The Impact of Space and Space-Related Activities on a Local Economy

A Case Study of Boulder, Colorado

Part II
The Income-Product Accounts

by

Don Seastone, Ernest R. Bonner Charles M. Franks and William McCormick

prepared under

National Aeronautics and Space Administration
Research Grant No. NsG - 474

Bureau of Economic Research
nstitute of Behavioral Science
University of Colorado
Boulder, Colorado

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INTRODUCTION

The administrative budget for space research and technology in fiscal 1966 was estimated at $5.1 billion, or about five per cent of estimated total Federal administrative expenditures. This represents an increase of $200 million in 1966, a relatively small gain compared to the annual increases of about $1 billion over the past four years.[1/] In less than a decade the space effort has grown from a minor program to a major component of Federal government activity. It is inevitable that a program of this magnitude will have significant economic consequences. Since the space program is supported by public funds its budget has been subject to careful scrutiny. Much less attention has been paid to the job and income-creating aspects of space research and technology.

It should be evident to even the most casual observer that the space program has created thousands of new jobs, and has generated billions of dollars of new income. But what of its impact on a local community? The answer to this question depends upon a number of variables. Although much of the space program is concentrated in a relatively small number of states, the interdependence of economic activities in the Nation leads to widely diffused income and employment effects. Most communities probably do not include a "space sector," and the impact of the space program on such communities is not readily apparent. The network of sub-contractors, and suppliers to contractors and sub-contractors, spreads throughout the national economy, and many of the indirect links to the space program are not easily traced. Even if a community has a space sector, the measurement of the impact of space and space-related programs on the local economy requires intensive analysis. The objective of this study is to measure these impacts on an economy of the latter type -- that of Boulder, Colorado.

There were several reasons for selecting Boulder as the object of this study. First, the Boulder economy has fairly well-defined boundaries; it is a "local" community rather than an indistinguishable part of a larger agglomeration. It is small enough to permit intensive analysis without a major expenditure of research funds. Also, the combined space and space-related sectors in Boulder are the third largest economic activity in the community.

[1/] The Budget in Brief, Fiscal Year 1966, Executive Office of the President, Bureau of the Budget, Washington: U. S. Government Printing Office (1965), p. 30.

The present study consists of two parts. Part I is an input-output analysis of the Boulder economy. Its objective was the development of a series of income and employment multipliers for each sector of the local economy which would permit accurate estimates of the total income and employment generated in the community by expenditures on a variety of space and space-related programs.

There was a final reason for selecting an area of the size and industrial composition of Boulder for this study. Earlier small-area input-output studies have produced excellent estimates of inter-industry transactions. But to our knowledge no earlier study has devoted as much attention to the household or consumer side of the local economy as the present one. One of the hypotheses which we were interested in testing was that earlier small-area input-output studies had overstated the induced effects on local production and income resulting from exogenous changes in final demand. The evidence in this study, in our opinion, clearly supports this hypothesis. The major innovation in Part I was the development of a new type of income multiplier which we believe has resulted in more accurate estimates of induced changes in the economy than earlier studies have produced.

The local impact of any program which affects a community through its final demand sector will vary significantly with the industrial structure of the community involved. Large metropolitan areas are expected to show a significant amount of interdependence among the various sectors of the local economy. An economy such as that of Boulder is relatively "open," however. That is, there is a great deal of specialization in a community of this size, particularly one which contains a major university, and there is heavy reliance on purchases from elsewhere in the State and in the Nation. A priori, it might be expected that such a community would show virtually no interdependence. Our study shows that this is not the case, although the major impacts resulting from exogenous changes in final demand clearly come by way of the household sector.

The measurement of local impacts involves lengthy and detailed analysis, and no attempt will be made to summarize the analysis here. But the results can be given in terms of an example. Shortly before the analytical work on this study was completed, the National Aeronautics and Space Administration awarded a $9 million contract to one of the establishments in the Boulder space sector. Assuming that this represented an addition to existing contracts, and ignoring the capital effects (i.e. assuming that no new plant capacity will be added), after all the direct, indirect and induced effects have worked themselves out

the $9 million contract will add an estimated $15.5 million to the total output of the Boulder economy. Included in this amount is an estimated addition to household income of $3.6 million which is expected to lead to an estimated increase of 678 man-years of employment. Thus even in a small and relatively open economy, space expenditures have a substantial multiplier effect.

Part II of the study, which appears in a separate volume, reports the results of a companion investigation concerned with the development of income and product accounts for the Boulder area analogous to those reported regularly for the Nation as a whole. Aggregate income and employment multipliers for the local community were also constructed in this part of the study. The data collected by survey for construction of the basic input-output table were also used in the development of local income and product accounts. Both the input-output and the income-product studies required supplementary data taken largely from published sources, but the two studies draw upon a common body of original data.

It should be emphasized that the two parts of the study are not competitive in any sense; rather they are complementary. The major difference is that in Part I the emphasis has been upon disaggregation, while in Part II the approach has been an aggregative one. It is the hope of the authors of both parts of the study that at least modest contributions have been made to regional economic analysis by the concepts which have been developed and statistically implemented in these reports.

The input-output analysis was carried out under the supervision of the Project Director assisted by the co-authors of Part I of the report. The income-product accounts were developed under the direction of Dr. Don Seastone, Associate Professor of Economics at Colorado State University, and a Research Associate in the Bureau of Economic Research at the University of Colorado. Both parts of the study were genuinely team efforts, however, and the authors of the two reports were assisted by a large number of graduate research assistants, programmers, secretaries, and clerical assistants, whose efforts were indispensable to the successful completion of the project. Finally, a study of this kind could not have been successfully completed without the cooperation and support of the Boulder business community and the many residents who participated in the household survey. The entire staff of the NASA-Boulder local impact study join the Director in extending sincere gratitude to the businessmen and residents of Boulder who devoted so much of their time and cooperated so fully in providing the basic data upon which the analysis rests.

The staff members of the NASA-Boulder local impact project are listed on a preceding page. The authors of the reports gratefully acknowledge the contributions to this study made by the supporting staff. We are particularly grateful for the important contributions made by the project consultants who are listed with the project staff.

Hundreds of businessmen and residents gave unstintingly of their time, and provided us with highly detailed and confidential information, but a number of individuals must be singled out for special mention because without their specific contributions the business, government and household surveys could not have been completed. It is a pleasure to acknowledge the contributions to the study made by the following: Mr. Francis Reich and Mr. Robert Schelling of the Boulder Chamber of Commerce; Mr. Archie Twitchell, Mr. James Bowers, Mr. Marvin Gause, Mr. Carl Chapel and Mr. Fred Burmont, representing various departments and agencies of the City of Boulder. From the University of Colorado, Mr. Chester Winter and Mr. Mark Meredith (Planning Office), Mr. Raymond Johnson (Purchasing Services), Mr. James Byrum (Data Processing), and Mr. John W. Noaecker (Physical Plant). Others who provided invaluable data include Mr. Charles Veysey (Director of Accounting, Boulder Valley School District), Mrs. Mildred Stilley (Administrative Assistant to the Board of County Commissioners, Boulder County), Mr. Thomas Rizzi (Chief of Fiscal Section, Boulder Laboratories, National Bureau of Standards); Mr. Horace Brannon and Mr. Stephen Hoskin (National Center for Atmospheric Research); Mr. R. C. Mercure, Jr., Director, and Mr. G. W. Burkhead, Controller (Ball Brothers Research Corporation); Mr. E. C. Burns, Vice-President, and Mr. M. R. Calkins, Auditor (Beech Aircraft Corporation).

While the assistance provided by those named above, and by many others, is gratefully acknowledged, it is necessary to add the customary caveat that any errors of interpretation, omission, or of any other kind are the sole responsibility of the authors.

Boulder, Colorado
July, 1965

William H. Miernyk
Project Director

PART II

THE INCOME - PRODUCT ACCOUNTS

VI

OBJECTIVES OF THE REGIONAL INCOME-PRODUCT ACCOUNTS

Two major objectives weighed heavily in the construction of the Boulder area income and product accounts. The first emphasized the accounts *per se*, since the task of measuring the level of economic activity in Boulder was considered an important analytical goal in itself. The second was to design a set of income and product accounts which would accurately reflect the aggregate multiplier effects of space expenditures, and the changes in the local economy occasioned by a change in the magnitude of those expenditures. In this chapter, we first consider the income-product accounts as techniques for measuring regional economic activity, and secondly we turn to the accounts as instruments for a general multiplier analysis of space expenditures.

The Income-Product Accounts as Economic Indicators

The development of regional accounts -- About twenty years after the National Bureau of Economic Research and the U. S. Department of Commerce pioneered domestic efforts to construct national income and product accounts,[1/] economists with regional science inclinations began the serious work of designing analogous measures of economic activity at local, state and regional levels. Aggregate economic analysts in the 1930's had been seriously hampered in explaining the determinants of national income, both in terms of levels and variations, by the absence of a reliable framework for data analysis. As regional scientists began to apply economic tools to explain such phenomena as industrial location and variations in regional growth, they too encountered the need for systematic measurement of economic activity. Two of the major systems of measurement and analysis which have emerged in regional studies are the inter-industry relationships of input-output analysis discussed in Part I, and the aggregate relationships of regional income and product accounts.

By 1957, the National Bureau of Economic Research was able to bring together a group of regional scientists to report on the state of regional analysis,

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[1/] Paul Studenski, *The Income of Nations*, New York: New York University Press (1958).

including the measurement of regional income.[2/] The efforts of professional economists such as Werner Hirsch,[3/] Charles Leven,[4/] and Harvey Perloff[5/] to systematically organize regional income and product accounts attracted the attention of Resources For The Future at about the same time. With Perloff, its director of regional analysis spearheading the effort, Resources For The Future helped bring together a group of economists and others for an intensive analysis of regional accounts. In 1960 the Committee on Regional Accounts met in formal conference at Washington University, St. Louis, and RFF published the proceedings of the conference in 1962.[6/]

The proceedings of the first conference represented an attempt to summarize the state of regional accounts as they existed in 1960, and the discussions were almost entirely general in scope. By the time of the second conference, in 1962, the contributors had moved beyond general models. They had concentrated on such factors as the measurement of public sector activities in regional accounts and the implications of these accounts for public decision-making; the relationships between stocks and flows in regional growth, and other specific topics.[7/]

[2/] National Bureau of Economic Research, Regional Income, Studies in Income and Wealth, Vol. 22, Princeton University Press (1957).

[3/] Werner Z. Hirsch, "Regional Accounts: Objectives and Framework," Proceedings, American Statistical Association (1959).

[4/] Charles Leven, Theory and Method of Income and Product Accounts for Local Areas, Ames, Iowa (1958), reprinted by the Center for Regional Economic Studies, University of Pittsburgh (1963).

[5/] Harvey Perloff, et al., Regions, Resources and Economic Growth, Baltimore: Johns Hopkins University Press (1960).

[6/] Design of Regional Accounts, Papers Presented at the Conference on Regional Accounts, 1960, sponsored by the Committee on Regional Accounts, edited by Werner Hochwold, published for Resources For The Future, Inc., by the Johns Hopkins University Press, Baltimore (1962).

[7/] Elements of Regional Accounts, Papers Presented at the Conference on Regional Accounts, 1962, sponsored by the Committee on Regional Accounts, edited by Werner Z. Hirsch, published for Resources For The Future, Inc., by the Johns Hopkins University Press, Baltimore (1964).

Perhaps the most obtrusive characteristic of regional accounts in their present state of development is the wide variety of accounting systems employed by the different contributors; a function of the diverse purposes for which the accounts are formulated and the research funds available. Leven's and Perloff's contribution to the second conference, for example, focuses on the relationships between stocks and flows in a developmental context, the first explicit attempt to assess the impact of the stock of human and natural resources on the flow of regional economic activity.[8/] At the same conference, on the other hand, Burkhead concentrated on the development of a highly detailed analysis of public sector activity which he felt had been too long neglected in regional accounting systems.[9/] Thus there is developing a wide variety of an increasingly sophisticated set of systems for measuring the activities generated by regional economies. The proper regional accounting system to be used in a specific study will depend upon the precise purposes of the particular study.

The requirements of the Boulder accounts -- One of the major requirements in the design of the Boulder area accounts was that they reflect as accurately as possible the impact of space and space-related expenditures on the local economy.

In designing the accounts for this study, an effort was made to follow wherever possible the accounting conventions of the national income accounts developed by the U. S. Department of Commerce. The national accounts have familiarized the public with such terms as "Gross National Product" and "National Income." This study builds on the national income accounting base, using the same descriptive phrases insofar as possible, and following the same procedures where this can be done without compromising the other objectives of the study.

The design of the Boulder regional accounts was also influenced by the fact that the income-product accounts were constructed in conjunction with the

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[8/] Harvey Perloff and Charles Leven, "Toward an Integrated System of Regional Accounts: Stocks, Flows and the Analysis of the Public Sector," ibid., pp. 175-210.

[9/] Jesse Burkhead, "Public Finance as an Integral Part of Regional Accounts," in Elements of Regional Accounts, ibid., pp. 51-77.

development of an inter-industry table for the same area based to a large extent on common data. The complimentary input-output approach affects the income-product design in two ways. First, some interesting variations of regional accounts, such as Leven's value-added sector classifications need not be extensively used here since value-added data are included in the input-output matrix.[10/] Similarly, Leven's and Tiebout's experiments with "from-to" or "rows only" tables were not relevant to the present study because of the availability of a fully-developed input-output table.[11/] Thus in the present study it was possible to concentrate on data collection in areas and to an extent often precluded in previous studies.

The importance of the public sector in the Boulder economy also helped shape the requirements of the Boulder income-product accounts. Most importantly, Boulder is the location of the University of Colorado's main branch, which in effect is the city's largest "industry." Boulder is also the county seat of an important metropolitan county. Moreover, the University complex has attracted other public-sector activities. These include the Boulder Laboratories of the National Bureau of Standards and the Joint Institute for Laboratory Astrophysics. The National Center for Atmospheric Research, also in the public sector, is almost entirely supported by Federal grants. The space-related activities of private firms such as Ball Brothers and Beech Aircraft, both important recipients of Federal government contracts, are also closely tied to the public sector.

Because of the importance of the public sector it was necessary to design the regional income-product accounts in a way which would focus attention on government activity at all levels of organization and on the many functions performed. In effect, it was possible in this study to implement many of Burkhead's suggestions relating to the public sector in regional accounts; that is, to place more stress on the details of public activities than is found in earlier studies.[12/] To accomplish this, four divisions of government were used -- Federal government, State government exclusive of the University of Colorado,

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[10/] Leven, op. cit.

[11/] Leven, op. cit.; Charles Tiebout, et al., Markets for California Products, Sacramento: California Development Agency (1961).

[12/] Burkhead, op. cit.

the University of Colorado, and local government. In every instance in which the division is pertinent, government expenditures are divided between current and capital spending. In addition to the general operations of government, public enterprise activities have been separately reported where data are available, as have the transfer-trust fund activities of the various government divisions.[13/]

The design of the Boulder area income and product accounts was also influenced by the growing need of other localities and regions to investigate their economic bases as they contemplate development and planning problems. Hopefully, a carefully conceived and well-documented set of regional accounts for Boulder will provide useful benchmarks for subsequent studies by other research groups investigating similar problems of economic development.

Local Multiplier Analysis

Income-product accounts are useful for describing the broad outlines of a regional economy. But the time and expense involved in their construction can scarcely be justified unless they are to be incorporated within the analytical framework of an economic model. Although it is of some interest to know, for example, that the level of Gross Area Product in the Boulder area in 1963 was $178,325,957, it is clearly necessary to know more than this if Boulder area growth potential is to be clearly understood. The income-product accounts, in other words, must be put to more dynamic uses than the ex post description of a previous period. Fortunately the accounts are adaptable to more analytic uses and, indeed, their major purpose in this study is to demonstrate how the Boulder area is likely to respond to a specified set of changes in exogenous variables.

The basic purpose of this study is to determine the economic impact of space and space-related expenditures on the Boulder economy. The contribution of income-product accounts to the impact study is in the formulation of an aggregate multiplier which identifies the total changes in income, expenditures, and product which grow out of an original change in space expenditures in Boulder. An aggregate multiplier is a formal model which shows the continuing economic repercussions of an original change in demand. More specifically, we trace through the effects of variations in space and other spending upon business

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[13/] For more detail on the treatment of government, see Chapter IX.

decisions to vary the units of inputs employed, the corresponding changes in productive activity and income flows, and the resultant changes in household consumption expenditures based upon changes in Disposable Personal Income.

To quantify this sequence of economic events, from the first change in, say, space expenditures to the last induced change in household purchases, it was necessary to construct a Boulder area consumption function. This function is based on some 800 household interviews[14/] and shows the relationship between family spending and family Disposable Personal Income. A basic requirement for multiplier analysis is the marginal propensity to consume (mpc), which is the relationship between changes in Disposable Personal Income and the resultant changes in household consumption expenditures. The mpc identifies the household consumption response to an initial change in Disposable Personal Income which in turn grows out of an original change in, say, space expenditures and the resulting decisions by local businesses to vary the levels of inputs and outputs. Computing a multiplier is thus the analytical process of quantifying the sequence of household reactions to consecutive changes in Disposable Personal Income.[15/] At the same time the multiplier provides an estimate of the effects of variations in space expenditure on the local economy. It also permits estimation of the impact of other forces on Boulder income, for example the expansionary forces of the University of Colorado with its large payroll and purchasing activities.

The major difference between national and regional multiplier analysis as demonstrated in this study is in the construction of the Boulder area consumption function. At the national level the most important leakages from the stream of Disposable Personal Income are the propensities of households to save part of income, and the obligations of these households to meet personal tax liabilities. Both of these drains have the effect of limiting personal consumption expenditures by households and lowering the value of the multiplier. Another leakage, much more important regionally than nationally, is the propensity of households to import commodity purchases from the "rest-of-the-world." At the national level the propensity to import from foreign countries is relatively

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[14/] The household interviews are discussed in Chapter III of Part I.

[15/] For a more detailed discussion of the multiplier process, see Chapter IX.

small; in 1963, $26.3 billion out of a Disposable Personal Income of $403 billion. At the regional level, however, the propensity to import assumes much more importance for two reasons. First, households in Boulder import directly by making purchases in the Denver metropolitan region and from other business establishments outside Boulder. Secondly, Boulder firms import most of the goods subsequently sold to Boulder residents. Such imports depress the value of the local multiplier, since the income flows generated by these expenditures will be directed to outside firms and households. An important part of this study is the identification of patterns of imports by local households and business establishments.

The local consumption function not only identifies the import leakages which depress the value of the local multiplier, it simultaneously identifies the broader regional impact of space and other expenditures. What represents a leakage from the Boulder income stream constitutes incremental income to the Denver Metropolitan Area, other parts of the State of Colorado, and the "rest-of-the-world." Thus, in effect the aggregate multiplier analysis shows the <u>total</u> income effects of a specified change in expenditures, and the allocation of additional income among Boulder, metropolitan Denver, the rest of the state, and the "rest-of-the-world."

VII

DATA COLLECTION PROCEDURES FOR THE INCOME-PRODUCT ACCOUNTS AND AGGREGATE MULTIPLIER ANALYSIS

The Household Survey

One of the major objectives of this study was the acquisition of reliable data concerning household economic behavior. From the original research proposal to the final write-up, the importance of precisely identifying the income and expenditure characteristics of Boulder-area households was continuously emphasized. In the early stages of the project a high priority was assigned to sampling procedures and the design of a questionnaire capable of eliciting the necessary data on household activities. The design of the sample and the significance of the results have been discussed in Part I, and this section deals with the questionnaire used in the household survey.

The questionnaire -- The fundamental data sought in the household questionnaire involve the level and sources of family income and the level and composition of family expenditures. In the interest of building rapport with the respondents less detailed and perhaps less personal data were sought first. Four categories of questions preceded the vital inquiries into income and expenditures.

The first set of questions identified the personal characteristics -- age, sex, race, marital status, education, and family size -- of the heads of households. The second set of questions covered employment status including the location, longevity and type of employment. A third set concerned housing characteristics, ranging from assessed and market values of houses to utility costs and the owner's residence for renters. The final part of the rapport-building section of the questionnaire centered on such behavioral and attitudinal variables as degree of geographic mobility, market comparison of Boulder and outside business firms, public sector activities ranked in terms of needed expansion, and assessment of the value and role of space and space-related activities.

