AN INPUT-OUTPUT APPROACH TO THE STUDY OF THE FLOW OF FUNDS TO AGRICULTURAL CAPITAL MARKETS

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Agriculture is experiencing an increasing reliance on commercial and governmental sources of capital in order to finance the adoption of new technology and the organizational changes made necessary by that technology. If this trend progresses, it is reasonable to suppose that the interdependence of flows of funds to the farm sector with flows to other sectors will become greater and will become a more important consideration in matters of farm credit policy. In a recent paper, Lee [5] has called for further research into the implications of changes in the financial structure of the farm sector, among them the growth of alternative sources of funds and the changing roles of major lending groups. It is the intent of this paper to suggest a procedure through which the financing of the farm sector can be analyzed as one of a number of economic sectors which are financially interrelated.

The procedure which this paper will propose combines some of the concepts of input-output analysis, which should be familiar to most, with data generated in the flow of funds accounts, which may be less familiar. For this reason, exposition of the mathematics of input-output analysis will be omitted in this outline of the procedure in favor of a brief discussion of the data contained in flow of funds accounts.

Copeland [2] was the first to suggest the construction of a comprehensive system of social accounts which would record the flow of funds corresponding to the exchange of all goods and services in the economy. This system was originally conceived to be even more comprehensive than the GNP accounts, since flows of funds involved in the exchange of intermediate goods and services were also to be included. Later, the scope of the flow of funds idea was revised downward by the Federal Reserve Board and the National Bureau of Economic Research to a system of accounts describing the capital budget of the national economy. The Federal Reserve Board began the publication of these accounts, under the title "Flow of Funds/Saving Accounts" (later abbreviated to "Flow of Funds Accounts"), in the Federal Reserve Bulletin in 1959 on a quarterly and annual basis.[1]

The flow of funds accounts have two major parts. One part contains summaries of financial and non-financial saving and investment activities by economic sector. The second and most important part (from the standpoint of this paper) shows the flow of funds among economic sectors by type of credit instrument or transaction category involved in the flow. Savings activities are portrayed in the accounts as uses of funds; investment activities are shown as sources of funds.[2] In general, the accounts show how financial assets, in the form of demand and time deposits, insurance premiums, pension funds, and so forth, are mobilized by the financial sectors of the economy in order to finance the creation of liabilities such as mortgages, bank loans, bond and stock issues, and the like. By the equality of saving and investment, total uses of funds are by definition equal to total sources for any given time period.

The Federal Reserve System employs a three-way classification system in the construction of the accounts. Each entry is classified according to the economic sector in which it occurs, the type of credit instrument used, and whether it is a use or source of funds to the sector. Each entry in the F.R.S.'s flow of funds accounts can be thought of as belonging on one side or the other of a flow equation. Just which

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[1] See [1] and [7] for more complete descriptions of the accounts.

[2] Uses and sources of funds are flow concepts which correspond to the more familiar terms of assets and liabilities. A "use" of funds refers to a change in financial assets, while a "source" of funds refers to a change in liabilities.

side the entry might be on depends entirely on the way one looks at the problem. For instance, the use of $1 billion by households as demand deposits and currency is clearly also a source of funds to the banking sector in the same amount. This dual nature of fund flows allows a transformation of the F.R.S.'s accounts into a format which emphasizes the intersectoral nature of the flow of funds.

Since each flow item in the accounts represents both a use and a source of funds, the way is clear to classify flows by sectors, with any given flow item being a use of funds to one sector and a source of funds to the same or some other sector. For instance, the use of $4.3 billion by households as demand deposits and currency in 1963 is clearly a source of funds to the banking system. Instead of grouping this source of funds with demand deposits from all other sectors, as the F.R.S. accounts do, the intersectoral character of this flow can be preserved by treating it as one cell in a matrix having households as a use sector on one axis and the banking system as a source sector on the other. Uses of funds as demand deposits and currency by other sectors can be similarly classified. The result will be to show the flow of funds into the banking system in the form of demand deposits and currency as a vector of intersectoral flows, rather than as a single source entry of $6.0 billion in 1963, as the F.R.S. accounts have it.

