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SEASONAL FLUCTUATIONS IN FACTOR AND PRODUCTS MARKETS: IS THERE A NUTRITIONAL RISK?

by

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The Cornell Food and Nutrition Policy Program (CFNPP) was created in 1988 within the Division of Nutritional Sciences to undertake research, training, and technical assistance in food and nutrition policy with emphasis on developing countries. The Nutritional Surveillance Program (CNSP), which was formed in 1980 with support from the Agency for International Development, is part of the CFNPP.

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FOREWORD

Seasonal fluctuations in incomes, prices, and infectious diseases are important risk factors for food security and nutrition among low-income rural households. The extent to which they in fact result in serious deteriorations in household food security and the nutritional status of vulnerable household members varies greatly, as does a household's ability to cope successfully. David E. Sahn, Deputy Director of CFNPP and editor of the recently published book "Seasonal Variability in Third-World Agriculture, the Consequences for Food Security," here addresses seasonal problems in nutrition and food security and identifies the role of government in alleviating undesirable effects.

The issues discussed in this lecture relate closely to other aspects of food security and nutrition for Africa as discussed in Pew lectures by von Braun and Pinstrup-Andersen (see a complete list of lectures in the back of this publication).

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INTRODUCTION

The importance of the seasons has found numerous manifestations, transcending virtually all areas of study and intellectual pursuit. These range from the earliest literary classics where Persephone ate six pomegranate seeds in Hades and, in so doing, fated the world to a cycle of spring and winter, to the work of anthropologists concerned with understanding how the cycles of time, as observed in the annual rhythms of climate, fauna, and flora, influence the social cultural and economic dimensions of life. Likewise, sociologists have focused on the mechanisms employed by the poor to address seasonal shortages and stresses, biologists and genetic engineers have labored to develop technology that circumvents the constraints represented by the short growing season, and economists have endeavored to understand intertemporal behavior of markets and market agents.

This pursuit of knowledge represents ample evidence of how the seasons have conditioned all aspects of our lives and provides some context to the understanding of the seasonal dimension of nutrition and food security. In that regard, a multiplicity of approaches and perspectives is necessary to

answer the question of why seasons matter to researchers and policy makers concerned with the welfare of the poor.

The purview of this paper is concerned with a rather specific set of issues that revolve around the impact of the seasons on food security and nutritional status, and more particularly whether the seasonality in factor and product markets represents a nutritional risk and contributes to food insecurity. In exploring these issues, the first question to be addressed is: to what degree do seasonal patterns of anthropometric indicators of nutritional status (i.e., measures of leanness and linear growth) and seasonal patterns of household food security (as measured by caloric intake) have deleterious functional consequences? After addressing this question, the issues of the causes and predictability of seasonal patterns in nutrition and food security are analyzed. This is followed by a discussion of policy options for mitigating the potential food security and nutritional risks associated with seasonal undulations and a series of concluding remarks that summarize the most salient findings and implications of this study.

THE FUNCTIONAL CONSEQUENCES OF SEASONAL VARIABILITY

There is considerable evidence that indicators of nutritional status and household food security display pronounced seasonal fluctuations in developing countries. The literature is replete with examples of weight loss and increased levels of wasting among children and adults, linear growth retardation among children, and declining nutrient consumption among women, children, and households during periods of seasonal stress. For example, in Bangladesh, women's body weight declined almost 5 kilograms between the pre-harvest and post-harvest period (Abdullah, 1989). In the Gambia, the body weight of pregnant women controlling for their stage of pregnancy was more than 4 kilograms lower during the lean season, which in turn contributed to lower birth weights among their offspring (Lawrence,

Lamb, Lawrence, and Whitehead, 1984). In a similar vein, mean per capita energy intake for households in northern Nigeria ranged from 2,458 to 1,949 during the course of the year (Longhurst, 1984), while anthropometric indicators of nutritional status show significant increases in the incidence of malnutrition during the rainy season in Gambia (Khan and Gupta, 1977), as well as weight loss for children between 13 and 33 months during the pre-harvest season in Bangladesh (Chen, Chowdhury, and Huffman, 1979). While this type of variability in dietary intake and anthropometry has been summarized elsewhere (Schofield, 1974; Longhurst and Payne, 1979; Chambers, Longhurst and Pacey, 1981), an important underlying question is, what are the implications of such seasonal changes for human performance?

To amplify, the implications of observed changes in anthropometric indicators, especially the velocity of growth or degree of leanness, underlies much of the concern over the seasons. In particular, while severe and sustained levels of wasting and linear growth retardation are associated with higher probabilities of mortality and functional impairment (Chen, Chowdhury, and Huffman, 1979; Smedman, Stuky, Mellander, and Wall 1987), the evidence on the functional effects of more moderate declines in nutritional status is ambiguous. This is a consequence of the uncertainty regarding the limits of self-regulation, or adaptability to periods of stress, as manifested in the slowing of growth or increased leanness. Specifically, one model views the body as a homeostatic self-regulating system for which there is a range of preferred values for growth and body size. This viewpoint is perhaps most widely articulated by Sukhatme (1982), as well as Seckler (1982), who argue that smallness is an adaptive mechanism without deleterious effects. The logical extension of this idea is that "normality" is characterized by a state of dynamic disequilibrium with constant and cyclical adjustments over a range of values.

