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ON GETTING AGRICULTURAL GROWTH IN SUB-SAHARAN AND SOUTH AFRICA

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In this paper basic considerations underpinning agricultural supply are revisited. Some conditions are easier said than achieved, but little growth is likely to be feasible unless nearly all are adequately catered for, including the policy and institutional environments, with particular emphasis on the effective provision of public-sector services, from infrastructure to knowledge and information.

INTRODUCTION

This is a first and for me most welcome opportunity to share some thoughts with this Association about African agricultural development. For lack of country-specific knowledge, most of these thoughts will be at a generic continental level, a theme on which I have had occasion to reflect from time to time (e.g., Anderson 1992, Crosson and Anderson 1995), but I believe there will be much of direct relevance to South Africa itself as it faces new and urgent challenges in this domain.

Reference to China has been made at several points in this Conference and, in the same spirit, it is useful to do so again. China has been something of a success story, averaging nearly five percent output growth per annum over the period 1965-9. Fan and Pardey (1996), in a recent econometric investigation of the sources of growth, have decomposed the growth picture into the massive (some 46 percent) contribution of conventional inputs, such as land, labor and capital. Most notably, the increasing use of fertilizer has played a major role (nearly one-half of the 46 percent) in the growth of Chinese agriculture, as it has in many parts of the world, including Sub-Saharan Africa (Heisey and Mwangi 1996). Perhaps of greater novelty and interest to this Association may be the considerable effect ascribed to some of the institutional developments. The major economic reforms of the late 1970s and early 80s in China (Perkins and Yusuf 1984) were identified as explaining 18 percent of the total growth over this period. An even more remarkable result has been the 20 percent of the growth attributed to the Chinese investment in agricultural research. Needless to say, the selected variables did not explain everything, and there is a residual of some 16 percent of growth attributable to other factors.

SOME POLICY REQUIREMENTS

The Chinese experience serves as a convenient backdrop to our discussion because we need to reflect on at least the several factors measured in the China study when we begin to contemplate what might be useful in an African agricultural policy context (e.g., McNamara 1985, Jaeger 1992, Cleaver 1993, Piesse et al. 1996, Tolley, Thomas, Nash & Snyder 1996). Accordingly, some key findings of studies pertinent to the theme are briefly reviewed. I also want to make brief mention of a World Bank study directed by Anne Krueger in the mid-80s (Krueger, Schiff & Valdés, 1988, 1991, Schiff & Valdés 1992, 1996). By way of an excessively cryptic overview of a many-volume study, the main finding is the high level of (mostly indirect) taxation in the agricultural sector, severe in many cases, often running to effective rates of the order of 50 percent. In the cross-

country examination, unsurprisingly, it was found that the high incidences of discrimination against agriculture were strongly related to low-growth achievements. Much of this taxation was through overvalued exchange rates. As we ponder such policy perspectives, it is evident that many countries still have far to go in correcting such impediments to progress.

Hans Binswanger addressed this Conference some years ago, explaining what he calls our "painful lessons" (Binswanger 1994), and I thought it would also be helpful to remind us of Hans' painful lessons when we're thinking about growth challenges. For brevity, I will not belabor these points, probably well known to analysts in South Africa before Hans visited. The consequences of urban bias in so much of African development, and the problems of dealing with both food scarcity at one end of the spectrum and the "compensation" policy for the rural elites at the other end, were not exactly new, and similarly for the misguided land policies that have often bugged development, the neglect of women farmers in far too many cases and a general lack of appreciation by the planners at many levels of the positive effects in poverty reduction that can be achieved through agricultural growth. Agricultural growth is still very much on the policy agenda.

