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DEMAND MANAGEMENT OF ASIAN AND NEAR EAST FOOD SYSTEMS:

AN INTRODUCTORY OVERVIEW

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EXECUTIVE SUMMARY

The paper begins with the question, "What did countries do with their Green Revolution production increment?" A simple food accounting identity is presented to illustrate that the answer to this question depends upon the relative importance of conflicting policy objectives and the policy instruments which are employed to channel food system resources toward competing ends. The paper presents a quantitative analysis of structural forces impacting food demand in South and Southeast Asia and in the Near East. The relative importance of these forces varies among countries and between periods as do the policy interventions which attempt to modify the impact of these forces. The food accounting identity and the analysis of structural aspects of food demand are placed in a conventional supply and demand setting to clarify the role of price policy. The answer to the question posed at the beginning of the paper cannot be determined by casual assumptions about economic "closure rules," a common feature of many studies. The demand management framework, which calls attention to the interface between structural forces, competing objectives, scarce resources, and pricing policy, can be used to guide investigation of food system behavior and as a basis for anticipating the future impact of structural forces and possible policy responses. Although there are important structural features which seem to be common among the countries studied here, only country specific case studies can translate these features into an effective understanding of how food systems develop, including an answer to the question, "What did countries do with their Green Revolutions production increment?"

1. INTRODUCTION

Over the past 25 years there have been important changes in the level of per capita food consumption in many Asian and Near Eastern countries. Many of these same countries have achieved impressive levels of agricultural growth, particularly growth in cereals production. Are these two features related? Does food production drive food consumption? What do countries do with their Green Revolution output? The answers are not straight forward because they require understanding not only about the dynamics of demand and supply linkages within the economic structure but also about policy instruments that manipulate these linkages to serve the conflicting objectives of the political economy.

The desire for food self-sufficiency or food security is strong in most countries. So is the need to increase food consumption. These two objectives are in conflict, at least in the medium run. Which objective is served by rapid agricultural growth? Analysis of the implications of agricultural production growth or of factors influencing aggregate per capita food consumption often fail to take into consideration the larger food policy context in which production and consumption behavior takes place. Yet the answers to the above questions go to the heart of the policy interface that brings together production and consumption in the aggregate economy. For example, the analysis of the Green Revolution impact on food consumption or on prices often proceeds from an implicit assumption about how the domestic food economy is "supply accommodating": either the food economy is assumed to be "closed" to international trade, so that a production expansion has a direct influence on domestic prices, thus ensuring a direct connection between changes in food production and consumption or that it is assumed to be "open," so that domestic food prices are determined by world, or "border," prices, thus ensuring that increments in production will be exported or serve as import substitutes. Similarly, projections about food demand are usually premised on the assumption

that the food economy is "demand accommodating," that supply will be forthcoming from some source, ensuring that the real price level will remain unchanged.

Economic modelers call these assumptions "closure rules" because they determine how an economy moves from one resource allocation equilibrium to another while accommodating an increase in supply or demand. The choice of closure rules in policy analysis is strategic and is frequently done implicitly or with little consideration about how specific political economies have actually performed in this regard.

In reality food production and consumption usually take place within economic contexts that cannot be characterized exclusively as either "open" or "closed." These features, to a large extent, are determined by the manipulation of economic policy instruments that directly impact price levels and/or the level of aggregate demand and supply. In this sense, "demand management" refers to the array of policy instruments that manipulated food supplies to rationalize the conflicting objectives of economic policy as fiscal and foreign exchange balances, world prices, exchange rates, urbanization, and agricultural technology -- in other words, the larger economic environment -- change.

This overview paper explores some of the underlying structural features which impact on the demand management process in the context of the important food economies of South and Southeast Asia and the Near East. The demand management approach is discussed briefly in Section 2. This is followed by a review of recent empirical work exploring the relationship between economic growth and food consumption in developing countries. The section discusses the strengths and weaknesses of simple applications of Engel's Law to explain staple food consumption in Asia and the Near East. Section 4 presents a model which captures some of the

important structural relationships in the demand management approach and tests the model on data from eleven Asian and Near Eastern countries. Section 5 contains a discussion of price and non-price influences on food diversification, citing recent empirical analysis. The paper concludes with a brief discussion of the role of policy, particularly pricing policy, as the interface between structural forces influencing food demand, on the one hand, and competing political economic objectives, on the other.

2. DEMAND MANAGEMENT

The need for a demand management approach to the questions posed above emanates in part from the following food accounting identity:

(1) $$\frac{Q}{N}=\frac{C}{N}*\frac{Q}{C},$$

where the first term, $\frac{Q}{N}$, represents food production per capita; and the two right side terms represent consumption per capita and the production/consumption ratio (the self-sufficiency ratio), respectively. Simplifying the notation, we can substitute

(1') $$q=cs.$$

Translated into growth rates the identity becomes,

(2) $$q'=c'+s'.$$

The identity captures two of the major competing food economy objectives: domestic production (and changes in domestic production) must always be allocated between consumption objectives and self-sufficiency objectives, the one at the expense of the other. The term, c', of course, may reflect the influence of various political economic motives, including a genuine concern for poverty alleviation or, more narrowly, a desire for lower urban wage goods prices. Even the objective of a stable *nominal* consumer price, in the face of an inflationary environment, implies a falling *real* price, and thus an increase in c at the expense of s. Similarly, policy instruments which promote the s' term could reflect pressure to increase foreign exchange earnings or savings, the powerful political symbolism associated with staple food self-sufficiency, or the desire to build domestic buffer stocks to protect the country's food security.

The growth rate decomposition represented in (2) provides a context for answering questions about what countries do with agricultural production growth and the policy process which influences the expansion path of food consumption. It leads away from implicit or casual assumptions about closure rules, specifically that a change in output is automatically accommodated exclusively by either c' or s', rather than some combination of the two. The utility of a demand management approach to the analysis of food economies and of the food balance identities discussed above lies in the recognition that food consumption behavior, measured at the aggregate national level, is the outcome of country and period specific economic and policy processes, and that commodity specific or sub-sectoral analysis must be rationalized or validated in an aggregate context, in terms of both physical food balances as well as policy consistency.

