Chinese Urban Consumption Behavior under the Current Mixed System of Planning and Markets

Shihua Pan
and Stanley R. Johnson

Working Paper 92-WP 88
January 1992

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011

Shihua Pan is a research associate with CARD; and Stanley R. Johnson is Charles F. Curtiss Distinguished Professor of Agriculture and director of CARD.

Journal paper No. J.-14780 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa; Project No. 2872.

Abstract

Under the current mixed system of planning and markets in the Chinese urban consumption sector, marginal decision rules in market economies are directly applicable. The demand functions in such mixed system involve not only market prices and income but also the state prices and quotas. Besides substitution and income effects, consumers respond to changes in the price of the commodity with government intervention as an implied income effect in the same way as they respond to changes in real income. Changes in the state price and/or state quota have no substitution effect. Consumers would perceive the changes as a result of anticipated income effect through their equivalent income variation. The policy implications involve the importance of not ignoring the free market in the state planning process. To monitor grain consumption, the government should increase the state grain prices and/or decrease the state grain quotas.

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Introduction

Chinese urban grain consumption was controlled by straight rationing from 1955 to 1978. Under that system, the government was the sole grain seller. The quantity rationed to each urban resident was fixed and varied with a consumer's age and type of work. The composition of grain rationing usually changed each month due to supply changes. The consumer prices were fixed and were subsidized by the government.

Since 1978, a series of economic reforms have been adopted in China to reduce central planning and to give market forces an increasing role in economic decision making. In rural areas, the People's Commune system was replaced with production responsibility system, which then became the contract responsibility system in 1985. Under this new system, a farm household is allocated a piece of collective land and is responsible for all production activities. In return, the farmer is obligated to sell certain amount of major outputs including grain, cotton, and oil-bearing crops to the state at prices that are lower than market prices. After fulfilling the state quotas, farmers may then sell the surplus in free markets.

In urban areas, grain rationing and the price subsidy are still in effect. However, the availability of grain commodities on free markets provides consumers with feasible alternatives. Consumers can purchase more or better food grains from free markets at free market prices. Since market prices are higher than state subsidized prices, consumers will not go to free markets unless there are certain advantages. The subsidized rationing quotas must be binding if grain commodities from rationing and free markets are perfect substitutes. If the rationing quotas have a surplus, consumers can get a coupon to trade for fine

grain commodities or any other commodities. This is the prevailing system even though it is against government regulations. As grain commodities become available on free markets, the state rationing associated with the price subsidy is no longer a way to restrict grain consumption. It guarantees urban consumers a certain amount of grain for consumption at lower prices. It is actually an income transfer to urban consumers from taxpayers.

Most of the literature dealing with Chinese urban grain consumption behavior under the current mixed system of planning and markets is descriptive in nature. Some exceptions include Sicular (1988), Pan and Johnson (1989), and Chern and Wang (1990). Sicular developed a theoretical model in a general equilibrium framework and used an income transfer to reflect the interaction between planned and market sectors. Pan and Johnson modeled urban grain consumption and the interaction between planning and market economies. The results from an associated empirical model show that the demand function possesses the basic features ascribed by classical consumer theory. The complication is an additional demand shifter due to government intervention. Following the "matched pair" of demand functions derived by Deaton (1981), one rationed and the other unrationed, Chern and Wang estimated Chinese urban consumption using the almost ideal demand system. They found that imposing rationing would create income and substitution effects associated with the changes in rationed quantity and prices.

The objective of this study is to analyze how consumers behave in the mixed system of planning and markets and how the planned and market sectors interact with each other. To accomplish this objective, a theoretical model incorporating both planned and market economies is developed. The model is followed by the conventional static analysis and policy analysis. The last section summarizes the results and discusses their implications.