In contrast with this theory of adaptability is the more conventional viewpoint, termed the genetic potential model. This latter construct is based

on the premise that there is a preferred state characterized by an optimal set of body size measurements and rate of growth. Any deviation from these optima due to seasonal constraints on food intake or disease are assumed to have short and/or long-term undesirable consequences for performance (Gopalan, 1980). These negative outcomes may include a reduced potential for physical work, less resistance to infection, and a negative psychosocial response. While this model follows from the idea that health is a positive condition and not simply the absence of recognizable disease, its proof, as measured in sub-optimal responses, is not any more straightforward than verifying the limits to adaptability.

There are starkly contrasting implications for public policy depending on whether one believes the adaptability model or the genetic potential model. Adherence to the former would imply that the seasonal episodes of growth faltering and leanness is a healthy adaptive process that portends no functional consequence. The latter perspective implies that seasonal declines in growth must be checked, and doing so is a major objective of public policy (Payne, 1989).

The evidence regarding these two theories, unfortunately, is limited. While some clinical studies do suggest that size contributes to work productivity (Strauss, 1985), the preponderance of casual observation does not indicate any strong effects of limited growth retardation and leanness on productivity. The literature provides little compelling evidence to refute either theory. The issue is further complicated by the seasonal patterns of weight gain and linear growth routinely observed among children even in healthy populations (Payne, 1989).

In a similar vein, the implications of transitory episodes of food insecurity during the lean seasons as measured in declines in energy intake are even less certain than periodic wasting and a temporary slowing of linear growth. While there is a growing literature that shows productivity declines in adults as a consequence of reduced food-energy intake (Sahn and Alder-

man, 1988; Deolalikar, 1988), interpreting seasonal declines in consumption is extremely difficult. For example, individuals may regulate their intake to correspond to levels of energy expenditure, resulting in marked fluctuations in intake. And the approach to this auto-regulation may have a variety of social and biological determinants that, for example, may even involve individuals storing energy in the form of adipose, just as they would in the form of grain reserves in anticipation of the coming lean season.

Given the complexity of human adaptation and social behaviors, it is not possible to draw firm conclusions as to the functional consequences of moderate changes in indicators of nutritional status and food security. There are, nonetheless, clear thresholds beyond which adaptability is no longer possible. In addition, seasonal episodes of malnutrition and food insecurity are associated with other indicators of poor health and social and economic stresses that, in combination, have deleterious short and long-term impacts upon individuals and households. Therefore, we next turn to an examination of causes before proceeding to a discussion of policy implications.

CAUSES OF SEASONAL MALNUTRITION AND FOOD INSECURITY

Malnutrition, a concept that is primarily measured at the individual level employing anthropometry, contrasts with food security, which can either be measured at the national or household level using food consumption data. While much of the remaining discussion will be devoted to discussing the causes and appropriate policy responses to seasonal household food insecurity as measured by the household's inability and/or lack of desire to acquire sufficient quantities of food for good health, activity, and growth, this section will first begin with a discussion of the seasonal aspects of intrahousehold food distribution that condition the nutritional status of household members.

Intrahousehold Food Distribution

Regardless of the household's overall levels of consumption (i.e., food security), there is the prospect that children and women will still be malnourished due to unequal access to food resources (Longhurst and Payne, 1979). While there is only limited literature on the dynamics of food allocation within the household owing to the methodological difficulties of measuring and modeling intrahousehold decision-making, a number of hypotheses can be proposed that suggest these patterns will change with the seasons. For example, the intrahousehold distribution of food may shift in accordance with seasonal changes in the labor force participation of different household members. Relatedly, the share of income earned by household members may differ from one season to another. To the extent that the share of income earned corresponds to authority over both how money is spent and the subsequent distribution of available food resources within the household, and that household members have different utility functions and marginal propensities to consume, the seasons may also bring about large shifts in the nutritional well-being of women and children.

While the evidence on seasonal changes in household food distribution is limited, the major concern is that vulnerable household members are most discriminated against during seasons of stress, as households allocate resources in a manner to maximize productivity rather than equity. This was evident in Nigeria (Longhurst, 1984), the Philippines (Garcia and Pinstrup-Andersen, 1987) and India (Behrman and Deolalikar, 1989). Just the opposite was observed in Bangladesh, however, where during the pre-harvest season the share of household resources allocated to young girls is increased, compensating somewhat for the fact that they generally consume a significantly lower share of their dietary requirements than other household members during the rest of the year (Abdullah, 1989). While this latter strategy of protecting the most vulnerable household members during the season of greatest stress contrasts with the other findings alluded to above, the need to analyze the

seasonality of malnutrition requires going beyond understanding the food acquisition behavior of households and the performance of markets. Indeed, an improved knowledge of intra-household decision making is required.

