ANALYZING ECONOMIC IMPACT IN ALASKA

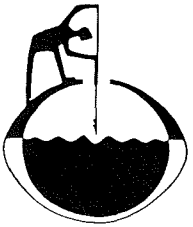

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TABLE OF CONTENTS

List of Tables

List of Figures

INTRODUCTION

Growth of the Alaskan economy in the next few decades will result from the development and processing of the state's natural resources. In the private sector, the exploration and production of the petroleum resources of the Outer Continental Shelf (OCS) represent a long-term development process which forms a backdrop for other projects. The proposal to develop a world-scale petrochemical facility in Alaska to utilize North Slope natural gas is the most recent and well-publicized of a number of projects which will be suggested for Alaska in the coming years. In the public sector, the state government is heavily involved in assisting the development of the state's natural resources. The heavy commitments recently made to the development of hydropower and the agricultural industry are examples of a general concern with broadening the economic base of the state.

Why Study Impacts?

When new, large-scale economic activities are introduced into a small, immature economy such as Alaska's, the economic effects are far reaching and sometimes subtle. It is important to try to understand these effects for several reasons. First, these projects influence everyone. They touch people and communities only remotely associated with the projects. For example, the inflation that accompanied the construction of the oil pipeline was not confined to the pipeline corridor but affected every community in the state. Large projects may even change the whole path of the state's economic development. One effect of the development of oil at Prudhoe Bay

was to change the long-run growth path of the state economy by stimulating population growth and the size of the local market. This, is turn, attracted many types of businesses to Alaska that were not here previously.

A second reason for studying impacts is that, because of their widespread and potentially dramatic nature, planning in anticipation of economic effects is important. This is as true for the private sector as it is for the public sector. The decision by an investor to develop a new shopping center requires accurate estimates of future population, income, and other indicators of the demand which economic development engenders. The public sector in turn must plan to meet the demand for new roads and schools which may accompany development.

A third reason is that, in many instances, the Alaska State government is directly involved in development projects as owner of the resource, such as natural gas, or developer of the resource, such as hydropower. In these cases, the government has a direct responsibility for identifying the effects of its actions.

Part I

In Part I of this primer, we describe the economic effects, or impacts, resulting from development projects. Economic impact is defined as a special case of a constantly occurring phenomenon—economic change. What singles out certain activities and types of change for impact analysis is their size and far-reaching effects.

We describe the types of impacts which a project may generate but do not measure them. This is because each project has its own characteristics which make its effect on the economy unique; in addition, the condition of the economy at the time the project is introduced also influences its impact. Furthermore, it is impossible to quantify some economic effects. The objective of Part I is to provide a detailed checklist of the types of economic effects which projects produce.

In studying the impact of a particular project, the researcher must be aware that each of the effects described in Part I may be

present. Generally, however, the data needed to measure all important impacts cannot be obtained. Commonly, only selected aggregate indicators such as changes in employment, income, population, and government revenues will be available. Often the impacts which have not been measured may be as important as those for which indicators are available. The description of impact in Part I is designed to help fill in the gaps left by shortcomings in the indicators available to measure impacts.

A common purpose of economic impact analysis is to provide information on which to judge the "desirability" of a particular economic development for Alaska. Such an analysis would obviously include consideration of many elements, of which the economic effects are only one. Social and environmental effects are also important considerations which must be addressed, and there may be others as well.

Nonetheless, economic impact analysis is generally at the core of any "desirability analysis"[1] since it produces quantitative results which reflect an important component of our well-being. Unfortunately, there is no formula for incorporating all economic impacts into a single equation to measure "economic desirability." This is because different economic indicators measure qualitatively different things which cannot be directly compared. For example, there is no generally accepted method for equating the creation of one private-sector job with an increase in government revenues. Another problem is is that different people interpret the same indicator in different ways. Population growth is desirable to the individual who values the amenities provided by a large market but is undesirable to the person who dislikes congestion. For these reasons, economic impact analysis can describe impacts but cannot judge whether they are good or bad.

Part II

This primer does not develop a method for calculating the desir-

[1]We distinguish "desirability analysis" from the more common benefit-cost analysis. Benefit cost analysis is a narrow analytical tool for calculating the profitability of public investment projects. Multiple objectives may be introduced into such an analysis, but the major objective remains a positive social rate of return on investment. "Desirability analysis" may include a broader range of objectives.

ability of projects based upon their economic impacts. That task is reserved for our elected officials and should be based upon accurate analyses of what the impacts are likely to be. Part II of the primer does however provide some suggestions for measuring the fiscal effects of a project. The need for these criteria is based upon the facts that (1) the public sector is directly involved in many projects which will have a fiscal impact, and (2) that Alaska has an unusual fiscal situation which complicates fiscal analysis. The inclusion of a discussion of fiscal impact assessment is not an implicit assertion on our part that only fiscal impacts are important, but rather that the fiscal impacts are important and can and should be systematically analyzed from several perspectives.

Part III

Part III of the primer describes the special effects and problems which arise when a boom-bust situation occurs. The boom is characterized by growth which is so rapid that markets do not have sufficient time to respond to economic signals. The boom may be followed by a period of deceleration which creates difficulties associated with planning for such a decline.

PART I. ECONOMIC IMPACT ANALYSIS

I.A. What is Economic Impact?

The profitability of operating a business in any location is constantly subject to change because prices, the cost of labor, transportation costs, market size, taxes, and other factors affecting sales and costs of production are never constant for long. Variation in profitability results in changes in employment opportunities, personal income, and other measures of economic activity. Broadly defined, any change that any economic activity causes in the status quo of the economy is an impact. Cases of particular relevance consist of those changes in economic activity resulting from the introduction somewhere in Alaska of a new factory, processing plant, or other large-scale economic activity.

More specifically, we can then define the *economic impact* of a project as the differences in the economy between two alternatives: one in which the project occurs and the other in the absence of the project. Two important points concerning this definition are as follows:

1. At least one of these alternatives is hypothetical. It is impossible to experience and measure the economy both with and without the project at the same point in time. This makes measurement of the size of the impacts imprecise and subject to substantial error and disagreement.

2. Economic impact analysis does not compare a before-and-after situation. Because economic change occurs contin-

uously, an analysis which compares the economy before and after the project would include some changes which could not be attributable to the project itself but which would be the result of other factors such as the underlying economic growth of the economy.

Economic impact is a special type of economic change that is specifically and causally related to a particular economic development. Viewed in this way, the word *impact* should carry no pejorative connotations but should be viewed as neutral, just as *change* is a neutral word. Impacts of a development may be good or bad, according to the particular situation and the individual making the evaluation.

The size of the economic impacts of any project will depend upon the characteristics of the project, the economy into which it is introduced, and the phase of the project which is being analyzed.

1. **Project Characteristics.** The most important economic characteristics of a project are the quantity and quality of labor involved, the amount of other direct local purchases of goods and services, and the taxable capital of the project. A capital-intensive project may employ few workers directly and provide a large tax base to a local community. Another project may provide employment for a large number of workers and contribute a small amount to the tax base of the local community.

2. **Economy.** If a world-scale petrochemical plant were to be constructed in Alaska at the same time that a natural gas pipeline were being built, the impact on the economy would be much different than if the petrochemical plant were constructed during a time when no other large projects were under way.

3. **Project Phase.** There are three phases in the life of any economic project: planning, construction, and operation. The impacts on the economy of each project phase will differ.

Because of these factors, which make the measurement of impact different in each case, it is not possible to quantify economic impacts in this primer. We concentrate instead on a description of the types of impact which occur as a result of project development.

I.B. Measures of Aggregate Regional Economic Activity

Three candidates vie for the role of primary indicator of economic activity levels in the region. Employment is most commonly chosen, and we use employment to discuss impacts in this primer; but value of output and personal income are also useful indicators, and it is important to understand their meanings.

1. **Employment.** This usually means the number of jobs in the economy, but because some workers have more than one job (are multiple job holders), the actual number of people employed will be somewhat less than employment. In spite of this, employment is a superior measure of economic activity because a count of jobs is easy to obtain and is unambiguous. An increase in employment is almost always directly and positively related to the other important measures of total economic activity such as output of the economy, income of the economy, and market size. The major drawback of this indicator is that the number of jobs does not tell us *who* is working or *where* the workers live. A change in the number of jobs could, in theory, result in no change in resident employment.

   This illustrates an important general consideration when analyzing economic impacts in Alaska. People and goods can move freely across the border between Alaska and the rest of the United States, and in performing economic impact analysis one must always consider the potential of these movements. In this sense, the economic impacts on a region may be very different from those on the nation as a whole because these *regional spillovers* do not occur on the national level.

Example

A project which creates 1,000 jobs within the United States will not result in any in-migration from foreign countries to fill those jobs. It is safe to assume those jobs will go to American citizens. If there is unemployment, the rate of unemployment will fall; if there is full employment, high-wage rates will induce some people to abandon their old jobs to fill the newly created ones, and those jobs which pay the lowest wages will go unfilled.

It does not follow, however, that if that project is situated in Alaska, the jobs will go to Alaskans who were residing in the state before the project was started. Persons from outside the state may get those jobs.

2. **Value of Output.** The best measure of the value of output of a regional economy is the *gross regional product* which is analogous to the *gross domestic product* of the national economy. It is the value, at market prices, of all the goods and services produced by the economy in a year. It is similar to the concept of the *value added* of an economy. *Value added* is the difference between (1) the cost of all the materials and services imported into the region to be used in production and (2) the value of the output of the economy.

   The largest component of gross regional product or value added for most Alaskan industries is payments to labor. Since employment is a variable which is more readily available, it is more useful together with wages and salaries for measuring the labor component of value added.

   The advantage of measures of output is that they explicitly include payments to other factors of production. These payments are a *capital consumption allowance*, which is a return for capital goods consumed in production; *interest*, which is a return for the use of borrowed money; *rents* for the use of scarce resources; and *dividends* for the provision of equity financing. Purchases of materials and services from other firms are not counted in value added because this would involve double counting—once by the seller and once by the purchaser.

   In particular instances, payments to factors other than labor

can be important as a dimension of impact, particularly in the natural resource industries, such as petroleum, where the resource itself earns a substantial rent or return over and above its extraction cost. However, the ownership of the factors of production is not identified in the gross product calculation, and ownership may or may not be by Alaskan residents.

Finally, regional gross product figures are imprecise. They must generally be calculated using national data together with local employment data, and this reduces their precision and reliability as indicators of regional economic activity.

Example

The annual gross regional product of the petroleum industry in Alaska is dominated by payments to the lease holders at Prudhoe Bay. These oil companies are not Alaskan residents. The most important economic effects of the petroleum industry on the Alaska economy are the employment generated by the exploration and development process and the revenues and subsequent government spending from petroleum taxation. The employment impact is greatest in the exploration and development phases of the petroleum extraction cycle when gross product is very small. When gross product is large, during the production phase, employment is small. Thus, in the case of petroleum, gross product does not accurately reflect the impact of the industry on the economy either in terms of employment or in government spending.

3. **Personal Income.** Personal income is the sum of all payments to individuals residing in Alaska, and it generally will increase when overall economic activity goes up, and vice versa. The most important component of income in Alaska is wages and salaries, which is determined by employment, so employment and personal income are closely related as measures of total economic activity. Personal income has the advantage of showing all sources of income to residents, and thus in the sense of being a measure of Alaskan residents' income, it is superior. The difficulty with it lies in the fact that the data on nonwage and nonsalary resident income is not precise enough to justify its use as an indicator of economic activity.

I.C. Types of Employment Impact

I.C.1. Direct Impact

The construction and operation of an economic activity requires the purchase of *labor*, *goods*, and *services*—some of which are locally available while others must be imported into Alaska. The most important locally purchased input is generally *labor*. The employment directly related to the project is the primary direct economic impact of a project. Another important input is *goods* which are used in construction and operation of an economic activity. However, because the manufacturing industry in Alaska is very small, most such goods must be purchased outside the state. *Services*, such as banking, insurance, security, maintenance, and repairs, may be purchased locally. Another direct impact results from the purchase of local goods and services, which generates a cash flow to those individuals and businesses providing them .

Example

Construction of a petrochemical plant in Alaska would require a variety of different inputs. Labor would be the largest single component of cost. The majority of this would be craft labor, but a large component (perhaps 25 percent) would be technical (engineers, scientists) and administrative (secretaries, clerks, managers). Most, but not necessarily all, of this employment would occur physically in Alaska. The equipment which comprises the plant itself would be purchased outside the state and put together on site. Some goods used in construction would be locally purchased. Sand and gravel conglomerate is an important example. Many services would be purchased locally. Communications and transportation of equipment are good examples, but other services would include car rentals, security services, legal, accounting, clerical services, and equipment leasing.

It is common to summarize the direct project impact as the number of jobs directly created by the project, but other direct effects are also important since they produce cash flow to businesses and *indirectly* create jobs. This indirect impact will be described in the next section.

The proper identification of the direct impact of a project, or

direct requirements, is important because the analysis of all subsequent impacts follows from these numbers. Unfortunately, it is difficult to be precise about the direct requirements before the project takes place. There are four reasons why different people may develop very different assumptions regarding the direct requirements for facilities which produce the same product.

1. Two different engineering firms may use very different concepts in the design of a facility. One may choose an expensive construction design which results in a highly automated plant while another may design a less expensive facility. Another common source of variation is the degree of prefabrication before materials reach the plant site. Different construction designs may imply different employment requirements both in the construction and operation phases.

