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Comments

Technological Change in Illinois Agriculture

Grabowski, R., Kraft, S., Mehdian, S. and Pasurka, C., 1989. Technological change in Illinois agriculture, 1982-1984. *Agric. Econ.*, 2: 303-318.

1. COMMENTS ON METHODOLOGICAL PROBLEMS

(a) *Remarks on the models described*

The need for alternative models describing technological change is evident. Therefore, the authors' approach leading to a new model is highly agreeable. This particularly because their procedure is often neglected by economists doing empirical research. To date, few results are available which allow an empirical comparison of the methods applied.

It has to be emphasized that the authors give a comprehensive overview of available models which makes good reading. As far as I know, it is the first article presenting all models of importance which deal with analyses of production in firms to be offered to a wide audience. However, it would have been more fruitful if the comparison were not restricted to theoretical reasoning but included empirical arguments.

Whereas an accurate description of models used would have gone beyond the scope of the article by Grabowski et al., remarks complementing the first method mentioned (econometric estimation of average functions, index number formulas) would have been most helpful.

By applying these methods it is possible to underline an arbitrary primal or dual functional form (cost-, profit-, distance- or production functions) and to involve corresponding regularity conditions. This is due to the duality of the functions mentioned above. Moreover, since index numbers could be inserted into present shifts of functional forms, both approaches are based on similar assumptions in analysing changes in total factor productivity.

Apart from these disadvantages, some advantages of these methods should be mentioned. The econometric estimation of average production functions allows statistical inference based on results. By applying the index number approach, an arbitrary set of inputs and outputs could be considered in the analysis, so several problems caused by aggregation of goods are neglected.

Furthermore, the question arises as to what extent the underlying structure in all the "parametric" concepts will have restrictive effects. Since flexible functional forms like the translog or generalized Leontieff can be used, no a-

priori restriction of elasticities of substitution or of price and cross-price, elasticities are involved. Thus, only weak assumptions with respect to the underlying functional forms are made.

(b) *Comments on measurement of bias of technical change*

The authors have measured the bias of technical change by regression analysis, using factor shares as independent variables. My remark aims at the use of factor shares. In a production analysis based on a production function it is necessary to use physical units. But changes in factor shares lead to changes in physical and monetary units. So, the result that land-use technologies were mainly implemented should be regarded with care. It would probably be better to argue only in a qualitative sense. For instance, by analysing the growth of productivity of land and changes in man-land ratio (both measured in physical units) the land-saving or labour-saving nature of technical progress could be deduced.

2. COMMENTS ON THE DATA BASE

In their theoretical exposition, the authors emphasize the difficulties of determining relevant factor shares and factor prices (pp. 305, 309). Furthermore, they stress the fact that their approach does not require such information (p. 309).

Considering, furthermore, that their analysis is based on a production function which represents a relationship of physical units, it is surprising that the authors return to monetary inputs. Despite the difficulties in determining factor prices, they use factor prices in order to estimate labour input. Due to the necessity of using physical inputs underlying a well-defined production function, the authors should use data represented in constant prices. Apart from the possibility that no price changes happen, true results can only occur if all input prices grow simultaneously and at equal rates; even then the results would not be correct because a proportionality factor has to be mentioned. Otherwise, different results in changes of total factor productivity between firms will happen. These differences will also influence the estimated average rate of technical changes.

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