Earned income. With the introductory questions in hand, the interview was then directed to a detailed analysis of income levels and sources. One category of data involved earned income (as opposed to transfer payments) for the calendar year 1963. Earned income was defined as the usual factor payments included in national and regional income accounts: wages and salaries,

dividends, personal interest, net rental income of individuals, and net income or profits of unincorporated firms. A sixth classification, "other, specify," was used for the purpose of inducing respondents to think again of income receipts and was later assigned by questionnaire auditors to one of the specified earned income or transfer classes. When employer and/or employee contributions to social insurance or private pension, health or welfare funds were identified here, the data were not used because it was felt that the business survey would be more accurate in estimating the total amount of these supplements to wages and salaries. Ultimately, such items as employer supplements were included with wages and salaries in the category "compensation of employees."

These earned income categories represent the larger part of the income account referred to as Personal Income. Data from the household survey, when combined with personal transfer payments, make possible a first determination of Boulder area Personal Income.

Wage and salary data represent gross wage and salary receipts not corrected for payroll deductions such as taxes, insurance, savings bonds, etc. All personal income receipts, whether earned or in the form of transfer payments, were divided according to source, inside or outside Boulder. Thus, out-commuter wage and salary receipts, dividends received from corporations outside Boulder, and similar payments were identified for Boulder area residents.

Gross dividend receipts were defined exclusive of insurance dividends, which were treated as a deduction from insurance premium expenditures at a later point in the questionnaire. Personal interest income was defined in terms of private bonds, savings accounts, etc. The definition of interest on government bonds as transfer receipts is arbitrary and debatable, and was used here simply to make the category consistent with the national accounts. Net rentals were defined as gross rental receipts minus all expenses on rental property and real estate. Royalties were included in net rent. Net income or profits of unincorporated firms were included whether or not they had been withdrawn from the firm.

Transfer payments. To distinguish in some detail between public and private transfer payments, and within the public sector among Federal, State and local sources of transfers, several forms of transfers were identified. The first transfer item, unemployment compensation, is a State payment administered by the State Department of Employment through local offices. Receipts of social security payments from the Federal government was the next transfer item recorded, followed by State old age pension receipts, again administered by local

offices. A broad category entitled "straight welfare payments" was used to record the transfers administered by the Boulder County Welfare Department and includes such items as aid to dependent children, aid to the blind, etc. In this instance, of course, as in others, it is recognized that the ultimate source of funding may be either State or Federal government.[1/]

Workmen's compensation payments for job-related injuries were identified as transfers originating in the State government and included medical as well as cash payments. Separate treatment was accorded veterans' payments, largely from the Federal government, excluding educational assistance under the G. I. Bill. Educational assistance was a separate transfer classification, including not only Federal tuition payments and cash items but State and local scholarships as well.

Because of the influence of University students on the local economy, private transfers to the Boulder area were included in Personal Income. This is at variance with national accounts procedures in which all personal transfers are excluded from Personal Income. To exclude the large personal transfers to students, however, would be to ignore an important source of consumer expenditure in the Boulder area. The personal transfers to Boulder residents, however, were partially offset by transfers from Boulder residents to those outside the community. Thus only a net personal transfer item was built into the area's Personal Income account. Private transfers include all private gifts, prizes, awards and educational assistance from families. Finally, an "other" category was used for miscellaneous transfers, particularly to record interest on government bonds and private pension income.

These categories of earned income and transfer payments (receipts) were used primarily for the purpose of formulating Personal Income and Disposable Personal Income accounts. To identify other funds available for financing current household consumption expenditures, three additional revenue sources were identified, but were not included in the Personal Income or Disposable Personal Income accounts. The first was sales of existing assets, specifically durable goods such as automobiles, and stocks and bonds. Personal, installment and insurance policy loans were identified separately. Finally, changes in personal bank savings were examined to identify the amount of accumulated savings used for current expenditures. While these three sources of funds are not

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[1/] Intergovernmental transfers are explicitly identified in Chapter IX.

germane to the income and product accounts, their values are interesting for other reasons, including the reconciliation of current Disposable Personal Income and current expenditures. They also helped us estimate debt creation at the household level as a residual.

Consumer expenditures. There were a number of reasons for quantifying the level and composition of personal consumption expenditures by households. A Gross Area Product account, for example, requires an estimate of spending by household consumers, while aggregate multiplier analysis requires an estimate of the level of consumer expenditures by Boulder area residents both inside and outside the study area. For this and other reasons considerable time and effort were devoted to accurate measurement of consumer expenditures.

All expenditures by households were divided into those inside and outside the Boulder area, and a ten-sector model was used to allocate expenditures by industry. The first and largest type was retail expenditures, and the first category within the retail sector was automotive dealers, divided into new car, used car, and parts-repair classifications. As in all consumption items, only the final dollar value of 1963 purchases were recorded. If, for example, a car was purchased in 1962 but payments were made throughout 1963, no entry was made. Similarly, if a new car were purchased in 1963, and only partially paid for in that year, the full purchase price was included as a current consumption expenditure. The method of payment was identified but was not used for income-product accounting. Used car purchases, of course, were treated differently. A used car purchased in 1963 represented the resale of an existing asset. Clearly the dollar value of the sale overstates the current level of final product since it includes assets manufactured in a previous period. The only current economic product associated with the sale of a used car is the service rendered by the used car agent, if an agent is involved. Therefore in used car purchases, only the mark-up of the agency was recorded in measuring consumer expenditures. In regard to automotive dealers parts and repairs, only expenditures for parts were noted, repair services being treated in a later category called "other services."

Another category under retail purchases was gasoline service stations, and this included all expenditures at these establishments. Eating and dining included not only the obvious expenditures at restaurants, but also expenditures by students and non-students in dormitories, boarding houses, etc. Food store purchases included drugs, kitchenware, and other commodities usually sold at supermarkets.

"General merchandise purchases" was a broad category in the retail sector. It included all spending at department stores except where respondents were able to break out spending on apparel and accessories, a separate retail classification. Furniture, home furnishings and appliances were recorded according to new and used purchases, the same accounting procedure being used here as was employed for new and used automobile purchases. Lumber and building materials purchases were included in the retail sector although treated as an investment expenditure in the accounts rather than as a personal consumption expenditure. A miscellaneous category, "other retail," completed the retail purchases sector.

Wholesale purchases by households were recorded separately from retail purchases. Although small, this activity was included to identify any unusual merchandising practices in the area.

The second expenditure sector was services, in which the first sub-sector was medical and health services. Tuition in a university town is an important spending item, and was therefore recorded separately as a sub-sector. If a family included a student who was head of the household (or a student not head of the household but residing with the family) tuition payments were recorded at this point. If a family had students residing elsewhere, tuition and other educational expenses were treated as gifts to others. The third classification of expenditures under the service sector was a general "other services," and included such items as automobile repairs and professional services. Special expenditures such as vacation expenses were not recorded here but were allocated to the particular sectors involved wherever possible. Lodging expenditures, on the other hand, were included in "other services."

The finance, insurance, and real estate sector was difficult to handle because of the methods used by households in keeping financial records. After an initial period of experimentation, the sector was defined to include four items: (1) regular service charges of banks;[2/] (2) insurance premiums split into life insurance (some part of which was later reassigned to personal savings) and casualty insurance, including accident, health, fire, theft, auto, etc.; (3) real estate service expenditures, including services provided in the sale of used houses purchased in 1963, and service charges on title searches, rental services, selling services, etc.; and (4) interest payments on all

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[2/] Imputed interest payments were estimated from the business survey.

installment loans, including home mortgages. Thus from a homeowner's total payment of principal, taxes, insurance and interest, only the latter two items were recorded in this sector.

Tax payments were reported separately. Personal income taxes were recorded by Federal or State payments. Property taxes were divided between local and State levies, and social security taxes were listed separately.[3/] Non-tax payments included fines and penalties, on the one hand, and fees or permits, such as license plates, vending, hunting, and driver's licenses, on the other. Sales taxes, levied on all commodity sales at retail but not on services, were computed by auditors according to income and expenditure levels. Personal income taxes were defined in net 1963 terms -- 1963 withholding plus current tax payments, minus refunds from 1962 tax payments.

The contract construction sector included expenditures for new homes plus additions and alterations to older homes. Only the purchase price of the new home was included here, interest and service charges being assigned to their appropriate sectors. Consistent with the national accounts, the contract construction totals were later excluded from personal consumption expenditures and treated as an investment expenditure by households operating as business firms.[4/]

Expenditures in the transportation sector did not include expenses growing out of private automobile ownership, but related to public conveyances only. A utility sector included utility expenses paid as part of household rental. The rental sector was for housing rental only, and included student payments for housing, but not board, in dormitories, rooming houses, etc.

Household expenditures for personal home services such as maids and gardeners were distinguished from other service payments. A final expenditure item, usually not treated separately, was gifts to and from others. Because gifts from others is an important part of student income in the income accounts, gifts to others outside Boulder was a necessary offsetting item.

[3/] For a discussion of other kinds of retirement contributions, see Chapter VIII.

[4/] For a discussion of imputed income problems involved in home ownership, see Appendix II-I.

A preliminary attempt was made to reconcile income and expenditure data through the use of two residual categories -- cash repayments and personal savings.

Throughout the study it was necessary to be consistent in the treatment of student income and expenditures. Thus, if a student lived at home with parents or guardians in Boulder, his income and expenditures were aggregated with the rest of the household. If a Boulder student did not reside with his family, he was treated as a separate household.

The Public Sector -- A Census of Government Expenditures and Revenues

Two kinds of government expenditure and revenue data were required to fully probe the impact of the public sector upon the Boulder economy. The first category traces the budgetary processes of governmental units which are either headquartered or have branch offices in Boulder. Since the City of Boulder is the county seat of Boulder County, city and county activities are both concentrated in the study area. The same is true of the University of Colorado which has its main campus in Boulder, although the medical school and major extension division are in Denver. Similarly, the National Bureau of Standards operates a large facility in Boulder along with hybrid Federal-State-University agencies such as the Joint Institute for Laboratory Astrophysics and the National Center for Atmospheric Research. The latter two, although not Federal operations per se, are treated as such since they are financed largely by Federal appropriations. Finally, branch operations of State and Federal government such as the Colorado State Employment Service and the U. S. Post Office also represent government functions identifiable through analysis of their local budgets.

The second type of governmental impact on the local economy grows out of the expenditure and revenue activities of the State and Federal governments which are not processed through a local branch of these governmental units. On the expenditure side are such payments as those by NASA to the local branch of Ball Brothers Research Corporation. There are also transfer payments made directly, for example, by the Social Security Administration to Boulder residents. At the same time, there are large revenues accruing to the State and Federal governments directly such as income tax payments.

Because of the two different kinds and sources of government expenditures and revenues, two kinds of information systems were devised. The first was a census of all government units in Boulder. This included all local government activity, the University of Colorado, and those State and Federal agencies with branch operations in Boulder. The second system for full accounting of

government impact involved the use of the household and business questionnaires to identify (1) the tax payments of individuals and firms directly to State and Federal government, and (2) the transfer receipts of individuals from State and Federal government, as well as business sales to the latter.

Because the University of Colorado looms so large in the Boulder economy, it was treated as a separate government unit. Thus four, rather than three, levels of government activity were analyzed -- local, University of Colorado, State and Federal.

Expenditure and revenue data were collected and analyzed according to (1) current expenditures of general government, (2) capital expenditures of general government, (3) current expenditures of public enterprise, (4) capital expenditures of public enterprise,[5/] and (5) current expenditures of transfer (trust fund) activities.[6/]

Expenditures for all levels of government -- whether general or enterprise, current or capital -- were analyzed in the first instance by function performed, e.g., defense, education, welfare. Secondly, all expenditures were classified according to the geographic location of the recipient -- the Boulder area, the Denver Metropolitan Area (including the parts of Boulder County not included in the study area), the rest of Colorado, and the "rest-of-the-world." A similar division was made for revenues. A final distinction was made for expenditures by industrial sector, to identify the direction of each government unit's expenditure by type of industry recipient.

[5/] It was not possible to separate the public enterprise activities of the University of Colorado from its academic activities because of insufficiency of accounting detail.

[6/] This practice follows the general suggestions made by Burkhead in Elements of Regional Accounts, op. cit. Professor Burkhead's suggestions for the treatment of the public sector in regional accounts formed the basis for much of the present analysis of government expenditures and revenues. For the most part, the data collected for the income-product accounts and the transactions table lent themselves readily to a system of accounts roughly analogous to the Burkhead system. The most notable lack of data for this purpose occurred in the recording of local area payments to outside government agencies. These payments, in the form of State and Federal income taxes, non-tax payments and payments to government trust funds (PERA, social security, etc.) were not readily available. Some of the data were therefore obtained from the household and business questionnaires. As will be noted later, the remaining gaps were filled by estimation.

A listing of the specific agencies and organizations located in the Boulder area and included in the census follows:

1. Local Government

    a. City of Boulder
    b. Boulder County
    c. Boulder Valley School District
    d. East Boulder Sanitation District

2. University of Colorado

3. State Government (not including the University of Colorado)

    a. Department of Employment
    b. Department of Highways
    c. National Guard
    d. Department of Revenue

4. Federal Government (or hybrid government units)

    a. Department of Agriculture
    b. Army Recruiting Station
    c. Federal Bureau of Investigation
    d. National Bureau of Standards
    e. Naval Reserve
    f. Navy Recruiting Station
    g. Post Office
    h. Selective Service Board
    i. Treasury Department
    j. Army Reserve
    k. Air Force Recruiting Station
    l. National Center for Atmospheric Research
    m. Joint Institute for Laboratory Astrophysics

Most of these agencies were studied in depth by members of the staff. In a few instances, such as the recruiting stations, data on operations were estimated according to the number of persons employed.

Three major problems were encountered in the collection of data for the government sector. First and foremost, the agencies did not record income and expenditures by sector and location. The University of Colorado, which keeps data on the location of vendors and destination of expenditures, is an exception. This data problem was not as crucial for the income-product accounts as for the inter-industry table. The accounts required information on the source of government funds and location of expenditure recipients. The input-output table, however, required both sector and location classification in some detail.

Since the necessary data were not available in published form, the data-collection procedure required a lengthy search of each unit's financial records. In most cases, the agency's check registers or payments accounts were examined. Each expenditure was recorded along with the person or firm to whom payment was made. Thus, each person or firm could be placed in a sector and locations could be determined, often in consultation with agency officials.

A second problem involved the separation of all expenditures into those made for current operations and those made for capital expansion or replacement. Most governmental units made some distinction between these two kinds of expenditures. In the cases where the agency itself made a distinction, and expenditures were classified as either current or capital, the agency's definition was accepted -- realizing that the definitions were not necessarily uniform and sometimes arbitrary. Where no distinction was made by the agency, the staff assigned expenditures to capital account on the basis of experience with other agencies.

The third major problem occurred in those units of government which accounted for income and expenditures on a fiscal year basis. Since the Boulder study was based on the calendar year 1963, some adjustments were necessary. However, since a detailed survey of original data sources was required, it was possible to sum monthly or quarterly data for the fiscal years 1963 and 1964 to obtain totals for calendar 1963. Thus, it was necessary to estimate calendar year data from fiscal year data for only one agency, the National Center for Atmospheric Research. And even in the case of NCAR only a part of the data had to be estimated.

No special questionnaire was used in the government survey since the diverse accounting systems used by different agencies did not lend themselves to this approach. Instead, officials of each unit were interviewed separately and data were collected in a manner dictated by their final use in the study.

Some governmental agencies in the area were extensively involved in space activity -- notably the National Bureau of Standards and the National Center for Atmospheric Research. In these instances, that portion of total activity devoted to space or space-related research or development was separated from expenditures associated with non-space activities. The National Bureau of Standards considers a large part of its activity to be space or space-related and National Center for Atmospheric Research officials stated that their entire operation is either space or space-related. Both accounts, fortunately, were

structured in a way which made the separation of space and space-relatd activities relatively easy.[7/]

[7/] See Chapter III for the criteria employed in identifying space and space-related activities.

VIII

INCOME-PRODUCT ACCOUNTS FOR THE BOULDER AREA

A First Set of Basic Accounts

The derivation of Personal Income and Disposable Personal Income -- One of the most widely used indicators of economic activity, both nationally and regionally, is that of Personal Income. In part, its widespread use as a measure of economic performance is due to the ease with which it is understood. Stated simply, Personal Income is that part of the total income stream, generated by current productive activity and transfer payments, which filters down through business and government units to households. In essence, it is the income flow upon which households base their consumption and personal savings plans, and from which they meet their personal tax liabilities.[1/]

Since the U. S. Department of Commerce publishes estimates of state and regional Personal Income each April in the Survey of Current Business, it is natural that regional economists have used the Personal Income concept to measure both levels and changes in economic activity at regional, state and local levels. In this study the household questionnaire was designed to obtain data for the careful measurement of Personal Income in the Boulder area.

Personal Income is here defined as the level of income accruing to households in the Boulder area from current productive activity, and the transfer payment programs of government and business, before personal tax and non-tax liabilities. Unlike the national measure, it also includes net gifts accruing to local residents from outside the area. This was done because of the importance to the study of the University of Colorado student population. Ordinarily (and always at the national level) this kind of personal transfer receipt is excluded from the Personal Income total.

The situs problem is handled simply for Personal Income by including the income of all residents of the study area regardless of the place of employment. Thus,

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[1/] An associated measure, to be discussed subsequently, is Disposable Personal Income which is Personal Income minus personal tax and non-tax liabilities. Actually, personal consumption expenditures of households in most cases is more closely correlated with Disposable Personal Income than with Personal Income. At the same time, however, Personal Income is a more widely used and understood economic indicator.

the income of a Boulder resident working in Denver is included in Boulder area Personal Income, although his productive contribution is made elsewhere.

For the Boulder area, then, Personal Income has three basic components: (1) earned income, (2) transfer receipts from government and business, and (3) net personal gifts. The last measure includes gifts to Boulder residents from outside the area minus gifts from Boulder residents to persons outside the area. Personal transfers within the region (economic transactions involving no current service or product, for example, transfers of existing assets) are excluded from Personal Income.

Earned income is the largest part of Personal Income. The categories of earned income are: (1) wage and salary receipts, (2) dividends (including receipts of Boulder residents from corporations outside the area), (3) personal interest receipts, (4) net rental income of individuals, and (5) net income of unincorporated firms.

A difference between the Personal Income account constructed here and the national accounts involves the concept of imputed income. In the national accounts, two imputed items affect Personal Income -- imputed rental income of homeowners, and imputed personal interest receipts from financial intermediaries. For the Boulder account we first estimated Personal Income exclusive of imputed items, to which various additions were made, including imputations, to formulate a Gross Personal Income account.

Wages and salaries constitute the largest part of Personal Income, shown in Table VIII-1 by geographical source, by public and private units, and by industrial sector. Wage and salary totals do not include retirement taxes or contributions paid by employees or employers to Social Security, the Teachers' Insurance and Annuity Association, the Public Employees' Retirement Fund, Federal employee retirement funds and private pension funds. Although all contributions to retirement plans are excluded from Personal Income, all receipts by individuals from retirement plans are included in Personal Income as government transfer or private pension receipts. This is a departure from the convention followed in the national accounts where social insurance contributions are excluded from but employee and employer contributions to other retirement plans are included in Personal Income.