2. Two different firms may have very different direct employment requirements for the same project, even if they have the same engineering design. This results from differences in the amount of labor hired directly, compared to the amount used indirectly through contracts with other firms. One firm may prefer to have its staff do all of its maintenance while another may choose to contract for this service. In this case, the direct employment requirements reported by the two firms would be quite different even though operation of either plant would actually require the same amount of labor.

3. Some jobs are more visible than others, but the less visible jobs are just as important as the construction and operations positions and must be included in the analysis. These less visible jobs, in such areas as security and clerical positions, may be overlooked by the person estimating direct requirements.

4. Some visible jobs may be unanticipated or underestimated in large projects. This may happen because the estimate is being made for purposes other than calculating the economic impact. For example, an engineering analysis may be unconcerned with security requirements.

Example

The original estimates of the construction labor force for the Alyeska pipeline were half of the actual number employed. The operations phase of the Alyeska pipeline was originally estimated to provide approximately 500 jobs. The actual number is closer to 1,000, and this number does not include special capital projects to upgrade the pipeline, such as security improvements and staff amenity additions at the pump stations.

These differences indicate that it is impossible to predict with certainty a correct level of direct employment for a particular type of activity carried on at a particular level of output. Also, in evaluating a firm's estimated employment requirements one must recognize that there may be substantial subcontracting of employment services which may not appear in the estimate but which represent employment directly related to the production of the firm's output.

Knowing the following characteristics of a project's direct requirements is important in determining the size and nature of its total economic impact:

1. The salary levels for employees.
2. The extent and nature of locally purchased nonlabor inputs.
3. The skills required for the jobs.
4. Length of employment.

I.C.2. Indirect Impact

The indirect impact of a project results from the increase in the output of intermediate goods (goods which are inputs in the production of final goods), necessary to satisfy the direct requirements of the project. These indirect effects are sometimes called the *backward linkages* within the economy because they are the result of new demands for the output of the economy which occur one step before the production of the project and are linked to it by demand requirements.

There are two types of indirect impacts. The first are those resulting from the provision of inputs to the project itself. But because this increased production of intermediate goods will itself

result in increased demand for inputs, a second component of the indirect impact consists of the additional expansion of production to fill those requirements. (The multiplier effect of this backward expansion of production is what an input-output model measures.)

When people discuss indirect impacts, they tend to think about manufacturing sector effects. These make up only a portion of the indirect effects, however, since business services are important inputs to many production processes in Alaska.

Example

One of the items budgeted for construction of the Alyeska pipeline was transportation of the materials to the site. This did not directly generate employment, but there were indirect employment effects of the two types mentioned above. First, the demand for transportation services to move the materials to the site required that trucking firms hire additional employees to meet the direct pipeline construction requirement. Demand for trucking services expanded in other ways also. Many of the other businesses providing goods and services to the construction companies themselves required the services of transportation companies. Increased output of the sand and gravel industry increased demand for transportation services to move the aggregate to the site.

The total increase in demand for transportation services exceeded the direct demands associated with Alyeska pipeline construction. For example, in order to provide the trucks and spare parts where they were needed, it was necessary first to transport them there.

Figure I-1 shows the annual level of employment in trucking and warehousing in Alaska during the Alyeska pipeline construction years. A dramatic growth in employment in this sector can be seen during those years and can be largely attributed to pipeline construction. The doubling of employment in this industry was one of the significant indirect effects of pipeline construction.

Also shown for comparison is the level of manufacturing employment over the same period. In this industry, there is no identifiable response to or linkage with the construction of the pipeline. Growth follows a smooth trend primarily reflecting fish processing employment increases. This demonstrates that although in Alaska there are limited indirect effects which occur in manufacturing (which is where people generally look for them), there may be substantial indirect effects in other segments of the economy.

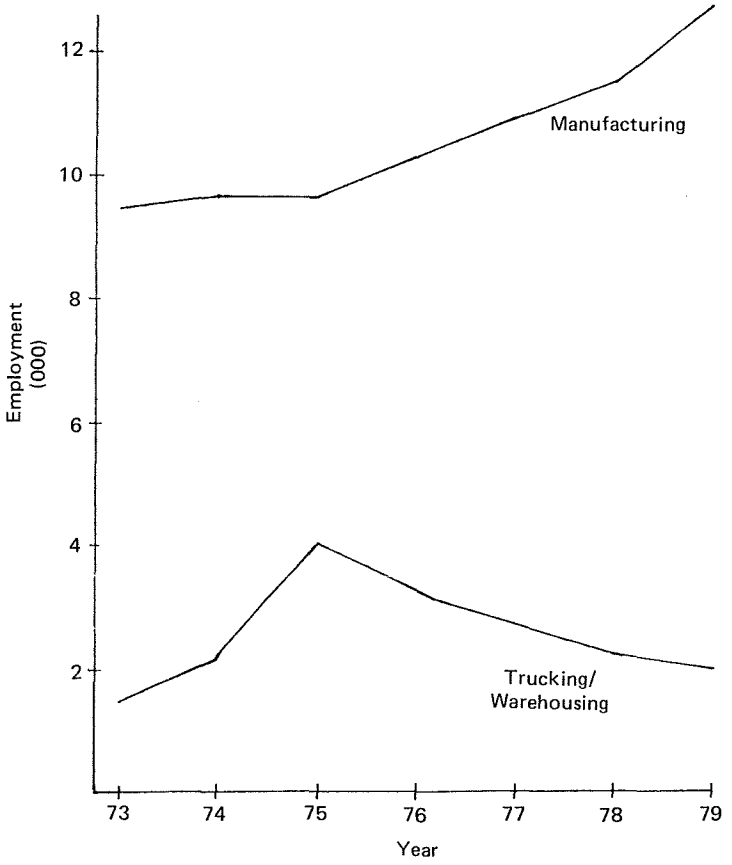

Figure I-1. Different Employment Responses to Pipeline Construction Activity

I.C.3. Induced Impact

When new businesses locate in Alaska or existing businesses expand to supply products for an industrial process, a portion of the costs incurred by those businesses will be wages and salaries to workers in Alaska and other factor payments to Alaskan residents. These payments become personal income increases for consumers of Alaskan goods and services, and a portion of the increase will be

spent consuming those goods and services. This local spending will stimulate further expansion of the economy, and it is this expansion caused by personal income growth which is the induced impact of the project.

Induced impact is felt in those industries that provide services to consumers, such as the banking and restaurant industries, and those providing goods, primarily retail trade. Since Alaska has a very small manufacturing industry, most purchased goods are produced elsewhere and imported into the state for sale. Consequently, there is a substantial *leakage* of money out of the Alaskan economy whenever a consumer goes into a store to buy something. The largest part of each dollar spent on consumer goods will leave the state to pay for wholesale purchases. Only the portion of the $1 retained by the local shopkeeper as wages and salaries (and possibly profits and interest) will further impact the economy. Thus, the key to understanding the size of this impact is to understand what goods and services Alaskans purchase and the local labor component of those purchases.

The size of the induced impact for a given amount of income which is initially brought into the local economy by a new project depends upon who receives that income. Typically, calculations of induced impact assume a constant level of population and *do not* take into account that some population growth may occur through migration as employment opportunities expand. For a constant population experiencing an increasing income, a large portion of the increased purchases of consumer goods may go to goods with a high leakage. If the growth in income goes to new residents of Alaska, they may spend their incomes in ways that have more of a local impact. The primary reason for this is that a new individual or family will have substantial "set-up" costs when moving into a new state. These costs and their economic impact are separate from the usually calculated induced impact and are discussed separately in the next section under the heading of "Accelerator Impact."

I.C.4. Accelerator Impact

When the population of a region grows, the capital stock in the private sector, consisting of housing and commercial buildings, must

expand to accommodate the added demand placed upon it by the larger population. This expansion of the capital stock is a normal part of the economic activity of a region, and in those economies where growth is constant, additions to the private capital stock will occur at a relatively constant rate.

When a new project results in increasing demands for local goods and services, businesses will expand their commercial space to accommodate these demands. Also, when population increases through migration, housing requirements will increase. To accommodate these needs, a construction boom may result which increases activity in the construction industry by a much larger percentage than the expansion of total employment. This is sometimes called an *accelerator* effect because the output of the construction industry depends not on the *level* of population, but rather on the *change* in population from year to year. When population *growth* is constant, the output of the construction industry is relatively constant or grows at a constant rate, but when the population growth rate increases, output of the construction industry will expand rapidly to meet the new demand. Thus, in a year when growth is 2 percent, the net additions to the housing stock would be 2 percent. If the growth rate jumps to 4 percent, then the net additions to the housing stock, and output of this sector of the construction industry could double.

Example

The accelerator effect is dramatically illustrated in the case of Valdez. The tremendous population increase experienced by Valdez during the Alyeska pipeline construction years resulted in an easily identifiable accelerator effect as measured by the number of housing units built annually. Figure I-2 compares the number of housing units authorized in Valdez for each year during the last decade with what the number would have been each year if growth had followed a smooth trend during the decade. During the four pipeline years, the actual number of units authorized exceeded the trend. In the peak year of 1974, the actual number of units was over ten times the trend value, implying that for housing construction, the pipeline impact increased the level of activity by about ten times over what it would have been in the absence of the pipeline.

This dramatic fluctuation in the construction activity indicator can be seen in other parts of the state during the same period. Other locations reflect a smaller accelerator effect because of a smaller relative population impact.

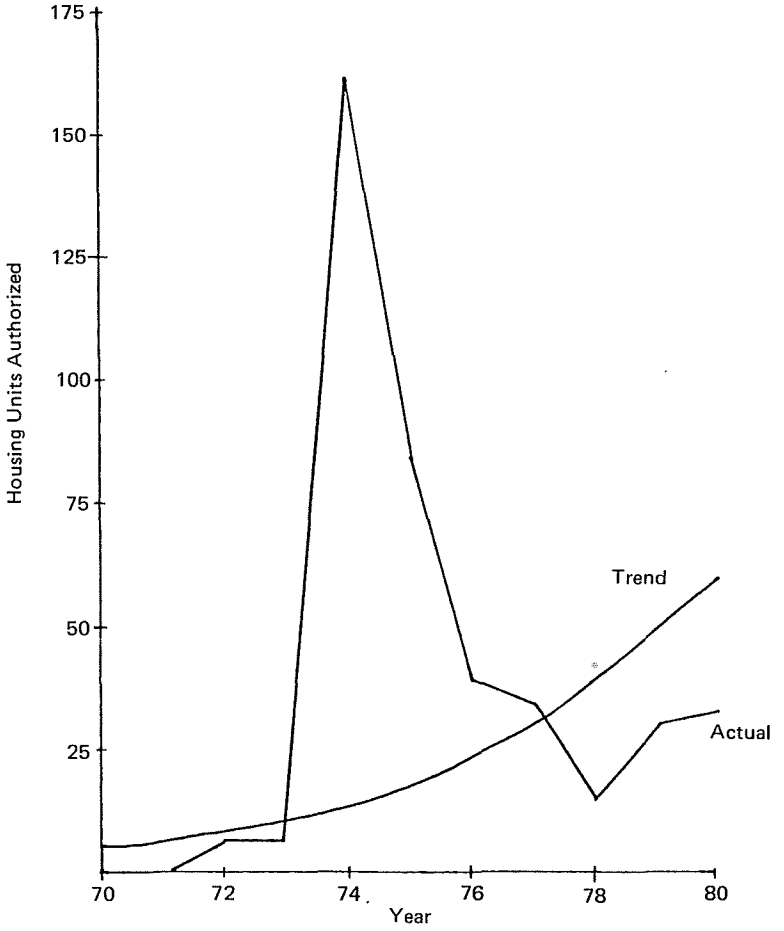

Figure I-2. Housing Units Authorized in Valdez: Economic Boom Reflected in Construction

In Fairbanks, the peak year was 1977, when building permits were 100 percent over the trend; in Anchorage, 1977 was also the peak, with permits increasing 89 percent over the trend for the decade.

The same type of response occurs in the commercial building stock and in other areas of private infrastructure such as communications and transportation. For example, not only will the number of telephone calls handled by the telephone company increase with

population growth, but the capital equipment necessary to handle those calls, such as floor space for additional operators, will also have to increase. In Fairbanks during the Alyeska boom, new commercial construction included (with a time lag) three shopping malls, several multistory office buildings, more than a dozen new restaurants, several banks, a medical clinic, and a number of retail outlets.

When the demand for housing or commercial space grows, the supply response will depend upon a number of factors:

1. The amount of *excess capacity* or *excess supply* of the commodity which is available to meet the demand without increasing production.

2. The availability of financial capital. The cost of new capital facilities and hence the profitability of investment is partially determined by the cost of borrowing.

3. Perceptions about the length of time that growth will continue. The longer people expect growth to last, the more optimistic they will be about investment in new facilities, because the more likely it is that the facilities would be fully utilized over their economic lifetimes.

I.C.5. Structural Change (Development) Impact

The impacts discussed so far have not included any change in the structure of the economy as a result of development. They have all described dimensions of the growth of the economy and have shown what factors go into making the economy *bigger* than it was previously. They have not described how the economy may change in terms of the *kinds and variety* of goods and services produced within the economy.

Structural change refers to the changing pattern of goods and services produced within the economy. Some people use measures of structural change to define different stages of economic development. Basically, an immature economy is unable to locally provide for many of the demands which it generates. The goods and services which the population demands must be imported from outside the

region. A mature economy is able to locally produce a larger proportion of the goods and services demanded by its residents. As extreme examples, a place like Seward would be characterized as an immature economy while San Francisco would be mature.