Access to Food at the Household Level

The immediate causes of a household's inability to acquire sufficient quantities of food during certain periods of the year revolve around a decline in their income (either in-cash or in-kind) and an increase in market prices. The undulations in income and prices are largely a reflection of the cyclic nature of agriculture, although income from sources other than agricultural activities may be highly seasonal (e.g., tourist trade, sale of woolen garments). Variations in income and prices, however, represent a threat to food security when either (or both) of two conditions hold: (1) the household does not have the ability to save intertemporally, either in the form of food stocks or cash; (2) the pattern of the seasonal changes is not predictable, introducing an element of risk into household intertemporal savings and consumption behavior.

Quite clearly, access to credit institutions represents an important element of any strategy to improve seasonal food security. If credit is quantity constrained at a given interest rate, and the costs of borrowing differs among income groups or landownership classes, one would expect intertemporal patterns to vary among groups. This problem of rationed credit is especially likely to arise in the pre-harvest season, when the need to purchase inputs may coincide with the need for consumption credit to maintain an adequate diet. Similarly, the financing for processing, transporting, and storing crops after the harvest also increases the demand for credit, which is likely to be limited in most rural areas, raising the costs to the borrower. In particular, the evidence suggests that the poor, who lack collateral and political patronage and must pay off creditors after the harvest when cash income is received, are the same households that are least likely to gain access to

reasonably priced credit from the poorly functioning banking and savings institutions characteristic of most developing countries (Bell and Srinivasan, 1985a, 1985b).

The rural poor and rich alike have traditionally relied upon in-kind agricultural based savings. Once again, however, there are indications that the smaller farmers in most Asian and an increasing number of African countries are net consumers of staple foods (Sahn, 1988 and Weber, et al., 1988). Because these households deplete their stocks well before the next harvest, wage labor activities become even more vital once family stocks are drawn-down. However, the need to engage in wage labor is often in competition with preparing one's own farmland for the next harvest (Sahn, Arulpragasam, and Merid, 1989). This raises the prospect of a ratcheting effect whereby the inability to save and/or borrow will lead to a variety of responses that may lower productivity in the following year, increasing the household's reliance on the labor market for income to purchase food.

Another particularly important form of savings in Africa is livestock. Goats and sheep, in specific, are relatively liquid modes of savings and compensate for ineffective or non-existent banking systems in rural areas. Evidence from Burkina Faso has amply illustrated that savings in the form of livestock protect the household from dramatic seasonal declines in caloric intake during the long and dry pre-harvest period (Reardon and Matlon, 1989).

Households employ a variety of other mechanisms in addition to savings to ensure household food security during the lean season. For example, the purchase of durables and semidurables can be timed to coincide with seasons when income is highest. There is also evidence that households adhere to Bennet's Law, even in a seasonal context. That is, during the pre-harvest season of stress, households substitute less expensive commodities and alternative food sources such as wild roots and tubers for expensive meat and milk products. Similarly, household members engage in seasonal migration

in search of work and food. This migration takes any number of forms. For example, 30 to 40 percent of the active population has been shown to migrate from rural to urban areas of Senegal during the dry seasonal (Waterbury, 1983). Rural to rural migration is also evident in West Africa, where workers migrate from the Savanna zone to the Forest regions in search of seasonal employment on coffee and cocoa plantations (Berg, 1965). The same is true of Java, where women find off-seasonal employment working on sugar plantations (Hart, 1986). Migration may even involve searching out government employment schemes during the lean season, as witnessed in Bangladesh (Chaudhury, 1980). Of course, the effectiveness of the migration strategy is contingent upon a number of factors such as the cost of the job search, whether the family or just a household member moves, and whether there are secure channels to send back remittances. In addition, consideration must be given to the impact of seasonal migration on the receiving areas, which, in fact, may suffer declines in food security if labor market conditions deteriorate.

There are also well-documented systems of communal sharing and gift-giving and even feasting to help vulnerable households through the lean season. Mexican societies have been shown to engage in feasting involving the distribution of food during periods of the year when the poor are in need (Ford, 1972). Similarly, there is evidence of exchange of food among pastoralists as food stocks are depleted (Benefice, Chevassus-Agnes, and Barral, 1984). But while food flows through feasting and food gifts have been an important strategy for dealing with seasonal food shortages, these mechanisms are increasingly scarce as grain boards and relief agencies take on traditional roles and responsibilities once assumed within the community (Messer, 1989). In sum, the combination of the variety of economic and social responses will condition how well a household copes with the seasonal patterns in their environment. However, an equally important issue is the

household's ability to anticipate seasonal fluctuations and to plan for the cycles they will confront.

