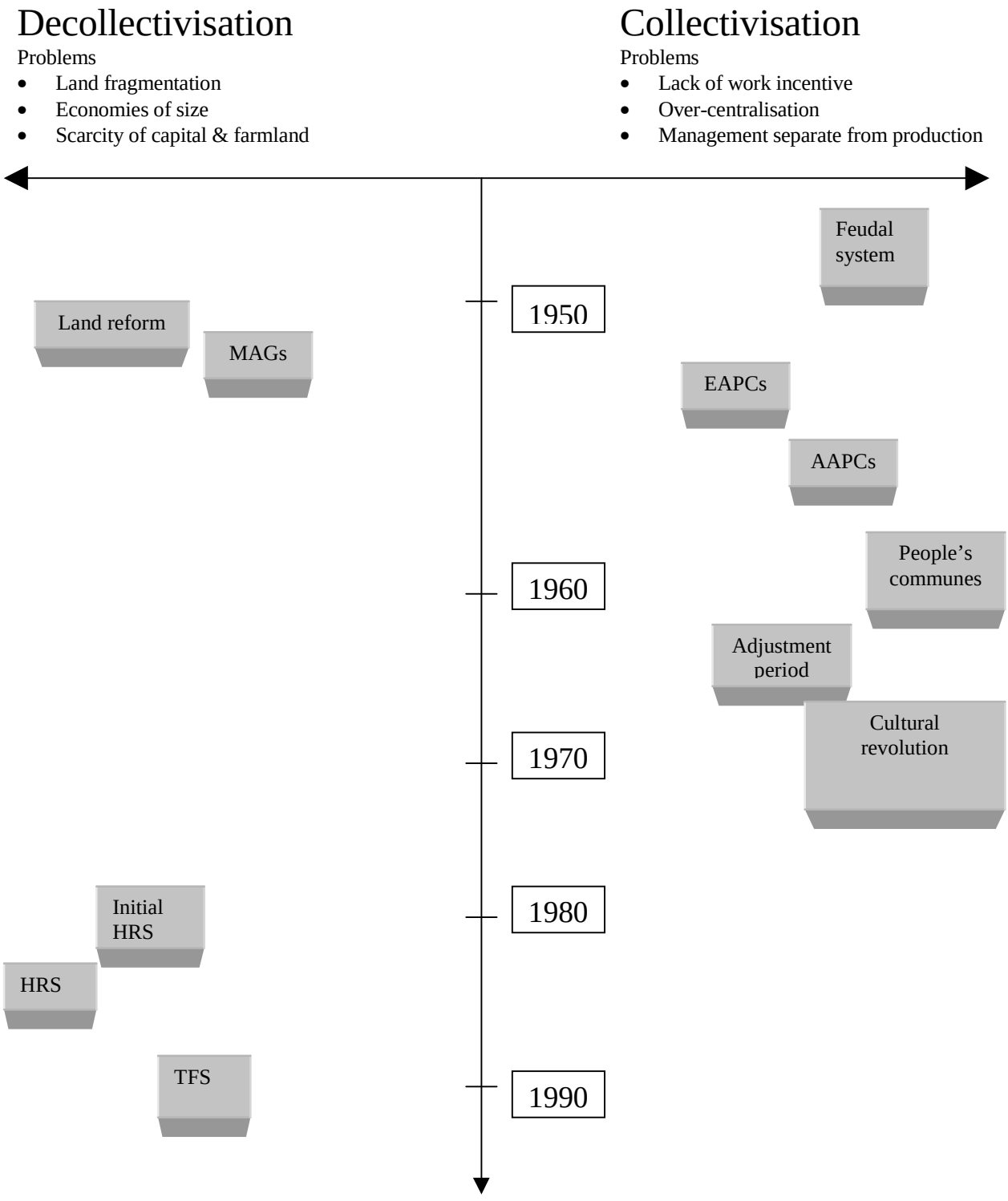
[2] Colin Brown is a Senior Lecturer and Chen Kai, at the time of the study, a Research Master's student within the School of Natural and Rural Systems Management at The University of Queensland. Much of the discussion about the Two-farmland system is drawn from the thesis of Chen Kai (Chen 1998). Many of the comments on specialisation and the beef industry are drawn from fieldwork carried out as part of an Australian Centre for International Agricultural Research (ACIAR) project and a Meat and Livestock Australia (MLA) project on an analysis of socio-economic and agribusiness developments in the Chinese cattle and beef industry. Further details on these projects can be found at http://www.nrsm.uq.edu.au/Nrsm/Research/ChinaP.htm.