One process by which an economy is transformed from an immature to a mature economy is *import substitution.* This means substituting local production of goods and services for goods and services that were previously imported from outside the region or were not available at all. The local manufacture of goods comes to mind as an important element of import substitution, but it has been the local provision of services that has been most important in the structural change observed in Alaska.

Structural differences based upon size can be seen among Alaskan communities. Small communities cannot support the services of a dentist while large communities can. There is some *threshold size* in terms of population or aggregate income or some other variable which, when reached, triggers the local provision of goods and services not previously available.

Example

The phenomenon of import substitution can be identified in various historical indicators of Alaskan economic activity. Import substitution has occurred primarily in the *support* industries, defined to include trade, finance, insurance, real estate, services, transportation, communications, and public utilities. These are the industries which primarily support the resident population. We include state and local government in this category, although some of its components are basic. The *commodity-producing* or *basic* industries are the natural-resource extraction and processing industries, federal government, and a large component of construction. The ratio of support to basic employment is shown in Table I-1 for Alaska for 5-year intervals since 1950. This ratio represents the average number of jobs provided in the support industries of the economy to support each job in a basic industry. In 1950, there were .35 jobs in the support industries for each basic industry job. By 1979, the number had more than tripled to 1.18, and the steady pattern of growth over the 30-year period was interrupted only by the large military buildup (basic sector employment) in the 1950s during the height of the cold war period. This same pattern is also observable in individual communities.

This ratio is only a rough measure of structural change since these general employment categories do not allow accurate classification of all jobs as

Table I-1

Structural Change in the Alaskan Economy Reflected in the Ratio of Support-to-Basic Sector Employment

Year	Employment (thousands)		Ratio of Support to Basic Employment
	Support	Basic	
1950	19.8	56.6	.35
1955	24.6	80.5	.31
1960	29.5	63.5	.46
1965	35.7	66.0	.54
1970	39.0	67.1	.58
1975	73.8	83.5	.88
1979	82.4	69.9	1.18

support or basic. In particular, some manufacturing and construction jobs serve the local community and should be classified as support while some jobs in trade and services are tourism jobs and, as such, should be classified as basic employment. However, these adjustments would not change the basic trend of the ratio.

Some growth in support sector employment relative to the basic sector is attributable to increases in personal income per capita which have allowed people to purchase more goods and services. The majority of the increase, however, must be explained by the introduction of services and other businesses into the state that were not previously here. If there had been no change in the ratio of support-to-basic sector employment between 1950 and 1979, then with the current (1979) level of basic sector employment of 69.9 thousand, support employment would have been 24.5 thousand rather than its actual level of 82.4 thousand. The difference, 57.9 thousand, must be attributed to the growth in real incomes and structural change in the economy.

A very rough estimate of the importance of structural change in explaining changes in the level of employment over time can be obtained by noting the absolute growth and ratio of the growth of the support and basic sectors since 1950. Basic sector employment has expanded by 13.3 thousand while support sector growth during the same period has been 62.6 thousand. For every new job in the basic sector since 1950, there have been 4.7 new jobs in support industries.

Structural change may or may not result in an increase in locally provided goods and services; by identifying those factors causing the structural change, we can see how structural change may

result in some local firms losing out to development. The profitability of locating a support sector activity in Alaska depends upon the price and quantity of sales and the costs of the inputs required for production. As the economy grows, several things occur. First, the size of the market expands so that economies of scale in the local production of some goods and services can be obtained. Simultaneously and as a consequence of this, the costs of some items will fall, and this will also encourage the local expansion of businesses. On the other hand, the costs of some things may increase. For example, certain kinds of skilled labor may be in short supply, and competition for the services of this labor may drive up its price. These higher prices may actually result in the abandonment of some local business activities which were once profitable but which can no longer compete.

Example

An example of structural change which has resulted in the elimination of local employment opportunities is the experience of the dairy industry in Alaska, particularly in the Matanuska Valley. Demand for dairy farming land there has been outstripped by the demand for residential development land. Because of this and other factors, the cost of production for the dairy industry has been driven up by population growth, and its profitability has declined. Figure I-3 compares the actual value of milk sales by Alaskan farmers with what sales would have been if the 1960 per capita level of sales could have been maintained through the mid-1970s. It is clear that this was one industry where growth did not keep pace with the overall growth of the economy.

The problem facing these declining industries is that while their costs of business are driven up, the price for which they can sell their output is unchanged, so that their profit margins are squeezed until they disappear. At some point in this process, it becomes profitable for a firm outside of Alaska to supply the local market.

Another component of structural change which can work against growth of the local support sector is the effect of increasing market size on the unit cost of transporting goods (and services) to Alaska. An increase in market size can result in economies of scale in transportation, which in turn can reduce the cost to firms outside Alaska of supplying the Alaskan market. This may have been an

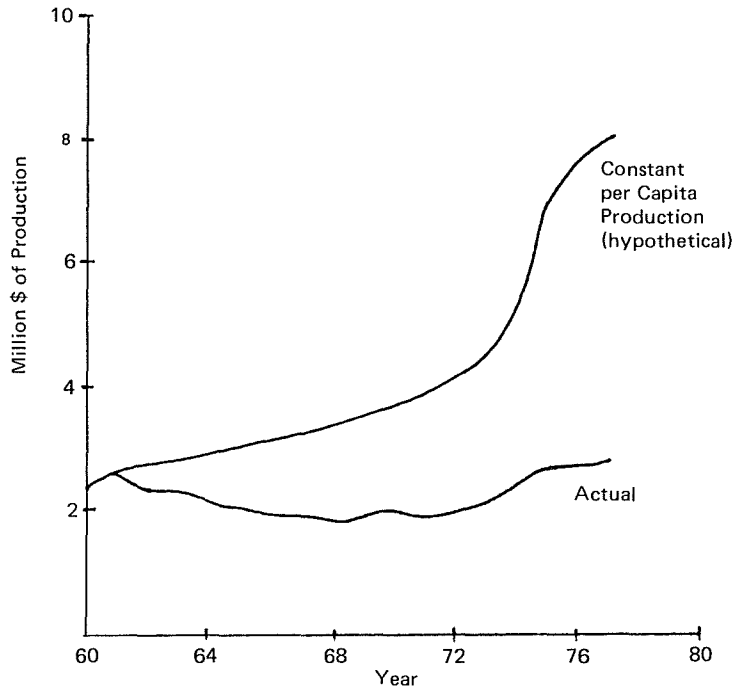

Figure I-3. Structural Change in the Alaskan Dairy Industry: Actual vs. Proportional Value of Milk Produced

additional factor reducing the sales volume of the Alaskan dairy industry.

I.C.6. Government Impact

When economic activity and/or population increase, the demands placed upon government services will grow. Industrial projects require such things as roads, ports, and airports. New population requires schools, teachers, drivers' license examiners, and so on. The services provided by local government are very closely related to the size, composition, and location of population. On the other hand, the level of federal employment in Alaska is very insensitive in the aggregate to changing population size. Between these two extremes is the state government, which provides many functions that are population sensitive and others that are not.

The response of the government sector to increased private

sector economic activity and population is partly *automatic* and partly *discretionary*. It is possible to estimate the nondiscretionary or automatic component of government spending which occurs in response to population growth, and this provides a lower bound estimate of the effect of changing population on the budget. Because state government directly or indirectly provides most of the funding for government in Alaska, we concentrate on state expenditures in this discussion, but the same general description also applies to local government. Identifying nondiscretionary budget items is complicated because different types of people place different demands on government. Thus, it is useful to distinguish, as much as possible, the particular nondiscretionary demands of these various groups.

Table I-2 shows the results of an analysis of the 1981 operating budget for the state of Alaska which identified (1) those items in the budget which would be sensitive to increases in population and (2) the particular components of the population that would be the users of each population-sensitive service. The study revealed that although the total level of expenditures per capita was $3,713, only $2,764, or about 74 percent of the total, was population sensitive.

Table I-2

Per Capita Analysis of 1981 State Operating Expenditures

1. Average Resident	
A. Total operating budget	$3,713
B. General fund component	2,826
2. Population-Sensitive Items: Average Resident	
A. Total operating budget	2,764
B. General fund component	1,956
3. Population-Sensitive Items: Average Employed Migrant	
A. Total operating budget	1,626
B. General fund component	1,235
4. Population-Sensitive Items: Average Employed Itinerant	
A. Total operating budget	813
B. General fund component	618

The components of the budget which are not population sensitive include:

1. "Pure public goods," which are items that additional people can consume at no additional cost, such as educational TV.
2. One-time appropriations, such as related to national lands legislation.
3. Debt service.
4. Appropriations related to basic industry, such as for tourism promotion.

In addition, some programs are designed for certain rural regions of the state which would probably not be affected by in-migration; such migration tends to impact the more urban areas. The analysis suggests that an increase in population of one person would increase state expenditures in 1981 by $2,764. The impact on the general fund of the state would be significantly less than this ($1,956), because a portion of the total budget is funded by automatic federal transfers, which increase with population, and by user fees, which directly compensate the government for services provided.

The outlay for a new employed migrant might be less than for a migrant with the same characteristics as the average resident, because the definition of average resident is a weighted average of children and working-age dependents, as well as those employed and officially unemployed. Some government programs, most notably education, are not directly affected by increases in the employed population. The annual outlay for an employed new migrant was estimated to be $1,626, with a cost to the state general fund of $1,235.

Another category of migrants are those who do not become residents of the state, but rather remain *itinerant* workers. The average demand for state services by these workers is less than that of residents. Although their requirements have not yet been analyzed in detail, they are included in Table I-2, where the average annual cost for an itinerant worker is estimated to be half that of a new permanent resident worker. This results in an expenditure estimate of $813 and a cost to the state general fund of $618.

This analysis assumes that the cost of providing services to new migrants will be the same as the average cost of providing those same services to current residents. Some people feel that *economies of scale* exist in government service delivery so that additional people can be served at a lower-than-average cost. Table I-3 shows the result of allocating the population-sensitive items in the state general fund budget into four basic categories based on their costs in relation to population. Programs in which expenditures appear to be *correlated with* a particular *user group* are the largest category. The largest programs in this group are maintenance and operation of transportation facilities ($54.6 million), financial support programs for education ($36 million), and local government assistance grants ($27.5 million). These types of programs may display some economies of scale with additional service recipients, but there is no compelling evidence, either theoretical or empirical, that such is the case. *Entitlements* are legally mandated payments to any individual fulfilling certain qualifications. The education foundation program is the largest entitlement program, accounting for 74 percent of the total; medical and general assistance payments total an additional 14 percent. Next is the category of *government support services.* These are not directly related to population but vary indirectly with population, as the level of support they provide for population-sensitive services varies. The largest individual programs here support public facilities maintenance and operations in the Department of Transportation and Public Facilities and the Department of Revenue. Finally, there is the category of *quasi-public goods* which is dominated by the administrative functions of the legislature

Table I-3

The Population-Sensitive Portion of the 1981 State General Fund
(million $)

Cost Correlated with User Group	$483.3
Entitlements	291.2
Government Support Activities	78.0
Quasi-Public Goods	35.4

($20.7 million). This category includes items which in theory should not have expenditures related to population but which in fact do seem to grow with population. Although the number of legislators is not sensitive to population size, the complexity and thus cost of the legislative process seems to be related to population to some extent.

The possibility of *diseconomies of scale* should not be ruled out in service delivery in the public sector. This happens when the cost of providing a service to a new migrant exceeds the average cost to current residents. As programs grow in size to accommodate larger numbers of people, their complexity may need to increase in order to provide the same quality of service.

Table I-4 shows how government has grown in response to population growth in two communities, one of which has been impacted by a large project and another which has not. Between 1965 and 1979, total employment in Seward doubled and the state and local government proportion kept pace, changing from 24 percent in 1965 to 23 percent in 1979. In contrast, total employment in Valdez tripled, and the ratio of government to total employment fell from 44 to 39 percent; and in these two cases the growth in state and local government has kept up with growth of overall employment. There may have been some economies of scale in the case of the faster-growing Valdez, but they are not substantial.

Many types of government capital expenditures are also population sensitive. As government programs expand to provide services to a larger population, the capital stock in terms of schools and roads and office buildings must also grow. These capital stock additions, if they are to occur at a rate which maintains the pre-existing quality of services delivered to the population, must occur at a rate which is a multiple of the growth rate in population. For example, in a large and growing community, the school-age population may be increasing at the rate of 1,000 students annually, requiring the construction of one new school each year. If in one year the growth rate of school-age population doubles, the number of new schools needed will also double. Consequently, the annual requirement for new schools is not a function of the *level* of the school-age population,

Table I-4

Government Employment Growth in Two Alaskan Census Divisions

	Seward			Valdez		
Year	(1) State/Local Government	(2) Total Employment	(3) Ratio (1)/(2)	(4) State/Local Government	(5) Total Employment	(6) Ratio (4)/(5)
1965	149	621	.24	332	757	.44
1966	132	645	.20	356	826	.43
1967	132	638	.21	379	773	.49
1968	131	602	.22	374	667	.56
1969	169	626	.21	397	786	.51
1970	252	689	.36	465	859	.54
1971	273	774	.35	510	1,087	.47
1972	262	809	.32	495	906	.55
1973	257	862	.30	507	988	.50
1974	258	934	.28	548	1,529	.36
1975	274	1,152	.24	613	4,763	.13
1976	281	1,137	.25	733	8,049	.09
1977	296	1,155	.26	739	4,199	.18
1978	241	1,226	.20	790	2,043	.39
1979	307	1,329	.23	840	2,143	.39

but rather of the *change* in the school-age population, which is much more volatile and unpredictable. (This effect is similar to the previously identified *accelerator impact* in the private sector.)

