SECONDARY IMPACTS AND BENEFITS OF WATER REALLOCATIONS IN THE SNAKE RIVER BASIN OF IDAHO

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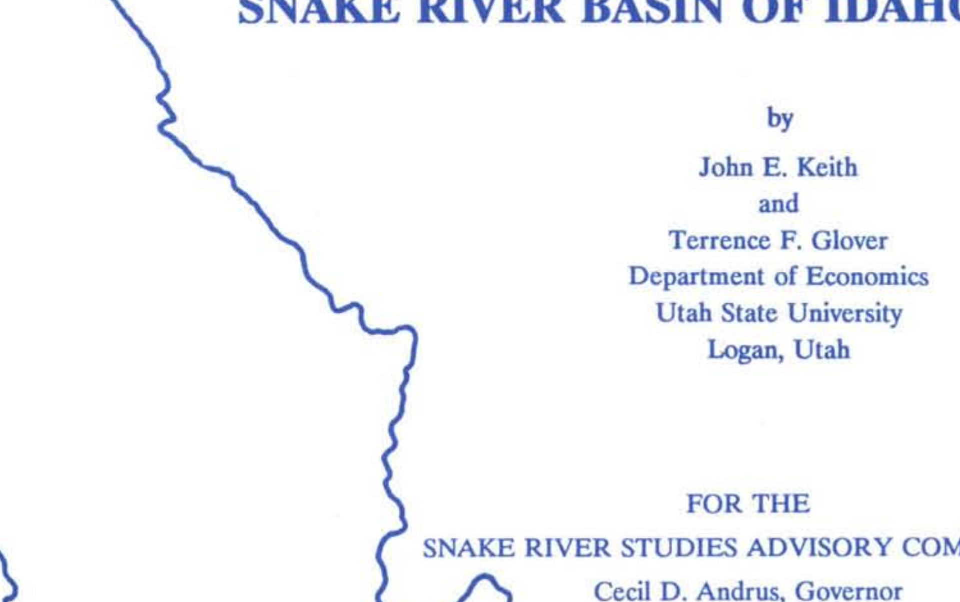
FOR THE

SNAKE RIVER STUDIES ADVISORY COMMITTEE

Cecil D. Andrus, Governor

STATE OF IDAHO



WATER for IDAHO

IDAHO WATER RESOURCES RESEARCH INSTITUTE

This research was funded in part by the Snake River Technical Studies Committee, Office of the Governor, State of Idaho.

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October, 1988

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INTRODUCTION

The Swan Falls agreement recently resolved a long-standing water rights issue in the State of Idaho, and Congress recently approved the agreement. As part of that agreement, Idaho Power Company subordinated some of its water rights, and, as a result, new water supplies have become available for other uses. The State is now charged with the task of estimating the potential benefits which would accrue to other uses, particularly new irrigation. Three studies of potential new uses and reallocations were contracted by the State; these studies included a guide to benefit estimation, a study of water markets, and an examination of economic impacts. The objectives of this study were to estimate the economic impacts and multipliers for the State, with particular reference to the involved sectors, and to discuss the use of impacts and impact analysis in the estimation of benefits of the new water supply to the region and the State. Economic impacts can be estimated using several techniques, including econometric models, simulation models and input-output analysis; this study utilized input-output approaches.

There have been several discussions of the use of secondary benefits in project benefit/cost analysis in the past four years (Olson, 1983; Young and Gray, 1985; Hamilton and Gardner, 1986; and Weber, et. al., 1986) all reaching the same conclusion: secondary "benefits," particularly those derived from changes in values added produced by input-output analyses, are at best difficult to calculate. This report attempts to briefly recapitulate the arguments, discuss possible methods of deriving secondary benefits from input-output analyses, and indicate the problems which arise when calculating secondary benefits from impact estimations, particularly impacts derived from input-output analysis.

The report consists of four major sections. The first section describes input-output analysis in general, using a simple three-sector model (although the model is constructed to be similar to a highly aggregated Snake River Basin economy). The calculation of economic impacts from changes in production and the meaning of the related multipliers are discussed, and the characteristics of the various components (production sectors, households, and import-export activities) are described in the context of the simple model.

The second section of the report is a description of the relationships between impacts, value added (the residual of total sales less payments for all inputs which are produced or manufactured in the region), and benefits to the region, with some reference to the agricultural sectors. This section is divided into discussions of direct benefits (to the sectors which will be directly affected by the project), and indirect benefits. Indirect, or secondary, benefits can be separated into two major categories: benefit to sectors which will be affected as a result of providing inputs to the sectors which are directly affected (backward-linked), and benefits to sectors which process the additional output of the directly-affected sectors (forward-linked). The relationship between primary and secondary benefits is examined in these contexts. General methodological discussions and recommendations are made in this section.

The third section of the report is an analysis of the impacts and benefits of the potential irrigation development in the Snake River Basin. Most of the analysis will be reported on a per-thousand-acre basis. However, the Snake River Technical Advisory Committee has estimated that an additional 195,000 acres may eventually be brought under irrigation. This example will be used to calculate total impacts and benefits. A comparison of input-output based and budget based calculation of direct benefits is made, and estimates of secondary benefits are also made, using the available data and an input-output table developed for the Snake River Basin.

The final section of the report provides the conclusions drawn from the analysis of the Snake River Basin, and the recommendations regarding the size and use of secondary benefits which have been calculated. It also contains a recapitulation of the assumptions and reservations which have been examined in the analysis.

INPUT-OUTPUT ANALYSIS

Input-output analysis is a means of tracing the effects of a change in one sector of an economy on all other sectors (See Miernyk, 1965, for a discussion of regional input-output analysis). The basic input-output relationships consist of a set of purchases or sales, called "transactions," for each sector of the economy of interest. A sector is a group of more or less similar firms which produce a specified product, including both intermediate products (manufactured products sold as inputs to other sectors) and labor and capital inputs (termed basic inputs). Transactions tables include the purchase of necessary inputs by each sector from other sectors in the economy, sales to final consumers and purchases of basic inputs. A transactions table for the "processing" sectors includes sales and purchases of intermediate goods from production sectors (but not necessarily from the basic input sectors). Impact analysis can be accomplished starting from these transactions tables.

Example Transactions Table.

An example of the transactions table is given in Table 1. The entry in each "cell" of the table (the square which shows the intersection of one sector with another) is the total expenditure of the purchasing sector (the column) on inputs from the selling sector (the row). While it would be desirable to use the Idaho input-output table to explain the analysis, there are 529 sectors in the transactions matrix, making both presentation and explanation difficult. Instead, a hypothetical 3-sector economy (with approximately the same ratios of purchases and sales as the aggregate sectors in the Idaho economy) is presented below.

In the transactions table (Table 1), the agricultural sector uses $100 worth of its own product as input (for example, seeds produced on the farm), purchases $500 in inputs from the manufacturing sector (for example, fertilizers and equipment), and $300 in inputs from the service sector (such as accounting or wholesale trade). The manufacturing sector uses $500 of its own product, and purchases $500 from agriculture and $200 from the service sector, and so on.

Table 1. Hypothetical Input-Output Table Based on Transactions

	Processing Sectors				
Sector	Agricul- ture	Manufac- turing	Service	Final Demand	Total Gross Output
Agriculture	$100	$500	$300	$900	$1800
Manufacturing	$500	$500	$100	$1500	$2600
Service	$300	$200	$300	$1400	$2200
Imports	$800	$1000	$1400		
Value Added	$100	$400	$400		
Total Outlay	$1800	$2600	$2200		

The final demand column represents the sale of the sector's product to the region's final consumers, or to users from outside the region of interest. Thus, government purchases, private investment, and export are all part of final demand. Note that households may be either final demanders, or they may be included as a sector in the processing sectors in a household column. However, if households are included as a sector, then payments to households (wages, salaries, etc.) must be included as a row (i.e., sales of inputs by households to other sectors)in the processing sectors.

The value added row includes returns over and above the costs of purchasing inputs from the other sectors and from outside the region (imports). In some sense, value added measures the increases in household income from wages, salaries, and entrepreneurial skill, payments to owned fixed resources, and indirect business taxes. If the household is included in the transaction table, wages and salaries and other payments to household labor would be included in a separate row. Not all value added accrues to local households; imported labor, capital owned by non-residents, and similar kinds of returns to non-local individuals may be included in the value added row. The imports row represents the purchases of inputs from outside the region by each sector (e.g., the purchase of $800 in inputs from outside the region by the Agriculture sector).

The Total Gross Output (TGO) column represents the total sales by each sector; the Total Outlays (TO) row represents total expenditures by a sector. Note that the TGO must equal the TO for each sector within the transactions table, although the final demand entry may have a different total than the sum of imports and value added.

It is more convenient (although also somewhat more abstract) to form a table of coefficients, by dividing the purchases (column cells) of each sector by the total outlays of that sector. This yields a coefficient in each cell which signifies the portion of each dollar of total output which is required to purchase the needed inputs from other sectors. The coefficient table for the above simple table is indicated in Table 2.

Impact Analysis for the Example

The impact analysis using input-output tables consists of examining the effect of a change in final demand of one sector (say the Agriculture sector) on the entire economy. Suppose there is an increase in export demand for the Agriculture sector's products of $100. From the Agriculture column it can be seen that the Agriculture sector would purchase $5.50 (100 * .055) of inputs from other firms in its sector, $27.80 of inputs from firms in the manufacturing sector, $16.70 of inputs from the service sector, $44.40 of inputs from outside the region, and $5.50 of inputs from

Table 2. Hypothetical Input-Output Table Based on Coefficients

Sector	Agriculture	Manufacturing	Service
Agriculture	.055+	.192	.136
Manufacturing	.278	.192	.045
Service	.167	.077	.137
Imports	.444	.385	.500
Value Added	.056+	.154	.182

+Rounding differences in order to have the column sum to 1.0

household labor and other resource owners (the value added cell). These are the direct effects of economic growth. Now, notice that all three sectors have increased their production: manufacturing by $27.80, service by $16.70, and agriculture by $5.50 (over and above the initial $100). Each of these sectors must purchase inputs to produce this increased output. As inputs are purchased, the other sectors' outputs are again increased, augmenting the demand for inputs further. These effects continue, with diminishing impact, until a new equilibrium level of production is reached in each sector. The changes due to these increases in production are termed the indirect effects. For this example (as for the Idaho economy), there is significant importation of inputs (leakages) from the region, so that the impacts will be relatively small.

The total direct and indirect effects can be calculated by a relatively simple manipulation of the coefficient table (there are many books available which explain these manipulations in detail; for example, see Miernyk, 1965). These effects are the bases for "multipliers." The multipliers from this manipulation are given in Table 3.

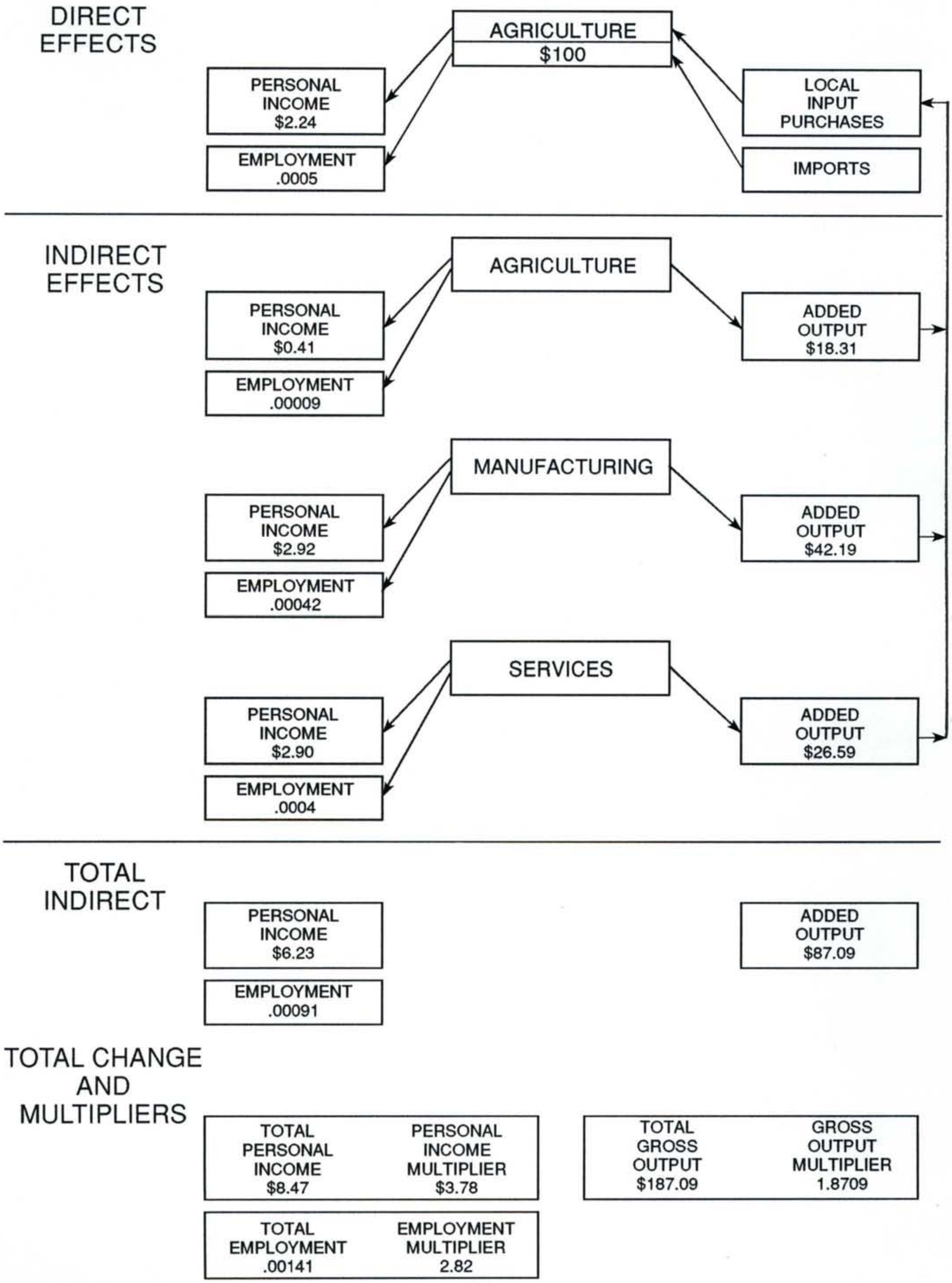
Table 3. The Multiplier Table (Direct and Indirect Effects) for the Hypothetical Case.