The Effect of Unpredictability

In theory, seasonal cycles, unlike interyear fluctuations, are predictable, making it easier for consumers, producers, and traders to respond to the expected seasonal movements of prices, work opportunities, and earnings. In practice, however, seasonal patterns are highly unstable as manifested in year to year irregularities. To understand why, one must examine the two other components of a data series: trends and stochastic inter-year fluctuations. Changes in the general trend level of food production, for example, are brought about primarily by technological changes that also contribute to shifts in the seasonal patterns of output, prices, labor input, and so forth. Stochastic inter-year fluctuations also contribute to unpredictable seasonal undulations by making supply and demand conditions in various markets unpredictable. To the extent that the farmer, trader, and consumer confront changing circumstances and uncertainties from one year to the next, this will be reflected in differing seasonal patterns of production, marketing, prices, expenditures, consumption, and nutritional status.

The implications of an inability to predict patterns of seasonal variability from year to year are manifold. For example, even if credit markets were efficient and other forms of savings available, the ability of a household to avoid periods of seasonal poverty and stress is predicated on information and knowledge of future conditions. That is, insight into future food availability, income streams, and prices is necessary to effectively engage in intertemporal budgeting.

To illustrate inter-year instability in the pattern of seasonal price increases, Table 1 presents data on food prices where the entries are based on monthly index numbers of prices for different commodities in different countries. The indices represent monthly prices as a percentage of the

Table 1 - Selected examples of seasonal range of agricultural prices in the third world (percent).

	Com-modity	Wholesale/ Retail	No. Years	Mean[a]	Max[b]	Min[c]	CV[d]	Mean/[e] Month
Brazil	Millet	W	7	16.4	23.9	11.4	0.3	5.3
Ivory Coast	Millet	R	12	25.1	79.9	0.9	1.1	12.5
Niger	Millet	R	14	85.5	468.6	13.3	1.3	51.5
Niger	Sorghum	R	17	65.0	188.7	26.3	0.6	22.6
Brazil	Rice	W	7	19.2	48.1	9.0	0.7	6.2
Brazil	Rice	R	7	12.2	19.2	6.6	0.3	2.2
Costa Rica	Rice	R	7	6.0	24.1	1.2	1.3	4.8
Dominican Republic	Rice	R	6	12.9	24	44.4	0.6	5.2
Indonesia	Rice	R	8	24.1	40.6	17.5	0.4	4.7
Ivory Coast	Rice	R	11	41.8	89.0	11.2	0.6	15.1
Korea	Rice	W	5	17.6	29.3	3.9	0.5	4.7
Niger	Rice	R	19	36.9	81.4	10.4	0.6	11.7
Philippines	Rice	W	3	9.5	11.7	7.7	0.2	2.9
Philippines	Rice	R	5	16.3	56.9	3.4	1.3	3.6
Sierra Leone	Rice	R	15	46.6	96.0	11.8	0.6	12.2
Tunisia	Rice	R	8	4.8	6.9	0.5	0.6	1.8
Costa Rica	Maize	R	5	14.1	32.5	3.7	0.8	3.1
Dominican Republic	Maize	W	12	53.8	98.7	29.9	0.3	13.1
Indonesia	Maize	R	8	26.9	46.1	15.1	0.4	5.3
Ivory Coast	Maize	R	12	33.0	96.0	4.6	0.8	14.9
Bangladesh	Wheat	W	10	79.7	216.6	21.0	0.7	19.1
Brazil	Wheat flour	R	8	15.8	30.0	7.4	0.5	2.8
Ivory Coast	Wheat flour	R	11	7.3	27.8	0.3	1.1	4.5
Philippines	Wheat flour	W	14	15.5	48.9	0.1	1.0	7.4
Tunisia	Wheat flour	W	8	9.6	17.4	2.5	0.6	0.2
Tunisia	Wheat flour	R	5	8.3	10.7	5.8	0.3	5.9
Brazil	Sugar	R	13	27.1	111.9	4.3	1.3	10.3
Costa Rica	Sugar	R	7	10.1	27.0	—	1.2	6.0
Indonesia	Sugar	R	7	10.5	40.4	1.9	1.1	3.9
Ivory Coast	Sugar	R	11	9.4	34.1	0.1	1.3	7.3
Sudan	Sugar	R	10	14.6	40.4	—	0.9	3.4
Tunisia	Sugar	W	7	9.6	17.4	2.5	0.6	1.4

where the seasonal price index, S_{ijk} for commodity k, month i, year j, is a percentage of the corresponding centered 13-month moving average of prices.

[a] Average of the range over j years.

[b] Maxima of the range over j years.

[c] Minima of the range over j years.

[d] Coefficient of variation of the range over j years

[e] Corresponds to "mean" except that the mean spread is divided by the number of months between max (Sijk) and min (Sijk).

SOURCE: Calculated from FAO food price data tape.