The Model

Consider a price-taking urban resident consuming grain and nongrain commodities. Assuming rational behavior and local nonsatiation, this consumer will choose a most preferred bundle of grain and nongrain from the set of feasible alternatives in order to maximize utility, subject to budget constraint with equality:

$$\text{Max } U = f(G_s + G_f, X), \tag{1}$$

subject to

$$P_sG_s + P_fG_f + P_xX = I, \tag{2}$$

$$G_s + G_f = G, \tag{3}$$

where U is a strict quasi-concave von Neumann-Morgenstern utility function; G_s and G_f are quantities of grain commodities from the state and the market, respectively; X is the quantity of nongrain commodity; P_s and P_f are the state price and market price of the grain commodity, respectively; P_x is the price of the nongrain commodity; I is income; and G is total grain commodity.

Assuming G_f is positive and substituting (3) into (1) and (2), the Lagrangian expression for this maximization problem is

$$L = f(G, X) + \lambda[I + (P_f - P_s)G_s - P_fG - P_xX], \tag{4}$$

where λ is a multiplier of the marginal utility of income.

The first-order conditions for the maximum give

$$\partial L/\partial G = \partial f/\partial G - P_f = 0, \tag{5}$$

$$\partial L/\partial X = \partial f/\partial X - P_x = 0, \tag{6}$$

$$(7) \qquad \partial L/\partial \lambda = I + (P_f - P_s)G_s - P_f G - P_x X = 0.$$

The ratio of the first two equations yields

$$(8) \qquad (\partial f/\partial G)/(\partial f/\partial X) = P_f/P_x.$$

That is, the rate of commodity substitution must equal the rate of market prices for the maximum.

The Equations (5) and (6) can also be written as

$$(9) \qquad (\partial f/\partial G)/P_f = (\partial f/\partial X)/P_x.$$

That is, the marginal utility divided by market price must be the same for all commodities at maximum. Equations (8) and (9) indicate that only market prices matter in the marginal consumption decision.

The assumption of strict quasi-concavity ensures that the second-order condition is satisfied at any point at which the first-order condition is satisfied. Solving the first-order conditions gives the demand functions for G and X,

$$(10) \qquad G = f(P_f, P_x, (P_f - P_s)G_s, I)$$

and

$$(11) \qquad X = f(P_f, P_x, (P_f - P_s)G_s, I).$$

The demand functions have two properties: (1) the demand for any commodity is a single-valued function of prices and income plus a difference term between the market price and state price times the state quota; and (2) demand functions are homogeneous of degree zero in prices, including state price, and income. That is, if all prices and income change in the same proportion, the quantities

demanded remain unchanged.

The question is, what is $(P_f - P_s)G_s$? In Figure 1, D represents the demand curve and S denotes the supply curve for the grain commodity. Since the government supplies grain to consumers up to G_s at state price P_s, the supply curve is horizontal until it reaches to G_s, then it slopes upward. P_f and G are market equilibrium price and quantity. Under the current policy regime, urban consumers are guaranteed the consumable grain commodity G_s at subsidized price P_s. Consumption beyond G_s, in this case $G - G_s = G_f$, needs to move to the free market at market price. Thus, $(P_f - P_s)G_s$ is the change in the consumer's surplus due to the state price subsidy for consumption, G_s.

To better interpret the model, we define $(P_f - P_s)G_s$ as equivalent income variation, EIV, an approximation used to measure the impact of state intervention on consumer welfare. As long as demand curve is observable, the EIV is measurable.

Comparative Static Analysis

Changes in prices, income, and EIV due to changes in the state price and quota will normally affect the quantities demanded. To examine the effect, take total differentiation of (5), (6) and (7):

$$f_{11}dG + f_{12}dX - P_f d\lambda = dP_f \tag{12}$$

$$f_{21}dG + f_{22}dX - P_x d\lambda = dP_x \tag{13}$$

$$- P_f dG - P_x dX = - dI - dEIV + GdP_f + XdP_x. \tag{14}$$

Note that $dEIV = G_s dP_f - G_s dP_s + (P_f - P_s)dG_s$. To solve this system of three equations with three unknowns, dG, dX, $d\lambda$, the terms on the right-hand side must be regarded as constant. The array of the coefficient formed by (12) to (14) is

the determinant of the bordered Hessian:

$$\begin{matrix} f_{11} & f_{12} & -P_f \\ f_{21} & f_{22} & -P_x \\ -P_f & -P_x & 0 \end{matrix} \quad . \tag{15}$$