Sector	Agriculture	Manufacturing	Service
Agriculture	1.1831	0.3010	0.2026
Manufacturing	0.4219	1.3517	0.1377
Services	0.2659	0.1785	1.2093
Multiplier (Column Sum)	1.8709	1.8311	1.5500

The entry in each cell indicates the total change in total gross output (TGO) in a sector for each $1.00 change in final demand in a given sector. Each column sums to the Type I multiplier for that sector. <u>The type I multiplier includes the impacts on the processing sectors included in the transactions table only (in this case, the three sectors excluding households), and encompasses both the direct and indirect effects.</u>

As an example, a $100 change in final demand for the agriculture sector results in a total change of $118.31 in the agriculture sector (the initial $100 of sales to final demanders and an additional $18.31 of indirect sales). The manufacturing sector increases its output by $42.19, and the service sector increases its output by $26.59 as a result of the direct and indirect effects of the increased agricultural production (all sectors will increase production to provide inputs to new production in every sector - see Figure 1 for a schematic diagram of these interrelationships). For the agricultural sector, the total gross output multi-

Figure 1. Effects of a $100 Increase in Final Demand for the Agricultural Sector.



plier is 1.8709; that is, for every dollar of increased final demand (export or final consumption), the total sales of goods and services within the region will increase by $1.8709, so that the internal purchases of inputs results in an added $0.8709 of total sales. For the example above, which uses a final demand increase of $100, total regional gross output (sales) resulting from the initial increase in export from the agriculture sector would equal $187.09.

If the relationships among total output, value added, personal income (employee compensation and proprietor's income), total income (personal income plus property income) and employment levels are known, it is possible to generate Type I multipliers for each of those categories. These multipliers relate the initial increase in personal income, total income, value added and employment to the total direct and indirect increases in the same categories.

For the case given above, a $100 increase in final demand for the agriculture sector would generate an increase in value added of $5.60. Suppose that personal income was 40 per cent (the approximate average percentage for the agricultural sectors in Idaho) of Value Added for the agriculture sector, and that a $100 increase in sales resulted in an increase of .0005 jobs (or .000005 jobs per $1.00 increase in sales), also the approximate average for agriculture in Idaho.

The initial increase in personal income in the agricultural sector would be $2.24 (40% of $5.60); the increase in employment would be .0005 jobs. Suppose for the manufacturing sector, personal income is 45 per cent of value added and employment per $100 of sales is .001 jobs (.00001 jobs per $1.00 sales), and for the service sector, personal income is 60 per cent of value added and employment is .0015 per $100 of sales (.000015 jobs per $1.00 sales). These values are also more or less consistent with the averages for the aggregated sectors in Idaho. The total resulting personal income from a $100 change in final demand for agriculture would be $8.47. This value is the sum of the changes in total sales in each sector's value added. For example, the agricultural increase in value added would be $2.65, which is $118.31 multiplied by .056 (the value added per dollar of increased output) multiplied by .4 (40 percent of value added is personal income). The increase in personal income in the manufacturing sector would be $2.92 ($42.19 times .154 times .45) and for the service sector, it would be $2.90 ($26.59 times .182 times .60). The personal income multiplier is 3.78 ($8.47 / $2.24). Employment changes would include .00059 jobs in agriculture ($118.31 times .000005), .00042 jobs in manufacturing ($42.19 times .00001), and .0004 jobs in services ($26.95 times .000015). The employment multiplier is 2.82 (.00141 divided by .0005).

As in the example, <u>even though the multipliers may be relatively large, the relatively small increase in personal income and employment in the agriculture sector leads to a relatively small total change in personal income and jobs in the economy.</u> Each sector will have a different proportion of value added and employment per unit of total sales. In general (as in the example), agricultural sectors have low personal income and employment (as well as low wages per job), compared to manufacturing sectors have moderate to high personal income and jobs for a given change in output. Service industries have a wide range of personal income (low wages for the wholesale and retail trade, but high wages for professional services) and relatively high rates of jobs for a given change in output (i.e., they are labor intensive).

Including the Effect of Household Expenditures.

Since households receive added income (included in the value added row), from which they will also purchase goods and services from some or all of the sectors in the economy, there will be an increase in demand which causes added production in the economy, and purchases of additional inputs. The effect of household consumption is termed the "induced effect." It is possible to include the household sector in the transaction matrix, by having a household row and column (which again must have the same row and column sum) inserted into the matrix. The multipliers which are generated by doing so are called "Type II" multipliers and include direct, indirect, and induced effects.

If inclusion of the household row is accomplished with care and a firm knowledge of household earnings and purchasing patterns, both within the region and outside the region, the Type II multiplier will be an accurate measure of all three types of effects. One problem with the household row is determining leakages. Leakages are defined as savings (current income not spent on currently produced goods and services) and purchases of goods from outside the region, particularly those which are provided within the region (called competitive imports). For example, the purchase of consumer goods from retail stores although the same goods are available within the region are part of these leakages. Unfortunately, the leakages which occur in household expenditures are frequently difficult to determine from secondary data.

A second problem occurs because the household row assumes that all households have identical (average) spending patterns. These expenditure patterns generally do vary considerably among households. For example, the payments to labor from the agriculture sector are likely to be smaller and to go to a different type of family than those from the manufacturing sector. Therefore, the differences in family expenditures are likely to be significant.

Finally, the household row seldom includes consideration of transfer payments which typically accompany changes in economic activity. Therefore, the Type II multipliers generally inaccurately measure the total economic effect. Type I multipliers, then, underestimate total economic activity because they ignore the effect of household consumption; Type II multipliers generally overestimate economic activity due to failure to accurately reflect leakages.

An alternative approach is often used (Alward, 1985), in which the increased local income distribution, including transfers, and the projected demand by households is calculated outside the matrix and included in a revised final demand change. The resulting multipliers have been termed by some as "Type III" multipliers (although the term Type III multipliers has been applied to other types of multipliers as well). Because of their increased accuracy and detail, Type III multipliers will be used in this report. <u>It is recommended that these Type III multipliers be used by the State of Idaho for impact analysis and planning purposes.</u>

Aggregation and Disaggregation of Sectors.

The complexity of the input-output analysis depends on the number of sectors involved; the complexity can be reduced by aggregating sectors (that is, combining firms which produce somewhat similar, although not identical products). For example, a detailed input-output transactions table might separate farms which produce dairy livestock from farms which produce range-fed livestock. A more aggregated table would have both types of farms in a general livestock sector, which would also include pork, lamb, and poultry producers. The projected impacts would be based on a weighted average of transactions of all these producers. There are numerous articles in the literature discussing the potential biases which result from aggregating sectors. However, the general conclusion is that aggregation of those sectors not directly impacted by changes is more appropriate than aggregating sectors which will experience a direct change in final demand.

Conversely, if some sector is "too" aggregated, for example, if potatoes were included in the vegetable sector but were of significant importance to the economy or if the livestock sector was made up in part by producers who were dependent on public land grazing and some who were dependent only on private land grazing, data could be collected to separate the aggregated sector into more finely defined sectors. This disaggregation results in a table which is more reflective of the regional economy and specific to the problem of interest. However, disaggregation also requires considerable data and effort. The smaller and more economically isolated a region is, the more likely that national aggregate sectors will not accurately reflect the local economic dependencies (expenditures). It is recommended disaggregation of critically important sectors be accomplished where possible.

IMPACTS, VALUE ADDED, AND BENEFITS

The use of impact analyses from input-output models to produce benefit estimations has become more frequent during the past decade. Values added have been used as a direct measure of regional benefits by some analysts. The relationship between value added and benefits is of major concern. The discussion will first consider this relationship for directly-effected sectors, and then for the indirectly-effected sectors, specifically the backward-linked sectors (those sectors supplying inputs to the directly-effected sector) through the input-output tables, and the forward-linked sectors (those sectors which buy the products generated by the primary sector and process them for further sale or export). Each of these topics will be discussed separately, although the problems encountered often have the same bases.

Value Added and Direct Benefits.

As Young and Gray (1972, 1985) and Young and Howe (1988) have pointed out, a part of the problem of using value added projections from input-output analysis for benefit estimation is semantic. The distinction between benefits and impacts has been slurred in some, if not many, studies. The distinction is crucially important. <u>Value added is the sum of payments to all local basic factors of production (that is, all returns to local capital, land, labor, management and entrepreneurial skill, and other natural resources)</u>. Value added is, of course, less than the Total or Regional Gross Output, often much less. <u>Benefit-cost analysis (based in economic efficiency criteria) determines whether or not the residual returns, after all costs are deducted from revenues, are sufficient to pay the project costs; that is, whether or not the recipients of the project services can generate sufficient returns net of all costs to offset project</u>

costs. If a water project is to meet economic efficiency criteria, the benefits accruing to the increase in water supply must be equal to or greater than the costs of the project. All other resources used by recipients of the water must be paid out of the gross returns to the water used. These resource costs are opportunity costs, in that they represent the earning potential of these inputs in their best alternative use. Some may be explicit market costs (e.g., prices of inputs) and some may be implicit or imputed (e.g., foregone recreation benefits or earnings of family labor). Whether the net benefits are measured on a per unit of water basis (a shadow price) or on an aggregated basis (total net benefits) is a matter of choice.

Value added, then, overstates benefits to recipients of project services because the costs of inputs, such as labor and capital, are included in the value added measure. For that reason, estimates of residual returns (usually from budgets, in the case of agriculture or industry, or demand functions, in the case of household consumption or non-market goods) are normally used for the calculation of economic benefits (See Young and Howe, 1988).

When can the total value added for the water using sectors be considered benefits? Only when all the basic resources other than water are obtained free. This implies that all other basic resources involved in water use are unemployed, and have no opportunity cost. Otherwise, value added of the water using sectors overstates the benefits. As long as the appropriate opportunity costs of all inputs are known, an accurate estimation of benefits to the user of project services can be made from value added measures.

Impacts, Value Added, and Secondary Benefits.

Economic impacts are defined as the total economic activity which results from a water (or any other) project. Construction expenditures, project operation and maintenance expenditures, the expenditures and sales directly related to water use, the expenditures and sales of those sectors which provide inputs to water use, and the value added generated by successive "rounds" of sales in the economy are all part of the economic impacts. Clearly, the total sales (or regional gross output) involves considerable double-counting, since sales of intermediate goods from one firm to another are included. The value added impacts include total increases in payments to all basic factors of production -- labor, capital, land, purchased natural resources, entrepreneurial skill, and risk --resulting from the economic activity associated with an increase in final demand for one or more sectors of the economy. Total value added can be calculated using the value added multipliers, discussed above.

The underlying structure of the input-output model (termed a fixed-coefficients production function) assumes that resources are required in fixed proportions for each unit of output from a given sector. That is, there can be no substitution of one input for another. For example, a pair of shoes requires two upper pieces and two soles (fixed proportions), while other manufacturing may substitute capital (e.g., robotics) for labor. Further, these resources are assumed to be available in unlimited quantity at their going market prices. Moreover, any output produced is assumed to be sold at its going market price. Note that if input or output prices change relative to one another as a result of the economic activity generated (either in the primary or secondary sectors), the assumptions of the input-output analysis are violated. Coefficients must change, since each one is calculated from the expenditures by sector divided by total outlays. When the coefficients change, all the multipliers may also change. <u>Thus, the static nature of the input-output analysis restricts the usefulness of the approach.</u>

It should be acknowledged that most benefit estimates based on budget information assume constant prices also; that is, the added production is assumed to be such a small part of the market, that prices and costs do not change. Where adjustments in price are expected, it is easier and more direct to adjust budget information than to attempt to adjust an input-output model. As price of output falls (as might be the case for increased supply of products on the market), final demand and total gross output values may fall. If all input prices remain constant, then all non-zero coefficients will rise and total outlays will be reduced. Because expenditures on intermediate goods will not change, the value added component will decline for every sector (column).

