MARKET DEVELOPMENT AND FOOD DEMAND IN RURAL CHINA

Jikun Huang and Scott Rozelle

ABSTRACT: The authors hypothesize that rural demand for foodstuffs in China amy be restricted in part by incomplete development of markets, in particular markets for meat. They model this relationship, and test it on 1993 Statistical Bureau data (supplemented by field surveys) for rural households in six counties of hebei Province. They find a multidimensional impact for their market development variable on food consumption behaviour. The results imply that if households purchased 100% of their foodstuffs on markets, rather than the current 38%, income elasticity for grain would fall from .85 to .51, and for meat would rise from .35 to .85. If market development rises with rising income, these results suggest that previous estimates of China's income elasticity for purchased foodstuffs are biased. *JEL Classification Numbers: D1, D4, and P23.*

INTRODUCTION

During the prereform period in the People's Republic of China, rules and regulations limited the exchange of goods and services in the rural economy. Trade among regions and sectors was discouraged and undertaken almost exclusively according to officially approved plans. Market interactions among households within local economies were similarly constrained. Rural consumption was consciously dampened by policymakers in order to funnel resources directly into China's industrialization movement (Walker, 1985).

Even after the implementation of the bold rural reform program in the late 1970s and early 1980s, markets have developed unevenly (Lyons, 1992). Rural factor markets remain notoriously incomplete. National plans still controlled most or all of the interregional movement of grain, oil, sugar, cotton, tobacco, and a number of other specialized agricultural products into the early 1990s (Sicular, 1991).

Part of the reason that markets remained incomplete is that liberalization was not part of the initial step in China's economic reform plans (Lin, Li, & Cai, 1994; Rozelle, 1994). The leadership's commitment to gradual reform resulted in policies which concentrated mainly on providing incentives to agents within the original economic framework. Only in more recent years have official calls for market liberalization been heard (Tian, 1992). Even today, however, cotton and tobacco are still subject to strict national monopoly procurement laws. Formal limitations on transactions of such fundamental factors as fertilizer and credit remain prominent. The effects on current consumption of these goods are mainly the result of policy decisions.

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Another set of markets—including those most closely associated with rural food consumption—have not become fully developed despite the abolishment of prohibitive regulations. Rural residents officially have been able to trade food and other consumption goods among themselves since the late 1970s (Sicular, 1988). Wider regional markets were encouraged during the second stage of the rural reforms beginning in the mid-1980s. Yet during a series of recent surveys by the authors it became apparent that rural consumption markets in some areas remain rudimentary and incomplete. Rural residents in these regions are still primarily self-sufficient and commercial activities involving staple goods remain at low levels. This is true even in some non-remote coastal regions. In one rural area adjacent to one of China's original 14 open coastal cities, even the richest households reported that fresh meat was typically only available during the two days during each 10 day interval that there is a local periodic market. Many respondents reported that their choice of quality products on daily markets and in small shops is limited. If this is the case, the limited nature of rural consumption markets could be having an important impact on food demand in farming communities.

However, unlike the case where policy restrictions have purposely been imposed, it may be that the officials in charge of rural economic policy are unaware of the extent of imperfection in rural consumption markets and the impact that this may be having on rural food demand. It is often assumed that once prohibitions against market transactions are dropped, supply and demand forces will quickly and costlessly begin to allocate goods. There is an emerging literature in development economics, however, that is exploring the reasons why efficient and complete markets in developing countries may not immediately appear (Udry, 1990; Platteau, 1991; Fafchamps, 1992). High transaction costs, lack of infrastructure, and underdeveloped institutions can limit the scope for transactions. While this body of research has begun to theoretically address why efficient markets do not always immediately appear, there is little empirical evidence (beyond a number of anecdotes) that assess the impact of market incompleteness on rural welfare.

The overall goal of this paper is understand how underdeveloped food markets affect the behavior of consumers in China's rural economy. Specifically, the paper will review consumption patterns in rural China in communities where the level of market development differs. The paper seeks to understand how market imperfections affect food demand. Does it mainly affect how consumers respond to prices? Or, does it limit how consumers allocate their income? The paper estimates the impact of incomplete markets on consumption behavior.

In addition to contributing empirically to the market development literature, this study is unique in several other dimensions. Based on a new set of primary, household-level data collected jointly by the authors, their collaborators, and local State Statistical Bureau (SSB) enumerators, this paper will add to the nascent literature on rural food demand in China's post-planning rural economy (Fan et al., 1994a; Halbrendt et al., 1994). Such micro-based empirical studies are needed given great discrepancies in the forecasts for the future demand for food in China (Garnaut & Ma, 1992; Brown, 1994; Crook, 1994; Fan et al., 1994b). If market development affects consumption behavior, and forecasts are based on estimates of structural relationships (e.g., expenditure and price elasticities) which do not account for changes in market activities, then it could be that these forecasts will lead to radically wrong predictions for economies where market structures are changing rapidly. The study will also provide another observation in the study of the impact of the rural reforms in China's economy-in-transition. Specifically, could it be that governments of the

Table 1
Annual Per Capita Income and Consumption of Selected Major Foods in Rural China, 1978-92

Commodity	*1978*	*1980*	*1985*	*1988*	*1989*	*1990*	*1991*	*1992*
Income (yuan):								
Nominal income	134	191	398	545	602	686	709	784
Real income	165	221	398	417	388	429	434	462
Consumption (kg):								
Grain	248	257	257	260	262	262	256	251
Fine grain	123	163	209	211	213	215	214	211
Meats	6	8	11	11	11	11	12	12
Vegetable	142	127	131	130	133	135	127	129

Notes: Grain is measured at unprocessed form.

Sources: SSB, *Statistical Yearbook of China,* 1993.

former centrally planned economies have a greater role in fostering markets than the mere elimination of anti-market legislation?

Patterns of Rural Food Demand and Market Development

One of the most curious facts found by those working on food demand in rural China is the difference in the patterns embodied in China's rural consumption data. From 1978 to 1992, real rural incomes increased dramatically and consistently (except for the leveling off in the late 1980s—Table 1). During the first 10 years of the reform period (1978–88) the consumption of fine grain followed the rise in income. Direct consumption of these grains, however, actually began to decline in the early 1990s. One explanation for this trend is that fine grains had reached a point where they had become an inferior good in China's rural economy. Average meat consumption, on other hand, has risen rapidly, doubling over the period 1978-92 (although meat consumption is still low).