Table 1 Overview of agricultural institutional forms in China over the last 50 years

Period	Characteristics
Prior to formation of People's Republic – before 1949	• 70-80% of farmland owned by landlords and rich peasants who accounted for 10% of rural population • small farmer's paid rent in kind
Land reform and mutual aid groups – 1949 to 52	• Land reform under Agrarian Reform Law abolished feudal system & confiscated "redundant" land of landholders • 47m ha of cultivated land distributed among 300 million peasants • farm produce sold on free markets until state monopoly & purchase marketing system introduced in November 1953 • problems of scarcity in farmland & capital • formation of mutual aid groups which helped small farmers with manpower, tools and draught cattle; however households remained the independent decision unit
First 5-year-plan; Elementary to Advanced agricultural producer co-operatives (APCs) – 1953 to 1957	• individual households and mutual aid groups organised into elementary APCs in which land & capital were put into collective use with peasants retaining small plots • by end of 1996, 96% of farmers in advanced APCs which involved a fully collective management system. Land & capital confiscated and collectively owned. Income based on labour-days. Only 2 to 5% of cultivated land in private plots • problems of over-centralisation of management, lack of individual incentive & corruption at managerial level
People's Communes and The Great Leap Forward – 1958 to 1960	• Move from advanced APC's to People's Communes which became the basic production, accounting & administration unit in rural China: belief that APC's too small to mobilse rural surplus labour for large rural infrastructure projects • By end of 1958, some 740,000 cooperatives had been organised into 26,500 communes • High degree of unified management, over-concentrated system of labour management & egalitarian distribution of collective income • Private plots and sidelines of households taken over by communes • Distribution of income in kind according to subsistence & not work performance or shares of capital • Production teams given little decision making power
Adjustment Period – 1961-65	• Commune functions reduced to administration & co-ordination • Production decision making delegated to production teams (20-30 households) • Production teams allowed to retain some income to overcome problems of egalitarianism • Households again allowed to have small private plots & sidelines • Embryonic forms of responsibility system with output quotas & remuneration for over-quota output but forced underground with Mao view that it would undermine production team
Cultural Revolution – 1966 to 1976	• Large institutional swings • Moves from small to large co-operatives and from team to brigade to commune • Prohibition of local free markets, sidelines & private plots • Political factors had a great influence on production decisions
Household Responsibility System (HRS) – 1979 to present	• Collective farming to "tenant-landlord" type system or labour contract to output linked type system • Initially production teams contracted out land, other resources and output quotas to individual households • Gradual dismantling of communes with 99% of households in HRS by December 1983 • Formation of output and input markets and various property and usage rights
Adjustments to HRS – 1988 to present	• Contracting out farmland and output quotas

Source: Derived from Chen (1998)



Note: MAGs – mutual aid groups; EAPCs – elementary agricultural producer co-operatives; AAPCs – advanced agricultural producer co-operatives; HRS – Household responsibility system; TFS – Two Farmland System

Figure 1. Institutional reforms in China – 1940s to 1990s

to purchase and own everything except land subject to meeting contract quotas. The HRS brought about a more prosperous agriculture in China. From 1978 to 1984, grain output in China increased at an annual average rate of 5% and the gross value of agriculture by 7.7% (Lin, 1997)

However, the central plank of the HRS, namely decollectivisation of farmland, implicitly contained some fundamental problems. In particular, the HRS led to fragmentation in land cultivation (Reisch, 1992). Farmland was shared equally not only on an area basis, but also according to soil fertility. Thus, farmland for individual farm households was scattered with different qualities in different locations. In Pingdu City of Shandong Province, most farm households cultivated more than 7 pieces of land in 1988 even though their total farm area averaged only 10.5 mu or 0.7ha (Wu, 1993).

The numerous, small, disaggregated plots restricted the application of agricultural machinery and pesticides, and farmers devoted much time in moving between the fragmented blocks. More-and-more farmers realised that land distribution under the HRS could be improved so as to increase their technical efficiency. Thus, to a large extent, farmers themselves initiated the TFS in Pingdu City to overcome difficulties associated with the shortcomings of the equalitarian land distribution under the HRS. The system was then encouraged by governments from the Central level to the county level. Problems associated with land fragmentation have also been raised in other fora (see, for example, Nguyen et al. (1996), Fleisher and Liu (1992), and Findlay (1997)).

Post-Household Responsibility System – the case of the Two-farmland System

One example of the type of reforms that have emerged to address the shortcomings of the HRS is the Two-farmland system (TFS). The TFS was trailed from 1988 in Pingdu City of Qingdao Prefecture in Shandong Province. Pingdu City is one of two model counties in Shandong and 27 throughout China designed to trial agricultural reforms. Thus the TFS trial in Shandong became the model for further reform elsewhere in China throughout the 1990s.

Under the TFS, farmland in a village is essentially divided into two categories, namely land for basic provisions (subsistence farmland), and land for contracting (contract land). A third minor, though important, category of farmland is reserved land that is used for various contingencies.

Subsistence farmland, which is distributed according to the number of people in the village, seeks to meet the basic consumption needs of the farm household. Average grain requirement per year for each person determines the allocation of subsistence farmland.[3] The only obligatory payment made by farmers for the subsistence farmland is an agricultural tax based on the area of land they cultivate.

After distribution of the subsistence farmland, most of the farmland left in a village is treated as contract land. The village committee, which acts as the representative of the owner of farmland, considers soil fertility, irrigation infrastructure and location of land when classifying land for contracting into three broad grades. The committee constructs a reference map with areas, grades, and minimum (reserve) fee for different pieces of contract land that is made public before distributing the contract land. Farm households with the ability and interest to farm more land bid for the planting right to contract land.

