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TYPES OF MODELS AND ANALYSIS OF IMPACT

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Much of the work performed by regional economists involves tracing the economic impacts of specific exogenous actions through the regional economy. The impacts of tax structure changes, of the location of new industry, or of increases in export markets are common examples of this type of study.

Three types of models are available to assist the researcher in this work--economic base models, input-output models, and econometric models. Each is best suited for particular problems and situations. The economic base model is the easiest of the three to construct and use, requiring in its simplest formulation only that the basic and nonbasic sectors of the economy be identified by one of several established techniques. The ratio of nonbasic to basic activity becomes the estimate of activity which would be generated by an increase in basic activity. The simplicity of the model means that it can be widely used but also presents problems which severely limit its usefulness as the change being analyzed increases in size and/or occurs within a time dimension. The use of a single unit of measure of economic activity such as employment is misleading, since different industries can have very different levels of average wages with very different effects. The identification of basic and nonbasic sectors is a problem. Finally, the model assumes a constant basic/nonbasic ratio which is clearly not realistic over time.

The input-output model provides much more detail on the inter-relationships within a regional economy and can trace the impact of a change in much greater detail than an economic base model. Differential impacts from changes in different sectors of the economy can be traced.

Data requirements are the largest problem in model implementation, although techniques have been developed to make input-output models transferable from region to region. The basic conceptual problem with these models is the assumption of constant coefficients which rules out economies of scale, other types of agglomeration economies such as urbanization, and technological change. This is not a problem in the short run but does introduce bias in any long-run analysis.

Econometric models of regions are not confined to the theories of regional growth implicit in either the economic base or input-output type models but are more flexible in terms of being able to apply other components of regional economic theory to the analysis of impact. Many adopt concepts from the economic base models, but a variety of factors can be handled within the econometric framework which are important in regional economic analysis, but which are not capable of being handled in the other model types.

Some of these capabilities include the ability to handle a changing ratio of basic to nonbasic employment, to incorporate a fiscal sector into the model of the economy, to include relative regional prices in the model, to differentiate the impacts of employment and wages, and to handle the determination of personal income and population based on activity within the region.

Econometric models have data requirements falling somewhere between those of economic base studies and input-output analyses. A basic problem from which they suffer is the availability of sufficiently long, stable, and accurate time series data to enable the researcher to adequately specify his relationships.