AGRICULTURAL SUPPLY BASICS

Now, to get back briefly to some basic economics, I would like momentarily to remind us of some of what we learned as undergraduates about the nature of agricultural supply response. First, what happens to individual crop supplies? We can get high levels of response to changing prices in the short run but what we are really doing is just shifting around farm-area allocations and variable factors of production. Short-run individual own-price supply response can be quite elastic, even more than 0.5 in one-year supply response (there is a large literature, distilled by many authors, including Johnson (1950), Binswanger (1990) and Dillon and Anderson (1990)). Naturally the situation is more complex with long-cycle crops, such as tree crops, and of course we all know the special problems with livestock supply response in the short run, where we get quite the "perverse" short-run effects as people make livestock investment decisions based on their price expectations.

What we're really concerned with when we're talking about getting growth out of the sector, however, is much more the matter of aggregate agricultural supply, and we need to highlight that we can really only get this through a program of investment, and achievement of productivity growth in particular, with migration playing

an important part in many countries, especially this one. It is not surprising that we find that aggregate supply response is extremely inelastic in the short run, but what several recent studies, mainly in Latin America, have shown us is that, over a long enough adjustment period, the long-term response to investment and changing prices in agriculture can indeed be quite elastic, reaching unit elasticity in about ten years in the case of Southern Cone countries in Latin America (these studies are conveniently summarized by Mundlak 1996). Non-agricultural industrial growth differences are critical to the story on labor mobility and its contribution to long-run supply, but agricultural profitability is the key force that drives investment decisions that will give us the long-run response (Binswanger et al. 1987, Mundlak 1996). Mundlak's modeling of long-run supply phenomenon represents the most insightful analysis of such processes generally and, personally, I find this a much more insightful way of representing such empirical regularities than, say, the Nerlovian type of models on which we all cut our teeth, even if they are sometimes nearly observationally equivalent.

For brevity I won't dwell on this part of the story, except to re-emphasize that profitability is what really drives it, conditioned as it is by taxation rules and rates, the costs of borrowing and, of course, many other things. Our subjective expectations in an uncertain world about such factors as weather, markets and policies determine expected profits and thus directly influence our individual investment decisions, as well as our public investments to some extent. The particular problems of dualism in this regard were certainly strongly to the fore in much of the discussion in this Conference. But whether we're looking at the commercial or subsistence sector, one of the most important messages is that related to the role of technical change in getting growth in either one of these sub-sectors (Thirtle et al. 1993, Jayne et al. 1994, Thirtle, Hadley & Townsend 1995, Alston & Pardey 1996). It's this message on which I'd like to concentrate some attention below, if space permits, which is not to suggest that other themes such as irrigation (Crosson & Anderson 1995, Jones 1995), and structural adjustment, and some of its problems, are not important (Cleaver 1993, Mosley 1996, OED 1993b, 1996c), but I think that I can make the best use of my time now by moving on to a brief consideration of some of the other major supply factors involved in getting all-around growth.

SHIFTERS OF SUPPLY

There are many shifters that we could consider, and space limitations oblige some selectivity. Clearly the of availability of capital generally is vital, as is the provision of public inputs. Aspects only of these are taken up here. For those who know me, the emphasis I will eventually give to technology will come as no surprise.

The first shifter—first in several senses—is **education**. It is too easy to underplay the value of investment in education, particularly as a major source of public intervention that will ultimately drive agricultural growth. This phenomenon has, to the extent that it has been considered, largely been dealt with on an intuitive level. There are very few cogent, careful analytical studies on which to draw. Some of the best are those conducted by Binswanger and colleagues in India (Binswanger et al. 1987), where they found that, even

concentrating on low levels of primary schooling, powerful growth effects pertain, as measured by increasing agricultural productivity, and labor productivity in particular.

Literacy generally also helps underpin strong agricultural growth, and this is another finding from the Indian case studies. It is, however, salutary to reflect as well on the rather dismal growth experience in contemporary former Soviet Union countries, where literacy levels are outstandingly high, almost 100 percent, and agricultural growth has recently been absolutely dismal—with explanations naturally lying elsewhere. One other interesting recent study is by Evenson (1996), in which he found remarkably high marginal internal rates of return (of the order of 40 percent) to investment in education in rural areas of the USA, and clearly also a strong contribution to economic growth.

