Chapter 9

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Budgeting and Engineering Analyses of Normative Supply Functions

THE ASSIGNED TITLE, "Budgeting and engineering analyses of normative supply functions," probably implies the synthesis of supply response estimates from basic input-output data. Use of the phrase "budgeting and engineering" vaguely restricts this paper to studies which build up supply response estimates from micro data instead of estimating them directly from macro-price and output data. This limits the discussion to such works as that of Mighell and Black on interregional competition in milk production or that of Schuh on the influence of cost of production on supply responses for milk in the Detroit milk shed (14, 17). The author is restrained from discussing the type of study represented by his own work on burley tobacco, by Hathaway's study on dry edible beans, or Nerlove's on the use of distributed lags to derive supply estimates for corn, wheat, and cotton (17, 5, 15).

The term "normative," which appears in the title, has unfortunately tended to become an opprobrious epithet reserved in certain circles for inaccurate supply estimates while accurate estimates are labelled "predictive" or "positive."[1] This unfortunate distinction arises from the desire of positivists to avoid purpose or ends as being animistic, teleological and, hence, non-scientific (in their opinion). The use of this distinction implies that the behavior of producers can be accurately predicted without reference to desire for profit, liquidity preference, desires for security as reflected in risk discounts, and the desires for income as reflected in willingness to make long chance investments which condition the behavior of producers. The author feels that appropriate handling of subjective matters involving purpose and ends will produce more accurate (in the positivistic sense) supply response estimates than attempts to eliminate consideration of such matters. Obviously, studies which assume entrepreneurs to maximize what they do not, in fact, try to maximize may produce at least as inaccurate estimates as studies which avoid all maximization. Human behavior (and production decisions are a form of human behavior) is often a compromise between the entrepreneurs concepts about "what

[1] "Normative" is an adjective relating a subject to norms. Restricting normative to mean optimizing profits may destroy a respectable adjective in our vocabulary.

ought to be" (values or norms) and concepts about "what is or can be" (beliefs - facts or predicted facts). It seems obvious that more accurate predictions of facts about supply decisions and responses must, generally speaking, be obtained in studies which take both values and beliefs into account than by non-normative studies. In addition, of course, errors in the process by which "right actions" are determined from value and belief concepts would have to be considered in order to arrive at still more accurate predictions. The point is that the behavior of producers is in part a social phenomenon, "a serious analysis" of which, in Knight's words, requires "a quite complicated pluralism" including but not limited to positivism (12, 13).

A principal problem encountered in synthesizing macro supply estimates from micro data has to do with predicting which inputs or resources are changed and which are not changed. In what follows, it will be taken as self-evident that a supply estimate will have to reflect changes in the inputs which determine output. Arbitrary assumptions about resource fixity do not permit prediction of changes in output resulting from changes in resources arbitrarily assumed fixed. Changes in inputs to be considered include, of course, those necessary in introducing new technologies and in securing the benefits of regional, sector, and farm by farm specialization and diversification. It goes without saying that the problem of predicting when resource flows will and will not occur is a common problem for budgeting, continuous function, simultaneous equation, programming, and Leontief-type studies.

THE GENERAL PROCEDURE

Fundamentally, there are seven more or less related steps in producing a supply estimate by the method under discussion here. While some of these steps may be omitted in a particular study because they have been done previously or are unimportant, they must all be considered. The seven steps are:[2]

1. Securing an appropriate set of input-output coefficients.
2. Devising a method of determining which resource flows can and cannot be varied.
3. Selecting a range over which variation in product price will be considered.
4. Computing optimum outputs (in terms of a selected set of norms) as a function (discrete or continuous) of product price.
5. Repeating steps 1 to 4 for different situations within the industry.
6. Aggregating results from steps 1 to 5 into an estimate of how output for the industry depends on price.

[2] See Schuh (17) for an illustration of how each of these problems can be handled in a budgeting study. Schuh's treatment of step 2 is inadequate for anything but very short lengths of run.

7. Adjusting the results obtained in 6 for their shortcomings as partial equilibrium estimates, i.e. for the influence which expanded use of an input may have on its price and, hence, on marginal costs and on the ability of the industry to expand production.

The three main kinds of data required have to do with (1) input-output relationships, (2) prices, and (3) aggregation. Controlled experiments, surveys, farm accounts, and time and motion studies are common sources of input-output data. Mighell and Black used farm survey and account data to good advantage in their work while Schuh drew heavily on input-output data produced by the controlled experiments reported in USDA Technical Bulletin 815, "Farm surveys and time and motion studies." Time and motion data are of particular value because their "building block" nature permits easy synthesis. In predicting supply responses through time, input-output data of a forward looking nature with respect to new technology must be used if accurate estimates are to be secured. Price data are difficult as input prices may become functions of quantities used. For the most part, various USDA secondary sources and surveys are useful but often inadequate sources of market prices. The law of comparative advantage and the principle of opportunity costs must be utilized in pricing committed resources between the limits imposed by acquisition costs and salvage values which are sometimes market values and sometimes internal (to the industry or firm) costs and values. Programming employs the law of comparative advantage and the principle of opportunity costs to price fixed assets. Data for use in aggregation can often be secured from surveys and the census. Though the author has never used them, the USDA typical family farm studies must have valuable unpublished as well as published data to contribute to supply response studies.

Much time could be wasted discussing the best method of carrying out step 4 – the location of optima – and loyalties to budgeting, programming, and continuous function analysis would probably interfere with the objectivity of such a discussion. So would the unfortunate distinction between normative and positivistic or predictive work. The important points to consider in selecting an appropriate method appear to be (1) the avoidance of arbitrary restrictions on input variability, (2) the maintenance of scope for originality and flexibility in the computations and in conceiving of the patterns of production which will be followed in the future, and (3) the maximization of appropriate or realistic norms.