Denoting this determinant by D and the cofactor of the element in the i^{th} row and j^{th} column by D_{ij}, the solutions of (12), (13) and (14) by Cramer's rule are

$$dG = [D_{11}dP_f + D_{21}dP_x + D_{31}(-dI - dEIV + GdP_f + XdP_x)]/D \tag{16}$$

and

$$dX = [D_{12}dP_f + D_{22}dP_x + D_{32}(-dI - dEIV + GdP_f + XdP_x)/D. \tag{17}$$

Direct Effects

Assuming that I, P_s, G_s, and P_x do not change, and dividing both sides of (16) by dP_f, gives:

$$\partial G/\partial P_f = D_{11}/D + G(D_{31}/D) - G_s(D_{31}/D) \tag{18}$$

The partial derivative on the left-hand side of (18) is the rate of change of the consumer's purchase of G with respect to change in P_f, all other things being equal. Henderson and Quandt (1980) show that the rate of change with respect to income, given unchanged prices, is

$$\partial G/\partial I = - D_{31}/D. \tag{19}$$

It is worth noting that the rate of change with respect to equivalent income variation is the same as the rate of change with respect to income. That is,

$$\partial G/\partial EIV = - D_{31}/D. \tag{20}$$

When a price change is compensated by an income change such that the consumer remains on the initial utility level, then

$$(\partial G/\partial P_f)_{u=const} = D_{11}/D. \tag{21}$$

Equation (18) can now be rewritten as

$$\partial G/\partial P_f = (\partial G/\partial P_f)_{u=const} - G(\partial G/\partial I)_{prices=const} + G_s(\partial G/\partial EIV)_{prices=const} \tag{22}$$

Changes in the market grain price cause direct and indirect effects. The direct effect, as described by the first and second terms on the right-hand side, expresses the rate of change compensated by an income change that leaves the consumers on their initial indifference curve and the rate of change due to change in real income as a result of price change. The indirect effect of the third term indicates how consumers respond to a change in own market price as a result of implied income effect through their equivalent income variation, given state price subsidy of some grain commodity.

Equation (22) can be modified as

$$\partial G/\partial P_f = (\partial G/\partial P_f)_{u=const} - (G - G_s)(\partial G/\partial I)_{prices=const} \tag{23}$$

and it is known as the Slutsky equation. The quantity $\partial G/\partial P_f$ is the slope of the ordinary demand curve for G. The first term on the right-hand side is the slope of the compensated demand curve for G. It is the substitution effect, or the rate at which the consumer substitutes G for X when the price of G changes and the consumer moves along a given indifference curve. The second term on the right is the income effect, or the rate at which the consumer alters the purchase of G with a change in real income, given constant prices. Income now includes the normal concept of income plus the equivalent income variation. The sum of

the two rates equals the total rate of change for G as the free market price of G changes.

Henderson and Quandt (1980) proved that the sign of the substitution effect is always negative, so the compensated demand curve is always downward sloping. The income effect may be either sign because the commodity may be either a normal or an inferior good.

The Slutsky equation can be expressed in terms of price and income elasticities as

$$\epsilon_{11} = \xi_{11} - \beta_1\eta_1. \tag{24}$$

The price elasticity of the ordinary demand curve, ϵ_{11}, equals the price elasticity of the compensated demand curve, ξ_{11}, less the corresponding income elasticity, η_1, multiplied by the proportion of total expenditure spent on a grain commodity from the free market, β_1. Thus, the ordinary demand curve will have a greater demand elasticity than the compensated demand curve if the income elasticity of demand is positive for a normal good. This more elastic ordinary demand curve can be deleted when the price subsidy is in line with quota. The higher the subsidized quota is, the less elastic the ordinary demand curve will be. The ordinary demand curve without government intervention will be much more elastic than it would be with intervention.

