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**MARKET DEVELOPMENT AND FOOD DEMAND
IN RURAL CHINA**

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ABSTRACT

This paper seeks to understand how market imperfections affect the behavior of consumers in China's rural economy. A theoretical and empirical model is developed and estimated using a household-level data from six counties in Hebei Province. The results show that market development plays an important role in explaining food consumption behavior in China. As the market develops, farmers demand less grain and vegetables and consume more meat, fruit, and other food products after control for income and price effects. Moreover, the elasticities of demand also change as farm households begin to rely more on rural markets. The results of this paper suggest that a government concerned about the welfare of its rural population may want to be paying a more active role in fostering rural markets. Understanding the forces behind these consumption pattern shifts also will aid academics and policymakers in making better projections about future consumer needs and price levels.

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1. INTRODUCTION

During the pre-reform 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 to funnel resources directly into China's industrialization movement (Walker 1984).

After the implementation of the bold rural reform program in the late 1970s and early 1980s, markets developed unevenly (Lyons 1992). Rural factor markets remain notoriously incomplete (Lin, Yao, and Wen 1989). National plans have still

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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).

Markets remained incomplete in part because liberalization was not an initial step in China's economic reform plans (Lin, Cai, and Li 1994; Rozelle, forthcoming). The leadership's commitment to gradual reform resulted in policies that concentrated mainly on improving 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.

Another set of markets—including those most closely associated with rural food consumption—has 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 was 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 nonremote coastal regions. In one rural area adjacent to one of China's original 14 open coastal cities, 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, 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. To date, however, there is little empirical evidence assessing the impact of market incompleteness on rural welfare.

The goal of this paper is to understand how underdeveloped markets affect the behavior of consumers in China's rural economy. The paper reviews consumption

patterns in rural China in communities where the level of market development differs. It seeks to understand how market imperfections affect rural food demand. Are there differences in food consumption patterns among consumers who have the same income and face the same prices but have varying degrees of access to food markets? Does the level of market development limit how consumers allocate their income? The paper estimates the impact of incomplete markets on consumption behavior.

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-reform rural economy (Fan, Wailes, and Cramer 1995; Halbrecht 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 and Ma 1992; Brown 1994; Crook 1994). If market development affects consumption behavior and forecasts are based on estimates of structural relationships (for example, expenditure and price elasticities) that do not account for changes in market activities, forecasts could lead to biased predictions for economies where market structures are changing rapidly. The study also will provide another observation in the research effort, examining the impact of the rural reforms in China's economy-in-transition. It examines whether governments of the former centrally planned economies have a greater role in fostering markets than the mere elimination of anti-market legislation.

MARKET DEVELOPMENT

Rural incomes increased dramatically and consistently (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, began to decline in the 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 the other hand, has risen rapidly, doubling over the period 1978-92 (although meat

Cross-sectional data from the annual Household Expenditure and Income Survey (HIES) for 1991, grain consumption increased from 274 grams per capita for the lowest income group to 274 grams per capita for the highest income group. For those with income levels exceeding 2,000 yuan per capita (in nominal terms), grain consumption exceeded 2,000 yuan per capita (in nominal terms). According to these results, grain is not an inferior good, even for consumers who have income levels nearly 250 percent higher than the national average.

The same contradictions appear in multivariate analyses of China's grain economy. Expenditure or income elasticity estimates are generally

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cross-sectional data. For example, Ito, Peterson, and Grant (1989) and Petersen, Jin, and Ito (1991) find that fine grain consumption varies negatively (or not at all) with

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 (kilograms):								
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

Source: ZGTJNJ (1993).

Note: Grain is measured at unprocessed form.

Table 2—Annual per capita food consumption by income group in rural China, 1991

Annual per Capita Food Consumption	Income Group (Yuan)								
	Mean 709	(1) < 200	(2) 200-400	(3) 400-600	(4) 600-800	(5) 800-1,000	(6) 1,000-1,500	(7) 1,500-2,000	(8) > 2,000
	(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

Source: HIES (China's Rural Household Expenditure Survey Yearbook), 1993.

income in their analyses, using time series data. In contrast, Halbrendt et al. (1994) and Huang and Rozelle (1994), using cross sections of data, report positive expenditure elasticities for grain.

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 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 nonstaple 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 caused a similar set of seemingly contradicting results in national aggregates of rice consumption data (that is, 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 and Bouis 1995).