The other categories of non-transfer Personal Income include: (1) labor income not in wage and salary form, e.g., payments by employers of worker insurance plans or other health and welfare contributions, (2) personal interest income, (3) net rental income of persons, (4) corporation dividend receipts, and

TABLE VIII-1

BOULDER AREA PERSONAL INCOME AND DISPOSABLE PERSONAL INCOME, 1963

Boulder Area Personal Income	Total	Source of income	
		Inside Boulder	Outside Boulder
Total labor income	$119,709,259	$ 88,766,161	$ 30,943,098
Wages and salaries[a/]	119,709,259	88,766,161	30,943,098
From business, total	78,619,502	47,676,404	30,943,098
Extractive	626,170		
Manufacturing	13,741,700		
Space and related	3,258,532		
Trade	11,167,802		
Services	37,386,365		
Contract construction	2,504,465		
Transportation	1,439,139		
Utilities	3,797,485		
F.I.R.E.	4,697,844		
From government, total	40,204,016	40,204,016	
Local	7,021,428	7,021,428	
University	19,472,129	19,472,129	
Other state	193,000	193,000	
Federal	13,517,459	13,517,459	
From households	885,741	885,741	
Total property income	35,533,707	30,740,946	4,792,761
Personal interest income	1,621,437	967,916	653,521
Rental income of persons	11,140,732	9,777,813	1,362,919
Dividend income of persons	3,474,304	732,886	2,741,418
Net income of unincorporated firms	19,297,234	19,262,331	34,903
TOTAL CURRENTLY EARNED INCOME	155,242,966	119,507,107	35,735,859
Total transfers	27,840,502	2,382,611	25,457,891
Government transfers	11,911,316	1,647,871	10,263,445
Unemployment compensation	398,840	398,840	
Social security benefits	3,810,338		3,810,338
Old age benefits	881,581	881,581	
Welfare payments	367,450	367,450	

(continued)

TABLE VIII-1 (cont.)

Boulder Area Personal Income	Total	Source of income: Inside Boulder	Source of income: Outside Boulder
Government transfers (cont.)			
Workmen's compensation	$ 234,280		$ 234,280
Veterans' payments	334,979		334,979
Educational assistance	3,300,342		3,300,342
Military retirement benefits	1,207,436		1,207,436
Other (PERA, TIAA, etc.)	1,376,070		1,376,070
Private pensions	152,897		152,897
Business transfers in bad debt losses	1,328,728	$ 734,740	593,988
Personal transfers (net gifts)	14,447,561		14,447,561
PERSONAL INCOME (NET)	183,083,468	121,889,718	61,193,750
Plus: Imputed rental income	10,220,028	10,220,028	
Imputed personal interest	4,009,714	4,009,714	
Business transfers to non-profit institutions	684,481	204,504	479,977
EQUALS PERSONAL INCOME (GROSS)	197,997,691	136,323,964	61,673,727
Less: Personal tax and non-tax payments	19,847,229	720,808	19,126,421
EQUALS DISPOSABLE PERSONAL INCOME (GROSS)	178,150,462	135,603,156	42,547,306

Allocation of Personal Income	Total	Location of expenditure recipient: Inside Boulder	Location of expenditure recipient: Outside Boulder
Consumption expenditures by households	$141,322,584	$125,237,145	$ 16,085,439
Net purchases from business	121,586,483	121,586,483	
Durables	17,727,927	17,727,927	
Non-durables	60,281,453	60,281,453	
Services	43,577,103	43,577,103	
Net purchases from "rest-of-the-world"	14,742,197		14,742,197
Durables	4,156,695		4,156,695
Non-durables	6,004,482		6,004,482

(continued)

TABLE VIII-1 (cont.)

Allocation of Personal Income	Total	Location of expenditure recipient	
		Inside Boulder	Outside Boulder
Services	$ 4,581,020		$ 4,581,020
Purchases of direct services of households	4,993,904	$ 3,650,662	1,343,242
Compensation of employees	900,559	885,741	14,818
Interest paid	4,093,345	2,764,921	1,328,424
Personal saving including net contractual savings	21,913,655		
Actual consumer expenditure and saving	163,236,239		
Imputed consumption expenditures for services[b/]	14,914,223	14,434,246	479,977
Imputed net rental payments on owner-occupied dwellings	10,220,028	10,220,028	
Imputed factor payments to financial intermediaries	4,009,714	4,009,714	
Consumption expenditures by non-profit institutions	684,481	204,504	479,977
Gross personal consumption expenditures and personal saving	178,150,462		

[a/] Includes wages and salaries gross of personal tax and non-tax liabilities but net of all retirement taxes, including employee and employer social insurance contributions. Other supplementary labor income is included in Personal Income, but aggregated with wages and salaries.

[b/] See Appendix II-I for a discussion of imputed income and expenditures.

(5) profits of unincorporated firms. In all instances the situs problem is handled by including income from these sources for all persons who live in Boulder irrespective of the source of payment. These categories of earned income are also shown in Table VIII-1 by geographical source.

Transfer payments included in Personal Income are divided into government, business, private pension, and personal transfers. Government transfers include a miscellaneous "other" category, comprised of such items as interest payments on government bonds and retirement income from trust funds such as Teachers' Insurance and Annuity Association (financed in Boulder by University trust fund payments), and the Public Employees' Retirement Fund. Following the national accounts convention, interest paid to persons by private firms is treated as earned income, while interest paid by the public sector is treated as a form of transfer payment. Private pension receipts are handled separately and are not treated as a business transfer because they represented a factor cost to business firms at the time the pension fund contribution was made. Since this contribution is not included in the wage supplements shown in Table VIII-1, the proceeds of the pension funds must later be included in Personal Income.

The only business transfer included in Net Personal Income is bad debt loss, although business transfers in the form of charitable contributions are later added to the estimates of Gross Personal Income. Finally, personal transfers in the form of net gifts to Boulder residents are added to complete the construction of Personal Income. Gross Personal Income, which is the Personal Income account to be used subsequently, is computed by adding to Net Personal Income the business transfer of charitable contributions and two items of imputed income, rents and interest.[2/]

The next step in Table VIII-1 involved the subtraction of personal tax and non-tax payments from the Gross Personal Income total to obtain Disposable Personal Income. This is the level of current income available to households to finance current consumption expenditures.[3/]

[2/] For a discussion of the techniques used in estimating the imputed income and expenditure items, see Appendix II-I.

[3/] Consumer expenditures were estimated from the household survey. The imputed expenditure items were derived from the household and business surveys. The consumption and savings behavior of non-profit institutions, the last items used to estimate gross consumption expenditures and savings from net consumption expenditures and savings, was based largely on the business survey.

Area income -- The next income account estimated in this first set of basic accounts corresponds to what is called "National Income" at the national level and is referred to here as Area Income. It is derived in the first instance from Personal Income, but represents a different income concept. Whereas Personal Income measures the level of income flows accruing to area residents, regardless of the nature (earned or transfer income) or geographical source (inside or outside Boulder) of this income, Area Income measures the level of income flows associated with the level of productive activity inside Boulder in 1963. Boulder Area Income is the total income earned by the productive factors employed in Boulder. As such it excludes, of course, all forms of government, business, and personal transfers included in Personal Income, and it includes the gross receipts of all productive factors employed in Boulder before personal and corporate income taxes and retirement contributions are paid. Likewise, while Personal Income includes only that part of corporate profits paid to shareholders as dividends, Area Income includes total corporate profits earned in Boulder operations, i.e., corporate income taxes and corporate retained earnings as well as dividends. Also, Personal Income excludes both employee and employer retirement tax contributions while Area Income includes both items since they represent factor earnings from the point of view of the employee, and factor costs from the point of view of the employer.

The calculations in Table VIII-2 describe the derivation of Area Income from Personal Income. In summary, Personal Income was modified as follows to construct Area Income. Because all retirement taxes and contributions were excluded from Personal Income, they were added to Personal Income in the estimation of Area Income because: (1) employee contributions are paid out of current wage and salary receipts, and (2) employer contributions represent a factor cost.

From the data obtained in the business survey, a corporate profit total was computed. There is considerable variation in the treatment of corporate profits in regional studies, according to whether the corporation is a branch of an "outside" corporation or a locally-based business activity. In this study, the corporation is treated as a single, local entity to get around the situs problem. Montgomery Ward, for example, has a branch retail store in Boulder which includes a catalogue department. For the Area Income account profits associated with the local operation were calculated from the cost and revenue data gathered in the business survey. While this procedure would not necessarily be optimal for some purposes, e.g. explaining the investment behavior of establishments in Boulder, it is the best procedure for showing their contribution to Area Income and Gross

TABLE VIII-2

BOULDER AREA INCOME

Boulder Area Personal Income (Gross)			$197,997,691
Plus:	All retirement taxes paid by resident employees and employers to all public and private pension plans		6,130,339
Plus:	Retained earnings of Boulder area corporations		3,833,554
Plus:	Income tax liability of Boulder area corporations		4,284,052
Less:	Dividends from non-local corporations	$ 2,741,418	
Less:	All unincorporated income received from non-local unincorporated firms	34,903	
Plus:	Net income of unincorporated local firms accruing to in-commuters		240,186
Less:	Rental income to Boulder area residents from property located outside Boulder area	1,362,919	
Plus:	Rental income to non-residents from property located inside Boulder area		1,465,577
Less:	Interest income to Boulder area residents from outside Boulder	653,521	
Plus:	Interest income to non-residents from Boulder area		3,601,363
Less:	Net personal gifts to Boulder area residents	14,447,561	
Less:	Government transfer payments to Boulder area residents	11,911,316	
Less:	Business transfers to Boulder area residents (bad debt losses, charitable contributions)	2,013,209	
Less:	Private pensions	152,897	
Less:	Out-commuter labor income	50,943,098	
Plus:	In-commuter labor income (business, households and government)		9,838,809
Boulder Area Income		$163,130,729	

Area Product. Thus, retained earnings and corporate income tax liabilities associated with the local operations of all corporations doing business in Boulder were added to Personal Income. Dividends received from non-local corporations were deducted, since the productive activity of outside corporations generates income in other areas.

The same situs procedure was used for unincorporated establishments. Although there was no problem of allocating retained earnings, dividends, and corporate income taxes for such establishments, a decision had to be made about how to handle local branches of regional, unincorporated companies. From the business survey a net profit statement was calculated for each unincorporated firm operating in Boulder, whether it was the main office or a branch. This profit represented the contribution of the establishment to Area Income. The profit of unincorporated businesses whose owners live in Boulder was, of course, measured in the household survey and therefore included in Personal Income. Thus two corrections were necessary to obtain Area Income. First, the profits of businesses located outside the study area whose owners live in Boulder were deducted from Personal Income. Secondly, the profits of unincorporated businesses located in Boulder whose owners live elsewhere were added to Personal Income.

The same kinds of adjustments were required for other forms of property income. Rental income to Boulder residents from property owned outside the study area was deducted, and rental income on Boulder property accruing to non-residents was added. Similarly, interest income to Boulder residents from outside sources was subtracted, and interest income paid to non-residents by Boulder sources was added.[4/]

Personal transfers, from within or outside the area, are not relevant to the concept of earned factor income. Therefore net personal gifts to Boulder residents were deducted from Personal Income. At the same time, government and business transfers and private pensions, since they did not constitute current factor earnings, were also excluded in the calculation of Area Income.

One other important adjustment completed the estimation of Area Income from the Personal Income base; this related to labor income, the single most important component of both Personal Income and Area Income. The labor income of Boulder

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[4/] This last adjustment was made primarily in the interest of maintaining consistency in the Area Income account. Since it is a small item, it could easily have been ignored without substantial effect on Area Income.

residents for work performed outside the study area was deducted, since this productive contribution accrued to another region's Area Income. By the same token, the earnings of in-commuters, persons who work in Boulder but who live elsewhere and who were thus excluded from the household questionnaire, were added to Personal Income to complete the Area Income account.

Gross Area Product and Net Area Product -- At this point the first set of basic regional accounts is in one sense halfway complete. The ordinary flows of income -- disposable, personal, and area -- have been defined and measured. Still missing from this network of accounts, however, is a direct measure of the 1963 flow of product, as opposed to the flow of income, in Boulder. To estimate this we must turn to the productive activity which gave rise to the income flows in the first instance. Rather than measure income associated with a specified level of economic activity, it is necessary to define and measure the productive activity itself as reflected in the value of the goods and services produced during a specified period of time, in this study calendar 1963.

It is possible, of course, to measure the level of productive activity directly by counting the goods and services produced and summing their dollar value. Following the practice used in estimating the national (and other regional) accounts, goods and services will be divided into four basic classes: (1) goods designed for consumption by households, usually during the accounting period but sometimes lasting for a longer time, e.g., autos; (2) investment or capital goods, designed to be used by business establishments in the production of other goods and services; (3) public goods purchased by units of government, and (4) goods and services sold to and purchased from the "rest-of-the-world." The last calculation permits deduction of the value of imported goods from the product of the Boulder area. The latter, of course, includes goods and services produced locally and sold outside the area.

If the dollar value of the goods and services produced locally in 1963 is summed, the total corresponds to Gross National Product in the national income accounts. In this study it is referred to as Gross Area Product -- the dollar value of all final goods and services produced in Boulder in 1963.[5/]

[5/] The components of Gross Area Product are usually found by measuring expenditures by the various sectors of the economy for goods and services: household consumption, business investment, government expenditures for goods and services, and net foreign investment.

It is defined as GAP = $C + I_g + G + X - M$, where C represents Boulder expenditures for personal consumption, I_g represents gross investment expenditures in Boulder,[6] G represents total government expenditures in Boulder (not including transfer payments), X equals exports of goods and services to, and M represents imports from, the "rest-of-the-world." If the amount of plant and equipment used up in the productive process by Boulder businesses is deducted from gross private domestic investment the result is net private domestic investment. This represents net additions to capital plant, or capital formation, in 1963. When the value of capital plant used up in producing goods and services (called capital consumption) is deducted from the Gross Area Product, the remainder equals Net Area Product, which represents the net output of the regional economy during 1963. The components of Net Area Product are $C + I + G + X - M$, the same terms used in Gross Area Product except that private domestic investment is measured net rather than gross.

It is also possible to estimate Gross and Net Area Product by another method. The relationship between the area's income flows on the one hand and the area's product flows on the other is given in Table VIII-3. This table shows how the area's product flows can be calculated from income flows plus additional data, with no reference to sector expenditures.

If Net Area Product represents current consumption, net investment and government goods and services at market prices, it is clear that the factor costs defined in Area Income will be included in the determination of these market prices. Indeed, if factor earnings only were reflected in market prices, Area Income and Net Area Product would be equal. Some non-factor costs are included in these prices, however. The most important are sales, excise and property taxes levied by various units of government. Because these taxes are levied on commodities rather than incomes, the market prices of commodities must reflect indirect business taxes.[7]

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[6] See Table VIII-7 for a detailed account of the components of gross private domestic investment.

[7] Indirect business taxes and non-tax accruals at the state and local levels of government include the following: sales taxes (general, gasoline, liquor and tobacco), motor vehicle licenses, property taxes, gross receipts taxes, franchise taxes, licenses, permits, severance taxes, documentary and stock transfer taxes. Non-tax payments at the state and local levels consist mainly of charges for government products and services not accounted for under government enterprises (including rents and royalties), fines and penalties, special assessments, and

TABLE VIII-3

GROSS AREA PRODUCT AND NET AREA PRODUCT
(derived from Area Income)

Boulder Area Income		$163,130,729
Plus: Indirect business taxes		7,051,656
Plus: Business transfers		2,013,209
Statistical discrepancy	$ -3,432,682[a/]	
Net Area Product		168,762,912
Plus: Capital consumption allowances		9,563,045
Gross Area Product	178,325,957	

[a/] Data problems in the construction of Area Income make this statistical discrepancy differ from the statistical discrepancy in Table VIII-7.

TABLE VIII-4

GROSS AREA PRODUCT
(derived from expenditures by sector)

Consumption expenditures	$135,816,225	
Non-durables		$ 67,336,427
Services		48,677,102
Durables		19,802,696
Gross investment expenditures, domestic	36,007,841	
Residential construction		10,874,908
Business plant construction Business durable equipment		18,037,753
Inventory change		7,095,180
Government expenditures for goods and services	70,300,481	
Local		10,416,268
University of Colorado		26,396,586
State (not including University)		1,215,700
Federal		32,271,927
"Rest-of-the-world": Net exports of goods and services on private account	-63,798,590	
Exports		54,685,907
Imports		118,484,497
Gross Area Product	178,325,957	

Indirect business taxes are non-factor costs which must be recovered by sellers in their final market prices, along with factor costs, if they are to remain in business. Other non-factor costs which must be added to market prices are the transfer payments made by business firms. In this study we have identified two kinds of business transfer payments: (1) charitable contributions by business firms, and (2) bad debt losses.[8/]

In Table VIII-3 indirect business taxes and the two categories of business transfers discussed above are added to Area Income. A third item, statistical discrepancy, results from reconciliation of the indirect estimates of Gross Area Product and Net Area Product from Area Income and the direct estimates from sector expenditures.[9/]

The final expansion is from Net Area Product to Gross Area Product, which is accomplished by addition of capital consumption allowances. A measure of capital consumption allowances is necessary to distinguish between total business expenditures for new plant and equipment and that part of new plant and equipment which represents net addition to capital stock. Capital consumption allowances are composed of three items: (1) depreciation allowances by businesses which approximate capital used up in production, (2) accidental destruction of capital equipment through acts of God, and (3) capital expenditures charged to current account. The depreciation component comprises the largest part of capital consumption allowances.

At this point, a set of five basic income-product accounts has been constructed, based upon the income flow data included in Area Income. The product

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donations. At the federal level, indirect business tax and non-tax accruals include: excise taxes (liquor, tobacco and other), customs duties, capital stock taxes, and non-tax payments. Non-tax payments consist mainly of charges for government products and services not accounted for under government enterprises (including rents and royalties), fines and penalties. Receipts from the sale of surplus property are not included. Cf. U. S. Department of Commerce, Survey of Current Business, Washington: U. S. Government Printing Office, July, 1964.

[8/] Private pension contributions are treated as a factor cost and thus included in Area Income; thus only charitable contributions and bad debt losses are considered here as business transfers.

[9/] One other item -- subsidies minus the current surplus of government enterprises -- is customarily added in the estimation of Net Area Product. In the present study it was assumed to be zero because of data problems; it is always a small item, and does not substantially affect the account totals

accounts, however, have been constructed indirectly from the various income flows. In Table VIII-4, the product flows are measured directly, estimating Gross Area Product from the expenditure side. From here on, it is a simple matter to construct Net Area Product, and the three income flows, by merely reversing procedures.

Household consumption expenditures are classified according to the nature of the commodity purchased: non-durable goods, durable goods, and services. This consumption total differs from that shown in Table VIII-1. In that table the total consumption figure represents expenditures on consumer goods (and services) by resident households, both inside and outside Boulder. Table VIII-4, however, measures total sales of consumer goods (and services) to the Boulder area residents only. Sales of consumer goods and services produced in Boulder, but sold outside, are included in exports.

Gross investment expenditures are measured on the basis of four kinds of activity. Following the procedures of the national income accounts, homeowners are treated as business establishments in the analysis of residential construction expenditures. That is, purchases of new homes and additions and alterations of older homes are treated as investment rather than consumption expenditures.[10/]

The other categories of investment expenditure represent the construction of physical facilities for business operations, purchases of durable equipment by businesses, and changes in the stocks of business inventories in 1963. Inventory change includes the net addition or depletion of finished goods ready for final sale, as well as changes in the stock of goods in process. This study does not include an inventory valuation adjustment, which is an attempt to measure the impact of changes in the price level on the value of inventories.

Current expenditures of government for goods and services represent the amount of Boulder area product used by the public sector. They do not, of course, measure the total impact of government spending because they do not include government transfer payments. They are "exhaustive" expenditures of government in the sense that goods and services used by the public sector are not available for use by the private sector. On the other hand, the "non-exhaustive" expenditures of government, i.e., transfer payments, do not represent an allocation of resources to government but are a device for financing part of private sector

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[10/] Correspondingly, principal payments on home mortgages are treated as a form of personal savings.

expenditures. While exhaustive expenditures by government reallocate resources from the private to the public sector, non-exhaustive expenditures reallocate resources within the private sector.

Finally, to avoid double counting and to measure the magnitude of product flows between Boulder and the "rest-of-the-world," a net export total is required. Because many of the materials which go into final sales in Boulder are imported, it is essential that imports be deducted from the value of total sales if an accurate statement of Boulder area product is to be derived. Intermediate transactions among Boulder firms are deducted in the calculation of area product by considering only final goods and services produced, and it is necessary to deduct intermediate goods and services imported from outside Boulder since their value is included in final sales prices. In 1963, the import total was only partially offset by the export of intermediate and finished goods and services by Boulder establishments. For many small, economic areas, the net export balance is usually negative as in the case of Boulder.