This paper aims to shed preliminary light on two questions about the demand management process in the food economy:

1) Does economic structure influence the relationship between c and s, particularly the process of rural/urban demographic transition and the possibility of linkage between agricultural production growth and food consumption other than the one accounted for by the general growth in national income?

2) How does pricing policy, with its associated fiscal and foreign exchange implications, perform as the interface between c' and s'?

3. AGGREGATE FOOD DEMAND AND ENGEL'S LAW

The most commonly researched and discussed impact on food demand patterns in the context of economic development is encapsulated in Engel's Law. This reflects an empirical regularity: as per capita income increases, the demand for food increases but at a slower rate than income. In other words, the income elasticity of demand for food is less than one. While the food share of aggregate consumption expenditure may decline in the course of economic development, in any particular food economy there is as well a hierarchy of food preferences. Engel's Law ensures that patterns of consumption expenditure will diversify as economic development (measured in terms of rising per capita income) unfolds. The notion of a hierarchy of food preferences suggests that part of the diversification process will involve diversification within the set of food commodities itself. The growth in demand for some food commodities can be quite dynamic, while slow, stagnant, or even negative growth characterizes the demand expansion path for other foods. In relative terms, the slower growing groups tend to dominate.

The results of a large, recently completed study of patterns of economic structure related

to the development process is summarized in Table 1. The "typical" economic structure expansion path shown here hides a good deal of variance. Much of the study is devoted to understanding the differing expansion paths of large versus small countries and trade-oriented versus inward-looking countries. The one expansion pattern that is common to all sub-groupings is that which reflects Engel's Law--the declining share of food in consumption expenditures. About half of the decline in the food share of consumption expenditures occurs between the $300 and $1000 levels (1980 dollars), a range which comprises only 17 percent of the income transition represented in Table 1. From the lowest poverty level to the $300 per capita level, the food share of consumption expenditures does not change, reflecting relatively high income elasticities of demand for staple foods at very low levels of income, a feature of food consumption recently emphasized by Poleman. It is important to note that although the *share* of food in total expenditure falls as economic growth proceeds, the *level* of per capita food expenditure more than doubles between the $300 and $1000 per capita income range. Most ANE countries are approaching the lower end of or are actually in this income transition range. A few have traversed the range in the past twenty years.

Recent research by Marks and Yetley, using time-series data from FAO food balance sheets for a large number of countries, provides some confirmation as well as confusion about the power of Engel's Law to explain food consumption behavior in developing countries. Their research, summarized in Figure 1, shows that the diversification process starts at a very low level of income as the percent of diet (share of food calories) accounted for by coarse grains, such as maize and sorghum, declines rapidly to accommodate the substitution of the more preferred grains: wheat and rice. Throughout the development process, the demand for meat expands.

Table 1 Shares of Economic Structure Associated with Levels of Per Capita Income (percent)

Component of economic structure	Income per capita (1980 U.S. dollars)								
	Actual average <300[a]	Predicted[b]					Actual average >4,000[c]	Total change	Midpoint of change
		300	500	1,000	2,000	4,000			
Final Demand									
Private consumption	79	73.3	70.2	66.4	63.1	60.3	60	-19	600
Government consumption	12	13.6	13.5	13.7	14.[illegible]	15.4	14	02	---
Investment	14	18.4	20.8	23.3	25.0	25.9	26	12	400
Exports	16	19.3	20.7	22.6	24.5	26.4	23	07	400
Imports	21	24.6	25.2	26.0	27.0	28.0	23	02	---
Food consumption	39	38.7	34.5	29.1	23.9	18.9	15	-24	1,200
Trade									
Merchandise exports	14	15.2	16.9	18.8	20.3	21.2	18	04	400
Primary	13	13.9	14.9	15.2	14.1	11.8	07	-06	---
Fuels	03	04.8	06.3	07.3	07.2	06.1	02	-01	---
Other	10	09.1	08.6	07.9	06.9	05.7	05	-05	1,250
Manufacturing	01	01.3	02.0	03.7	06.1	09.4	11	10	2,000
Merchandise imports	16	18.2	19.3	20.6	21.7	22.7	19	03	---
Primary	05	06.4	06.7	07.1	07.5	08.0	07	02	---
Manufacturing	11	11.8	12.6	13.5	14.2	14.7	12	01	---
Production (value-added)									
Agriculture	48	39.4	31.7	22.8	15.4	09.7	07	-41	700
Mining	01	05.0	06.6	07.7	07.5	06.1	01	0	---
Manufacturing	10	12.1	14.8	18.1	21.0	23.6	28	18	1,200
Construction	04	04.4	04.9	05.5	06.1	06.7	07	03	1,000
Utilities	06	06.7	07.4	08.1	08.8	09.3	10	04	900
Services	31	32.4	34.6	37.8	41.2	44.7	47	16	1,300
Manufacturing									
Early	07	06.8	07.6	08.3	08.3	07.8	07	0	---
Middle	02	03.3	04.3	05.3	06.0	06.5	06	04	500
Late	03	01.8	03.2	05.3	07.6	10.2	13	10	2,500
Production									
Agriculture	81	74.9	65.1	51.7	38.1	24.2	13	-68	1,300
Industry	07	09.2	13.2	19.2	25.6	32.6	40	33	1,600
Services	12	15.9	21.7	29.1	36.3	43.2	47	35	1,000

--Not applicable: change is not monotonic or significant.

Note: Expressed as shares of GDP, except for labor force variables, which are expressed as shares of total labor force.

a. Based on 1960-72 period for countries with per capita income less than $300 in 1970; mean approximately $180.

b. Assumes average population (20 million).

