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## ON IMPROVING EXPORT BASE STUDIES\*

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Introduction

The export base model of a local economy has been severely criticized by numerous writers.<sup>1</sup> In 1970 Roland Artle wrote that "...the so-called economic base theory has probably been laid to rest as an essentially useless approach" [2]. Yet the export base model continues to be widely used. Why has the model survived and retained its popularity despite the severe criticism? Are the criticisms unfounded or are the users oblivious of the model's faults? Is the model worse than no model--does it give misleading and inaccurate results so that the model does more damage than good?

The model has survived and remained popular foremost because no real substitute for it exists. A strong demand continues to exist for local economic studies, especially those that lead to forecasts. Local officials and planning bodies want to have, or are required to have, such studies in dealing with problems such as growth or stagnation, instability, future needs for public and private facilities, impacts of anticipated developments, environmental quality, and so on. Obviously, the export base model is not the only model that can be employed in studies of local economies. But it is alone in its price class, and the cross elasticity of demand between it and its alternatives is quite low. No other model can approach the export base technique in terms of inexpensiveness and simplicity. Many studies have small budgets that preclude the use of other more complex models. In some cases, the constraint is that the personnel conducting the study do not have the skills to construct anything but the simplest of models.

Widespread use of the export base model seems certain to continue. Its use has not lessened despite the criticisms, so it has demonstrated its staying power. My objective in this paper is to suggest uses and procedures that will alleviate some of the model's shortcomings and thus improve the quality of export base studies. Because of the wide variety of uses and procedures the results of the many export base studies do not inspire confidence. The estimated values of the multiplier depend heavily upon the estimation procedures. An investigator can get almost any result he wants

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\*The comments of Thomas Langford were helpful in revising this paper.

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<sup>1</sup>Criticisms of the export base model have appeared in many articles and books. Among the more important sources of criticism are [1, 2, 4, 28, 31].

by choosing procedures that yield the desired results. A cynic is justified in considering base multipliers as random numbers between one and five. My goal in suggesting ways to improve base studies is to make the results less capricious and more credible.

I believe that export base studies can be substantially improved without greatly increasing their cost. Many of the economic base studies are poorly done and do not represent the "best practices." Such studies deserve the criticism they have received. Some of the criticism is, however, directed at practices or assumptions that are infrequently used in current studies [4]. And some of the critics are "purists" whose objective is simply to maximize the mathematical or logical elegance of a model with little or no consideration to the problems of implementation. These purists may or may not suggest alternatives to the export base model; if they do, they generally do not consider the cost-effectiveness of the alternatives.

The primary value of an export base model is its simple portrayal of the process of income determination in a local economy. The model is similar to a Keynesian income-expenditure multiplier model [34, 35, 36]. The primary differences are that the local sector substitutes for consumption, exports substitute for investment (in the simplest Keynesian model of  $Y = C + I$ ), and employment usually substitutes for income or expenditures as a measure of activity. Investment is exogenous in the Keynesian model while export employment is exogenous in the base model.<sup>2</sup>

Most export base models are highly aggregated with only two sectors (export and local) and one general industry. But they can be disaggregated into numerous sectors and industries as Tiebout has described [36]. Many regional input-output and econometric models can be considered as disaggregated export base models in the sense that exports are the driving force (the key exogenous variable) for the models. Export base models are used frequently in developing local area projections, but the models are not projection models as such. To use base models for projections, one must first develop other models for projecting the exogenous variable (exports) and the parameters which determine the multiplier.

The remainder of this paper will consider various criticisms of the base model, assess the validity of the criticisms, and suggest procedures for alleviating the shortcomings of the model. The discussion will focus upon the most common base study in which employment is the measure of economic activity, exports are the only exogenous activity, and the location quotient is used to estimate exports.

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<sup>2</sup> If the export base model were a true Keynesian model, it would focus on the external balance (payments inflows minus outflows) rather than just on exports.