Table VIII-5 presents a more detailed summary of consumer expenditures included in Gross Area Product than was given in Table VIII-4, and Net Area Product is given in Table VIII-6. To obtain Net Area Product capital consumption allowances are charged against gross investment; that is, Net Area Product differs from Gross Area Product by capital consumption allowance. The statistical discrepancy in Table VIII-3 reconciles the difference between Gross Area Product measured directly from expenditure totals and indirectly from income flows.

Aggregate Analysis of the Basic Accounts by Sectors

Income originating (value added) by aggregate sectors: Consolidated area business income and product accounts -- Thus far a set of basic accounts has been formulated. These are built up from Disposable Personal Income to Gross Area Product, and they portray the income (receipt) and product (expenditure) flows reflecting aggregate economic activity in the Boulder area in 1963. In the GAP account, expenditures by the economy's four sectors -- household, public, business, and "rest-of-the-world" -- were aggregated to measure the total flow of goods and services. This form of the account, however, did not include an analysis of the income originating in or value added by sector to produce a Gross Area Product of $178 million and an Area Income of $163 million. To do this it is necessary to simulate the processes by which the various sectors organized inputs -- factors of production -- to turn out their products and services.

TABLE VIII-5

CONSUMER EXPENDITURES BY INDUSTRIAL SECTOR

Autos, new	$ 8,705,498
Autos, used	3,339,387
Parts and repairs	1,435,852
Service stations	4,561,176
Eating and drinking	6,392,247
Food stores	15,413,787
General merchandise	5,057,963
Apparel and accessories	3,276,886
New furniture	3,592,454
Used furniture	122,271
Lumber	1,641,069
Other retail	6,896,270
Wholesale	390,432
Medical services	3,424,150
Tuition services	5,729,675
Other services	6,902,328
Contract construction	10,843,954
Transportation	1,884,557
Utilities	4,777,042
Rentals	7,097,809
Household	848,291
FIRE - service charges	285,007
FIRE - life insurance	3,089,598
FIRE - casualty insurance	2,503,634
FIRE - old house	9,163,310
FIRE - re service charges	356,065
FIRE - interest on loans	3,855,772
Net purchases from businesses	121,586,483
Plus: Imputed expenditures	14,229,742
Gross local consumption expenditures	135,816,225

TABLE VIII-6

NET AREA PRODUCT

Consumption expenditures	$135,816,225		
Durables		$ 17,727,927	
Non-durables		60,281,453	
Services		43,577,103	
Imputed		14,229,742	
Net investment expenditures, domestic	26,444,796		
Residential construction		10,874,908	
Business plant construction and business durable equipment			$ 18,037,753
Less CCA			9,563,045
Net investment in business plant and equipment		8,474,708	
Inventory change		7,095,180	
Government expenditures for goods and services	70,300,481		
Local		10,416,268	
University of Colorado		26,396,586	
State (not University)		1,215,700	
Federal		32,271,927	
"Rest-of-the-world": Net exports of goods and services on private account	-63,798,590		
Exports		54,685,907	
Imports		118,484,497	
NET AREA PRODUCT	168,762,912		

Table VIII-7, labeled Consolidated Area Business Income and Product Account, identifies the basic role of Boulder business establishments in the income (product) creating activity of the local economy. Because businesses represent the primary method of organizing economic activity, it is no surprise that the greater part of income (product) originates in the productive operations of business firms or establishments.

In Table VIII-7, Parts 1A through 1E, the various inputs of Boulder area establishments are tabulated, and their total indicates income (product) originating in the business sector. In this treatment the value added by wage and salary earners is attributed to the business sector while in the initial input-output table of Part I the value added by households is separated from the processing sector.

As the Consolidated Area Business Income and Product Account is developed, a distinction will be made between that part of business product which generates income accruing to local factors, and that part which accrues to non-local factors. This will sharpen the distinction between earned income in the Personal Income account, and earned income of local factors in the business account.

Further Refinements of the Area Income Analysis

At this point it might be useful to review the differences between National Income and Area Income. National Income represents the aggregate earnings of labor and property (measured in terms of factor costs) resulting from current production. The factors of production are all the labor and property resources contributing to production inside the Nation, whether those resources are owned domestically or abroad. A distinction between factor incomes accruing to owners abroad and those accruing to residents is not necessary because the former account for a very small percentage of total factor incomes.

In the case of a region, however, the significant role of non-local factors in producing the region's output requires a distinction between locally-owned resources and resources owned outside the region, and their respective factor incomes. Let the aggregate of all incomes accruing to locally-owned factors be referred to as Net Area Income originating in the business sector, and the aggregate of all factor incomes as Area Income originating in the business sector. Now consider how the various items in the business income and product account can be separated into factor incomes accruing locally and factor incomes accruing outside the region (as shown in Table VIII-7). The total income originating in the business sector is larger than net income originating in the business sector

TABLE VIII-7

CONSOLIDATED AREA BUSINESS INCOME AND PRODUCT ACCOUNT

I. Income allocation				
Gross compensation of employees	$ 54,298,105			
Accruing to area residents		$ 51,195,554		
Wages and salaries			$ 47,676,404	
Student				$ 554,533
Non-student				45,643,324
Supplements			3,519,150	
Accruing to non-residents (in-commuters)		3,102,551		
Wages and salaries			3,006,936	
Supplements			95,615	
Income of unincorporated enterprises	19,502,517			
Accruing to area residents, main office located in Boulder		19,262,331		
Accruing to non-residents, main office located outside Boulder		240,186		
Corporate profits	12,942,160			
Accruing to the area		6,575,931		
Dividends accruing to area residents from corporations which are not locally-oriented			128,381	
Profits of locally-oriented corporations			6,447,550	
Dividends accruing to local residents				2,613,996
Undistributed profits				3,833,554
Accruing outside the area		6,366,229		
Dividends accruing to non-residents plus undistributed profits of non-locally oriented corporations			2,082,177	
Corporate tax liability of all corporations			4,284,052	
State				301,378
Federal				3,982,674

(continued)

TABLE VIII-7 (cont.)

Rental income of persons	$ 10,744,379		
Accruing to area residents		$ 9,777,813	
Accruing to non-residents		966,566	
Net interest payments	4,031,541		
Accruing to area		1,758,602	
Accruing outside the area		2,272,939	
Area income originating in business sector	101,518,702		
Indirect business tax and non-tax liability	7,051,656		
To local government		4,786,724	
To State government		2,102,006	
To Federal government		162,926	
Business transfer payments	2,013,209		
Bad debt losses		1,328,728	
To Boulder			$ 734,740
To "rest-of-the-world"			593,988
Charitable contributions and gifts		684,481	
To Boulder			204,504
To "rest-of-the-world"			479,977
Statistical discrepancy	1,018,543		
Charges against business net area product	111,602,110		
Capital consumption allowances	9,563,045		
Charges against business gross area product	121,165,155		
II. Current business product			
Consolidated net sales	228,544,758		
To Boulder area households		121,586,483	
To government		23,374,525	
Local			2,455,913
State (University)			6,940,377
State (other)			788,977
Federal			13,189,258
To "rest-of-the-world"		54,671,089	
Final consumer goods			24,322,034
Capital goods			9,641,228
Intermediate goods			20,707,827

(continued)

TABLE VIII-7 (cont.)

Capital goods sold to businesses inside region		$ 18,037,753
Residential construction		10,874,908
Change in inventories	$ 7,095,180	
Imputed product of financial intermediaries	4,009,714	
Less imports	118,484,497	
AREA BUSINESS GROSS PRODUCT	121,165,155	

by the amount of factors used in local production but living (in the case of labor) or owned (in the case of property) outside the area.

Compensation of employees is divided according to whether the employee is a resident or an in-commuter. Since a measure of the excess of accruals over disbursements was not obtainable for Boulder, compensation of employees can only be broken down into wages and salaries and supplements.

In Table VIII-7, the income of unincorporated businesses is divided according to the geographical location of the main office but the entire amount is treated as a contribution to Area Income. Income of an unincorporated enterprise is considered part of Net Area Income if the main office is located within the local region; otherwise it is considered as factor income accruing outside the region.[11/]

Applying the above criterion to the profits of corporate enterprises, however, involves several difficulties. First, many corporations serve relatively large market areas -- in most cases extending across state boundaries, and in many cases extending across the Nation. Thus the investment decisions of corporate managers may be expected to have little relationship to the location of the main office.

Because of the difficulties in assigning a "place of residence" to a corporation, the components of corporate profits for corporations having widespread markets are assigned as follows:

(1) Since the corporate tax liability accrues to the Federal government, this is considered to be a payment outside the region.

(2) Corporate dividends are separated, some going to factors inside the region, and the rest to factors outside.

(3) Undistributed profits are considered as accruing to factors outside the region.[12/]

[11/] This convention was adopted because the nature of capital transactions and their relation to a local region often depends on whether or not the proceeds of the business are controlled by interests residing in the region. A locally-owned single proprietorship is likely to allocate most of its new investment to expansion of capacity in the local region or an immediately adjoining area. This is typically the case when the business has a limited market area, as do many single proprietorships, although some larger establishments of this kind invest in large population centers in the general proximity of the local region as they gradually expand their markets.

[12/] The corporate establishment itself is considered to be an agency outside the local region even though it has facilities inside the region, except in the case of corporations with headquarters in Boulder. This view is consistent with the exogenous nature (i.e. exogenous with respect to investment in the region) of large corporations discussed above. Smaller corporations whose markets are predominantly local can be handled in the same way as unincorporated enterprises;

Rental payments by firms is not the same as the net rental income of persons in Personal Income. It does not include the component of rental income earned by area residents from property outside the region, and it includes rental income originating inside the region but accruing to outside owners. An alternative treatment of rents, involving further disaggregation, is discussed in Appendix II-II.

Since the objective is to determine actual production and income generated by all businesses inside the region, it might be better to exclude imputed rents, and include them as part of area product (added by the household sector). In fact, it is largely a matter of indifference whether net rental income is considered as part of income (product) generated in the household sector or in the business sector. Since a large part of rental property is owned by individual households, and is an additional source of income, a case can be made for assigning value added from the rental services of property to the household sector. This can be done for most net rental income as defined in Personal Income. There are other types of rent, however, that cannot be considered in this way. These include rents paid by businesses to residents for property used strictly for business purposes, and rents from either businesses or residents for property owned outside the region. The recipients of these rents are engaged in rendering business services rather than providing household services.

Finally, consider net interest and net dividends. In the business account all inter-business interest and dividend payments cancel out in the process of consolidation leaving only net payments to persons, government, and to the "rest-of-the-world." These net payments were determined as the residual of total interest or dividend payments made by all businesses minus the total interest or dividends received by all businesses. Net dividends have been divided into those accruing to local residents and those accruing to the "rest-of-the-world" using the same ratio which divided gross dividends into the two categories.[13/] Alternatively, net dividend payments can be determined for the household sector and

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that is, assign all profits except dividend payments accruing to non-local factors and corporate tax liability as part of Net Area Income. Inventory valuation adjustment is ignored because of its relative unimportance and the difficulties of estimation.

[13/] Net dividends and net interest can be separated into three categories: (1) payments accruing to persons, (2) payments accruing to non-residents, and (3) payments accruing to government. In fact, given the data, item (3) could have been subdivided into four more categories corresponding to the four levels of government defined in this study. However, the business data were not sufficiently detailed to permit a finer breakdown than local payments and non-local payments.

the "rest-of-the-world" sector separately. Net payments to "rest-of-the-world" are total payments by businesses to persons, business establishments, or government agencies, outside the region minus total dividends received from businesses outside the region. Net payments to the household sector equal the residual of total payments by businesses to sources inside the region, and total receipts by businesses from persons, government agencies, and other businesses inside the region. In this case, the inter-business money flows cancel out in the consolidation. Net payments to local government agencies were computed directly from data obtained in the survey of government agencies.

It is useful to know the distribution of gross dividend payments between the household sector and the "rest-of-the-world" sector as well as the net payments to each. Therefore, in Table VIII-7 the following breakdown has been employed:

Gross Dividend Payments

1) To the local region
2) To non-residents

Less: Inter-business dividend payments

Equals: Net dividend payments

1) To the local region
2) To non-residents

The net interest item in the business account involves further difficulties because of the "special" nature of financial intermediaries. In the case of commercial banks and investment trusts, actual interest paid to depositors must be added to the imputed interest item developed in Personal Income to obtain gross interest payments. This is so because the interest income deriving from a bank's deposits accrues to the depositors, not the bank. But since the banks actually receive the same amount in interest receipts (as interest from loans) their net interest income is zero.[14/]

Next, on the credit side of the business account, gross interest payments are included as sales of services to depositors. If the depositors are other business firms, the service charges net out in the consolidated account. If the depositors are persons, this item is considered as consumer expenditures for

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[14/] All property income is considered to be part of gross interest receipts in the national accounts. This includes net dividends received and net rental income as well as gross interest. Also, imputed interest is defined as property income minus interest paid to depositors. Thus, since all property income is considered to be paid to depositors as imputed interest, the net interest payment is zero.

financial services. Finally, current account purchases from other firms must be deducted from service charges to obtain value added by financial intermediaries. This treatment of financial intermediaries is illustrated in Table VIII-8.

TABLE VIII-8

IMPUTED INTEREST IN NATIONAL ACCOUNTS

Wages paid	50	Service charge receipts	105
Net interest paid		Monetary	10
Monetary interest paid on deposits	5	Imputed	95
Imputed interest paid on deposits	95	Less: Current account purchases from other firms	25
Less: Monetary interest received	100		
Profit	30		
Income originating	80	Product originating	80

Source: National Income, U. S. Department of Commerce (1954), p. 47.

Thus, for banks and similar financial intermediaries the net interest payments (Table VIII-7) is zero. Of course, imputed interest payments minus monetary interest payments are a part of value added by households. Also, interest payments from persons to financial intermediaries are counted as part of personal interest; hence, the gross interest payments by financial intermediaries are eventually counted as part of Gross Area Product generated by households. In the business sector, however, the only value added consists of wages and profits.

Consider next two other types of financial intermediaries -- life insurance companies, and mutual financial intermediaries. First, all transactions involving claims and premiums are disregarded. Then the property income which is

withheld to the account of policyholders is treated as if it were actually disbursed in the current period and thus becomes part of imputed interest. Finally, the companies are regarded as explicitly charging policyholders for their services, as measured by operating expenses. An imputation equal to these expenses is entered in the business account under sales to persons. Table VIII-9 illustrates the treatment of mutual life insurance companies:

TABLE VIII-9

IMPUTED INTEREST FROM MUTUAL LIFE INSURANCE COMPANIES

Wages	200	Interest	800
Cost purchases	400	Sales	600
Interest	800		
Value added to Gross Area Income	600	Value added to Gross Area Product	600

Source: National Income, U. S. Department of Commerce (1954), p. 48.

The net interest component of value added is zero and value added includes wages plus the cost of intermediate materials from other sources (including business sources). Of course, as in the case of banks, the imputed interest item will be included as part of value added in the household sector. Thus all net interest payments (Table VIII-7) consist of net payments made directly by businesses to persons, government and "rest-of-the-world." As in the case of dividends, the allocation may be made as follows:

Gross Interest Payments

1) To the local region
2) To non-residents

Less: Inter-business interest payments

Equals: Net interest payments

1) Net interest payments to the local region (to local government and to residents)

2) Net interest payments to non-residents

Net Area Income and Area Income: A Summary

This section has described a method for determining the distribution of Area Income among the factors of production inside the region and outside. A criterion has been suggested for the allocation of profits to factors inside the region and to outside factors -- a criterion that ties investment decisions closely to business activity in the region. The business sector can be divided into two categories -- activities endogenous to the region, and exogenous establishments. This division may be used in calculating a "leakage ratio" defined as

$$\frac{1 - \text{the sum of local factor payments}}{\text{aggregate business output in the region}}$$

This would describe the distribution of income among local factors, factors outside the region, and non-factor charges as a ratio determined by establishments which are likely to be instrumental in producing the multiplier effects of an exogenous change in aggregate expenditure.

In addition to classifying firms according to their potential for future investment, a classification according to the dependency of their products on aggregate consumer demand in the region might be helpful in estimating a leakage coefficient. A comparison of the investments of all local branches of non-local firms and their retained earnings would also be worthwhile in determining the impact of space and space-related spending on the rest of the local economy; that is, such a comparison justifies the disaggregation of corporate as well as non-corporate profits according to whether the firms are locally-owned or not. Finally, the distribution of all factor incomes between local and non-local recipients is necessary for development of the "rest-of-the-world" account to be described subsequently.

Non-Factor Charges Against Business Product

The last five items (Part I, Table VIII-7) apply concepts employed in national accounts regionally with little modification. Indirect business tax and non-tax

liabilities were estimated directly from the business and household survey data. Business transfer payments include consumer bad debts and gifts to non-profit institutions, but not payments from private retirement funds since these are already in Area Income and are treated as factor costs. Gifts to non-profit institutions are divided into gifts to resident institutions and gifts to institutions outside the region. Subsidies minus current surplus of government enterprises are assumed to equal zero.[15/] Capital consumption allowances are estimated on the basis of depreciation charges obtained in the business survey. Finally, the statistical discrepancy is computed as the difference between total gross product on the credit side of the account and total factor and non-factor charges.

Current Business Product

Part I of Table VIII-7 shows the estimates of income originating (value added) activity in the Boulder business sector and also identifies the non-factor charges included in Gross Area Business Product. Part II of the table lists the sources of current business product in 1963.

Two characteristics of Gross Area Business Product should be mentioned. First, the consolidated net sales refer to final goods, but including intermediate purchases from abroad. Thus a specific correction for intermediate goods imported from the "rest-of-the-world" is necessary. Secondly, total income originating in the business sector is less than Area Income by the amount of value added by households and government.

Table VIII-10 identifies income originating in the public sector. The compensation of employees represents the value added by government, since purchases from local firms is included in income originating activity of the business sector. Table VIII-10 differs from the national tables in several respects, the primary difference being the inclusion of an "other income" category made necessary by our inability to single out the operations of all public enterprises. Also the regional table requires an inter-governmental transfer item not included in the national tables.

Value added by households amounts to $4,993,904. This income originating activity, shown in Table VIII-1, represents the purchases of direct services by

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[15/] Government subsidies to business include farm subsidies and other monetary grants to business. The sum of such subsidies is small for the Boulder area.

households, and includes compensation of employees hired by households and interest paid by households.

Tables VIII-11 and VIII-12 complete the formal accounts. Appendix II-III explains the derivation of the gross savings and investment account, including a statement on the modified form of the "rest-of-the-world" account used in this study.

TABLE VIII-10

CONSOLIDATED GOVERNMENT RECEIPTS AND EXPENDITURES ACCOUNT
BOULDER AREA, 1963

Uses[a]		Sources	
Purchases of goods and services	$ 98,799,718	Property taxes	$ 6,397,931
		Sales taxes	1,732,131
Compensation of employees, including supplements (equals income originating in public sector)	46,925,956	Personal and corporate income taxes	18,337,090
		Other taxes[b]	9,675,690
Net purchases from local business firms	23,374,525	Non-tax receipts	2,174,552
		Tuition	6,003,377
Net purchases from non-local business firms	28,499,237	Other income[c]	36,275,952
Transfer payments	11,911,316	Inter-governmental transfers	28,317,016
Total expenditures	110,711,034	Total receipts	108,913,739
Deficit	1,797,295		

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[a] Net interest paid and subsidies minus current surplus of government enterprises are not separately identifiable.

[b] Includes social insurance contributions.

[c] Includes sales of public enterprises, contractual income, income from operations, etc.

