COMMODITY FIELDS

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COMMODITY FIELDS

The accompanying maps were produced in conjunction with a larger study of spatial interaction.* They are extracted here because they have as a common theme the movement of commodities. The larger study treats of more general classes of geographical interaction, specifies in greater detail the theoretical justification for the particular technique used, and develops additional consequences therefrom. It is asserted that the method of representation employed provides a particularly felicitous and dramatic summary of the asymmetry of large geographical exchanges. A table of county to county trade in the United States would contain in excess of 9×10^6 numbers, for example, and this is an incomprehensible amount of data. A flow field, on the other hand, showing and summarizing these data as a set of vectors seems more tractable. The reader knowledgeable in commodity studies is invited to comment on the degree to which the maps do in fact accord with insights obtained from alternatve modes of study and analysis. The choice of the particular commodities represented here was made on the basis that a person with general knowledge of the economic geography of the United States has a priori expectations in each case. The livestock flow pattern may also, for example, be compared with that given in G. Judge, J. Havlicek, and R. Rizek, "A Spatial Analysis of the U.S. Livestock Economy" (pp. 261-273 of G. Judge, and T. Takayama, Studies in Economic Planning Over Space and Time, New York, Elsevier, 1973), or, inter alia, E. Ullman, American Commodity Flow, Seattle, University of Washington Press, 1957.

The data in each case consist of square (48 x 48), asymmetric, tables in which are indicated the dollar value

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*National Science Foundation Grant GS-34070X, "Geographical Patterns of Interaction", the University of Michigan, Department of Geography, 1972-1974.

(M_{ij}) of goods moving from region i to region j. The data are all taken from J.M. Rodgers, State Estimates of Interregional Commodity Trade 1963 (Lexington--Heath Books, New York; 1971) as supplied on magnetic tape by the Department of Transportation. In addition the coordinates (x,y) of a point within each region are required, and, for display purposes, the coordinates of an outline of the area. The following calculation is then performed.

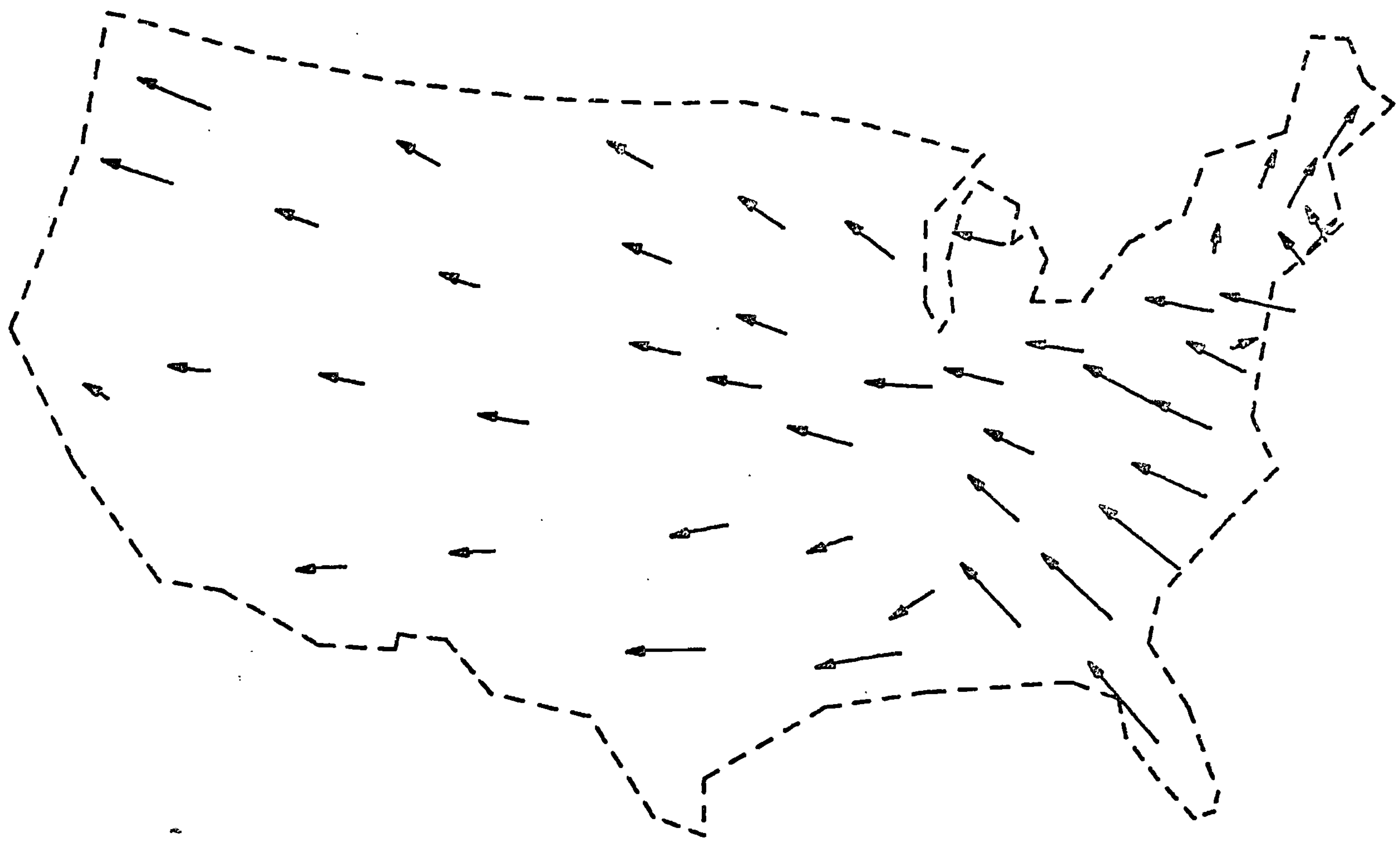
$$\vec{V}_i = \frac{1}{n-1} \sum_{\substack{j=1 \\ j\neq i}}^{m} \frac{M_{ij} - M_{ji}}{M_{ij} + M_{ji}} \circ \frac{1}{d_{ij}} \circ \left[(X_j - X_i),\ (Y_j - Y_i)\right]$$