The list of public investments that contribute to agricultural growth is potentially long, but one I do want to highlight is **rural roads**. Here again it would be nice to have much stronger data than we do on the direct effects of investments in roads and road maintenance, especially in terms of the role played in growth. There are a few studies that have documented some of these effects quite nicely, and we see high rates of return and strong contributions to growth (e.g., Ahmed and Donovan 1992, Platteau 1993). And as we look towards the more liberal trading environment emerging from the WTO discussions, I think we'll see that this will give us even stronger returns to our investments in rural transport systems.

Not just because of our Conference venue, it is also appropriate to mention the rural **electricity** supply. Again it would be very nice if we had a much better understanding of some of these linkage effects involved. Clearly, the wide availability of rural electricity has been critical to growth in South Africa, and must be the envy of many elsewhere in Sub-Saharan Africa, even if smallholder access still requires deepening.

More generally, if I could try to modernize this observation, I think we'll see that investment in **communication** systems in general will also prove to be a strong force (Zijp 1995), as farmers and farm groups and small-scale farmers' organizations get linked at low and decreasing cost to electronic mail, and have access to all the information systems that can be accessed through such means as the World Wide Web. Needless to say, this may take a little time to become as pervasive in South Africa as it is already today in many MDCs, but happen it surely will.

It would be remiss if a speaker from my organization didn't at least touch on the issue of **rural finance**. Our experiences here have been diverse (e.g., Binswanger, Khandker & Rosenzweig 1993), and I am surely not doing justice to a complex history of endeavor in the terse way that I will, but what we've found, and through much of World Bank experience in the field of supporting rural finance, is that subsidies inevitably compromise rural finance systems (Adams, Graham & Von Pischke 1984, Adams 1994, Gurand, Pederson & Yaron 1994). The important thing to strive for is much better access to more adequate finance for all the players in the rural sector (OED 1993, 1996a, Von Pischke 1996). Generally, we should try to keep subsidy levels

and the consequent distortions to credit markets to a minimum. We need to be more innovative in getting effective mechanisms to reach those who have the worst connections to rural finance systems, and there is still much to be done in the way of institution building to help this particular element of agricultural growth (Krahnhan & Schmidt n.d., Yaron 1992, Sacay & Randhawa 1995, Yaron, Benjamin & Piprek 1996). I'm sure those of you who heard the Binswanger address would have enjoyed a detailed exposition of some of the painful lessons associated with our less than fully successful rural finance interventions (Binswanger et al. 1993).

TECHNOLOGY

Although I've left this topic to last, I don't think it is by any means the least, with my own opinions reinforced by some instructive interactions with Stephen Carr (Carr 1989, 1993). My use of the term "technology" is shorthand for agricultural knowledge systems more generally. I've already mentioned the education dimensions briefly, and I will now concentrate on agricultural research (Pardey, Roseboom & Beintema 1995, 1996) and touch on extension.

I belong to a school of thought that gives great importance to the contribution that **agricultural research** can and should make in agricultural development (World Bank 1980, Anderson 1994). The mentioned Chinese experience matches my own prejudice and experience quite closely. Fortunately, the World Bank has been a major supporter of agricultural research and its role in economic development but, as we shall see, some things remain yet less effective than they should be.

In many countries we have downplayed the role that universities might play in this wider agricultural knowledge system. Perhaps this is not the case in South Africa, where I am assured there is a healthy engagement between the university sector and the formal agricultural research system (Roseboom, Pardey, Sartorius von Bach & van Zyl, 1996). Yet again, however, we've not yet learned adequately how to involve farmers themselves in the agricultural knowledge system. Particularly as we move towards engaging more closely and effectively the research system with the subsistence sector, I think we have to be imaginative and innovative in seeking mechanisms that direct our research systems to the most pressing problems/opportunities of those resource-poor farmers. The role that non-government organizations can play in this particular aspect is considerable, and we have diverse experiences around the world to guide us in how we might better engage them (Antholt 1994).