TABLE VIII-11

GROSS SAVING AND INVESTMENT ACCOUNT

GROSS SAVINGS		
Gross business saving	$ 14,514,127	
Undistributed corporate profits		$ 3,833,554
Net contributions into private pension funds		1,209,757
Capital consumption allowances		9,563,045
Gross personal saving net of public expenditures	588,365	
Personal saving		21,913,655
Less: Purchases from government		9,979,951
Tuition payments		1,125,311
Imputed rental income		10,220,028
Surplus of local government on current account	- 428,632	
Total receipts from the area	10,864,436	
Total taxes from the area		5,416,879
Operating income		1,454,506
Inter-governmental transfers		3,967,740
Tuition payments		25,311
Less: Total expenditures	11,293,068	
Expenditures on current account in the area		8,674,697
In-commuter wages on current account		1,369,340
Transfer payments to the area		1,249,031
Statistical discrepancy	1,018,543	
Less: Net flow of funds from exogenous sectors	-23,450,545	
GROSS REGIONAL SAVING	39,235,177	
GROSS INVESTMENTS		
Business investment	32,922,375	
Investment expenditures by business		18,037,753
Residential construction		10,874,908
Change in inventories		4,009,714
Government investment	6,312,802	
Investment expenditures from business		6,200,466
Wages and salaries on capital account		112,336
GROSS REGIONAL INVESTMENT	39,235,177	

TABLE VIII-12

FLOW OF FUNDS BETWEEN ENDOGENOUS AND EXOGENOUS SECTORS

Net current payments to Boulder region		
Net receipts on private accounts		
Net purchases from business	$-79,898,847	
Consumer goods and services		$-69,540,075
Capital goods		-10,358,772
Net purchases of direct services	25,797,715	
Wages and salaries		26,566,822
Net interest		-1,619,418
Net rent		396,353
Net dividends		659,241
Net unincorporated profits		- 205,283
Net gifts	14,447,561	
Net receipts from non-local government	16,203,026	
NET CURRENT PAYMENTS DUE AREA	-23,450,545	
Net flow of funds from the "rest-of-the-world"		
Private sectors	-39,653,571	
Government sectors	16,203,026	
NET FLOW OF FUNDS FROM EXOGENOUS SECTORS	-23,450,545	

IX

INCREMENTAL INCOME TO BOULDER FROM THE PUBLIC SECTOR

The impact of government activities upon a region can be analyzed in a number of ways. In a previous chapter we identified the value added to regional product through wage and salary payments by Boulder government agencies. Later in the study we will consider the multiplier effects of specified changes in the level of government expenditures on the region.

The purpose here is to study the impact of government by bringing together the data on tax and non-tax payments by Boulder residents, and relating them to the expenditures in Boulder of all government units. These data are interpreted in terms of: (1) function performed, (2) recipients of government expenditures by industrial sector and geographic location, (3) revenue sources, and (4) the immediate surplus or deficit accruing to the Boulder region as a result of the expenditure, transfer, and tax programs of government. This analysis will be directed toward four levels of government -- local, University of Colorado, State (not including the University), and Federal. It will consider capital as well as current expenditures. Programs are analyzed according to the general activities of the four governmental levels, the public enterprise facets of local and Federal government, and the transfer-trust fund activities of local, State, and Federal governments.

Local Government[1/]

Table IX-1 identifies the current account expenditures of general local government. Here the current account, as distinct from capital account, spending of general local government is recorded by function, industry and location while the current revenue sources of general local government are listed by location and revenue type. The functional division of expenditures demonstrates the primary local government concern with public safety, welfare, highways and in particular with education. Table IX-1 also shows expenditures classified by industry and location. About 30 per cent of expenditures for manufacturing goods by Boulder local government on current account accrues to Boulder area firms. There was a large leakage of local government expenditures in 1963 to the Denver Metropolitan Area, the rest of Colorado and the "rest-of-the-world." The same pattern of leakages characterized the trade sector, but more than half the expenditures for services and virtually all spending for utilities was directed to local firms.

[1/] Includes city and county government, school and special districts.

TABLE IX-1

LOCAL GOVERNMENT EXPENDITURES AND REVENUES
(General Government Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Public safety	-	-	-	-	$ 990,771
Highways	-	-	-	-	1,320,141
Primary and secondary education	-	-	-	-	7,977,503
Libraries	-	-	-	-	127,732
Public welfare	-	-	-	-	523,800
Parks and recreation	-	-	-	-	203,080
Other	-	-	-	-	785,522
Total	-	-	-	-	11,928,549
Expenditures by industry					
Goods and services					
Extractive	$ 7,125	$ 2,509	-	-	9,634
Manufacturing	118,568	129,979	$ 54,228	$138,450	441,225
Space and related	-	-	-	-	-
Trade	318,574	557,352	120,724	-	996,650
Services	648,248	367,874	12,499	410	1,029,031
Contract construction	60,186	-	-	-	60,186
Transportation	20,481	2,239	265	-	22,985
Utilities	365,780	1,825	-	-	367,605
F.I.R.E.	42,075	388,678	-	169,022	599,775
Government	84,058	14,869	-	-	98,927
Miscellaneous and other	111,693	90,000	-	-	201,693
Total goods and services	1,776,788	1,555,325	187,716	307,882	3,827,711
Total goods and services less government	1,692,730	1,540,456	-	-	3,728,784
Wages and salaries	6,742,069	1,358,769	-	-	8,100,838
Total all expenditures	8,518,857	2,914,094	187,716	307,882	11,928,549

(continued)

TABLE IX-1 (cont.)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Revenues					
Individual and corporate income tax	-	-	-	-	-
General sales tax	-	-	-	-	-
Property tax	4,557,856	1,725,214[a/]	-	-	6,283,070
Other taxes	404,350	67,900	-	-	472,250
Non-tax payments	454,673	190,986	-	-	645,659
Intergovernmental transfers					
Federal appropriations	-	-	-	-	-
State appropriations	-	3,625,644[b/]	-	-	3,625,644
Contractual income	-	-	-	-	-
Other	-	-	-	342,096	342,096
Tuition	25,311	9,773	-	-	35,084
Income from operations	135,014	-	-	-	135,014
Other	334,360	55,372	-	-	389,732
Total income	5,911,564	5,674,799	-	342,096	11,928,549
Surplus or (Deficit) to Area on Current Account	2,607,293	(2,760,795)	187,716	(34,214)	-

[a/] County and school districts taxes collected from residents of Boulder County outside Boulder area.

[b/] This is a State appropriation. Although it originates throughout the State in tax collections, it comes to the agency concerned from the State offices in the Denver Metropolitan Area.

At the same time there was a relatively small drain of wage and salary payments to outside residents.

On the revenue side, local government revenue sources are concentrated in property taxes and inter-governmental transfers from the State government. Considering only the operations of general local government on current account, expenditures in Boulder are $2,607,293 larger than revenues accruing from local sources -- a surplus to the area on this account. The surplus is largely a function of the movement of tax funds from the Denver Metropolitan Area -- $5,674,799 -- to Boulder, which is not matched by Boulder government expenditures in the Denver area -- $2,914,094.

Part of the surplus on current account of general expenditures of local government was offset in 1963 by a deficit on capital account, as defined in Table IX-2. Boulder sources of income on capital account amounted to $1,524,298, but only $747,471 of this was ploughed back into the local economy. The leakage out of Boulder is explained for the most part by the capital construction sector, expenditures for which were concentrated in Denver and the "rest-of-the-world." While the Denver Metropolitan Area again ran a deficit to Boulder of $207,607, a large surplus, nearly a million dollars, accrued to the "rest-of-the-world."

Table IX-3 continues the construction of local government accounts, switching from general government activity to public enterprise activity on current account. The service provided by local public enterprise is water delivery and sewage disposal by a municipal corporation, with a resulting deficit of $346,193 to the local area. The deficit is explained by two expenditures by the corporation in Denver -- $89,877 for utility services and nearly $200,000 in interest payments. The deficit on current account would be appreciably larger, but for the $418,388 transfer to capital account treated as a deduction from current account revenues which are all from the Boulder area. Clearly, in this case, the accounting system employed by the municipal corporation has considerable influence upon the surplus-deficit relationship between current and capital account items.

Sizeable capital construction expenditures with local firms on public enterprise capital account produced a small surplus for the Boulder area in 1963 of $41,597, as shown in Table IX-4. The surplus items accruing to Boulder, the Denver Metropolitan Area, and the rest of Colorado derived from the large 1962 bond issue which was financed largely by sources outside Colorado. As the service charge on this bond issue creates large local charges to be paid to the

TABLE IX-2

LOCAL GOVERNMENT EXPENDITURES AND REVENUES
(General Government Capital Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Public safety	-	-	-	-	$ 20,706
Highways	-	-	-	-	193,100
Primary and secondary education	-	-	-	-	2,067,399
Libraries	-	-	-	-	5,400
Public health and welfare	-	-	-	-	30,314
Parks and recreation	-	-	-	-	76,189
Other	-	-	-	-	428,569
Total	-	-	-	-	2,821,677
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	--
Manufacturing	$ 39,513	$ 88,592	-	$ 46,718	174,823
Space and related	-	-	-	-	-
Trade	159,351	159,763	-	9,011	328,125
Services	57,600	-	-	-	57,600
Contract construction	378,671	841,337	-	746,297	1,966,305
Transportation	-	-	-	-	-
Utilities	-	-	-	-	-
F.I.R.E.	-	-	-	-	-
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	182,488	182,488
Total goods and services	635,135	1,089,692	-	984,514	2,709,341
Wages and salaries	112,336	-	-	-	112,336
Total all expenditures	747,471	1,089,692	-	984,514	2,821,677
Revenues					
State appropriations for capital construction	-	-	-	-	-
Transfers from current revenue for capital outlay	1,524,298	-	-	-	1,524,298
Proceeds of borrowing	-	1,297,379	-	-	1,297,379
Service charges	-	-	-	-	-
Other	-	-	-	-	-
Total income	1,524,298	1,297,379	-	-	2,821,677
Surplus or (Deficit) to Area on Capital Account	(776,827)	(207,687)	-	984,514	0

TABLE IX-3

LOCAL GOVERNMENT EXPENDITURES AND REVENUES
(Public Enterprise Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Water and sewer	-	-	-	-	$901,104
Total	-	-	-	-	901,104
Expenditures by industry					
Goods and services					
Extractive	-	$ 486	-	-	486
Manufacturing	$ 1,130	2,926	$920	$27,557	32,533
Space and related	-	-	-	-	-
Trade	12,714	7,114	-	-	19,828
Services	2,987	380	-	6,453	9,820
Contract construction	-	-	-	-	-
Transportation	308	-	-	-	308
Utilities	8,975	89,877	-	-	98,852
F.I.R.E.	17,876	-	-	-	17,876
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	-	-
Total goods and services	43,990	100,783	920	34,010	179,703
Wages and salaries	167,023	10,571	-	-	177,594
Debt service (interest only)	-	199,909	-	-	199,909
Payments in lieu of taxes	131,830	-	-	-	131,830
Total expenditures	342,843	311,263	920	34,010	689,036
Plus: Depreciation allowances	212,068	-	-	-	212,068
Total	554,911	311,263	920	34,010	901,104
Revenues					
Sale of water	986,945	-	-	-	986,945
Sewer maintenance charges	213,383	-	-	-	213,383
Other sales of goods and services	119,164	-	-	-	119,164
Less: Transfers to capital account	418,388	-	-	-	418,388
Total	901,104	-	-	-	901,104
Net Surplus or (Deficit) to Area on Current Account	(346,193)	311,263	920	34,010	0

TABLE IX-4

LOCAL GOVERNMENT EXPENDITURES AND REVENUES
(Public Enterprise Capital Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Water and sewer	-	-	-	-	$3,288,326
Total	-	-	-	-	3,288,326
Expenditures by industry					
Buildings and other construction	$ 993,977	$538,593	$721,143	$ 830,405	3,084,118
Machinery and equipment	29,008	5,200	-	5,000	39,208
Additions to inventory	-	-	-	-	-
Total gross capital formation	1,022,985	543,793	721,143	835,405	3,123,326
Purchase or redemption of bonds	-	165,000	-	-	165,000
Total	1,022,985	708,793	721,143	835,405	3,288,326
Revenues					
Transfers from current revenues	418,388	-	-	-	418,388
Transfers from plant investment fees	200,000	-	-	-	200,000
Transfers from water utility fund	363,000	-	-	-	363,000
Interest on investments and other	-	56,554	-	-	56,554
Proceeds of 1962 bond issue	-	113,274	-	2,137,110	2,250,384
Total	981,388	169,828	-	2,137,110	3,288,326
Surplus or (Deficit) to Area on Capital Account	41,597	538,965	721,143	(1,301,705)	0

"rest-of-the-world," subsequent deficits on Boulder's public enterprise capital account are a strong possibility.

Table IX-5, which shows transfer activity on current account for local government, completes the statement of accounts for local government since there is no capital account counterpart for transfer payments. The computed surplus of $1,220,146 originates in the inter-governmental transfer from the State to local government of $2,927,635. In a real sense the surplus is exaggerated because it does not identify the sales taxes paid by Boulder area residents into the trust funds out of which aid and assistance programs and old age payments are financed in large measure. The table suffers from the arbitrary decision to exclude that part of the Colorado sales tax paid by Boulder residents which is then returned to transfer recipients. On the other hand, it would be equally arbitrary to assign some share of Boulder area sales tax to the specific trust funds involved. The total surplus to the Boulder area from government activities will not be affected in any event. By treating the accounts in this manner, the surplus to the Boulder area through local government activity may be somewhat exaggerated, but this is offset by slightly overstating the deficit to the local area from State government activities.[2/] Thus the net surplus or deficit to the Boulder area from the public sector is not influenced -- only the composition in terms of local and State impact, and this only minimally. The whole problem could be avoided by treating aid and assistance programs and old age payments as wholly State activities but at the cost of ignoring the administration of these programs by county welfare departments.

In Table IX-6 the net surplus-deficit relationships of the five local government accounts are summarized and a net surplus of $2,746,016 revealed. The summary data show the difference between local expenditures of local governments and leakages from the income stream of Boulder area residents in the form of local taxes to support the local expenditure programs. In this instance the tax leakage is $2,746,016 less than the magnitude of local expenditures by local government.

The University of Colorado

The largest public activity in the Boulder area is the University of Colorado. In 1963, as Table IX-7 shows, the University made expenditures of $34,065,375 for

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[2/] See Table IX-8.

TABLE IX-5

LOCAL GOVERNMENT EXPENDITURES AND REVENUES
(Transfer Activity Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures					
Administrative		(Included in General Government)			
Transfers or payments to beneficiaries	-	-	-	-	-
Aid and assistance programs	$ 367,450	$ 443,236	-	-	$ 810,686
Old age payments	846,147	1,235,068	-	-	2,081,215
Social Security payments	-	-	-	-	-
Unemployment compensation	-	-	-	-	-
Workmen's compensation	-	-	-	-	-
PERA	-	-	-	-	-
Police and fire pension fund	35,434	5,640	-	$50,756	91,830
Total	1,249,031	1,683,944	-	50,756	2,983,731
Revenues					
Employer taxes	-	-	-	-	-
Employee taxes	28,885	-	-	-	28,885
Inter-governmental transfers	-	2,927,635	-	-	2,927,635
Other	-	-	-	13,986	13,986
Total	28,885	2,927,635	-	13,986	2,970,506
Net Surplus or (Deficit) to Area on Current Account	1,220,146	(1,243,691)	-	36,770	13,225

TABLE IX-6

NET SURPLUS TO BOULDER LOCAL GOVERNMENT

	Surplus to Boulder	Deficit to Boulder
General government current account	$2,607,293	-
General government capital account	-	$ 776,827
Public enterprise current account	-	346,193
Public enterprise capital account	41,597	-
Transfer activity current account	1,220,146	-
Totals	3,869,036	1,123,020
Net Surplus on All Local Accounts	2,746,016	-

higher education on current account. $32,123,330 of these expenditures are treated in a functional sense as local, since the budget of the University's medical school in Denver is administered in Boulder.

An analysis of expenditures by industry and by wage and salary payments demonstrates an interesting difference in local economic impact. While virtually all wage and salary payments -- $19,472,129 of a total of $21,291,769 -- were received by local residents with consequent multiplier effects, less than 25 per cent of the University's expenditures for goods and services accrued to local firms. In some industrial sectors, e.g. manufacturing, less than 20 per cent of spending was local and in others, e.g. finance, real estate and insurance, less than two per cent of expenditures found their way to local firms. On the other hand, the local transportation and utility sectors were the major recipients of University expenditures for these categories of goods and services.

In terms of impact, by way of surplus of local spending in excess of local revenues, the economic effects of the University dwarf most other government activities. In 1963, expenditures in Boulder by the University were $14,052,491 larger than were the receipts from local sources on current account. This surplus is only slightly overstated by not allocating some percentage of Boulder

TABLE IX-7

UNIVERSITY OF COLORADO
(General Government Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Higher education	$32,123,330	$ 1,304,616	$637,389	-	$34,065,335
Total	-	-	-	-	34,065,335
Expenditures by industry					
Goods and services					
Extractive	43	-	-	-	43
Manufacturing	421,368	906,181	21,055	$2,167,542	3,516,146
Space and related	-	-	-	-	-
Trade	690,394	1,457,762	119,490	840,965	3,108,611
Services	427,597	616,777	176,552	406,419	1,627,345
Contract construction	31,357	-	-	-	31,357
Transportation	365,587	65,993	2,723	45,339	479,642
Utilities	417,405	37,692	9,660	2,522	467,279
F.I.R.E.	36,852	1,180,641	377	1,469,641	2,687,511
Government	15,920	15,030	1,295	42,000	74,245
Miscellaneous and other	290,112	190,475	-	300,800	781,387
Total goods and services	2,696,635	4,470,551	331,152	5,275,228	12,773,566
Total goods and services less government	2,680,715	4,455,521	329,857	5,233,228	12,699,321
Wages and salaries	19,472,129	1,704,000	40,586	75,054	21,291,769
Total all expenditures	22,168,764	6,174,551	371,738	5,350,282	34,065,335
Revenues					
Individual and corporate income tax	-	-	-	-	-
General sales tax	-	-	-	-	-
Property tax	-	-	-	-	-
Other taxes	-	-	-	-	-
Non-tax payments	785,540	6,800	-	-	792,340

(continued)

TABLE IX-7 (cont.)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Intergovernmental transfers					
Federal appropriations	-	-	-	-	-
State appropriations	-	9,365,693	-	-	9,365,693
Contractual income	20,000	-	-	8,008,602	8,028,602
Other	5,000	-	-	942,597	947,597
Tuition	1,100,000	1,383,739	-	3,484,554	5,968,293
Income from operations	6,138,971	1,032,035	300,000	865,554	8,336,560
Other	66,762	744,529	100,000	364,157	1,275,448
Total income	8,116,273	12,532,796	400,000	13,665,464	34,714,533
Surplus or (Deficit) to Area on Current Account	14,052,491	(6,358,245)	(28,262)	(8,315,182)	(649,198)

Note: Tuition waivers, scholarships and grants of $680,990 are excluded from both expenditures and revenues.

TABLE IX-8

UNIVERSITY OF COLORADO
(General Government Capital Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Higher education	-	-	-	-	$9,009,794
Total	-	-	-	-	9,009,794
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	-	$ 273,854	$40,853	$ 431,543	746,250
Space and related	-	-	-	-	-
Trade	-	112,786	12,055	93,875	218,716
Services	$ 32,464	527,090	80	538,937	1,098,571
Contract construction	4,211,278	2,571,047	-	130,932	6,913,257
Transportation	-	-	-	-	-
Utilities	-	-	-	-	-
F.I.R.E.	-	-	-	-	-
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	33,000	33,000
Total goods and services	4,243,742	3,484,777	52,988	1,228,287	9,009,794
Revenues					
State appropriations for capital construction	-	200,000	-	-	200,000
Transfers from current revenue for capital outlay[a/]	702,123	982,973	-	1,123,598	2,808,694

(continued)

TABLE IX-8 (cont.)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Proceeds of borrowing	-	308,415	-	5,859,895	6,168,310
Service charges	-	-	-	-	-
Other	-	-	-	-	-
Total income	702,123	1,491,388	-	6,983,493	9,177,004
Surplus or (Deficit) to Area on Capital Account	3,541,619	1,993,389	-	(5,755,206)	(220,198)

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[a] University transfers from current revenues are allocated among areas in the same manner as current revenues. The Denver Metropolitan Area total includes $429,236 appropriated for capital outlay specifically as part of general fund budget. The same procedure is used to allocate transfers from current revenue on public enterprise capital account.

resident income and sales tax payments back to the University through the State appropriation to the University. This means that the deficit to other State government operations is also slightly overstated.[3/] The large surplus to the area is accompanied by large deficits for both State and Federal governments. The State deficit is largely a function of the State appropriation to the University of $9,365,693, while the Federal deficit derives most importantly from contractual services purchased from the University by agencies of the Federal government, mostly for the research talents of the University faculty.