Intersectoral flow matrices can be derived from the F.R.S. flow of funds accounts for each type of credit instrument or transaction category. These individual matrices might be of interest to the researcher, especially perhaps the intersectoral flow matrix for farm and commercial mortgages. Generally, though, the individual matrices would be added together to derive a matrix expressing the summation of all intersectoral flows of funds for the time period under consideration.[3] Such a matrix is shown in Table 1 for six economic sectors in 1963.[4] Reasons of space rather than data dictate the use of six sectors in this table. At least 11 sectors are identifiable in the F.R.S. accounts; in principle, any number of sectors could be included.

The intersector flow matrix of Table 1 bears some resemblance to an input-output matrix. In an input-output matrix, the row elements express the quantities of goods and services, measured in value terms, supplied by one sector to itself and to all others; column elements measure quantities obtained by a sector from itself and all other sectors [6, pp. 134-137]. From this standpoint, the matrix in Table 1 appears to be the transpose of an input-output matrix. The rows express quantities obtained from sectors listed in the columns, and columns show quantities supplied to sectors listed in the rows. Thus, the elements of the farm-sector row indicate the net amounts of funds each sector advanced to the farm sector in 1963. Elements of the farm-sector column indicate the net amounts that the farm-sector advanced to other sectors that year. Other rows and columns are to be interpreted similarly.

If it served no other purpose, the intersector flow matrix would serve to remind us that the financial activities of the farm sector are closely connected with those of other economic sectors. The matrix shows that the sectors which are sources of funds for the farm sector have access to a variety of alternative uses for those funds. It brings the financial structure of the farm sector into perspective as an integral, though minor, part of the financial structure of the over-all economy.

The intersector flow matrix can be made to serve other purposes, however, by continuing to apply the techniques of input-output analysis. In input-output analysis, final outputs of goods and services can be treated as a set of variables which are functions of another set of variables, the total outputs of goods and services. The functional relationship between the two is expressed in a matrix of linear inputs coefficients known as a structural matrix [6, pp. 138-140]. In a similar manner, the total quantity of sources of funds in each sector can be expressed as a linear function of total uses of funds by all sectors, the functional relationship between the two sets of variables being embodied in a matrix of flow coefficients. A flow coefficient is defined as the ratio of funds advanced to source sector i by use sector j over the total quantity of funds used by sector j, or

$$c_{ij} = u_{ij}/U_j.$$

These coefficients can be computed from the data contained in intersector flow matrices.

Table 2 displays a flow coefficient matrix computed from the intersector flow matrix of Table 1. The individual coefficients show the amount of funds advanced to row sectors per dollar of total funds used by the corresponding column sectors. For example,

[3] Different kinds of credit instruments, such as bank deposits, pension funds, mortgages, stock issues, and so forth, are, thus, added together in the same way that activity levels are added in input-output matrix. . .by their dollar values. The high degree of fungibility of most credit instruments makes this kind of addition even more defensible than in an input-output matrix representing dissimilar physical quantities.

[4] The 1963 flow of funds accounts were chosen to illustrate the procedure for ease of reference to the summary matrices published in the Federal Reserve Bulletin. Since 1963, the farm sector has not been identified separately in these matrices, although separate data have been published in statistical supplements.

TABLE 1. INTERSECTOR FLOW MATRIX, 1963, FOR SIX SECTORS, IN BILLIONS OF DOLLARS[a]

Sources of Funds	Uses of Funds						
	Households	Farm	Nonfinancial Business	Governments	Banks and Savings Institutions	Other Financial	Total Sources[b]
Households	-.3	0	1.1	-.8	19.2	7.0	26.2
Farm	-1.6	0	.7	.5	1.6	.4	1.6
Nonfinancial Business	-8.0	0	9.2	4.5	9.6	9.8	25.2
Governments	8.0	0	1.4	.2	6.0	0	15.7
Banks and Savings Institutions	27.4	-.1	3.1	5.0	1.1	2.2	38.8
Other Financial	11.6	.2	3.8	2.6	3.3	2.8	24.4
Total Uses[b]	37.2	.1	19.4	12.0	40.8	22.2	131.8

[a] Sources: *Federal Reserve Bulletin*, 53:851-859, May 1967.
Flow of Funds, Annual, 1946-65, Washington, Board of Governors of the Federal Reserve System, October 1966.