Cross sectional data present a different story (Table 2). Based on China's detailed, annual Household Expenditure and Income Survey (HIES) for 1991, grain consumption rises from 221 kilograms per capita for the lowest income group to 274 kilograms for those with income levels that exceed 2000 yuan per capita (in nominal yuan). According to these data, grain is not an inferior good, even for those consumers who have income levels nearly 250 percent higher than the national average.

These same contradictions appear in multivariate analyses of China's grain economy. Expenditure or income elasticities reported by analysts working with time series of consumption data vary sharply from those calculated by researchers using cross sectional data. For example, Ito et al (1989) and Petersen et al. (1991) find that fine grain consumption varies negatively (or not all) with income in their analyses using time series data. In contrast, Halbrendt et al. (1994) and Huang and Rozelle (1994) report positive expenditure elasticities for grain using cross sections of data.

One plausible explanation for this apparent contradiction is that the consumption patterns of rural residents over time also are being driven by changes in the relative prices of

Table 2
Annual Per Capita Food Consumptions by Income Group in Rural China, 1991

		Income Group (Yuan)							
Annual per capita food consumption	*Mean 709*	*(1) < 200*	*(2) 200-400*	*(3) 400-600*	*(4) 600-800*	*(5) 800-1000*	*(6) 1000-1500*	*(7) 1500-2000*	*(8) > 2000*
				(kilograms)					
Grain	256	221	226	250	269	273	274	271	274
Meats	12	6	8	11	13	14	16	17	20
Vegetable	127	76	95	122	139	147	151	147	146
Oils	6	4	4	5	6	7	7	7	8
Poultry and eggs	4	2	2	2	1	2	2	3	6

Sources: HIES (*China's Rural Household Expenditure Survey Yearbook*), 1992.

Table 3
Price Indices of Major Food Commodity Groups in Rural China, 1978-92

	Price Index						
	CPI[a]	*Total Food*	*Grain*	*Non-Grains*	*Meat*	*Vege-tables*[b]	*Other Foods*
1978	81	73	72	61		46	67
1979	83	76	76	65		49	71
1980	86	81	81	78		55	79
1981	88	83	82	81		60	81
1982	90	87	85	84		61	85
1983	91	88	85	85	81	69	87
1984	93	89	85	87	83	74	90
1985	100	100	100	100	100	100	100
1986	105	108	113	109	110	103	106
1987	112	117	120	122	129	122	114
1988	131	141	137	158	181	160	136
1989	155	166	171	185	206	163	167
1990	160	169	165	191	201	163	174
1991	163	171	165	194	195	173	178
1992	170	179	186	200	202	189	182

Notes: [a] Consumer Price Index is the calculated on the basis of rural retail prices (*nongcun lingshou jiage zhishu*).
[b] The price index of vegetables are for both urban and rural consumers.

Sources: SSB, Statistical Yearbook of China, 1993.

goods. Price series of major food goods in China's rural economy from 1978-92, however, do not support this conjecture (Table 3). Grain prices have increased slower than other major food categories—especially meat and other non-staple foods. Hence, price factors should have helped bolster the demand for grain, instead of inducing consumers to move away from grain consumption into meat production.

An alternative explanation is that the rural economy has been undergoing structural change. In the rest of Asia, increasing urbanization has been shown to have caused a similar set of seemingly contradicting results in national aggregates of rice consumption data (i.e., rice demanded by the combined rural and urban population—Huang and David, 1993). Urbanization itself leads to lower rice consumption apart from

demand responses to changing levels of prices and income. The demand for grain in China's national economy is being influenced by similar dynamics (Huang & Bouis, 1994).

But the urbanization hypothesis can not explain the observed consumption contours in the rural economy. Instead, China's rural areas have been undergoing their own structural transformation. In recent years, leaders have gradually pushed the nation from a centrally planned economy to one where more resources and commodities are being allocated by market-based prices and consumer choice. The proportion of food consumed by rural residents that has been purchased in rural food market has grown over time. In 1978, over three-quarters of the food consumed by farmers was self-produced (ZGTJNJ, 1991). The proportion of food purchased in the market increased steadily—to 31 percent in 1980, 42 percent in 1985, and 45 percent in 1990. It may be that this process is affecting food demand, and can partly explain the observed consumption trends.

In fact, during long periods of intensive field work in rural China in the early 1990s, the authors repeatedly found evidence supporting the hypothesis that the level of market development affects food demand patterns. Rural consumption markets have developed at uneven rates across China. In some places, rural consumers have convenient access to a wide range of products on a daily basis. In these areas, food shops have high quality refrigeration facilities. Processed, semi-processed, and high-quality fresh goods can bought any time of the day or evening. Traders and vendors come on a regular basis, and their products can be purchased with a minimum amount of effort. In some of the better off villages, rural residents have purchased their own refrigerator-freezer units. In areas where such marketing facilities have grown up, rural residents claim that such conveniences have increased their consumption of fresh meat (which they prefer to dried or salted preserved meat, the traditional meat product in rural areas).

In other areas, however, the variety and quality of food products available to rural consumers is more limited. Even within fairly nonremote regions, fresh meat frequently can only be purchased during the periodic market days, or when one household happens to slaughter a family-raised hog. County seats and some larger townships have daily markets, but shopping expeditions to these centers can entail a significant amount of time and expense for all villagers except those in the nearby hamlets. Most villages have small retail outlets, but many deal largely in dry goods because they lack reliable refrigeration facilities. Casual inspection of fresh fruit supplies in many of these small shops clearly betrays their poor quality. Even in areas with incomes high enough to afford large consumer durables, electricity supplies often are undependable, and refrigerators often go unused. Peddlers are increasingly part of the local economic landscape, but in most areas they come infrequently and are sometimes suspected to sell unsanitary products. Interviews with households reveal that the lack of robust and reliable food markets in rural villages makes farmers more dependent on food they produce on their own farm. Except for specialized livestock and orchard-owning households, this means that most Chinese farmers are consuming more of their self-produced grains and vegetables.