## Criticisms of the Export Base Model

Oversimplification. A common criticism of the export base model is that it ignores important exogenous variables other than exports such as business investment, housing construction, and nonlocal government spending. The economic base model is, like any model, an abstraction. The goal in model building is generally to identify or isolate a few key variables and relationships that portray the essence of a process. The export base model is an abstraction of the process of local income determination in which exports are the only exogenous variable. The question is whether other exogenous variables are sufficiently important that the model is not a reasonable portrayal of the process. The answer depends upon the size of the local economy. For small local economies (areas with less than 100,000 population), export production clearly looms large in relation to other types of exogenous activity. In general, the smaller the economic unit, the greater the relative importance of exports. Exogenous variables other than exports are relatively unimportant in small economies but increase in importance in the larger economies (such as states or major metropolitan areas). The export base model is thus appropriate only for small areas. To use it for large areas results in a major understatement of exogenous activities and a comparable overstatement of the multiplier.

A related criticism concerns the failure of the export base model to allow for interregional feedback effects. But again these feedbacks are relatively unimportant for small areas. To omit them does no great damage to reality as long as the model is confined to small local economies. If feedbacks are important, then the local economy is too large for the export base model to be an appropriate tool.

Fixed Relationships. A major criticism of the base model is that it assumes fixed relationships and thus a constant multiplier or a constant base-service ratio. The validity of this criticism depends upon how the parameters of a base model are estimated. Critics claim that the multiplier is unstable over short periods and that a priori reasoning suggests that it should change over long periods. The multiplier may fluctuate significantly over short periods (say from year to year) in response to cyclical factors, and it should change over a longer period in response to secular or structural changes in the local economy.

Base-service ratios are especially apt to show fluctuations if employment is the measure of activity. One should never estimate a multiplier from observations for only one or two years. Employment is not a sensitive measure of activity and the base-service ratio for any one year or any one period may reflect a disequilibrium. To project by assuming a constant multiplier based upon only one or two observations is obviously foolish. The sensible approach is to assemble a time series for the employment data and to use regressions to estimate the parameters and the multiplier. The regressions will smooth out the erratic period-to-period fluctuations and should also reveal the trend over time in the relationships. By following this technique, the analyst can use the model in longer-run studies and not assume fixed relationships and a fixed multiplier. The criticism that base models assume

constant multipliers is valid only for the poorly executed studies. The relationships need not be constant but need to be predictable.

Probably the best approach is to obtain annual or quarterly employment data and regress service employment on basic employment. Serial correlation will usually exist and will require the use of an adjustment procedure to minimize it [17]. The resulting regression will give both a marginal and an average multiplier. If the constant term is significantly different from zero, then the marginal and average multiplier will be different. Too many studies ignore the possibility that the average and marginal multipliers may differ.

Some export base models involve the estimation of separate multipliers for each basic industry. Such a practice involves an improper use or implementation of the model in my opinion. The reason for isolating exports is that the demand for them depends not upon the local economy but upon the outside world. This outside demand determines not only the amount of direct exports but also the amount of indirect exports. The multiplier should be the same for all export activities if exports include both direct and indirect exports. The multiplier will depend only upon the marginal propensity to spend income locally and the local income generated per dollar of local spending.<sup>3</sup> When a study yields different multipliers for different export industries, the reason is probably that indirect exports have not been identified to the same extent for all the industries.<sup>4</sup>

Neglect of Imports, Savings, and the Balance of Payments. Another criticism of the base model is that the emphasis on exports gives it a mercantilist flavor and that it neglects imports, savings, and the balance of payments. While imports are not explicitly listed in the usual formulation of the base model, they are implicitly a part of it. Imports influence the base-service ratio (or the marginal propensity to spend locally and the income generated per dollar of local spending). The greater are imports relative to total economic activity, the smaller will be local or service employment relative to total. Local areas with much importing will have a low base ratio (service to export employment) and a small multiplier when compared with areas

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<sup>3</sup>Conceivable these marginal propensities could vary among export industries but I have seen no compelling reasons to expect such variations as a general rule.

<sup>4</sup>Several articles have appeared recently that have compared the multipliers of input-output models and economic base models [3, 8, 32]. The prevailing view is that with appropriate specification the composite I-O multiplier is the same (or similar) mathematically and empirically with aggregate economic base multipliers. I believe this literature contains two mistakes: (1) indirect exports are considered local (interindustry) activity and not exports, and (2) industries are assumed to be either entirely in the local or in the export category. I have already indicated why indirect exports should be included as exports. The output or employment in each industry should be allocated between the local and export sectors. Few industries will be producing entirely for export. To make the "either-or" classification can only give misleading results.

having relatively less imports. Import substitution (for consumption) constitutes an increase in the service sector relative to the export sector.