NOTE: A range of price index is defined as follows:

$$\left(\frac{Mx[S_{ijk}] - Mn[S_{ijk}]}{Mn[S_{ijk}]}\right) x100$$

centered 13-month moving average of the same price series, thereby standardizing the prices across years and countries. The results firstly show that there are frequently large seasonal price spreads that differ dramatically from country to country and crop to crop. Secondly, there is considerable divergence in the range of the price index over the year, as shown in Columns 5 and 6, and reinforced by the high coefficient of variation in Column 7. Third, the marked instability in seasonal price spreads is attributable to the farmer and trader not being able to formulate accurate expectations about future grain supply and demand conditions, and consequently prices. When expectations are incorrect, subsequent imbalances contribute to the erratic pattern of seasonal price increases (Working, 1958), rather than the desired situation where prices increase each month commensurate with the cost of storage. While the extent of inter-year instability in seasonal price spreads differs for each country and commodity, such uncertainty implies a heightened element of risk for producers, traders, and consumers. The farmer will fail to maximize his profit and stabilize his income if his anticipations concerning future relative to present prices are incorrect. Traders will also often face high levels of uncertainties, adding a risk premium to their work which is ultimately paid for by the farmer and consumer. The erratic movement of seasonal prices also impedes intertemporal decision-making by consumers who are trying to stabilize their real purchasing power from one season to the next. In the face of such losses, policy is needed to reduce both the absolute magnitude of seasonal price spreads in some cases and their unpredictability in all cases.

POLICY OPTIONS FOR REDUCING SEASONAL MALNUTRITION AND FOOD INSECURITY

Policy makers have many options for reducing the seasonal patterns of malnutrition and food insecurity observed in vulnerable populations. They revolve around stabilizing the ability to obtain food during different seasons

of the year as well as addressing other related factors such as the seasonality of disease.

As intimated above, the household's access to enough food for health, activity, and growth is determined by (1) the level and pattern of income in its various forms, including wages, earnings from the sale of agricultural products, food available for home consumption, and transfers and remittances; (2) the seasonal pattern of food availability and food prices; and (3) the household's intertemporal saving behavior. be it savings in the form of money, food, or other physical assets. Policies designed to relax constraints among these three factors fall into two broad categories. The first includes untargeted policies that in essence are designed to improve the efficiency of factor and product markets. These indirect interventions, which generally revolve around promoting agricultural growth and market development, are the most propitious long-term mechanisms for reducing seasonal problems. The virtual absence of seasonal cycles of malnutrition and food-energy intake in developed countries, and the greatest severity of the problem in the most underdeveloped countries in Africa, provide ample evidence that the introduction of modern agricultural techniques and the development of markets for inputs, credit, labor, and products hold the key to reducing seasonal stress.

In the interim, however, before commercialization, monetization, and market development address the problems wrought by the seasons, more targeted interventions are needed. These initiatives must be designed to mitigate problems that arise during the transition to a modern economy. Targeted nutrition and food security projects will be especially important during the period of transition when households are shifting from cultivating for home production to earning cash in an environment characterized by inefficient factor and product markets. This is especially the case when this transformation is accompanied by an erosion in traditional forms of social

security and agricultural practices and technologies that had served to mitigate the stresses of the seasons.

Untargeted Interventions

Price Stabilization

Broadly speaking, there are two potential objectives for seasonal price stabilization. The first is simply to reduce the degree of uncertainty about the seasonal price spread from one year to the next. The second is to set as an objective the actual reduction in the average seasonal price increase across years. In turn, there are two broad channels through which governments can pursue these objectives. The first is the direct approach which involves active participation and intervention in product markets as a buyer and seller of food-grains. The second is the indirect approach which involves promoting and facilitating market conditions that foster efficiency and competitiveness.

Concerning direct government intervention, there are examples from Indonesia and the Philippines where government has actively intervened in the market to reduce the magnitude of seasonal price spreads and increase the predictability of these movements (Bouis, 1983 and Goldman, 1974). The key ingredients to their success has been the marketing agencies (1) having good market intelligence on prices throughout the country; (2) performing well-timed and comprehensive intervent[illegible] the markets where targets are set in terms of prices, not quantities to be procured; (3) engendering confidence among traders, producers, and consumers in the activities and reliability of government intervention; and (4) being assured adequate access to virtually unlimited credit for the government to achieve its objectives.

Despite the successful attempts of a few governments in stabilizing seasonal prices and reducing the price spread, the experiences illustrate the high costs involved, the great demands for trained and skilled manpower, and the requirement that such an effort take place in a context of well-developed storage, transport, and communication infrastructure. Given that

least-developed countries cannot usually comply fully with the prerequisites for direct intervention in markets, it is likely that indirect government intervention should be the focus, if not the totality, of their efforts to reduce seasonal price spreads. In particular, governments should endeavor to increase the competitiveness of markets and marketing opportunities for farmers and traders. First, this should involve developing infrastructure in the form of markets, roads, storage facilities, and so forth to improve the functioning of commodity markets and encourage risk-sharing over a broader population. Second, governments should concentrate on improving the quality of information collection and dissemination to promote more accurate anticipations of supply and demand for food-grains, thereby reducing risk and speculative behavior. Third, improvements in capital markets that will reduce impediments to accessing reasonably priced credit will also go a long way toward reducing the costs of intertemporal arbitrage. In combination, these factors are expected to prove quite effective in moderating and stabilizing off-season price increases.