Government expenditures may change in response to increases in economic activity in the absence of population change. They may increase as a result of the special needs of a project, such as the construction of a port or some other infrastructure. They may increase or decline as a function of the changing needs of the resident population.

Discretionary changes in government spending involve the introduction of new government programs or changes in the functions of existing programs. In an impact situation these include measures to

mitigate or offset adverse effects. For example, the timing of public capital construction projects could be scheduled not to coincide with major private sector project construction in order to minimize inflationary pressures and temporary population inflows. Because there is a discretionary element in public spending, which is controlled by community and state leaders, it is difficult to accurately predict the level of government spending which will occur in response to an increase in population or economic activity in the economy.

Increasing government expenditures will create jobs in the public sector and will increase private sector demands in construction and other industries. These demands in turn will contribute to the economic impact previously described, including indirect, induced, accelerator, and structural change effects.

I.D. Population Impact

I.D.1. Who Fills the New Jobs?

An economic project which generates new job opportunities will have an impact on population, because although some or even all of the jobs directly created by the project will be taken by current residents, the increase in the number of jobs will create an incentive for people to migrate to Alaska. (If the economy is in a slump, the project would provide an incentive for people to remain in the region rather than to move out in search of jobs elsewhere.) The population response will depend upon the type of employment created, the available labor supply, and changes in the labor force participation rate. In addition, factors beyond the control of the state, such as the unemployment rate in the rest of the United States, will affect the size of the population response.

To illustrate, in the decade of the 1970s, Alaskan employment grew by 74 thousand. During the same period, population increased 98 thousand; of that increase, about 58 thousand resulted from natural increase in the population that was in Alaska in 1970. The remaining 40 thousand increase was in-migration that largely resulted from increasing job opportunities within the state. Thus, population increase and, by implication, growth in the resident labor supply, could not keep up with the growth in the number of new jobs.

Figures I-4 and I-5 show who gets the new jobs created by economic developments and where they come from. The inner ring in Figure I-4 represents the four sources for direct project employment. They are as follows:

A_1 Current Alaskan residents who were unemployed before they took a job on the new project.

B_1 Permanent migrants who move to Alaska to work on the project.

C_1 Itinerants who move to Alaska temporarily to work on the project but retain residence elsewhere.

D_1 Current Alaskan residents who change jobs to work on the new project.

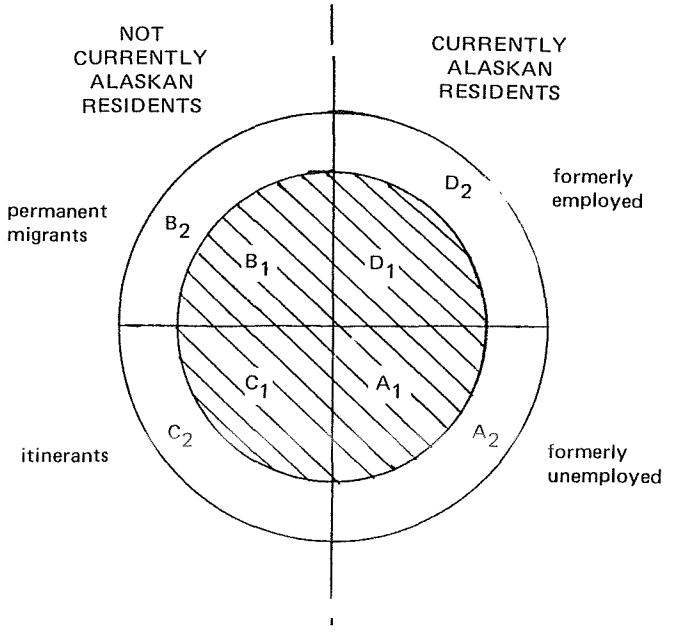

Figure I-4. Sources of Workers for
a) Direct Project Employment ($A_1 + B_1 + C_1 + D_1$)
b) Total Project Employment ($A_{1,2} + B_{1,2} + C_{1,2} + D_{1,2}$)

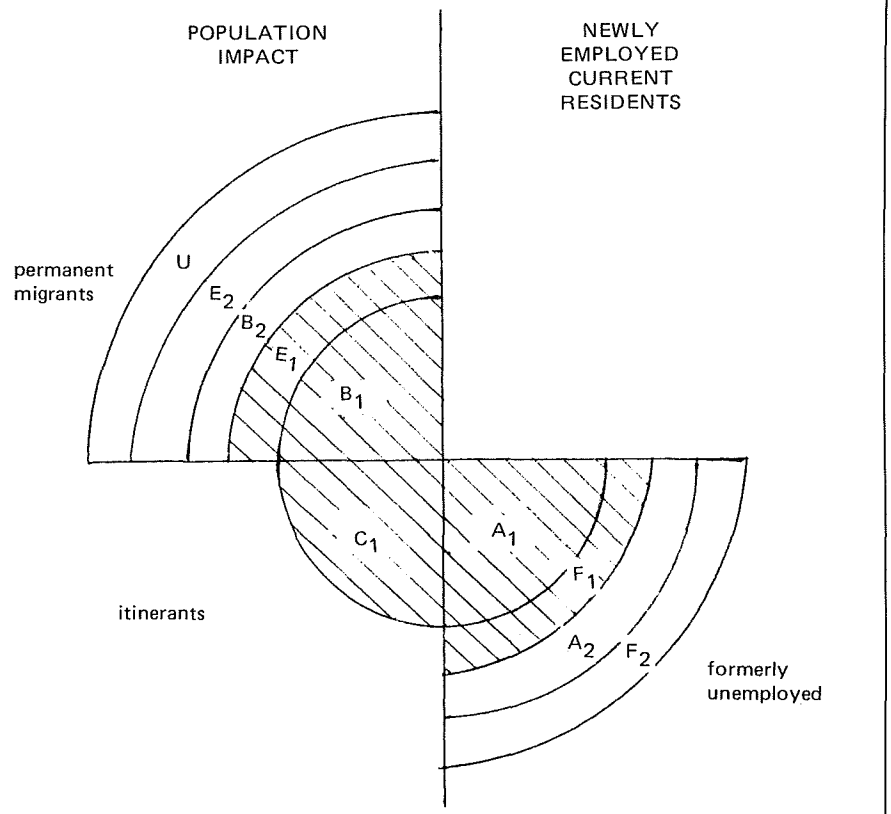

Figure I-5. Resident Employment and Population Impact of Project's
a) Direct Job Requirements (A_1, F_1, C_1, B_1, E_1)
b) Total Job Requirements

Of these direct jobs, $A_1 + D_1$ go to current residents and $B_1 + C_1$ to people who are not currently residents. New population working on the project will include both permanent residents and itinerants. But these two categories comprise only a portion of the population impact from direct project employment. This is because the jobs left by those individuals in category D_1, current residents who upgrade their employment by job switching, are now vacant. Figure I-5 modifies Figure I-4 to show where the workers come from to fill those jobs. They are indicated in the figure as:

E_1 Permanent migrants who move to Alaska to fill vacated jobs.

F_1 Current Alaskan residents who were formerly unemployed but now fill vacated jobs (E_1 plus F_1 equals D_1).

The *direct population impact* consists of migrants who fill project jobs as well as migrants who fill jobs vacated by residents who shift to project jobs. The *newly employed current residents* consist of those who take jobs which become available because of upgrading by currently employed residents as well as those who directly take project jobs.

All other employment impacts which occur as a result of the economic activity can be termed *secondary employment*. People filling these secondary employment jobs come from the same sources as those who fill the direct project employment slots. These people are shown in Figure I-4 by the outer ring with a subscript 2 to denote secondary employment. Figure I-4 illustrates several facts about the labor market. First, there may be upgrading to newly created secondary jobs by current residents (D_2), thus leaving old jobs vacant. Second, secondary jobs may be taken by currently unemployed residents (A_2). Third, even itinerants may obtain secondary jobs (C_2).

The total effects on resident employment and population are shown in Figure I-5. There are now five components of the permanent migrant portion of the new population, as follows:

B_1 Migrants who move to Alaska to work on the project.

B_2 Migrants who move to Alaska and take secondary employment jobs.

E_1 Migrants who serve as replacements for currently employed residents who upgrade to project employment and leave their jobs vacant.

E_2 Migrants who serve as replacements for currently employed residents who upgrade to secondary employment and leave their jobs vacant.

U Migrants who desire to work but fail to find employment and consequently increase the ranks of the unemployed.

Newly employed current residents can be divided into four groups as follows:

A_1 Current Alaskan residents who were unemployed before they took a job on the new project.

A_2 Current Alaskan residents who were unemployed before they took a secondary employment job.

F_1 Current Alaskan residents who were unemployed and who serve as replacements for currently employed residents who upgrade to a direct project job.

F_2 Current Alaskan residents who were unemployed and who serve as replacements for currently employed residents who upgrade to a secondary job.

For a given number of new direct and secondary job openings which are created by new economic activity, the proportion that will be filled by current residents and migrants, respectively (the sizes of the areas in Figures I-4 and I-5), will depend upon *supply* and *demand* conditions in the labor markets.

The locally available supply of labor is a function not only of current unemployment but also of the skills of the resident population and the potential for an increase in the number of people who would be interested in working if the prospect of getting a good job were a real one. The proportion of people who are interested in working is the *labor force participation rate*. If for some reason that rate is rising, it means that the number of new jobs which could be filled by the local population is increasing. If these people who desire jobs do not have the requisite skills, however, the unemployment rate will rise .

Nationally, the labor force participation rate has been rising because of the entrance of the baby-boom generation into the labor force and the increased participation of women in the labor market.

The increasing labor force participation rate is one factor helping to explain rising unemployment because the economy has not been able to absorb all these people who want to work. In Alaska, the labor force participation rate has also been rising. In 1970, the ratio of civilian employment to civilian population was 37.4 percent; by 1979, it had climbed to 47.2 percent. This dramatic shift means that the future population response to newly created jobs may be small compared to the response historically. On the other hand, it is unlikely that the labor force participation rate in Alaska can get much higher. Consequently, the population impact of new jobs in the future could be larger than in the recent past.

Employers determine what skills are needed in the new jobs directly created by the project as well as in the secondary jobs. Market forces determine how jobs and employees become matched, and there is no guarantee that even with the requisite skills current residents will get the newly created jobs. The Alaska hire laws attempted to establish this requirement for direct employment on the Alyeska pipeline, but the law did not extend to the secondary jobs which the pipeline created.

To illustrate the operation of the labor market, unemployment and the unemployment rate for Alaska are shown in Table I-5 for the decade of the 1970s. The number of unemployed increased annually from 1970 to 1978. The only sharp decline in the unemployment rate occurred in 1975 at the start of the pipeline construction period. By 1976 it had returned to its old level, which it has exceeded in all subsequent years. Thus, although the number of jobs increased in the 1970s, the number of unemployed also grew so that the unemployment rate trended upward. The sources for the new unemployed were current residents, either already in or newly entering the labor market, and migrants.

I.D.2. Demographic Characteristics of New Migrants

The total population impact is determined by the number of dependents—persons not in the labor force—who accompany each job seeker to Alaska. Currently, for each job in Alaska there are

Table I-5

Alaskan Unemployed and the Unemployment Rate

Year	Unemployed (000)	Unemployment Rate
1970	6.474	7.1
1971	8.037	8.2
1972	8.586	8.3
1973	9.251	8.5
1974	9.894	7.9
1975	10.750	6.9
1976	14.000	8.3
1977	16.000	9.2
1978	20.000	11.0
1979	16.000	8.9

1.12 persons either not in the labor force or unemployed (military and their dependents excluded). The *dependency ratio* for migrants will not be the same as the current population but will differ depending upon the types of jobs available and because of the general characteristics of migrants.

The permanency of the job is an important consideration in whether a migrant employee decides to relocate his family to the state. Also, there are some types of jobs which are commonly filled by individuals who are highly trained in a special skill and who commute all over the world to do their jobs. For these *itinerant* workers, Alaska is a work place, but not a residence.

Demographic studies show that migrants to Alaska (as well as other states) are generally younger than residents, less often married, and have on average fewer children. A survey conducted in 1975 by the Bureau of the Census provides a rough measure of the dependency ratio of recent migrants. For those adult household heads who had been in the state less than one year, 40 percent were married, the mean number of children per family was 1.11, and the unemployment rate was 10 percent. Making reasonable assumptions about the

labor force participation rate for these people,[2] we can estimate that the number of nonworkers (dependents and unemployed) per employed person was .67, and the number of dependents per individual in the labor force was .50. These figures are approximately one-half of the average dependency ratio for the resident population.

A survey of in-migrants to Alaska conducted in 1976 sponsored by the U.S. Department of Labor found that the age structure of migrants was heavily weighted toward the 20-to-29 age group and away from the under-15 category. The migrants were also predominantly male. In contrast to this migration associated with the pipeline, which was largely based upon temporary employment, the migration between 1965 and 1970, identified by the Census, had a much larger proportion of children under 15 years. The Department of Labor survey also found that a large proportion of the in-migrants were skilled workers, and they were going to destinations throughout the state. These findings support the idea that the labor market is supplied by people both from within and without the state and that migration occurred to fill secondary jobs created by the pipeline.

The immediate population impact may be smaller than the long-term effect. The dependency ratio for new migrants is low, but as they age, they tend to settle down and start families. Consequently, the birth rate may rise.