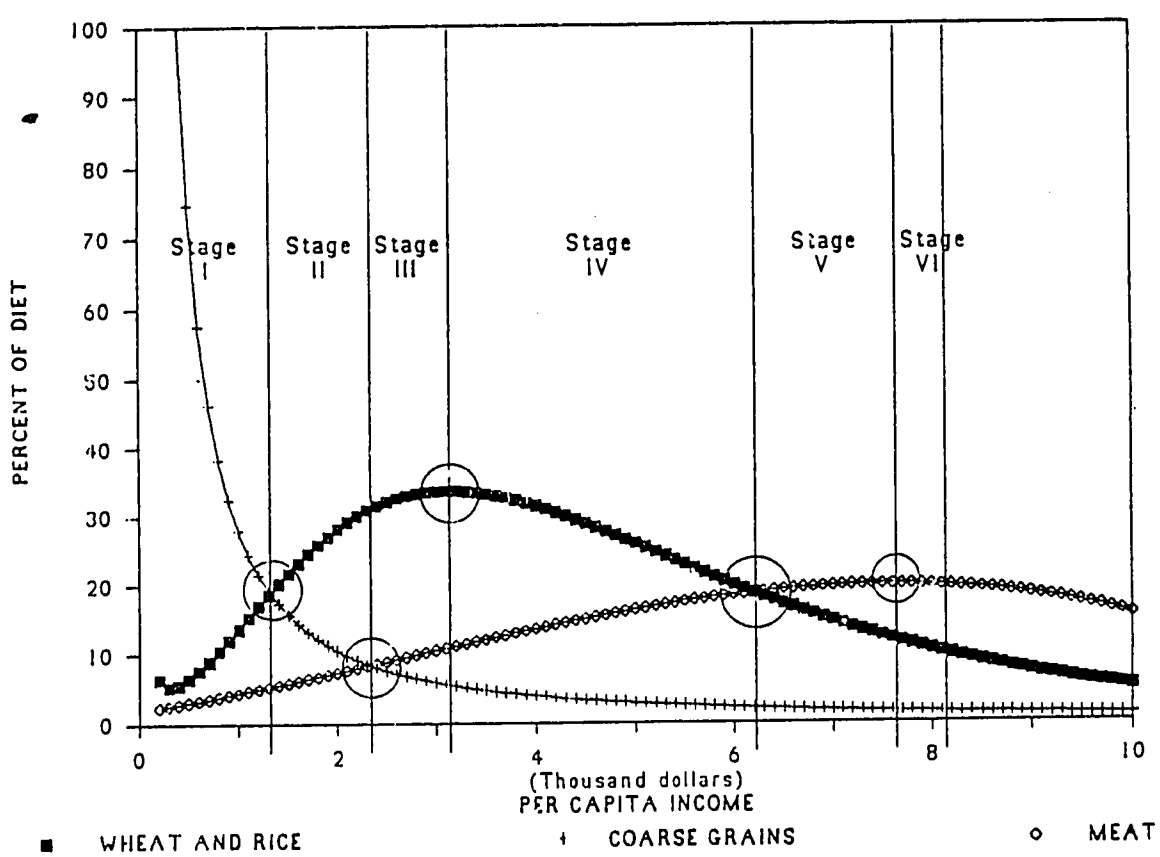
c. Based on 1960-72 period for countries with per capita income greater than $4,000 in 1970; mean $7,300. Countries with income only slightly over $4,000 in 1970 are excluded; these are Israel ($4,035), Ireland ($4,135) and Spain ($4,310).

Source: *The World Bank Economic Review*, Vol. 3, No. 2, May , 1989, pp. 152-153. Caluculations based on data from The World Bank.

The pattern shown in Figure 1 suggests that coarse grains, while declining, continue to dominate the diet until a per capita income level of about $1250, higher than that of most South and Southeast Asian and Near Eastern (ANE) countries. Yet even casual observations in most Asian and Near Eastern countries attest to rice or wheat as the dominant staple foods. Is the ANE pattern different from that generated by Marks and Yetley's research?

The answer is "yes" and "no." Patterns similar in some respects to those shown in Figure 1 can be discerned over time in ANE countries. The share of calorie consumption represented by root crops and pulses has declined and the consumption of animal protein sources has risen rapidly, for example, in all of the fast growing ANE food economies. However, the peak in per capita consumption of the preferred starchy staples, wheat and rice, seems to come much earlier in many ANE countries than might be expected by reference to Figure 1.

Figure 1: Stages of Economic Development Seen in Shares of Wheat and Rice, Meat, and Coarse Grains in the Diet



The scatter diagrams in Figure 2 show per capita wheat/rice consumption against income in the original set of countries considered for analysis by Marks and Yetley. Figure 2a shows two distinct consumption expansion patterns. The lower pattern (representing 80 countries, both developing and developed) recreated in Figure 2b was chosen for analysis by Marks and Yetley and produced the summary expansion curve shown in Figure 1, where the wheat/rice consumption share of calories peaks at a per capita income level somewhat over $3000. The developing countries in this sub-sample are those where wheat and rice consumption growth reflects their status as economic "luxury" goods, being generally imported to satisfy the demand of the urban population.

