ESTIMATING IMPORT SUBSTITUTION POTENTIAL IN SMALL RURAL ECONOMIES*

Bruce A. Weber**
Stephen G. Wood***
Ronald A. Oliveira****

Abstract

Empirical estimates of benchmarks for determining import substitution potential of four basic sectors in small rural economies are made using data from nine survey-based county input-output models. Predicted values of "expected local purchases" for three export sectors are compared with actual local purchases for a rural county outside the sample.

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** Bruce A. Weber is associate professor of agricultural and resource economics, Oregon State University, Corvallis. B.A. Seattle University, 1965; M.S. University of Wisconsin-Madison, 1972; Ph.D. University of Wisconsin-Madison, 1973. Project associate, University of Wisconsin, 1972-74; assistant and associate professor, Oregon State University 1974 - present.

*** Stephen G. Wood is regional economist, Bonneville Power Administration, Portland, Oregon. B.A. Oregon State University, 1979; M.S. Oregon State University, 1982.

**** Ronald A. Oliveira is senior economist, Economic Research and Financial Analysis, with the Public Utility Commissioner of Oregon, Salem. B.S. University of California, Berkeley, 1968; M.S. University of California, Davis, 1969; Ph.D. University of California, Davis, 1973. Assistant and associate professor, Oregon State University, 1976 - 1981.

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Bruce A. Weber, Oregon State University
Stephen G. Wood, Bonneville Power Administration
Ronald A. Oliveira, Oregon Public Utility Commissioner Staff

There are two basic ways in which open economies can grow: export expansion and import substitution. Export expansion brings additional dollars into the community setting off a chain of respending which increases community income. Import substitution reduces income leakages from a community and allows income which was previously spent on imports to be spent and respent in the local community. Local economic development efforts have traditionally emphasized export expansion. Recently economists have begun to focus more on import substitution as a way of increasing community income.[1/] This paper reports progress in a search for benchmarks which can be used by rural communities to identify sectors that are now importing goods and services that could be produced or marketed locally. Identification of such sectors would narrow the search for businesses in which there may be unexploited market potential.

Determining Import Substitution Potential

Both basic (export) sectors and service sectors import goods into the local economy. Economists have been involved for a number of years in studies to determine the trade area and market potential for local service sectors. (Scott and Johnson, 1976; Simon et. al., 1981) No technique currently exists, however, for estimating the local market potential for sectors which provide inputs to the basic sectors. That is, there is no technique for determining the potential for import substitution by the basic sectors.

One needs two pieces of information to determine, for a given basic sector, whether or not there could exist a local market for items it currently imports: (1) the actual local spending patterns of the export sector; and (2) a benchmark which identifies "expected" local spending for that sector.

Actual local spending in any given basic sector can be determined by survey. This type of information is gathered, for example, in most input-output studies, although merely to determine local spending patterns of the export sectors, one would need to do a much less ambitious survey than one required for an input-output model. It is much more difficult, however, to know for any given sector and any given community what the "expected" local spending should be.

Factors Affecting Local Spending Out of Basic Sector Export Sales

There are three types of factors which affect, at any point in time, a basic sector's "propensity to purchase locally" (the proportion of each export dollar which is spent in the local community by the exporting sector--hereafter referred to as PPL): (1) characteristics of the community such as size and distance from other input markets; (2) characteristics of the sector itself; and (3) characteristics of the macroeconomy such as the phase of the business cycle and secular trends in consumption and investment.

Three community characteristics are expected to be particularly important. Regional economic theory suggests that market size is directly related to population size and inversely related to distance from competing markets. The larger the local market, the less the probability that inputs will be purchased outside the community. Therefore, the greater the local population and the further away the competing markets, the greater the expected PPL. In addition, one would expect the rapidity of population growth to have an effect on the development of service sectors to provide inputs to basic industries. In rapidly growing communities, one would expect the PPL to be less than in stable communities on the hypothesis that there is some lag time between the development of market potential and the development of businesses to serve that market.

A number of sectoral characteristics might be expected to be important in determining the PPL of the basic sectors. Large sectors, for example, would be expected to be able to purchase more locally than small sectors on the hypothesis that there would be more developed markets for inputs to a large sector than for a small sector. In rural counties one would expect that the capital intensity would affect the local purchase propensity. A capital-intensive sector might not be able to purchase as many of the inputs it needs locally as a labor intensive sector. Sectors dominated by large firms might be expected to purchase fewer inputs locally than sectors dominated by small firms. Large firms tend to have access to (and incentive to purchase in) national markets to a greater extent than small firms. Finally, ownership might be expected to affect a basic sector PPL. "Foreign-owned" firms would be expected to purchase fewer inputs locally than locally owned firms.

A number of macroeconomic conditions reflecting cyclical and secular trends could affect the local purchase propensity. During periods of high unemployment, for example, the PPL of a basic sector may well be reduced relative to what it would be in good times, both because the basic sectors may be hiring less local labor and because they may be attempting to save more.

Finally, the rapid growth in the service sector relative to the basic sectors over the past several decades suggests a secular trend in consumption towards purchasing services. Since markets for services tend to be more locally oriented than markets for goods, this trend suggests the hypothesis that over time, local economies are becoming more self-sufficient and that the local purchase propensities of the basic sectors may be increasing over time.