While substantial problems are involved in executing each of the seven steps,[3] none seems more neglected or more important than the one of avoiding arbitrary restrictions on input variability by securing endogenous determination of when resources flow into and out of the enterprises producing the product under consideration. Thus, the

[3] See Mighell and Black (14) and Schuh (17) for examples of the difficulties and for practical help in overcoming the difficulties encountered in carrying out these steps.

remainder of this paper will concentrate on this problem and its many facets. While the organization to be followed and a small part of the content to be presented is new, most of the content will be a repetition of material presented elsewhere (8, 9, 10, 11).

SECURING ENDOGENOUS DETERMINATION OF RESOURCE FLOWS

Inputs used in producing farm products typically have acquisition costs which exceed their net salvage values. This difference between acquisition costs and salvage value arises, in part, because of (1) the geographical dispersion of producing units from each other and from supply centers, (2) institutional costs involved in transferring ownership, and (3) subjective premium and discounts attached to ownership of certain inputs and to the production of certain products. When the value of a marginal unit of an input useful in the production of a particular product exceeds its acquisition cost, it pays to acquire that unit for use in producing that product. When the value of a marginal unit of an input useful in the production of a particular product is less than its salvage value, it pays to dispose of it or uncommit it. When the value of a marginal unit of an input committed to the production of a particular product is less than its acquisition cost but in excess of its salvage value, it does not pay to change the resource committed insofar as this input is concerned. The problem of concern today is the problem of working this definition of resource commitment into the theory of the firm, costs and supply responses. The main subproblems are now fairly clear; some of them are solved, some are being worked on while others await our efforts. The main subproblems involve:

1. The conversion of stocks to flows — this involves capitalization, maintenance, obsolescence, depreciation, and user costs.
2. Subjective premiums and discounts for acquisition costs, salvage values, and marginal value products or capital values of inputs.
3. Discrete inputs.
4. Optimum rates of flow are different for a fixed discrete input than for the same input when variable.
5. The influence of credit availability on acquisition costs and salvage values for durables.
6. The role played by erroneous expectations with respect to product prices, input prices, technology, institutional arrangements, and the human factor in inducing overcommitment[4] of resources to the production of farm products.
7. The role played by capital gains due to inflation and increased demand, war, and population growth as sources of:

[4] Undercommitment of resources was the point of emphasis in earlier work on capital rationing. Overproduction in terms of producing market rates of return to labor and capital is, however, the outstanding characteristic of American agriculture to be "explained."

a. credit
b. errors in expectations (i.e., such gains are easily confused with marginal value productivities).

8. The role played by capital losses.

Much work has been done on the above subproblems. The references (8, 9, 10, 11) (a) relate the basic theory to classical, neoclassical, and modern literature; (b) show how the theory explains the overcommitment of resources to agricultural production, shifts from one cost structure to another, and irreversible and discontinuous supply responses; (c) show the origin of substantial capital losses; and (d) explain the roles played by advancing nonfarm wage rates, macro adjustments and technological advance in the development of erroneous expectations. Edwards (3), in a rather carefully developed mathematical thesis, has developed theoretical solutions to some aspects of the stock-flow problem and has related credit supply functions for individual firms to acquisition costs and salvage values. Hildebrand and Dvorak (2, 6) have used Edward's theoretical results in programming and have developed an ad hoc but not particularly original method of handling discrete durable inputs; they have not handled the problem of varying optimum flows from committed discrete durables, even on an ad hoc basis.

Marginal cost responses have been developed graphically for the one and two variable input cases and algebraically for the N variable case (3), but have not been aggregated into commodity supply response estimates. However, the success of both micro-synthetic and direct estimates from macro data suggests that the aggregation problem may not have to be entirely solved before effective work can be done.

Some progress has been made on classifying inputs into categories relevant for the type of analysis suggested above. These classifications were reported in the author's "facts and notions" article (11). In the same article, 72 hypotheses about resource flows were tested; despite a regrettable mistake in which undeflated data were reported in terms of 1910-14 dollars, these hypotheses are substantiated and offer much hope for micro-synthetic studies incorporating these hypotheses. Hathaway's data on resource flows and capital gains and losses (4) offer similar encouragement.

The success of Mighell's and Black's work (which handled several of the above problems on an ad hoc basis) offers further reason for hope. Bird, an ARS contract employee at MSU, seems to be making some progress on subjective premiums and discounts, user costs, obsolescence, and expectations.

One of the biggest deterrents to progress is the lack of data (1) on resource flows (farm-nonfarm, among farms in different regions, among farms in a given region, and among enterprises on given farms) and (2) on credit opportunities as influenced by net worth. Compilation of such data for one or two minor commodities should permit completion of one or two supply response studies incorporating the theory suggested above.

Despite the work of Interstate Managerial Study cooperators and Bird's efforts referred to above, the formulation of expectations is poorly understood. Nerlove's distributed lags appear helpful but still inadequate.

More work along the lines carried out in the Interstate Managerial Survey (1, 16) seems to be required before we evolve more adequate theories on the role played by price, technological, institutional, and human factor expectations in the determination of resource flows and supply responses. Unfortunately, much past work has concentrated on risk and uncertainty as a source of capital rationing which restricts output rather than as a source of overcommitment of resources and surplus production (8).

TWO VERY GENERAL CONCLUSIONS

1. Syntheses of macro supply response estimates from micro data have been moderately successful in the past, despite serious difficulties in carrying out the seven steps involved in making such estimates; there is much hope that these studies can be improved by overcoming these difficulties. One of the difficulties involves the problem of obtaining endogenous, as opposed to arbitrary, determination of resource flows.

2. Slow, rather painful progress is being made and will continue to be made on this problem.

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