Uncertain Marriage of Price Policy and Agricultural Research: Case of Cassava in Latin America

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Abstract: To foster agricultural development, a number of strategies are available. A well-known, long-run strategy is productivity-increasing research. Another familiar, short-run strategy is input and output price policy. This paper argues that effectiveness of price and research policies can only be obtained if they are defined interactively, with one complementing the other. This is illustrated by showing how cassava, a traditional crop in Latin America, has evolved with respect to research and price policy over the last few decades. Three main dimensions are distinguished. The first is appropriate timing of research and price policies in relation to changing structural features of the economy. The second is price policy to support diffusion of research-based technology. The third is definition of research policy in relation to the socioeconomic environment in order to maximize the impact of price policies. The historical development of Latin American agriculture and cassava's position within it over the last 10 years is used to illustrate these points. A major problem in obtaining more consistent and development-focused research and price policy is that the locus of decision making for these two policies is often in completely different institutions.

Introduction

Should price policy and investment in agricultural research[2] be more functionally integrated? Prices will influence the adoption of technologies and in turn the potential returns to research investment. Induced innovation theory would extend the relationship even further by suggesting a functional link between relative prices and selection of research lines (Binswanger and Ruttan, 1978). Conversely, widespread adoption of an improved technology can radically change relative prices in an agricultural economy, fundamentally altering consumption patterns, producer incentives, and income streams. How price policy should be more consistently integrated into decision making within agricultural research programmes is by no means clear. Do policy makers have a clear framework for incorporating agricultural research resource allocation into medium-to-long-term price policy objectives? To date, decision making in each area has usually been independent of the other area, often leading to significant inconsistencies and inefficient use of resources. This paper will argue for a better integration of the two, focusing on the case of cassava in Latin America.[3]

Subsector Approach to Linking Agricultural Research and Price Policy

Price policy principally influences relative commodity prices. Price supports, subsidies, and interventions by marketing boards have a commodity focus. Exchange rate policy, although having a more generalized effect, nevertheless has a significant impact on relative prices of tradeable versus nontradeable commodities. Moreover, many governments will intervene through import controls to further mediate the effect of exchange rates on relative commodity prices. Even input price policies have direct impacts on commodity prices by favouring crops where those inputs are intensively used; furthermore, rationed credit is usually linked to particular commodities. Thus, although price policy objectives in the agricultural sector may derive from broader development goals, the instrument is normally relative commodity prices.

Agricultural research is predominately organized along commodity lines. A natural congruence occurs, therefore, between price policy and resource allocation within agricultural research. That this congruence has not been exploited has in part to do with the short-to-medium-term planning frame of price policy compared to the medium-to-long-term planning frame of agricultural research, as well as with the weak institutional linkages between policy

and agricultural research institutions. Nevertheless, the frequent complaint from scientists that economic incentives are limiting the diffusion of new technologies points to the need for a more consistent integration of decision making within the two areas.

Agricultural research, particularly within commodity programmes, focuses almost exclusively on production issues, usually on research to overcome yield constraints. Price policy, on the other hand, is principally formulated in terms of objectives that originate on the demand side; e.g., price of wage goods, nutrition and food costs for low-income consumers, and inflation control. Where producer income and/or commodity trade objectives are not consistent with price norms to meet demand objectives, usually subsidies rather than increased investment in commodity research are used to meet these multiple and otherwise inconsistent objectives. However, because of the increasing ease of substitution among commodities, such interventions give rise to a favouring of some commodities over others, often resulting in redistribution of income among regions and farm size strata.

Governments have not fully exploited either the cost reductions or the substitution possibilities arising from agricultural research in the planning of the agricultural sector. Like subsidies, agricultural research allows governments to reconcile otherwise inconsistent objectives, but, unlike subsidies, research investment does not introduce market inefficiencies. Medium-to-long-term changes in relative commodity prices induce real resource allocations in terms of shifts in farm investments, processing capacity, and marketing channels and can cause significant changes in consumer preferences. The link between investment in commodity research and impacts on production costs and market prices is more uncertain in terms of the size of the impact and the time frame, but the market, resource, and demand adjustments are economically efficient rather than dependent on the size and stability of fiscal budgets.

To begin to forge better links between price policy and agricultural research, the latter must integrate demand issues more effectively into research planning. The idea that commodity research should encompass postharvest and use aspects raises questions about how demand studies should influence what is essentially production-oriented research. The argument in this paper is that production, processing, marketing, demand, and policy studies can be integrated within a commodity subsector analysis. The approach, as shall be seen, broadens the scope of research and technology development and attempts to introduce a dynamic element in research planning, especially through attempting to forecast changing demand.