An alternative approach still using the input-output model would be to reduce the value of final demand and treat that reduction as simply a lower level of output. While this latter approach would lead to a bias (in that the coefficients within the table would not change), the error may be relatively small if the price and/or quantity changes are small. In order to estimate indirect benefits from the value added changes in each sector, it is necessary to subtract all payments to resources at their current opportunity costs (just as in the case of the primary sectors). First, the proportion of value added paid to each resource must be determined for each sector. Then the proportion of the value added paid to each resource must be divided into payments to fully employed and less-than-fully employed portions of that resource. If all the inputs are fully employed, the market costs of those resources must be subtracted from value added to obtain an estimate of total secondary (indirect and induced) benefits. Because the only sectors which generate returns to unpaid factors provided by project services are the primary sectors, any "residual" benefit in the secondary sectors must be the result of the use of unemployed or underemployed resources. For example, if water is supplied to agriculture (at little or no cost), returns to that water are benefits; however, the purchase of fertilizer as an input to agricultural production would not use the water (that is, there is no <u>direct</u> return to the water resource). Only if under- or unemployed resources (labor or capital, for example) were used in the production of fertilizer would there be returns in excess of input costs to fertilizer. Since the input-output model generates only changes in total value added, and because the returns to an increase in fertilizer production are, assumably, paid out in the form of wages, capital payments, and returns to risk, it is necessary to determine if any of these inputs are under- or unemployed in order to calculate benefits.

Furthermore, these unemployed or underemployed resources must be permanently under- or unemployed. That is, use of resources which are temporarily under- or unemployed resources (under- or unemployment of less than 1 or 2 year duration, or resulting from cyclic economic changes) can not be counted as a long-term benefit to development. The temporary under- or unemployment would be absent as a result of normal, long-term economic changes. Once the level of permanent under- or unemployment is determined for basic factors of production, most detailed input-output analyses can be used to determine payments to labor, but returns to capital and management are often lumped in proprietor's income and other property income. In such cases, it is necessary to obtain the payments to those factors from other sources. The opportunity cost for the less-than-fully employed resources must be determined from existing data (it is zero for totally unemployed resources). These opportunity costs must be subtracted from the value added measures to determine the residual secondary benefits to the water.

These calculations, while theoretically straight-forward, involve considerable data collection and a number of assumptions. First, the type of resource employed by the affected sectors must be known. For example, the kinds of labor employed by each sector as well as the typical wage rate should be obtained. Then, the status of those resources must be determined (that is, if the resources are fully-employed, unemployed, or under-employed) and estimates made for the term of the project. For labor, a time series of statistics for unemployment are available by county from state or federal sources. A few studies exist on underemployment of labor, but generally no data are available for most counties. Wage rates compared to skill levels of employees has generally been used as a measure of under-employment where both are available. For capital stocks, any short and long term excess capacity must be identified. Other resources should be examined, if they are relevant.

If the results from a study of Oklahoma water development by Olson (1983) can be generalized, it is unlikely that the levels of long-term unemployment required to generate positive economic efficiency results exist in most regions of the State of Idaho. His results indicated that labor unemployment rates of from 7 to 19 per cent, and excess capacity measures of from 12 to 39 per cent are necessary to assume that unemployed resources exist in sufficient quantities to be considered in the benefit calculations.

If unemployed or underemployed resources are employed as a result of the project, the returns to those resources (calculated as a part of value added) should be counted as regional benefits. If, on the other hand, existing local resources are fully employed, then either resources must be imported from outside the region, or the price of those resources will rise as businesses attempt to increase the use of them. If wages or prices of fully employed resources rise, the coefficients of the input-output table are changing, since a larger proportion of each dollar's worth of output will be paid in value added. Furthermore, while increasing payments to these "scarcer" resources may be seen as a benefit to the recipient (for example, an increasing wage rate), all employers of them will be faced with increased costs of producing. There will be a net transfer of income (value added) from other sectors as wages rise. Further, the static input-output model will not capture the changes in the existing coefficients. If increasing incomes result from unemployed or underemployed persons being fully employed, the benefits are clear. If the increasing incomes are a result of a general price increase of that resource, the benefits are not so clear. Therefore, increasing resource costs can not be considered as a general benefit to the economy.

There is considerable controversy concerning the payments to imported labor as a regional benefit. If workers are transient, then long-term changes in payments to labor are not likely to result in large gains to the local economy. As long as it is a permanent change, imported labor represents an increase in resident population and household income. However, these benefits do not necessarily accrue to the population which was resident in the region prior to the project development, even though a substantial part of increasing service costs (such as schools, roads, etc.) and/or other costs (housing, food, etc.) may be born by current residents. Thus, there is a choice between estimating benefits to existing or to projected populations. If regional population growth is desirable, or is a direct goal of a project, then perhaps benefit estimates should include net income to permanent immigrants in the benefit calculations. However, any increasing costs of consumer goods or public services to existing population should be netted from the calculated benefits. It is highly doubtful that payments to imported capital will be paid to residents of the local community. In order to be as conservative as possible, to avoid counting benefits which may be fugitive (i.e., may not remain in the region), and to minimize the problems of calculating increases in, and distribution of, increasing social costs, it is recommended that only benefits accruing to current residents of the region be calculated.

Cases in which increasing social costs (particularly the provision of social overhead capital, such as roads and schools) are generally relatively easily handled when the budget-based approach is used, but which generate problems when input-output analyses are employed. These expenditures are, in fact, costs of the project, and would be deducted from the benefit streams in a budget-based analysis. However, these costs add to gross regional product, value added, and, given the approach to calculations from input-output models, generate an increase in benefits, if unemployment exists. If there is no unemployment, calculations of benefits from the input-output model would yield a zero value, while the budget-based approach would net out the costs of social overhead increases from **direct** benefits. If unemployment exists, then the input-output analysis would suggest positive net benefits for the provision of the infrastructure itself, whereas the budget based approach would indicate negative net benefits (the cost of infrastructure would necessarily exceed value added because of leakages).

The case of local government subsidies to a project is similar. If the local government provides services at low or no cost relative to the actual cost of producing those services in order to induce development, the tax burden will increase costs to other, or perhaps all, sectors in the region. These costs will not be captured in the input-output approach, since government expenditures are part of final demand. In this case, the input-output analysis will again overestimate benefits (assuming under- or unemployed resources are used) compared to a budget-based analysis.

Secondary benefits, then, must be derived from the employment of previously permanently under- or unemployed resources, since the value added in indirectly affected sectors does not derive from previously unavailable unpaid factors of production (such as water). The measurement of benefits must rest on data bases which reflect long-term unemployment or underemployment of labor resources (above the structural rate of unemployment), and long term excess capacity in land or other capital resources. It is recommended that secondary benefits be very carefully measured and used only if significant long term under- or unemployment and/or excess capacity is evidenced in time series data.

Forward Linkages, Value Added and Benefits.

One source of secondary benefits which is not automatically included in input-output analysis is forward linked processing. The provision of intermediate goods such as agricultural products (which could be further processed for export) or electric power (which might be used in manufacturing), may or may not stimulate the processing sectors. In order to include forward linkages it is necessary to establish that the increase in the supply of inputs (at the present prices) will cause processing to increase. If those inputs are a constraint on the production of processed outputs, as might be indicated by shortages of stocks of inputs, rising prices of inputs, or other evidence of constraints, then forward linkages should be included in benefit calculations. However, if there are large stocks of inputs available to processors or if excess capacity in the processing industry is due primarily to lack of demand for the output (e.g., surplus output), then additional inputs will likely have no effect on processing, or, alternatively, will cause a decrease in the prices for those inputs. In the latter case, there is a benefit transfer from the producers of inputs to the processors, but not necessarily an increase in net benefits to society. <u>The processing markets must be carefully examined to determine whether input supply or output demand is the constraining factor on processing before forward linkages can be considered as a source of secondary benefits.</u>

Forward linkages can not be automatically incorporated into an input-output analysis. Changes in a processing sector (which does not use the project services) must be included as a change in final demand (either export or consumption) for the processed output, and deducted from the final demand of the sectors producing the inputs. For example, if potato production increases and the previously-existing availability of potatoes for processing was the reason for excess producing capacity in the processing industry, then increases in sales of processed potato products should be added to the final demand for the processing industry. However, the sale of potatoes by farmers to the processing industry is **not** a part of the farmers' final demand; rather, that sale is captured by the coefficient in the input-output table. Thus, the value of the potatoes would not be explicitly used in the calculation of benefits to the processing industry; it would appear in changes in value added to the farming sector, and the **net** value added in the farming sector would be credited to the project as a benefit. As discussed above, the value added for the processing is not a project benefit; the only benefit arising from the processing sector would be the employment of existing under- or unemployed resources among which would be the excess capacity in processing plants (assumed to be caused by limited potato production).

WATER REALLOCATION STUDY

An analysis of the direct, indirect and induced benefits to the reallocation of Snake River water in Southern Idaho which will result from the subordination of Idaho Power water rights was undertaken. This analysis used an input-output framework, and the best available data to calculate benefits. The study first examined direct benefits using both budget-based data and value added from the input-output model, and then analyzed secondary benefits, both backward- and forward-linked.

Snake River Basin Input-Output Model.

Snake River Basin input-output model was developed using the U. S. Forest Service IMPLAN program (Alward and Palmer, 1983). The program produced an input-output model (a table coupled with income and employment characteristics by sector) for the Snake River Basin consistent with the sectors which exist in the region and the amount of economic activity within those sectors. This model is based on the 1980 United States table of coefficients with 528 sectors. An examination of that Snake River model indicated that some sectors needed to be modified from existing data, specifically the vegetable sector. That sector includes potatoes, the major vegetable crop which the new irrigation will produce. A potato sector (sector 529) was developed from farm budget information available from the University of Idaho, and disaggregated from the vegetable sector. The IMPLAN model already includes some specialized sectors which are not in the national table, such as a range livestock sector.

In addition, since Idaho Power electrical production will be involved in the reallocation, the private power sector was examined for consistency. In general, Idaho Power purchases do differ from the national average in that the firm's production is much less dependent upon coal-fired plants.

However, all the available aggregate budget data for the Idaho Power Company contained purchases for their coal-fired plants in Wyoming, which made separation of hydropower from coal-fired generation in the input-output table impossible. Since the coal sector (the major supplier of input to coal-fired generation) did not appear in the Snake River Basin input-output model, the coefficients generated by the IMPLAN model for the Snake River Basin were generally consistent with local purchases of inputs.

It is impossible to include the transactions and coefficient matrices, and the multiplier tables for the 529 sectors. The appendix contains multipliers for the 529 sectors of the model.[1] However, the sectors which will be directly affected by the water exchange, agriculture and private power generation are of crucial concern. These sectors include sector 11 (food grains); sector 12 (feed grains); sector 13 (hay and pasture); sector 14 (grass seeds); sector 18 (vegetables); sector 19 (sugar crops); sector 456 (electric services); and sector 529 (potatoes). The agricultural sectors purchased inputs primarily from themselves and other agricultural sectors (principally sectors 8 - other meat products, sector 9 - miscellaneous livestock products, and sector 26 - the agricultural, forestry and fishery services sector); fertilizer production (sector 215 - organic and inorganic fertilizers, and sector 216 - nitrogen and phosphates); sector 332 (farm machinery) ; transportation sectors (sector 446, rail transport and sector 448 - truck transport); utilities (sector 456 -electricity services primarily); sector 461 (other wholesale trade);

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1. For details on the transactions or coefficient matrices, contact the authors; information and copies are also available from William Eastlake of the Idaho Department of Water Resources, or Dr. Joel Hamilton, Department of Agricultural Economics, University of Idaho.

-electricity services primarily); sector 461 (other wholesale trade); sector 463 (other retail trade); and the sectors involved in finance and real estate (sector 464 - banking, sector 465 - credit agencies, sector 467 - insurance carriers, sector 468 -real estate agencies, and sector 470 -real estate). The latter sector was the single most significant expenditure for every agricultural sector. The electrical services sector indicated major expenditures in sector 74 (maintenance and repair); sector 446 and 448 (rail and truck transportation); sector 456 and 457 (electricity services and gas production and distribution); and sectors 461 and 470, as above.

Snake River Basin Multipliers.