Table 3—Price indices of major food commodity groups in rural China, 1978-92

	Price Index						Other Foods
	Total CPI ^a	Food	Grain	Nongrains	Meat	Vegetables ^b	
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

Source: ZGTJNJ (1993).

^a Consumer Price Index is 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.

But the urbanization hypothesis cannot explain the observed consumption contours in the rural economy. China's rural areas have been undergoing 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 markets 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. Similar trends are observed in rural economies in Taiwan and Philippines (Huang and Bouis 1995). One hypothesis is that as rural consumption markets develop, and rural residents can more conveniently purchase and store products such as meats and fruit, consumption patterns change (even when accounting for differences in income levels and prices).

During long periods of intensive fieldwork 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 be bought at 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 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 be purchased only 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. Only four households in a sample of 400 households in Hebei Province owned freezers. Peddlers are increasingly part of the local economic landscape, but in most areas, they come infrequently and are sometimes suspected of selling 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, most Chinese farmers thus are consuming more of their self-produced grains and vegetables.

Descriptive statistics from the enumeration of 400 farmers in Hebei Province support these impressions. The consumption patterns of the consumers in this sample (Table 4) follow those found in national survey data (Table 2). As income rises in the cross section, consumption of major food types all rise in most cases. However, the consumption of grain varies sharply among groups of consumers who differ in their access to rural food markets (Table 5, Row 1).¹ In villages where farmers purchase less than 20 percent of their food in local markets, the average consumption of grain is 242 kilograms per capita. It is only 180 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

¹ It is assumed that the level of market development is measured in part by the proportion of food purchased by villagers in the market. This measure of market development was created by dividing the total market purchases of all samples in a village by total expenditures on food, including both market purchased and own-produced. It is recognized that in Table 4, the differences in consumption of different commodities arise from a number of factors in addition to the level of market development. These correlates will be held constant in the subsequent econometric analysis.

Table 4—Annual per capita food consumption, by income group of sample households, Hebei Province, China, 1992

Food Groups	Income Groups (Yuan)							
	Mean 961	(1) < 400	(2) 400-600	(3) 600-800	(4) 800-1,000	(5) 1,000-1,200	(6) 1,200-1,400	(7) > 1,400
	(kilograms)							
Grain	212	232	211	201	215	208	200	220
Meats	9	5	6	8	8	9	11	15
Vegetable	141	145	132	139	137	140	148	153
Fruits	13	6	7	9	17	13	18	23
Other Foods	10	5	7	8	10	10	14	17

Source: Primary data collected by authors in collaboration with local State Statistical Bureaus in six 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

Food Groups	Proportion of Food Purchased in Rural Food Markets (Percent)			
	(1) < 20	(2) 20-30	(3) 30-40	(4) >40
	(kilograms)			
Grain	242	233	198	180
Meats	6	7	12	10
Vegetable	182	135	143	115
Fruits	7	12	16	16
Other foods	5	9	14	11
	(budget share ^a)			
Grain	48	49	40	47
Meats	9	10	15	18
Vegetable	35	30	30	20
Fruits	2	4	5	5
Other foods	5	7	10	10

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

^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).

of market development (Row 2). Producers in areas with poor markets only consume 6 kilograms per capita, while those in areas with better markets consume more than 10-12 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, nonstaple food products are purchased. Hence, meat and fruit consumption is limited by the extent of market development, and consumers in these areas are forced to rely on their own-produced grains and vegetables. 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. 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.

3. 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 any point on the budget line, I^0 , is feasible (Figure 1, Panel A). Under some circumstances, however, there may be something constraining the consumption choice of the individual. In this case, the feasible region shrinks to area OX_m^*BG (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 unconstrained markets) when some change (for example, the construction of a road or the development of a permanent market site)

Figure 1—The budget set and different forms of market development

reduces the real price of a good to consumers. In this case, the size of the budget set increases from OMG to $OM''G$ (Panel D).

The market development being measured in the following analysis is limited to the definitions embodied in Panels B and C.² In Chinese rural areas, during most of the year, fresh meat and fruit only are available for most villagers in periodic markets. Competition in these markets makes the prices exogenously determined. When markets convene every day, or if every villager has refrigeration 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 one or two times during each 10-day period. In this situation, during a number of days each month, villagers who do not have operable refrigerators or face electricity shortages, a common problem in most areas of rural China, cannot eat all of the fresh pork they want. Any amount bought in excess of what can be consumed in a given day spoils. During 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.