Major foods crops are a principal focus of agricultural research in developing countries. Nevertheless, as incomes increase and these economies urbanize, direct food demand for starchy staples becomes very inelastic. Since a principal objective of agricultural research is improved farmer income, often linked to increased labour productivity and employment, diffusion of new technology under inelastic demand conditions can lead (but only rarely does in LDCs) to immiserizing growth in rural areas. This has led to what may be termed the "diversification" problem (Schuh, 1987): how to achieve a balanced adjustment in commodity mix and resource use as the agricultural sector declines in relative importance in the economy, as growth in rural labour starts to decline absolutely, and as urban food markets start to supersede rural markets in relative importance. Crop diversification is the traditional solution; diversification of end markets for a particular commodity is an alternative solution. Agricultural research has an obvious role in facilitating these adjustments, but planning must employ a dynamic framework that explicitly incorporates demand issues.

Latin America: Structural Change and the Policy Framework

In the postwar period, tropical Latin American countries have been beset by a complex environment in which to administer food policy. Latin American economies underwent significant structural change, led by significant growth in the industrial and service sectors, relatively high rates of population growth, and what in many instances amounted to

hyperurbanization. In the postwar period, these countries were transformed from essentially agrarian economies to urban, industrial economies, a process that created significant economic and social stresses. These stresses had their origin in the skewed distribution of land in the agricultural sector. Push factors, such as the rapid mechanization and intensification of large-scale farming—capital inputs increased from 20 to 48 percent of the value added in the agricultural sector in the period (CIDA, 1986)—and pull factors such as the disparity between industrial and agricultural wages, resulted in "excessive" rates of rural-urban migration. Unbalanced growth set up the food policy context; i.e., high rates of urban underemployment leading to growth in urban malnutrition, rising incomes and urbanization leading to changing food consumption patterns, and significant imbalances in availability and demand for key commodities leading to upward pressure on food prices. Policy makers were faced with the contradictory objectives of maintaining producer incentives in order to increase food supplies and control migration and of keeping the prices of key food staples in urban areas low.

Tropical Latin American countries have all intervened in their domestic agricultural markets. State marketing agencies were created as agents for administering price policy, usually with control over price supports and varying degrees of control over agricultural trade. Credit subsidies, often linked to other input subsidies, were used to stimulate priority commodities differentially. Governments often used consumer subsidies and programmed imports, usually under overvalued exchange rates, to maintain low, urban staple prices. Resulting fiscal deficits, nevertheless, either fuelled inflation or contributed to a growing external debt, a flexibility that was lost in the 1982 debt crisis.

Cereal grains were the logical focus of these interventions, due to the ease of controlling prices through stocks, import controls, and purchases, as well as their overall importance in the diet. However, the rising demand for animal products and the shifting of grain use to animal feeds created problems in the management of price policy due to unforeseen substitution effects; e.g., Mexico had to prohibit the use of maize in animal feeds, while in Brazil and Venezuela significant quantities of subsidized wheat went into feed rations. Moreover, substitution effects in basic foods as well were significant; in particular the rise of rice and wheat as urban staples came at the expense of the traditional staples, especially cassava and maize—apart from Mexico and parts of Central America. The latter resulted in a stagnation of income for producers of these commodities, mainly small-scale farmers, usually in poorer agricultural regions, and thus accentuated the dualism in the agricultural sector. Thus, while governments attempted to design programmes to address the problems of rural poverty and small-farm incomes, price policies indirectly undercut the economic basic of such programmes.

Cassava Subsector: Research Strategy within a Policy Context

Cassava, a tropical starchy staple, is a commodity that clearly demonstrates the value of the subsector approach to designing a research strategy. The crop's physiological characteristics result in high starch yields under a wide range of tropical conditions and with a comparative advantage over other crops in marginal agroclimatic zones. These factors, together with cassava's indeterminate harvest period, make it an ideal subsistence crop. Cassava's postharvest characteristics, on the other hand, define cassava's potential as a cash crop and are especially demanding in the provision of timely marketing services. The roots, once harvested, are highly perishable, bulky to transport, and normally contain about two-thirds water by weight. These characteristics, together with the hydrocyanic acid content, usually require cassava to be processed to develop extensive markets.

Because of perishability and bulkiness, processing should be well integrated with root supply in the production zones. Processing, however, is defined by the use characteristics of individual end markets; price signals and marketing channels should therefore be sufficiently flexible to convey and respond to the changing needs of diverse end markets, normally centred in urban areas. The difficulty is that in these end markets (i.e., starch,

animal feed, traditional food products, and flours) cassava must usually compete with relatively dissimilar substitutes, resulting in demand and price being determined quite independently in each market. These supply and demand characteristics create the problem of defining an appropriate development strategy within a cassava subsector.