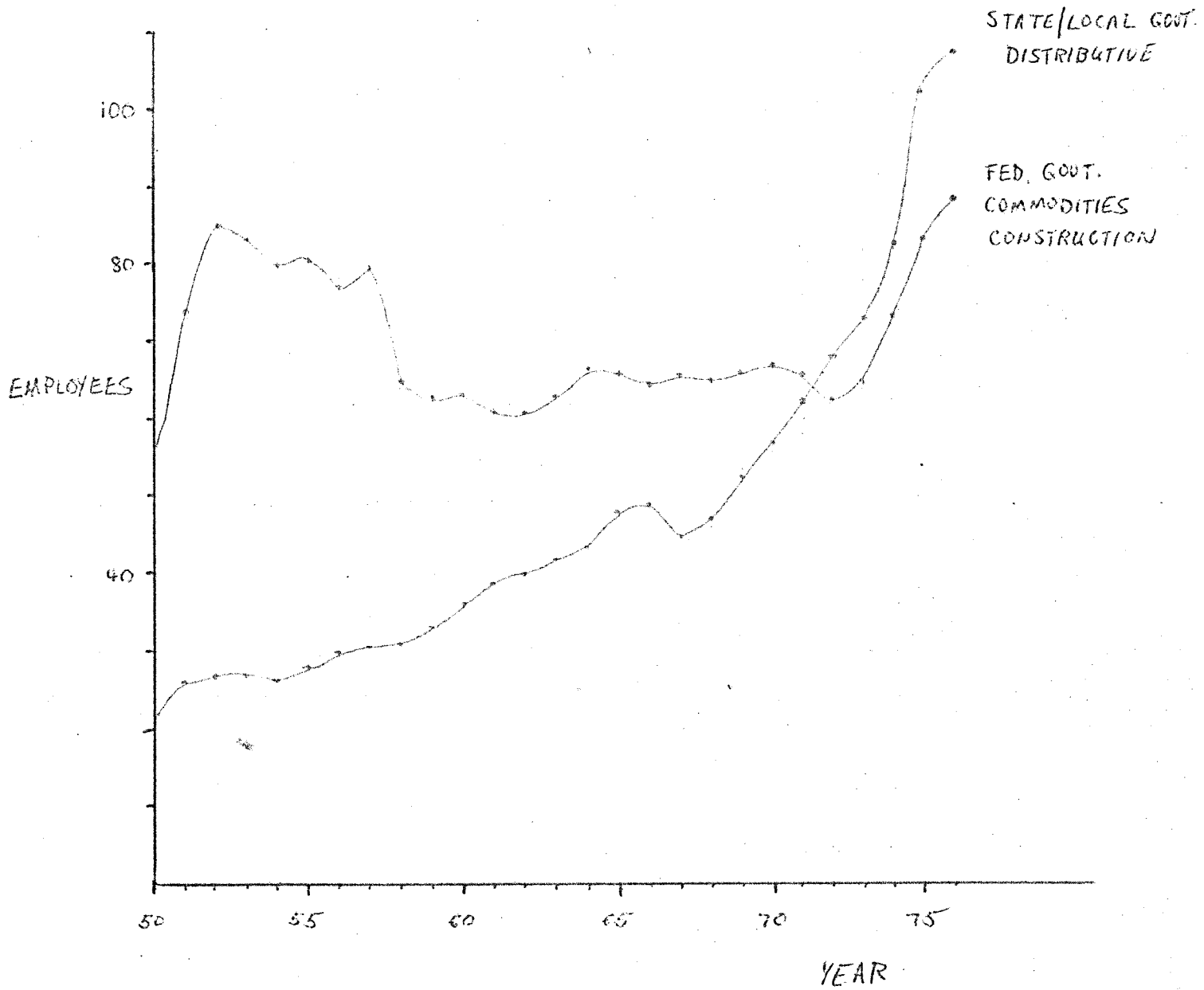
What sort of a model is best suited for identifying economic impacts in the Alaskan economy? For several of the reasons just mentioned, econometric models seem to have the most flexibility and the ability to

incorporate the widest range of factors when large multi-year impacts are being measured. In addition, one of the most important aspects of the Alaskan economy, the fact that it is underdeveloped but rapidly growing, cannot be reflected properly by the other model types. Inability to handle this basic feature greatly distorts long-run impact analyses done by these models.

To indicate the Alaskan dimension of this characteristic of an underdeveloped but growing economy, Figure 1 shows the growth since 1950 of the basic and support sectors in Alaska measured by employment. One may disagree over the proper classification of an industry as basic or non-basic, but the overall pattern is unmistakable. The relationship between the basic and support sector employment has clearly changed dramatically over the years. Whereas in 1950 there were 39 employees in the distributive industries and state and local government for every 100 in the basic sector, in 1976 there were 121. The change over the period amounted to 267 distributive and state and local employees for every 100 in the basic sectors. This marginal ratio of 2.67 is quite different from the average ratio in 1950 of .39. Thus, any long-run analysis in 1950 applying the average nonbasic/basic ratio of that year to the economy and projecting into the future would vastly underestimate actual growth. In the same manner, it would underestimate the level of impacts in a growing economy.