I.E. Price Changes

There are two varieties of price changes: *permanent adjustments* and *temporary inflation*. Price adjustments result from permanent changes in supplies relative to demands for inputs and outputs of the economy. As the Alaskan economy grows, the structure of prices and the general price level approaches that of the national economy. The changing structure of prices, in turn, enhances the profitability of some industries, causing them to expand, and reduces the profitability of others, causing them to contract. Specific large projects may accelerate that trend. Those items which are in fixed supply

[2]We assumed that the labor force participation rate for unrelated individuals was 100 percent and for families 78 percent (based upon the national average for the 25-to-35 age group in 1978, the most recent year for which data is available).

will go up in price (faster than the general inflation rate) when demand for them increases. Office space in downtown Anchorage is an example. Those items which can be provided less expensively as a result of an increase in the size of the market or because costs of production have permanently declined due to the increased availability of inputs, will decline in price (or will increase in price more slowly than the general rate of inflation). Economies of scale in warehousing is an example.

Inflation results from a temporary shortage of labor and materials associated with the project either directly or because of secondary effects. It serves an economic purpose by signaling to labor and businesses that shortages exist and that more supplies are necessary to balance supply and demand in the market. When additional supplies are forthcoming or when the demand subsides, the price will return to normal. When the general price level is rising, this means that the rate of price increase will exceed the national average during periods of very strong demand and then return to normal levels. Following a period of strong demand, the rate of inflation may temporarily dip below the national average in order to restore the long-run relationship between regional and national prices.

Example

A comparison of annual rates of increase of the Anchorage and the U.S. city average consumer price index is shown in Figure I-6. The trend in the Anchorage inflation rate has consistently been below the U.S. city average. (Since the Anchorage price level is considerably above the U.S. city average, this means that the price levels have been slowly converging.) Since 1967, this trend has been reversed only during the years of oil pipeline construction in 1975 through 1977. Subsequent to 1977, the long-term trend has re-emerged and the Anchorage inflation rate has been less than the national average.

I.F. Competition for Resources

The initiation of an economic activity or the development of a resource may eliminate the possibility or foreclose the opportunity of using the resource in some other process or of using some other resource. An example of the former would be the use of the natural gas liquids from Prudhoe Bay as a feedstock for a petrochemical

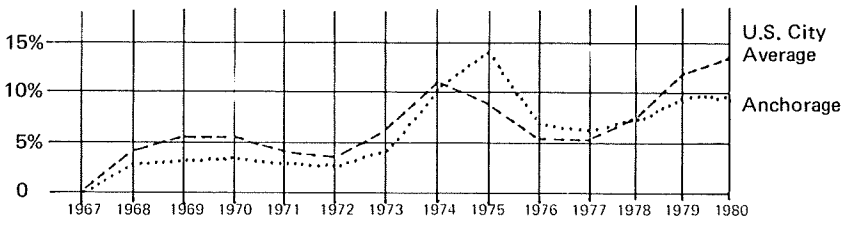

Figure I-6. Annual Rates of Price Increase: Anchorage and the U.S. Average

industry in Alaska, which would foreclose their use to power a gas separation plant and other facilities at Prudhoe Bay. An example of the latter would be elimination of a fishery resource in a particular area because of oil development.

In the normal operation of an economy, this foreclosure of opportunity occurs whenever any action is taken. When a person decides to use sand to make concrete, that sand is no longer available for use on a beach or in a sandbox. In a properly functioning economy, the sand is allocated to its best use, and the foreclosing of other opportunities is not a loss to society. The value of the sand as concrete exceeds its value in a sandbox, and the value foreclosed because the sand did not go into the sandbox is not a real cost. [3]

However, the economic consequences of foreclosing an opportunity can be real and should be included in any catalog of economic impacts. If a new economic activity causes the level of an already established activity to contract, this will have the effect of reducing the aggregate economic impact of the project. For example, if petroleum exploration and development were to interfere with the harvesting of a fishery resource, then the economic impact of petroleum development would be the economic activity generated by the petroleum development *minus* the economic activity lost as a result of the reduced fishery.

[3]Foreclosed opportunities may have a distributional effect, causing income to rise for those who win in the competition for resources and incomes to fall for the losers. The question of distribution is taken up later.

I.G. Other Economic Effects

I.G.1. Location of Impact

There are two reasons why employment impacts of an economic activity will not all take place where the direct activity occurs. First, people may chose to live in a place different from where they work. Prudhoe Bay workers who live in Anchorage are an example of this, but it is a common phenomenon in Alaska, particularly in industries such as mining and construction. Second, the secondary employment that a project generates may be at a different location than the direct employment. Secondary employment in the support sector industries of trade, services, and finance-insurance-real estate tends to be centered in the larger communities of the state, such as Anchorage and Fairbanks, independent of the location of the direct employment.

Other impacts will also occur outside the immediately affected area. Price increases tend to ripple throughout the economy. If the demand for labor increases in one part of the state, it may draw workers from other regions and result in labor shortages in those areas.

Consequently, in measuring or anticipating economic impacts it is necessary to consider the whole state, because effects can occur anywhere.

I.G.2. The Structure of Demand

The age-sex-race distribution of the population is constantly changing because of natural increase and migration. This change will be augmented when migration into or out of the state occurs as a result of a new economic activity. It is useful to distinguish *net migration* from *gross migration*. Net migration is the difference between the number of people moving into the state (gross in-migration) and out of the state (gross out-migration). The gross flows represent the turnover of the population over time as newcomers to the state replace people leaving. The characteristics of in-migrants and out-migrants are generally similar, and these gross flows consequently do not significantly alter the composition of the population. For example, each year there is a significant turnover of

the military population, but new arrivals have the same characteristics as those departing. Net migration, since it is the residual of the gross flows, does have an impact on the composition of population because the characteristics of migrants are not representative of the population as a whole. As was earlier noted, net migrants will be young and have few dependents but will increase the birth rate because they tend to be concentrated in the primary childbearing years.

The demand for goods and services in both the private and public sectors depends upon the composition of the population. An increase in new families will increase the demand for larger housing units, and subsequently, the demand for primary education facilities. An increase in the young adult male population will often be correlated with an increase in the crime rate and consequently with the demand for crime prevention and the justice system.

I.G.3. Changing Expectations

People tend to form their opinions about the future based upon their perceptions of the present. Some people interpret an increase in the rate of economic expansion as a temporary phenomenon, while others see it as the start of a trend. These perceptions affect the decisions people make about investment choices and location decisions. Consequently, there may be more investment, which may lead to some increase in stability, but also more speculation, which may lead to instability.

I.G.4. Announcement Effect

All of the economic impacts of economic activity do not occur during the period when the direct effects take place--the construction and operational phases of the project. Specifically with large projects, some of the effects will occur prior to the official start date of the project in anticipation of its initiation. For example, announcement of a plant site can cause an increase in the price of land surrounding the site. Such an announcement may also lead to an inmigration of job seekers who anticipate finding work related to the project.

I.G.5. Economic Integration

An increase in flows of goods and services into Alaska will result in an increase in information about Alaska flowing out and information about the rest of the United States flowing in. This will change perceptions of people outside the region concerning the Alaskan economy and will affect the flow of people and capital into the state. For example, it may increase speculative migration and it may reduce the risk premium associated with the cost of borrowing money in Alaska.

I.H. How Is Impact Distributed?

Distribution of the effects from new economic activity has two aspects. The first is whether *aggregate* real income in Alaska has increased or decreased as a result of the project. For example, a "development" from outside which leaves a region poorer than it would have been in the absence of the economic activity is known as "colonialism." A fall in aggregate income is possible if the costs which the development imposes upon the region exceed the local benefits generated by the project. An example might be a development which provides only low-paying jobs locally and which transfers returns to all other factors out of the state.

The second aspect of the distribution question is whether a particular *individual* is better or worse off as a result of the impacts of the project. Project impact spreads beyond those directly affected by job creation, as prices faced by businesses and consumers change for everyone. Some people will be worse off as a result while others will be better off.

I.H.1. Income and Wealth

Three things will determine whether the real income of an individual has increased or declined as a result of changing prices: (1) the price changes themselves, (2) the income-earning assets controlled by the individual (including his labor skills), and (3) the goods and services that he likes to buy.

When prices change, an individual's income may change as well as the amount of goods that he can purchase from that income. Because the assets controlled by each person differ and each person's

tastes and preferences for consumer goods are different, it is difficult to generalize about who will be made better off in terms of being able to consume the items they prefer as a result of the price changes associated with impact.

If all prices increased or declined at the same rate, no one, of course, would be any better or worse off. In fact, in an expanding economy the prices of items in short supply such as skilled labor and certain types of land will tend to rise more rapidly than the general price level. This results in benefits for people who control those assets and losses for those who consume them. At the same time, some prices will be rising and others falling because the structure of the economy is changing.

One likely group of winners are those people possessing skills or income-earning assets in demand, because their incomes will likely rise faster than the general price level. One likely group of losers are those people who have fixed incomes which do not rise as fast as the general price level.

The difficulty with trying to unravel the effect of price changes on an individual's economic well-being can be illustrated by considering the cost of housing. When the price of housing goes up, the person who does not own a house clearly loses because the price he must pay for purchasing one has increased, all other prices are unchanged, and his income has not changed. Homeowners are the beneficiaries of increases in the price of housing. It seems initially that the homeowner is no better off because even though the *value* of his house has increased, the *price* he would need to pay to replace it has gone up by the same amount. This suggests there are no gainers when housing prices increase.

This is not the case, however. Housing has become more expensive *relative* to other goods and, consequently, by consuming less housing and more of other goods, a homeowner could make himself better off. For example, imagine that the price of housing increased by a factor of 10 overnight while the prices of all other goods remained unchanged. A $100,000 house would become a $1,000,000

house, and a $80,000 house, an $800,000 house. The possibility of getting $200,000 for nonhousing purchases by moving from the more- to the less-expensive house would be an attractive opportunity for some individuals. (However, there is a practical difficulty in converting the change in asset value into income. The homeowner, must actually sell his home in order to enjoy its increased value.)

Table I-6 shows how the monthly wages earned in Alaskan industry changed during the 1970s. These only roughly reflect changes in earnings for individuals and well-being levels, because over time the kinds of jobs in an industry may change and the average hours worked may also vary. Thus, the relatively small increase in the average wage in services during the 1970s may be partly attributable to more unskilled or part-time employment. The larger wage increase in construction may partly result from longer hours worked. Nevertheless, some general patterns emerge from this information.

The change in wage rates between 1973 and 1976 reflects increases in labor demand as a result of the pipeline construction boom. In this interval, average wage growth in all industries, except the finance-insurance-real estate sector, exceeded the increase in the Anchorage consumer price index, and all average wages grew faster than per capita income in the United States as a whole. By these aggregate measures, Alaskans fared well during pipeline construction. The upward pressure on wages was not felt uniformly across the economy, however. Industries most closely related to pipeline construction—construction, transportation, and services (presumably business services)—showed the sharpest increases.

The change in wage rates over the interval between 1973 and 1979 is more indicative of long-term industry trends. By 1979, most wage rates were above their 1973 levels by approximately the same proportion as the consumer price index. This indicates that the earlier income increases were largely of a temporary nature due to labor shortages, long hours, and special skill requirements.

Just as each individual is uniquely affected by changing prices for consumption goods and changing values for assets and the income derived from them, each person is also affected by changes in the

Table I-6

Alaskan Wage Rate Growth in the 1970s

Industry	Average Monthly Wage 1973	1976	1979	Increase (percent) 1973-76	1973-79
All Nonagricultural Employment	$1,006	$1,928	$1,741	92	73
Mining	1,617	2,705	3,370	67	108
Construction	1,635	4,041	2,910	147	78
Manufacturing	961	1,409	1,745	47	82
Transport, Communications, & Public Utilities	1,141	2,023	2,264	77	98
Trade	778	1,149	1,239	48	59
Finance, Insurance, & Real Estate	897	1,197	1,572	33	75
Services	751	1,499	1,272	100	69
Government	1,024	1,418	1,749	42	71
		* * * * *			
U.S. per Capita Annual Income	$4,981	$6,401	$8,706	29	75
Anchorage Consumer Price Index (Oct.)	123.8	167.6	211.4	35	71

availability of public goods as well as taxes and other government payments. Some people will gain because the value of the services they receive from the government will rise relative to their taxes. Others will lose because their taxes will increase more than the value of services received, or the value of those services may decline, or both. This is discussed in more detail in Part II of this primer under the heading of "Fiscal Impact Assessment."

I.H.2. Jobs

If a person obtains a job or upgrades his employment as a result of new economic activity, this is a personal economic benefit independent of any changes in prices. This is obvious because it is a change based upon personal choice. Clearly, the more new jobs that are created by the activity, the more opportunity will exist to exercise that choice. The benefits from new job opportunities, however, are correctly measured as the differences in quantity and quality between the new jobs and the old jobs. For example, a survey of Alyeska records indicated that 5,770 Alaska Natives held 15,047 different jobs on the oil pipeline during its construction. This compares with a total of about 60,000 individuals filling 131,000 jobs for the total project. Thus, Natives held 11.5 percent of the jobs and represented 9.7 percent of the workforce. Considering the average length of employment and probable average wage, the total wages and salaries earned by Natives was approximately $100 million. (This is considerably less than their proportion of jobs or work force). We do not know what proportion of these Native employees would have held jobs in the absence of the pipeline or what their earnings would have been. This information would be necessary in order to estimate the direct job-related benefits to Natives of pipeline employment. Those benefits are income and employment measured after subtracting the income and employment which those Natives would have had in the absence of the pipeline.