The Type III multipliers for each of the sector are listed in Table 4. These multipliers represent the total impacts, by category, of the sectors listed, as discussed above. Note that many of the multipliers appear to be large, particularly those for income and employment. However, these multipliers are based on total direct, indirect, and induced changes for a one unit direct change in the specified category (for example, an employment multiplier of 2.9 suggests that for every full-time job created by increasing final demand, an additional 1.9 jobs will be created in indirectly-affected sectors, for a total increase of 2.9 jobs). In order to determine the impact of a change in final demand (direct sales), it is also necessary to know the amount of initial change in each category per dollar change in final demand. These data are listed in Table 5 for the selected sectors. It should be clear that large multipliers do not necessarily imply large impacts from increases in production. For example, a $100 increase in exports from the feed grains sector (sector 12) would result in an initial increase in employment of .0005 jobs and a total

Table 4. Snake River Basin Type III Multipliers

Sector	Total Gross Output (per $1.00 TGO increase)	Personal Income (per $1.00 PI increase)	Value Added (per $1.00 VA increase)	Employment (per 1 job increase)
11 Food Grains	1.72	4.00	2.11	1.93
12 Feed Grains	1.61	4.70	1.92	2.81
13 Hay and Pasture	1.61	4.84	1.94	2.85
14 Grass Seeds	1.45	4.57	1.56	2.63
18 Vegetables	2.30	2.62	2.31	3.31
19 Sugar Crops	1.60	2.31	1.65	1.72
456 Private Power	1.28	1.46	1.24	1.71
529 Potatoes	1.31	1.64	1.25	2.10
Weighted Average for Agriculture[a]	1.62	2.44	1.67	2.36

[a]Weighted by proportion of total sales by crop per acre for the existing cropping pattern.

Table 5. Direct Effect per $100 Increase in Final Demand

Sector	Personal Inc	Value Added	Employment
11 Food Grains	25.46	35.89	.0011
12 Feed Grains	24.31	34.99	.0005
13 Hay and Pasture	24.31	34.99	.0005
18 Vegetables	45.88	57.35	.0010
19 Sugar Crops	40.03	53.98	.0014
456 Private Power	13.53	50.42	.0005
529 Potatoes	39.33	51.38	.0013
Weighted Average for Agriculture[a]	38.05	49.94	.0012

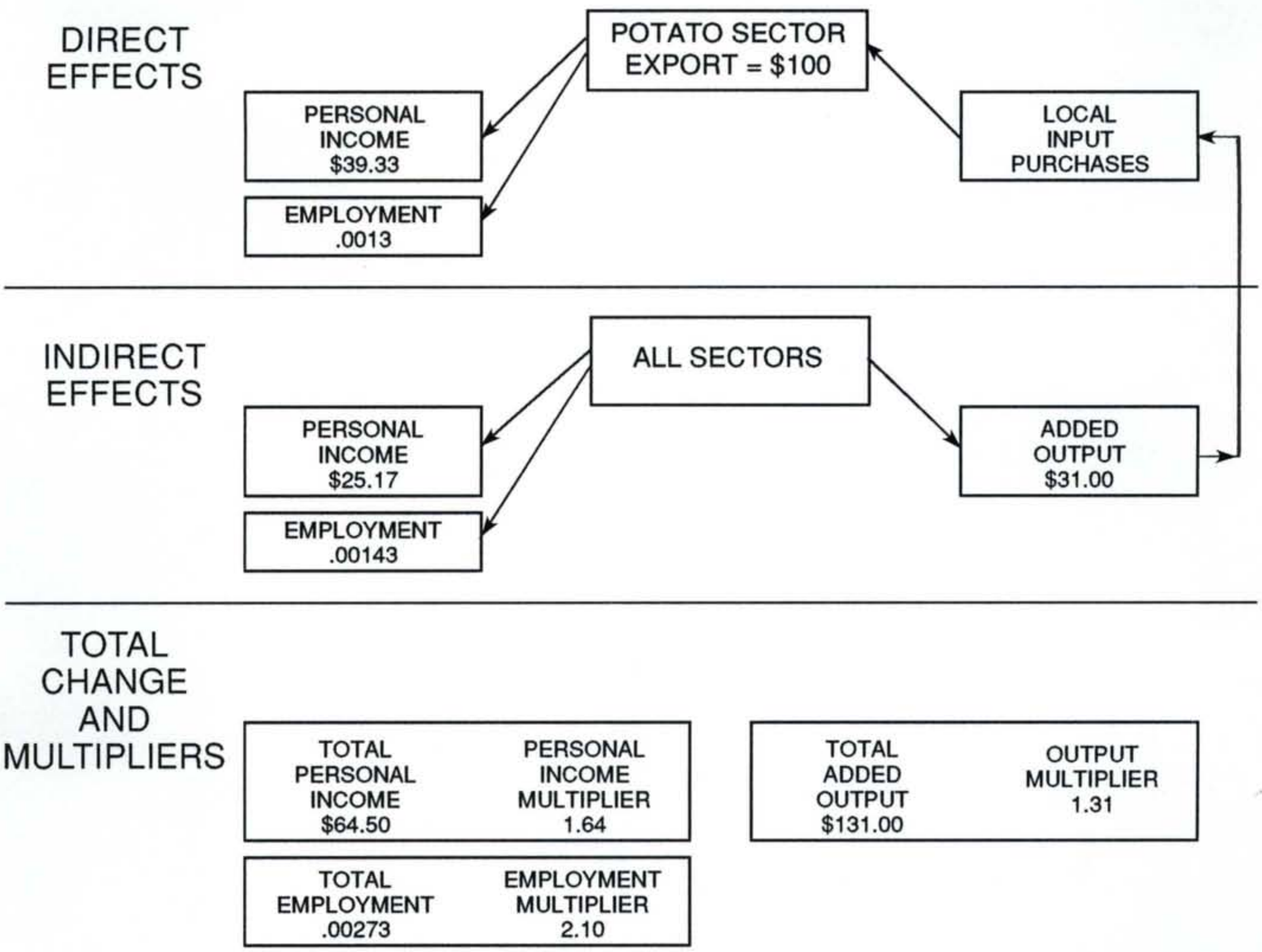
[a]Weighted by proportion of total sales for the existing rotation.

increase of about .0014 jobs (.0005 times the multiplier 2.81). At $3.00 per bushel, it would require about 3,500 acres of small grain production to increase export (final demand) by $1,000,000 and jobs by 14. The sale of potatoes for the fresh market (household consumption) is included in the potato sector. For that reason, the employment within the sector per $100 in total sales is relatively large compared to the other agricultural sectors (.0013 to.0005), because of the labor required for sorting, packaging, etc. However, the employment multiplier for the potato sector is comparatively low (2.1 compared to a 2.81 for feed grains). A schematic example of a change in the potato exports of $100 is presented in Figure 2.

Snake River Basin Direct Benefit Calculations

The direct agricultural benefits to water reallocation were calculated using both the value added and budget-based approaches for each of the crop sectors in the expected rotations. There are two projected rotations of crops to be used for the calculation of total value per acre foot of consumptive use. The first rotation will be termed the gross rotation, and assumes no change in current cropping: a mix of 25% potatoes, 20% vegetables, 20% food grains, 15% feed grains, 10% hay crops, and 10% sugar crops. The second, termed the net rotation, includes the effective increase in crops suggested by Hamilton and Gardner (1985), who considered changes on existing crop land as well as new crop land. Implicit in their analysis was the fact that increasing production would likely cause declining prices for non-contracted or controlled productions (potatoes and hay), as well as an inability to sell commodities which are currently being contracted at a limited amount (sugar beets and some vegetables). Thus, the elasticity of demand was incorporated in the development of their net rotation. The resulting rotation was made up of 5% potatoes, 10% vegetables, and 60% small grains (specified as 34% food grains and 26% feed grains for this study), 25% hay and pasture, and no sugar crops. Table 6 indicates the total value of sales per acre for each crop (that is, the value of the

Figure 2. Impacts for the Potato Sector for a $100 Increase in Final Demand



harvest from an average acre of the crop in the Snake River Basin, taken from the Idaho Agricultural Statistics series), from which the total sales per acre for each rotation can be calculated.

Budget-Based Direct Benefit Calculations. According to Hamilton and Gardner (1984) and Idaho Agricultural Statistics series, the gross rotation yields a net return to own labor, land, entrepreneurship, and risk of $100 per acre. The net rotation generated net returns of $50.50 per acre. The farm budget information included the return to land as a cost; since land was assumed to have a zero opportunity cost (i.e., no alternative uses) in this project, that land cost was added into the calculations of benefits.

Table 6. Value of Sales by Crop and Rotation.

Crop	Total Sales per Acre
Potatoes	$1,430
Vegetables	800
Feed Grains (Barley)	275
Food Grains (Wheat)	320
Sugar Crops	950
Alfalfa Hay	350
Gross Rotation	$ 758
Net Rotation	419

An estimate of the opportunity cost of own labor was derived from the average income for hired farm labor. In fact, the average wage per job in the agricultural sectors in each rotation was less than $10,000 per year. However, $10,000 was felt to be a reasonable opportunity cost for own labor. The average farm size in the Snake River Basin is about 600 acres (from the Idaho Agricultural Statistics series), of which about 65 per cent is irrigated. Because only new irrigation is considered in the development, an average of 390 irrigated acres was assumed, yielding a rounded own labor payment of $25.50 per acre ($10,000 divided by 390). Subtracting this opportunity cost of own labor from the returns per acre leaves a net annual benefit to the project development of $74.50 per acre for the gross rotation, or a net annual project benefit of$25 for the net rotation. Using the typical water development numbers, the present value of the two rotations at 8 percent for 50 years is $911 per acre for the gross rotations, and $306 per acre for the net rotation. Assuming 2.5 acre feet of water consumptively used per acre, the present value per acre foot would be $364 and $122 for the gross and net rotations, respectively.

Value Added-Based Direct Benefit Calculations. The value added per acre for each rotation was $236.64 and $114.94 for the gross and net rotations, respectively. In order to estimate the returns to own labor, land, entrepreneurship, and risk, the payments to hired labor were subtracted from these values added. Labor costs were also taken from the Idaho Agricultural Statistics series and crop budgets available from the University of Idaho. Value added after deduction of labor costs were $187 and $91 per acre for the gross and net rotations, respectively, which resulted in an after-own-labor value added-based benefits of $161.50 and $65.50 per acre, respectively. The present value of the value added-based net benefits was $1,975 and $801 per acre, or $790 and $321 per acre foot. Table 7 presents a comparison of the two approaches.

Quite clearly, some elements of returns to capital which are costs in the budget approach may be included in value added (such as payments to owned capital other than land). The separation of payments to other than water and land from value added requires considerable knowledge of the

Table 7. Present Value of Annual Benefits to Development (8 percent for 50 years)

	Net Benefits			
Crop Mix	Value Added		Budget	
	Acre	Acre Foot[a]	Acre	Acre Foot[a]
Gross Rotation	$1,975	$790	$911	$364
Net Rotation	801	321	306	122

[a]Consumptive Use

components of value added for the specific case. For all the above stated reasons, <u>adjusted values added are uncertain measures of benefits to water development. The calculation of direct benefits should be derived from budget information</u>.

The loss of net return to power production should be deducted from these benefits to determine the net return to the water reallocation. There have been several estimates of the value of water in the production of electricity through the Snake and Columbia River systems. Some have argued that the cost of thermal power production is a reasonable estimate of foregone benefits to power output reduction. Given the current reduction in planned capacity increases for Western power companies and the relative excess power production, it is difficult to assess the actual loss to power production from this reallocation, or the timing of those losses. There are too few data on which to base actual or projected losses from power production. For this reason, no estimate of the benefits to power production was attempted for this study. Note, however, that any reduction in power profits would lead to a reduced benefit estimation for the development of irrigation.

Two additional issues with respect to direct benefits need to be considered. First, if the additional production will cause changes in prices of output, the direct benefits and the calculation of secondary benefits should be adjusted accordingly. Second, if there is an increase in employment of currently unemployed or underemployed resources, those benefits should be included. Each of these issues will be considered below.

Elasticity Effects. Elasticity effects are the changes in the value of the crop (prices) which would occur as supply increases, as a result of decreasing scarcity. While demand elasticity is generally calculated as the percentage change in quantity demanded with a given percentage change in price, these data can also be used to estimate a "flexibility ratio" which estimates the percentage change in price with a percentage change in quantity. The more inelastic the demand (that is, demand elasticity approaching zero from the negative direction), the larger the flexibility ratio. The elasticities of demand for the agricultural products are, in general, inelastic. This means that relative price changes in the market are greater than relative quantity changes. Therefore, significant increases in production will cause declines in prices greater, proportionally, than the supply increase. The result is a decline in total revenue (or expenditures) in that market. Since Idaho produces over 20 percent of the total national potato supply, price changes might be expected. The development of the net rotation (Hamilton and Gardner, 1986) was implicitly based on the inelasticity of demand for potatoes and sugar crops, although they did not explicitly calculate the changes in prices and revenue which might be expected.

Studies by Blakeslee, et al. (1981) and Estes (1979) suggest that Northwest potato prices fall on average 6.7 percent with a production increase of 10 percent. The estimated elasticity of demand for Idaho potatoes to the grower is approximately -0.44 at current production levels. This farm-gate elasticity includes sales to both processing plants and to the fresh market (home consumption of fresh potatoes). The elasticity measure suggests that a 5 per cent increase in production (supply) would cause the price to decline by 11 per cent. Thus, total value of sales would decrease by approximately 5 per cent. While large changes of supply create relatively unreasonable estimates of price declines (e.g., a 30 per cent increase in supply would cause a 70 per cent reduction in price, which is clearly unlikely), it is also clear that significant price declines should be expected. The fresh market (that is, sales of potatoes to marketers for home consumption) is especially sensitive to quantity changes; the elasticity at the market level is approximately -0.10. Thus, if processing plants have sufficient potatoes on hand and do not purchase the added potato production, when those potatoes are sold for the fresh market, prices in the fresh market can be expected to fall precipitously.