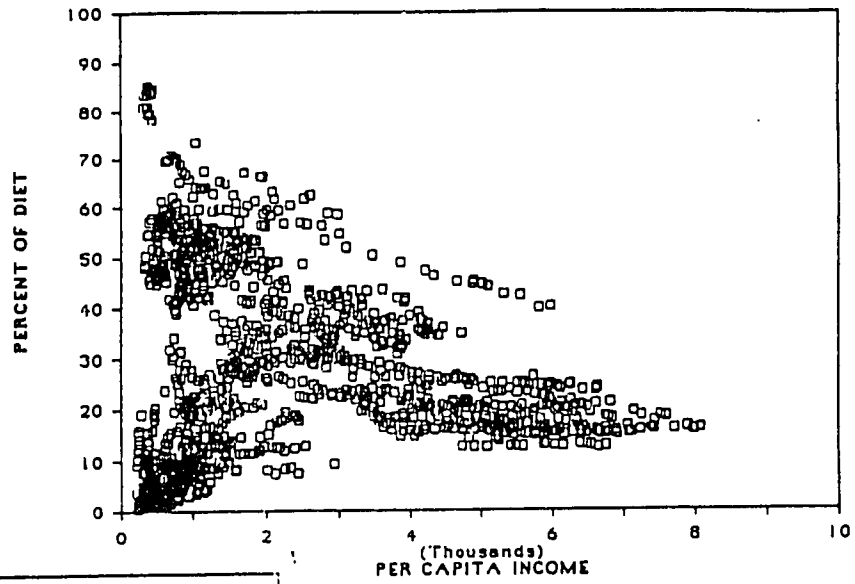
The cluster of observations in the upper portion of Figure 2, reproduced in Figure 2c, was not analyzed by Marks and Yetley. Yet it includes all the ANE countries plus 13 more nations, which together account for a preponderance of developing country population and wheat/rice consumption. The characteristic pattern shown in Figure 1 is not easy to discern in this undisciplined sub-set of observations. If the higher income observations (e.g. Japan) are excluded, no clear pattern emerges over the income range of $200 to $2000. Although there is some suggestion by the position of the scatter that the calorie consumption shares for wheat/rice peak at a much lower per capita income level than is shown in Figure 1, there is also a great deal of variance at the lower income levels. Do Engel's and Bennett's Laws not apply to the wheat/rice dominated ANE countries or are other factors at work which overwhelm them?

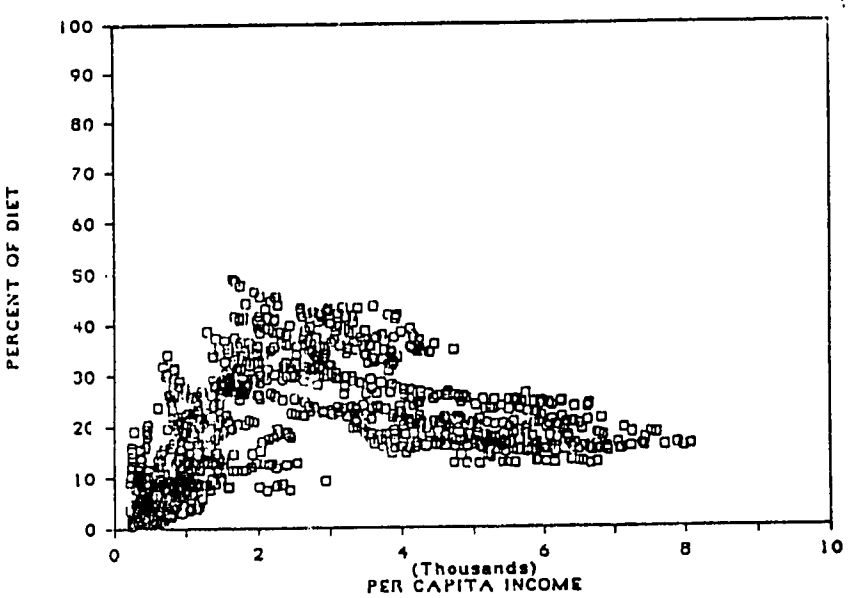
4. A MODEL OF AGGREGATE FOOD CONSUMPTION IN ASIA AND THE NEAR EAST

Although the process of economic development in Asia and the Near East is consistent with historical experience in that food and agriculture decline as a *share* of aggregate economic

Figure 2 Wheat and Rice Consumption

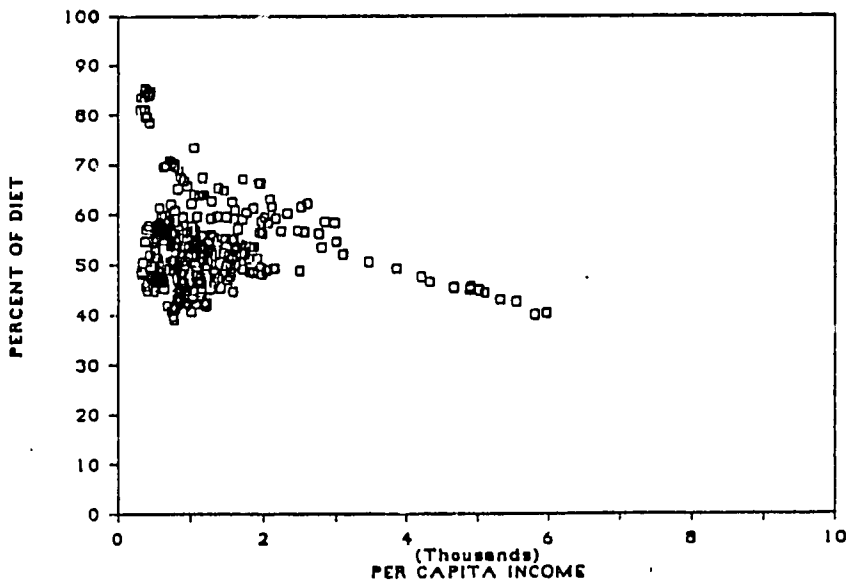
2a: Graph of 105 Countries





2b: Graph of 80 Countries

2c: Graph of 25 Countries



activity, it is clear from the undisciplined scatter of observations in the upper portion of Figure 2c that the simple application of Engel's Law is not a strong predictor of aggregate per capita food consumption in most Asian and Near Eastern countries. A more plausible model should acknowledge directly that at the national aggregate level food consumption may be influenced by prices and other elements in economic structure, in addition to general economic growth reflected in rising GNP per capita. The model employed in this section is summarized as follows:

(3) $$C = f(Y, Ya, P, G, U)$$

where

C = aggregate calorie consumption per capita as estimated from FAO food balance sheets;

Y = real per capita income measured at the national aggregate level -- in this case the macroeconomic measure of "absorption" is employed, rather than the more conventional GNP, for reasons explained below;

Ya = real agricultural GDP per rural person weighted by the beginning period share of agriculture in GDP;

P = the real (deflated) price of calories, proxied by an index of food prices for each country;

G = a nutrition "gap" index proxied by a ratio of the country's nutritional adequacy standard (measured in calories per capita) relative to aggregate per capita consumption measured at the beginning of the period;

U = a measure of the rate of urbanization: the urban population growth rate weighted by the beginning period urban population share.