Basic Sector Propensities to Purchase Locally for Oregon's Rural Counties

Consistent data on input purchase patterns of the basic sectors in small open economies is extremely difficult to come by. Primary data (survey)

input-output models provide this kind of data. Such models are, however, expensive and therefore seldom constructed for small regions.

Nine survey-based input-output models were constructed for seven rural Oregon counties during the period 1963-1978. The existence of this data set allowed construction of nine input-output models of small rural counties with 14 consistently-defined endogenous sectors.[2/]

Estimates of the propensity to purchase locally of the various basic sectors were derived from the direct coefficients matrix of the input-output models. In this study the propensity to purchase locally is formally defined as the column sum of the direct coefficients over the endogenous sectors including households:

$$PPL = \sum_{i=1}^{n} a_{ij} \qquad (1)$$

where a_{ij} is the "direct coefficient" from the input-output model specifying the proportion of the jth sectors purchases from the ith endogenous sector; and n = the final endogenous sector.

Four basic sectors were identified: agriculture, fishing and fish processing, lumber and wood processing, and other manufacturing. From Table 1 it is clear that the agriculture sector has the highest propensity to purchase locally followed by fishing and fish processing and finally by lumber and wood processing and other manufacturing. It is also clear that there is no small amount of variation among the counties in these propensities. In the next section we attempt to explain some of this variation using the factors identified in the previous section.

TABLE 1

BASIC SECTOR PROPENSITIES TO PURCHASE LOCALLY

	Mean	Standard Deviation
Agriculture	.683	.185
Fishing/Fish Processing	.534	.168
Lumber and Wood Processing	.459	.148
Other Manufacturing	.453	.172

Estimating Basic Sector Propensities to Purchase Locally: An Empirical Model

Nine factors were identified in an earlier section as possible determinants of the propensity to purchase locally. The empirical model developed in this paper uses data on seven of these characteristics to estimate the propensities. Distance of the county seat from a standard metropolitan statistical area (SMSA) is used to measure proximity to other major market centers. County population in the year in which the input-output model was constructed is used as one measure of market potential. The percent change in population in the five years prior to this study is used as a measure of growth.

Four sectoral characteristics were identified as possible determinants of the propensity to spend locally. Two of these is used in the empirical model. The size of the sector is measured by employment in that sector in the relevant year and the percent of workers employed in plants with fewer than 100 workers is used as a measure of concentration in size distribution of firms in the sector. The larger this percentage, the less the sector is dominated by large firms. Measures of capital intensity and ownership were not available. Since the propensity to purchase locally measures only current

input purchases as opposed to capital input purchases, the omission of a capital intensity variable is not expected to affect the results. In order to allow for the possibility that different sectors might have different intercepts, a dummy variable was included for each of the following sectors: agriculture, lumber and wood processing, and other manufacturing.

The average county unemployment rate in the year of the model was used as a measure of business cycle phase and the year of the model was entered in order to capture any secular trends in local input purchases.

The counties in the sample are relatively small (averaging under 30,000 population), relatively slow growing (at less than one percent a year) and relatively isolated from metropolitan areas (Table 2). The average sector is relatively small (with slightly more than a thousand employees) and it is dominated by small firms. In the average sector, 70 percent of the work force was employed in plants with fewer than 100 workers.

Regression Results

Regression results as reported in Table 3 suggest that indeed the propensity of the basic sectors to purchase locally is dependent on characteristics of the economy, characteristics of the sector and cyclical and secular trends. All coefficients had the expected signs. Both population size and recent population change were significant predictors of the propensity to purchase locally. An increase of 10,000 population is associated with .03 increase in local purchase propensity, ceteris paribus, implying that PPL is relatively insensitive to population size. The local purchase propensity seems moderately responsive to population change, however. The size of the population change coefficient implies that basic sectors in a county with a 10 percent growth over a five year period, for example, would be expected to have a PPL which was .026 lower than a similar sector in a county which grew only 9 percent over the same period,

TABLE 2

FACTORS AFFECTING LOCAL PURCHASE PROPENSITIES

		Characteristics of Sample Counties		
County Characteristics	Unit	Mean	Maximum	Minimum
Distance from SMSA	Miles	120	173	71
Population Change	% change, 5 years prior to model	3.0	8.4	-4.5
Population	Persons	29,015	71,743	7,434
Sector Characteristics				
Size of Sector	Employment	1,172	7,704	26
Capital Intensity	--	--	--	--
Size of Plant in Sector	% employed in plants with under 100 workers	70	100	10
Local/Nonlocal Ownership		--	--	--
National Economic Conditions				
Unemployment	% unemployed in county	7.4	10.3	4.7
Secular Trends in Consumption Patterns	Year of model	70	77	63