Tuition receipts of the University are the fourth largest revenue source, totaling nearly $6 million. Although students outside Colorado constitute much less than half the student population, they account for considerably more than half the tuition payments.

On the capital accounts side of the University ledger, Table IX-8 reveals a substantial surplus (of $3,541,619) accruing to the Boulder area. This surplus for Boulder is accompanied by a smaller surplus to the Denver Metropolitan Area, both of which originate in the large volume of capital construction expenditures with Colorado firms. The outside Colorado deficit of nearly $6 million results from large-scale borrowing by the University from sources outside Colorado. This debt creation explains in large measure the leakage on current account of the finance, insurance and real estate sector. Clearly, the interest payments by the University to outside financiers for capital construction identifies the reason for the small local impact of the finance, insurance, and real estate sector.

The basic "export" nature of the University's impact on the local economy is summarized in Table IX-9. The expenditure total of $26,412,506, less revenues from local sources of $8,818,396, means that the University accounted in 1963 for $17,594,110 of income flowing into the community from outside Boulder. In terms of basic, exogenous sources of local economic growth, the University effect is similar to a manufacturing firm exporting $17,594,110 worth of goods to the "rest-of-the-world."

This sum, of course, does not measure the total University impact on Boulder since it does not trace through the multiplier effects of the consumption expenditures growing out of the wage and salary payments of $19,472,129 to local residents. Neither does it measure the local expenditures of the more than

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[3/] Cf. Table IX-14.

TABLE IX-9

NET SURPLUS TO BOULDER THROUGH UNIVERSITY OF COLORADO ACTIVITY

Local expenditures for goods and services, current account	$ 2,696,635
Local wage and salary payments, current account	19,472,129
Local expenditures for goods and services, capital account	4,243,742
Total	26,412,506
Less revenues from local sources, current account	8,116,273
Less revenues from local sources, capital account	702,123
Total	8,818,396
Net Surplus to Boulder Area	17,594,110

11,000 students residing in or commuting to the area, whose spending with local firms constitutes a large additional "export" of goods and services and corresponding "import" of dollars.[4/]

The State of Colorado (Not Including the University of Colorado)

The State of Colorado has relatively few branch operations in Boulder outside the University of Colorado. This is demonstrated in Table IX-10 by the small expenditures of local branches of Colorado State offices -- $212,971 in 1963. Boulder area residents, on the other hand, contributed $6,308,932 in tax and non-tax payments to the State government and in the process accumulated a deficit to State government on current account of $6,095,961. The actual deficit, as noted previously, would be somewhat less if the Boulder area proportion of tax support for the University was deducted, or added to State expenditures in Boulder, but the total would not be significantly altered.

4/ The total impact of student expenditures upon the Boulder economy will be discussed in Chapter X as part of the discussion of aggregate multipliers.

TABLE IX-10

STATE OF COLORADO, EXCLUDING THE UNIVERSITY OF COLORADO,
EXPENDITURES AND REVENUES
(General Government Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Commerce and labor	-	-	-	-	$ 98,011
Highways	-	-	-	-	128,200
Total	-	-	-	-	226,211
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	-	-	-	-	-
Space and related	-	-	-	-	-
Trade	$ 11,657	$ 10,000	-	-	21,657
Services	5,000	-	-	-	5,000
Contract construction	-	-	-	-	-
Transportation	628	-	-	-	628
Utilities	2,686	-	-	-	2,686
F.I.R.E.	-	3,240	-	-	3,240
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	-	-
Total goods and services	19,971	13,240	-	-	33,211
Wages and salaries	193,000	-	-	-	193,000
Total all expenditures	212,971	13,240	-	-	226,211
Revenues					
Individual and corporate income tax	1,652,286[a/]	-	-	-	1,652,286
General sales tax	1,732,131[b/]	-	-	-	1,732,131
Property tax	114,861[c/]	-	-	-	114,861
Other taxes	2,073,101[d/]	-	-	-	2,073,101
Non-tax payments	736,553[e/]	-	-	-	736,553

(continued)

TABLE IX-10 (cont.)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Intergovernmental transfers					
Federal appropriations	-	-	-	-	-
State appropriations	-	241,211	-	-	241,211
Contractual income	-	-	-	-	-
Other	-	-	-	-	-
Tuition	-	-	-	-	-
Income	-	-	-	-	-
Other	-	-	-	-	-
Total income	6,308,932	241,211	-	-	6,550,143
Surplus or (Deficit) to Area on Current Account	(6,095,961)	(227,971)	-	-	(6,323,932)

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a/ Household questionnaire states 1963 personal income tax of Boulder Area residents equals $1,350,908; State income taxes from corporations, $301,378.

b/ Report of Bureau of Business Research.

c/ 1963 State property mill levy times Boulder Area assessed valuation.

d/ All motor fuel and motor vehicle taxes; number of registered motor vehicles times average tax per vehicle in 1962 as reported by State Department of Revenue.

e/ Allocated on basis of population. The Boulder Area population was 2.85 per cent of State population in 1960.

Since State government capital expenditures for construction were made with non-local firms and financed from non-local sources, the surplus or deficit for the local area was not affected in 1963 by the State capital account in Boulder (see Table IX-11).

Transfer payments by State government to local residents in 1963 totaled $1,106,388. Payments into State trust funds by Boulder residents reached $2,051,737 in 1963. Thus Table IX-12 indicates a local deficit through State government transfer activities of $945,649 in 1963.

Tables IX-10, IX-11 and IX-12 identify the programs of State government agencies which have branch operations in Boulder. Table IX-13, however, measures State government expenditures to Boulder establishments in which local branches of State government agencies are not involved. Since all revenues from local establishments and persons have been previously recorded, the $769,006 of direct expenditures can be considered a surplus to Boulder.

The net deficit to Boulder through non-University branch operations of State government is shown in Table IX-14. The $6,272,304 net deficit represents a leakage from Boulder income flows to State government resulting from tax and non-tax payments of $8,360,669, minus branch expenditures for goods and services of $213,971 and transfer payments to local residents of $1,106,388. The net deficit also takes into account direct expenditures by State government of $769,006 to Boulder establishments not processed through local branches.

Federal Government

The Federal government activity which has the largest expenditure impact upon Boulder is the Boulder Laboratories of the National Bureau of Standards. Data in Table IX-15 demonstrate how the activities of this single Federal agency almost offsets the large leakage from the local area in the form of Federal personal and corporate income taxes. The latter totaled more than $17 million in 1963, and would have offset the University of Colorado's surplus impact on Boulder were it not for the National Bureau of Standards. This facility, along with other routine and relatively small Federal government activities, generates a payroll of nearly $13 million in Boulder. In addition, expenditures to local firms for goods and services total more than $2 million. Thus a potential income leakage of $17 million is reduced to a leakage of only $4,110,243 from the local area to the Federal government on current account, with only branch operations of the Federal government considered. The $4 million deficit exists, moreover, not because local income tax payments to the Federal government are greater

TABLE IX-11

STATE OF COLORADO, EXCLUDING THE UNIVERSITY OF COLORADO,
EXPENDITURES AND REVENUES
(General Government Capital Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Highways	-	-	-	-	$480,000
Total	-	-	-	-	480,000
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	-	-	-	-	-
Space and related	-	-	-	-	-
Trade	-	-	-	-	-
Services	-	-	-	-	-
Contract construction	-	$480,000	-	-	480,000
Transportation	-	-	-	-	-
Utilities	-	-	-	-	-
F.I.R.E.	-	-	-	-	-
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	-	-
Total goods and services	-	480,000	-	-	480,000
Wages and salaries	-	-	-	-	-
Total all expenditures	-	480,000	-	-	480,000
Revenues					
State appropriations for capital construction	-	-	-	-	-
Transfers from current revenue for capital outlay	-	-	-	-	-
Proceeds of borrowing	-	480,000	-	-	480,000
Service charges	-	-	-	-	-
Other	-	-	-	-	-
Total income	-	-	-	-	-
Surplus or (Deficit) to Area on Capital Account	-	0	-	-	0

TABLE IX-12

STATE OF COLORADO, EXCLUDING THE UNIVERSITY OF COLORADO,
EXPENDITURES AND REVENUES
(Transfer Activity Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures					
Administrative	-	-	-	-	-
Transfers or payments to beneficiaries					
Aid and assistance programs	-	-	-	-	-
Old age payments	-	-	-	-	-
Social Security payments	-	-	-	-	-
Unemployment compensation	$ 398,840[a]	$170,932[a]	-	-	$ 569,772
Workmen's compensation	234,280[b]	-	-	-	234,280
PERA	473,268[c]	-	-	-	473,268
Police and fire pension fund	-	-	-	-	-
Total	1,106,388	170,932	-	-	1,277,320
Revenues					
Employer taxes	1,259,856[d]	-	-	-	1,259,856
Employee taxes	791,881	-	-	-	791,881
Intergovernmental transfer	-	-	-	-	-
Other	-	-	-	-	-
Total	2,051,737	-	-	-	2,051,737
Net Surplus or (Deficit) to Area on Current Account	(945,649)	170,932	-	-	(774,417)

[a] The Colorado Department of Employment reports $569,772 of unemployment compensation payments made to Boulder County residents in 1963. In the absence of reliable data on allocation, 70 per cent of that amount was assumed to be paid to Boulder area residents.

[b] Estimated on basis of population; see footnote e of Table IX-10.

[c] 10 per cent of fiscal 1964 payments to State of Colorado residents.

[d] Includes $791,881 for PERA contributions, $209,612 contribution to State unemployment compensation funds, and $258,363 to State workmen's compensation funds.

TABLE IX-13

DIRECT STATE GOVERNMENT EXPENDITURES WITH LOCAL FIRMS BY INDUSTRIAL SECTOR NOT PROCESSED THROUGH LOCAL BRANCHES OF STATE AGENCIES

Extractive	-
Manufacturing	$142,940
Space and related	150
Trade	23,765
Services	24,151
Contract construction	578,000
Transportation	-
Utilities	-
F.I.R.E.	-
Government	-
Miscellaneous and other	-
Total	769,006

TABLE IX-14

NET DEFICIT TO BOULDER, STATE GOVERNMENT EXPENDITURES AND REVENUES
(Excluding University of Colorado)

Local expenditures by local branches of State government, current account	$ 212,971
Local expenditures by local branches of State government, transfer activities	1,106,388
Total expenditures	1,319,359
Less: State government tax and non-tax receipts from Boulder, current account general	6,308,932
Less: State government tax and non-tax receipts from Boulder, transfer activities	2,051,737
Total revenue	8,360,669
Deficit	7,041,310
Less: Direct State government expenditures with local firms, not processed through local branches of State agencies	769,006
Net deficit	6,272,304

TABLE IX-15

FEDERAL GOVERNMENT EXPENDITURES AND REVENUES
(General Government Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
National security	-	-	-	-	$ 67,000[a]
Space and related	-	-	-	-	3,504,935
Commerce and labor	-	-	-	-	19,658,758
Agriculture	-	-	-	-	82,400
Other	-	-	-	-	143,939
Total	-	-	-	-	23,457,032
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	$ 27,241	$ 209,926	$ 1,685	$ 267,199	506,051
Space and related	137,372	-	-	-	137,372
Trade	238,999	1,238,273	18,532	127,553	1,623,357
Services	60,577	69,000	78,622	1,284,022	1,492,221
Contract construction	-	-	-	-	-
Transportation	908,940	27,117	-	-	936,057
Utilities	262,218	-	42,149	46,464	350,831
F.I.R.E.	-	114,640	-	585,160	699,800
Government	674,041	57,858	-	579,025	1,310,924
Miscellaneous and other	-	-	-	-	-
Total goods and services	2,309,388	1,716,814	140,988	2,889,423	7,056,613
Total goods and services less gov't.	1,635,347	1,658,956	-	2,310,398	5,745,689
Wages and salaries	12,917,459	2,406,549	290,660	785,751	16,400,419
Total all expenditures	15,226,847	4,123,363	431,648	3,675,174	23,457,032
Revenues					
Individual and corporate income tax	18,337,090[b]	-	-	-	18,337,090
General sales tax	-	-	-	-	-
Property tax	-	-	-	-	-
Other taxes	1,000,000[c]	-	-	-	1,000,000

(continued)

TABLE IX-15 (cont.)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Non-tax payments	-	-	-	-	-
Intergovernmental transfers					
Federal appropriations	-	-	-	9,563,000	9,563,000
State appropriations	-	-	-	-	-
Contractual income	-	-	-	13,183,493	13,183,493
Other	-	-	-	-	-
Tuition	-	-	-	-	-
Income from operations	-	-	-	203,000	203,000
Other	-	-	-	-	-
Total income	19,337,090	-	-	22,949,493	42,286,583
Surplus or (Deficit) to Area on Current Account	(4,110,243)	4,123,363	431,648	(19,274,319)	(18,829,551)

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a/ Colorado National Guard.

b/ Personal Federal income tax payments from Boulder Area = $14,354,416 (from household survey). Corporate income taxes collected totaled $3,982,674.

c/ Estimate.

than expenditures of Federal agencies located in Boulder, but because there is a $5 million expenditure leakage for goods and services out of Boulder plus a $3 million payroll leakage to persons who work in but live outside the Boulder area.

Functionally, the concentration of Federal expenditures for space and space-related, and commerce and labor purposes illustrates the importance of the National Bureau of Standards and the National Center for Atmospheric Research in the Federal government sector.

The local economy was little affected by the capital account of the Federal government's general activity in 1963. This is reflected in Table IX-16 which shows a surplus to the local area of $298,604 on Federal government capital account. The capital expenditures of $260,404 (for local capital construction), $20,000 (for local services), and $18,200 (to local manufacturing establishments) are treated as a surplus accruing to the local area because all Federal government tax and non-tax receipts from the local area were allocated to current account. Federal agencies -- again the National Bureau of Standards and the National Center for Atmospheric Research for the most part -- were not inactive in terms of capital account expenditures since these totaled more than $4 million. But most of these transactions, for example the import of manufactured durable equipment of $2,252,011, involved "rest-of-the-world" payments, leaving Boulder largely unaffected by these capital expenditures.

Postal receipts by the Boulder post office in 1963 reached $2,386,474. In one sense, the local post office rendered services in this amount to local citizens, since postal services are recorded in Table IX-17 as enterprise activity under Federal government contract. In terms of economic impact, as distinguished from services provided, the post office was a deficit operation in Boulder. Since only $690,000 was spent in Boulder for wages and salaries plus purchases from local firms, while $2,386,474 was collected from Boulder residents, the income impact locally was a negative $1,696,474. The operation of the post office in Boulder resulted in a surplus of $1,380,097 to the public enterprise but not to the area.

The next activity of the Federal government analyzed here pertains to transfer payments made to local residents under the various titles of the Social Security Act not treated elsewhere, e.g. unemployment compensation under State government transfers. Transfer receipts of Boulder residents in 1963 were $9,555,897 and for the most part represented retirement income. Payments into the Social Security trust funds by Boulder employees and employers amounted to

TABLE IX-16

FEDERAL GOVERNMENT EXPENDITURES AND REVENUES
(General Government Capital Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Space and related	-	-	-	-	$1,783,992
Commerce and labor	-	-	-	-	2,403,182
Total	-	-	-	-	4,187,174
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	$ 18,200	$322,179	-	$2,252,011	2,592,390
Space and related	-	-	-	-	-
Trade	-	474,907	-	303,537	778,444
Services	20,000	-	-	227,110	247,110
Contract construction	260,404	-	$10,128	268,698	539,230
Transportation	-	-	-	-	-
Utilities	-	-	-	-	-
F.I.R.E.	-	-	-	-	-
Government	-	-	-	-	-
Miscellaneous and other	-	-	30,000	-	30,000
Total goods and services	298,604	797,086	40,128	3,051,356	4,187,174
Wages and salaries					
Total all expenditures	298,604	797,086	40,128	3,051,356	4,187,174
Revenues					
State appropriations for capital construction	-	-	-	-	-
Transfers from current revenue for capital outlay	-	-	-	4,187,174	4,187,174
Proceeds of borrowing	-	-	-	-	-
Service charges	-	-	-	-	-
Other	-	-	-	-	-
Total income				4,187,174	4,187,174
Surplus or (Deficit) to Area on Capital Account	298,604	797,086	40,128	(1,135,818)	0

TABLE IX-17

FEDERAL GOVERNMENT EXPENDITURES AND REVENUES
(Public Enterprise Current Account, 1963 Dollars)

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures by program					
Post office	-	-	-	-	$1,006,377
Total	-	-	-	-	1,006,377
Expenditures by industry					
Goods and services					
Extractive	-	-	-	-	-
Manufacturing	-	-	-	-	-
Space and related	-	-	-	-	-
Trade	$ 38,000	-	-	-	38,000
Services	-	-	-	-	-
Contract construction	-	-	-	-	-
Transportation	20,000	$ 60,000	-	$206,377	286,377
Utilities	32,000	-	-	-	32,000
F.I.R.E.	-	-	-	-	-
Government	-	-	-	-	-
Miscellaneous and other	-	-	-	-	-
Total goods and services	90,000	60,000	-	206,377	356,377
Wages and salaries	600,000	50,000	-	-	650,000
Debt service (interest only)	-	-	-	-	-
Payments in lieu of taxes					
Total expenditures	690,000	110,000	-	206,377	1,006,377
Plus: Depreciation allowances	-	-	-	-	-
Total	690,000	110,000	-	206,377	1,006,377
Revenues					
Sale of water	-	-	-	-	-
Sewer maintenance charges	-	-	-	-	-
Other sales of goods and services	2,386,474	-	-	-	2,386,474
Less: Transfers to capital account	-	-	-	-	-
Total	2,386,474	-	-	-	2,386,474
Net Surplus or (Deficit) to Area on Current Account	(1,696,474)	110,000	-	206,377	1,380,097

$4,049,717. Thus a substantial surplus to the local economy of $5,506,180 resulted from the Federal transfer programs (see Table IX-18).

Thus far in discussing the Federal government impact on the Boulder economy we have considered only those expenditures which are channeled through local branches of Federal agencies. To stop here would be to neglect the 1963 impact of space and space-related Federal expenditures made directly to local firms. Table IX-19 gives the level of expenditures made directly by the Federal government to the various sectors of the local economy, in which space and space-related spending dominate.

The deficit to Boulder from Federal government branch expenditures less Federal taxes paid by Boulder residents is shown in Table IX-20. This deficit of $1,933 is the result of Federal taxes paid and expenditures by local branches of Federal government only. In other words, it does not measure the expenditures made directly to local firms by Federal government agencies which have no local office. When the $10,491,261 of direct Federal expenditures are added to the expenditures of local branches, the $1,933 deficit is converted into a $10,489,333 surplus. Since $9,398,258 of this amount is related to space programs, the 1963 space and space-related expenditure creates a large local surplus out of what would have been a small local deficit.

The net surplus of all government tax and expenditure programs in the Boulder area is summarized in Table IX-21. The $30,829,459 surplus generated by local government, the University of Colorado, and the Federal government is offset by a deficit in only one government sector -- the State of Colorado excluding the University. The $6 million deficit at the State level, however, merely lowers the net surplus to the area from $31 million to $24,557,155. This last total identifies the direct, first-round difference between government expenditures in the area and revenues to all governments from local sources.

Table IX-22 summarizes the expenditures by all governments for goods and services purchased from business establishments, but does not include wage and salary payments. These expenditures totaled nearly $52 million in 1963, less than half of which are made locally. Of the $23,374,525 expenditures with local businesses more than 40 per cent are related to space programs.

Finally, Table IX-23 identifies the aggregate spending of the public sector for goods and services, classified by function. More than half the expenditure total of $102,498,672 is allocated to education. The two other dominant functions are the programs of the National Bureau of Standards and the space and space-related programs of the Federal government.