To avoid fragmentation of cultivation, successful bidders obtain the right to plant prescribed crops on contract farmland instead of the right to plant whatever they like. In reality, however, the regional crop plan is drawn up after discussion with agricultural experts, experienced farmers and the village committee, and is implemented with the consent of most farmers. From the farmers' perspective, the regional crop plan is a compromise between land fragmentation and freedom in their cultivation. From the village committees' perspective, the regional plan is a convenient and economical way for the committees to serve farmers with extension and other services in the specified crop region.

Because subsistence and contract farmland are distributed in different ways and for different purposes, the financial obligation of farmers who cultivate contract land are different from the obligations of farmers who cultivate subsistence farmland only. The agricultural tax is paid on the total area of farmland, including subsistence and contract land. Farmers who cultivate contract land also pay the contract fee to the village committee, and bear the responsibility of the production quota for that contracted land.

Apart from subsistence and contract land, around 3 per cent of the total farmland in the village is kept in reserve by the village committee to deal with various contingencies such as households who have forfeited farmland seeking to return to the village. The main purpose of the reserved land is to avoid frequent changes in planting rights.

Impact of land and related institutional reforms

Impact on grain production and land productivity

The discussion below highlights a number of foreseen and unforeseen impacts of the land reforms. However, central in the mind of Chinese decision-makers is the impact on grain production. The TFS allows more land to be assigned to farmers wanting and able to cultivate more and so alleviates the problem of land fragmentation. In

[3] In Pingdu City, the average grain requirement per person per year is around 350 kilograms. Given a grain yield level of 9.8 to 10.5 ton per hectare, the area of subsistence farmland for one person is about 0.033 hectare.

a survey of farm households in Pingdu City, Chen (1998) found that the average number of land plots cultivated by the surveyed farmers decreased from 7.6 plots per household in 1987 under the HRS to 3.4 plots per household in 1996 under the TFS. In 1987, each plot averaged only 0.1 hectares compared with an average of 0.23 hectares per plot in 1996. Overall a census of the 270,000 farm households in Pingdu City by the Experiment Office of Pingdu City revealed that almost half of the farm households used the TFS to enlarge the area of land they cultivated, while 30% of households used the TFS to reduce their land area cultivated (Table 2). Thus the TFS has had a major impact on farm structure in Pingdu City.

Table 2. Participation in the Two-farmland System in Pingdu City

Change in land area cultivated	Household Survey[a]	Census[b]
	-- % and number --	-- % --
Enlarged area		
• cultivated more than 20mu	7	6
• cultivated less than 20mu	37	41
Reduced area		
• subsistence farmland	17	14
• contracted land	19	16
Left farming[c]	2	2
Other		21
• no change in area[d]	6	
• did not participate in TFS	12	

[a] Survey of 100 farm households in Pingdu City as described in Chen (1998) and footnote 4. Thus, units in this column refer both to number and percentage of households.

[b] Census of the 270,000 farm households in Pingdu City undertaken by the Experiment Office of Pingdu City. See Chen (1997) and Wu (1993) for details.

[c] Contracted no farmland and did not farm any more.

[d] These households used the TFS to reduce the number of blocks they cultivated but not the total area of farmland they cultivated.

Other studies from different regions have also examined the impact of land fragmentation. Fleisher and Liu (1992) estimated a rise in total factor productivity of 8% if the number of plots fell from four to one. Nguyen et al. (1996), in a survey of 1200 Chinese farm households, also identified large impacts on productivity from land fragmentation.

Chen (1998) quantified the impact of the TFS on technical efficiency and agricultural production using a stochastic frontier production function model. The model is listed in Appendix 1, while the main results are reported in Table 3. One key requirement in the development of the model was the need to isolate the impact of the TFS on technical efficiency from the effect of other factors that also influence technical efficiency. Various studies, such as Pitt and Lee (1981), used a two-stage procedure to address problems of this nature by estimating a stochastic frontier to predict firm level efficiencies and then regressing the predicted efficiencies upon firm-specific variables such as managerial experience and ownership characteristics to identify some of the reasons for differences in predicted efficiencies among firms. However Kumbhakar, Ghosh and McGukin (1991) and others identified shortcomings with the two-stage procedure. The model developed by Chen was based on a single-stage estimation procedure proposed by Battese and Coelli (1995). Data used in the analysis came from a survey of 100 farm households in Pingdu City of Shandong province.[4] Households were surveyed for a range of physical, economic and other information for the period 1987 to 1996.

Formal tests of hypotheses for coefficients of technical efficiency effects in the stochastic frontier production function indicated that the efficiency effects were present and stochastic and that the coefficients of the variables in the efficiency effects model were statistically different from zero. The coefficient of the TFS dummy was negative indicating that farm households in Pingdu City who participated in the TFS were less

[4] Specifically, ten clusters were selected from 1,700 villages covered by the project. In each of these ten villages, 10 farm households were selected at random from the village list of farm households. Table 2 indicates that participation in the TFS by households in the sample corresponded very closely with participation by all households in Pingdu City.