Descriptive statistics from the enumeration of 433 farmers in Hebei province support these impressions. The consumption patterns of the consumers in this sample (Table 4) follow those of found in national survey data (Table 2). As income rises in the cross section, consumption of all major food types rises. However, the consumption of grain varies sharply among groups of consumers who differ in their access to rural food markets (Table 5, Row 1). In areas where farmers purchase less than 20 percent of their

Table 4
Annual Per Capita Food Consumption by Income Group of Sample Households, Hebei Province, China, 1992

	Income groups (yuan)							
Food Groups	*Mean 961*	*(1) < 400*	*(2) 400-600*	*(3) 600-800*	*(4) 800-1000*	*(5) 1000-1200*	*(6) 1200-1400*	*(7) > 1400*
				(kilograms)				
Grain	215	210	216	201	220	213	225	225
Meats	10	4	7	9	10	9	10	18
Vegetable	133	139	125	134	135	119	151	138
Fruits	14	6	7	11	17	13	18	24
Other Foods	11	5	8	9	12	10	13	18
Total share of budget used for food	60	70	66	64	62	61	61	51
Total share of budget used for foods from 5 major food groups	48	61	57	51	59	48	45	40

Sources: Primary data collected by authors in collaboration with local State Statistical Bureaus in 6 Hebei counties.

Table 5
Annual Per Capita Food Consumption by Households Belonging to Groups Purchasing Different Proportions of Food Consumption in Rural Markets, Hebei Province, China, 1992

	Proportion of food purchased in rural food markets (percent)			
Food Groups	*(1) < 20*	*(2) 20-30*	*(3) 30-40*	*(4) > 40*
		(kilgrams)		
Grain	251	228	199	190
Meats	7	8	9	13
Vegetable	154	138	140	112
Fruits	7	12	16	18
Other Foods	6	8	11	16
		(budget share[a])		
Grain	56	49	45	44
Meats	9	13	14	20
Vegetable	27	26	25	19
Fruits	2	4	5	6
Other Foods	5	8	10	13

Note: [a] Budget share within the five major food groups used in this study. Columns in rows 6–10 sum to 100 percent (subject to rounding).

Sources: Primary data collected by authors in collaboration with local State Statistical Bureaus in 6 Hebei counties.

food in local markets, the average consumption of grain is 251 kilograms per capita. It is only 190 kilograms per capita when households procure more than 40 percent of their food. Vegetables follow a similar falling pattern (Row 3). Meat production, however, is positively correlated with the level of market development (Row 2). Producers

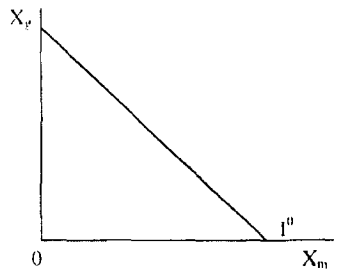
in areas with poor markets only consume 7 kilograms per capita, while those in areas with better markets consume more than 13 kilograms. The demand patterns of fruits and other food parallels that of meat.

When this observation is combined with figures on the sources of food consumption, a fairly convincing argument can be made for reconciling food consumption patterns in rural China. Nationally, farmer consumption can be divided into two broad groups—own-produced and purchased. In 1992, less than 10 percent of grain and less than 15 percent of vegetables consumed by rural households were purchased (HIES, 1993). In contrast, rural consumers purchased almost half of their fruit and over 60 percent of their meat and fish from the market. Nearly all of the rest of major, non-staple food products are purchased. Hence, if meat and fruit consumption is limited by the extent of overall market development, and consumers in these areas are forced to rely on their own-produced grains and vegetables, then as markets have developed during the reform period, even with income and price constant, a change should be expected in the consumption of different commodities. Specifically, these facts are consistent with the consumption trends over time and among areas. At the level of income in China's rural area, it is likely that expenditure elasticities are still positive. The drop in grain consumption in the early 1990s may have occurred not because fine grains are not demanded in greater quantities by those with higher incomes. Rather, since the reforms, developing markets have given rural consumers more choice, and allowed previously constrained buyers to enrich their diets with more meat, fruit, and other commercial products, allowing them to reduce their grain consumption.

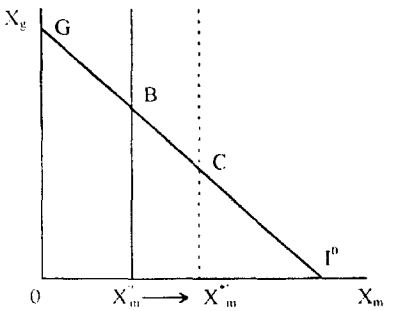
A Model of Consumer Demand and Market Development

The term market development has a number of connotations. In a perfect market, all goods are available at whatever quantity a consumer desires. From the point of view of a consumer who has a fixed budget, a complete market is one where the any point on the budget line, I^0, is feasible (Figure 1, Panel A). Under some circumstances, however, there may something constraining the consumption choice of the individual. In this case, the feasible region shrinks to area $0X_m^*GB$ (Panel B). One definition of market development is any process by which the constraint X_m^* can be pushed to the right, to say $X_m^{*'}$, which would expand the budget set by $BX_m^*X_m^{*'}C$. Alternatively, there may be a situation where the quantity of a good is rationed at a low price, p_m^0, but a secondary market emerges with the same good being sold at a higher price, p_m'. This type of market development also expands the original feasible consumption set by $X_m^*M'B'$. Finally, another form of market development may occur (in either constrained or constrained markets) when some change (e.g., the construction of a road or the development of a permanent market site) reduces the real price of a good to consumers. In this case, the size of the budget set increases from $0MG$ to $0M''G$ (Panel D).