² 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.

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 a 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 one or two per 10 days to every other day or even every day.³ 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 often will appear only during off-market days. As local economies develop, however, shopkeepers and traders begin to find customers everyday. Some households find it inconvenient to attend

³ This case would also apply 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.

the market and are willing to pay higher prices for fresh meat and fruit. This set of events is similar to what is 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 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, $p_g X_g + p_m X_m = I$, 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 good that can be purchased, the demand function for either good is

$$X_i = x_i[p_i, I], \quad (1)$$

for $i = g$ and m . However, if the consumption of one of the goods, say X_m , is constrained to X_m^* , then an additional constraint is added:

$$X_m \leq X_m^*. \quad (2)$$

In this case, the demand function in equation (1) becomes

$$X_i = x_i[p_i, I, X_m^*], \quad (3)$$

for $i = g$ and m , 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 means X_m^* increases. When the choice of the consumer is limited by the constraint, it can be shown that

$$\partial X_m / \partial X_m^* > 0, \quad (4)$$

and

$$\partial X_g / \partial X_m^* < 0. \quad (5)$$

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 (for example, grain) falls.

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 , 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^* . Hence, utility falls to U^1 . As markets develop, the constrained level of X_m^* moves to $X_m^{*'}$. As implied in equation (4), the demand for X_m meat would rise. Utility also rises as the consumer moves from point B to C. In this type of market development, the amount of the unconstrained good,

Figure 2—Consumer choice under different forms of markets

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

In 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:

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

for $i, j = 1, \dots, n$, 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 $\ln p^* = \sum_i w_i \ln p_i$, and α_i , β_i , and γ_{ij} are parameters to be estimated.

An index of market completeness, Z , can be 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 two effects, equation (7) is specified:

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

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

$$w_i = \alpha_i + \alpha'_i Z + (\beta_i + \beta'_i Z) \ln\left(\frac{y}{p^*}\right) + \sum_j (\gamma_{ij}) \ln p_j + \theta_i SIZE + \lambda_i PRESCHOOL + \mu_i EDU + \sum_{im} d_{im} D_m, \quad (8)$$

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

The adding up restrictions for equation (9) require:

$$\sum_i \alpha'_i = \sum_i \beta_i = \sum_i \beta'_i = \sum_i \theta_i = \sum_i \lambda_i = \sum_i \mu_i = \sum_i d_{im} = 0. \quad (9)$$

$$\sum_j r_{ij} = 0$$

The homogeneity restriction is

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

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 and David 1993):

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

$$e_{iy} = -\delta_{ij} + (\gamma_{ij} + \gamma'_{ij} Z)/w_i - (\beta_i + \beta'_i Z)/w_i [w_j + \sum_k w_k \ln p_k (e_{kj} + \delta_{kj})], \quad (13)$$

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

where δ_{ij} is the Kronecker delta. Equations (12) to (14) demonstrate that 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

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

either by taking the first-order derivatives of equations (12) through (14) with respect to Z (and after appropriate manipulations, "elasticities of elasticities of demand" 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 10-percent increase in the market development variable.

A stochastic structure is specified for equation (8):

$$\begin{aligned} w_{ih} = & \alpha_i + \alpha'_i Z_h + (\beta_i + \beta'_i Z_h) \ln(y_h/p_h^*) + \sum_j \gamma_{ij} \ln p_{jh} \\ & + \theta_i \ln(SIZE_h) + \lambda_i \ln(PRESCHOOL_{ih}) + \mu_i \ln(EDU_h) + \sum_{im} d_{im} D_m + \epsilon_{ih}, \end{aligned} \quad (16)$$

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:

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

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.

4. 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 1993). 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 have been aggregated (for example, Wang and Kinsey 1994; Fan, Wailes, and Cramer 1995; Wang and Chern 1992; Huang and Bouis 1995). Data on the households themselves, however, are used in this study. The data for this study come from 400 rural household surveys in

Hebei Province. The households were relatively evenly distributed throughout 60 villages in six counties in the province.⁴

Disaggregated data on food consumption, expenditures, and demographic attributes were made available to the authors by the local statistical bureaus.⁵ 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). Prices used in the analysis are market prices. Education is the level of attainment of the household head in China's school system.