The other sectors involved in the rotation -- food and feed grains, hay, vegetables, and sugar crops -- may also have a price sensitivity to production increases. Note that food and feed grains may have some price or quantity controls under various government programs, and sugar beets are generally contracted, with little or no expansion in the market anticipated. Hence, elasticity of demand for those products may or may not be applicable. It is assumed, therefore that additional production will have no effect on price for these commodities.

For alfalfa hay, unlike the national distribution of Idaho potatoes, the market is generally local or at best extended to regional markets, except in unusual years such as 1988. A significant increase in output will very likely have a price depressing effect. There have been a few studies of elasticities of demand for alfalfa hay in the region. These studies suggest a price elasticity in the range of -0.25 to -0.32 (Konyar and Knapp, 1986, and El-Habbab, 1982, respectively). Using the lower elasticity measure, a 5 percent increase in production would generate a price reduction of about 20 percent and a total revenue reduction of slightly less than 10 percent. The 1987 hay production was relatively large (in excess of 20 percent greater than the average year). Prices of hay fell by 40 - 60 percent.

These elasticities were not considered in the direct benefit analysis involving either value added or budget bases. However, the adjustment price would be much more easily taken into account in the budget approach than in the input-output approach, as discussed above. Given the information in the crop budgets available from the University of Idaho, a significant decrease in price would cause alfalfa to be only marginally profitable (Alfalfa hay averages about $90 per acre net returns to land, water, own labor, and entrepreneurial skill and could decline to $20 per acre net return), and the net returns to potatoes would be significantly reduced (i.e., a current return of $280 per acre could decline to about $140 per acre). As an example, the benefits to the net rotation would decline by about $17 per acre after subtraction of own labor cost.

Unemployed Resources. The second issue in benefit calculations concerns the increased use of unemployed or underemployed resources. The inclusion of the value of land (from the budgets or from value added) suggests that the land has no current opportunity cost, although most of the land which would come under irrigation provides dry grazing at the very least. This opportunity cost has not been subtracted from the benefit calculations. There does exist some unemployment of labor in the Snake River Basin. The unemployment rate for 1987 averaged 6.04 percent for the entire basin, although this rate has been declining for the past two years. The decline in unemployment rate may be as much the result of discouraged workers no longer actively seeking jobs as increasing employment opportunities. The bulk of the unemployed persons (64 percent, or 11,981, of the 18,720 unemployed persons) are in the five urban-centered counties of the region: Ada (23 % of the total unemployed persons), Bannock (10.6 %), Bingham (5.7 %), Canyon (15.4 %), and Twin Falls (9.1 %). The highest county unemployment rates (rates greater than 10 percent) occur in the fringe counties in which lumbering or other natural resource industries predominate. Further, while unemployment rates average 6 percent, and some counties in the major agricultural zone have rates exceeding 9 percent, not all of these unemployed could be expected to be employed in the expanded agricultural sector.

In general, the structural unemployment (that is, the measured unemployment at full employment levels) in these regions would not be less than 4 percent . Long run (for the past 10 years) measured unemployment in the region has averaged 4 to 5 percent, so that at most only 1 or 2 percent of the unemployed could be expected to be absorbed by agricultural development in the long term. Given the 1985 labor force of approximately 310,000 in the counties analyzed, this amounts to about 3,000 to 6,000 jobs. In fact, Olson's (1983) study would suggest that permanent labor unemployment over the whole basin would not be sufficient to generate secondary benefits . The only counties in which unemployment is above the 7 percent calculated by Olson are Twin Falls, Gem, and Power counties.

A second, related, issue is the existence of underemployed persons. First, there are no data on underemployment in the Snake River Basin counties of interest. Secondly, the direct jobs provided as a result of agricultural development generally involve wages of less than $10,000 per year. It is doubtful that underemployed persons with full-time jobs are earning significantly less than the agriculturally-related jobs would pay Further, many of the agricultural jobs generated will likely involve part-time summer or harvest-related employment, which will likely be taken by either part-time workers or transient labor. Despite these reservations about benefits arising from employment of unemployed labor in agriculture, an estimate of possible benefits is completed below.

According to the IMPLAN data, agricultural sectors on average generate 1 job per $100,000 to $200,000 in total sales (TGO). These jobs generally command annual compensation of from $7,500 to $11,000 each. It is clear that added employment from agricultural production will be relatively small and relatively low-paying. Given the data, the increase in employment and wages associated with the net rotation would be about 4.00 jobs (23 percent from potatoes and 15 percent from vegetables) per 1,000 acres; the gross rotation would yield about 8.97 jobs per 1,000 acres, primarily from the potato, vegetables, and sugar crops (7.69 jobs). If each of these jobs were to be filled by a currently unemployed person, the net benefits would be a maximum of $40 per acre or about $15 per acre foot for the net rotation, and $90 per acre or about $36 per acre foot for the gross rotation.

Hamilton and Lyman (1983), following information provided by the Swan Falls Technical Advisory Committee, estimated that at most 195,000 acres is likely to be irrigated in the foreseeable future. Using the above data, the additional employment would be about 780 persons and an additional income of $7.8 million for the net rotation and 1,750 jobs and $17.3 million for the gross rotation.

If price elasticities of potatoes and alfalfa, and increased benefits from the employment of unemployed resources are both considered, the benefit measure is likely somewhat higher than for the benefits without these adjustments, but the price elasticity effect will likely offset most of the gain in local income from new jobs. In addition, it is not clear that new jobs will be forthcoming in the face of price falls for the agricultural commodities, since revenues may fall enough to reduce demand for labor inputs in the longer term. Because of the difficulty in estimating the elasticity effects and the uncertainty within the employment measures (also discussed in the following section), it is recommended that the budget estimates of benefits be used, and adjusted for employment or elasticity effects only if accurate and sufficient data are available to ensure that both effects will be significant.

Snake River Basin Indirect Benefit Calculations.

The major purpose of this study was to examine and attempt to calculate the indirect benefits of the reallocation of water from hydropower to irrigated agriculture. It must be acknowledged that there is considerable professional debate about the size and use of secondary, or indirect, benefits. Most economists agree that the employment of unemployed resources or the increase in income to existing households would be a benefit. The debate centers primarily around the circumstances under which unemployed resources can be assumed to exist, or measured, and about the potential for the generation of benefits from forward-linked (processing) sectors, as discussed in the theoretical sections of this paper. The Snake River example should serve to underline the problems in estimating secondary benefits, both indirect and forward-linked.

It is appropriate to reiterate the cautions associated with using indirect benefits. These effects are associated with sectors which are not direct users of the product or service being contemplated (in this case, the reallocated water). As such, these sectors would not have returns which could be attributed to the resource directly. In fact, the input-output framework is based on the assumption that all added revenues will be exhausted in payments to inputs and value added. Therefore, secondary, or indirect, benefits are generated only if unemployed resources (i.e., those with low or no opportunity cost) are used in the expansion of those sectors which provide inputs to the directly affected sectors (backward-linked) or which expand their processing of commodities purchased from the directly affected sectors (forward-linked). The resources most likely to be employed by the secondary sectors are labor and capital. Only if unemployment or underemployment of labor is significant and if the existing unemployed or underemployed persons are provided added work (as opposed to imported or immigrant labor), would there be net regional increases in benefits to water from increasing numbers of jobs (assuming that regional benefits are those which accrue to current residents, as discussed above). Only if there exists excess capacity in capital stocks which results from limited commodity supply would added returns to capital be a gain in regional benefits. The effect of irrigation development on these indirect benefits is, of course, a function of the cropping pattern assumed.

Backward-linked Indirect Benefits. Backward-linked indirect benefits (or disbenefits) will arise from changes in irrigated agriculture and hydropower, as previously discussed. The backward-linked effects are included in the input-output multiplier analysis for each sector.

Irrigated Agriculture. As indicated above, there are pockets of unemployment in the Snake River Basin. The major sectors which are linked to agriculture generally employ relatively few persons per $1 million in sales, and those employed are at a relatively low income. These sectors include wholesale and retail trade, real estate and other financial sectors, repair services, etc.

A multiplier for each rotation was generated, using a weighted (by total sales per acre) average of the multipliers listed in Table 4. The net rotation's employment multiplier was 2.08, the gross rotation's was 2.36. The secondary employment for the net rotation would be 4 jobs per 1,000 acres (4 times 2.08 less 4), or about $48,000 ($48 per acre or $20 per acre foot), assuming an average of about $12,000 income per job in the secondary sectors which will be affected (an approximate weighted average). For the gross rotation the results are 12.2 additional jobs (8.97 times 2.36 less 8.97), and $146,400 increase in income ($146 per acre or $59 per acre foot). These values are approximately equal to the budget-based benefits. For the assumed maximum of 195,000 acres of new irrigation, the results indicate a 780 (195 times 4) increase in jobs and $16 million increase in income for the net rotation and a 2,380 (195 times 12.2) increase in jobs and $28.5 million increase in income for the gross rotation.

If no long-term unemployment above the structural unemployment is assumed, then there will be no net increase in benefits to employment, either directly or indirectly for either rotation. If a 1 percent long-term unemployment rate is assumed (i.e., a 5 percent structural [measured] unemployment at full employment), the results for the net rotation are the same, since there would be 3,000 unemployed persons who would be available in the job market. However, the gross rotation total demand for workers would exceed the supply (4,130 new jobs in both agriculture and backward-linked industries for 3,000 workers). The net result would be an increase in indirect employment of 1,250, and an increase in total income of $15 million annually ($77 per acre or $31 per acre foot). The remaining jobs would have to be filled from immigrants. If two percent unemployment is assumed, then all the added direct and indirect jobs could be filled locally, amounting to 4,130 total jobs (1,750 direct and 2,380 indirect), with an associated $49.6 million increase in income ($254 per acre or $102 per acre foot). The latter values would apply if immigrants' income were included in the calculation.

Other resources may also be unemployed or underemployed. Land resources are generally included under direct benefits. However, capital may be underemployed in the indirectly affected industries (as evidenced by excess capacity). Before returns to idle capacity are counted as benefits, however, the reason for the excess capacity must be shown to be a function of inadequate demand for its product from the sectors which will be developed. For example, if long-term excess capacity exists in the fertilizer production sector as a result of insufficient demand for inputs by agriculture, then increases in production will yield secondary returns to the idle capital which are benefits. However, for most capital goods associated with input production, ownership of that capital and payments to it are likely out-of-region. It is impossible to determine the proportion of capital returns which accrue to local owners from the input-output analysis without access to detailed capital ownership records. Since none of these records were available for those sectors in which substantial impacts are projected, no attempt to isolate regional benefits from returns to excess capital capacity was made.

The influence of changing prices on both direct and indirect employment is difficult to assess. There is little doubt that added production will result in increasing demand for labor. However, declines in the value of total sales for those sectors with inelastic demands (potatoes and alfalfa) will also, without doubt, adversely affect employment and benefits. The inclusion of those price changes in the input-output model would require restructuring the sectors, as discussed above. The alternative is to reduce the final demand value of the new production consistent with the price reduction to determine the change in employment. For the net rotation, the result is a loss of about 30 direct jobs or about $300,000 of income. This is calculated assuming a 5 percent increase in potato production with the resulting 11 percent loss in total value of sales, and a 2 percent increase in the supply of hay with the resulting 9 percent loss in total value of sales. The indirect loss would be about 30 jobs and $360,000 loss of income. These losses amount to about $3.50 per acre or $1.40 per acre foot of water developed.

For the gross rotation, the losses are greater for potatoes, since the gross rotation contains large changes in output (a 15 percent increase in production and a 34 percent reduction in price for a net change of total revenue of 24 percent). The change in potato employment is about 220 jobs for a total direct income loss of $2,175,000 ($11 per acre and $4.50 per acre foot) and indirect loss of 242 jobs and an additional $2.9 million (about $15 per acre or $5.95 per acre foot). The change in alfalfa is relatively minor (less than 2 percent) and leads to a relatively small reduction in price (8 percent) and in total sales (5 percent) and employment (5 jobs).

There are several reasons for caution in interpreting the indirect, or secondary, benefit calculations. First, there is the question about the existence of long-term unemployment in the "without development" case. The historical unemployment rates in each county, coupled with a downward trend in measured unemployment in most of the counties in the region, suggests that unemployment may not be sufficient to warrant secondary benefits of the size calculated. Further, the Olson (1983) conclusions, coupled with the seasonal nature of many of the jobs generated indicates that secondary benefits, if they exist, may not accrue to regional residents. Finally, the nature of the market elasticities for the various crops involved suggests that primary benefits may be significantly overstated, which casts doubt upon the existence of large secondary benefits.