where

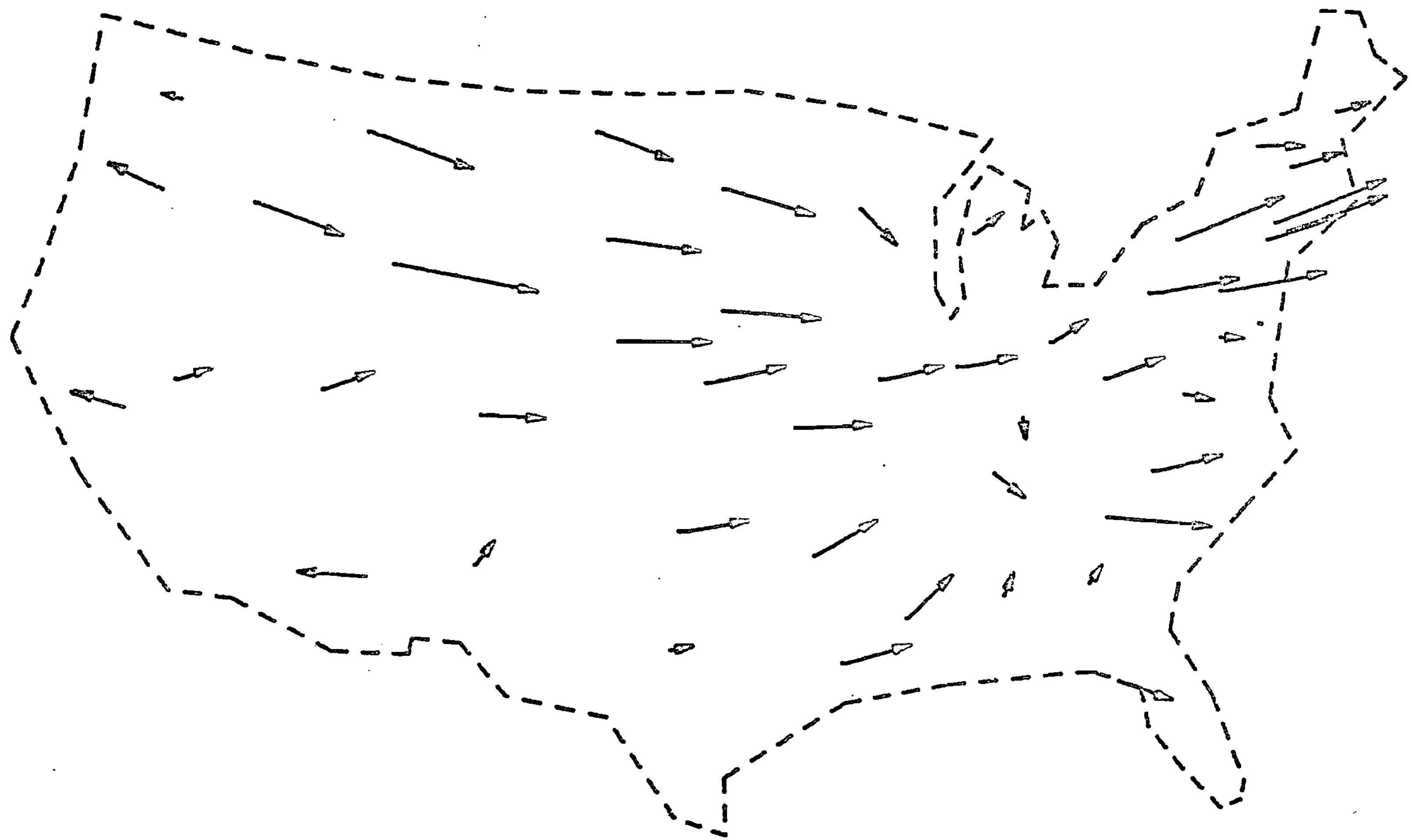
$d_{ij}^{\,2} = (X_j - X_i)^2 + (Y_j - Y_i)^2$. The vector $\vec{V}_i$ is

plotted at the map location ($X_i Y_i$), after an arbitrary scaling appropriate to the particular map. It appears to be a dimensionless number, the relative net exchange. The interpretation is thus not quite as simple as would be the case for a vector field based on the net flows. The field seems to show the directional tendancy toward trade rather better than would the absolute amount of flow. "If, at any point on the map, a commodity were thrown into the air, it would tend to fall in the direction indicated by the exchange field". The patterns are more easily studied when the irregular scattter of vectors is interpolated to a regular lattice, and interpolated vector fields are thus also shown for each commodity. This has the advantage of reducing the somewhat arbitrary placement of vectors within each state, but also the compensating disadvantage of yielding values outside of the U.S. borders, where there are no observations.