Technological and Institutional Change

Technological change in agriculture, combined with farm management decisions, will affect seasonal variability in work, food production, incomes, and consumption. On the one hand, the replacement of traditional forms of cultivation with modern techniques may introduce and/or exacerbate the seasonality problems faced by households. Specialized commercial production may result in incomes becoming more lumpy, mechanization may contribute to increased seasonal labor bottlenecks, and the use of hybrid seeds may increase the perishability and storage costs of agricultural output. At the same time, some forms of technological change may destroy traditional solutions to coping with seasonality such as production of root crops, mixed and relay cropping, exploitation of vertisols, participation in mixed livestock enterprises, and bush collection.

While these problems are important to recognize, the fact remains that technological change, promoted by advances in agricultural research and facilitated by economic incentives and extension services, is one of the major components of any set of public policies designed to improve nutritional status and food security. Given that transitory episodes of seasonal food insecurity are a manifestation of poor performance of the food and agricultural sector, especially of factor, product, and credit markets, there is all the more reason to focus efforts on technological and institutional changes that promote rural and agricultural development. In placing a priority on accelerating agricultural growth, policy-makers should focus on a number of areas. They revolve around ensuring that breakthroughs on new varieties and increases in cropping intensities will reduce the seasonality of production, prices, and labor use.

To amplify, attention should be focussed on developing new crops that are not as susceptible to infestation or other sources of losses during storage. Improved irrigation schemes also hold considerable promise for raising production during the dry season and for reducing the farmer's dependence upon erratic and unpredictable rainfall. Small-scale irrigation schemes, in particular, are commended in contrast to the large scale projects that rely on expensive investments.

Increased research expenditure on secondary food crops, including roots and tubers, coarse grains, pulses, and legumes is also an important priority for reducing seasonal food deficits. To date, research on these crops has been underfunded (Longhurst and Lipton, 1989). This is especially important, given their numerous roles. Secondary crops can generate income and constitute a source of food at critical periods of seasonal scarcity; they also provide significant quantities of micronutrients that otherwise may be lacking in the diet; and they play an important role in reducing soil erosion and fixing nitrogen. Of course, as with most broad policy prescriptions, there are qualifications attached to a call for further research and extension

emphasis on crops other than rice, maize, and wheat. Specifically, it may prove more cost-effective to concentrate on breeding into a major cereal the robust characteristics of millet or the famine-preventing characteristics of cassava, for example, than to try to increase the yields of these secondary crops. The calculus required to resolve such a question must consider a range of issues, from who produces the various crops to the expected costs of investments in plant breeding that are required to achieve the desired crop characteristics.

In a similar vein, development of technologies should focus on alleviating bottlenecks in labor and other seasonal scarcities of productive resources. Doing so is not only important to reducing the seasonal variability in income and labor demand, but is a key element to encouraging adoption of new technology. For example, a new technology might not be adopted because the labor requirements during harvesting far outstrip the available work force. Similarly, a new technical package for hybrid maize production may be rejected by the farmer even if it dramatically raises yields, because it does not provide the same level of food security during seasonal shortages as, for example, a mixed cropping strategy that ensures some food output throughout the year. Quite simply, not taking into account seasonal constraints and bottlenecks may impede adoption and thereby indirectly worsen the food security and nutritional status of the household and community. This implies that the focus on profit maximization and risk minimization should be broadened to include the farmer's concern with transforming lumpy input requirements, production, and profits into access to food in all seasons. Agricultural research and extension will therefore best serve the needs of the poor if technologies: (1) take advantage of seasons of low labor demand and increase labor efficiency at peak season; (2) promote cropping strategies that minimize input requirements during periods of scarcity; (3) provide for reasonably priced credit through well-organized and accessible institutions at strategic periods of the year; (4) take into account the need for on-farm

and other forms of storage between harvests; and (5) improve upon, rather than totally ignore, the traditional cropping strategies employed by the farmer.

Infrastructure

Development and improvement of infrastructure are essential ingredients in the reduction of the harmful effects of seasonalities in the food system. Enhancing market, transport and storage infrastructure will raise productivity and improve the efficiency of marketing. Doing so is the key to increasing food availability, reducing prices of agricultural inputs and food products, and moderating the intertemporal costs of storage through lowering post-harvest losses. Development of irrigation infrastructure is also a key element of any strategy to increase food availability. At the same time, appropriate irrigation schemes will often allow farmers to plant a second crop, or at least be more certain of success, thereby enhancing food availability during the dry season.

Improved credit infrastructure, where the cost of borrowing does not dramatically exceed the returns to savings, is also of paramount importance in enabling the household to engage in intertemporal budget allocation to smooth out consumption in the face of lumpy incomes and seasonal price increases. Institutional credit is often quantity constrained and thereby difficult for smallholder and landless households to obtain, highlighting the urgency in the area. This priority is given further impetus by the recognition that the major cost to traders of intertemporal arbitrage is that of borrowing money. To the extent that credit systems are made more efficient and accessible, the seasonal increases in prices will be dampened.