Hydropower. Hydropower may have two effects: First, if the loss in hydropower production is sufficient to cause an increase in price, then there will be a cost increase to all users of electricity (including irrigated agriculture). No attempt has been made to project these costs, or the probability that price rises would occur.

Secondly, the reduction in indirect employment which would occur as a result of any decrease in hydropower production would be classified as an indirect disbenefit, or cost. Because no forecast of this loss has been made, the backward-linked losses have not been calculated. However, it should be noted that employment per $100 of sales in the private power sector is less than half of that for the average for agriculture (.0005 compared to an average of .0012 for the agricultural sectors). In addition, the employment multiplier for private power is also considerably smaller (1.71 compared to an agricultural average of 2.36). Thus, even with a loss to hydropower production, a gain in secondary benefits from the transfer of water would be likely, unless the loss to hydropower sales was very much larger than the gain from increased agriculture production.

Forward-Linked Indirect Benefits. It is difficult to project forward linkages to the hydropower sector which might be reduced, other than agriculture (see the previous discussion) and increased costs to other users. The focus of this part of the analysis will be on irrigated agriculture. The issue of forward linkages to agricultural production is less straightforward than indirect impacts, at least with respect to the technical calculations. It is necessary to determine if processors of agricultural or power inputs will be encouraged to expand as more input becomes available outside the input-output framework. There does exist some excess capacity in the potato processing sector. Current capacity is about 66 million cwt including the Malheur County, Oregon, processing plant (which appears to be directly linked to both Idaho potato growers and Idaho processors), while current production is 55-60 million cwt also including the Malheur County plant. However, stocks of processed and fresh potatoes in the processing sector are now about one year's supply, and have been increasing somewhat in the past five or six years. Several potato processors have indicated, in personal communications, that their plants could absorb additional potato production. Whether this added production would create added output from the processing sector, or simply become a part of increased storage of fresh or processed potatoes for future sales is not clear. In 1987, a large potato crop was forthcoming. The production increased from 90,220 cwt in 1986 to 99,710 cwt in 1987 (about a 10 percent increase), and average price (table and processing) declined from $4.30 to $3.55 per cwt (a 20 percent decline). While some increase in production of processed potatoes has occurred over this period, significant farm-gate price declines have been observed in the market for potatoes for processing (as well as for table markets). Thus, it does not appear that the availability of potatoes from producers is a significant constraint on the processing industry. The same could be said of most of the other crops in either rotation.

Alfalfa hay does not appear to be a constraining factor on fluid and processed milk markets, nor on meat production. From 1985, when about 4 million tons of hay were produced, to 1987, when about 4.5 million tons of hay were produced, prices of hay dropped from $64.50 per ton to $51.50 per ton. Thus, there appears to be a significant excess of hay already in the market. An overabundance of fluid milk in the region and national surplus programs for the milk products would suggest that additional supplies of hay will be unlikely to induce increased output of dairy products, unless the price of the hay falls dramatically. Livestock prices have varied considerably over this period, but the general, long-term real price trend has been downward. Even if prices of hay fell much lower, it is doubtful that increases in output from either the livestock or dairy sectors could be sold without price declines.

Government grain supply and/or price programs govern much of the food and feed grain industry. There is consistent long-term evidence to conclude that neither of these products are in short supply. Sugar beet crops are contracted throughout Southern Idaho, and significant reductions in acreages of sugar beets have occurred over the past 15 years in response to lack of demand on the part of sugar processors.

For these reasons, the use of forward-linked secondary benefits appears to be lacking a strong foundation. In addition, this information suggests that the net rotation of Hamilton and Gardner (1986) is more appropriate than the gross rotation suggested for new irrigation. An attempt to estimate some forward-linked benefits for potatoes from the input-output framework is made below for the purpose of explanation, but it is highly doubtful that those benefits will materialize.

An examination of the potato market suggests that from 60 to 70 percent of annual production is purchased by the processing sector, depending upon the existing stock of fresh and processed potatoes. The transaction matrix cell for sales of potatoes to the processing sectors (frozen and dehydrated vegetables) is consistent with this range (65 percent). Further, the processing sectors are split. Both existing data and the transactions matrix indicate that 80 to 85 percent of total processed potatoes are sold to the frozen vegetables sector, with 15 to 20 percent going to the dehydrated processors. The coefficient matrix from the input-output analysis suggests that the purchase of potatoes is about 13 percent of the total sales value of the frozen processing sector and about 7 per cent of sales value for the dehydrated processing sector. From personal communications, the former value appears to be relatively accurate

(12 to 16 percent was the range suggested), but the latter appears to be an underestimate (10 to 12 percent was the range suggested by the processors).

To estimate increased processing production, the proportion of increased potato sales going to each of the processing sectors was calculated for the 195,000 acre assumption ($8.1 million to the frozen sector and $1.6 million to the dehydrated sector for the net rotation; $40.8 million and $8 million, respectively, for the gross rotation). Then the increase in total sales was calculated by dividing the estimated increase in purchases by the proportion of potato costs to total sales. This resulted in an increase in total sales of $62.3 million for frozen processing and $24.1 million for dehydrated processing for the net rotation, and $313.8 million and $121.5 million, respectively, for the gross rotation. It was assumed that all added production was exported from the region, simply because the local demand is being satisfied by existing production at the present price. Direct benefits to these sectors would be the payments to other capital (since all the processors are incorporated and management costs are included in the employee compensation calculations for the input-output table). However, the ownership of that capital is not clear. For the largest processors, it is doubtful that a significant portion of the returns to capital (stock) would be captured in the region. The proportion of local ownership of smaller processing plants is probably higher, but no data are available for most of the plants. It was assumed, to be conservative, that only 10 percent of total returns to capital are captured inside the region.

Of the total value of production, approximately 10.6 percent of the dehydrated sales and 4.9 percent of the frozen sales are captured by other property income (returns to corporate capital). Using the above assumptions, approximately $305,000 and $256,000 in net benefits to local capital in the frozen and dehydrated processing sectors, respectively, would accrue for the net rotation (about $3.00 per acre). The net benefits to local capital assuming the gross rotation would be $1.44 million and $1.29 million for the frozen and dehydrated processing sectors, respectively (about $14 per acre).

Note that within the input-output framework, the net final demand for the potato sector would be reduced by the amount of potatoes sold to the processing sector. The benefits to increased employment in potato production which was sold to processing sectors would be subsumed in the indirect employment impacts of the processing sectors. That is, the employment in the potato producing sector would become an indirect effect accounted for by the employment multipliers for the processing sector. Thus, the direct employment benefits to the agricultural sector (see calculations in the direct benefit section) would be reduced from $7.8 million ($40 per acre times 195,000 acres) to $6.6 million (a reduction of 117 jobs at $10,000 per job) or a reduction of $4.50 per acre foot of new water (from $15 to $10.50). The reductions for the gross rotation would be about $5.85 million (585 jobs at $10,000 per job) or $13 per acre foot (from $36.40 to $23.40), or $21 per acre foot.

The increase in employment due to increased processing would be 888 direct jobs (623 in the frozen processing sector and 265 in the dehydrated processing sector) for the net rotation, and 4,475 jobs for the gross rotation (3,138 in the frozen processing and 1,337 in the dehydrated processing). These jobs would result in an increase in income of about $13.3 million (623 times $15,344 plus 265 times $13, 981) or about $27.30 per acre foot for the net rotation and $66.8 million or about $137 per acre foot for the gross rotation. The indirect employment would be relatively large, since the employment multipliers for the two processing sectors are 2.48 and 3.29 for the frozen and dehydrated processing sectors, respectively. This suggests an additional 1,530 jobs from the processing sector (at an average of about $12,000 per job given the indirect sectors affected) or about $18 million ($38 per acre foot) for the net rotation and about 7,713 additional jobs and $92 million ($190 per acre foot) for the gross rotation. These effects would be added to the remaining agriculturally-related increases in direct and indirect benefits, of 716 jobs ($17.50 per acre foot) for the net rotation and 1,530 jobs ($38 per acre foot) for the gross rotation.

Note that, in both cases, the increase in total employment is greater than the unemployment which exceeds structural unemployment, particularly when the increase in direct and indirect agricultural employment is added to that of the processing sectors. If income to immigrants to the region is not counted as a benefit, <u>a maximum benefit to the existing population of about 3,000 to 6,000 jobs should be expected (1 to 2 percent unemployment above structural unemployment). In fact, if no long-term unemployment is assumed, only the net returns to capital would be considered as a benefit to increased processing.</u>

Table 8 lists the annual benefits of the new irrigation development per acre foot, based on the net rotation with no adjustments for price changes and an unemployment rate one percent above structural employment. These values appear somewhat higher than expected. However, If adjustments for price reductions and a limited number of local unemployed persons available for work (3,100 at 1 percent above structural unemployment rates) are made, these values are somewhat reduced as indicated in Table 9. Note that the table also indicates the benefits assuming no unemployment above structural employment (the direct benefits only without benefits to increased employment). Table 10 indicates the net present value of each of the annual streams of benefits (discounted at 8 percent for 50 years).

Table 8. Comparative Benefits Per Acre Foot for the Net Rotation and a 1 Percent Unemployment (3,100 Persons) Above Structural Unemployment With No Price Adjustment.

Direct Benefits Only				Total Direct Benefits + Total Indirect Benefits	
Agric- culture	Agriculture + Processing	Agriculture + Agriculture Employment	Agriculture + Processing + Employment	Agriculture Only	Agriculture + Processing
$35.70	$39.90	$51.10	$73.50	$70.70	$116.20

Table 9. Benefits Per Acre Foot for the Net Rotation, 1 Percent Unemployment (3,100 Persons) Above Structural Unemployment, and Reduced Prices.

Direct Benefits Only				Total Direct Benefits + Total Indirect Benefits	
Agric- culture	Agriculture + Processing	Agriculture + Agriculture Employment	Agriculture + Processing + Employment	Agriculture Only	Agriculture + Processing
$23.80	$28.00	$39.20	$65.25	$58.80	$98.15

Table 10. Present Value of Benefits (at 8 Percent for 50 Years) per Acre Foot of Water, Taken from Tables 8 (Line 1) and 9 (Line 2).

	Direct Benefits Only				Total Direct Benefits + Total Indirect Benefits	
Table of Origin	Agric- culture	Agriculture + Processing	Agriculture + Agriculture Employment	Agriculture + Processing + Employment	Agriculture Only	Agriculture + Processing
Table 7	$436	$489	$624	$944	$1,036	$1,347
Table 8	$291	$343	$343	$798	$ 890	$1,201

It must be noted that no foregone benefits to power production are included in the above tables. The benefit estimates per acre foot are generally smaller than those estimated for power production by several researchers (see, for example, Butcher, et al., 1986). Long (1987) compared total revenue (regional gross output for the agricultural sector) for all irrigated agriculture in Idaho to the value of hydropower sales, and concluded that water was more valuable in agricultural uses. His analysis was flawed in several respects, the most important of which was the failure to examine the value of changes in agricultural production to the value of changes in power production <u>net of production costs</u>. His estimate of "benefits" was not consistent with the general concept of economic benefits described above (and in Young and Howe, 1988). It is true that secondary benefits to agriculture are likely larger than those for power production since employment per $100 dollar sales is low for the private power sector in Idaho (.0005 compared to an average of .0012 for the agricultural sectors) and the employment multiplier is lower than that for agriculture, also (1.71 compared to an average of 2.36 for the agricultural sectors). <u>It is recommended that the annual benefits to reallocated water per acre foot of between $25 and $40 (a present value of between $300 and $800) be used, considering only the direct benefits and a limited employment benefit. It does not appear that forward linkages are a realistic source of increasing benefits at the present time.</u>

CONCLUSIONS

In summary, there are important differences between impacts of water supply development and benefits to the provision of water itself. Direct benefits are derived from the residual incremental net returns (net of payments to labor, capital, management and risk) attributed to the use of the water, including consideration of foregone net returns to displaced users (contrary to the treatment of Long, 1987). The use of value added from input-output tables for direct benefit calculations is difficult, requires the same kinds of data as benefit estimations from budgets, and is subject to misinterpretation and misuse. <u>It is recommended, therefore, that farm budget information should be used for calculating direct benefits</u>.

The added employment in new agriculture, estimated by the input-output analysis, should be included only with reservations. First, the level of unemployment above structural unemployment rates in the Snake River Basin appears to be relatively small. In addition, the added agricultural employment is likely to be part-time and may well be provided by transient laborers already in the region. <u>If immigration is a desirable effect and the income earned by permanent immigrants is of interest, then calculation of benefits based on total increased employment is warranted. However, because the costs of social overhead due to economic growth are likely born mostly by existing residents, it is suggested that the benefits be calculated for the existing population only. It is also suggested that the reduction in direct benefits due to the price change patterns estimated for the markets of major agricultural products should be included in the analysis where feasible.</u>

The economic multipliers generated from the Snake River Basin input-output table must be used with an understanding of their meaning. Multipliers are associated with impacts, not necessarily benefits. Further, large multipliers do not, in and of themselves, suggest large impacts. The input-output, or other impact, analysis measures effects which would normally be considered as costs in an economic efficiency analysis. In order to assess benefits, it is necessary to know the direct effect of the policy or program on employment or income, as well as the multiplier associated with that effect. Then, further analysis is required to determine if those impacts result in employment and increased income to un- or underemployed resources (the only sources of secondary benefits).