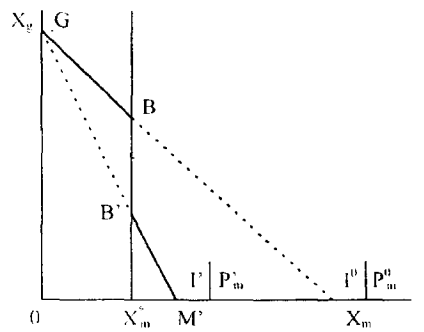
The market development being measured in the following analysis is limited to the definitions embodied in Panels B and C.[1] In fact, Chinese rural consumption markets and their process of development are very much in the spirit of the market situation being considered here. For example, fresh meat and fruit are available only for many villagers during most of the year in periodic markets. Competition in these markets makes the prices exogenously determined. When markets convene everyday, or if every villager has refrigeration



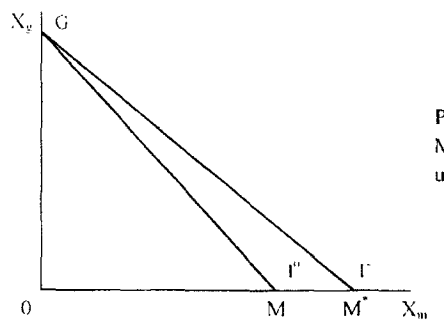
Panel A:
Budget constraint
in complete market



Panel B:
Constrained mareket for X_m



Panel C:
Constrained market for X_m at price P^0_m with newly emerging market for X_m at P'_m



Panel D:
Market development in an
unconstrained market

Figure 1
The Budget Set and Different Forms of Market Development

facilities, then meat can be thought of as one of the goods on the horizontal axis of Panel A, and it is available at all times.

But in many areas markets only occur 1 or 2 times during each 10 day period. In this situation, during a number of days each month, villagers who do not have operable refrigerators (including those who own refrigeration facilities but who also face electricity shortages, a common problem in most areas of rural China) can not eat all of the fresh pork they want. Any amount bought in excess of what can be consumed in a given day spoils. In fact, on the off-market days fresh pork may not be available at any price. In a special survey conducted by the authors in Hebei and Liaoning Provinces in 1994, nearly half of the respondents said that they would eat more fresh pork at the current prices if it were easily available. Consumers in these constrained markets are forced to consume at point B or less. In these villages, meat is unavailable for purchase in the market for all villagers regardless of the level of household income. Prices are determined primarily outside of the local market.

Market development in such areas occurs in the number of ways. The number of periodic markets that are convenient for villagers have been increasing (ZGTJNJ, 1993). Typically, the most noticeable change for residents arises when periodic markets in a locality go from 1 or 2 per 10 days to every other day, or even every day.[2] In such a case, the constrained level of the market (X_m^*, Figure 1, Panel B) would move to the right. In other areas (where periodic markets are still far apart both temporally and spatially), alternative sources of meat may appear. Small shops (outfitted with refrigeration facilities and generators), peddlers, or butchers in the regional urban center are observed to be beginning to supply meat in rural areas. But, because of their higher costs, they often have to charge higher prices. In the initial years after their appearance, these butchers-cum-traders will often only appear during off-market days. As local economies develop, however, shopkeepers and traders begin to find customers every day. Some households find it inconvenient to attend the market, and are willing to pay higher prices for fresh meat and fruit. This set of events is similar to what is being portrayed in Figure 1, Panel C.

Market Constraints and the Optimizing Consumer

The impact of the availability of food on the optimum consumption bundle can easily be seen from a simple example. The welfare-maximizing consumer is assumed to face a choice of two goods, X_g and X_m, with a utility function, $U(X_g,X_m)$. The consumer's choices are subject to a budget constraint, $p_gX_g + p_mX_m = I$, where p_g is the price of X_g, p_m is the price of X_m, and I is income. When there are no limitations to the amount of either type of goods that can be purchased, the demand function for either goods is:

$$X_i = x_i[p_i,I], \text{ for } i = g \text{ and } m, \tag{1}$$

However, if the consumption of one of the goods, say X_m, is constrained to X_m^*, then an additional constraint is added:

$$X_m \_ X_m^* \tag{2}$$

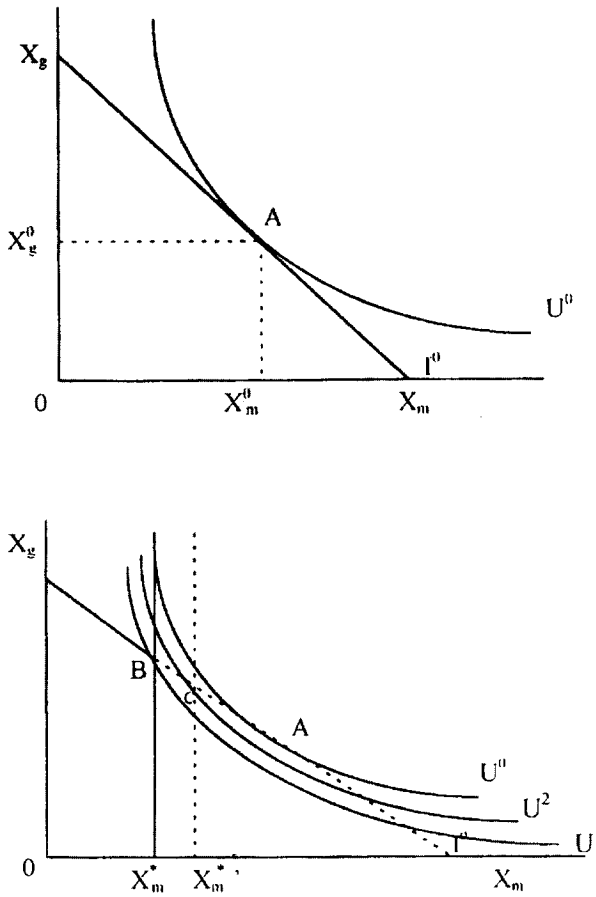


Figure 2
Consumer Choice under Different Forms of Markets

In this case the demand function in equation 1 becomes:

$$X_i = x_i[p_i, I, X_m^*], \text{ for } i = g \text{ and } m, \tag{3}$$

and the demands for both the constrained and unconstrained good are affected by the constraint if it is binding. Market development (in the sense discussed above) relaxes the constraint, which in the context of this problem means X_m^* increases. When the choice of the consumer is limited by the constraint, it can be shown that:

$$\partial X_m / \partial X_m^* > 0, \text{ and} \tag{4}$$

$$\partial X_g / \partial X_{m^*} < 0. \tag{5}$$

These results provide a theoretical explanation for the consumption patterns described in the preceding section. As markets develop, even if incomes and prices are constant, the demand for the constrained good (in the case of rural China, meat and other primarily purchased goods) rises, while the demand for the available good (e.g., grain) falls.