Savings are not an explicit part of the base model, but they constitute a leakage that affects multipliers. I doubt that local savings have great significance as a determinant of local investment. Money is highly mobile among areas. Attractive investment opportunities in one area are not apt to be foregone because of inadequate local savings. Local savings would be a component of a local income accounting system or flow of funds account. But savings do not have the same significance for local areas that they have for relatively closed national economies. Their omission from explicit consideration in the model should not be considered a serious defect.

Base models do ignore major parts of a balance of payments account. The most serious omission is the "invisibles" that constitute payments to local residents from outside the local area. If such payments are relatively important, base models as usually implemented would be seriously deficient. If employment is the measure of activity for the model, it would miss "invisibles" entirely. Among the more important invisibles are returns on investments outside the local area and transfer payments from the outside. Factor payments for labor may be a major invisible flow if commuting across the area's boundaries are important. An investigator should know the local economy well enough (or consult other who do know it) to determine if invisibles are important. If they are, he should estimate them separately or not use the base model. The county estimates of personal income will be helpful in attempting to estimate these invisibles.

Base models undoubtedly give discussions a mercantilist tone if that means to emphasize exports and attempts to increase them. Those who make this criticism probably dislike the "beggar-thy-neighbor" policies that frequently come from base studies. An increase of one area's exports must result in an increase of imports in some other area. The rise in exports increases income in the one area, but the complementary rise in imports elsewhere extinguishes income there. The rise in exports in one area could also be at the expense of exports of another area. We cannot escape the fact that local areas do compete with one another in the process of economic development. Such competition will exist whether we use base models or not.

Another fear of those who object to the mercantilist aspects of the model is that attention will focus upon exports alone and neglect other measures that might stimulate growth in the local economy. Attempts to promote import substitution and thus to change the parameters of the model may be more effective in stimulating local growth than attempts to promote exports. Local officials should never forget that the efficiency of the non-basic sector may be an important determinant of the local area's competitive position in export production. All that is necessary to avoid these potential disadvantages of the export base model is for the analyst to emphasize that local policy should not stress exports to the exclusion of the other methods of promoting local growth.

Failure to Explain Level of Exports. An occasional criticism of the base model is that it does not explain the key determinant of income, i.e., the level of exports. All economic models have certain exogenous variables that the models do not explain but take as given. To criticize a base model for not explaining the level of exports is to criticize it for not doing what it was never intended to do. To use a base model for projecting requires another model to project exports. Too often model builders devote great effort to constructing elaborate structural models but then use the simplest and crudest methods in forecasting the exogenous variables that drive their structural models. Builders of economic base models are frequently guilty of this practice when they devote nearly all their efforts to implementing the model and then casually forecast exports of a region.

Unreliable Estimation of Exports. A common criticism of base models is that the division of the local economy into export and service sectors is often inadequately or poorly done. Most such studies do not have enough money to conduct a survey to determine the amount of exports. Consequently, the studies employ indirect methods of estimating export employment, most likely the location quotient. Criticisms of the location quotient are well known [13, 16, 23, 35, 36].

What can be said about these criticisms? Any model requires measurement of the variables. Regional scientists are accustomed to doing without the data they would like to have and to using proxies. The most desirable data for an export base model would be local income and product accounts. But local income and product data are rarely available and are expensive to generate. Analysts must therefore rely upon less expensive even though less desirable data. Employment figures are always available for local areas though not always in the detail desired. Employment is not a sensitive indicator of economic activity, and its use in location quotient calculations involves numerous questionable assumptions.