Information in the survey is also available regarding the number and size of the transactions that farm households carry out on local consumption markets. The market development index is measured as the proportion of the total value of consumed food products that were purchased by households on the market (as opposed to being self-produced). Differences in this index arise from variations in income (households with higher incomes may consume higher proportions of certain goods, many of which are available only from markets); variations in prices (when market-purchased goods are relatively more expensive, consumers may demand less);

⁴ The study counties are Zhending, Shanghe, Qingxian, Qianan, Dingzhou, and Jixian.

⁵ However, data on nonfood consumption and expenditures were not provided by the local SSBs.

and differences in access to markets. Since the study's demand model includes variables representing income and prices, the net regression coefficient of this variable measures the effect of market access on the consumption decision. Endogeneity may be a problem with this specification, since a household's consumption of a certain good may be a significant part of the total amount of goods purchased on the market. To avoid this problem, an index, Z , was constructed as the share of total food expenditure from food purchased in markets by sample households within a single village. Hence, the market development variable varies by village, not by household within a village.

Although China's standardized data collection provides 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 five occasions during 1993 and 1994. They observed highly uneven development of markets, even within a geographically circumscribed region. A survey helped the authors identify the ways markets affect consumption. Open-ended interviews were conducted with more than 50 farm households, traders, shopkeepers, market managers, and local leaders. Questions were asked about the history of market development, the remaining barriers to the free flow of goods, and how markets develop.

On the basis of preliminary fieldwork, 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 are derived, in part, from the province's geographical diversity. Hebei adjoins the Bohai Gulf in the east, has 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 surrounds Beijing and Tianjin, two of the three 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. Hence, Hebei is a natural laboratory for studying the impact of market completeness on consumption behavior.

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 six sample counties was 417 yuan, somewhat above the national average of 374. Farmers across China purchased 46 percent of their food from markets in 1992, but the farmers in the sample purchased only 35 percent.

5. EMPIRICALLY MEASURING THE IMPACT OF MARKET DEVELOPMENT ON FOOD DEMAND

Estimated parameters from the system of disaggregated staple food commodity equations are robust (Table 9, Appendix) and hold up to theoretical testing.⁶ The signs of the coefficients of the income and price variables have expected signs in nearly every case. Those of the expenditure variables in all of the equations and price variables for grain, vegetables, and meat mostly have high t-ratios. The impacts of family size (SIZE) and PRESCHOOL variables vary among the goods (although the t-values are small for the latter). Education does not have an important effect on consumption.

The expenditure, uncompensated own-price, and compensated own- and cross-price elasticities confirm the high quality of the coefficients of the estimated model. The elasticities, evaluated at the overall means of the sample, show that the uncompensated and compensated own price elasticities are all negative (Table 6, column 4, and Table 10 in the Appendix). The compensated cross-price elasticities are almost all positive, implying that most of the major food groups are substitutes,

⁶ The test statistics for Wald tests of homogeneity and symmetry are 14.25 (with 4 degrees of freedom) and 17.93 (with 6 degrees of freedom), respectively. The joint hypothesis tests of homogeneity and symmetry are rejected at the 5 percent level of probability. Homogeneity, however, cannot be rejected, given the assumption of symmetry (the Chi-square test statistic is 4.15 with 4 degrees of freedom). Symmetry also cannot be rejected, given the assumption of homogeneity (the test statistic is 8.06 with 6 degrees of freedom). These test results provide relatively strong evidence of utility maximizing behavior (Barten 1977; Deaton and Muellbauer 1980).

an expected result, given the level of aggregation. The food expenditure elasticities for all goods are positive and in some cases are higher than (for example, grain) and in other cases lower than (for example, meat and fruit) those found in (or implied by) the results produced by studies in other parts of Asia (Huang and 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.

Market development 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 a number of dimensions of the impact (Table 7). First, market development affects the average budget share if the effect of total expenditure and prices are held constant ($\alpha' \neq 0$). Second, market development also has a significant impact on the budget allocation, resulting from additional income ($\beta' \neq 0$).⁷

The direction of the joint impact of market development can be seen by the elasticities of market development in Table 6, column 5 (as derived from equation

⁷ The joint test of significance (Table 6, Row 3) also cannot lead to a rejection of the hypothesis that the market variable affects the food budget shares both directly and through changes in marginal income.