Table 3. Maximum Likelihood Estimates of Parameters of the Stochastic Production Function Frontier and Inefficiency Models for Surveyed farmers

Variable	Parameter	Value	Variable	Parameter	Value
Stochastic Frontier			**Inefficiency model**		
Constant	β_0	3.7410 (0.2470)[a]	Constant	δ_0	0.3247 (0.0334)
Land	β_1	0.3056 (0.0167)	TFS	δ_1	-0.0650 (0.0117)
Capital	β_2	0.0324 (0.0181)	Age	δ_2	-0.0009 (0.0006)
Labor	β_3	0.3184 (0.0299)	School	δ_3	-0.0023 (0.0072)
Chemical Fertiliser	β_4	0.1898 (0.0210)	time trend	δ_4	-0.0047 (0.0020)
Manurial Fertiliser	β_5	0.1569 (0.0241)			
Variance Parameters					
	σ_s^2	0.0102 (0.0006)			
	γ	0.9322 (0.0464)			
Log-likelihood Function		852.6352			

[a] Data in parentheses are standard deviations.

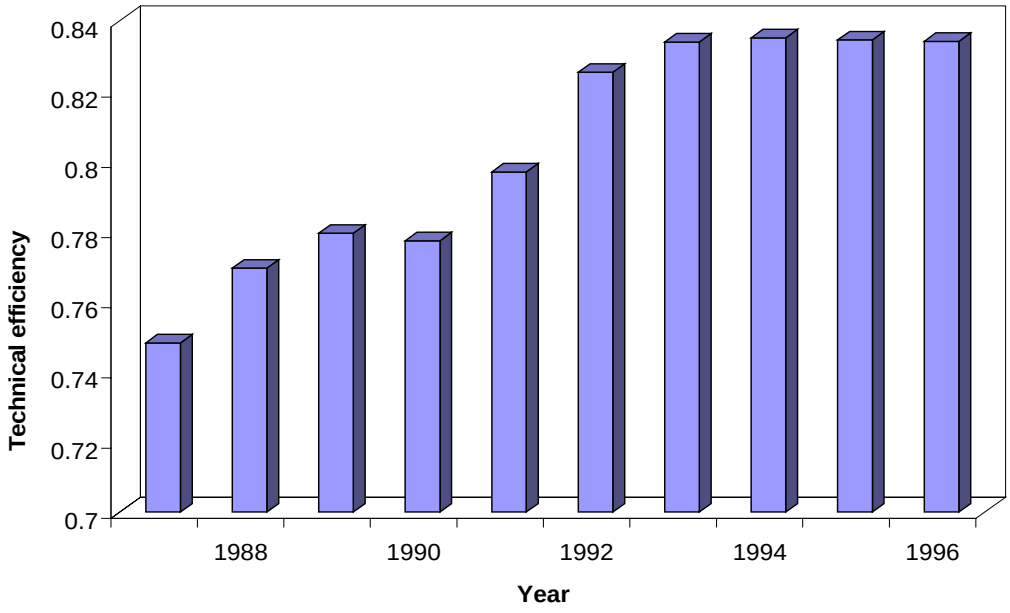


Figure 2 Average Technical Efficiency of Surveyed Farm Households – 1987 to 1996

inefficient (or more efficient) than households who did not participate. Specifically, the technical efficiency of the farm household who participated in the TFS was 6.7 per cent higher than that of the farm household who did not participate in the TFS. In Figure 2, it can be seen that the average technical efficiency of the farm households increased from around 0.75 in 1987 to 0.83 in 1996. The empirical analysis supports the theoretical case and lessons learnt from past decollectivisation that the TFS gives households the opportunity to farm more efficiently.

Impact on non-grain production

The TFS and related reforms have allowed some farmers to expand their land area and increase their grain production. At the same time, it has allowed other farmers to reduce their grain areas and quota commitments and concentrate on other farm activities such as more intensive but potentially more lucrative cash crops.[5] However, in many other cases it has allowed farmers to increase their livestock production. This has involved more traditional livestock activities such as pig raising, or as the example used in this paper, relatively new enterprises such as raising cattle for beef production.

Reforms such as the TFS have facilitated the move into other activities for a variety of reasons. A major reason is that they have relieved the burden of supplying the grain quota. However, they have also freed up some key farm resources, notably capital but, in particular, labour. One of the ironies in the Chinese agricultural sector is that although there still exists much surplus labour, for an individual farm household there are still critical shortages of labour at particular parts of the crop cycle, notably at harvest time. Judicious choice of activities can enable spreading of these peak labour periods and so a better utilisation of labour in agricultural areas.

An example of the labour constraint is provided by the case of raising beef cattle. Farmers in agricultural areas have been encouraged to raise a few head of cattle, with the bulk of China's herd of almost 120 million cattle now coming from the intensive agricultural areas (Lu et al. 1995). Moreover the primary stated reason for official encouragement of cattle was for a better utilisation of crop wastes especially treated straw. Indeed this is the rationale for the over 250 million Rmb "Straw for Beef" program which provides funds for among other things, straw ammoniation pits[6]. However, the time farmers have to treat the straw is precisely the busiest time in their grain cycle, namely the harvest period. Thus some farmers will need to reduce their grain activities if they are to undertake some of these livestock activities properly.

