

Leslie Nulty, **The Green Revolution in West Pakistan: Implications of Technological Change**, with foreword by Sir Arthur Gaitskell, Praeger Special Studies in International Economics and Development, Praeger Publishers, 1972, xxii- 151 pages, Appendices.

If one is to consider a common interpretation of the phenomenon of "The Green Revolution", the introduction of a new variety seed and/or a more intensive use of fertilizer, pesticide, herbicide- in short, a superior irrigation package used in agricultural production- the title of Mrs. Nulty's book can be misleading. The book analyses irrigation with the use of tubewells. The fact that in West Pakistan, irrigation with tubewells has been developed by private investment has been shown to be contrary to some common hypotheses of development, namely;

- a) Agriculture is supposed to generate a surplus in terms of food, investment funds and of labour to be utilised in the development of industry,
- b) Investment in agriculture is not considered in this process, but is assumed to be part of public investment.

Mrs. Nulty relates the spectacular increase in private tubewells in West Pakistan to higher agricultural productivity and profitability in four different farm sizes- 12.5,25,50 and 100 acres. The findings of two studies by Kaneda and Ghaffar (1) and Ghulam Mohammed (2) are extensively used to support the analysis in this study.

The data used to support the analysis are explained in Appendix B. Although Mrs. Nulty repeatedly warns us about the data, this reviewer feels that it is necessary to repeat this warning. For regarding the relative profitability of tubewell irrigation as compared to non-irrigation and among different farm sizes, the data can support only the direction of the relative differences and definitely cannot give any information about the magnitude of such differences.

(1) Kaneda, Hiromitsu and Ghaffar, Mohammed, "Output Effects of Tubewells on the Agriculture of the Punjab: Some Empirical Results," Pakistan Institute of Development Economics Research Report No. 80, Karachi, March 1969, mimeographed.

(2) Mohammed, Ghulam, "Private Tubewell Development and Cropping Patterns in West Pakistan," **Pakistan Development Review**, V, 1 (1965), 1-53.

As can be expected, "net farm income" with tubewell irrigation is larger than without tubewell irrigation (1), but, relative profitability of different farm sizes, given the data, is not that evident. Of course, the larger the farm the larger the net farm income, but, even with acceptable data, the concept of "increase in Net Farm Income with Tubewell" applied to each farm size is not a convincing criterion for relative profitability of different farm sizes. Is the increase due solely to tubewells? What about the effects of fertilisers, or the new variety seeds, or the switching of techniques (Labour intensive or Capital intensive)?

Obviously, the weakness of the data does not allow for analysis of variance or regression techniques to be utilised to determine the magnitude of the effects of tubewells and other factors.

Again, the weakness of the data has apparently forced Mrs. Nulty to make some rather extreme assumptions. Prior to the explanation of the data in Appendix B, the following statement is made,

"Before total production of each crop can be computed, the **acreage planted to each must be multiplied by some assumed yield.** (1) A better evaluation of tubewell irrigation could have been made by comparing it not with the situation where there is no tubewell irrigation, but with alternative ways of irrigation. Uniform yields are for all farm sizes. This may be somewhat unrealistic since large farms are likely to apply more chemical fertilizer than small farms, especially to cash crops, and thereby obtain higher yields. In traditional agriculture, this is compensated for by higher cropping intensities on smaller farms so that in general there is little difference in gross output per cropped acre. Since uniform cropping intensities have been assumed for all farm sizes, it is consistent to assume uniform yields per acre." p. 151.

This is quite confusing. If among farm sizes uniform yields are assumed and if uniform cropping intensities are assumed (this reviewer has not been able to determine where and how consistency comes into the picture), what is it that we are not holding constant? Is it only "cost of fertilizer" and "cost of tubewell" that changes? A look at the figures indicates that fertilizer intensities do not change either. So, one is left with the fixed annual charge for tubewells being a larger burden for smaller farms. (The 12.5 acre farm size does not have tubewells but purchases irrigation water.) Consequently, we can answer our earlier questions about the effects of new

variety seeds, fertilizer, and switching of techniques. The analysis in Mrs. Nulty's book does not cover such effects except casually, e.g. through "eyewitness reports". It is difficult to accept that so much can be attributed to tubewells.

What, then can be derived from this study?

"Perhaps the most important lesson is that the adoption of new techniques requisite for higher levels of productivity in agriculture is very rapid when farmers can see a clear, substantial, and unequivocal return from it." p. 121

As an economist, with vested interests in the success of economic theory, we are very happy with this result. If people do not react to "clear, substantial, and unequivocal returns, there is not much hope for the science of economics...

A piece of self-criticism can be derived from Mrs. Nulty; "... the influence of technological change (is) likely to be distorted by prevailing economic and political relationships. Economists who overlook these effects can offer only a partial analysis of the mechanism of development, and it is unfortunate that a great deal of the literature on West Pakistan has erred in this direction."

Economic analysis, with historical and theoretical tools, can usually predict *a priori* the direction of the effects of technological change. What is needed is empirical work on the magnitude of these effects. Mrs. Nulty's book does not provide any dependable information in this respect.

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