I.H.3. Resident vs. Nonresident

An important distinction is often made between residents and nonresidents in analyzing the distribution of impact. There are two reasons for this. First, the residents of a region are primarily concerned with their own well-being. Second, a presumption is often made that new migrants into a region are automatically made better off as a result of their project-induced move because the move was a free-choice decision. The current residents, on the other hand, have not exercised any choice and, in a sense, the impacts have been thrust upon them. Thus, in judging the overall distribution of impacts, one need only consider the effects on current residents.

While it is simplistic to assume that migrants are, in fact, better off as a result of their move, the distribution of impact on current

residents is usually the primary concern of analysis. The advantages possessed by current residents are physical presence in the state and ownership of resources. Nonresidents will get jobs and income to the extent that they can successfully compete in the job market and gain control of those resources which increase in value because of their scarcity.

PART II. FISCAL IMPACT ASSESSMENT IN ALASKA

II.A. What is Fiscal Impact Assessment?

Fiscal impact assessment is one dimension involved in analysing whether the potential benefits of an economic development outweigh the potential costs. Specifically, it compares the public sector costs (expenditures and changes in the quality of services provided) and public sector revenues which a project will engender. If the revenues exceed the costs, a fiscal surplus is indicated for the project. If the costs exceed the revenues, a fiscal deficit is indicated.

Before discussing fiscal impact assessment, we will review the fiscal impacts of economic activity.

II.B. Fiscal Impacts

II.B.1. Government Spending

A change in government spending may occur because of a direct project requirement, changing needs by the resident population, or needs attributable to a new population.

Direct expenditures are those which are directly attributable to the project being analyzed. In addition to the standard provision of services by government to business, there may be special expenditure requirements of the industry that are best met by government. One component of this would be the development of infrastructure such as a port or road or the maintenance of existing infrastructure affected by the project. An example would be the cost of main-

taining the highway system during the construction of the Alyeska pipeline. Environmental costs are another category.

Secondary expenditures can result from changing needs of the resident population or from a change in demands caused by population change. If the unemployment rate falls when job opportunities increase, expenditures for certain programs such as food stamps may fall. If the jobs cause families to be separated for long periods, expenditures for certain social service programs may increase.

Most secondary expenditures are related to population changes. Analysis of the state operating budget indicates that the population-sensitive per capita expenditure level in 1981 was $2,764, about 74 percent of the budget. This means that if the per capita cost of providing services to new population is the same as for existing population, each new resident would increase the state operating budget by $2,764 annually in 1981 dollars, if the 1981 package of government services were provided to that individual. However, a portion of the increase in expenditures is not paid out of the general fund and is, thus, not a demand on general fund revenues. Most of the non-general fund revenues is an automatic pass-through of federal funding in the form of entitlements and other funds allocated on a per-capita basis. In addition, user fees pay for some of the added government expenditures. After accounting for these self-financing items, the per capita expenditure level falls to $1,956. The total impact on expenditures of a change in economic activity could then be calculated as the change in population multiplied by the per capita costs of government.

Expenditures for local government services are also closely linked to population, although they are much smaller in the aggregate than those of state government. The average per capita cost of providing population-sensitive services to local Alaska communities varies because of cost and service differentials. A survey of the larger local governments, which assumed that all local operating expenditures except debt service were population sensitive, indicated that the level of expenditures per migrant would be $350 after subtracting self-financing items.

Analysis of capital budgets indicates that the state and local proportions are more even. A preliminary estimate of the annual per capita cost of population-sensitive capital budget items is $70 for the state and $70 for the local government. These numbers are very rough because there is no reliable estimate of the replacement cost of the current stock of public capital in Alaska. These estimates assume a 20-year asset life, so if the capital stock were to be put in place immediately, the "up front" costs would be $1400 for state and $1400 for local government per capita.

This simple analysis of secondary fiscal impact overlooks the fact that the changing *composition* of the population will result in changing demands for public services. This fact is most significant for the education and social service functions. Because migrants have fewer dependents than residents, the percentage increase in the demand for primary education may be less than the percentage increase in population. Although the cost of population-sensitive state services provided to the average resident is $1,956, the cost of such services provided to the average *employed* migrant is $1,235, after the cost of services targeted to dependents has been subtracted. For local government, the cost falls to $230.

These figures estimate the expenditure levels needed to maintain service levels for the new population. Actual expenditures as a result of impact will most likely differ from this standard. Many items in government budgets are discretionary; consequently, the size of the government spending impact (and, in fact, the total *economic* impact) is partially determined by discretionary government response. The changes may be in quality, per capita quantities, or types of services provided; but whatever the type, they occur because of the new opportunities or constraints that the economic activity engenders for the public sector. The size of the government expenditure impact is thus partially under the control of government; and government can moderate the impact by holding discretionary spending to a minimum or expand it by increasing discretionary spending, particularly by increasing the level of the capital budget. This implies that part of the responsibility for the size of the economic impact must rest upon the government.

II.B.2. The Cost of Government

The cost of delivering a specific package of public goods and services may change because of inflation or because there may be economies or diseconomies of scale in serving a different-sized population. Changes in costs attributable to demand-induced price changes (inflation) may be matched by inflation-generated changes in government revenues. In Alaska, this is generally not true because the prices of things the government buys are independent of the price of oil, which largely determines state revenues.

Economies of scale and cost savings result when the cost to service each individual is reduced as more people are served. If this happens, the fiscal impact of the additional population will be less than if the impact were estimated on the basis of average costs. The reverse would be true if there were diseconomies of scale.

Unfortunately, much of the government's budget consists of services, and significant economies of scale are difficult to identify in such big budget items as education and social services. This is particularly true if the population additions do not increase the density of existing communities but instead result in expansion of community boundaries. For example, an existing fire station might be able to serve a larger population if it were within the same spatial boundary. However, if the same population were widely scattered, then additional fire stations would become necessary to provide the same degree of fire protection.

The public domain includes many goods and services which are publicly consumed but not directly priced, such as a uniquely productive public fishing site in the vicinity of a city. These goods also may be subject to increasing or decreasing returns to scale. When the population is small, a few more people will not affect the enjoyment that the existing residents derive from the fishing site. In this case, additional benefits from the fishing site can accrue to new residents at no cost. At a larger population size accompanied by more intense use of the site, however, congestion will begin to occur, and the fish catch may begin to decline due to overfishing. When the population reaches this size, the addition of more people will impose a cost on those already there by reducing their enjoyment of the publicly owned resource.

II.B.3. Government Revenues

Government revenues associated with a project will include those collected as a *direct* result of the project and those collected as a result of *secondary* activity. The largest direct revenues will, in most cases, come from the property tax. Table II-1 shows the property tax revenues currently collected by various communities on the oil and gas facilities within their jurisdictions. However, they are not necessarily representative of the revenues which a particular new activity would engender. A rule of thumb would be that a $500 million capital facility would generate $5 million annually at 10 mills and $10 million at 20 mills. The smaller the community relative to the tax base, the larger the per capita revenue share. The state corporate income tax also produces a small amount of revenue attributable directly to the project.

Secondary revenues include all the increased tax receipts which result from the secondary economic impact of the project. Those taxes would come from the additional businesses, income, and population resulting from the project. At the local level, they would

Table II-1

1980 Property Tax Revenues from Petroleum-Related Property in Selected Alaskan Communities

Community	Oil and Gas Property Tax Revenue (million $)	Population (000)	Revenue per Capita ($)
North Slope Borough	49.870	4.160	11,988
Valdez	9.211	4.066	2,265
Fairbanks North Star Borough	5.694	60.227	95
Kenai Peninsula Borough	1.433	25.507	56
Municipality of Anchorage	.381	204.328	2
Yakutat	.036	.422	82

include additional property tax receipts and sales tax revenues. A large number of taxes occur at the state level. Table II-2 shows 1980 general fund receipts from taxes and other sources of state government by category, not including those directly resulting from natural resource industries. Average revenues collected per employee were

Table II-2

1980 State of Alaska General Fund Unrestricted Revenues Not Directly Attributable to Petroleum or Fishing

Revenue Source	Total (million $)	Per Employee[a] ($)	Per Capita[b] ($)
Sales/Use Taxes	$35.1	$199	$94
Facilities-Related Charges	26.0	148	69
Licenses and Permits	18.8	107	50
General Corporate Income Tax	17.9	101	48
Gross Receipts	12.5	71	33
Miscellaneous Revenues	6.7	38	18
Services-Related Charges	4.8	27	13
Business License Tax	4.2	24	11
Estate	.2	1	1
Vehicle Registration	.1	1	0
Total	$126.3	$716	$338

[a]Number of employees based on 1979 nonagricultural wage and salary employment plus military, but net of oil and gas, food processing, and miscellaneous employment (176.5 thousand).

[b]Assuming 1.12 dependents per employee.

$716, primarily from sales and use taxes (fuel taxes) and facilities-related charges (airport and ferry charges). On a per capita basis, the receipts totaled $338. For new population, the same per capita revenue response could be expected, but if the population did not increase, the per capita revenue response would be smaller, since some of these revenues are paid whether or not a person is employed.

II.B.4. Timing and Jurisdiction

When growth occurs, there is no assurance that revenues will flow to the government over the same time frame that they are needed to provide for expansion of services. A common occurrence is that population-related expansion of government services precedes the generation of revenues by several years. This happens because a substantial portion of the revenues, particularly at the local level, is related to the operational rather than the construction phase of the facility, while the major expenditure phase is associated with project construction.

The jurisdictional problem arises because the level of government with the capacity to collect the revenues is not necessarily the level responsible for providing the services. The problem generally is that higher level governments—state or federal—collect or have the power to collect revenues that are needed locally to pay for impacts occurring at the local level. One reason for this is that the higher level governments normally collect revenues on the profits or rents of the development. These are the logical source of revenues for such specific project costs as those associated with the environment and with the special needs of the impacted population. Also, higher levels of government normally collect revenues and transfer them to lower levels in the form of revenue sharing or grants. An impact situation may require a redefinition of the formula or method for determining the distribution of those revenues.

In Alaska, the jurisdictional mismatch works in the opposite direction. Project-related revenues are likely to accrue to local governments in the form of property tax receipts while expenditures for direct and secondary fiscal effects will primarily be the responsibility of state government. At the local level, the important variable in determining whether the fiscal impact will be negative or

positive is population growth since the more population grows, the more people must share the *direct* revenues from the property tax. The same observation applies to the combined state and local effects because the secondary state revenues which a project generates from population growth are very unlikely to match the expenditure requirements of the new population.

Some regions of the state have no formal local government with taxing power. For these regions, the state government collects the revenues and provides the government services. In the absence of a state property tax on facilities outside local government boundaries, there may be a revenue shortfall for the projects.

II.C. What (Whose) Costs and Revenues Should Be Included in the Fiscal Impact Assessment?

A fiscal impact assessment might actually address three questions. They are:

1. How will the new economic activity caused by a project effect the level of government spending and the fiscal balances of state and local government, considering all of its economic effects, as compared to the case where no such project is undertaken?

2. What costs does this project impose upon government—costs for which, in fairness, the project should reimburse the government through taxes and other revenues? (In other words, what costs of government should be included in determinating the full costs of the project?)

3. What costs and revenues should be considered in evaluating the desirability of the project for the long-term economic benefit of the region?

When attempting to anticipate the economic effects of a new project, *all* the fiscal effects resulting from *all* of the direct and secondary economic impacts should be counted as part of the total fiscal impact, since without the project they would not have occurred.

Perhaps in fairness, however, the fiscal consequences of certain economic effects should not be attributed to the project. An example would be what we earlier labeled as "development impact" (structural change). Suppose that the population increase associated with economic activity results in certain local wholesaling and warehousing activities becoming economically viable. Whereas this activity formerly took place in Seattle, it would now be carried out within the state. If this shift should result in a population increase, the employees and their families in this new industry would require government services and would pay taxes. Should this fiscal impact be attributable to the project which stimulated the warehousing activity?

In one sense, the answer is yes. The warehousing development would not have taken place in the absence of the project, and, consequently, any public costs and revenues which result because of the warehousing function are caused by the project. When calculating the additional spending required of government and how much additional revenue would be forthcoming as a result of a change in economic activity, there is no doubt that *all* effects should be included and counted.

On the other hand, the local warehousing function is made possible by the fact that total population and the local market now exceed a certain threshold level. The whole population and economy benefit from the (presumably) lower costs which result from a local warehousing facility. Because of these obviously shared benefits, any fiscal surplus or deficit associated with the warehousing facility should be shared by the whole population, rather than attributed to just the new population.

Public costs associated with impact can be divided into the categories of *direct costs* which can be directly traced to the impacting project, and *indirect costs* which are a result of secondary economic impacts. Direct costs should be borne by the project. In allocating indirect costs, one should give the project the same treatment as other industries. Thus, if most existing industries are not paying for the indirect public costs associated with their presence in the state, fairness would require that the new project not pay also.

The existing tax system in Alaska collects from each individual only a small portion of the cost of public services the government provides to him. The oil wealth of the state provides a subsidy to cover the cost of government for all citizens. New developments should not necessarily be required to subsidize government for the difference between the cost of government services provided to their employees and the revenues which those projects generate at existing tax rates.

In some cases, the government services provided new project employees directly or indirectly may be qualitatively different than the services provided to the current population. In other cases, the cost of providing government services may be substantially different for new migrants compared to that for current residents. In these instances, revenues collected should be sufficient to cover these costs. The revenues could be collected directly from the project *or* from those to whom the services are provided.

It is not possible to develop general rules based on fairness for determining what secondary costs the project should pay for. Two examples can be presented to demonstrate some of the complexity involved in determining "fairness." In the first case, suppose a project's labor requirements result in the in-migration of a population group with an unusually large percentage of school-age children. The resultant strain on school system finances would not be eliminated under normal types of full taxation such as the property, sales, or income tax. The fiscal burden imposed on the community should, in this case, be met by a direct tax upon the development as the only practical means of raising the money.