The issue then is how to link research strategy on cassava to development objectives and price policy in Latin American countries. Cassava provides a natural linkage to development of the small-farm sector, especially that portion that tends to be concentrated in more marginal agroclimatic regions such as Brazil's Northeast. Cassava is relatively difficult to mechanize, provides a significant return when the land resource is limited, and responds well to improved management. Cassava is almost exclusively grown by small-scale producers. One rarely finds a crop in Latin America where new techniques can be directed principally towards small-scale producers. Cassava research is virtually alone in being able to be targeted on small-scale farmers in marginal agricultural areas.

However, if increased small-farmer income is the objective of cassava research, efficient marketing channels and elastic market demand become complementary and in many cases necessary components of the strategy. In Latin America, cassava markets are still dominated by traditional food products: *farinha de mandioca* in Brazil, *casabe* in the Caribbean, and fresh roots in the rest of Latin America. Demand for both *farinha* and *casabe* is inelastic, and markets for fresh cassava are highly fragmented. However, unlike what has occurred in Asia, no diversification of cassava markets has occurred; extreme price variability in traditional markets and discriminatory price policies for grain substitutes have limited the development of a multiple market structure for cassava. Thus, for a research strategy in cassava to be successful, it must incorporate demand and price policy as well. Integrating production, marketing, use, and price policy is the hallmark of a subsector analysis.

The limited research history in cassava compared to that for grain crops also provides arguments for the integration of research on both production and use. Production research in this tropical root crop has been very scarce compared to the research on grains in temperate countries. What is often not noticed is that processing and use research is even more limited. Developed countries have done extensive research on technologies for processing rice, wheat, maize, and, to a lesser extent, sorghum, and significant manufacturing capacity has developed. Grain milling capacity in developing countries has been based on this imported technology and, in general, has captured economies of scale as urban centres have developed and processing capacity has concentrated there. Not only does cassava processing and use have a limited research history, but achieving economies of scale has been difficult because of the concentration of processing and use in production zones. When the setting up of large factories has been rushed, cassava projects have failed miserably. In Latin America, the limited investment in production research on cassava has achieved little because of the lack of investment in processing research and market development.

In the case of cassava in Latin America, the orientation of subsector studies should focus on evaluation of market diversification and/or improving market efficiency. In tropical Latin America, market diversification implies the capture of an increasing market share, which can be achieved by substitution for maize, sorghum, or wheat imports. However, this is the juncture where price, exchange rate, and grain import policy influence whether cassava can begin to compete in these alternative markets. Because of policy interventions, cassava's competitive ability can be independent of comparative costs of production, processing, and marketing. Cassava subsector studies must thus begin with a macro, country-level assessment of grain markets, existing cassava markets, and price policies. The dual side of the problem focuses on comparative costs—optimally within a DRC framework. By necessity, this is more disaggregated, requiring specification of principal production regions, production systems, and marketing and processing costs. The analysis leads optimally to a targeting of research; i.e., policy research, market development priorities, the mix of production and use research, and production region priorities. Small-farmer income generation provides the common thread that must run through the analysis,

and the process necessarily leads to a better integration of price policy formation and research investment.

Strategies for Cassava Development in Latin America

Agricultural price has been a principal mechanism for achieving development objectives in Latin America. However, too often policy makers have resorted to subsidies in order to accommodate conflicting objectives, and when individual policy objectives have been matched with single commodities, substitution effects have often either undercut the effectiveness (or budgetary cost) of the policy or have had unanticipated negative impacts in other sectors of the agricultural economy. The 1982 debt crisis and the policy commitments to control inflation have severely curtailed traditional policy interventions by eliminating subsidies, correcting overvalued exchange rates, and reducing import capacity. Tropical Latin American countries have thus been forced to stimulate their domestic agricultural sectors with less flexibility in terms of traditional policy options. In this environment, well-focused agricultural research linked to market and agroindustrial development, exploitation of a larger range of crops, and policy interventions on the basis of sectors (e.g., the grain-livestock or oilseed sectors) rather than individual commodities, would all provide increased alternatives to meeting a range of difficult development objectives.

Within this "new" policy environment, cassava provides an unexploited means of having an impact on such objectives, particularly increased small-farm incomes in more marginal agricultural regions, increased rural employment and rural incomes in more marginal agricultural regions, increased rural employment and rural incomes through rural-based agroindustry, and improved domestic supplies of food and feed. With the changes in price policy, cassava is now competitive in a range of end markets. Thus, bringing cassava into the policy process and ensuring consistency across starch sources introduces new flexibility to policy makers in meeting difficult policy goals/objectives.