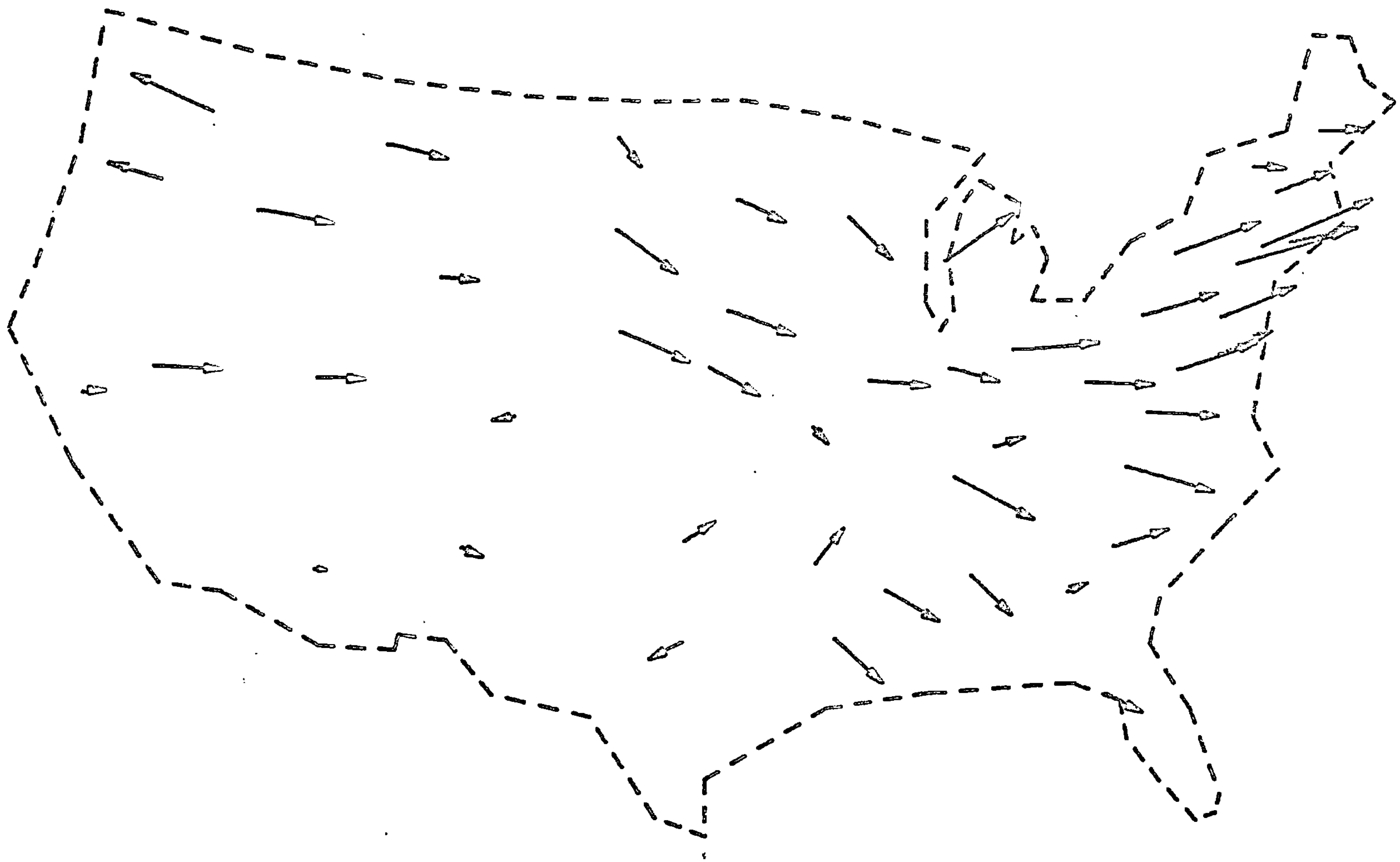
W. Tobler,
Laxenburg,
2 March, 1975.