In many cases, however, the reforms have not only allowed farmers to take up sideline activities but also to specialise in these activities. Thus there are now numerous specialist beef cattle raising households throughout China. Although the bulk of cattle in China are still raised on households with three or less head of cattle as a sideline activity, an increasing number of households are now specialising in raising cattle. Thus in Dezhou Prefecture, a major cattle producing prefecture in the north of Shandong, more than half the cattle are now raised by specialised households with more than four head of cattle. Furthermore, specialised fattening households now turn-off, in aggregate, more cattle than do commercial feedlots in China.

It is not only in the scale, but also in the type of operation that some specialisation has occurred. Thus there is not only specialist beef raising households but also specialist calf raising households that raise calves to 6 to 12 months of age (90 to 150kg), specialist intermediate fattening households that feed these calves until they are from 18 months to 24 months of age (weight of less than 400kg), and specialised feedlot households that fatten these cattle for periods of 3 to 4 months to a slaughter weight of around 500kg.

Have these moves towards individual household specialisation been desirable from a Chinese policy perspective? To the extent that specialised beef households are more feed grain intensive than the non-specialised households with cattle as a sideline, then it may be out-of-kilter with the principle of grain saving and efficient use of household wastes. However other elements of beef industry policy including the modernisation and rapid development of the industry tend to conflict even more. Specialised households have exhibited the capability of responding quickly and fully to the economic incentives they face. Thus the task for Chinese decision-makers is to ensure the appropriateness of these incentives.

Impact on non-farm activities

The freeing up of commitments to cultivate land has enabled some agricultural households to seek opportunities off-farm. The range of potential non-farm opportunities is enormous, as are the challenges in pursuing them. This section focuses on a smaller sub-set of opportunities namely agricultural and livestock husbandry processing, distribution and marketing activities. County governments in rural areas have pursued investments in agricultural and animal husbandry value-adding activities for more than a decade in the hopes of generating

[5] In one township (Yandianlou) visited in Shandong, of the 63,000mu of cultivated land, 35,000mu was planted to peanuts and 15,000mu to asparagus.

[6] By 1999, the "Straw for Beef"project, which has now been extended to a "Straw for Ruminants" project covered 268 counties in 29 provinces and had involved a Central government investment alone of 253 million Rmb (Li et al. 1999).

employment opportunities as well as fiscal revenues. Brown and Longworth (1992) highlighted how many of these ventures have had mixed results. Of apparently greater success has been individual households pursuing some of these activities on a much smaller scale in their own right.

Often households have evolved into these activities. For instance, many of the agricultural households who first went into beef cattle raising when beef prices were high obtained sufficient animal husbandry and market experience, and generated the necessary capital, to branch into activities such as live cattle dealing which they found more lucrative than raising cattle especially as beef prices stagnated. In turn, many cattle dealers have become specialised slaughter households.

These specialised activities have become critical parts of rural development in a number of areas. In many parts they account for a significant component of the local economy. Where some of these activities have grown up and become large township or village enterprises then the impact can be profound. Although many villagers will benefit from the enterprise as a source of employment and as a generator of (fiscal) revenues, most of the benefits may arise through the demand for specialised services that these plants require. Thus most of the households in the village of Nanguan in Cao County of Shandong Province act as live cattle, offal and hide dealers for the Wangguang plant established by a householder in 1992 and now with assets in excess of 60 million Rmb.

In some sectors these activities form an important part of the whole sector. Thus it is estimated that household slaughtering accounts for around 90% of overall cattle and pig slaughtering in China.

In many cases specialised households provide the most appropriate form of development. That is, the structure of some industries is so diffuse, heterogeneous and small scale as to render large centralised activities as cost ineffective. An example of this are cattle offal dealers who purchase the offal from a plethora of abattoirs and slaughter households and sell to a limited number of specialised offal processors. Without this network of small offal dealers it is unclear whether a market for specialised offal products would exist, as the factory-delivered price for the raw offal may be too high relative to the derived or implicit price that offal consumers are prepared to pay. Similarly in more remote and diffuse beef cattle areas, it is doubtful whether various beef cattle production systems involving individual households would exist without a well-developed network of cattle dealers. Undoubtedly many aspects of these live cattle, beef and offal distribution channels involving individual households could be improved but, in general, they are well suited to the production and marketing systems.

Implementation and facilitation

Adoption of reforms

Although the TFS had a significant impact on technical efficiency, Figure 2 reveals that there was delayed response to participation in the scheme while a small proportion of farmers still remain outside the scheme. Thus Chen (1998) also investigated the adoption by farmers of the TFS. Understanding the adoption of the TFS by farmers in Pingdu City was important because of the insights it could reveal on extension of the TFS to other areas of China and on the implementation of land and related institutional reforms.

Chen used a multinomial logit model to explore fully the factors affecting adoption of the TFS and the timing of that adoption. Full details of the model and the reasons for adopting the multinomial logit model are outlined in Chen (1998), while a listing of the model and variables used in the model are reported in Appendix 2. Tests for overall coefficients and individual coefficients were conducted using the log likelihood ratio test and these results are reported in Table 4.