Graphically, the change in consumption bundle between the constrained and unconstrained model is shown in Figure 2, Panel A. In the unconstrained case (when all markets are complete, the demand for X_g and X_m is at point A, the tangency point between the indifference curve, U^0 and the budget line, I^0. When markets are incomplete, and the consumer is unable to purchase all of X_m that is desired at p_m, then the consumption bundle moves to point B, a point still in the affordable consumption set, but at a point where the consumption of X_m is reduced to X_m^*, and utility falls to U^1. As markets develop, the constrained level of X_m^* moves to $X_m^{*'}$. As implied in equations 4, the demand for X_m meat would rise. Utility also rises as the consumers moves from point B to C. In this type of market development, the amount of the unconstrained good, X_g, falls (equation 5). When the constraint moves beyond point A, there are no shortages (unless tastes or other exogenous parameter changed).

Empirical Model

Using an Almost Ideal Demand System framework in linear form (AIDS/LA—Deaton and Muellbauer, 1980), the standard relationship between food consumption, commodity prices, and income can be empirically measured by a system of budget shares:

$$w_i = \alpha_i + \beta_i \ln\left(\frac{y}{p^*}\right) + \Sigma_j \gamma_{ij} \ln p_j \tag{6}$$

for $i, j = 1,\ldots.n$, where w_i is the budget share of the i*th* commodity, Y is food consumption expenditure, p is commodity price, p^* is defined as $\ln p^* = \Sigma_i w_i p_i$, and α_i, β_i, and γ_{ij} are parameters to be estimated.

An index of market completeness, Z, can constructed and included in the equation to represent the impact on the allocation of the average budget share. Market development may also affect how marginal increments to income affect consumption decisions. To capture these effects, equation 8 is specified:

$$w_i = \alpha_i + \alpha'_i Z + (\beta_i + \beta'_i Z)\ln\left(\frac{y}{p^*}\right) + \Sigma_j(\gamma_{ij})\ln p_j \tag{7}$$

To control for consumption differences due to demographic factors, family size (SIZE), the number of children in the household (PRESCHOOL), the level of education (EDU), and a set of county dummy variables (D_m) are added, and the resulting equation is:

$$w_i = \alpha_i + \alpha'_i Z + (\beta_i + \beta'_i Z)\ln\left(\frac{y}{p^*}\right) + \Sigma_j(\gamma_{ij})\ln p_j \tag{8}$$

$$+ \theta_i SIZE + \lambda_i PRESCHOOL + \mu_i EDU + \Sigma_{im} d_{im} D_m$$

where, θ_i, λ_i, and μ_i are also parameters to be estimated.

The adding up restrictions for equation 9 require:

$$\Sigma_i\alpha_i = 1$$
$$\Sigma_i\alpha'_i = \Sigma_i\beta_i = \Sigma_i\beta'_i = \Sigma_i\theta_i = \Sigma_i\lambda_i = \Sigma_i\mu_i = \Sigma_i d_{im} = 0 \quad (9)$$
$$\Sigma_j r_{ij} = 0$$

The homogeneity restriction is:

$$\Sigma_j r_{ij} = 0 \quad (10)$$

and, the cross-equation symmetry restrictions can be imposed as:

$$r_{ij} = r_{ji} \quad (11)$$

for $i \neq j$.

The elasticities of expenditure (e_{iy}), uncompensated price (e_{ij}), compensated price (ce_{ij}), and market development (e_{iZ}) are derived as follows (Huang & David, 1993):

$$e_{iy} = 1 + (\beta_i + \beta'_i Z)/w_i[\Sigma_k w_k \ln P_k(e_{ky} - 1)] \quad (12)$$

$$e_{ij} = -\delta_{ij} + (\gamma_{ij} + \gamma'_{ij} Z)/w_i[w_j \Sigma_k \ln P_k(e_{kj} + \delta_{kj})] \quad (13)$$

$$ce_{ij} = e_{ij} + w_j e_{iy}, \quad (14)$$

$$e_{iZ} = Z/w_i\left[\alpha_i + \beta_i\left(\ln\frac{y}{p^*}\right) + \Sigma_j\gamma_{ij}\ln p_j\right] \quad (15)$$

where δ_{ij} is the Kronecker delta. Equations 12 to 14 demonstrate expenditure and price elasticities of demand vary as the level of market development changes. The impact of market development on these demand parameters could be evaluated by taking the first-order derivatives of equations 12 through 14 with respect to Z (and after appropriate manipulations elasticities of elasticities could be calculated). Since the index of market development is itself measured as a proportion, a more intuitive calculation of the impact of market development on demand behavior is derived by simulating the response of the expenditure and price elasticities to a ten percent increase in the market development variable.

Estimation and Data

A stochastic structure is specified for Equation 8:

$$w_{ih} = \alpha_i + \alpha'_i Z_h + (\beta_i + \beta'_i Z_h)\ln(Y_h/P^*_h) + \Sigma_j\gamma_{ij}\ln p_{jh} \quad (16)$$
$$+ \theta_i \ln(SIZE_h) + \lambda_i \ln(PRESCHOOL_{ih}) + \mu_i \ln(EDU_h) + \Sigma_{im} d_{im} D_m + \varepsilon_{ih}$$

where h indexes households, and ε_{ih} is the error term. The commodities included in the system are rice, vegetables, meat, fruit, and other foods. The error term, ε_{ih}, in equation 17 is a random variable satisfying the following conditions:

$$\begin{aligned} E(\varepsilon_{ih}) &= 0 \\ E(\varepsilon_{ih}\varepsilon_{ih'}) &= \Omega_{ij} \text{ for } h = h' \\ E(\varepsilon_{ih}\varepsilon_{ih'}) &= 0 \text{ for } h \neq h'. \end{aligned} \tag{17}$$

An Iterative Seemingly Unrelated Regressions (SUR) procedure (or Iterative-Zellner Estimation procedure; Zellner, 1962) is used. The demand parameter restrictions described in equations 10 and 11 are imposed, and can be tested using Wald statistics. Since taken together in budget share form, the set of equations in 16 are singular, one of the shares is dropped during estimation. The adding up restrictions are embodied in the model.