Cassava development in Latin America depends on a close integration of production and use research. Nevertheless, cassava development starts with use, by defining a market of sufficient size and in which the product can feasibly compete with substitutes. Once this market has been defined, marketing, processing, and production plans have to be designed and coordinated. Care has to be taken that the scale of operations is compatible at different market stages and appropriate for the target group of beneficiaries. These will be mainly small farmers, for whom developing appropriate credit schemes, organization forms, and marketing arrangements will be critical to cassava expansion.

Given the need to restructure marketing channels, cassava development can best be promoted through pilot projects and their subsequent multiplication. Pilot projects facilitate fine-tuning and integration of production, processing, and marketing components, as well as adaptive research at each of these stages. The flexible nature and low investment costs in a small-scale, pilot project allow stepwise improvements in production, processing, and marketing efficiency. Matching a target production region and target farmer population with end-market development is the key to attaining effective impacts in cassava development projects.

Research and development strategy in cassava has been conditioned by the vagaries of price policy in competing grains. A dynamic and interactive relationship exists between cassava research and grain price policy, best analyzed within a subsector framework. Cassava research becomes focused by concentrating on the commodity subsystem (i.e., the vertical set of functions from production to consumption of the commodity), while profitability and impacts are guaranteed by focusing on markets and price policy within the whole grain subsector. The dynamic and interactive nature of the process depends on the link between research and policy institutions. What binds them together is the analysis; where the analysis is done depends on the makeup of the respective institutions, but some analytical capacity within crop research institutions is necessary. Grain price policy and cassava development are integrally linked in Latin America; policy makers must realize this.

Notes

[1]Centro Internacional de Agricultura Tropical, Cali, Colombia.

[2]Agricultural research in this paper means principally commodity-based research, including those activities that extend from more basic research to adaptive research, including extension.

[3]Price policy can either promote or inhibit the adoption of improved technologies. Whether or not price policy and investment in agricultural research are institutionally linked, the efficiency of research investment is necessarily linked to relative prices in agricultural markets. Conversely, agricultural research can be an efficient means of achieving price policy objectives. A rational, economic argument thus exists for consistent integration of the two. This integration, however, necessarily leads to institutional capacity to further politicize agricultural research. This is a legitimate concern and should condition how the institutional linkage is made; however, that topic lies outside the scope of this paper.

References

Binswanger, H.P., and Ruttan, V.W. (1978) *Induced Innovation: Technology, Institutions, and Development*, Johns Hopkins University Press, Baltimore, Md., USA.

CIDA (Canadian International Development Agency) (1986) "Agriculture and Rural Development in Latin America," Ottawa, Ont., Canada.

Schuh, G.E. (1987) "Meeting the Challenge of Diversification Out of Rice Production in Asia: Towards a Research Agenda," paper presented at a CGIAR Group Meeting, Montpellier, France.

DISCUSSION OPENING—*J.S. Sarma* (International Food Policy Research Institute)

The results of a cassava study recently completed by the International Food Policy Research Institute, "Past Trends and Prospects for Cassava in the Third World," illustrate some of the conclusions in the paper by Lynam *et al.* While analysis at the subsector level to study the integration between the price policy and agricultural research is useful and necessary, decisions on price policy need to be taken at macro level. Subsector analysis sometimes leads to certain commodities being advocated, when their development may not otherwise be justified. The Delphi survey for assessment of potential yields of cassava and constraints on farmers achieving the yields confirmed that lack of incentives inhibited the diffusion of technology. However, the technology route to increased net returns through increased productivity is preferable to the price policy route, although remunerative prices are necessary to ensure the adoption of new technology.

Application of fertilizer alone would increase cassava yields by five tons per hectare even on ordinary soils, without irrigation; and with high-yielding varieties, the productivity would rise further, reducing the unit costs. This would facilitate end-use diversification. Experience in Thailand showed that crop diversification was difficult to achieve in marginal areas where cassava is grown.

The high priority to be given to cassava R&D is justified by considerations of equity and poverty alleviation in marginal areas, as in Northeast Brazil and Northeast Thailand, and by food security considerations in Sub-Saharan Africa, where food shortages are expected to continue for some time to come.

GENERAL DISCUSSION—*Winfried Manig, Rapporteur* (Universität Göttingen)

The discussion on this paper centred on the importance of the price policy for cassava. Price policy has become important because cassava has for a long time been excluded from the market system. Since cassava is regarded as an inferior food, the analysis should use different income strata, as the demand depends on income, and not a general model. Another aspect stressed was the importance of demand for animal feed, which should be included in the analysis. Cassava has for a long time been neglected in research activities; however, the impact of technological improvement has been very significant in recent times.

Participants in the discussion included G. Escobar, R. Evenson, F. Jarrett, T.P. Phillips, S. Setboonsarng, and S.C. Thompson.