Research can be a very positive force, but there are many unresolved issues, particularly in the public research systems that are supposed to be doing all these good things. The one that we find frequently around the world, and especially Sub-Saharan Africa, is the unsustainability of the public funding of the research systems that were created, particularly in the 1970s and 80s (OED 1996b). It was then that they went through their major period of growth, oftentimes with assistance from donor communities generally and international lending agencies, such as the multilateral development banks. After project implementation, it has too often been the case that we have a relatively large system,

with many employees, and a ministry of finance that does not provide the wherewithal to maintain the system in a productive state. Naturally, we then see disappointed scientists, frustrated by the absence of adequate working funds to get to the field or even to operate their laboratories effectively. Disenchantment is reflected in many aspects, but particularly by the lack of research activity and low levels of scientific output. In short, all is not well with many of these systems.

The incentive structures that many research workers are confronted by often do little to encourage them. In many parts of the world, we find that agricultural scientists are working for about a dollar a day or less, and often that minimalist remuneration can be several months late in arriving. It is not surprising that people would look to other sources of employment to eke out an existence. Agencies concerned about these problems, such as the World Bank, thus have a continuing challenge to facilitate the design of systems that fit the needs and resources of countries more closely because, surely, we do really need effective research systems (Crosson & Anderson. 1992).

AN ASIDE ON AGRICULTURAL RESEARCH PRIORITY SETTING

Before leaving agricultural research systems, a word on their focusing through some sensible mechanism for priority setting may be in order. Measuring the benefits of research should take due cognizance of the market setting, but the various economic-surplus measurement formulae (Alston, Norton & Pardey 1995, Ch. 4) all involve some function of these core elements: commodity unit price, P ; volume of commodity production, Q ; and proportional reduction in marginal cost of production, k .

The first two elements combine to give the value of production, PQ . The third element combines many considerations about research opportunity and effectiveness, technology spillover and adoption over time, and the nature of supply and demand relationships, including their dynamics (Alston, Norton & Pardey, 1995, Ch. 5). Subjective judgments about research opportunity determine k and also play such a central role in research priority setting.

Quantifying research opportunity in a transparent and defensible manner is not an easy matter (Maredia et al. 1996). Some of the important component questions that require good judgment and experience to answer will include: What would constitute a "success" in a particular research effort (activity, project, program, ...) over a designated time period? What is the probability of the designated success? What would be the potential proportional reduction in unit costs of production that could be induced by that success? Will adoption of the fruits of the success be profitable, and who (and where and when) will adopt? What will the research effort cost over its life? How and when might the research success "depreciate" in the sense that it is replaced by a superior innovation?

The list could go on, but enough has been noted to illustrate the nature of the judgmental and measurement challenges involved, as well, by implication, as the obvious advantages of using a consistent framework and facilitating software (Alston, Norton & Pardey, 1995; Appendix A5.1, Wood & Wood-Sichra, 1995) in order

to deal with the conceptual complexities as well as the arithmetic burdens in such work. Needless to say, any rough and ready approach to endeavoring to short-cut such complexities, such as the widely-used scoring models (for a cutting critique, see Alston, Norton & Pardey, 1995, Ch. 7), is bound to encounter conceptual, empirical and, consequently, plausibility problems, and may well be quite misleading because of the poor guidance on priorities that results. We thus need to approach pragmatic "priority-setting" efforts cautiously, no matter how well-intentioned they may be, and to seek the installation within national research systems of appropriate state-of-the-art analytical methods, and the skills to make them really useful.