Data

Each year, China's State Statistical Bureau enumerates household income and expenditures for approximately 65,000 rural households in 900 counties in all 30 provinces. Data are collected primarily on an assisted, recordkeeping basis, with observations recorded daily. Results of the local surveys are reported in unofficial summary volumes in local statistical bureaus. The data also are sent to the State Statistical Bureau in Beijing where they are summarized and published (HIES, 1992). Information is collected on a wide number of consumption and durable goods.

These data have been used extensively by researchers interested in consumption behavior. Most analysts have used the data after they had been aggregated (e.g., Wang & Kinsey, 1994; Fan et al., 1993; Wang & Chern, 1992; Huang & Bouis, 1994). Data on the households themselves, however, are used in this study. The data for this study come from 433 rural household surveys in Hebei province. The households were relatively evenly distributed throughout six counties in the province.[3] Disaggregated data on food consumption, expenditures, and demographic attributes were made available to the authors from the local statistical bureaus.[4] Data on prices were recovered by dividing total expenditures by the total quantity consumed. Information in the survey is also available regarding the number and size of the transactions farm households have on local consumption markets.

Budget categories include grain (which includes the consumption of fine and coarse grains, noodles and other processed staples), meat (pork, beef, and poultry), vegetables, fruit, and other foods (soybean products, sugar, cakes, candy, and beverages). Education is the level of attainment of the household head in China's school system. The market development index is measured as the proportion of the total value of consumed food products which were purchased by household on the market (as opposed to be self-produced).

While China's standardized data collection instrument does provide a great amount of rich data, many important factors influencing demand are difficult to determine by examining the raw data. To overcome this shortcoming, the authors and their collaborators visited the field on 5 occasions during 1993 and 1994. After observing the highly uneven development of markets, even within a geographically circumscribed region, a survey was developed to help the authors better identify the way markets affect consumption. Open-ended interviews were conducted with more than 50 farm households, traders, shop

keepers, market managers, and local leaders. Questions were asked about the history of market development, the remaining barriers to the free flow of goods, and on factors which were believed to improve market development.

On the basis of preliminary field work, the study sites in Hebei were selected because of the variability within the province's borders. Although Hebei's farmers are near the national average in per capita income and food expenditure, the variation among its counties is one of the greatest in China. The great contrasts derive in part from the province's geographical diversity. Hebei adjoins the Bohai Gulf in the east, is pervaded by poor, but densely populated mountains in the north and west, and is dominated by the flat and dry North China plain in the south. The province also literally surrounds Beijing and Tianjin, two of the three richest provincial-level municipalities in China.

The development of rural consumption markets in rural Hebei is also highly variable. Some of the most robust markets in China appear in the province's northeast sector. Other areas in the north and west remain isolated and commercially barren. Such a place presents a natural laboratory for studying the impact of market completeness on consumption behavior using cross sectional analysis.

While Hebei as a province is marginally below average when compared to the rest of China's provinces, the sample households drawn from the sample counties are above the national average. In 1993, net income was 961 yuan for the sample households, versus 784 for the nation. Total food expenditure in the 6 sample counties was 417 yuan, somewhat above the national average of 374. In terms of market development, however, while farmers across China purchased 46 percent of their food from markets in 1992, the farmers in the sample only purchased 38 percent.

Empirically Measuring the Impact of Market Development on Food Demand

Estimated parameters from the system of disaggregated staple food commodity equations are robust and hold up to theoretical testing (Appendix 1). The test statistics for Wald tests of homogeneity and symmetry are 12.56 (with 4 degrees of freedom) and 15.89 (with 6 degrees of freedom), respectively. The results of the statistical tests provide support for the validity of the restrictions; they can not be rejected at the 1 percent level.[5] In addition, the parameters on the income and price variables have the expected signs in nearly every case. The coefficients on the expenditure variables in all of the equations and price variables for rice, vegetables, and meat mostly have high t-ratios. The negative coefficients on the PRESCHOOL variable in the grain equation reflects the expected reduction in caloric needs of the household when young children are present. Education does not have an important effect on consumption. The impact of family size varies among the goods.

The expenditure, uncompensated own-price, and compensated own- and cross-price elasticities confirm the high quality of the coefficients of the estimated model (Table 4). The elasticities, evaluated at the overall means of the sample, show that the uncompensated and compensated own price elasticities are all negative (Table 6 and Appendix 2). The compensated cross-price elasticities are all positive, implying that all of the major food groups are substitute, a result which is expected given the level of aggregation. The expenditure elasticities for all goods are positive, and in some cases are higher than (e.g., grain) and in other cases lower than (e.g., meat and fruit)

Table 6
Food Expenditure Elasticities, Uncompensated Own Price Elasticities, and Elasticities of Demand with Respect to Market Development in Rural China, 1994

Commodity	*Mean food expenditure share (%)*	*Food expenditure elastically, constrained market*[a]	*Uncompensated own-price elastically*	*Elastically of demand with respect to market development*	*Food expenditure elastically, unconstrained market*[b]
Grain	48.0	0.86	–0.57	–0.11	0.51
Meats	14.7	0.33	–0.74	0.32	0.85
Vegatable	23.5	1.70	–0.82	–0.25	1.40
Fruits	4.4	1.20	–0.54	0.47	2.32
Other Foods	9.4	1.02	–0.78	0.44	2.10

Notes: [a]Evaluated at the mean level of market development (or level of proportion of consumed food purchased on rural markets), $Z = 0.38$.
[b]Evaluated at level of complete market development, $Z = 1.00$.
All elasticities evaluated at the sample mean, unless otherwise noted.