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 Elasticity, Constrained Market ^a	Uncompensated Own-Price Elasticity	Elasticity of Demand with Respect to Market Development	Food Expenditure Elasticity, Unconstrained Market ^b
(percent)					
Grain	46.3	0.86	-0.52	-0.01	0.57
Meats	13.3	0.42	-0.69	0.30	1.19
Vegetable	27.9	1.76	-0.71	-0.21	1.33
Fruits	4.0	1.00	-0.45	0.21	2.13
Other foods	8.5	0.21	-0.41	0.19	1.44

Note: All elasticities evaluated at the sample mean, unless otherwise noted.

^a Evaluated at the mean level of market development (or level of proportion of consumed food purchased on rural markets), $Z = 0.35$.

^b Evaluated at level of complete market development, $Z = 1.00$.

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 ($\alpha_i=0$)	16.48 (4)	18.38 (4)
II. Slopes of interaction variable ($\beta_i=0$)	18.37 (4)	19.95 (4)
III. Joint test I and II ($\alpha_i=0$ and $\beta_i=0$)	47.06 (8)	47.86 (8)

Note: See equation (16) in text for definition of parameter and full model specification.

^a Degrees of freedom in parentheses.

[15]). The signs of all of the variables are as predicted by the comparative static exercises in equations (4) and (5) and graphical analysis. The elasticities on the grain and vegetable variables imply that farm households are consuming more food that is produced primarily on-farm in the sample areas, where some products are periodically unavailable. The negative sign means that as markets develop (or as farmers procure more food in rural markets), farmers demand less grain and vegetables, even though income and prices do not change. The magnitude of the elasticity for grain is small.⁸ In contrast, the positive elasticities for meat, fruit, and other food products imply that farmers begin to consume more of these 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 as farm households begin to rely more on rural food markets. When the proportion of food purchased by households increases by 10 percent, the food expenditure elasticities of grain and vegetables fall (Table 8, Row 1, Columns 1 and 3). With incomplete markets, households are unable to respond to changes in income in the same way as

⁸ The small size of the market development elasticity for grain is somewhat surprising, considering the steep decline in grain consumption associated with higher levels of market development shown in Table 4. Either income and price effects are causing this trend, or the main impact on grain consumption of market development is indirect, an idea that is supported by analysis later in the paper.

Table 8—Marginal changes in demand elasticities arising from a 10-percent increase in the level of market development

Demand Parameters	Marginal Changes to Elasticities				
	Grain	Meats	Vegetable	Fruits	Other Foods
Food expenditures elasticity	-0.060	0.162	-0.090	0.237	0.258
Uncompensated own-price elasticity	0.021	-0.030	0.023	-0.015	-0.037
Compensated price elasticities					
Grain	-0.007	0.003	-0.001	0.001	0.003
Meats	0.018	-0.009	0.004	-0.003	-0.009
Vegetable	-0.009	0.005	-0.002	0.002	0.005
Fruits	0.026	-0.012	0.005	-0.005	-0.014
Other foods	0.028	-0.014	0.006	-0.005	-0.015

Note: Calculated by using equations (12) - (14). Figures in the table are generated by taking the difference of the elasticity evaluated at $Z = 0.45$ and 0.35 (for example, the first row is $e_{iy}|_{Z=0.45} - e_{iy}|_{Z=0.35}$). The remainder of variables in elasticities are evaluated at their means.

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 values 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. The effect of market development on meat consumption may be one of the reasons that the demand for meat has risen so fast in recent years, driving up the prices of livestock products and feed.

These impacts on food expenditure elasticities mean that as China's rural consumption markets continue to develop, food expenditure elasticities of grain can be expected to fall and those of meat increase. Currently, only 35 percent of the food basket of rural consumers is purchased in local markets. But as farmers purchase an additional 10 percent of their food from markets, grain expenditure elasticities drop

by 0.060 and meat expenditure elasticities rise by 0.162 (Table 8, row 1). These figures imply that with complete markets (that is, 100 percent purchases of the household's diet), the food expenditure elasticities for grain would be 0.57, approximately 0.29 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 1.19. After full market adjustment, the meat expenditure elasticity estimated from the Hebei data set is consistent with 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).

While somewhat smaller in magnitude, the uncompensated own-price demand elasticities are also affected by market development (Table 8, row 2). Those for grain and vegetables, 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 0.021, moving from -0.52 to about -0.50. Meat, fruit, and other foods become more responsive as markets develop; their uncompensated, own-price elasticities decrease by -0.030, -0.015, and -0.037, respectively. The impact of market development on compensated price elasticities is small in almost all cases (Table 8, rows 3-7).