This model was estimated in terms of growth rates over two periods of time, 1963-72 and 1975-85, for eleven Asian and Near Eastern countries:

Bangladesh	Morocco	Thailand
India	Pakistan	Tunisia
Indonesia	Philippines	Turkey
Malaysia	Sri Lanka	

The observations were standardized in growth rate terms in order to avoid the problem of exchange rate conversion, given the highly varied macroeconomic experiences and exchange rate regimes of the countries involved, and to reflect a longer run adjustment process. The two periods were chosen because in many of the countries they encompass very different price, macroeconomic, and agricultural growth episodes.

The actual ordinary least squares specification is as follows:

$$C' = a + B_1 P' + B_2 Y' + B_3 Ya' + B_4 G + B_5 G^2 + B_6 U + e \tag{4}$$

Variables designated with ′ are measured in growth rate terms; the others are as defined above. In some specifications "absorption" per capita (ABS) was used to proxy Y and in other specifications GNP per capita was employed. The results of the most interesting runs of this model are reported in Table 2.

Table 2
Factors Influencing Growth in Aggregate Per Capita Calorie Consumption: South, Southeast Asian, and Near Eastern Countries

	P'	*ABS*	*GNP*	Ya'	*G*	G^2	*U*	R^2
Equation 1	-.05	.09		.17	-.22	.11	.002	.64
	(-1.73)	(2.19)	---	(2.24)	(-1.51)	(1.43)	(.9)	
Equation 2	.04	.09		.19	-.25	.12		.62
	(1.53)	(2.16)	---	(2.88)	(-1.72)	(1.67)	---	
Equation 3	-.05		.05	.19	-.33	.17		.52
	(-1.60)	---	(1.07)	(2.40)	(-2.20)	(2.15)	---	

NOTE: T Statistics in ( )

The results of this analysis confirm that in terms of calorie consumption growth, Engel's Law is at work in Asian and Near Eastern countries, but its reflection in national aggregate performance is a function of economic structure, particularly the sectoral source of income and the initial level of calorie consumption.

Two alternative measures of per capita income are employed in the analysis. The more conventional measure of GNP per capita does not work well here. Since macroeconomic policy varied widely across the countries and even in the same country within the two periods, the macroeconomic measure of absorption (the aggregate of national accounts items for private consumption, general government consumption, and gross domestic investment) was chosen as a better proxy for the aggregate expenditure capacity of food consumers. Absorption generally exceeds GNP and in many countries and periods the growth rates of the two measures differ substantially, with the difference accommodated by net foreign borrowing.

The measure of absorption works well in this analysis, suggesting an income elasticity of demand for calories of about .1 at the sample means. The strength of this variable relative to the GNP measure suggests the importance of fiscal policy and access to foreign credit in determining aggregate demand in the food system. Further interpretation and elaboration of this variable may provide some basis for establishing the importance of macroeconomic policy in the medium run performance of food demand (see Taylor).

The growth rate of agricultural GNP per rural inhabitant, weighted by the share of rural population, is employed in this analysis to test the premise that agricultural sector growth has a special impact on per capita food consumption. The statistical results support this notion. Understanding the actual process at work here requires further considerations, but two

interpretations are offered:

a) The rural sector, being the poorest, has higher than average income elasticities of demand for food calories, so when its income growth rate is high it has the effect of increasing the aggregate Engel's elasticity.

b) When cereals growth occurs it has both an income and a price effect. The price effect occurs through the implicit price effect on on-farm consumption.

The results here confirm in a general fashion the idea that development strategies promoting agricultural growth will have an especially powerful impact on food demand. On a country specific basis this potential is augmented or muted by structural features associated with labor markets, agricultural input intensity, and the extent of rural agro-processing (see Haggblade, et. al.).

The calorie gap terms are incorporated here to test the notion that at a given level of aggregate per capita income growth, countries with low levels of energy consumption will have faster growth rates in calorie consumption than countries with higher adequacy levels. The quadratic form is used to pick up the fact that the deceleration of calorie consumption growth rate (with respect to the lagged calorie gap) is non-linear. Two interpretations are suggested:

a) The behavior of aggregate per capita calorie consumption reflects the strong preference for calorie dense food expressed by a large number of consumers in economies where national aggregate energy consumption is low. This specification represents an explicit recognition of Bennett's Law on starchy staple foods.

b) Food policy managers are under more pressure from the political economy when calorie levels are low to bias the economy toward reaching calorie consumption adequacy rather than aggregate food self-sufficiency. If this is the behavior being measured, then it must be reflected in lower prices or else the desired increase in calorie consumption is not induced.

The statistical analysis suggests that a proxy measure for the "price of calories" provides only a marginal explanation of aggregate calorie consumption. A negative sign is expected, but this expectation is not so strong as in the commodity specific case. The weights used in forming the aggregate food price index may result in a poorly specified proxy for the "price of calories." The role of prices comes through more clearly in the commodity specific results shown in the next section.

Finally, the urbanization variable does little to explain *aggregate* calorie consumption. Its role in commodity specific demand in the diet diversification process is discussed below.

5. FOOD CONSUMPTION DIVERSIFICATION

An important feature which underlies Engel's Law is the slow growth in starchy-staple food consumption associated with rising levels of per capita income (referred to as Bennett's Law). There is a level of calorie intake beyond which there is a relatively weak desire to consume additional calories from starchy sources, such as root crops, maize, wheat, and rice. The desire for diet diversification begins to override the need for energy from calorie dense foods.