In another example, suppose that a development increases the size of a community to the extent that a sophisticated sewer system becomes necessary, where previously cheaper, private methods of sewage disposal had sufficed. The cost of providing services to new customers would far exceed the cost of sewage treatment to existing residents. In fact, the new residents would impose a cost on the old residents, because the latter would be required to switch to the more expensive system. The new residents should pay, directly or through taxes on the development project, their own share of the sewer system costs. The question of whom should pay the increased costs

forced upon the current residents is subject to different interpretations.

On the one hand, the sewage treatment facility might never have been necessary in the absence of this development. Thus, in this extreme case, the argument is strong for the development's bearing the cost, particularly if there is no increase in the quality of service as a result of the treatment plant upgrading. On the other hand, if the sewage treatment facility would definitely be required in the future anyway, the development project has only hastened the time when it becomes necessary. In this case, the argument is strongest for the costs incurred by the current residents being borne by the current residents.

This distinction introduces a special case, the boom-bust cycle, which we discuss in the final section.

II.D. The Mismatch Between Revenues and Expenditures

There are several reasons why the change in government revenues and expenditures may not match when construction or operation of a project causes the level of economic activity to change, and all the reasons apply to Alaska.

First, government may be required to make some expenditures directly related to the construction or operation of the project. Construction of a public port facility to load coal is an example. The direct taxes (property taxes) on the project at existing rates would not necessarily match the cost of the port facility. There would either be a surplus or a deficit.

Second, government taxes are established at levels which cover the *average cost* of providing public services. Thus, the property tax mill rate is calculated by first estimating the cost of government for the coming year and then dividing that by the assessed value of taxable property. The actual cost of public services for new residents may very well differ from the average cost for current residents, however. This *marginal cost* could be either above or below the average cost for all residents. If marginal costs exceeded the average, then new residents' tax payments would be less than the cost of the services they received. In this case, either the services would deteriorate if the tax rates were not altered or the tax rates would have to

increase if services were to be maintained at their previous levels. If marginal costs were falling, the opposite would be the case. The same analysis may be true of revenues.

Third, the tax structure and government expenditures may be such that although in the aggregate taxes equal expenditures, those who pay the taxes are not always those who enjoy the services, and vice versa. For example, an in-migration of people with no children would put no direct demand upon the school system, although these in-migrants would be contributing to the property tax base. Because there is no direct link between those paying the tax and those benefiting, a fiscal imbalance (in this case, a surplus) would result.

Finally, the majority of state (and a large proportion of local) government expenditures are financed in Alaska, not out of taxes on individuals or businesses in the state but rather by drawing upon the wealth of the state. By any measure, the costs of state government to support the typical resident are not covered by the revenues which that resident generates. We have estimated that in 1981 the average population-sensitive operating expenditures from the state general fund were $1,956 while per capita general fund revenues generated in 1980 were $338. The remaining $1,618 per capita was financed by the petroleum wealth of the state and not by the individual. Before returning to the question of rules for fiscal evaluation, we will briefly review this unique Alaskan condition.

II.E. Unique Characteristic of the Alaskan Fiscal Situation

Alaska gets about 90 percent[4] of its revenues from a depletable natural resource and, in fact, from a single occurrence of that resource—the Prudhoe Bay petroleum reservoir. Because the petroleum resource is being depleted, the revenues which it generates for the state cannot be expected to continue indefinitely. Although development of other petroleum reservoirs in the state will extend the life of the petroleum tax base, it cannot last forever. Just as

[4]In 1981, the proportion is estimated to be 89 percent, and if investment fund earnings (the Permanent Fund) are included, the proportion increases to 94 percent.

Texas and Louisiana are experiencing a decline in their petroleum tax bases, so Alaska will inevitably experience such a decline.[5]

Because the primary tax base of the state is a natural resource in fixed supply, the taxes which it produces represent both earnings and the principal of the state's share of the resource. Under this interpretation, the tax base is the present value of the revenues the state will receive in the future from production of the oil and gas at Prudhoe Bay. If the state could somehow sell the right to receive those revenues, the value of that right, and hence the value of the revenues to the state, might approximate $80 billion valued at current dollars. This is a very rough estimate of present value, dependent upon production rates, petroleum prices, tax rates, and the uses to which the state puts its royalty share of the petroleum. As such it is presented for expository purposes only.

The share of this state wealth for a typical family with two wage earners and two children is roughly $640 thousand.[6] We recall that recurrent state expenditures out of the general fund to provide operating services to the average Alaskan (adult and child, urban and rural) is about $1,956. Per capita taxes are $338. The tax shortfall is made up by spending a portion of the petroleum wealth. This is an annual expenditure of $5,272 from the typical family's share of state wealth.

When a new family moves into the state, three things may happen:

1. Per capita services provided by the government may change in quality or quantity.
2. Per capita revenues from nonpetroleum resources may change.
3. The per capita value of petroleum wealth will fall because the size of this "pie" is fixed, and it must be shared by new and old residents alike.

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[5]These states are concerned with this decline even though direct revenues from petroleum amount to, at most, 30 percent of their total revenues.

[6]An average of $200 thousand per capita at today's population of 400 thousand and $133 thousand per capita at a population of 600 thousand, as is projected in future years for the state.

Figure II-1 illustrates how the per-family share of the "pie" falls as the number of people who must share it grows. Each additional family which becomes a resident of the state immediately obtains a right to a $640 thousand dollar share of future revenues and reduces the share of each currently resident family by $5.00.

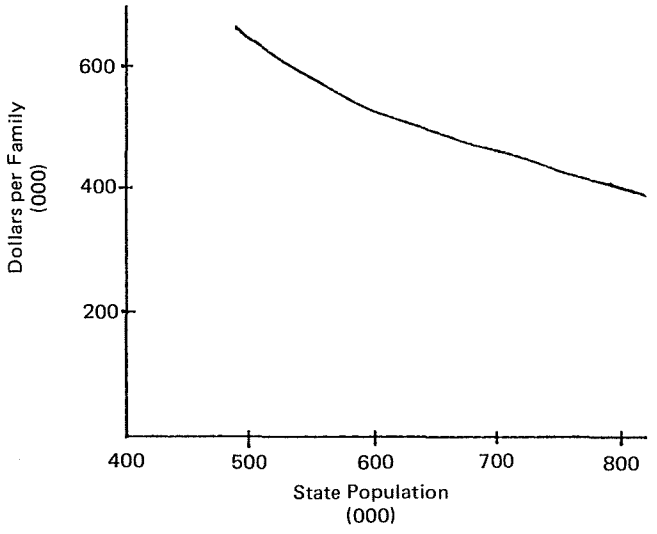

Figure II-1. Asset Value of State Wealth per Family (four people)

If per capita government expenditures remain unchanged when population changes, we can analyze the effect of the change on the fiscal balance by looking at how revenues change. To facilitate this comparison, we convert the state wealth share of the typical family to its equivalent annual revenue. If the real rate of return on this asset is 3 percent, the annual earnings on $640 thousand for a family of four would be $19,200. If we add to this the nonpetroleum revenues per family which are currently $1,350, then the total resources per family for government expenditures would equal $20,550 annually. This situation is shown in Figure II-2. If an increase in economic activity occurs without a population increase, very little fiscal effect will result because there are so few state taxes. The effects will be largely confined to the revenues and expenditures

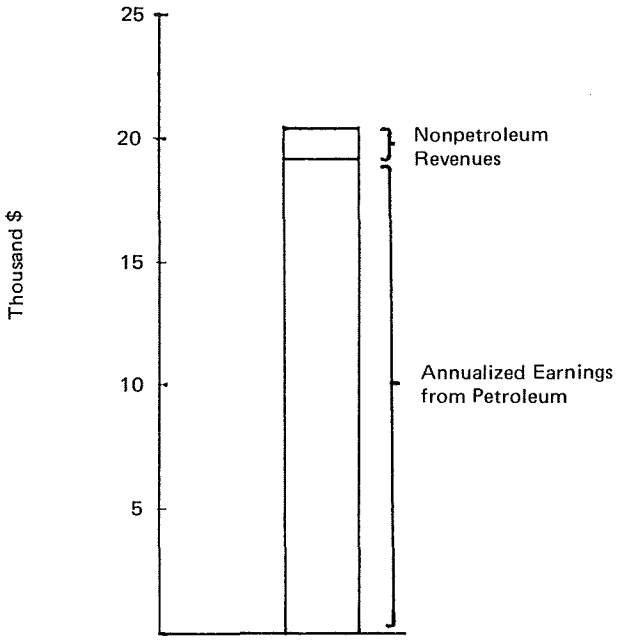

Figure II-2. State Revenue Sources from Typical Alaskan Family of Four

of the facility itself. If a new family enters the state in response to an increase in economic activity, the fiscal impact could be one of three types, as follows:

1. **Clearly Favorable.** New in-migrant families and the economic activity contribute enough in taxes to maintain average fiscal resources available per family on an annual basis at or above $20,550.

2. **Clearly Unfavorable.** New in-migrant families contribute less in taxes than current resident families (less than $1,350) and, thus, reduce not only the annual earnings from the asset holdings for the average family but also average recurrent revenues.

3. **Midrange.** New in-migrant families contribute more in taxes than current families (which average $1,350) but less

than enough to offset their effect on the reduction in asset value of current residents ($20,550).

The current tax structure is not representative of the structure which would be in place in the absence of petroleum, because the income and other taxes would have to be reintroduced to produce the revenues now produced by petroleum. Consequently, the Midrange category can be further subdivided into two cases:

a. New in-migrants contribute more per capita in tax revenues than current residents under the current tax structure, but less per capita than current residents would pay under a nonpetroleum based tax structure.

   When petroleum revenues have all been spent, the personal income tax will undoubtedly be reinstituted. It has been estimated that if this tax had been in place during FY 1981, receipts would have been $161 million or $402.50 per capita ($1,610 per family of four). Thus, a family of four in the absence of petroleum earnings would generate about $2,960 in government revenues.

   If under this nonpetroleum-based tax structure a new in-migrant family should not generate as much revenue as a current resident family, then this case, although initially appealing, loses that appeal on closer investigation. The reason is that in the long run, the state fiscal position will still have deteriorated when this economic activity is included since the per capita tax-generating capacity of the state has declined.

b. New in-migrants contribute more per capita in tax revenues than current residents under both the current and the nonpetroleum-based tax structure.

II.F. Rules for Fiscal Evaluation

This analysis of per capita revenues and expenditures suggests two different rules for screening development proposals if the basis

for the decision is their fiscal impact on the state. The *clearly favorable* rule is very restrictive because it requires that a project generate revenues which equal or exceed, for each in-migrant, the annualized value of per capita revenues from the petroleum industry. The *midrange* rule only requires that a project have greater revenue-generating capacity than the average nonpetroleum industry now in the state. The choice between these two rules depends upon two considerations. The first is an individual's view of the economic future of the state. The second is the individual's view regarding the value of publicly held wealth.

Two contrasting views of the economic future of the state are the *boom-bust* and the *continuous-wealth* view. The former presumes that the current level of economic activity is a function of the petroleum boom and when the boom associated with petroleum has gone, the economy of the state will contract just as it has expanded with the growth of the industry. Furthermore, this boom-bust is inevitable, particularly with respect to government revenues and spending. The economy in future years—both in the public and the private sectors—will be poorer than it is today. Because the state treasury will be poorer in the future and per capita revenues less, new projects and developments proposed during the petroleum revenue era should be evaluated on how they would affect the economy in the absence of petroleum revenues. Any project which generates more revenues per capita than the average for non-petroleum industries would satisfy this criterion.

In the *continuous wealth view*, the current level of the state's wealth will be maintained indefinitely by either (1) continuous discoveries of petroleum deposits to replenish those depleted or (2) investment of the proceeds from the state's share of petroleum revenues in assets which will earn a market rate of return. In either case, a temporary source of revenues is transformed into a permanent revenue flow.

In this view, because the current wealth level of the state in per capita terms will continue into the future, the proper yardstick against which to measure new development projects is the more

select criterion of the revenue-generating capacity of the petroleum industry.

Some people would suggest a third view of the future, *spending for continued prosperity*, in which government spending (including capital subsidies through loan programs) results in continuing prosperity in the private sector as well as the development of a tax base to replace the current petroleum tax base when it is depleted. Whereas there is little doubt that either the *boom-bust* or the *continuous wealth* view of the future will hold true for Alaska, there is no evidence that this third view of the Alaskan future is possible.

The reason is straightforward: There is no set of identifiable investments in natural resource development within Alaska where the state's $80 billion of petroleum wealth could profitably be invested to earn a real positive rate of return on investment, including the necessary government revenues to cover the cost of new population. The rate of return must include these two components:

1. A market rate of return equivalent to what the state could do as well by investing *out of state.*
2. Revenues sufficient to provide $19,200 annually for each new migrant family which moves into the state because of these in-state investments.

In other words, in order to annually produce $20,550 in state services for each additional family, so as not to reduce the wealth of current residents, we would have to secure $80 billion of investments within the state. Unfortunately, to date, *not one single investment* has been identified which satisfies that criterion. It is, therefore, extremely unlikely that $80 billion of such investments will be found.

The second consideration in the choice of a fiscal decision rule is an individual's valuation of publicly-held wealth relative to particular uses of that wealth. The value of $1 of publicly-held wealth may be worth less to the individual than if it were put to some other use. If this is the case, the individual will view the loss of public wealth resulting from population increase as a small price to pay for the development.