6. 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. Rural consumption behavior has been shown to differ among households and among regions not only on the basis of differences in prices and income; different levels of market development in the studies villages leads to systematic declines in the amount of grain and vegetable consumption by farmers, and increases in their demand for meat and fruit. These results, in part, reconcile the observed differences in patterns of rural consumption over time and across regions. As their incomes rise, rural residents may be expected to consume more grain and vegetables (that is, they may still have positive demand elasticities, as should be expected for populations at the stage of development generally found in China's countryside), but aggregate rural consumption of foodgrains may be falling as a result of the emergence of new consumer markets and urbanization.

If farm household decisions create these consumptions patterns (since rural consumption markets in the most part are *not* limited by policy), it must be assumed that farmer welfare is being increased by the emergence of rural consumption markets. In other words, greater choice leads to greater utility. Efficient and well-functioning markets, however, do not always materialize on their own. The results of this paper suggest that a government concerned about the welfare of its rural

population may want to be playing a more active role in fostering rural markets. Beyond merely eliminating prohibitions against market activity, local, regional, and national policymakers may want to subsidize market infrastructure construction, reduce or eliminate marketing taxes and fees, and improve information channels that may stimulate the more rapid development of food markets in rural areas.

Understanding the forces behind these consumption pattern shifts also will aid academics and policymakers in making better predictions about future consumer needs and price levels. In the past, most demand projections were based almost exclusively on income, population, and price forecasts. If changes in demand behavior arises because of the increasing availability of goods on more developed markets, accurate predictions may need to consider market development as an independent factor in their assessments of future demand. If the development of rural markets continue to progress, Chinese rural households can be expected to consume more meat and fruit and less foodgrains and vegetables, regardless of changes in their household income.

APPENDIX

Table 9—Estimates of food demand system in rural China

Variable	Demand Equation			
	Grain	Meats	Vegetables	Fruits
Intercept	0.367 (1.66)	0.691 (5.33)	-0.846 (-4.32)	0.173 (2.04)
Z (Market development)	1.517 (3.11)	-0.670 (-2.38)	0.372 (0.87)	-0.432 (-2.31)
Ln(Y/P*) (Food expenditure)	0.043 (1.14)	-0.109 (-5.01)	0.198 (5.95)	-0.028 (-1.96)
Z * Ln(X/P*) (Interaction term)	-0.270 (-3.05)	0.138 (2.69)	-0.095 (-1.21)	0.080 (2.36)
Ln(PGrain)	0.199 (10.64)	-0.023 (-1.90)	-0.120 (-13.57)	-0.015 (-2.38)
Ln(PMeats)	-0.023 (-1.90)	0.027 (2.08)	-0.005 (-0.82)	0.003 (0.57)
Ln(PVegetable)	-0.120 (-13.57)	-0.005 (-0.82)	0.136 (15.74)	-0.013 (-3.58)
Ln(PFruit)	-0.015 (-2.38)	0.003 (0.57)	-0.013 (-3.58)	0.022 (5.64)
Ln(POther)	-0.042 (-4.70)	-0.003 (-0.37)	0.002 (0.32)	0.003 (0.72)
Family size (SIZE)	0.014 (3.32)	-0.011 (-4.32)	0.015 (3.90)	-0.007 (-4.45)
Preschool children (PRESCHOOL)	-0.005 (-0.56)	-0.006 (-1.16)	-0.001 (-0.01)	0.005 (1.45)
Education (EDU)	0.006 (0.83)	-0.002 (-0.51)	-0.012 (-1.92)	0.003 (0.89)
R ²	0.591	0.405	0.699	0.270

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

Table 10—Food expenditure-compensated price elasticities of demand for major foods, evaluated at the sample mean in rural China

Commodity	Elasticity with Respect to the Price of ...				
	Grain	Meats	Vegetable	Fruits	Other Foods
Grain	-0.122	0.092	0.017	0.011	0.003
Meats	0.229	-0.633	0.232	0.074	0.098
Vegetable	0.115	0.077	-0.218	-0.021	0.047
Fruits	0.091	0.202	-0.034	-0.411	0.153
Other foods	-0.118	0.143	0.279	0.090	-0.394

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