As the Water Resource Council's guidelines suggest, secondary benefits cannot be attributed to water projects unless significant unemployment or underemployment of resources exists within the region. Water using sectors are considered as part of the calculation of direct benefits and costs. Because the level of long-term unemployment above structural unemployment of labor in Idaho appears to be quite small, it is recommended that no more than 1 percent of the current measured unemployment be considered as excess over structural unemployment. Further, capital resources do not appear to have excess capacity which will be reduced significantly by increased agricultural production. Thus, backward-linked secondary benefits should be regarded with some skepticism, unless economic growth in the form of increased population is regarded as a regional benefit. It is recommended that only the most conservative secondary benefits to backward-linked industries be used.

There exists little evidence suggesting that forward-linked industries (agricultural processing industries) are constrained by the supply of agricultural commodities. Rather, it appears that significant stockpiles of potatoes exist, and that increasing alfalfa hay production will likely result in long term depression of hay prices within the region. Benefits to forward-linked industries would most probably be transfers of income from the agricultural producers to the processing industries in the form of reduced commodity prices. It is recommended that no forward linkage be considered for this case, for the reasons cited, even though an estimate of benefits to these forward linkages has been made.

Thus, the total direct and indirect benefit of water for irrigation development in the Snake River Basin should probably not exceed $35 to $70 per consumptively used acre foot, or a present value of $425 to $850, and it may be significantly less. The total present value to the maximum irrigation development projected would be from $58.5 to $95.6 million. It must be recognized that these benefits have been calculated without consideration of any social overhead costs which would be forthcoming.

The loss to Idaho of a reduction in power production to the Idaho Power Company has not been taken into account, primarily because the power company has consented to release their water rights for no compensation. In any event, these calculations should be made in the determination of direct benefits. It is quite doubtful that a loss in power production will cause significant negative secondary effects on local employment or incomes in the Snake River Basin because both employment per dollar of gross output and the employment multiplier are low, and it is doubtful that a large proportion of returns to capital will accrue to residents of the region.

Finally, caution is urged in the use of the secondary benefits derived from input-output or other multiplier analysis. These benefits are derived from a model which, by its very structure, will not allow substitution of inputs (for example, increased activity by proprietors in lieu of the employment of additional workers). Benefits may be difficult to estimate for either labor or capital inputs because of the nature of the value added sector and the fixed relationships between inputs and outputs.

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APPENDIX - TYPE III MULTIPLIERS FOR THE SNAKE RIVER BASIN

Type III Gross Output, Value Added, and Employment Multipliers.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
1	Dairy Farm Products	1.7269	2.4382	2.3417
2	Poultry and Eggs	1.7770	4.8278	3.4128
3	Ranch Fed Cattle	1.7525	4.2701	3.4427
4	Range Fed Cattle	1.7881	4.4346	3.3979
5	Cattle Feedlots	1.6415	3.1223	2.4091
6	Sheep, Lambs and Goats	1.9332	4.5397	3.6419
7	Hogs, Pigs and Swine	1.7364	4.1212	3.1781
8	Other Meat Animal Products	2.8693	5.1633	4.1101
9	Miscellaneous Livestock	1.8079	3.4244	2.1405
11	Food Grains	1.7243	2.1079	1.9303
12	Feed Grains	1.6379	1.9248	2.8092
13	Hay and Pasture	1.6102	1.9433	2.8495
14	Grass Seeds	1.4498	1.5611	2.6259
16	Fruits	1.6955	1.7240	1.6199
18	Vegetables	2.2980	2.3128	3.3119
19	Sugar Crops	1.6073	1.6514	1.7242
20	Miscellaneous Crops	1.6255	1.7120	2.2241
22	Forest Products	1.3492	1.2697	1.6812
23	Greenhouse and Nursery Produ	1.9938	2.0931	1.4866
26	Agricultural, Forestry, Fish	1.9227	2.1913	1.4851
27	Landscape and Horticultural	1.6648	1.5298	1.4194
28	Iron Ores	1.5904	1.8523	1.5650
29	Ferroalloy Ores, Except Vana	1.5043	1.7115	1.7565
30	Copper Ores	1.4326	1.3817	1.5094
32	Gold Ores	1.5748	1.6873	1.6252
33	Silver Ores	1.5539	1.6612	1.6569
35	Metal Mining Services	1.6369	1.7668	1.5512
37	Uranium-Radium-Vanadium Ores	1.3957	1.4739	1.5028
38	Metal Ores, Not Elswhere Cla	1.5851	1.7008	1.6071
45	Crushed and Broken Limestone	1.4067	1.3990	1.5952
47	Crushed and Broken stone, N.	1.4048	1.3965	1.6243
48	Construction Sand and Gravel	1.4357	1.4493	1.6115
49	Industrial Sand	1.4339	1.4489	1.6224
50	Bentonite	1.5042	1.5585	1.6096
55	Nonmetallic Minerals (Except	1.4309	1.4644	1.5844
58	Misc. Nonmetallic Minerals,	1.4123	1.4426	1.6318
65	Chemical, Fertilizer Mineral	1.5801	1.5944	1.7180
66	New Residential Structures	1.7532	2.3381	2.2382
67	New Industrial and Commercia	1.4859	1.7583	1.9015
68	New Utility Structures	1.9511	2.4148	1.4314
69	New Highways and Street	1.4540	1.8170	2.2152
70	New Farm Structures	1.5531	1.8761	2.1463
71	New Mineral Extraction Facil	1.4642	1.7420	2.1649
72	New Government Facilities	1.4972	1.7502	2.1104
73	Maintenance and Repair, Resi	1.5628	1.8865	2.1392

Appendix (cont'd)

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
74	Maintenance and Repair Other	1.5284	1.6206	1.6245
75	Maintenance and Repair Oil A	1.3800	1.3791	1.5957
77	Ammunition, Except For Small	1.4493	1.4886	1.5579
82	Meat Packing Plants	2.0581	3.8101	3.5795
83	Sausages and Other Prepared	2.2871	2.9310	2.6913
84	Poultry Dressing Plants	1.5966	1.9770	1.9167
85	Poultry and Egg Processing	1.7176	2.6199	1.5855
86	Creamery Butter	2.6097	13.5319	6.0790
87	Cheese, Natural and Processe	2.5308	6.1369	5.1145
88	Condensed and Evaporated Mil	2.1704	3.1259	4.8222
89	Ice Cream and Frozen Dessert	2.0947	2.6087	2.6114
90	Fluid Milk	2.2524	2.9083	3.2550
91	Canned and Cured Sea Foods	1.4684	2.1168	2.0585
92	Canned Specialties	1.7085	2.3191	2.3232
93	Canned Fruits and Vegetables	1.7089	2.5232	2.2971
94	Dehydrated Food Products	1.8157	2.5895	2.2475
95	Pickles, Sauces, and Salad D	1.6861	2.5547	2.3800
96	Fresh or Frozen Packaged Fis	1.5347	2.7066	2.0610
97	Frozen Fruits, Juices and Ve	1.8011	3.1602	2.4151
98	Frozen Specialties	1.7563	2.3622	2.0876
99	Flour and Other Grain Mill P	1.8819	3.1105	4.0151
102	Dog, Cat, and Other Pet Food	1.6000	1.7129	2.5397
103	Prepared Feeds, N.E.C	1.6619	2.8178	2.8390
105	Wet Corn Milling	1.6855	2.1908	3.0009
106	Bread, Cake, and Related Pro	1.6105	1.6627	1.7657
108	Sugar	2.3387	5.1139	3.7885
109	Confectionery Products	1.5178	1.8010	1.9074
113	Malt	1.7717	3.0162	3.4870
114	Wines, Brandy, and Brandy Sp	1.5062	1.9425	2.6256
116	Bottled and Canned Soft Drin	1.5896	2.1414	2.0081
117	Flavoring Extracts and Syrup	1.6353	1.6181	3.3774
121	Animal and Marine Fats and O	1.5735	1.5398	1.9060
122	Roasted Coffee	1.6414	2.8967	2.2839
124	Manufactured Ice	1.5727	1.4838	1.3865
126	Food Preparations, N.E.C	1.6870	1.9399	1.6745
131	Broadwoven Fabric Mills and	1.3735	1.8133	1.6186
147	Knit Outer Wear Mills	1.4369	1.6400	1.4089
151	Apparel Made From Purchased	1.5203	1.8556	1.4329
152	Curtains and Draperies	1.7580	2.4707	1.4590
153	House Furnishings, N.E.C	1.4358	2.2106	1.7362
154	Textile Bags	1.4808	1.9237	1.4634
155	Canvas Products	1.6001	1.9178	1.4352
156	Pleating and Stitching	1.5541	1.9373	1.5662
157	Automotive and Apparel Trimm	1.2630	1.2779	1.5590

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
158	Schiffi Machine Embroideries	1.5668	1.6532	1.4684
159	Fabricated Textile Products,	1.4459	1.6825	1.5002
160	Logging Camps and Logging Co	1.3203	1.5589	2.0404
161	Sawmills and Planing Mills,	1.9649	2.1512	1.8400
162	Hardwood Dimension and Floor	2.1148	2.4794	1.6473
163	Special Product Sawmills, N.	2.0526	2.0777	1.4869
164	Millwork	2.0947	3.0798	1.8627
165	Wood Kitchen Cabinets	1.9530	2.3003	1.6211
166	Veneer and Plywood	1.9773	2.2713	1.9622
167	Structural Wood Members, N.E	2.0540	2.7148	2.0462
168	Prefabricated Wood Buildings	1.9452	2.8782	1.9912
169	Wood Preserving	2.0075	2.9049	2.3028
170	Wood Pallets and Skids	2.1086	2.4859	1.6964
172	Wood Products, N.E.C	1.8900	2.3422	1.7311
173	Wood Containers	2.3824	2.9226	1.5010
174	Wood Household Furniture	2.1386	2.5048	1.5153
175	Household Furniture, N.E.C	2.2502	3.0287	1.3839
177	Upholstered Household Furnit	1.6151	1.8714	1.5852
178	Metal Household Furniture	1.8628	2.3908	1.4430
179	Mattresses and Bedsprings	1.5917	2.1404	1.7102
180	Wood Office Furniture	2.0532	2.4681	1.5374
182	Public Building Furniture	1.7177	2.0889	1.6196
183	Wood Partitions and Fixtures	1.7715	2.0566	1.6219
186	Furniture and Fixtues, N.E.	1.4291	1.5388	1.8072
188	Paper Mills, Except Building	1.5803	1.8792	2.0732
192	Building Paper and Board Mil	1.9416	2.3386	1.5627
194	Bags, Except Textile	1.5298	1.9862	1.9960
198	Converted Paper Products, N.	1.4827	1.7906	1.6267
199	Paperboard Containers and Bo	1.3602	1.6622	1.7074
200	Newspapers	1.6338	1.8167	1.5745
201	Periodicals	1.7900	2.6210	1.9150
202	Book Publishing	1.6795	2.2538	2.0135
203	Book Printing	1.5117	1.6314	1.5342
204	Miscellaneous Publishing	1.6249	1.6649	1.5113
205	Commercial Printing	1.5222	1.6655	1.5217
206	Lithographic Platemaking and	1.4440	1.4177	1.6156
207	Manifold Business Forms	1.3661	1.5335	1.7709
208	Blankbooks and Looseleaf Bin	1.4715	1.5311	1.5307
211	Bookbinding and Related Work	1.6799	1.6307	1.4112
212	Typesetting	1.5631	1.4567	1.3632
213	Photoengraving	2.1763	2.2128	1.4239
215	Industrial Inorganic. Organi	1.6212	1.8982	2.3546
216	Nitrogenous and Phosphatic F	1.5429	1.7989	2.3306
217	Fertilizers, mixing Only	1.8572	3.4123	3.4286
218	Agricultural Chemicals, N.E.	1.6251	1.9248	2.9235