Improved infrastructure will also reduce the harsh effects of the seasons on nutrition and food security through a variety of indirect means. These include reducing the search and transport costs for off-season employment, facilitating the transfer of remittances to families that temporary migrants

leave behind, improving access to health clinics for the ill, and easing travel to villages for health workers charged with combatting seasonal diseases such as malaria.

Targeted interventions

There are limits to the speed at which the above solutions to seasonal malnutrition and food insecurity can be achieved. Likewise, even if the factor and product markets are made more efficient and their performance dramatically improved, there remains the prospect of a large number of indigent households still unable to cope adequately with the stress and strain of seasonalities in their environment. As a consequence, there remains a role for targeted interventions during the transitional period when a sub-set of the population is at risk.

A wide range of options is available to assist households in coping with marketing inefficiencies, dislocation, and other factors that imperil households during the lean season. These fall into three categories: (1) generating income through productive work; (2) transferring income directly to households; and (3) moderating prices faced by consumers. All the types of interventions that fall in these three categories can be applied in a seasonal fashion. It should be recognized, however, that the financial savings to temporal targeting may, in certain instances, prove extremely limited if the fixed overhead costs are high and/or there are costs of stopping and starting interventions, such as not being able to retain qualified personnel.

Among the three categories above, the first which involves generating income is in most cases preferred. Projects that generate employment and income during the slack season offer considerable opportunity for raising consumption and reducing malnutrition. Labor-intensive work in particular is the most promising of these types of interventions (Thomas, 1985, Clay, 1986, Sahn, Rogers, and Nelson, 1981, and Sahn, 1983) although other means of generating income during the slack season include home gardens and the

development of cottage industries. Concerning public works, not only do the participating individuals benefit, but so do others engaged in the wage labor market, as the project represents a means of instituting and supporting a wage floor during the slack season. In addition, there is long-term potential of promoting self-sustaining development and addressing seasonal constraints through developing infrastructure and creating economic assets. While many public works efforts involve partial payment in-kind, usually food, payment in the form of inputs such as fertilizer are also possible. The reason for using food rather than cash is generally dictated by its easier availability from the donors in the form of aid. While cash is the preferred form of payment in most cases, there are exceptions. Specifically, if the region faces a food shortage during the slack season, any large infusion of cash poses the risk of putting added pressures on food markets, thereby contributing to escalating prices. In a similar vein, payment in the form of fertilizer may be commended to alleviate seasonal shortages of the input itself.

While generating income is the ideal, these interventions often carry high costs in terms of the payment to workers, the necessary complementary inputs in the form of tools and equipment, and management. Coupled with the fact that income generating initiatives are likely to cover only a limited number of households (e.g., excluding those unable to work), it is frequently necessary to resort to transfer programs and price subsidies to reach the poor. The literature on these efforts, including mother and child feeding projects, food stamps, and price subsidies, is vast, having been reviewed thoroughly elsewhere (Pinstrup-Andersen, 1988, Kennedy and Alderman, 1987, Beaton and Ghassemi, 1982, Anderson et al., 1981, and Sahn, 1986). Let it therefore suffice to say that such intervention schemes provide an opportunity for temporal targeting. Food subsidies, for example, can involve a flexible price wedge, being relatively larger in the lean season than during the period after the harvest. Similarly, it may be possible to focus consumer subsidies on self-targeting foods such as cassava and other roots and tubers

that are also an important means of coping with seasonal food shortages and high prices of cereals.[1] In a similar vein, there is considerable scope for targeting food stamps and mother and child feeding programs to coincide with the season of greatest food stress. But, once again, the appropriateness of doing so will be conditioned by the relative costs of temporal targeting compared to year-around operations.

Finally, other initiatives not generally considered nutrition and food security interventions also warrant attention in the seasonal context. These include provision of consumption credit to needy households during the pre-harvest season; facilitating seasonal migration through improved child care services and housing for migrant families; augmenting mother and child health care service delivery to respond to the seasonal fluctuations in disease; spreading out tax collection so that it does not correspond to periods of the year in which the household is purchasing inputs; and adjusting the school calendar so that a period of vacation coincides with the peak demand for labor. Since the need for and appropriateness of the range of intervention programs must be determined on a community-by-community basis, there is considerable merit in carefully assessing the nature of the problem prior to selecting among the alternatives to reduce seasonal malnutrition and food insecurity.

CONCLUSIONS

This paper has highlighted the most important dimensions of the patterns and stresses that lead to seasonal episodes of malnutrition and food insecurity. In doing so, a number of salient conclusions emerge.

[1]Another benefit of subsidizing self-targeting foods is that these secondary crops are often produced by the poor. Raising their demand through a price subsidy may increase incomes of poor produce if the treasury drives a wedge between the consumer and producer price.

First, there is a need for further research to better understand the functional implications of seasonal growth faltering reductions in food energy intake. Doing so will provide a more sound basis for judging the urgency that should be accorded the observed variability in food consumption and anthropometry.