TABLE 3

REGRESSION RESULTS: FACTORS AFFECTING LOCAL PURCHASE PROPENSITIES

INDEPENDENT VARIABLE	DEPENDENT VARIABLE
	Propensity to Purchase Locally
County Characteristics	
Distance (hundred miles)	.009 (.076)
Population Change (%)	-.026 **1-tail (.013)
Population (100,000)	.248 *1-tail (.152)
Sector Characteristics	
% of Plants With Less Than 100 Employees	.003 **1-tail (.0008)
Other Manufacturing (dummy variable)	-.172 **2-tail (.064)
Macroeconomic Conditions	
County Unemployment Rate (5)	-.028 *1-tail (.019)
Secular Trend Variable	.021 **1-tail (.009)
Constant	-.979 *2-tail (.534)
R^2	.528
F-statistic	3.670 **
Degrees of Freedom	23

* Significant at $\alpha = .10$
** Significant at $\alpha = .05$
Standard error in parenthesis

ceteris paribus. Basic sectors in rapidly growing counties appear to have much lower spending propensities than those in slowly growing areas. There is evidently a lag in the development of sectors which service basic industry.

The signs on the other variables are in accord with a priori expectations.[3/] Sectors with large concentrations of small plants tended to purchase more locally than those sectors dominated with large plants. A ten percentage point increase in the proportion of small plants in a sector was associated with a .03 increase in the local purchase propensity of that sector. The only dummy variable that was significant was the "other manufacturing" dummy. Other things being equal, other manufacturing firms purchased a significantly lower proportion of their inputs locally than the other sectors. The cyclical and secular indicators also significantly affect the propensity to purchase locally. Basic sectors in counties with a high unemployment rate have a lower propensity to purchase locally. A one percent increase in the unemployment rate is associated with a .03 decrease in the local purchase propensity. The results also show a secular trend toward local self-sufficiency. With each passing year, the propensity to purchase locally had increased by .02.

While the variables all had the expected signs and most are significant, the overall explanatory power of the regression is not exceptional. The model explains only slightly over half of the variation in the dependent variable, suggesting that estimates of local purchase propensities based on this model would likely not be very precise.

Using the Results to Predict Import Substitution Potential

In order to get the preliminary idea of the value of this model in predicting a given basic sector's potential for import substitution in a given county, estimates of the propensity to purchase locally based on the model in Table 3 were compared with actual propensities to purchase

locally from a recent input-output model done for another Oregon county (Obermiller et. al., 1981). Table 4 reports the results. In each case the predicted value is above the actual value derived from the input-output model. The forestry sector, for example, in a county with the growth, size, and distance characteristics of Baker County in the phase of the business cycle that Baker County was in during 1979 would have been expected to purchase 57 percent of its inputs locally. In fact, the input-output model survey found that it only purchased 49 percent locally. The difference here is not large enough to allow one to make any kind of inferences about potential. For the agricultural sector, however, the situation is somewhat different. The agricultural sector in a county with Baker County's characteristics and in the phase of the business cycle that the county was in during 1979 would have been expected to purchase 78 percent of its imports locally. In fact, the local agricultural sector only purchased 56 percent of its inputs locally. While the actual value falls within the 90 percent prediction limits, it does not fall within the 80 percent prediction limits, suggesting that there is a good chance that there is an unexploited potential for agricultural service industries in Baker County.

TABLE 4

PREDICTED AND ACTUAL BASIC SECTOR LOCAL SPENDING PROPENSITIES

BAKER COUNTY, OREGON 1979

Sector	Predicted Value	Prediction Intervals[a/]		Actual Value
		90%	80%	
Lumber and Wood Products	.565	.281-.848	.346-.783	.487
Other Manufacturing	.611	.315-.906	.383-.838	.439
Agriculture	.783	.505-1.061	.569-.997	.561

[a/] Kmenta (1971, pp. 374-376) outlines the procedure used here for determining prediction intervals from a multiple regression model.

Additional Research Needs

We believe that the technique outlined in this paper for identifying the potential that exists in a local economy for developing businesses to serve already existing basic sectors has some merit. The small sample size and limited information on sectoral variables that might affect the propensity to purchase locally are partial explanation for the lack of precision in the model and its consequent inability to generate narrow prediction limits. Additional information about individual sectors which could help explain local purchase propensities would improve the model. Disaggregation of the other manufacturing sector and the lumber and wood products sector would also improve the precision in the model and help in the search for additional sector related factors explaining local purchase propensities. The current resurgence of interest in import substitution strategies for local economic development and the inability of currently available techniques to provide benchmarks for rural communities in determining import substitution potential suggest that the technique outlined here bears further exploration.

Footnotes

1/ Economists for many years have been interested in the effects of imports (or, more generally, leakages) on economic activity in a community. Wadsworth and Conrad (1965) and Little and Doeksen (1968) both focused on how import patterns and changes in imports would effect a local (or state) economy. The latter study explicitly addressed the question of the effects of import substitution. Neither looked at the potential for import substitution.

2/ Each of these models was constructed, of course, at different levels of sectoral aggregation. It was necessary to aggregate the sectors to the least common denominator and make other minor technical adjustments. A description of the nine models and the adjustments is found in Wood (1982).

3/ The coefficients on the "size of employment" variable were never significant in any of the early regression runs. Since there was no theoretical reason for including it, the variable is dropped from subsequent regression runs.

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