Despite the inadequacies of employment as a measure of activity, it will continue to be used because of the great expense of alternatives. And the location quotient, implemented with employment data, will continue to be used to identify and estimate export activity. It is important, therefore, to evaluate carefully the shortcoming of the location quotient. A problem in evaluating this technique is that the true value for exports is not known. Some studies have compared the results of using the location quotient with those from using the minimum requirements technique, transportation data, and surveys of local producers [13, 20, 36]. The usual assumption is that the survey gives the true figure. My experience in participating in field surveys is such that I am hesitant to assume that they yield the "truth." Firms simply do not keep records that will quickly and clearly reveal the amount of their exports from a local area. Legal requirements insure that records are kept concerning flows across the boundaries of a nation. No comparable requirements exist for regional or local economies. Furthermore, in using a survey one must attempt somehow to identify indirect exports which are normally included as local sales by respondents. The location quotient has the advantage of identifying indirect as well as direct exports.

Transportation surveys usually yield shipments in physical units by commodity classification. These physical units must then be converted to values and compared with the value of shipments or value added to determine exports as a share of production. Such calculations (which I have carried out) can hardly inspire confidence in the accuracy of the results.

As it is well known, the location quotient assumes that per capita consumption (or per worker consumption) of the individually classified goods and services is the same in the local economy as in the bench mark economy. Consumption in the two economies may differ because of differing preferences (including overall propensity to consume) and differing incomes. With our high mobility and our mass media, preferences among regions are not apt to be greatly different. A few products may have a regional bias in consumption--home heating fuels and outdoor swimming pools. But the major reason for differences in consumption patterns among regions is probably differences in income. It is not easy to determine variations in consumption patterns among regions. The problems are that family budget studies, being based on small samples, are available only for broad regions and the expenditure categories are too broad to be really useful. I doubt that differences among regions in consumption patterns are great, but the assumption of identical patterns is a weakness of the location quotient that cannot be readily corrected.<sup>5</sup>

Another implicit assumption of the location quotient is identical production functions and factor productivities in the local and the bench mark economies. These assumptions are strong ones and are not likely to be met. One could rather easily make an adjustment for differences in output (value added) per worker in manufacturing [6]. No simple adjustment seems to be available for differences in consumption of capital goods, intermediate products, and raw materials in production, so this defect will remain with the location quotient.<sup>6</sup>

The third major assumption of the location quotient is that of product homogeneity within each product class; this assumption leads to the product-mix problem. The technique assumes that no product class will have any exports until local consumption has been met. The assumption clearly leads to an understatement of exports and an overstatement of the multiplier. The problem can be lessened by using more disaggregated industry employment. The effort to disaggregate quickly encounters the disclosure rule in census data

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<sup>5</sup>Lee [19] found statistically significant differences in income elasticities in the four regions (N.E., South, N.C., and West). Rankings of regions by income elasticities agreed closely with rankings by degree of urbanization. Also the differences in elasticities, though statistically significant, appear to be small.

<sup>6</sup>Harvey [14] suggested an interesting approach that could be used in adjusting location quotients. He suggested that the base-service ratio could be expected to change over time as the result of different income elasticities of demand, rising incomes, and different rates of growth of labor productivity. His method of estimating this adjustment could undoubtedly be improved if one wanted to follow his intriguing suggestion.



for a small area. Users of the location quotient could spend some time on the telephone, write a few letters, or conduct a few personal interviews, to get employment by highly detailed industrial categories for small economies. Most firms will readily give employment so that one can use highly disaggregated data for calculating location quotients and thus greatly reduce the "netting out" or underestimating of exports. The underestimation will be minor if one uses highly detailed industrial employment. The level of disaggregation is crucial in using the location quotient. In reading an article that uses the location quotient, I always look first for the industry classifications, and I am amazed that so many articles do not even give the classification used.

Clearly, these assumptions of the location quotient represent weaknesses of the technique. We would prefer a simple technique that did not make unrealistic assumptions. Unfortunately, none is available. I feel strongly, however, that the location quotient is a useful technique if applied properly and if the user is aware of its shortcomings. One should not attribute a high degree of accuracy to the resulting estimates and should be aware of the probable bias.

The minimum requirements technique has the same faults as the location quotient plus some additional ones which make it even less desirable [13, 29]. The technique assumes each region exports but does not import. Furthermore, the results are highly sensitive to the level of disaggregation. In using highly detailed industry data, virtually all activity is classified as export. In a comparison of exports estimated by the location quotient, the minimum requirements, and a direct survey, the outcome depends critically upon the industrial detail used in applying the indirect techniques. Frequently, the investigator uses such aggregated data that the results will certainly place the indirect techniques at a disadvantage.