Factors found to be important in adoption of the TFS included the political beliefs or affiliation of farmers, the opportunity to access extension services, the land area cultivated per person in a farm household, and the number of land plots for a farm family. Political affiliations had a significant impact on implementation of the TFS. Members of the Chinese Communist party bore responsibility for implementing rural policies proposed by the party. Thus party members were expected to be among the early adopters of the reforms and act as demonstration farms for other party and non-party members alike. The empirical analysis here suggests that Party members did indeed take on this role in relation to the TFS system in Pingdu City. This supports other anecdotal observations of the importance of Party members in acting as “mentors” with new institutional reforms or opportunities.

Extension services also had a crucial impact on implementation of the TFS. The extension offices in the City and village committees provided extension services. These extension organisations formed an information channel to convey the government’s ideas, opinions, encouragement and subsidies to small households. The large increases in technical efficiency in 1998 and 1992 in Figure 2 reflects increasing participation rates in the TFS during these times as the result of concerted extension campaigns. The importance of extension services and Party members indicates the fundamental ongoing influence of government on agricultural activities in China. Despite reforms such as the Household Responsibility System that have led to private farm household structures, the role of the government in farmer’s decisions is still pervasive if now not as overt.

Table 4. Summary statistics and tests of hypothesis for multinomial logit model of adoption of TFS

Variable	Summary statistics		Test of hypothesis	
	Mean	Standard deviation	Log likelihood ratio	Probability[a]
Overall			162.83	
Constant			3.51	0.48
TFS	0.94	0.24		
AGE	41.92	6.81	3.62	0.46
EDUCATION	1.49	0.63	2.34	0.67
FAMILY SIZE	4.32	0.80	5.85	0.21
SEX	0.91	0.29	3.17	0.53
PARTYMEMBER	0.17	0.38	7.60	0.10
LANDSIZE	2.59	0.66	7.99	0.09
CAPITAL	10.49	3.21	2.43	0.66
LANDPIECE	7.64	2.38	9.79	0.04
EXTENSION	0.72	0.45	7.13	0.13
INCOME	0.54	0.06	3.42	0.49
Summary statistics for model				
• log likelihood for full model			-66.21	
• log likelihood for restricted model			-147.62	
• Madalla's pseudo R-square			0.80	
• McFadden's pseudo R-square			0.55	
• Cragg and Uhler's pseudo R-square			0.22	
• Per cent correctly predicted			0.74	

[a] probability of the estimated coefficient not being significantly different from zero.

Two characteristics of farmland, namely area of land cultivated per person in a farm household and the number of land plots for a farm family, also impacted on the adoption of the TFS. In general, farm households with a larger land area were more likely to adopt the TFS. This concurs with the policy of implementation of the TFS in that the Pingdu City government did not recommend the TFS to villages in which the average land area cultivated per farmer was less than 1.5mu since the potential to redistribute farm land in these villages was limited. However, within those villages with sufficient land area, often the smaller farm households were among the very-first adopters as they had the greatest incentive to increase their land area. Similarly the more pieces of land a farm household had the more likely it was to adopt the TFS. That is, the more serious the land fragmentation problem faced by the farm household, the easier it was for them to make the decision to participate in the TFS.

In interpreting these results, it must be realised that in Pingdu City most villages had sufficient land to be redistributed, that secondary and tertiary industries were developed to the extent where they did afford income opportunities for farmers, that many farm households had the skills and interest in cultivating more farm land, and that the extension services were reasonably well developed. As shown by the analysis, it was many of these characteristics that were central to the TFS being implemented successfully in Pingdu City. Other rural areas without these characteristics (for example, the Wudi region in northern Shandong) may not be so suited to adoption of this type of reform. Nevertheless the analysis provides some insights into conditions conducive to adoption of the TFS.

Facilitating household specialisation

A number of things can be done (or not done) to encourage a greater degree of specialisation in the agricultural sector. At a macro-level, there are still impediments to free movement of labour from the agricultural to other sectors. Central government policies that constrain or make this movement difficult need to be reviewed along with local policies that better identify off farm opportunities are needed.

Many opportunities for individual households arose from marketing activities associated with traditional and "new" agricultural enterprises. As State sole procurement and marketing agencies move out or relinquish their monopoly role in this area, then considerable opportunities have arisen for individual

households. However there are several areas of market transaction costs, such as the provision of information and enforcement of contractual arrangements, that could make this private market economy operate more efficiently.

Many regions, depending on their agricultural structure, characteristics and in some cases history, tend to show specialisation in particular areas. A common example of this is household slaughtering where whole villages exist in which the majority of households are slaughter households. Typically these villages or groups of villages slaughter around 50,000 head of cattle per year or roughly equivalent to a medium sized abattoir in China. There are many examples of these villages with large numbers of specialised slaughter households throughout the populous and cattle intensive agricultural areas of China. (Examples include Caoshi town, Gushi , Xincheng and Suizhong villages in Liaoning Province, Ganyu village in Jiangsu Province, Meitang town in Shandong Province.) In these typically Hui villages, while households slaughter in their own right, they often market and distribute their product on a collective basis. Thus a group of specialised households in 4 villages of Meitang town in Dezhou Prefecture of Shandong Province own and operates a small chiller and wholesale market in Tianjin. Often it is one or small number of dominant households that initiate these collective activities. However in the absence of such a group of households it may be in the interests of local governments to foster such co-operative efforts. This may prove a more cost-effective way than expensive State run value-adding activities.