[b] Matrix elements may not add to total because of rounding.

TABLE 2. FLOW COEFFICIENT MATRIX, 1963, FOR SIX SECTORS[a]

Sources of Funds	Uses of Funds					
	Households	Farm	Nonfinancial Business	Governments	Banks and Savings Institutions	Other Financial
Households	-.0081	0	.0568	-.0664	.4694	.3169
Farm	-.0430	0	.0362	.0415	.0392	.0180
Nonfinancial Business	-.2151	0	.4780	.3734	.2353	.4404
Governments	.2164	0	.0724	.0166	.1483	0
Banks and Savings Institutions	.7366	-1.0000	.1602	.4191	.0270	.0989
Other Financial	.3132	2.0000	.1964	.2158	.0809	.1258

[a] Source: Table 1.

Table 2 shows that the farm sector obtained $.0392 of every dollar advanced by banks and savings institutions in 1963. Total sources of funds for each sector (from Table 1) are equal to the sum of the products of the row coefficients and total uses of funds by the corresponding sectors. Thus, for sector i:

$$S_i = \Sigma c_{ij} U_j.$$

For n sectors, the relationships can be written compactly in matrix form as:

$$S = CU,$$

where S and U are n x 1 vectors and C is a n x n matrix of coefficients.

The relationships between sources and uses of funds by sector, stated in this way, are linear approximations of the supply functions for loanable funds, with supply equalling demand, at least in the ex post sense of an equality between aggregate saving and investment. If it can be assumed that equilibrium is an ex ante sense is also achieved, and that the relationships are in fact approximately linear, then the flow coefficient matrix will be unique and valid for any given vector of uses of funds. Under these conditions, the quantities of funds supplied to sectors could be determined for any given set of quantities of uses of funds. This argument also finds its corollary in input-output analysis.

What potential uses do flow coefficient matrices have in analyzing the flow of funds into the farm sector? Such uses must ultimately rest on the empirical properties of the matrices themselves. If, for instance, the row flow coefficients for the farm sector tend to remain stable over time, a situation of structural equilibrium in the supply of agricultural credit would be indicated. No significant reallocation of uses of funds would be occurring, so total funds advanced to the farm sector would fluctuate only with changes in the total use of funds by supplying sectors. Stability of the coefficients would lend potential forecasting power to the model. Forecasts of total uses of funds by the various sectors, in the form of estimates of personal and corporate saving, Federal lending budgets, and estimates of future loan commitments on the part of banks, insurance companies and the like, could be used to forecast the quantity of funds to be made available to the farm sector. On the other hand, if flow coefficients were found to be unstable over time, a disequilibrium situation would be indicated. These findings would give rise to questions concerning the choice of uses of funds by the sectors which extend credit to agriculture. Do the farm sector coefficients react systematically to interest rate changes and to changes in monetary policy? Can trends be discerned in the farm sector coefficients? If trends do exist, can they be attributed to changes originating in the agricultural credit market or are they residual effects from changes taking place elsewhere in the economy?

Redimensioning of the matrices might prove useful. Flow coefficient matrices computed on a quarterly basis could be used to examine the seasonal behavior of flow coefficients. They might also be useful in forecasting. Disaggregation of the present six-sector model would allow agricultural finance activities to be more closely identified with the institutions involved in them. Division of the present governments sector would enable one to distinguish Federal lending, which is important to the farm sector, from uses of funds by state and local governments, which are not. Similar identification of the farm loan activities of commercial banks and insurance companies could be secured by separating them from their composite sectors. Further separations could be made where desirable and where data availability allow.

Data availability becomes a restrictive factor when contemplating a regional application of intersector flow of funds analysis. Some state and regional data exist for the farm sector, particularly mortgage loan data. These could be used to estimate intersector flows of mortgage funds on a regional basis, allowing comparisons of the South with other regions. At this writing, however, a fully articulated intersector flow model on a regional basis seems unattainable. If supporting data does become abailable, it is more likely that their coverage will be along the lines of Federal Reserve Districts than along historic regional boundaries.

While much work remains to be done, the procedure outlined here seems well enough in hand to allow a start at empirical application at the national level. It is my opinion that intersector flow of funds analysis will prove to be a valuable tool in the study of agricultural capital formation.

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