The record of calorie consumption growth in Asian and Near Eastern countries from 1965 to 1984 is shown in Table 3. A good deal of this performance is attributed to factors identified in Section 4. The main food sources behind this consumption behavior since 1974 are shown in Table 4. In many cases, cereals contribute no more than fifty percent of the *net change* in per capita calorie consumption.

Table 3: Daily Per Capita Calorie Availability by Country, Asia and the Near East, 1965, 1973 and 1984

	1965	1973	1984	Index 1965	Index 1973	Index 1984
Bangladesh	1964	1949	1906	100	99	97
Egypt	2435	2631	3280	100	108	135
India	2100	1967	2185	100	94	104
Indonesia	1742	2031	2489	100	117	143
Pakistan	1747	2128	2223	100	121	127
Philippines	1936	1957	2328	100	101	120
Sri Lanka	2155	1075	2414	100	96	112
Thailand	2200	2302	2303	100	105	105
Morocco	2182	2593	2864	100	119	131
Tunisia	2296	2376	2888	100	103	126

Table 4: CONSUMPTION DIVERSIFICATION--Proportionate Contribution of Selected Food Sources to Change in Per Capita Calorie Source by Country, Asia and the Near East, 1973-1984

		Proportionate Contribution Change in Callorie Consumption (%)				
	Calorie Change	Cereals	Oils	Sugar	Roots	Pulses
Bangladesh	-43	83	-109	12	9	26
Egypt	649	41	28	16	3	-10
India	218	36	24	15	15	0
Indonesia	458	65	18	0	7	0
Pakistan	95	-35	123	-28	-3	-24
Philippines	371	40	9	13	0	0
Sri Lanka	339	52	13	10	0	0
Thailand	0					
Morocco	271	50	10	15	7	3
Tunisia	512	63	7	8	1	--

Within the category of cereals, however, important changes are taking place with respect to consumption. In addition to the income and structural features that explain changes in aggregate calorie consumption, the roles of price and urbanization become clear at the level of commodity specific analysis. Recent studies provide support for understanding this aspect of consumption diversification in ANE countries (see Ito, et al., and Huang and David).

Evidence provided by Huang and David (April, 1991) is summarized in Table 5. For our purposes, the main feature of these results involves the role of urbanization. While income (expenditure) elasticities for rice are positive in all the countries shown except Thailand, the impact of rural-urban demographic transition is uniformly negative. By contrast, the impact of urban population growth on wheat consumption is positive. A possible reason for this perference is the ease of household preparation of wheat based products such as bread or noodles combined with low cost commercial preprocessing or simply the direct consumption of these items as fast-food. These attributes are attractive in urban environments where the opportunity cost of household time for this type of work is high.

Bouis develops further evidence on the negative impact of urbanization on rice consumption. In addition, he observes that agricultural development combined with rural-urban demographic transition results in an increasing share of rice production coming from larger, commercial farms. He postulates that per capita rice consumption on these farms is lower than on the semi-subsistence farms they replaced, thus contributing a further negative influence on aggregate per capita rice consumption.

It is clear from the above that food demand is profoundly influenced by structural economic forces. The simple application of Engel's Law is not sufficient to account for the

Table 5: Price, Expenditure, and Urbanization Elasticities for Rice, Wheat, and Total Cereals

	ELASTICITIES		
	Own Price	**Expenditures***	**Urbanization**
Bangladesh:			
Rice	-.92	.38	-.15
Wheat	-2.48	1.82	2.95
Cereals	--	--	--
India:			
Rice	-.52	.53	-.24
Wheat	-.16	.20	1.56
Cereals	--	.22	.12+
Indonesia:			
Rice	-.88	.47	-.09
Wheat	-.83	.24	4.54
Cereals	--	.51	-.07+
Pakistan:			
Rice	-.40	.49	-.11
Wheat	-.31	.14	.29
Cereals	--	--	--
Philippines:			
Rice	-.96	.25	-.46
Wheat	-.35	.06	2.32
Cereals	--	.20	.69
Thailand:			
Rice	-1.07	-.14	-.04
Wheat	-.27	.12	1.22
Cereals	--	-.12	-.09+

*National accounts measure of "private consumption" used as a proxy for income in Engel's function estimate.
+Not statistically significant

SOURCE: Juang and David (April, 1991).