Some examples of local government efforts to foster co-operation and specialisation among households are already evident. For instance, Wangzifu village in Yucheng county in Shandong Province has an "amalgamated" household feedlot facility. Specifically an area set aside in the village contains a set of feedlot sheds and large straw ammoniation pit that are used by 65 cattle raising and fattening households (each with around 20 head of cattle). A Feedlot Committee, containing influential village and township officials, organises collective input purchases and sales channels for fattened cattle, arranges transport, and sets rules on health standards. Individual households did not pay a user fee for these services.

Another example is the establishment of live cattle markets in Suliazhuang town in Xiajin county, Dezhou Prefecture in Shandong Province. Although Dezhou is one of the major cattle producing prefectures in China, its slaughtering sector is poorly developed and many of the cattle are transported out of the Prefecture. Suliazhuang has taken advantage of its location to establish the live cattle markets which can handle around 10,000 head of cattle on a sale day. The live cattle market in turn has opened up many opportunities for local households with over 200 brokers and 200 cattle dealers servicing the markets. Furthermore, establishment of the market has led to Suliazhuang town now having 15 specialised cattle raising villages. Suliazhuang and Xiajin officials have taken advantage of the timing and circumstances to create a range of opportunities for individual households from the live cattle market. However, these circumstances could well change if all Xiajin's neighbouring counties decide also to invest in similar live cattle markets. Hence some of the previous concerns raised about State-investments in value-added, animal husbandry activities as discussed in Brown and Longworth (1992) need to be considered.

Conversely there have been areas of recent government activity that have served to stifle these moves towards specialisation. The Ministry of Agriculture and related organisations at all levels have embarked on a process of "agroindustrialisation" and modernisation and commercialisation of their agricultural industries. Part of this has involved the establishment of large integrated operations, such as integrated cattle breed stations, feedlots, and abattoirs. Often these activities have been co-financed by external development agencies such as the World Bank, and they can be at odds with household specialisation. For instance, a large World Bank funded cattle development project in central China calls, perhaps forlornly, for the closure of all household slaughtering within the project area. However these ventures involve a high cost operations designed around premium, high value markets. In the case of China this high value beef market is extremely limited. Conversely, household slaughtering provides a low cost, low value product more in line with the current demands of Chinese consumers. Unfortunately many of the agroindustrialisation projects to date have been ill-conceived, often failing due to an overreliance on expected, but non-existent, premium markets.[7]

Even if the large State involved enterprises provide a more profitable way of pursuing industry development; it must also be assessed in terms of regional and rural development. That is, the industry wide benefits must be weighed against the displacement of these specialised households and the flow-on effects on local economies. Given that many of the centralised activities have shown dubious economic results, and that the specialisation among households has fostered the transition towards a more decollectivised economy, then any centralised activity needs to be given close economic scrutiny. Waldron (1999) discusses the issues associated with agroindustrialisation and industry policy in much greater depth.

[7] The problems beseting the World Bank funded abattoir in Dexin County in Jilin Province, which has had a major shift in ownership and direction of operation since an ill-fated start in late 1997, exemplify these problems.

Concluding remarks

The latest series of land and institutional reforms designed at addressing some of the shortcomings of the HRS would appear to have been at least partly successful. However over the last half century since the formation of the People's Republic there have been numerous land reforms, and it is likely that such policy shifts will continue in the future. Thus the latest series of reforms discussed here should be seen as only part of an ongoing process of institutional change.

The primary focus of the reforms in addressing shortcomings of the HRS such as land fragmentation and economies of scale has been to increase grain production. In this regard they have been significantly, albeit modestly, successful. However an ex-post analyses of the adoption of these reforms reveals some key factors needed to make the most use of them, and the need to tailor the reforms to local conditions.

Although the impact on grain production appears to be of most concern to Chinese decision-makers, the reforms may have had a more profound impact on non-grain activities. Specialisation in non-grain activities has fostered higher incomes and a more diverse economic base in many rural areas. Although this type of specialisation is not without problems, and future policy adjustments will undoubtedly follow, it has promoted rural development in many areas of China. This positive spin-off of the land reforms remains largely ignored as the focus continues to be firmly fixed on grain output.

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Appendix 1. Model used to estimate technical efficiency effects

The Battese and Coelli (1995) model may be expressed as follows:

$$Y_{it} = X_{it}\beta + (v_{it} - u_{it}), \quad i = 1,2,...N, \quad t = 1,2,...T \tag{1}$$

Where,

Y_{it} is the logarithm of the production of the i-th firm in the t-th time period;

X_{it} is a k×1 vector of the transformations of the input quantities of the i-th firm in t-th time;

β is a vector of unknown parameters to be estimated;

v_{it} are random variables which are assumed to be independently and identically distributed, namely $N(0, \sigma_V^2)$ and independent of the u_{it}; and

u_{it} are nonnegative random variables associated with the technical inefficiency of production. The u_{it} are assumed to be independently distributed and thus obtained by truncation (at zero) of the normal distribution with mean, $z_{it}\delta$, and variance, σ^2. The z_{it} is a 1×m vector of explanatory variables associated with technical inefficiency of production of firms over time, and δ is an m×1 vector of coefficients to be estimated.