Table 7
Statistical Tests of Structural Changes in Demand for Foods in Rural China

Model/Hypotheses	*Wald test statistics*[a] *Without demand restrictions*	*With demand restrictions*
I. Intercept—shifter ($\alpha_i' = 0$)	34.80 (4)	36.19 (4)
II. Slopes of interaction variable ($\beta_i' = 0$)	44.20 (4)	45.53 (4)
III. Joint test I and II ($\alpha_i' = 0$ and $\beta_i' = 0$)	150.32 (8)	148.49 (8)

Note: [a]Degree of freedom in parentheses
See equation 16 in text for definition of parameter and full model specification.

those found in (or implied by) the results produced by studies in other parts of Asia (Huang & David, 1993; Bouis, 1989). Given the discussion and conceptual model presented above, this should be expected, and is a result that is examined in more detail below.

Impact of Market Development of Food Consumption

The market development variable plays an important role in explaining food consumption behavior in rural China. The results of three sets of tests examining the effect of the market development index on the budget shares demonstrate that there are a number of dimension of the impact (Table 7). First, market development affects the average budget share holding the effect of total expenditure and prices constant ($\alpha' \neq 0$). Second, market development also has a significant impact on the budget allocation resulting from additional income ($\beta' \neq 0$).[7]

Table 8
Marginal Changes in Demand Elasticities Arising from a 10 Percent Increase in the Level of Market Development[a]

Demand parameters	*Grain*	*Meats*	*Vegetable*	*Fruits*	*Other foods*
			(marginal changes to elasticities)		
Food expenditures elasticity	−0.069	0.104	−0.056	0.227	0.219
Uncompensated own-price elasticity	0.028	−0.019	0.013	−0.011	−0.024
Compensated price elasticities					
Grain	−0.005	0.003	0.000	0.000	0.001
Meats	0.007	0.004	−0.001	−0.0000	−0.002
Vegetable	−0.004	0.002	0.000	0.000	0.001
Fruits	0.015	−0.009	−0.001	−0.001	−0.003
Other foods	0.014	−0.009	−0.001	−0.001	−0.003

Note: Calculated by using equations 14-16. Figures in table generated by taking the difference of the elasticity evaluated at $Z = 0.48$ and 0.38 (e.g., the first row is: $e_{iY}|_{Z=0.48} - e_{iY}|_{Z=0.38}$). The remainder of variables in elasticities are evaluated at their means.

The direction of the joint impact of market development can be seen by the elasticities of market development in Table 6, Column 4 (as derived from equation 15). The signs of all of the variables are exactly as predicted by the comparative statics in equations 4 and 5, and the subsequent graphical analysis. The elasticities on the grain and vegetable variables imply that farm households in the sample areas where some products are periodically unavailable are consuming more of the food that is produced primarily on-farm. More precisely, the negative sign means that as markets develop (or as farmers procure more food rural markets), farmers demand less grain and vegetables, even though income and prices do not change. In contrast, the positive elasticities for meat, fruit, and other food products imply that farmers begin to consume more of the goods as markets develop. In terms of the graph in Figure 2, panel B, these elasticities are measuring the movement from point B to C.

The impact of market development on food consumption also can be examined by its impact on the demand parameters. The elasticities of demand change farm households begin to rely more on rural food markets. When the proportion of food purchased by household increases by 10 percent, the food expenditure elasticities of grain and vegetables fall (Table 8, Row 1, Columns 1 and 3). This result is what should be logically expected. With incomplete markets, samples households are unable to respond to changes in income in the same way as consumers who face markets where goods are always available. When total food expenditures increase as incomes rise, all of the additional food expenditure is spent on the available good. If markets develop (for a part of the previously constrained households), only a part of any newly acquired income is allocated to the previously unconstrained good; the remainder goes for the newly available commodity. As long as the originally constrained good is not inferior, an increase in the level of market development should lead to a reduction in the expenditure elasticity of the unconstrained product.

In contrast, the expenditure elasticities for meat, fruits, and other foods become more positive when the proportion of market-purchased food rises (Table 8, Row 1, Columns 2, 4, and 5). The absolute value of these effects are also larger than those of grain and

vegetables. When households become less limited in their choice of goods that can be purchased on the market, they are more sensitive to changes in income.

These impacts on food expenditure elasticities help explain why this paper's estimates of food expenditure elasticities of grain initially appear so high, and those of meat so low. Currently only 38 percent of the food basket of rural consumers is purchased in local markets. But for each incremental increase in the development of local markets (or more precisely, as farmers purchase an additional 10 percent of their food from markets), grain expenditure elasticities will drop by 0.069 and meat expenditure elasticities will rise by 0.104 (Table 8). These figures imply that with complete markets (i.e., 100 percent purchases of the household's diet such as in the US and Japan), the food expenditure elasticities for grain would be about 0.51, approximately 0.35 lower than when measured at the current level of market development (Table 6, column 5). By the same logic, meat food expenditure elasticities would rise to 0.85. It should be noted that even after full market adjustment, the meat expenditure elasticty estimated from the Hebei data set is still low relative to those from studies done in other parts of Asia (Bouis, 1989) and from other parts of China with better rural market infrastructure (Halbrendt et al, 1994). Part of this may be a function of the sample. The descriptive statistics show that that meat demand remains static across the third through sixth income groups (Table 4). Alternatively, it could also be that the impact of market development on the expenditure behavior of farmers in complete markets can not be predicted on the basis of estimates from a sample where markets are quite incomlete. It may be that after a certain point of market development, the response of meat consumption to food expenditure increases rises more rapidly than the preditions made here.

While somewhat smaller in magnitude terms, the uncompensated own-price demand elasticities are also affected by market development. Grain and vegetable, the two self-produced crops, become less elastic. For example, if markets developed to the point where consumers purchased 10 percent more of their goods on rural consumption markets, the uncompensated own-price elasticity would increase 0.028, moving from –0.57 to about –0.54 (Table 8, row 2). Meat, fruit, and other foods become more responsive as markets develop; their uncompensated, own-price elasticities decrease by –0.019, –0.011 and –0.024, respectively. The impact on compensated price elasticities is much smaller for almost all estimates (rows 3-7).

CONCLUSIONS

The impact of market development on Chinese consumer behavior has been analyzed using a set of household data from a part of China where incomes, prices, and market activity varies greatly from place to place. One should exercise caution in relying completely on policy implications based on results extrapolating from this size of a sample. Nevertheless, there still are some key lessons to be learned by policymakers interested in trying to forecast the future level of the demand for food in China. Additional information is needed given the sharp differences in opinions that are provided by analysts and observers (Garnaut & Ma, 1992; Crook, 1994; Brown, 1994; Fan, 1994).