The Slutsky equation and its elasticity representation for commodity X, in which there is no government intervention, are

$$\partial X/\partial P_x = (\partial X/\partial P_x)_{u=\text{const}} - X(\partial X/\partial I)_{\text{prices=const}} \tag{25}$$

and

$$\epsilon_{22} = \xi_{22} - \alpha_2\eta_2, \tag{26}$$

where ϵ_{22} is the price elasticity of the ordinary demand curve, ξ_{22} is the price elasticity of the compensated demand curve, β_2 is the proportion of total expenditure for X, and η_2 is the income elasticity of demand. Equations (25) and (26) are the standard forms ascribed by classical consumer theory. Therefore, we can conclude that the Slutsky equation will not be altered unless there is government intervention for that commodity.

Cross Effects

The Slutsky equation and its elasticity expression for changes in the demand for a grain commodity resulting from changes in the price of a nongrain commodity are:

$$\partial G/\partial P_x = (\partial G/\partial P_x)_{u=const} - X(\partial G/\partial I)_{prices=const} \tag{27}$$

and

$$\epsilon_{12} = \xi_{12} - \alpha_2\eta_1. \tag{28}$$

Henderson and Quandt (1980) define the first term on the right-hand side as the cross-substitution effect and its sign is unknown. The second term on the right-hand side, the income elasticity of the grain commodity multiplied by the proportion of total expenditure for the nongrain commodity, yields income effect. The total effect of a change in the price of the nongrain commodity on the demand for the grain commodity is the sum of the cross-substitution effect and the income effect, the same as in the conventional description.

When the market price of the grain commodity changes, the impact on nongrain commodity demand expressed by the Slutsky equation and its elasticity form are

$$\partial X/\partial P_f = (\partial X/\partial P_f)_{u=const} - (G - G_s)(\partial X/\partial I)_{prices=const} \tag{29}$$

and

(30) $$\epsilon_{21} = \xi_{21} - \beta_1\eta_2$$

Although the cross-substitution effect is of standard form, the income effect is not. The income elasticity of the grain commodity is multiplied by the proportion of expenditure rather than for the total grain commodity, but, in this case for the grain commodity from the free market.

The substitution effect on the i^{th} commodity resulting from a change in the j^{th} price is the same as the substitution effect on j^{th} commodity due to a change in the i^{th} price (Henderson and Quandt 1980). The sum of the compensated demand elasticities for grain commodities as a result of changes in P_f and P_x equals zero. This feature holds for the nongrain commodity.

The sum of the negative of the ordinary demand elasticities for G as a result of changes in P_f and P_x is, however, not equal to the income elasticity of demand for G, as defined in classical consumer theory. This is attributed to the fact that the income effect from the change in market grain price accounts for the income elasticity of demand for the grain commodity multiplied by the proportion of expenditure for the grain commodity from the free market. This same situation also applies to the nongrain commodity.

Policy Analysis

Impacts of State Grain Prices on the Demand for Grain

Consider first a change in the state grain price, other things being equal. Dividing both sides of Equation (16) by ∂P_s gives the changes in the demand for the grain commodity:

(31) $$\partial G/\partial P_s = - G_s(\partial G/\partial I),$$

and its elasticity expression is

(32) $$\epsilon_{1s} = -\beta_s \eta_1.$$

The state price elasticity of the ordinary demand curve of the grain commodity is equal to the income elasticity of demand for the grain commodity, multiplied by the proportion of expenditure for the grain commodity from state rationing. When the state grain price increases, the total ordinary demand for the grain commodity will decrease if it is a normal good or demand will increase if it is an inferior good. These results indicate that a change in the state grain price involves no substitution effect. Consumers respond to a change in state grain price as an anticipated income effect through changes in their equivalent income variation, other things being equal. As indicated in Equations (19) and (20), consumers perceive a change in equivalent income variation due to a change in state grain price as the same as a change in real income and reallocate their resources even if market prices do not change.

Note that the effect of a change in state grain price on the demand is the same as the indirect effect of a change in market grain price on demand.

Now, if the change in demand for a grain commodity due to a change in the state grain price is taken into account, the sum of the negative of the ordinary demand elasticity for G, as a result of changes in P_f, P_s, and P_x, is

(33) $$-(\epsilon_{11} + \epsilon_{1s} + \epsilon_{12}) = -(\xi_{11} + \xi_{12}) + (\beta_1 + \alpha_2 + \beta_s) = \eta 2) = \eta_1.$$

That is, the income elasticity of demand for the grain commodity equals the negative of the sum of ordinary price elasticities of demand with respect to own market price, own state price, and nongrain price.