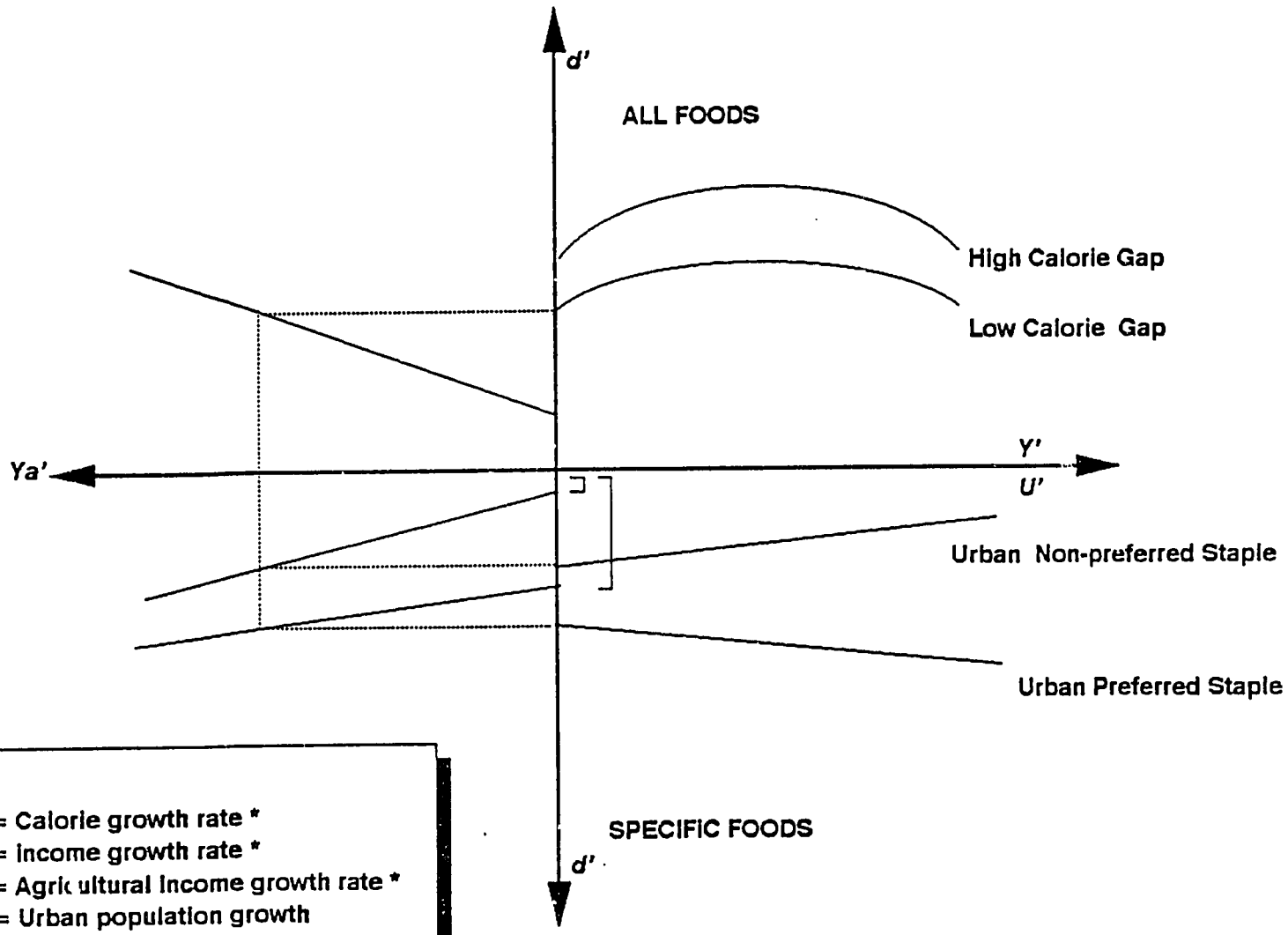
complex processes that increase aggregate energy consumption as well as promote diversification of the diet. The results of various studies presented in Sections 3 and 4 throw intriguing light on the impact of development strategy on food systems.

In the context of the simple food system accounting identity presented earlier,

$$q' = c' + s'. \tag{2}$$

the results of Section 3 suggest that, measured in terms of total calories, q' (which is a sub-set of general agricultural growth) may partially determine c' and generates a potential for a positive change in s' as well. This impact on c' is greater in food economies where the average level of energy consumption is low prior to the period of agricultural growth. A simple version of this process and the impact of urbanization on food consumption is depicted in Figure 3 where d' indicates the growth rate in food demand (c' indicates actual consumption which is the net *outcome* of both structural and policy interventions). The impact of agricultural income growth on aggregate food (calories) demand is shown in the upper left quadrant. Given a level of agricultural income growth, this curve is used to establish an intercept for the usual Engel's function, which is depicted in the upper right quadrant. The position of the Engel's curve is further influenced by the degree of nutritional stress in the food economy. The lower quadrants of Figure 3 show factors influencing food diversification, as it relates particularly to staple foods. The agricultural income/commodity specific demand relationship is depicted in the lower left quadrant. Agricultural income growth is shown to have a greater effect on rural preferred staples (called "urban non-preferred staples" here) than on "urban preferred staples". The intercepts for these curves are determined by the general income effect on demand for these

Figure 3: Income and Structural Factors Influencing Aggregate Food Consumption Per Capita



d' = Calorie growth rate *
Y' = Income growth rate *
Ya' = Agricultural Income growth rate *
U' = Urban population growth
] = Demand growth rate attributable to general income effect

* *per capita*

commodities. In other words, given a level of general income growth (read off the upper right quadrant horizontal axis) the corresponding Engel's impact on commodity specific demand growth (not shown in the figure, see Table 5) is registered on the lower left quadrant vertical axis. The intercept is equal to the rate of grown in general income times the income elasticity of demand. The latent expansion path of aggregate food (calorie) consumption and the pattern of consumption diversification, reflect the combined impact of the structural and behavioral features depicted in Figure 3. The actual expansion path reflects these as well as policy influences.

These curves in the lower left are used to establish the intercept for the urbanization/consumption relationships shown in the lower right quadrant. (Note that the horizontal axis associated with this quadrant measures the urban growth rate.) The process of diversification in food consumption results from a combination of the differential impact of urbanization on specific commodity demand as well as differing general income and agricultural income elasticities of demand for commodities.

The commodity specific analysis in Section 4 highlights the role of urbanization in the process of consumption diversification. Measured at the commodity level, urbanization tends to decrease c' for urban non-preferred foods such as rice. (In Africa both rice and wheat are probably urban-preferred relative to maize and root crops.) This has clear ramifications on s' in the case where urban-preferred foods are not domestically produced or where production costs are very high.

The economic processes which drive urbanization are critical here. For example, rapid agricultural sector growth is usually associated with successful economic structural

transformations. But the rural-urban demographic transition generally lags by a number of years the change of relative GNP shares as the economy grows. In other words, agricultural growth generally results in urbanization (another q'-c' linkage) but the rate of change is not exclusively determined by the speed of agricultural growth. In Africa rapid urbanization is occurring in many countries independently of agricultural growth (perhaps *because of* slow agricultural growth) and even ahead of structural transformation of GNP shares. Depending upon the process that generates it, urbanization can have varying implications for the food accounting identity.