Forecasts based on historical data from China's rural economy may be inaccurate since the level of market development, one of the conditions on which the estimates were based, has and will most likely continue to change. Since it has been shown that market completeness fundamentally affects consumption behavior, at the very least, these factors must be considered in deriving predictions about future demand trends. Specifically, it is expected that in times of rising income, expenditure elasticities of goods that are primarily self-produced will fall as markets develop, and those which are mostly purchased will rise. When goods are sometimes unavailable in food markets, households are unable to spend incremental income on such commodities. When households are more easily able to purchase any set of goods they want, the responsiveness of demand for that good may increase.

This may help explain why some analysts have over estimated future food demand. Whatever projected incomes are, as long as markets continue to develop, forecasters of food grain demand will necessarily have to revise their estimations if the food expenditure elasticities estimated in this study are representative of those on the national level.

The results also should provide a clearer picture of the assumptions underlying other researchers who have predicted China's future demand based on the assumption that consumers on the mainland will follow the path of their counterparts in Taiwan (e.g., Garnaut & Ma, 1992). Rural consumption patterns develop not only in response to rising incomes. They are also affected by structural changes, such as the development of rural consumption markets. Future consumption patterns are in part dependent on the continuance of China's market reforms. Accurate projections of demand must necessarily account for expected changes in market liberalizing legislation. For example, if China were to enter GATT (and agree to a complete deregulation of market constraints), the assumption of complete markets would be reasonable. Even in this situation, it will still likely take a number of years before markets are complete. On the other hand, if the political climate turns against the reforms, liberalization may be slowed or even reversed. Consumption projections under such conditions cannot be based on the assumption that they are similar to those of Taiwan or other East Asian countries. Instead, if markets continue to be incomplete, demand parameters must be appropriately adjusted.

As mentioned above, rural consumption markets in the most part are *not* limited by policy. In fact, agriculture as a whole is not very protected. With increasing budgetary pressures, and international trade pact discussions, it is most likely that the continued liberalization trends will continue. Given other work on the development of markets, the results of this paper suggest that the government should be playing a role in fostering emerging rural consumption markets. As markets become more complete, rural welfare expands. Beyond merely eliminating prohibitions against market activity, local, regional, and national government units concerned with the livelihood of rural residents may want to take a more active role in expanding markets. Activities such as subsidizing market infrastructure construction, reducing or eliminating marketing taxes and fees, improving information channels may stimulate the more rapid development of food markets in rural areas.

Appendix 1
Estimates of Food Demand System in Rural China

	Demand Equation			
Variable	*Grain*	*Meats*	*Vegetable*	*Fruits*
Intercept	0.276	0.761	–0.602	0.159
	(1.41)	(5.83)	(–3.81)	(2.22)
Z (Market	1.536	–0.415	0.164	–0.429
Development)	(4.13)	(–1.71)	(0.55)	(–3.16)
Ln(Y/P*)	0.055	–0.116	0.150	–0.025
(Food Expenditure)	(1.72)	(–5.60)	(5.80)	(–2.17)
Z * Ln(X/P*)	–0.291	0.094	–0.054	0.084
(Interaction term)	(–4.45)	(2.20)	(–1.03)	(3.52)
Ln(PGrain)	0.176	–0.031	–0.096	–0.006
	(9.79)	(–2.44)	(–10.26)	(–1.08)
Ln(PMeats)	–0.031	0.020	0.008	–0.003
	(–2.44)	(1.440	(1.19)	(–0.52)
Ln(PVegetable)	–0.096	0.008	0.077	–0.009
	(–10.3)	(1.19)	(8.82)	(–2.36)
Ln(PFruit)	–0.006	–0.003	–0.009	0.021
	(–1.08)	(–0.52)	(–2.36)	(5.46)
Ln(POther)	–0.042	0.006	0.019	–0.003
	(–6.49)	(1.08)	(4.50)	(–1.13)
Family Size	0.011	–0.010	0.010	–0.005
(SIZE)	(2.55)	(–3.53)	(2.66)	(–3.29)
Pre-school children	–0.016	–0.004	0.005	0.005
(PRESCHOOL)	(–1.84)	(–0.70)	(0.71)	(1.60)
Education	0.013	–0.003	–0.016	0.003
(EDU)	(1.809)	(–0.62)	(–2.70)	(1.19)
R^2	0.464	0.425	0.476	0.288

Note: *T*-values in the parentheses. Estimates for county dummy variables are not reported. The models are estimated using a Seemingly Unrelated Regression estimator with homegeneity and symmetry restrictions imposed.

Appendix 2
Compensated Price Elasticities of Demand for Major Foods Evaluated at the Sample Mean in Rural China

	Elasticity with respect to the price of				
Commodity	*Grain*	*Meats*	*Vegetable*	*Fruits*	*Other Foods*
Grain	–0.163	0.088	0.027	0.031	0.008
Meats	0.223	–0.687	0.285	0.028	0.142
Vegetable	0.101	0.154	–0.436	0.003	0.168
Fruits	0.348	0.076	0.029	–0.483	0.020
Other Foods	0.030	0.206	0.431	0.011	–0.687

NOTES

1. The market development in Panel D cannot be distinguished from any other change in price. Hence, in the results of the multivariate analysis reported later in the paper, part of the development of markets in rural China may be captured by the price variable.
2. This case would also cover the situation when a road was constructed reducing the cost of using other markets in the vicinity to a point where it became feasible to use on a more frequent basis for food consumption needs.

3. The study counties are Zhending; Shanghe; Qingxian; Qianan; Dingzhou; and Jixian.
4. However, data on non-food consumption and expenditures were not provided by the local SSBs.
5. The hypothesis tests of homogeneity and symmetry are rejected at the 5 percent level of probability. Given the results at the one percent level, this should still be considered as relatively strong evidence of utility maximizing behavior (Barter, 1977; Deaton, 1980a; 1980b).
6. The joint test of significance (Table 7, Row 3) also can not reject the hypothesis that the market variable affects the food budget shares both directly and through changes in marginal income.

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