Second, even if the extent of impaired performance and physical damage remains ambiguous, it is important to recognize that there may also be long-term deleterious economic and social consequences of seasonal stress faced by rural population. For example, during the pre-harvest season when resources are depleted, poor households have been known to sell off their assets to avoid going without food. Similarly, seasonal migration, leading to a dissolution of the family structure, carries a high social cost. While such outcomes will not be measured by nutritional status and consumption indicators, at least in the short-term, they may contribute to chronic impoverishment and despair.

Third, there is little question that agricultural growth and market development represent the long-term means of reducing seasonal food insecurity. One need only witness the almost total lack of seasonal cycles of malnutrition and food energy intake in developed countries. Likewise, the magnitude of seasonal fluctuations in consumption is generally smaller in middle-income countries where agricultural and market development are more advanced. This reduction in seasonal food insecurity occurs despite agriculture itself remaining a highly seasonal endeavor.

Likewise, seasonal patterns of work, incomes, and food security are most pronounced in the lowest-income countries, especially in Africa, where a combination of environmental factors (e.g., unimodal rainfall, soils that do not hold moisture) and economic stagnation contributes to making seasonal fluctuations in food security most acute. The evidence from Asia also indicates that in the poorest countries like Bangladesh, seasonal food insecurity is predominantly a characteristic of poor rural communities, especially in

areas where the agricultural calendar is highly seasonal in terms of the timing of food production and labor demand.

Fourth, in reducing the extent of seasonal variations in third world agriculture and mitigating the consequences of such patterns, the role of government should primarily be to create an economic and social climate that will encourage private sector initiatives to improve seasonal food security. This involves gathering and disseminating information to improve competition and the efficiency of intertemporal arbitrage among traders. There is also a need to assist farmers in increasing production through promoting systems that (1) ensure the availability of inputs (e.g., fertilizer) at reasonable prices, (2) encourage the development of small-scale irrigation and water management schemes to reduce the seasonality of production, (3) support national agricultural and farming systems research institutions that promote technological change to alleviate seasonalities in agriculture, and (4) disseminate knowledge and experience through extension services. In addition, government plays a key role in expanding the infrastructure that will allow the private sector to carry out its storage and interperiod marketing and processing functions more effectively. The development of institutions that facilitate rather than impede the functioning of credit markets is fundamentally important. It can be achieved most effectively by adherence to policies that reward savers and encourage borrowers through interest rate reforms.

In fostering the appropriate economic climate to reduce harmful seasonalities, effort should be made to exploit traditional social and cultural arrangements that afford a degree of protection form seasonal stress, as well as promote indigenous agricultural practices that provide some protection from high prices and reduced incomes during the lean season. In practice, however, as the process of economic development moves forward, many of these traditional practices will give way to reliance on product and factor markets to cope with seasonal fluctuations. While this transformation is to

be encouraged since it provides the basis for sustained income growth, seasonal stress may be attenuated during a period of transition from indigenous cropping strategies to increased reliance on markets and new technologies, especially if the former are distorted and inefficient, and the latter are not appropriate.

Vulnerability during such a transition is the basis for the fifth conclusion: there is a role for temporally targeted interventions such as food-for-work, food subsidies and stamps, and mother and child feeding projects. These initiatives represent a potential bridging mechanism to protect the poor. Nevertheless, concerns such as the difficulties of targeting needy households, the propensity for such targeted efforts to be poorly administered and not well planned, and the high budgetary costs involved suggest the need for great care in designing and implementing such initiatives. The same underlying factors that contribute to inefficient product markets (e.g., poor infrastructure, acute policy distortions, limited human and financial resources) will impede effective targeted intervention schemes. This represents a vexing problem which only serves to highlight the need for donor assistance to overcome these constraints.

Sixth, as with many problems related to economic development, it appears that rural populations are most susceptible to the deleterious effects of seasonality. Rural agricultural and wage employment, and therefore rural incomes, are linked to variability in the agricultural calendar. In addition, rural consumers are more likely to confront greater fluctuations in market prices, because imperfections in marketing systems are likely to be greatest in remote areas. This is partially attributable to the dearth of available physical and social infrastructure as one moves further from major urban settlements. Furthermore, action is required to address the pro-urban bias in terms of both the development of infrastructure and the implementation of targeted measures, such as subsidies and transfers, to ensure access to adequate food.

Finally, seasonalities vary from year to year, country to country, region to region, village to village, and household to household. This implies the need for decentralizing policy-making and for developing and promoting versatile responses to seasonal stress. Emphasis must be placed on creating a social, economic, and political environment at the local level that will facilitate initiatives among villages and households to cope with the changes and hardships wrought by the seasons. This applies to both indirect efforts such as the development of technologies that allow the farmer greater flexibility in planting and harvesting dates and direct interventions that, for example, provide food supplementation to pregnant women during the lean season or consumption credit to households when they are in greatest need. Accommodating the wide range of seasonalities with a diversity of responses represents the key to overcoming seasonal food insecurity and malnutrition.

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