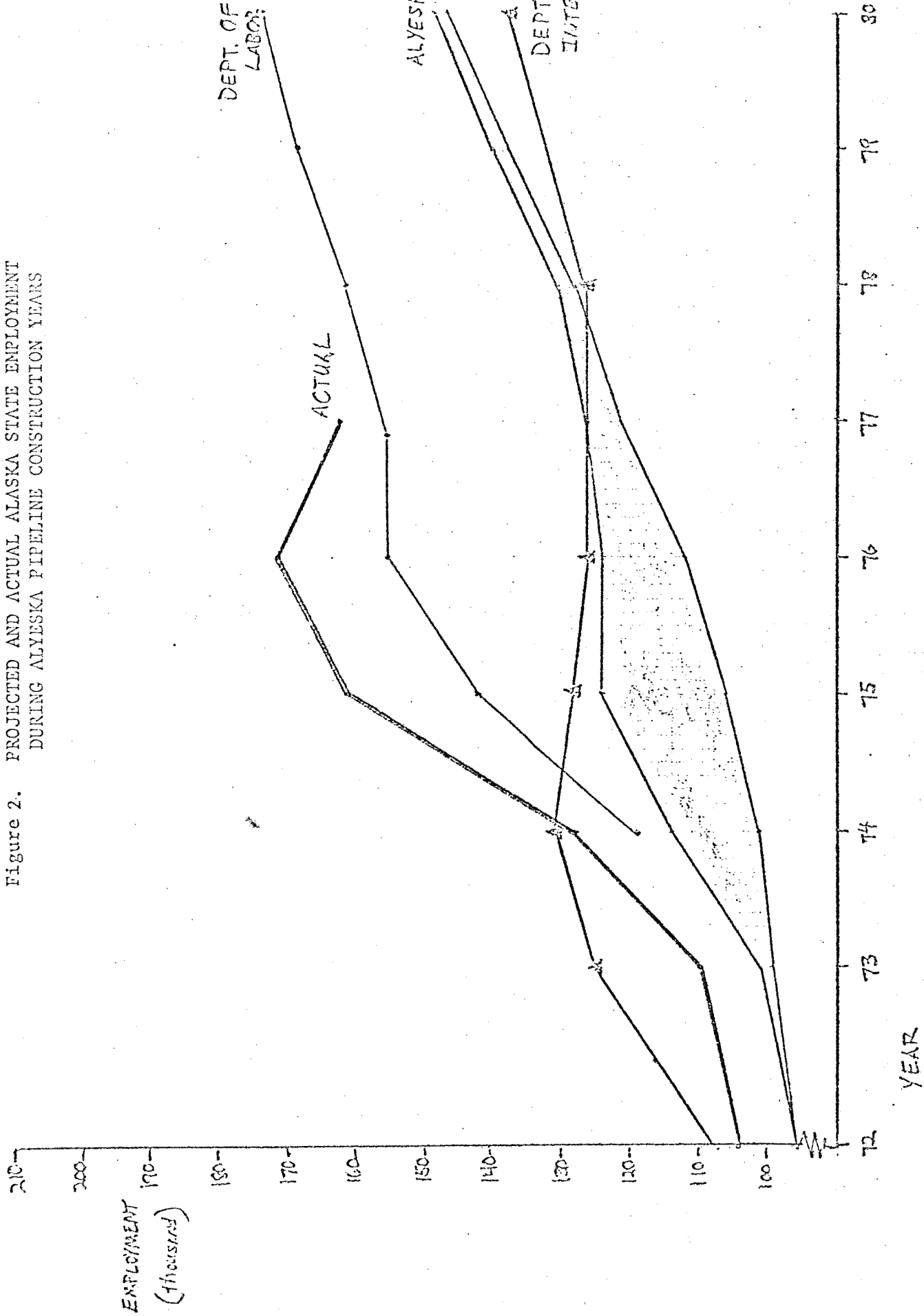
This mistake was definitely a factor in the underestimation of impacts for all a priori analyses of the Alyeska pipeline. As shown in Figure 2, all analyses done before the project completion underestimated the short- and long-run impact of the project substantially, partially because economic base models were employed which did not properly take account of the fact that growth changed the economy qualitatively as well as just increased its size. The actual impact could be called "blip-ratchet," whereas the economic base model describes the "blip" impact as shown stylistically in Figure 3.