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
224	Chemical Preparations, N.E.C	1.6731	2.0096	2.2392
225	Plastics Materials and Resin	1.6472	1.9311	2.6526
226	Synthetic Rubber	1.7590	2.4640	2.5201
229	Drugs	1.4970	1.5697	2.0689
231	Polishes and Sanitation Good	1.6757	2.1812	2.3332
233	Toilet Preparations	1.6480	1.9159	2.6523
234	Paints and Allied Products	1.6260	1.8830	2.4887
235	Petroleum Refining	1.1558	1.7575	3.5687
238	Paving Mixtures and Blocks	1.3566	1.6193	2.3199
239	Asphalt Felts and Coatings	1.3551	1.4817	1.9830
243	Fabricated Rubber Products,	1.7369	1.9379	1.5704
244	Miscellaneous Plastics Produ	1.7377	1.9347	1.7365
250	Leather Gloves and Mittens	1.6884	2.0297	1.3987
254	Leather Goods, N.E.C	1.7014	1.8175	1.4680
255	Glass and Glass Products, Ex	1.7433	1.8294	1.4951
257	Cement, Hydraulic	1.5298	1.7295	1.7454
258	Brick and Structural Clay Ti	1.7994	1.7936	1.4948
259	Ceramic Wall and Floor Tile	1.5909	1.4703	1.4712
261	Structural Clay Products, N.	1.7986	1.7282	1.4797
266	Pottery Products, N.E.C	1.7966	1.8344	1.5199
267	Concrete Block and Brick	1.5850	1.8626	1.6877
268	Concrete Products, N.E.C	1.5053	1.6708	1.5758
269	Ready-Mixed Concrete	1.5058	1.9557	2.1086
272	Cut Stone and Stone Products	1.7323	1.8767	1.4409
276	Minerals, Ground or Treated	1.5970	2.2565	1.9869
279	Nonmetallic Mineral Products	1.6976	2.1076	1.5543
280	Blast Furnaces and Steel Mil	1.3927	1.5614	1.9384
285	Iron and Steel Foundries	1.5126	1.5638	1.5945
286	Iron and Steel Forgings	1.4287	1.6449	1.5596
288	Primary Metal Products, N.E.	1.5913	2.1918	1.5229
292	Primary Aluminum	1.4763	1.7810	2.1015
294	Secondary Nonferrous Metals	1.8070	3.1141	4.3722
299	Aluminum Castings	1.3851	1.4246	1.5728
303	Metal Cans	1.3830	1.6935	1.6138
304	Metal Barrels, Drums and Pai	1.3784	1.6219	1.7044
305	Metal Sanitary Ware	1.7548	1.9370	1.4670
307	Heating Equipment, Except El	1.6232	1.8790	1.4942
308	Fabricated Structural Metal	1.3399	1.5053	1.7432
309	Metal Doors, Sash, and Trim	1.4190	1.6739	1.5536
310	Fabricated Plate Work (Boile	1.5111	1.6923	1.5043
311	Sheet Metal Work	1.3970	1.6037	1.5635
312	Architectural Metal Work	1.6087	1.7006	1.4126
313	Prefabricated Metal Building	1.4151	1.7731	1.7408
314	Miscellaneous Metal Work	1.3407	1.6663	2.0070
315	Screw Machine Products and B	1.4077	1.4761	1.5338

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
316	Automotive Stampings	1.4316	1.5872	1.4784
318	Metal Stampings, N.E.C.	1.4579	1.6369	1.5401
322	Hardware, N.E.C.	1.4031	1.4722	1.5833
323	Plating and Polishing	1.6607	1.6680	1.5188
324	Metal Coating and Allied Ser	1.4907	1.5993	1.6133
325	Miscellaneous Fabricated Wir	1.5182	1.7062	1.4790
326	Steel Springs, Except Wire	1.5067	1.5962	1.4369
327	Pipe, Valves, and Pipe Fitti	1.3889	1.5190	1.7381
329	Fabricated Metal Products, N	1.4920	1.7137	1.5570
332	Farm Machinery and Equipment	1.4060	1.6290	1.7633
334	Construction Machinery and E	1.3781	1.6754	1.6330
335	Mining Machinery, Except Oil	1.4401	1.6938	1.6372
338	Conveyors and Conveying Equi	1.3939	1.5697	1.6437
340	Industrial Trucks and Tracto	1.4102	1.6661	1.6098
341	Machine Tools, Metal Cutting	1.4399	1.5808	1.5413
343	Special Dies and Tools and A	1.4151	1.4350	1.4788
346	Metal Working Machinery, N.E	1.4399	1.5694	1.4937
347	Food Products Machinery	1.5558	1.7297	1.5098
349	Woodworking Machinery	1.6258	2.1420	1.4644
352	Special Industry Machinery,	1.4984	1.6955	1.5463
353	Pumps and Compressors	1.3669	1.5494	1.7688
355	Blowers and Fans	1.4106	1.6090	1.6163
356	Industrial Patterns	1.5329	1.4880	1.5229
359	General Industrial Machinery	1.4395	1.6021	1.5796
361	Machinery, Except Electrical	1.4068	1.4775	1.5265
362	Electronic Computing Equipme	1.3450	1.3696	1.7833
364	Scales and Balances	1.5210	1.6149	1.7869
365	Typewriters and Office Machi	1.4223	1.5181	1.7353
367	Commercial Laundry Equipment	1.5424	1.8523	1.5254
368	Refrigeration and Heating Eq	1.4041	1.6312	1.6825
370	Service Industry Machines, N	1.4253	1.5955	1.7692
373	Switchgear and Switchboard A	1.4640	1.6578	1.6753
375	Industrial Controls	1.5174	1.7251	1.7116
378	Electrical Industrial Appara	1.6706	2.0428	1.4712
385	Household Appliances, N.E.C.	1.4752	1.8124	1.7156
389	Radio and TV Receiving Sets	1.6215	2.0536	1.8607
390	Phonograph Records and Tape	1.7279	2.1635	2.1853
392	Radio and TV Communicatoin E	1.6243	1.6783	1.6418
394	Semiconductors and Related D	1.3941	1.2829	1.4997
395	Electronic Components, N.E.C	1.6771	2.0592	1.8221
399	Engine Electrical Equipment	1.4829	1.7269	1.6376
400	Electrical Equipment, N.E.C.	1.7328	2.2280	1.5787
401	Truck and Bus Bodies	1.5326	1.7228	1.4720
402	Truck Trailers	1.4368	1.6613	1.5653
403	Motor Vehicles	1.2627	1.6789	2.1324

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
404	Motor Vehicle Parts and Acce	1.4657	1.7862	1.4997
405	Aircraft	1.4111	1.9892	1.7077
407	Aircraft and Missile Equipme	1.4449	1.6336	1.6694
409	Boat Building and Repairing	1.5259	2.8562	2.1489
410	Railroad Equipment	1.4961	4.0602	1.6772
411	Motorcycles, Bicycles, and P	1.4993	3.8471	1.8099
412	Travel Trailers and Campers	1.6172	2.3622	1.7026
413	Mobile Homes	1.7452	16.1292	2.3009
414	Motor Homes	1.3865	3.8803	2.6197
415	Transportation Equipment, N.	1.4202	2.2776	1.7766
418	Automatic Temperature Contro	1.8632	1.9219	1.4058
420	Surgical Appliances and Supp	1.4408	1.4633	1.6587
421	Dental Equipment and Supplie	1.5444	1.8032	1.5337
423	Optical Instruments and Lens	1.3872	1.3590	1.6879
424	Ophthalmic Goods	1.5715	1.5432	1.4702
425	Photographic Equipment and S	1.4308	1.4537	2.0306
426	Jewelry, Precious Metal	1.4998	2.3829	1.7226
427	Jewelers Materials and Lapid	1.3402	1.4810	2.4982
429	Costume Jewelery	1.4306	1.4192	1.5261
431	Games, Toys, and Childrens V	1.5493	1.6784	2.2202
433	Sporting and Athletic Goods,	1.6038	1.7195	1.6245
435	Lead Pencils and Art Goods	1.7193	2.0807	1.6610
436	Marking Devices	1.6674	1.9266	1.5153
443	Burial Caskets and Vaults	1.4486	1.6473	1.7649
444	Signs and Advertising Displa	1.4792	1.5493	1.6915
445	Manufacturing Industries, N.	1.8248	2.0299	1.4627
446	Railroads and Related Servic	1.3779	1.3983	1.5140
447	Local, Interurban Passenger	1.5991	1.4933	1.4128
448	Motor Freight Transport and	1.6150	1.6057	1.6485
449	Water Transportation	1.3800	1.9321	1.6024
450	Air Transportation	1.3585	1.6405	1.6705
452	Transportation Services	2.0140	2.0980	1.4530
453	Arrangement of Passenger Tra	1.7351	1.7518	1.5492
454	Communications, Except Radio	1.2816	1.1866	1.3389
455	Radio and TV Broadcasting	1.6666	1.7912	2.0016
456	Electric Services	1.2841	1.2438	1.7114
457	Gas Production and Distribut	1.4793	1.6224	1.9459
458	Water Supply and Sewerage Sy	2.2782	2.4054	1.3487
459	Sanitary Services and Steam	1.6043	1.5499	1.4895
460	Recreational Related Wholesa	1.3764	1.3201	2.3180
461	Other Wholesale Trade	1.6683	1.5796	1.5180
462	Recreatoinal Related Retail	1.4235	1.3446	1.6238
463	Other Retail Trade	1.8918	1.7270	1.3845
464	Banking	1.5799	1.5878	1.5325
465	Credit Agencies	1.8450	1.7173	1.3941

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
466	Security and Commodity Broke	1.3238	1.2646	1.5621
467	Insurance Carriers	2.0958	3.2671	1.9944
468	Insurance Agents and Brokers	1.5203	1.4845	1.6115
469	Owner-Occupied Dwellings	1.2153	1.1439	.0000
470	Real Estate	1.2847	1.2127	1.8951
471	Hotels and Lodging Places	2.1384	2.5443	1.4532
472	Laundry, Cleaning and Shoe R	1.8781	1.8891	1.4458
473	Funeral Service and Cremator	1.6275	1.8638	1.6646
474	Portrait and Photographic St	1.6386	1.5842	1.4658
475	Electrical Repair Services	1.3654	1.3402	1.6604
476	Watch, Clock, Jewelry and Fu	1.3045	1.2343	1.5455
477	Beauty and Barber Shops	1.6936	1.5635	1.3710
478	Miscellaneous Repair Shops	1.3047	1.2313	1.4531
479	Services to Buildings	2.2022	1.8846	1.3285
480	Personnel Supply Services	1.8399	1.5827	1.3501
481	Computer and Data Processing	1.2615	1.2057	1.5729
482	Management and Consulting Se	1.7873	1.7012	1.4173
483	Detective and Protective Ser	2.1529	1.8878	1.3603
484	Equipment Repair and Leasing	1.3090	1.2407	1.6914
485	Photofinishing, Commercial P	1.5353	1.4844	1.4638
486	Other Business Services	1.7643	1.7194	1.4078
487	Advertising	1.6233	1.5204	1.4519
488	Legal Services	1.4973	1.4664	1.6966
489	Engineering, Architectural S	1.5095	1.4432	1.5885
490	Accounting, Auditing and Boo	1.5170	1.4187	1.4763
491	Eating and Drinking Places	2.0671	2.3577	1.5064
492	Automobile Rental and Leasin	1.4522	1.4992	1.7176
493	Automobile Repair and Servic	1.4596	1.6282	1.8864
494	Automobile Parking and Car W	1.6552	1.6813	1.5672
495	Motion Pictures	2.2476	2.8057	1.6097
496	Dance Halls, Studios and Sch	3.5596	3.4573	1.3326
497	Theatrical Producers, Bands	3.0599	3.4235	1.3685
498	Bowling Alleys and Pool Hall	2.7062	3.0371	1.3775
499	Commercial Sports Except Rac	1.6299	1.6000	1.7685
500	Racing and Track Operation	1.3927	1.3142	1.5651
501	Membership Sports and Recrea	3.0764	4.6373	1.3802
502	Amusement and Recreation Ser	2.3194	2.2451	1.3723
503	Doctors and Dentists	1.5527	1.5317	1.7640
504	Hospitals	1.8261	1.9392	1.4297
505	Nursing and Protective Care	2.1086	2.1263	1.4011
506	Other Medical and Health Ser	1.6935	1.7930	1.4980
507	Elementary and Secondary Sch	3.1906	3.8064	1.3449
508	Colleges, Universities, Scho	1.7695	1.7308	1.4163
509	Other Educational Services	1.4970	1.5534	1.8607
510	Business Associations	1.9684	2.3008	1.5530

Appendix. Continued.

NUMBER	SECTORS	GROSS OUTPUT MULTIPLIERS	VALUE ADDED MULTIPLIERS	EMPLOYMENT MULTIPLIERS
511	Labor and Civic Organization	3.1222	3.9639	1.3693
512	Religious Organizations	2.0417	2.0886	1.3732
513	Other Nonprofit Organization	1.8256	1.9706	1.5152
514	Residential Care	2.8293	3.3097	1.3688
515	Social Services, N.E.C.	1.7660	1.5421	1.3531
516	U.S. Postal Service	1.6738	1.5222	1.3718
517	Federal Electric Utilities	1.2312	1.4359	2.0733
518	Other Federal Government Ent	1.5451	1.4878	1.4775
519	Local Government Passenger T	1.9759	2.4391	1.3741
520	State and Local Electric Uti	1.4461	1.8826	1.8964
521	Other State and Local Govt E	1.6391	1.8161	1.5117
525	Government Industry	1.9885	1.5853	1.2947
526	Rest of the World Industry	.9923	.9954	1.2947
527	Household Industry	5.6311	3.7420	1.2947
528	Inventory Valuation Adjustme	1.0000	1.0000	.0000
529	Potatoes	1.3080	1.2545	2.1045