The TFS involves a redistribution of farmland rather than technical progress. Thus, implementation of the TFS is expected to boost the efficiency of agricultural production within a given level of technical progress. The method outlined below enables measurement of the changes in technical efficiency arising from the TFS alone.

Following the model of Battese and Coelli, a stochastic frontier Cobb-Douglas production function was estimated as:

$$\begin{aligned} \mathrm{Ln}(Y_{it}) = \beta_0 + \beta_1 \ln(land_{it}) + \beta_2 \ln(capital_{it}) + \beta_3 \ln(labor_{it}) + \beta_4 \ln(chem_{it}) \\ + \beta_5 \ln(manu_{it}) + v_{it} - u_{it} \end{aligned} \tag{2}$$

with the technical inefficiency effects, u_{it}, defined as:

$$u_{it} = \delta_0 + \delta_1(TFS_{it}) + \delta_2(age_{it}) + \delta_3(school_{it}) + \delta_4(year_{it}) + w_{it} \tag{3}$$

where,

ln denotes the natural logarithm;

Y_{it} is the total value of outputs (in yuan) for the i-th farm household in year t;

$land_{it}$ is the land area (in mu) sown by the i-th farm household in year t;

$capital_{it}$ is the machinery and livestock (in horsepower) owned by the i-th farm household in year t;

$labor_{it}$ is the time (in days) spent on farming activities by the i-th farm household in year t;

$chem_{it}$ is the amount of inorganic fertiliser (in kilograms) applied by the i-th farm household in year t;

$manu_{it}$ is the amount of organic fertilser (in kilograms) applied by the i-th farm household in year t;

TFS_{it} =1, if the farm household participates in the TFS, otherwise TFS_{it} = 0;

age_{it} is the age of the head of the i-th farm household in year t;

$school_{it}$ is the education level of the head of i-th farm household in year t;

$year_{it}$ is the time trend for the i-th farm household in year t;

w_{it} is defined by the truncation of the normal distribution with zero mean and variance, σ^2, with the point of truncation at $-z_{it}\delta$, that is $w_{it} \geq -z_{it}\delta$; and

βs and δs are coefficients to be estimated.

The technical efficiency of production for the *i*-th firm at the *t*-th observation is defined as

$$TE_{it} = \exp(-u_{it}) \tag{4}$$

The chosen model for the inefficiency effects, u_{it}, can only be estimated under the condition that the inefficiency effects are stochastic and have a particular distributional specification. Therefore, it is necessary to carry out the following tests:

- null hypotheses that the inefficiency effects are not present;
  $\mathbf{H_0}: \gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$
- null hypotheses that the inefficiency effects are not stochastic;
  $\mathbf{H_0}: \gamma = 0$

- null hypotheses that the coefficients of the variables in the inefficiency effects model are zero.

$\mathbf{H_0}: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$

$\mathbf{H_0}: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0.$

The generalised likelihood-ratio statistic, λ, is used in these null hypotheses tests. The λ is defined as:

$$\lambda = -2\ln[L(H_0)/ L(H_1)] \quad (5)$$

where,

$L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and alternative hypotheses, H_0 and H_1, respectively (Coelli, 1995).

The *FRONTIER (version 4.1)* program, developed by Coelli (1994), was used to estimate the stochastic frontier production function and inefficiency effects model, and to determine technical efficiency.

Appendix 2. Model used to analyse factors affecting adoption of the TFS

The empirical multinomial logit model specified to analyse the adoption of the TFS in Pingdu City was:

$$TFS = \beta_0+\beta_1 AGE+\beta_2 EDUCATION+\beta_3 FAMILYSIZE+\beta_4 SEX+\beta_5 PARTYMEMBER+\beta_6 LANDSIZE +\beta_7 CAPITAL+\beta_8 LANDPIECE+\beta_9 EXTENSION+\beta_{10} INCOME+\xi \quad (6)$$

where,

TFS is 1 if the farm household chose to participate in the TFS in 1988; 2 if in 1989; 3 if in 1991; 4 if in 1992; and 5 if the farm household did not choose the option to participate in the TFS until 11996

EDUCATION is the education level measured as the educational grade finished by the head of the farm household. Specifically it is 0 for no education experience or under elementary school level; 1 for elementary level; 2 for junior school level; 3 for senior school level; and 4 for university or college graduate.

FAMILYSIZE is the number of people in the farm household.

SEX is 1 for male; and 0 for female.

PARTYMEMBER is 1 for member of the Communist Party; otherwise 0.

LANDSIZE is the area of cultivated land per person in a farm household in mu.

CAPITAL is the total horsepower of capital for the farm household at year end.

LANDPIECE is the number of land plots cultivated by the farm household.

EXTENSION is 1 for having an extension contact; and 0 for no extension contact.

INCOME is the proportion of income from agriculture in total farm household income.