TABLE IX-18

FEDERAL GOVERNMENT TRANSFER ACTIVITY ON CURRENT ACCOUNT

	Boulder Area	Denver Metropolitan Area	Rest of Colorado	Outside Colorado	Total
Expenditures					
Administrative	-	-	-	-	-
Transfers or payments to beneficiaries	-	-	-	-	-
Aid and assistance programs	-	-	-	-	-
Old age payments	-	-	-	-	-
Social Security payments	$3,810,338[a/]	-	-	-	$3,810,338
Unemployment compensation	-	-	-	-	-
Workmen's compensation	-	-	-	-	-
PERA	-	-	-	-	-
Police and fire pension fund	-	-	-	-	-
Other[b/]	5,745,559	-	-	-	5,745,559
Total	9,555,897	-	-	-	9,555,897
Revenues					
Employer taxes	2,040,603	-	-	-	2,040,603
Employee taxes	2,009,114	-	-	-	2,009,114
Intergovernmental transfer	-	-	-	-	-
Other	-	-	-	-	-
Total	4,049,717	-	-	-	4,049,717
Net Surplus or (Deficit) to Area on Current Account	5,506,180	-	-	-	5,506,180

[a/] Estimate by local Social Security Office.

[b/] Includes veterans' cash payments, educational assistance, military retirement payments, interest on government bonds and similar items.

TABLE IX-19

DIRECT FEDERAL GOVERNMENT EXPENDITURES WITH LOCAL FIRMS
BY INDUSTRIAL SECTOR NOT PROCESSED THROUGH LOCAL
BRANCHES OF FEDERAL AGENCIES

Extractive	-
Manufacturing	$ 354,757
Space and related	9,398,258
Trade	249,413
Services	484,213
Contract construction	2,049
Transportation	-
Utilities	-
F.I.R.E.	-
Government	-
Miscellaneous and other	2,576
Total	10,491,266

TABLE IX-20

NET SURPLUS TO BOULDER, FEDERAL GOVERNMENT EXPENDITURES AND REVENUES

Local expenditures by local branches of Federal government agencies, current account general	$15,226,847
Local expenditures by local branches of Federal government agencies, capital account general	298,604
Local expenditures by local branches of Federal government agencies, current account, public enterprise	690,000
Local expenditures, Federal government, transfer activities	9,555,897
Total expenditures	25,771,348
Less: Federal government tax revenue from Boulder, current account general	19,337,090
Less: Federal government public enterprise receipts, current account	2,386,474
Less: Federal government Social Security trust fund receipts	4,049,717
Total revenue	25,773,281
Deficit	1,933
Less: Direct Federal government expenditures with local firms, not processed through local branches of Federal agencies	10,491,266
Net Surplus	10,489,333

TABLE IX-21

NET SURPLUS TO BOULDER, CONSOLIDATED GOVERNMENT
EXPENDITURES AND REVENUES

	Surplus	Deficit
Local	$ 2,746,016	-
University of Colorado	17,594,110	-
State	-	6,272,304
Federal	10,489,333	-
Total	30,829,459	6,262,304
Net Surplus	24,557,155	-

TABLE IX-22

CONSOLIDATED GOVERNMENT EXPENDITURES TO BUSINESS ESTABLISHMENTS
FOR GOODS AND SERVICES BY INDUSTRIAL SECTOR

	Local		University of Colorado		State (excluding University)	
	Inside Boulder	Outside Boulder	Inside Boulder	Outside Boulder	Inside Boulder	Outside Boulder
Extractive	$ 7,125	$ 2,995	$ 43	-	-	-
Manufacturing	159,211	489,370	421,368	$ 3,841,028	$142,940	-
Space and related	-	-	-	-	150	-
Trade	490,639	853,964	690,394	2,636,933	35,422	10,000
Services	708,835	387,616	460,061	2,265,855	29,151	-
Contract construction	438,857	1,587,634	4,242,635	2,701,979	578,000	480,000
Transportation	20,789	2,504	365,587	114,055	628	-
Utilities	374,755	91,702	417,405	49,874	2,686	-
F.I.R.E.	59,951	557,700	36,852	2,650,659	-	3,240
Government	84,058	14,869	15,920	58,325	-	-
Miscellaneous and other	111,693	272,488	290,112	524,275	-	-
Total	2,455,913	4,260,842	6,940,377	14,842,983	788,977	493,240

(continued)

TABLE IX-22 (cont.)

	Federal		Total	
	Inside Boulder	Outside Boulder	Inside Boulder	Outside Boulder
Extractive	-	-	$ 7,168	$ 2,995
Manufacturing	$ 400,198	$3,053,000	1,123,717	7,383,398
Space and related	9,535,630	-	9,535,780	-
Trade	526,412	2,162,802	1,742,867	5,663,699
Services	564,790	1,658,754	1,762,837	4,312,225
Contract construction	262,453	278,826	5,521,945	5,048,439
Transportation	928,940	293,494	1,315,944	410,053
Utilities	294,218	88,613	1,089,064	230,189
F.I.R.E.	-	699,800	96,803	3,911,399
Government	674,041	636,883	774,019	710,077
Miscellaneous and other	2,576	30,000	404,381	826,763
Total	13,189,258	8,902,172	23,374,525	28,499,237

TABLE IX-23

CONSOLIDATED GOVERNMENT EXPENDITURES BY FUNCTION[a/]

	Local	University of Colorado	State (excluding University)	Federal	Total
Public safety	$ 1,011,477	-	-	-	$ 1,011,477
Highways	1,513,241	-	$ 608,200	-	2,121,441
Education					
Primary and secondary	10,044,902	-	-	-	10,044,902
Higher	-	$43,075,129	-	-	43,075,129
Libraries	133,132	-	-	-	133,132
Public welfare	554,114	-	-	-	554,114
Parks and recreation	279,269	-	-	-	279,269
Commerce and labor	-	-	98,011	$22,061,940	22,159,951
National security	-	-	-	67,000	67,000
Research and development					
Space and related	-	-	150	14,687,185	14,687,335
Agriculture	-	-	-	82,400	82,400
Water and sewer	4,189,430	-	-	-	4,189,430
Post office	-	-	-	1,006,377	1,006,377
Other	1,214,121	-	-	143,939	1,358,060
Direct State and Federal expenditures, unassigned by function	-	-	768,856	959,799	1,728,655
Total	18,939,686	43,075,129	1,475,217	39,008,640	102,498,672

[a/] Includes current and capital expenditures by local government, University of Colorado, local branches of State and Federal government, plus direct local expenditures by State and Federal government, not processed through a local branch of State and Federal agencies.

X

THE AREA CONSUMPTION FUNCTION AND THE AGGREGATE MULTIPLIER

The primary objective of this chapter is to construct a model of regional growth based upon the income, expenditure, product and employment behavior analyzed in the preceding chapters. This model can then be used to show the impact of space and other expenditures upon the growth of the Boulder economy.

The first part of the chapter is an analysis of the basic macroeconomic structure of the local economy, including a brief description of the aggregate economic relationships to be defined between the variables in the model. The second part develops the entire consumption theory to be applied in the model and the aggregate consumption function based on this theory. The third part entails an analysis of the leakages which tend to dampen the aggregate multiplier, such as direct imports, personal taxes and indirect imports. The fourth is an investigation of the determinants of various types of investment as they are related to the multiplier-accelerator process. The formal regional impact model will be formulated on the basis of this investigation. The fifth part integrates the separate aspects of the model so that aggregate multipliers may be derived for the final analysis. The sixth and last part is the numerical implementation and interpretation of these multipliers.

The Determinants of Regional Economic Activity

In this section aggregate regional relationships are combined into a basic analytical structure. As in the traditional income model, total regional expenditure is partitioned into sectors -- local consumption of products originating in the region, exports, current expenditure by all levels of local and non-local government (including the University), capital expenditures by various branches of government, and capital expenditure by local and non-local sectors of the business community. This division of Gross Area Product can be represented by the equation,

$$(1) \qquad Y = C + E + \sum_{i=1}^{k} CG_i + \sum_{i=1}^{k} IG_i + \sum_{j=1}^{m} IB_j$$

where C = local consumption, E = total exports, and CG_i (i = 1, 2, . . ., k) = current area expenditures of local and non-local government, IG_i (i = 1, 2, . . ., k) = capital expenditures of government, and IB_j (j = 1, 2, . . ., m) = investment expenditures of business in the region.

An additional structural statement of area product necessary for this model is a division of Gross Area Income into Personal Income accruing to area residents, Personal Income accruing to the "rest-of-the-world," undistributed profits of incorporated firms in the region, business taxes and transfers, government transfers to area residents, and other net income and transfers from the "rest-of-the-world."[1/]

Equation (2) will be used in the determination of the leakages in regional income flows which have significant impact upon the value of the regional multiplier.

$$(2) \qquad Y_v = Y_p + P_r + T_b - T_{r_g} + R_t + CCA$$

where Y_v = Gross Area Income (by value added components),

Y_p = Personal Income,

P_r = retained earnings of regional corporations,

T_b = all business taxes less business transfer payments (including in this instance employer and employee payments into various retirement plans),

T_{r_g} = government transfer payments to area residents,

R_t = net earned income and personal transfer payments to "rest-of-the-world," and

CCA = capital consumption allowances.

Another breakdown used in the regional accounts is the separation of area product (final demand) into value added (area income) and indirect imports. This breakdown can be expressed in equation form as

$$(3) \qquad Y = Y_v + M_r$$

[1/] A detailed analysis of Area Income by Personal Income categories is given in our basic set of accounts in Chapter VIII.

where Y = gross area final demand or product,

Y_v = total value added in the region, and

M_r = total imports by business or government agencies considered endogenous to the regional economy.

The basic analysis will require the separation of exogenous and endogenous variables. Clearly, aggregate consumption as well as several categories of induced investment should be considered endogenous. Exports and certain autonomous types of investment are logically exogenous in character. The sectoral breakdown of the business survey data and the collection of government data by various levels of government, as well as a separation of all government expenditures by function, enabled us to make reasonable decisions as to what constitutes exogenous and endogenous investment expenditure.

In the business sector, all local firms are considered endogenous with the exception of the space and space-related sector which is considered totally exogenous. Branch offices or plants in the area are considered endogenous for some purposes and exogenous for others. The manner in which branch activities are separated will be discussed later.

All local government activities are considered endogenous. Other county, State and Federal activities are classified as exogenous or endogenous according to their function. All activity of the University of Colorado is considered exogenous.

It will be necessary to divide Personal Income into total consumption and personal saving. Further, total consumption will be broken down into consumption expenditures on local goods by local residents -- and non-local consumption (sometimes referred to as direct imports). Local consumption is the same consumption aggregate identified in equation (1) as a basic component of Gross Area Product.

The breakdown of Personal Income described above can be expressed by the following equation:

$$(4) \qquad Y_p = C + M + S + T_p$$

where C = local consumption,

M = direct imports by households,

S = personal savings, and

T_p = personal taxes.

If we let C_t denote total consumption, C + M, then equation (4) can be written as

$$(5) \qquad Y_p = C_t + S + T_p$$

Personal Income may also be defined as Disposable Personal Income plus personal taxes.

$$(6) \qquad Y_p = Y_d + T_p$$

The basic model shows the postulated functional relationship between total consumption and Disposable Personal Income.

$$(7) \qquad C = f\ (Y_d)$$

The stability of this relationship has been verified at the national level by an extensive collection of data on aggregate consumption and disposable income. Hence, it is a natural extension to assume that a consumption function exists for a region having a fairly large population.

It may be, however, that considerable differences exist between consumption patterns of regional populations and the national population. This may reflect the different spending norms of different social and economic groups making up a population. Regions may have different consumption functions because their respective populations are composed of different combinations of socio-economic groups and in varying proportions. These differences have significant effects on the sectoral consumption patterns of the region and they are also important in determining aggregate total consumption and the allocation of total consumption between local consumption and imports. Also, household spending on contract construction, which is classified as investment in most accounting systems, can be handled in a manner similar to the way sectoral consumption expenditures are handled in the input-output part of this report.

In the national model, investment expenditure is treated as a function of aggregate national income and the interest rate,

$$(8) \qquad I = F\ (Y, i)$$

In this regional model, however, we will modify the original formulation expressed by equation (8) by partitioning investment into an induced category and a strictly autonomous category. The induced component of investment will be assumed to be functionally related to aggregate income but will be assumed to be independent of the interest rate. These modifications may be represented by the following two equations:

$$I = I_a + I_i$$

(9)

$$I_i = F(Y)$$

where I = total investment,

I_a = autonomous investment, and

I_i = induced investment.

In the regional model it is essential that induced investment be associated with firms having strong connections with the region under study.

Regional Consumption Analysis

In addition to the basic assumption of a stable relationship between aggregate total consumption and national Disposable Personal Income as represented in equation (7), we also assume a stable relationship between aggregate local consumption and area Disposable Personal Income. The existence of a stable local consumption function, in addition to a total regional consumption function, implies that a stable import function exists for the region. Equation (7) may be restated as the two following equations:

(7') $C = f(Y_d)$, and

(7'') $M = g(Y_d)$

We postulate the above relationships on the basic assumption of a stable spending pattern for the region. By this we mean that the region is composed of a number of socio-economic groups which tend to develop definite norms of behavior which in turn are reflected in the average spending pattern of each group. For

example, in the Boulder area, there is a large student population which is a relatively homogeneous group, within which certain patterns of behavior seem to be accepted by each cycle of new students entering the University. These behavioral patterns are by no means static since considerable change can be observed between different generations of students. However, stability can be assumed in the overall "norms" of the student body over a short-run period of possibly ten years, and we assume that basic spending norms of this group remain stable in the short-run.

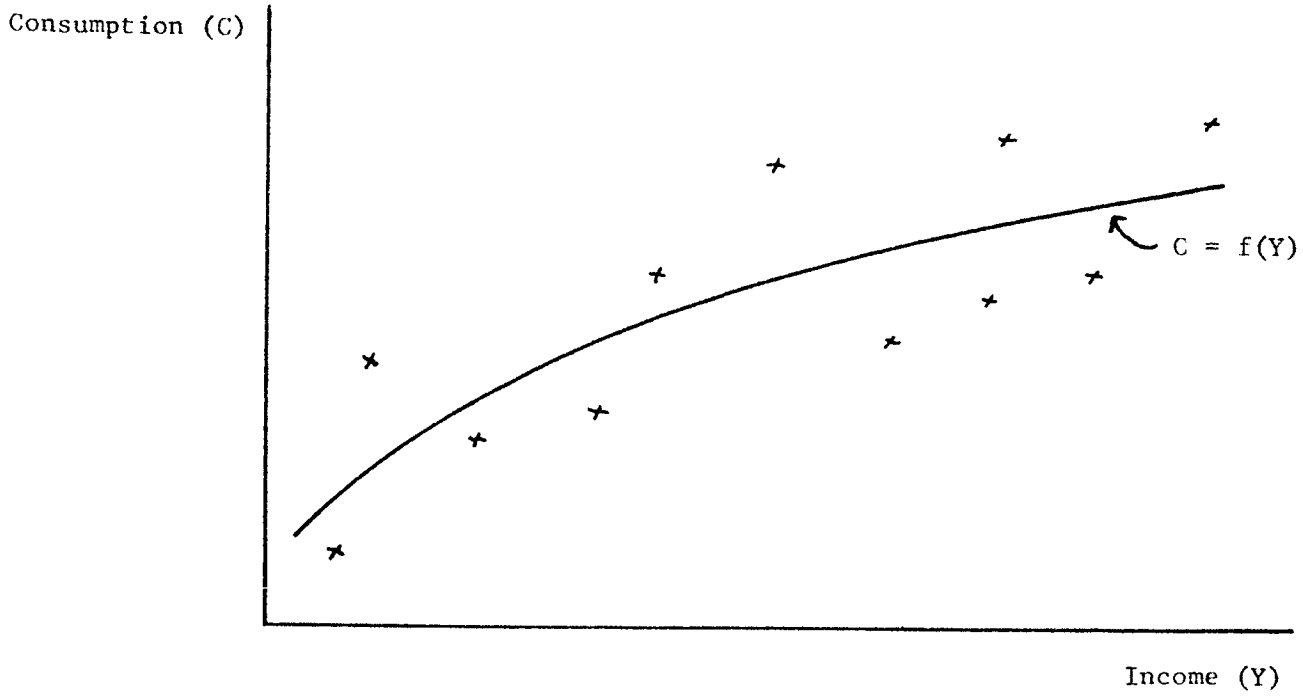
Another major socio-economic group in the area with distinct patterns of consumption behavior is the large professional, scientific and academic segment of the local population. This group, like the student group, is associated either directly or indirectly with the University, although the recent movement of space-oriented industries into the area and its immediate vicinity has significantly increased the number in this group with no direct tie to the University.

There are no doubt several other distinct social and economic segments in the area population with common patterns of group behavior. However, it is not the individual group behavior patterns that are important in the analysis of regional consumption patterns. The stability of regional consumption patterns in the short-run is based on the aggregate interaction of all the distinguishable socio-economic groups which collectively make up the area population. It is apparent that the stability of consumption patterns in a region depends essentially on a stable population structure which may change secularly, but which is not affected by short-run fluctuations in regional economic activity.

The aggregate consumption functions used in this model will be derived from the cross-section spending patterns of the major socio-economic groups which comprise the region. These spending patterns are defined as the average expenditure trends reflected in the scatter diagrams of consumption versus income for the respective groups. Consumption may be either sectoral or total, but for an aggregate analysis we are concerned with total consumption only. This, of course, will be broken down into local consumption spending and direct imports by households.

If we plot a scatter diagram of consumption versus income for a budget study sample of individuals from a major socio-economic group, it will have the appearance of the one shown in Figure X-1. The continuous line is the average spending trend of the population group represented in the scatter. We assume the existence of such a spending pattern for the entire socio-economic group. Then any sample of points taken from a budget study will vary about this average trend

FIGURE X-1



line with a certain variance.[2/] Thus, an average trend line estimated from the sample will not be the "true" spending pattern of the group, but an approximation of it.

The customary method of estimating this average trend is to fit a curve to the data by the method of least squares. In general, this function can be any continuous function, C = f (Y), with a continuous derivative.[3/] Usually the spending pattern is assumed to be linear, and may be expressed by the equation,

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[2/] If we assume that the sample is normally distributed with variance σ^2, the average trend line estimated from the sample will have variance σ^2/n. This implies that a close approximation to the true pattern can be obtained by taking a sufficient number of sample points.

[3/] Continuity of the function and its first derivative is not necessarily true for particular sectors; however, it is usually assumed for total consumption.

$$C = a + b_Y \tag{10}$$

If a least squares fit is used, a and b are estimated by standard regression formulas.

The fundamental assumption in the derivation of consumption functions is the stability of the spending patterns of all major socio-economic groups in the region.[4/] Long-run consumption studies have revealed that the average propensity to consume (APC) has tended to drift upward over time. This implies that the spending pattern will periodically shift upward; otherwise the tendency for f'(Y) to decrease with increasing income would require the long-run consumption function to have a declining marginal propensity to consume (MPC) and hence, a declining APC. However, over a short period, it is reasonable to assume a stable spending pattern.

Consider now the derivation of aggregate consumption functions given the spending pattern of a population. As a first approximation, we assume that the spending pattern has the linear form expressed by equation (10). Suppose that (Y_o, C_o) is the point on the aggregate consumption function determined from the income and product accounts. If it is assumed that the population under consideration does not change in size, the aggregate consumption function is

$$C = C_o + b(Y - Y_o) \ . \tag{11}$$

This form of the consumption function is derived from household shifts along the spending pattern. The MPC is b which is the slope of the linear spending pattern. However, in the case of a region, there are significant population shifts due to changes in aggregate income. These shifts result primarily from an increase or decrease in the demand for labor which affects the migration of workers.

If a change in aggregate income went entirely to new workers (or in the case of a decrease, resulted entirely in an exit of workers from the region), under the assumption that the new workers (or departing workers) are distributed about the spending pattern in basically the same manner as the total population, the aggregate consumption function will be

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4/ "Spending pattern" will henceforth mean the average trend curve, c = f(Y), for total consumption, local consumption, or non-local consumption.

$$(12) \qquad C = \left(\frac{C_o}{Y_o}\right) Y$$

which is a linear, homogeneous form.