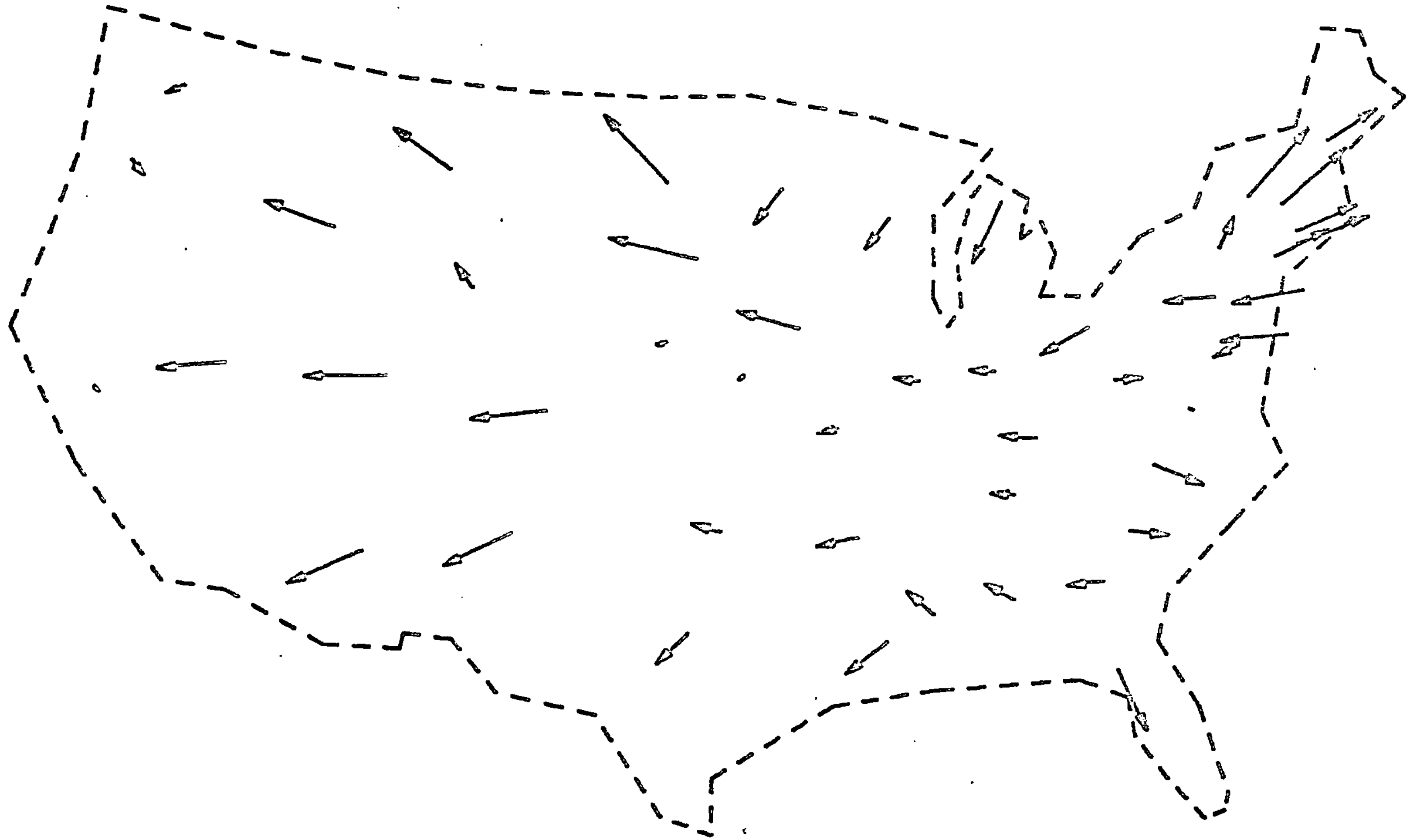
ASYMMETRY OF STATE TO STATE TOBACCO MANUFACTURES SHIPMENTS



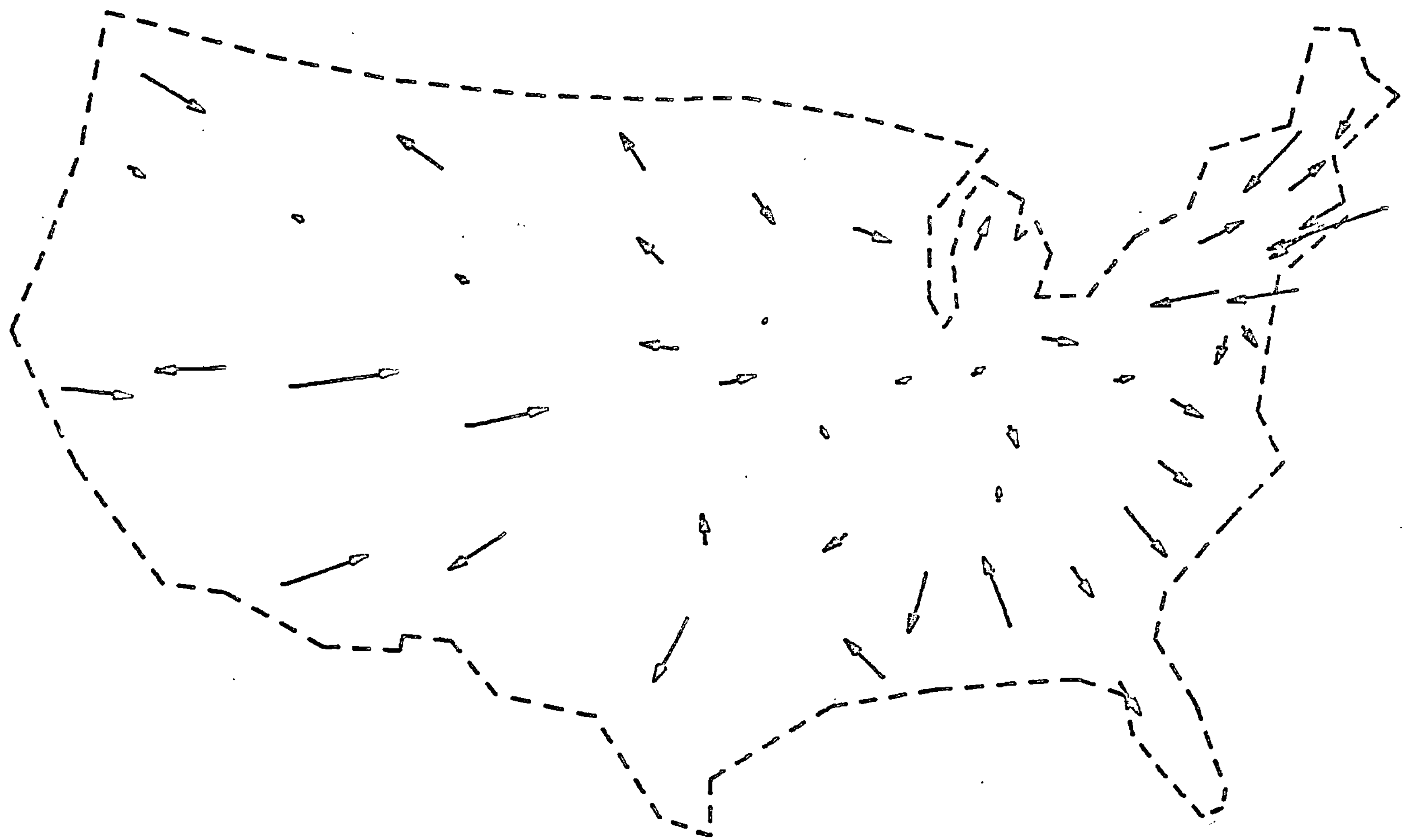
LIVESTOCK AND LIVESTOCK PRODUCTS



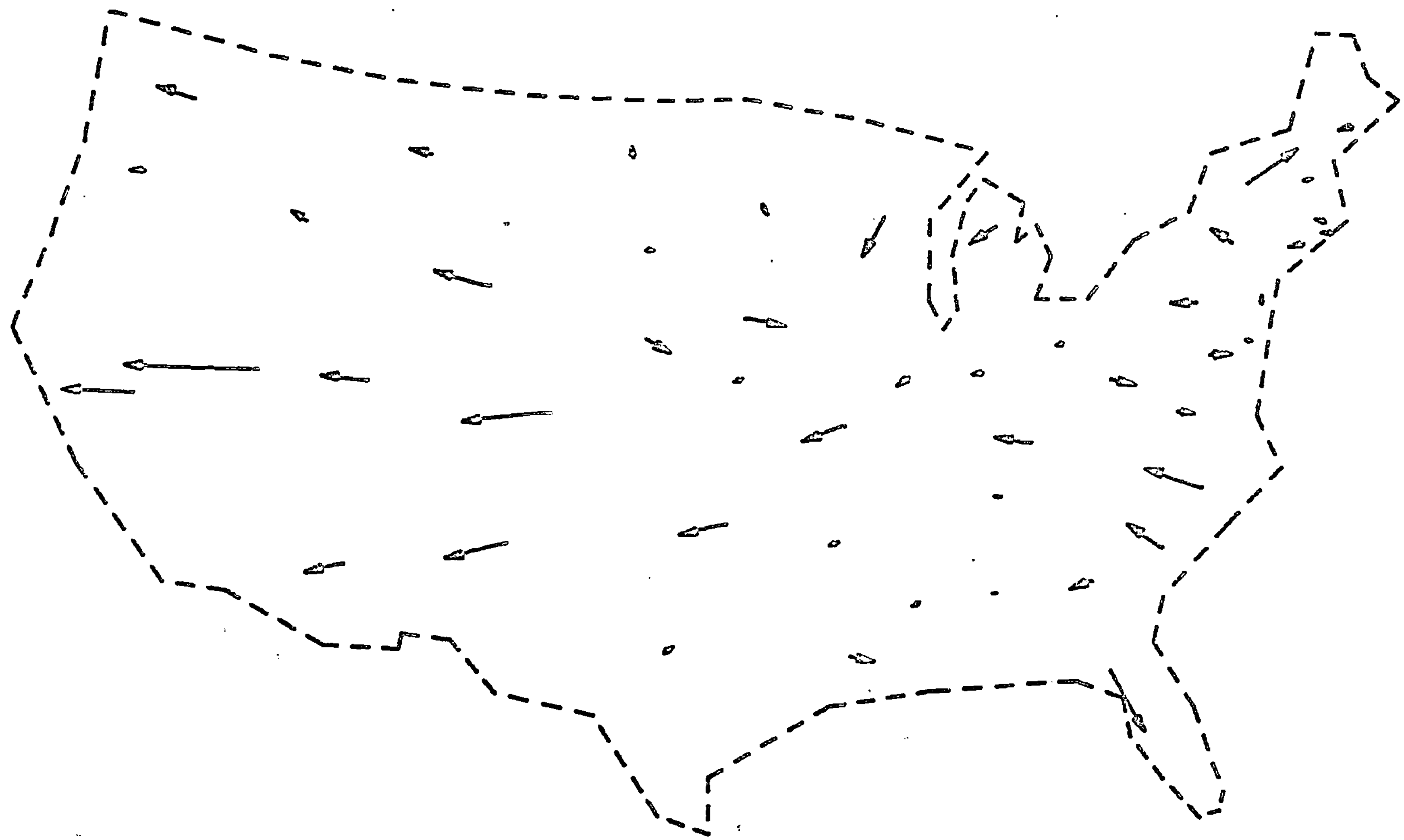