6. DEMAND MANAGEMENT: STRUCTURE AND POLICY

Over any specific period of time, the structural forces on demand discussed above constitute a major factor in the food system. Governments which are capable of sufficient foresight can, through development strategy, manipulate this structure. In the shorter run, however, the structural forces are given. When the ramifications of these trends conflict with critical policy objectives, a narrower set of policy instruments--pricing interventions, quantitative restrictions, and administrative actions--are employed to bring about consistency between policy goals and scarce resources, such as food, foreign exchanges, and public funds. In other words, these shorter run policy instruments aim to modify the impact of structural forces on elements in the food accounting identity.

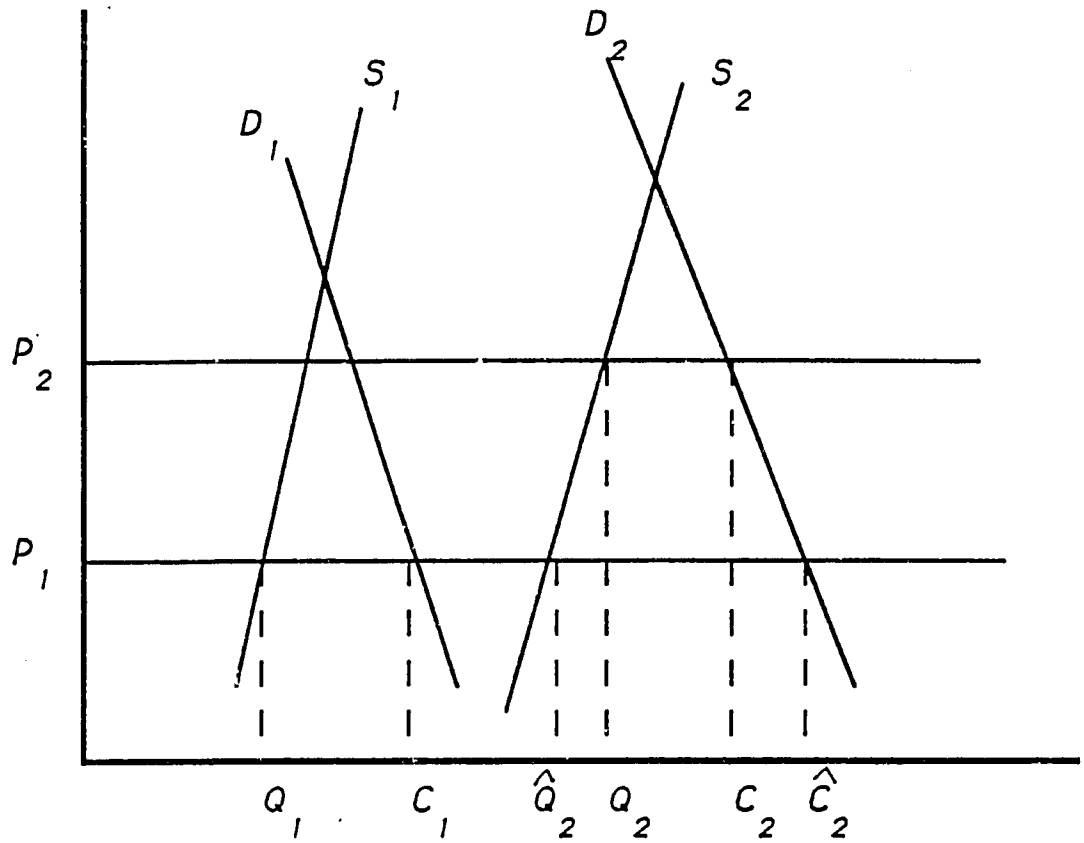
This demand management interface between structure and policy is shown in Figure 4. Demand and supply relationships (per capita) in some base period are depicted by D_I and S_I. Production and consumption in the base period, consistent with the prevailing price, P_1, are at Q_1 and C_1 (corresponding to q and c in the food accounting identity). The self-sufficiency ratio,

S_1, equals $\frac{Q_1}{C_1}$. Over a particular period of time, the structural forces on demand (summarized in Figure 3) shift the demand relationship to D_2. Technical change, investment, and other structural forces also shift the supply curve to S_2. If the real price level remains at P_1 then the period 2 elements in the accounting identity are shown by $\hat{Q}_2$, $\hat{C}_2$, and $\frac{\hat{Q}_2}{\hat{C}_2}$. Policy interventions aim to modify this outcome. In Figure 4, for example, the actual *observed* configuration of the food system, influenced at the margin by pricing policy, is Q_2, C_2, and $\frac{Q_2}{C_2}$. The task of the analyst, in this case, is to understand why the food system was "managed" toward the observed outcome. An assessment of both structural forces and policy instruments is essential to achieving this understanding.

Food systems do not evolve in a simple way that is easily summarized by Engel's Law of Consumption. They are rather a complicated reflection of the interface between development structural forces, policy objectives, and policy instruments. A simple food accounting identity was presented here as a general context for understanding the rationalization of production and demand forces without resorting to unwarranted assumptions about "closure rules." The paper placed particular emphasis on the structural forces which influence demand and the role of policy in modifying that influence.

The paper shows that food demand in major countries of South and Southeast Asia and the Near East is influenced in a regular fashion by structural features relating to income, agricultural growth, nutritional factors, and urbanization. The case studies and synthesis paper in this series will show that the relative importance of these features has varied substantially

Figure 4: The Interface of Structural and Policy Forces



among countries and between periods of time, however. In addition, policy objectives, resource constraints, and the choice of policy instruments has also varied. As a result, the development of the food system, the relative importance of commodities in consumption, and the allocation of food system resources between direct consumption and other objectives has varied. Cross-national studies can highlight underlying regularities, but nation-specific case studies are required for an understanding of actual outcomes. Understanding the interplay of structural and policy forces in the recent past may contribute to the basis for anticipating the next generation of pressures in the food system and assessing the implications of alternative policies. It is easier, perhaps, to know where to go when you know where you are and how you got there. The country case studies currently underway have that objective.

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