Impacts of a State Quota on Grain Demand

The changes in demand for a grain commodity from a change in the state grain quota are given as:

$$\partial G/\partial G_s = (P_f - P_s)(\partial G/\partial I), \tag{34}$$

and its elasticity expression is

$$\epsilon_{1q} = (EIV/I)\eta_1. \tag{35}$$

The state quota elasticity of the ordinary grain demand curve is equal to the income elasticity of demand for the grain multiplied by the ratio of equivalent income variation to income. When the state grain quota increases, the total ordinary demand for grain will increase if it is a normal good or demand will decrease if it is an inferior good.

Like a change in state grain price, a change in state grain quota involves no substitution effect. Consumers respond to a change in state grain quota as an anticipated income effect through changes in their equivalent income variation, other things being equal. And this response induces consumers to reallocate their resources as they do when there is a change in real income, even if all prices are unchanged. Given income elasticity of demand for the grain commodity, the larger the disparity between market price and state price, the more elastic the ordinary demand curve will be.

Impacts of the State Grain Price on Demand for the Nongrain Commodity

If all other parameters remain constant, changes in the state grain price will affect the demand for nongrain commodity as

$$\partial X/\partial P_s = - G_s(\partial X/\partial I), \tag{36}$$

and the corresponding elasticity expression is

$$\epsilon_{2s} = -\beta_s\eta_2. \tag{37}$$

The state price elasticity of the ordinary demand curve of nongrain commodity

is equal to the income elasticity of demand for this commodity multiplied by the proportion of expenditure for the grain commodity from state rationing, β_s. When the state grain price increases, the total ordinary demand for the nongrain commodity will decrease if it is a normal good or demand will increase if it is an inferior good.

These results show that a change in state grain price has no substitution effect on the nongrain commodity. Consumers perceive a change in state grain price as an anticipated income effect through changes in their equivalent income variation, other things being equal. Consumers respond to a change in equivalent income variation due to a change in the state grain price in the same way as they do to a change in real income; they reallocate their resources even if market prices are unchanged.

When all the changes in P_f, P_s, and P_x are taken into account, the sum of the negative of the ordinary demand elasticity for X is equal to the income elasticity of demand for the nongrain commodity,

$$(38) \qquad -(\epsilon_{21} + \epsilon_{2s} + \epsilon_{22}) = -(\xi_{21} + \xi_{22}) + (\alpha_2 + \beta_1 + \beta_s) = \eta 2) = \eta_2 \ .$$

Impacts of the State Quota on the Demand for the Nongrain Commodity

The changes in demand for nongrain commodity as a result of a change in the state grain quota is given as:

$$(39) \qquad \partial X/\partial G_s = (P_f - P_s)(\partial X/\partial I),$$

and its elasticity expression is

$$(40) \qquad \epsilon_{2q} = (EIV/I)\eta_2.$$

The state quota elasticity of the ordinary demand curve for the nongrain commodity is equal to its income elasticity of demand multiplied by the ratio of

equivalent income variation to income. When the state grain quota increases, demand for the nongrain commodity will increase if it is a normal good or demand will decrease if it is an inferior good.

Again a change in the state grain quota involves no substitution effect. Consumers respond to a change in the state grain quota as an anticipated income effect through changes in their equivalent income variation, other things being equal. And consumers reallocate their resources as they will do in responding to a change in real income even if all prices are unchanged. Given income elasticity of demand for the nongrain commodity, the larger the difference between market price and state price is, the more elastic the ordinary demand curve will be.

Summary and Policy Conclusions

Under the current mixed system of planning and markets in China, marginal decisions of consumers are affected only by market prices. Marginal decision rules in market economics are directly applicable even though the government plays the major role in consumption. The demand functions in such a mixed system involve not only market prices and income but also equivalent income variation, where is the difference between market price and state price multiplied by the state quota.