ASYMMETRY OF STATE TO STATE FOOD PRODUCTS SHIPMENTS



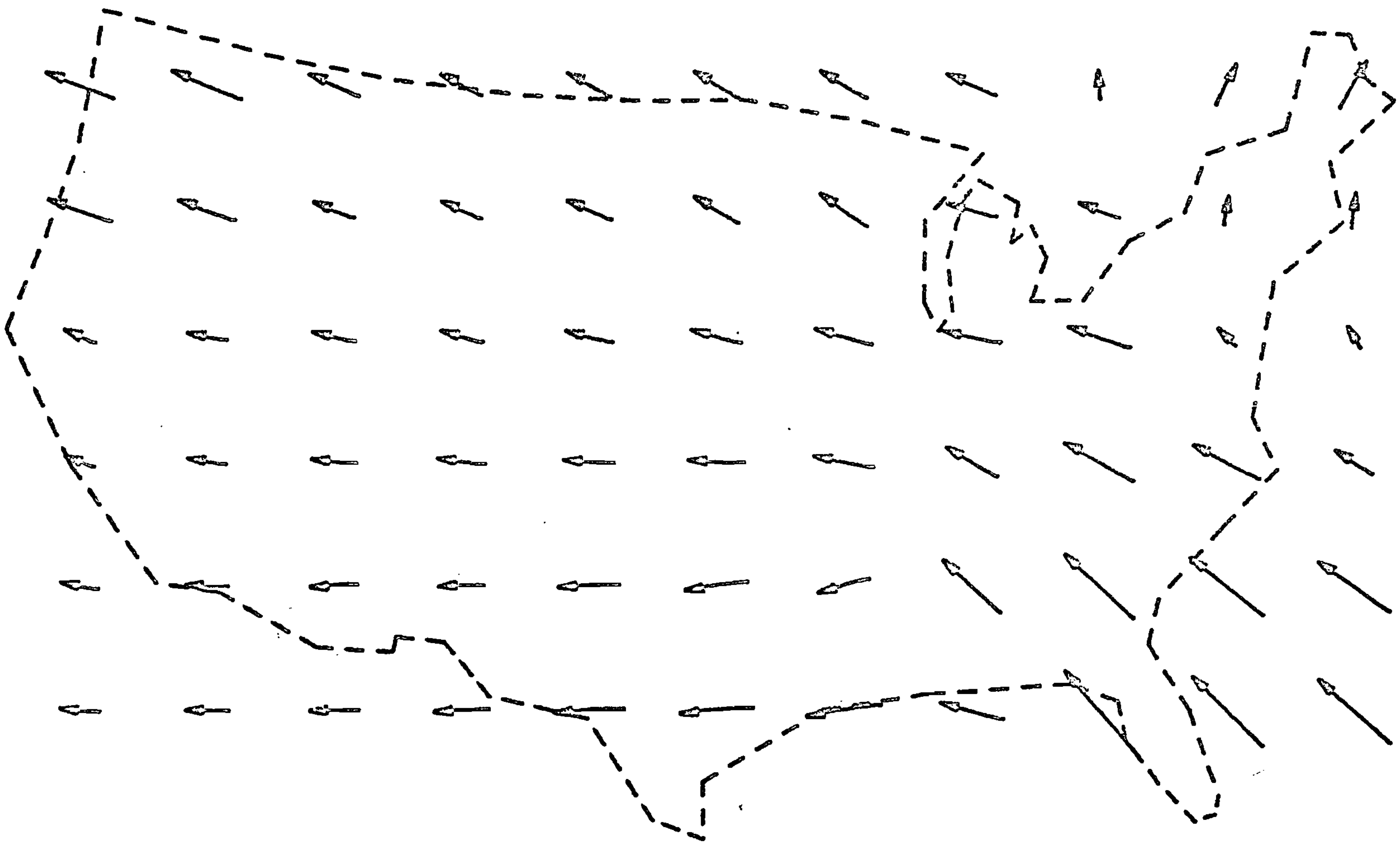
ASYMMETRY OF STATE TO STATE FLOW OF MOTOR VEHICLES AND EQUIPMENT, 1963



AIRCRAFT AND PARTS

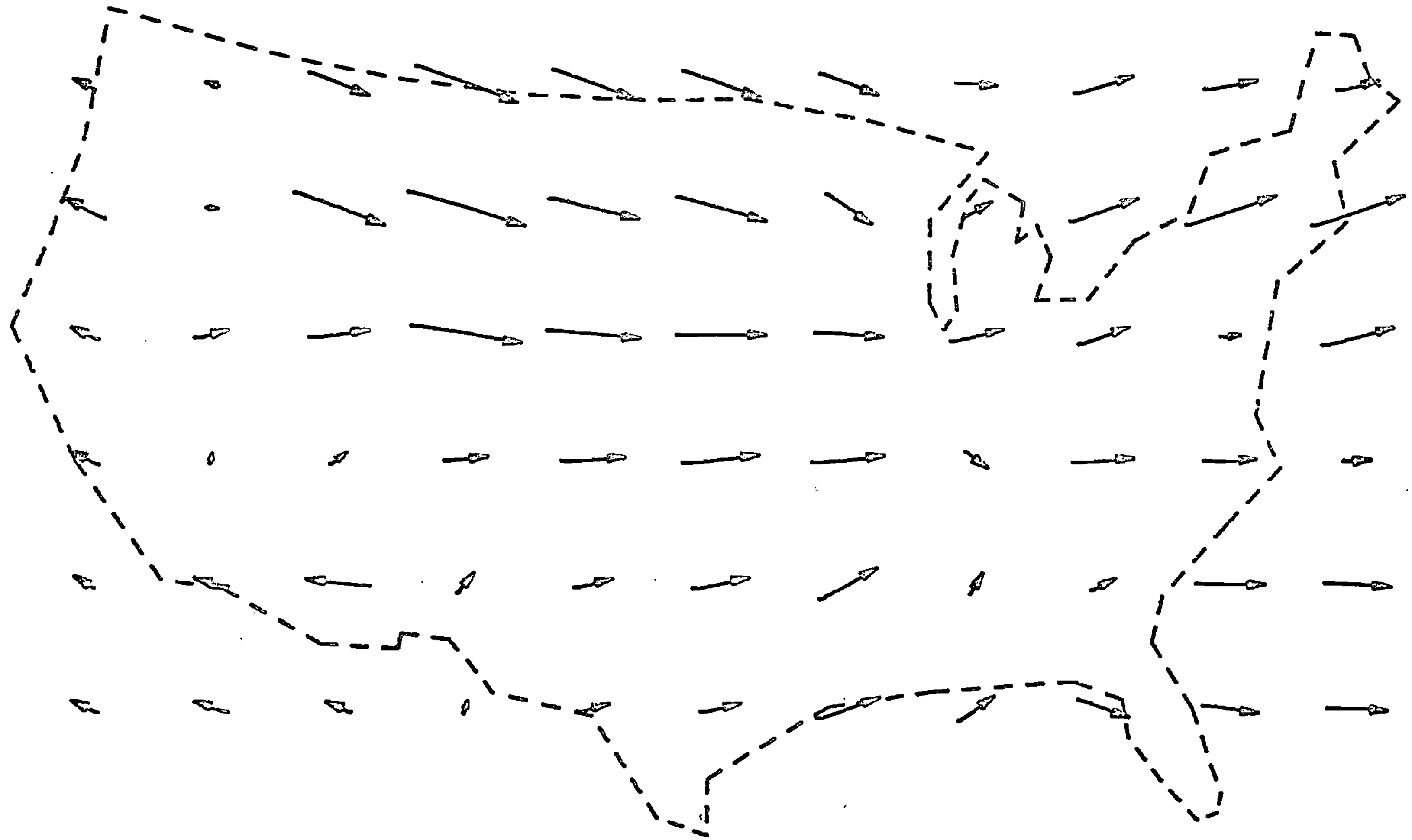