II.G. Tradeoff Between the Fiscal Balance and Other Objectives

It is useful to examine the tradeoff between a broader sharing of the wealth of the state with other objectives. One such objective is growth itself, of which population and employment are the primary indicators. Increasing population represents expanding cultural and recreational options, new stores, and other new opportunities. However, the addition of one new family to the resident population causes a reduction of $5 in an existing family's share of the publicly owned asset. The cost of 1,000 additional families amounts to about $5,000 to an existing family.

Whether the resident sees this cost as small or large depends upon the value to the resident of his share of public spending lost because of wealth sharing with the new population. If public spending has little value to the individual, sacrificing some of it for a larger population may be viewed as inexpensive. If the individual values public spending, he may not find it worthwhile to sacrifice some of this public asset in exchange for a larger population.

PART III. SPECIAL ASPECTS OF LARGE CONSTRUCTION PROJECTS AND BOOM-BUST CYCLES

III.A. What Are Rapid Growth and Boom-Bust Conditions?

No precise definition of *boom conditions* exists although some people have tried to define it as an annual growth rate in population in excess of a certain amount. However, a boom is characterized by the fact that the normal processes of economic adjustment are either (1) not working fast enough to allow the economy to function properly or (2) have completely broken down and are not providing the correct signals for people and businesses to follow in their economic activities. This results in rapid economic change that imposes costs upon society in the form of scarcity of goods, congestion, and misallocation of resources.

A special boom condition is the *boom-bust cycle*, which is characterized by a rapid increase in economic activity followed by a period of either much slower growth or an actual decline in economic activity. Boom-bust conditions have been common in Alaska. The most recent ones have been associated with the construction of large capital-intensive facilities, of which the oil pipeline is the best example. The period of slack activity following the boom could result from either of two factors.

First, the boom phase may have passed and the rate of economic growth naturally slowed. The slowdown does not occur immediately because there will be economic activity lagging the

boom. The level of employment in Fairbanks in the 1970s demonstrates this effect. Employment grew rapidly with the advent of pipeline construction and only gradually returned to a lower long-term level (see Figure III-1). This gradual adjustment of the employment level is explained by the accelerator effect of new additions to the capital stock of the community and the spending of personal income earned during the boom phase. Second, the expansion during the boom phase may have resulted in long-run excess capacity in some sectors. Consequently, activity in those sectors will be below normal until this excess inventory has been worked off. The housing stock provides a good example of where this phenomenon may occur. Overbuilding may result from competition and imperfect information about the length and magnitude of the boom. In a sense, this overexpansion amounts to "robbing the future" since it has shifted economic activity from the future to coincide with the boom and has thus accentuated the bust.

Thus, we can view analysis of the economic impact and the fiscal effects of rapid growth and boom-bust cycles as a special case in the general analysis of the economic impact and fiscal effects of economic change. The economic and fiscal effects of rapid growth and boom-bust are the same as those from any type of change except that they are intensified. When less time is available for adjusting to new conditions, particular problems arise.

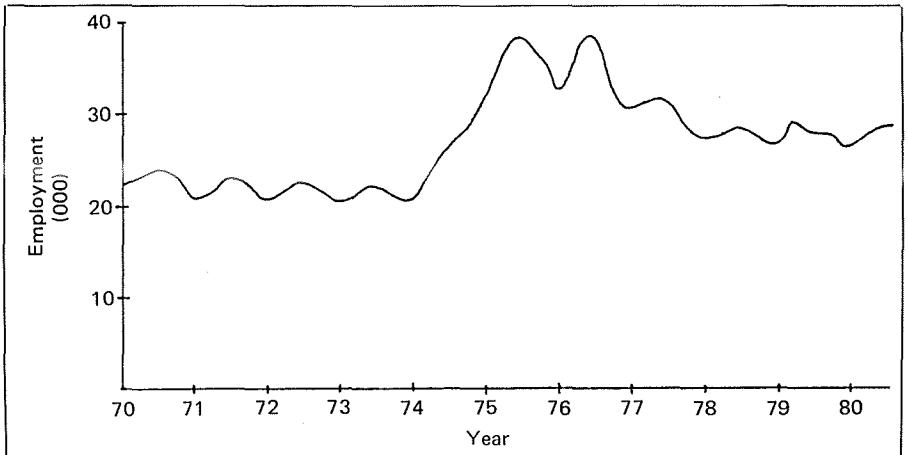

Figure III-1. The Boom-Bust Cycle in Fairbanks Employment

III.B. Private Sector Impacts of Rapid Growth and Boom-Bust

When growth accelerates, businesses expand, demand increases, and shortages develop. Prices rise to reflect scarcity and at the same time to signal that increased production would be profitable. This adjustment process describes the normal operation of the free market system. This can occur almost immediately for some commodities, and their prices will maintain stability near their former level at a higher level of demand. Other commodities require a considerable time for supply to respond to increases in demand. The result will be a temporary or permanent deterioration in the quality of these products available in the community.

Service quality deterioration is exemplified by the demands put upon a telephone utility system during a boom period. Since the system cannot expand instantaneously when the number of users increases, the time required to complete a call increases. The resultant deterioration of the quality of the service is spread among all users, old and new, and is not immediately eliminated by an increase in the price of the service.

Goods quality deterioration often occurs in the community housing stock during a boom. Accelerated growth may result in a reduction in the quality of newly constructed housing because of consumer willingness to accept lower quality housing and the desire of producers to maximize profits by building new housing as quickly as possible.

Productivity deterioration occurs when increases in demand cause skilled labor shortages and require business to hire inadequately skilled employees. The decline in labor productivity compounds the quality deterioration.

These impacts have a *distributional* aspect because they increase the incomes of the people who own scarce resources in high demand and reduce the incomes of those who demand them. In some instances, the impacts may affect the *efficient* operation of the economy. For example, during the oil pipeline boom, a lot of housing in Anchorage was built with electric space-heating equipment, although in the long run, gas is clearly the more economical and efficient

heating fuel. The inefficient choice resulted from the builder or initial owner calculating the least costly alternative based only on *initial* rather than lifetime costs of operation. The result is a housing stock which uses energy inefficiently.

However, the presence of an energy-inefficient housing stock left after a boom does not necessarily indicate that the market system has operated inefficiently. The quickest and most efficient method of meeting the demand for housing at the peak of the boom may have been with electric space-heating equipment, because it was readily available and quick to install. Viewed from the perspective of the immediate need, it may have appeared as the best solution.

Inefficient choices in these accelerated demand situations result from both a *lack of information* and an *uncertainty* about the size and length of time of the expanded economic activity, combined with haste. Information about the size and timing of the direct economic impact of the project is usually not available from the most knowledgeable source because the company that is contemplating a large investment is naturally reluctant to disclose the details of project design before they are reality. Consequently, estimates of the direct and total economic impacts must be based upon secondary information and guesses about the timing of events in a very uncertain environment. It is an environment in which government decisions, world market conditions, and other forces outside the control of the local economic sector play an important determining role in the growth of the economy.

Lack of accurate information and uncertainty can lead to wrong decisions that in turn result in the misallocation of resources and outright waste. An underutilized shopping center developed in the wake of a boom is an unfortunate example of this. The provision of more accurate information on the size, timing, and effects of the impact would help to minimize this misallocation of resources.

Uncertainty also tends to bias investment toward an immediate payoff. This will particularly be a problem if a bust is anticipated after the boom. The previously mentioned installation of electric space heating in new housing was an example of this.

III.C. Public Sector Impacts

Public sector impacts from accelerated growth can be divided into three areas: special demands for public goods and services, special revenue generation problems, and the handling of service delivery under conditions of boom-bust and uncertainty.

III.C.1. Special Public Sector Demands

A boom or boom-bust situation may result in new public sector demands among the resident population or may create new types of demands because of the rapidity of population growth, population turnover, or the presence of itinerant workers in the region. On the other hand, some service demands may fall as the boom occurs.

Increasing public sector demands among the current population can result from the rapidity of economic change and the instability this engenders. An example of this was the demand during the pipeline boom for social services to handle problems resulting from the isolation felt by young mothers whose husbands were away at remote job locations for several weeks at a time. On the other hand, some decreasing public service demands can also occur. For example, in Fairbanks in the mid-1970s, participation in most welfare programs declined markedly. This was observed in both the public assistance and food stamp programs.

Another effect which could reduce public costs would be the relocation of the resident population to lower-cost areas of the state. If the project has the effect of concentrating population in cities and towns where the cost of service delivery is lower than in scattered, smaller settlements, there would be cost savings for government.

The opposite may also occur. A typical Alaskan cost of boom activity results from having to establish a government where none had previously existed or having to expand the scope of government to handle functions not previously required by the public sector.

Population growth during a boom will increase public sector demands as well as change the mix of those demands. In particular, there will be an influx of young, single males. This component of the population puts substantial demands on the police force, but not on the educational system.

The cost of government will also be affected by the increase in the rate of migration into the state. The level of some government activities is best explained by the rate of change of population rather than its level. Automobile driver licensing is an example of this. In order to meet the demand for increased testing capabilities during a boom, the testing staff must increase by a much larger proportion than the increase in population, since the entire increase in population will require immediate testing.

III.C.2. Special Revenue Generation Problems

There may not be enough tax revenues to meet expanded public sector needs either because of an inadequate tax structure, an insufficient tax base, or because the costs to meet peak boom demands exceed average costs which are reflected in revenues. There are many possibilities for a mismatch between revenues and expenditures. A sales tax may not generate the necessary additional revenues needed to pay for an expanded police force because the tax is based upon the *level* of sales while the requirements for the police force are a function of the *change* in population. Another example occurs if a migrant population lives in trailers with low property values and a low tax base relative to their public sector demands.

The problem of timing also arises because the impacts on government spending normally precede the flow of revenues from the project. This occurs because the initial construction phase of the project will involve the greatest amount of manpower and will generate only a small portion of the total revenues. Revenues in this phase will consist of the normal taxes paid to the state and sales and property taxes paid to the local community. Direct property taxes and sales taxes on the development will not accrue to the local government until after the peak construction employment phase has passed. To handle this problem, the affected community would normally sell bonds in order to raise the necessary funds. However, this may not be possible in some cases because of the small size of the impacted community or because uncertainty surrounding the size and timing of impact makes the risk unacceptable to the potential lender.

III.C.3. Efficient Service Delivery under Boom-Bust Conditions

The most difficult problem the public sector faces is how to

plan the construction of public facilities when it is known that an increase in demand is temporary. The fact that there is no easy solution to this problem is illustrated by the demand for public school facilities. If a new school has an expected life of 30 years and an increase in school-age population is expected to last for 30 years, then there will be complete utilization of a new school over its total useful life. If the boom in population and the increase in the number of school children is expected to last only a few years, there are two choices. The first is to build the school to the requirements of the peak demand during the boom. After demand falls, there will be excess capacity in the school system for the remainder of the school's life. The alternative is to do without the new school and to suffer overcrowded conditions in the school system during the years of impact. Neither choice is attractive; the decision is between lingering excess capacity on the one hand and a temporary reduction in the quality of education on the other.

There is usually a compromise alternative available which lies between these two extreme cases and results in less long-term excess capacity and less deterioration in the quality of education. Temporary classrooms are an obvious example. And although a compromise solution may be preferred to either extreme alternative, it will still impose a real cost on the community. This is because the compromise will involve service delivery at a higher unit cost than would be the case under normal circumstances. The cost of providing education in a boom situation is an example of the *peak load* problem.

Three factors tend to complicate this issue: uncertainty, the distribution of the costs, and the economic impact of the facility itself. At the time a strategy is chosen to meet the added demand, there will be *uncertainty* not only over the amount and duration of the increase in demand but also the duration of the subsequent bust. If a period of excess capacity is not expected then there is no problem. For example, if growth of the economy from other sources is expected to eliminate any potential excess capacity in a short period of time, the attractiveness of the capital expansion alternative is enhanced. When there is uncertainty about future demands, the implications of an incorrect choice must be considered. Specifically, if the choice is made to build the school on the assumption that the demand will continue to be there, and demand subsequently falls off,

the community will be saddled in the future with a stream of payments to pay off the excess capacity, and the cost of educating each student will be higher than anticipated. On the other hand, if the expansion does not occur and demand stabilizes at a higher level, the community will have inadequate school facilities.

This highlights the second complicating factor —distributing the costs of the method chosen to deal with temporary capacity expansion. Of particular concern is the distribution of those costs between the temporary and the permanent residents of the community. The permanent residents of the community, in normal circumstances, would bear a substantial portion of the cost of the additional facilities. If capacity were not expanded, their children would share in the deterioration of the service level; if capacity were expanded, they would bear the long-run costs of repaying the bonds to finance the new school .

It can be argued that in fairness to permanent residents, they should not be forced to share in paying for the temporary cost increase associated with the peak demand. Unfortunately, it is difficult to structure the tax and service delivery systems so that these temporary costs are paid by those who impose them upon the community. One solution would be to levy an impact tax against the project to cover the excess cost of providing for peak demand. The drawback of this alternative is that it would not necessarily provide an incentive for the local government to provide the most efficient method of meeting the peak demand.

The final complication of the peak-load problem is that the construction of a new school coincident with a private construction project would tend to amplify the boom-bust cycle. This effect must be considered both in deciding the most efficient method of meeting the peak demand and in deciding how to share the costs of the peak service delivery. In other words, the community should be aware that its decision will amplify the boom-bust cycle when it undertakes a construction program at the same time that the private sector is involved in a large construction project, and it must bear some of the responsibility and presumably the costs of that decision.