Neglect of Supply. I want now to return to the export base model itself and consider another criticism of it. That criticism is its neglect of supply as the model does not explicitly consider supply. It will validly portray the process of income determination only if excess capacity exists or if factor suppliers are highly elastic. The extent to which these conditions exist will depend upon the particular circumstances at a particular time. Local economies frequently have the ability to expand output substantially in given plants without incurring a major increase in factor costs. Of course, this situation would exist less frequently if all local areas were trying to expand output simultaneously. The seriousness of neglect of supply will simply depend upon a given situation. Pratt [30] has shown the effects upon the multiplier of various supply situations.

The neglect of supply would seem to make the export base model inappropriate as a growth model. In studying growth, important elements are the supply of labor, investment in human and material resources, and technology. All of these elements are missing in the export base model. Yet a number of analysts have used the model for growth analysis and have been rather convincing [25]. I suspect the reason is that the supply of factors of production has been highly elastic to small, local economies so that the implicit supply assumptions of the

model have been fairly well met. Maybe the model was appropriate in some of the historical settings in which it has been used. Nevertheless, I do not suggest that the export base model be considered as a good, inexpensive growth model for the present. The best hope for reasonably satisfactory local growth models is a simple econometric model that would attempt to explain, among other things, changes in a local area's exports.

Other Criticisms. Engle [7] characterizes the base model as "woefully inadequate" as a policy model because it does not consider comparative costs, investments, government expenditure and taxation, and wage rates. This criticism is a valid one. To show the effects of policy measures upon exports and the base-service ratio, one must have another model or other models. The usual practice is simply to assert that the specific policy measures will have a particular effect upon the variables and parameters of export base models without developing a formal model to portray the effects of policy measures.

Several writers have conducted tests of the validity of the export base model. Some have reported negative results while others claim positive results from the tests [37]. The tests are not being reviewed here as many were not convincing. This area is one that needs more work. We need to devise better tests so that we can resolve some of the disputed questions concerning the base model.

### Conclusions

No close substitute exists for the export base model, so we can expect to see its widespread use continue. Further, if the model is implemented and used appropriately, its shortcomings are substantially mitigated. Appropriate implementation and use include the following: (1) use the model only for small local economies; (2) do not assume a fixed base-service ratio or a fixed multiplier--use time series to estimate the multiplier; (3) do not use it as a growth model for long periods; (4) use highly disaggregated employment in estimating export employment with the location quotient; (5) allocate each industry's employment between export and local production; and (6) pay more attention to forecasting exports in using the model for forecasting. If location quotients are used, check county income data to see if estimates should be prepared for "invisibles" in the local area's balance of payments. Not all shortcomings of the model can be overcome by following the above suggestions. Users of the model must be aware of its shortcomings and limitations and use it accordingly.

In this paper the primary concern has been with suggestions for improving export base studies. The paper does not answer the question of whether base studies are worth their cost or how they compare with other models of local economies. Any model must be evaluated by asking how well it served its purpose. Many questions can be asked which the base model cannot answer or for which it is not the appropriate model to use. No one model will be satisfactory for all purposes. Do not jump to alternative models just because

the base model has shortcomings. The alternatives have their shortcomings also.<sup>7</sup> Base models are most appropriate when the purpose is to determine orders of magnitude for some aggregate measures or impacts for a local economy.<sup>8</sup>

We should not be content with the status quo. We need to devise better techniques for implementing base models.<sup>9</sup> I suggest that we follow Garnick's advice (1969) and make greater use of BEA county income data in conjunction with employment. We should devise better tests of the reliability of the multiplier. We need to use data for periods of less than one year--probably quarterly would be best--and explore more fully the lags that may exist in the relationships. More can be done to evaluate and improve the base model. Such work will be useful because the model is going to be around for awhile yet.

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<sup>7</sup>For a discussion of some problems with input-output models, see [10].

<sup>8</sup>This idea was suggested by Thomas Langford.

<sup>9</sup>We should explore the suggestion by Mathur and Rosen [20] for identifying exports.

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