Nongrain commodity price changes involving no government intervention have a substitution effect and an income effect on the demand for commodities. Grain commodity price changes with government intervention, however, have an additional indirect effect on commodity demand through changes in the consumer's equivalent income variation. Besides substitution and income effects, consumers respond to changes in that price as an implied income effect in the same way they respond to changes in real income. This indirect effect will vanish if the state grain

price changes by the same proportion, and if the state grain quota remains constant.

A change in state grain price has no substitution effect. Consumers would perceive the change as an anticipated income effect through their equivalent income variation. Thus, the magnitude of the impacts of a change in state grain price on consumer demands depends on income elasticity of demand for that commodity and proportion of total expenditure for the grain commodity from rationing. State price level does play a role in consumer resource allocation.

Similarly, a change in state grain quota has no substitution effect. Consumers respond to the change as an implied income effect through changes in their equivalent income variation. The magnitude of the effects on consumer demand relies on income elasticity of demand for that commodity and the ratio of equivalent income variation to income.

Policy formulation in such a mixed system is more complicated. It is the free market price that primarily determines consumption decisions. But, if the free market is treated as a residual in the state planning process, unintended price variation may have significant impacts on producer resource allocation decisions and income. It is, therefore, important not to ignore the free market in this mixed system.

The state grain price and state grain quota work together like a consumer subsidy through income transfer. Given income elasticity of demand, the instrument of the state grain quota will have significant impacts on demand only if the disparity between market price and state price is very large. By contrast, the instrument of the state grain price will have significant effects on demand only if the state grain quota is sufficiently large. The evidence presented here supports arguments for increasing the state grain price and/or decreasing the state grain quota in order to monitor closely grain consumption

and reduce the government's financial burden.

Removing the state grain quota and price subsidy will make ordinary demand curves more elastic. However, the market equilibrium price will go down as the demand curve shifts back from decreases in the consumer's equivalent income variation. As a result, the new market equilibrium price will decline and the consumer's real income will increase. If the loss of equivalent income variation can be compensated by the rise in real income, consumers may not be worse off. Furthermore, if the government wishes to convert its price subsidy to an income subsidy, consumers can reach a higher utility level by spreading the extra income over diversified consumption bundle.

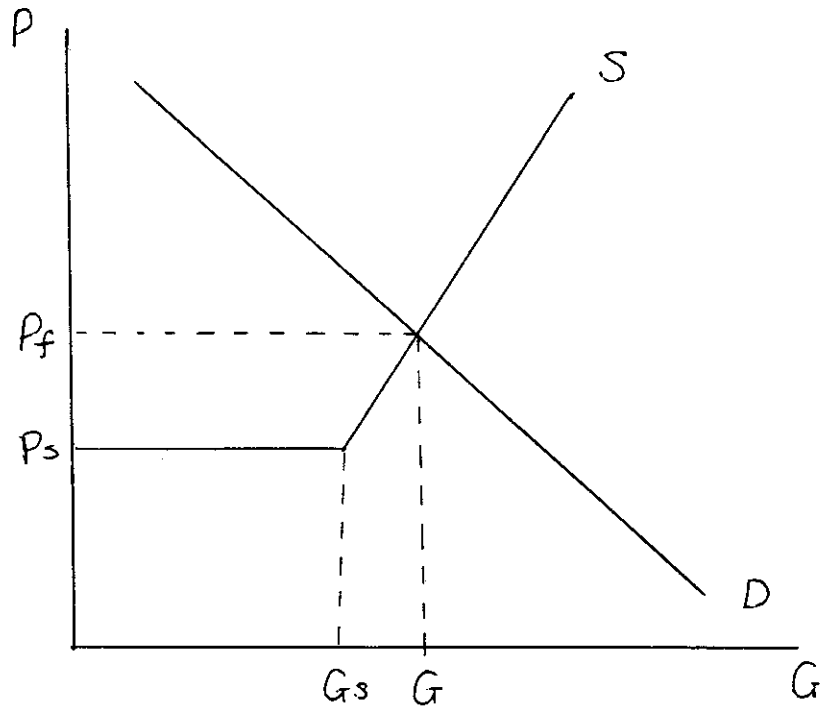

Figure 1. Consumer equivalent income variation

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