In spite of this warning, there is evidently a desire for simple, undemanding guidelines for use until the more consistent and comprehensive methods can be implemented routinely. A simple rule-of-thumb that could be tentatively entertained would be to apply the following criterion for each potential commodity research program: Invest the budgeted resources if $kPQ > 20c$, where PQ is projected annual gross revenue over the next few years, k is the expected proportional reduction in marginal cost of production associated with a research program that may take, say, five to ten years to accomplish, at an annual cost of about c . The subtlety and challenge lie in estimating k , which in a crude manner (based on unit-elastic supply), can be approximated by the proportional increase in average on-farm yield attributable to the research. Adoption of this criterion, when applicable, would lead to "acceptable" internal rates of return of research investments of the order of 20 to 40 percent (Echeverría 1990; Thirtle, Sartorius von Bach & van Zyl, 1993; Thirtle & van Zyl, 1994; Lubulwa *et al.*, 1995; Oehmke & Crawford, 1996). Noting that the ratio c/PQ is approximately the usually measured Agricultural Research Intensity (ARI), and taking an ARI of 0.005 or 0.5 percent as typical of that found in many LDCs (Pardey, Roseboom & Anderson, 1991), the crude criterion is equivalent to requiring that the expected cost-reduction factor k for such an hypothetical research program be greater than 0.1, or 10 percent. While the described rule-of-thumb analysis would suffice to screen programs, final inclusion in a prioritized research agenda should depend on comparative net benefits of feasible candidate programs. But enough of these technicalities in our all too limited space.

Let me now turn briefly to the topic of **agricultural extension**. Again, when one looks around the world one sees, especially in Sub-Saharan Africa, some massive public systems that, in spite of the claimed virtues of such institutional arrangements as training and visit systems, we see extreme levels of inefficiency, with many design problems (World Bank 1990). In spite of the record, the World Bank and others have gone on with designing similar systems. The linkages between research and extension systems are oftentimes miserable. A farming systems perspective has oftentimes been included as a feature of the design of both research and extension systems. Putting this in place is, however, not a uniformly happy story (Anderson 1991), and it's really that perspective that I was arguing needs to be coming the fore in South Africa as you strive to bring research and knowledge systems more directly to the problems of the smallholders.

The World Bank's Operations Evaluation Department recently examined its worldwide experience in agricultural research and extension (Purcell 1994, OED 1996b), and some of the main lessons have already been mentioned. One concerns the fiscal sustainability issue, which also a problem with extension systems. We must avoid "recipe-type" solutions and try to design schemes for particular needs in particular situations, emphasizing responsiveness to the clients of the system. We see an increasing role for the private sector for delivering extension services (Umali 1992, Umali & De Haan, 1992; Umali & Schwartz, 1994). Clearly, for servicing smallholders, we're going to have to rely largely on public assistance—at least for funding, if not necessarily the actual delivery of services. But for commercial farming, the trend around the world now is to move away from public-sector involvement in extension. The modified mechanisms are in many cases still in their infancy, and there is a fair way to go in distilling the advantages of various sorts of contractual arrangements. Public funding will remain critical in many extension systems but, however it is done, we need to think of extension as more of an educational process of getting clients to think more imaginatively about dealing with their problems, rather than simply setting in place simplistic message-transmission systems.

CONCLUSION

We have traveled extensively, albeit quickly, along the various policy, institutional and infrastructural paths open to those who would seek to predispose agricultural growth. Much remains to be discovered about just how effective the many possible different interventions might be, and herein lies a rich agenda for policy researchers for years to come. Agricultural economists have much to do, and should find their efforts personally rewarding as well as socially useful. Rather than attempt to summarize our tour of the highways and byways, the thought I would like to leave you with is the following. Beware of single-focus "fundamentalists"—agricultural growth necessarily depends on many factors, and their interdependencies mean that progress is likely to be thwarted unless nearly all of them can be brought to appropriate levels of performance. South Africa is one nation in Sub-Saharan Africa that should be able to get them all "right" at an early stage, and I wish you all the best with this important endeavor.

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