ASYMMETRY OF THE VALUE OF STATE TO STATE COMMODITIES TRADE



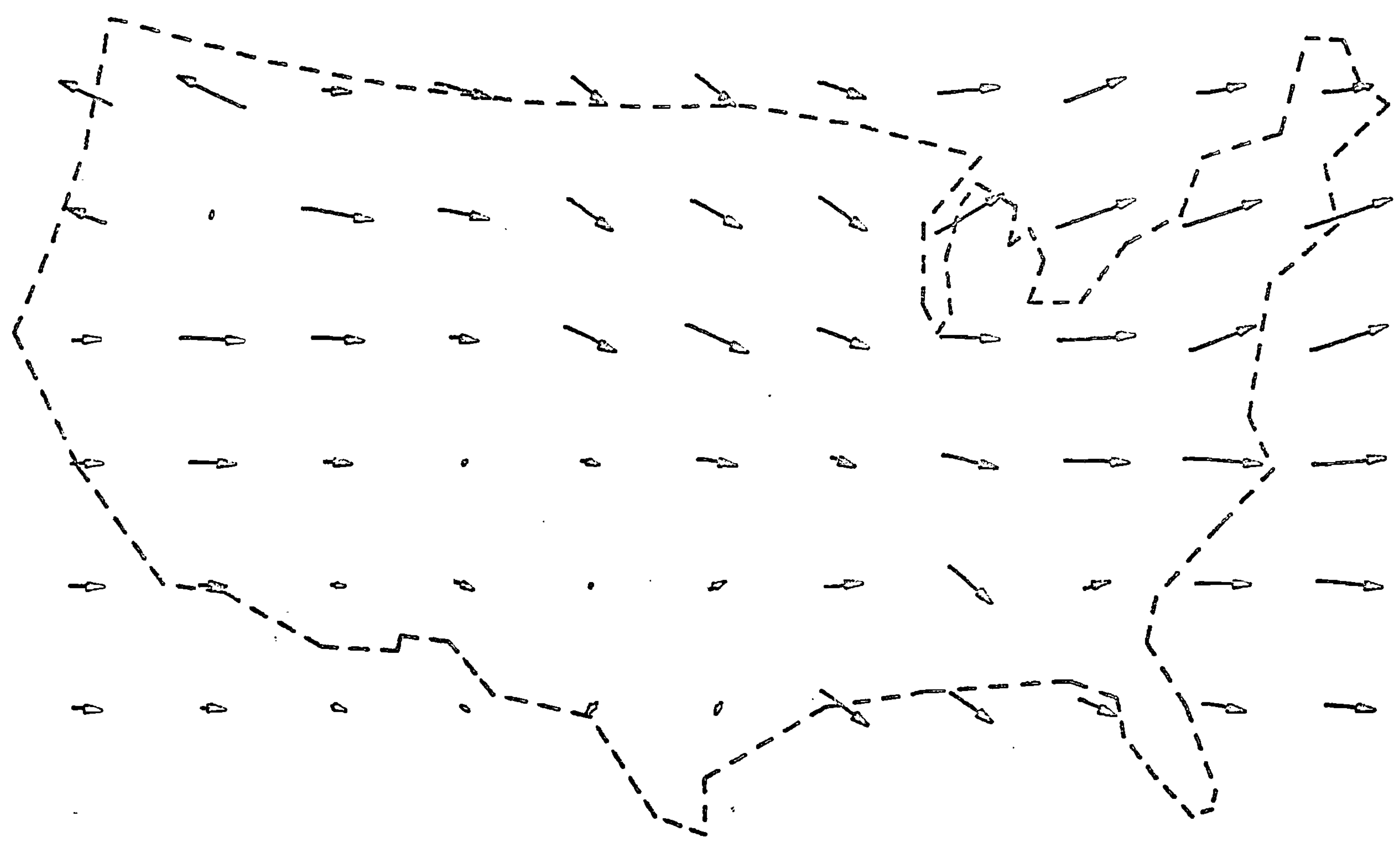
INTERPOLATED VECTOR FIELD

ASYMMETRY OF STATE TO STATE TOBACCO MANUFACTURES SHIPMENTS



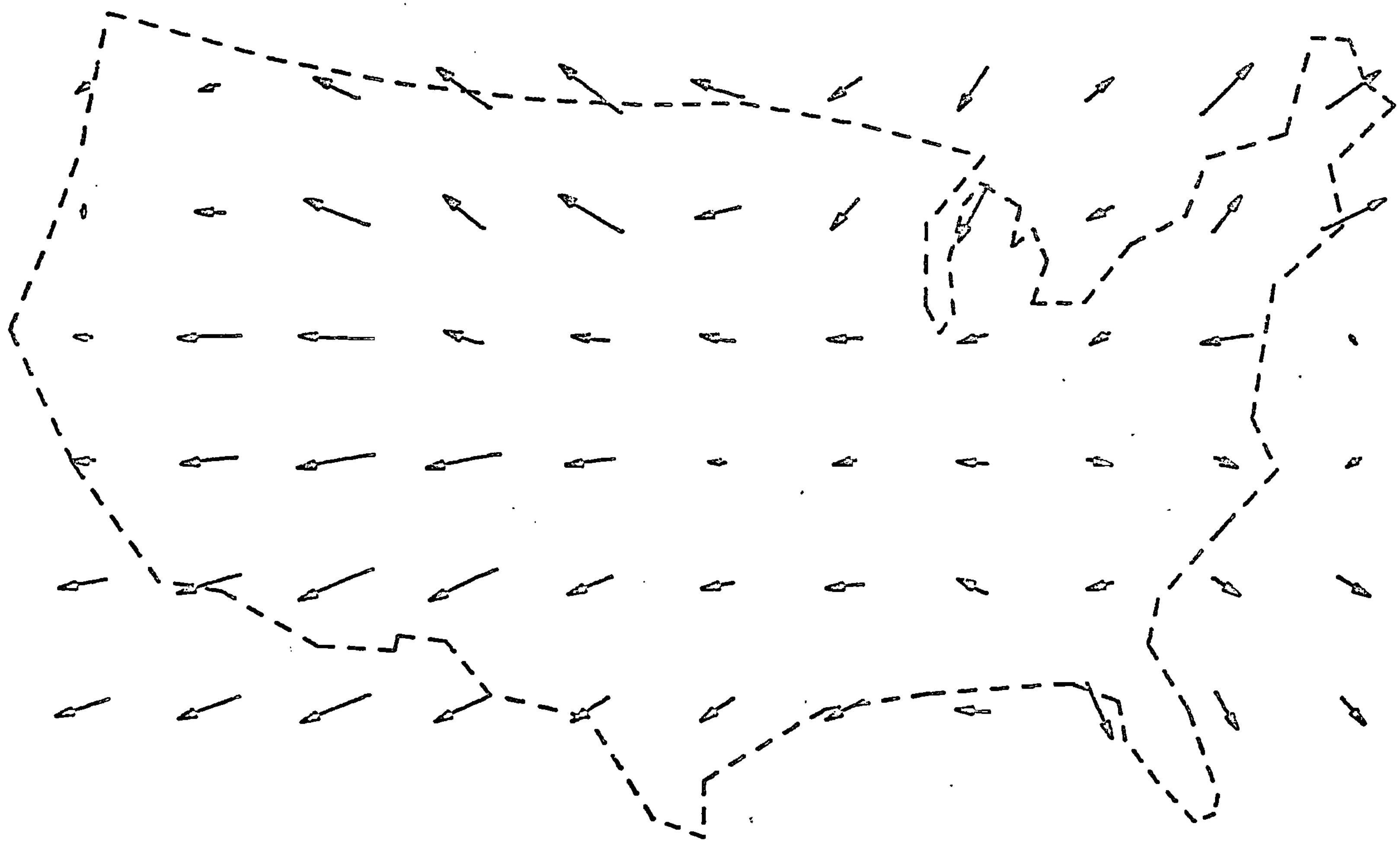