Figure 1



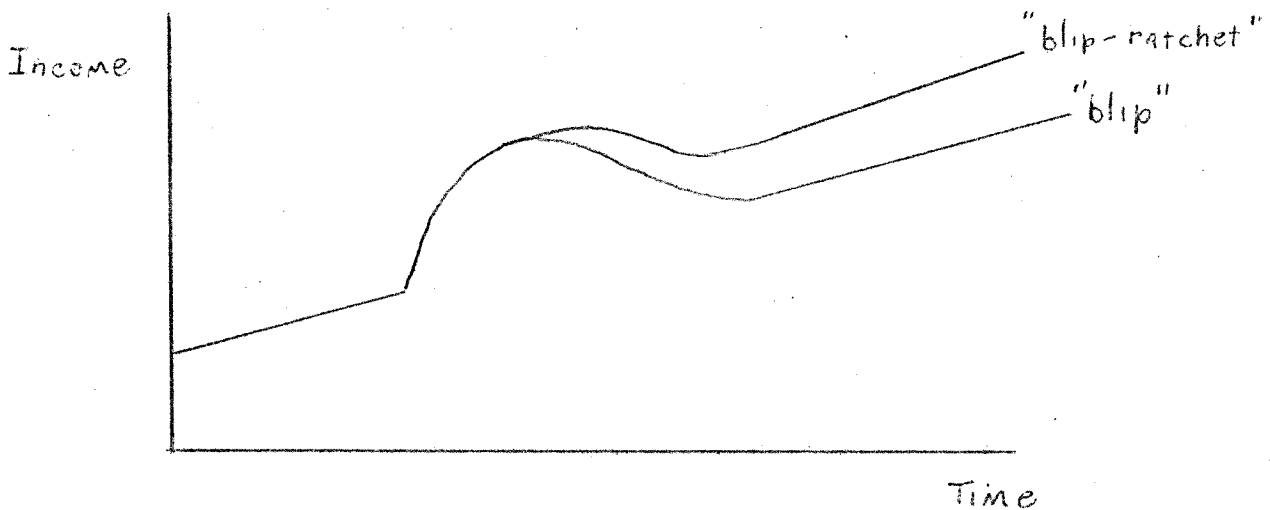
Adopted from Scott Goldsmith and Lee Huskey, "Structural Change in the Alaskan Economy: The Alyeska Experience," paper presented at the 29th Alaska Science Conference, August 15, 1978, Table 1.

Figure 2. PROJECTED AND ACTUAL ALASKA STATE EMPLOYMENT DURING ALYESKA PIPELINE CONSTRUCTION YEARS



Source: Scott Goldsmith and Lee Huskey, "Structural Change in the Alaskan Economy: The Alyeska Experience," paper presented at the 29th Alaska Science Conference, August 15, 1978.

Figure 3.



The difference in the level of economic activity after A between the "blip" and "blip-ratchet" cases is the impact attributable to structural change in the economy. This is essentially a change in the ratio of support to basic industry. Because of a variety of factors including economies of scale from increased market size, other agglomeration economies, reduced transport costs, changed expectations of growth, availability of capital, etc., there has been a "deepening" of the support sector--import substitution--rather than just an increase in its level, indicated by the shaded area.

This import substitution can be interpreted in two ways with respect to the analysis of impact of specific exogenous changes. On the one hand, the import substitution would presumably have occurred anyway at some future time, assuming continued growth of the economy, and the exogenous change merely altered the timing of the import substitution. This reasoning would argue that the import substitution that results after the exogenous change should not be counted as part of the impact

of the exogenous change but rather independently as part of the normal growth process. The alternative interpretation is that the import substitution was in fact the result of the exogenous change and should be counted among the project impacts.

The distinction is critical when one is doing a benefit-cost analysis of a project from a public perspective. The benefits and costs associated with the import substitution component of impact will generally not cancel one another out. Thus, their treatment could be critical in determining the outcome of the analysis. It seems clear that the import substitution effects of exogenous changes are correctly classified as impacts, and as such, it seems reasonable to weigh these impacts like all others as part of any benefit-cost analysis.