INTERPOLATED VECTOR FIELD

D-1 LIVESTOCK AND LIVESTOCK PRODUCTS



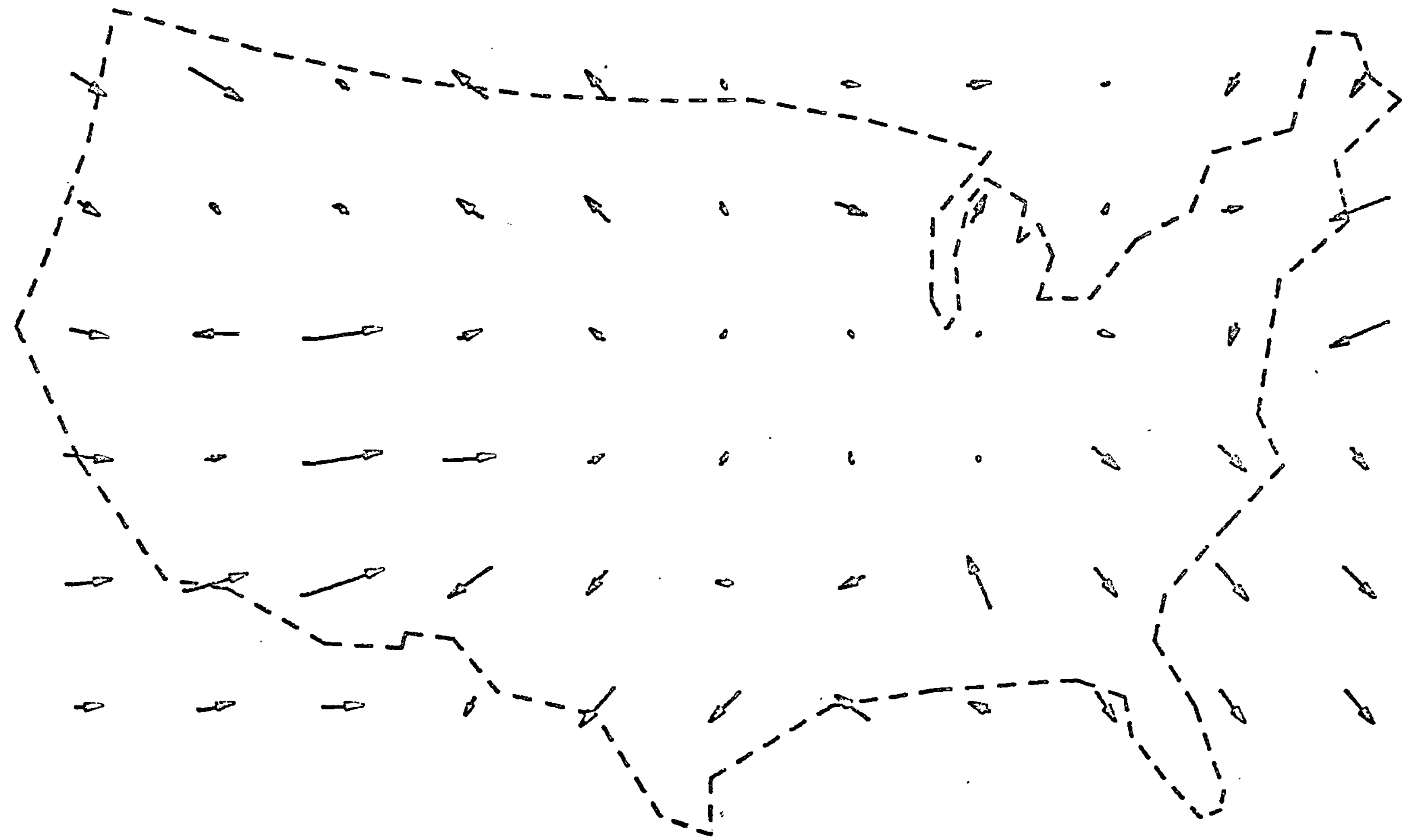
INTERPOLATED VECTOR FIELD

ASYMMETRY OF STATE TO STATE FOOD PRODUCTS SHIPMENTS



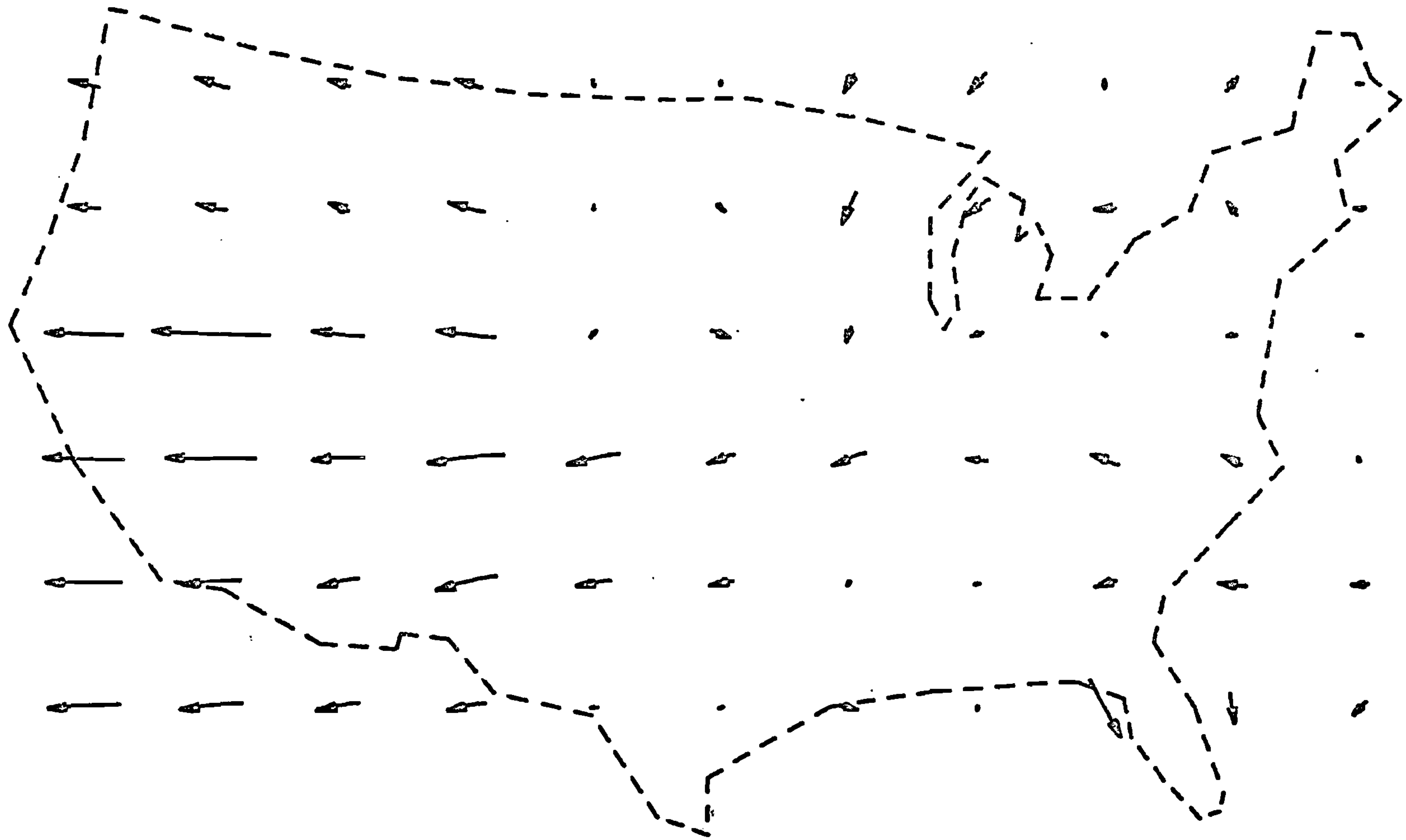
INTERPOLATED VECTOR FIELD

ASYMMETRY OF STATE TO STATE FLOW OF MOTOR VEHICLES AND EQUIPMENT, 1963



INTERPOLATED VECTOR FIELD

D-57 AIRCRAFT AND PARTS



INTERPOLATED VECTOR FIELD

ASYMMETRY OF THE VALUE OF STATE TO STATE COMMODITIES TRADE