The typical change in average income will involve both a change in income and a change in households and hence the aggregate consumption function should be some combination of (11) and (12). This combination may be found if the division of a change in aggregate income between new households and original households can be determined. If $r(Y - Y_o)$ goes to households residing in the region before the change in income, then

$$(13) \qquad C = C_o + br(Y - Y_o) + \frac{C_o}{Y_o}(1 - r)(Y - Y_o)$$

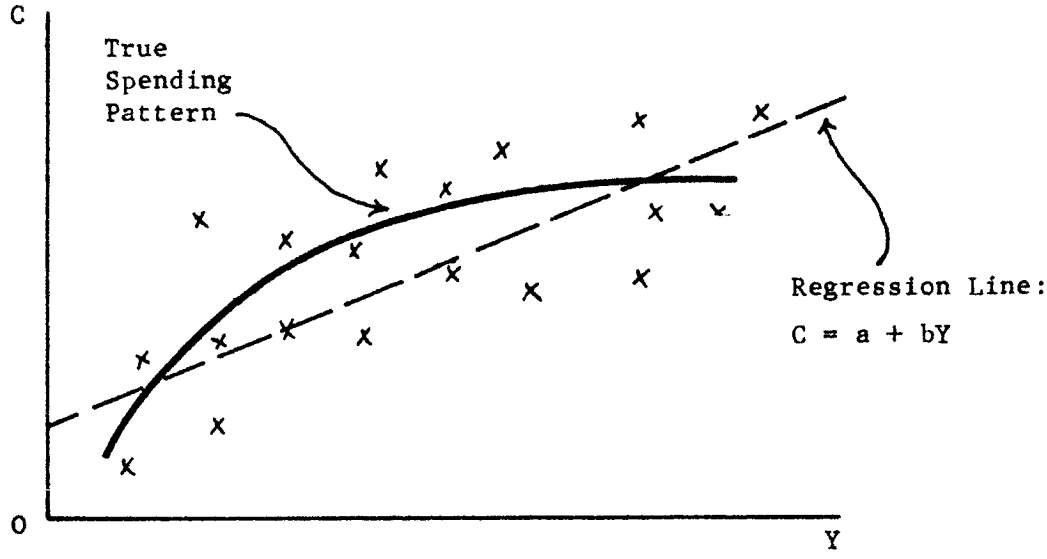
would be the form of the consumption function providing, of course, that the APC of all new households is the same as the APC at the time of the sample survey.[5/]

The second term on the right-hand side of equation (13) may be called the population effect since the change in the number of income recipients is expected to change aggregate spending by the total change in income times the original APC of the population. This is based on the assumption that the entering or departing members of the population are typical in terms of both income distribution and spending behavior. The validity of this assumption depends upon the homogeneity of the group under consideration, the particular combination of forces which affect population changes in the group, and possibly other factors. However, the assumption is reasonable for those groups that are constantly experiencing population changes primarily induced by income changes, since the group APC is always adjusting to the different characteristics of new entrants.

At this point, estimation of the constant population MPC should be examined (b in equation (13)). The method used in most studies is to estimate b from the average slope of the spending pattern determined by a least squares regression (equation (10)). However, this tends to over-estimate the constant population MPC due to the curvature of the group's spending pattern (see Figure X-2).

[5/] A better assumption would be that the APC of new residents is C/Y; however, this would unnecessarily complicate expression (13) since non-linear terms would be introduced. For small income changes, the loss in accuracy is negligible. In the case of a long-run analysis, use of the original APC effectively accounts for upward shifts in the spending pattern, and hence will yield a realistic long-run consumption function.

FIGURE X-2



A better approximation may be obtained by dividing the income distribution into a series of successive income classes, each of which corresponds to an approximately linear trend along the spending pattern. The determination of the "best" series of income classes based on some criterion is fairly difficult, but a reasonably good choice of income classes can be made by merely observing the trends in a scatter diagram.[6/] Once income classes have been chosen, it is a simple matter to represent the linear trends in each income class by linear regression equations. This procedure is illustrated in Figure X-3.

An average MPC for the population group can then be estimated from the individual linear trends. The basic assumption is that an aggregate change in income distributed to the constant population will cause the total population

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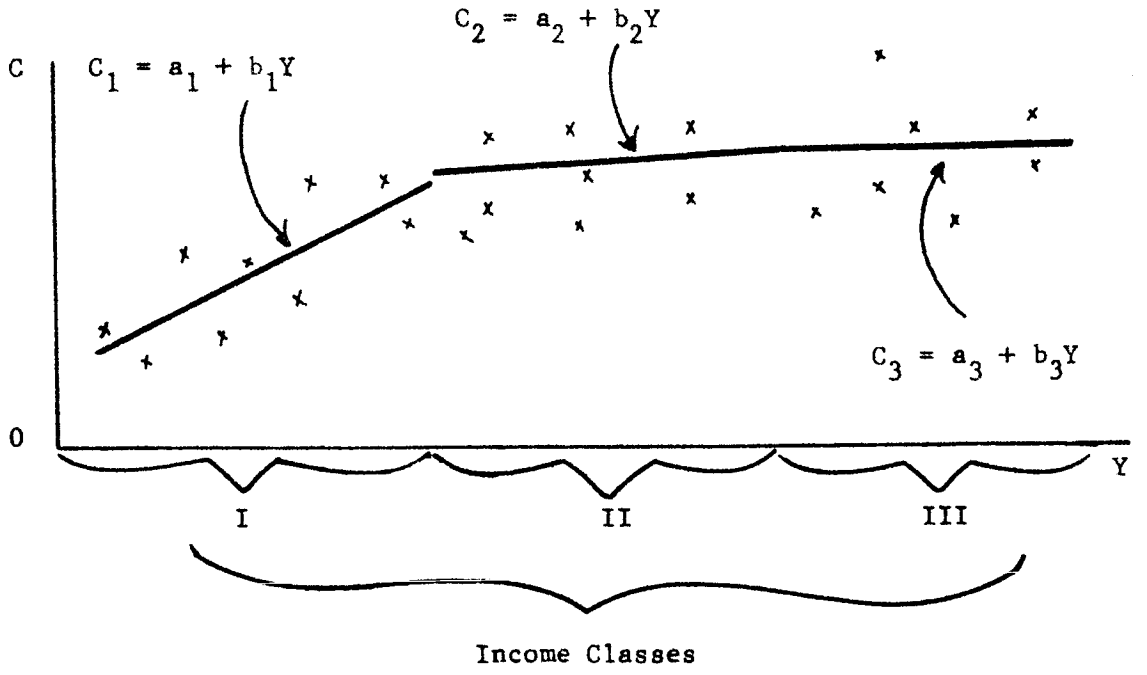
[6/] The precision required to identify linear spending trends depends upon the type of aggregate consumption function desired. In this development, we are approximating the consumption pattern by a linear, yet non-homogeneous, function.

FIGURE X-3



to change its aggregate spending and to move along the spending pattern. This is based on the assumption of group emulation applied to spending habits. That is, it is assumed that when a number of consumers move from one income level to another, they adjust their average spending habits in a way which conforms to the spending patterns of the original members of that income group.

This hypothesis allows for diversity in the scatter of points about the spending trend, but it requires that the average movement of a set of points relatively close together follow the original spending pattern. Thus it is assumed that the behavior norms of the group are sufficiently strong to mold the average spending behavior of the shifting population.

If it is further assumed that all changes in aggregate income are distributed uniformly to the original income distribution then, neglecting non-linear effects, the average MPC of the constant population is given by

$$(14) \qquad b = \sum_{i=1}^{n} r_i b_i$$

where the b_i's are the respective slopes of the n income classes, and the r_i's are the corresponding percentages of total income in each class.[7/]

We now derive consumption functions for the entire regional population using the basic model represented in equations (13) and (14). Suppose that we can divide the entire regional population into a number of relatively homogeneous socio-economic groups. Aggregate consumption functions may then be derived for each group separately, and assuming for the moment that the distribution of Personal Income among these groups can be determined, an aggregate consumption function for the entire regional population can be obtained by aggregating the individual group consumption functions.

A division of the regional population into socio-economic groups can be based upon the following criterion: if changes in Personal Income would change either the internal structure of the population group, or the relative size of that group with respect to the entire regional population, it may be distinguished as a separate socio-economic group. Otherwise it should not be considered separately. In other words, a large group should not be sub-divided into smaller groups if all the smaller groups can reasonably be expected to change homogeneously with respect to the large group. A final division of the total population into socio-economic groups will be based on a knowledge of the region's history.[8/]

In the Boulder region, for example, a division of the total population into two socio-economic groups -- students and residents -- should be sufficient for a short-term multiplier analysis. The nature of the student population is

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[7/] Equation (14), of course, neglects the shifting of households among brackets; that is, it assumes that all shifts occur entirely within the defined income classes. This suggests that equation (14) will best represent the average MPC if the income classes are chosen to be as large as possible, while at the same time preserving a high degree of linearity in the corresponding segments of the spending pattern.

[8/] For example, a long-run analysis would require a fairly detailed division since almost all larger groups change their structure over long periods. In a short period compatible with a multiplier analysis, however, fairly large groups can be expected to maintain their basic structures.

determined primarily by exogenous factors which would not be expected to change greatly over a time period considered reasonable for this analysis.[9/] Even if this group does change structurally in the future, it would be difficult to foresee such a change in view of the unpredictability of exogenous changes.

The resident population could, however, be further subdivided in a meaningful way. For example, it seems reasonable to divide this group into: (1) the large professional, scientific, and academic population, and (2) all others which collectively could be considered to be attached to subsidiary activities supporting the University and the scientifically-oriented industries in the area. However, the Boulder economy has been geared to the above export activities for a considerable period which leads us to believe that the subsidiary population will change homogeneously with the "export" population (professionals, etc.). A more crucial reason for not making this subdivision, however, is the lack of sufficient data.[10/]

The next step is to estimate group consumption functions for both students and residents. The population growth rate of students is determined by exogenous forces; therefore, for the multiplier analysis it will be assumed to remain constant. An average growth rate can be calculated on the basis of records covering the last ten to twenty years. The assumption is made that an instantaneous change in Personal Income will in no way affect the size of the student population. The population effect in equation (13) then becomes zero for this group. Student aggregate consumption functions will then have the form,

$$(15) \qquad C_s = C_{o_s} + b_s (Y_s - Y_{o_s})$$

The resident population, however, will have a significant population effect in equation (13) because of the net migration induced by a change in aggregate income. The magnitude of this effect can be determined from an aggregate

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[9/] Such factors as the reputation of the University, availability of recreational facilities, the climate and other attractions of the surrounding area, and permanent changes in relative tuition rates, can be expected to maintain a reasonable degree of stability over periods of perhaps as much as ten years.

[10/] The household questionnaire used in the survey did not completely separate the employment and income information of the different individuals comprising the household.

employment function in conjunction with a scale factor equal to the average number of employed members per household for this population group.

Linear employment functions were derived for each sector as a part of the sectoral multiplier analysis. Each of these functions had the form.

$$(16) \qquad E_j = e_j X_j + E_{jo} \ , \ j = 1, 2, \ldots, n$$

where e_j was estimated by the regression of employment versus total gross output of all the establishments in the j^{th} sector and E_{jo} was the 1963 employment total for that sector. The basic assumption underlying these functions is that each regression line is the average employment expansion path for the corresponding sector. Each sector is assumed to consist of homogeneous establishments producing a homogeneous output. It is further assumed that there is no entry or exit of establishments during a time span compatible with the analysis.

Aggregating the functions represented in equation (16), we obtain an aggregate employment function,

$$(17) \qquad E = eX + E_o$$

where

$$e = \frac{1}{X} \sum_{j=1}^{n} X_j e_j \ ,$$

$$E_o = \sum_{j=1}^{n} E_{jo} \ , \text{ and } X = \sum_{j=1}^{n} X_j \ .$$

Implicit in this aggregation is the assumption that the distribution of total gross output among the various sectors will not change substantially during the time period of the analysis. Actually, a better aggregation could be obtained by weighting each employment coefficient, e_j, by its marginal output and then dividing by the total marginal output.[11/] The latter requires the use of sectoral

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[11]The latter technique yielded a coefficient of .0226, which gave a consistent population effect of a change in income, whereas the method described in the text gave e = .0622 which would have greatly overstated this effect.

consumption functions and indirect coefficients from the input-output tables of Part I determine the marginal outputs.

Equation (17) can now be used to estimate the net in-migration of households induced by an increase in Personal Income. If we let D denote total final demand in the region (total value added as represented in equation (1)), the net change in employees resulting from the change in income, $Y - Y_o$, is given by the relation,

$$(18) \qquad \triangle E = e \left(\frac{X}{D}\right) (Y - Y_o)$$

Assuming that $\frac{X}{D}$ will not change appreciably in the short-run, we can replace $X_{/D}$ by the constant X_{o/D_o}.[12/] Also, if $\underline{h}$ is used to denote the average number of employees per household in the resident population (which is also assumed to remain constant), equation (18) can be modified as follows:

$$(19) \qquad \triangle P_n = \left(\frac{e}{h}\right) \left(\frac{X_o}{D_o}\right) (Y - Y_o)$$

$$= r\,(Y - Y_o) \quad \text{where } r = \frac{eX_o}{hD_o} \text{ , and}$$

$\triangle P_n$ is the change in households.

Suppose now, that the average Personal Income per household for the resident population is $\bar{Y}_n$, then the portion of the total change in aggregate Personal Income, $Y'_p - Y'_{p_o}$ going to new households is given by the equation

$$(20) \qquad Y'_p - Y'_{p_o} = r\bar{Y}_n\,(Y - Y_o)$$

Since sufficient accuracy is obtained in estimating $\bar{Y}_n$ by $\bar{Y}_{n_o}$, the net Personal Income change for the non-student population due to increased population is

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[12/] The assumption of a linear homogeneous relation between total gross output and total final demand is implicit in the input-output analysis.

$$(21)^{13/} \qquad Y'_p - Y'_{p_o} = r\bar{Y}_{n_o} (Y - Y_o)$$

Equation (21) is based on the assumption that all new employment is induced from outside the region. It can be used to build consumption functions for the resident population once aggregate final demand is related to Personal Income for this group, and Personal Income is related to Disposable Personal Income. However, consider for a moment the distribution of a change in total aggregate Personal Income between the student and resident populations.

Suppose that we have an aggregate change in Area Income, $Y - Y_o$, and an associated change in Personal Income, $Y_p - Y_{p_o}$. From the above discussion, $r\bar{Y}_{n_o} (Y - Y_o)$ of the total, $Y_p - Y_{p_o}$, will go to the resident population as a result of an induced change in the number of households, leaving

$$(22) \qquad Y_p - Y_{p_o} - r\bar{Y}_{n_o} (Y - Y_o)$$

to be distributed between the two populations.

Since the quantity represented in (22) is to be distributed between constant student and resident populations, assume that this residual will be distributed proportionately between these two groups;[14/] that is, if $Y_{p_{so}}$ and $Y_{p_{no}}$ denote the aggregate personal incomes of these two groups in the base year and Y_{p_o} is the total, then

$$(23) \qquad Y_{p_s} - Y_{p_{so}} = \frac{Y_{p_{so}}}{Y_{p_o}} \left[Y_p - Y_{p_o} - r\bar{Y}_{n_o} (Y - Y_o) \right] \text{, and}$$

$$(24) \qquad Y_{p_n} - Y_{p_{no}} = \frac{Y_{p_{no}}}{Y_{p_o}} \left[Y_p - Y_{p_o} - r\bar{Y}_{n_o} (Y - Y_o) \right] + r\bar{Y}_{n_o} (Y - Y_o)$$

13/ Average income should not increase as rapidly as aggregate income due to the influx of new households. However, expression (20) could be used directly if the total resident population is explicitly introduced in the model. This would introduce non-linear terms.

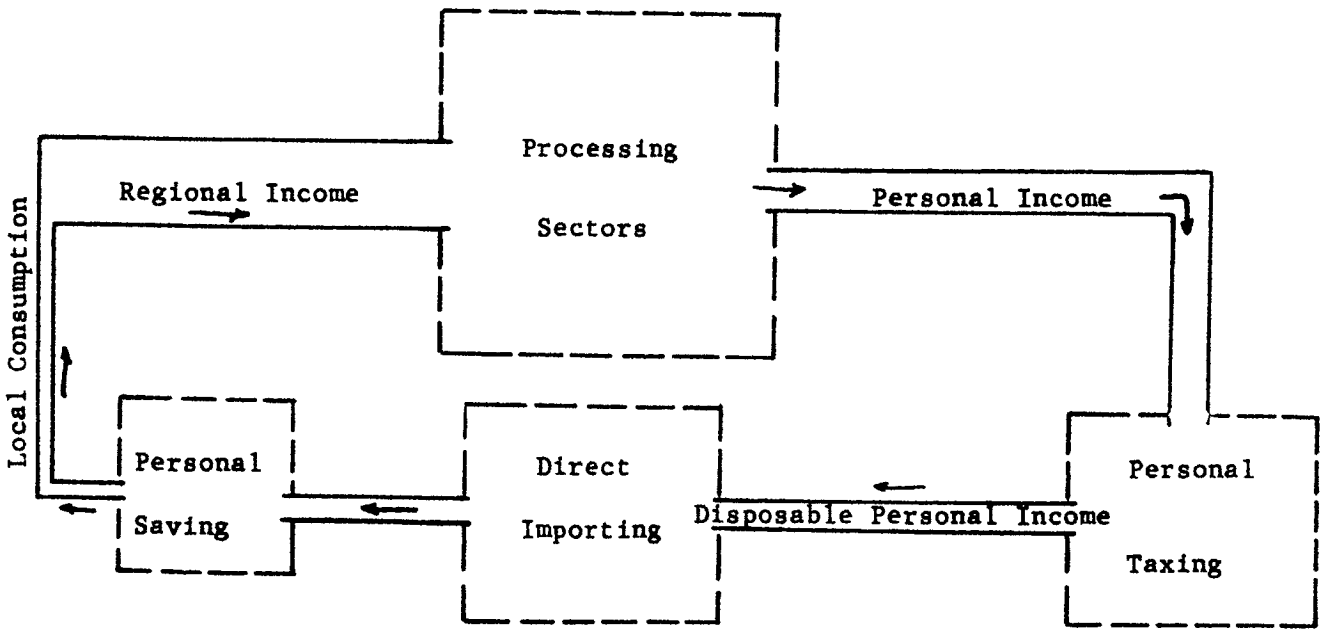
14/ This assumption is fairly realistic since the activity of the University, including the induced consumption effects of the student population, is a major determinant of the region's growth. Hence the earned personal income of the student population will tend to expand proportionately to total income.

All of the quantities, Y_{p_o}, $Y_{p_{so}}$, and $Y_{p_{no}}$, should include only earned income because equations (23) and (24) distribute a change in Personal Income resulting from a change in the region's total economic activity, $Y - Y_o$. Significant changes in the flow of transfer payments to both students and residents are determined primarily by exogenous forces and long-run structural changes in the regional economy. Hence, for a multiplier analysis focusing on the cumulative induced effects of a change in autonomous expenditure, it is reasonable to require that all Personal Income other than earned income remain constant.[15/]

Analysis of Leakages in the Regional Income Flow

This section analyzes the major leakages in the regional income flows. These can be divided into leakages: (1) through the processing sectors, (2) through personal taxes, (3) from direct imports, and (4) from personal saving. This breakdown is schematically illustrated in Figure X-4.

FIGURE X-4



[15/] The present development could easily be modified for a growth model by adding the term

$$r_{tr} (t - t_o) (Y_{to})$$

to both equations where r_{tr} is the average yearly rate at which transfer payments change, and Y_{to} is an estimate of all such unearned income during the base year.

These leakages will be incorporated into the consumption functions developed in the last section to complete the consumption aspects of the overall model.

Processing leakages[16/] -- In this section, a method will be developed to determine how much of a change in aggregate income (positive or negative) will be reflected in a change of income accruing to area residents. The difference between $\triangle Y$ and $\triangle Y_p$ is absorbed from the area income flow as the products and services in this flow are processed by businesses and government establishments. Hence let us call the difference, $\triangle Y - \triangle Y_p$, the "processing leakage."

An accurate determination of the processing leakage is difficult in an aggregative analysis because no differentiation can be made between different types of regional output. As an example, we are forced to aggregate services with manufactured goods -- two processes which have significantly different leakages. Hence, any aggregate estimate of a region's processing leakage should be viewed as an average leakage based on a combination of business and government activities which are assumed to be typical. A detailed determination of the different kinds of leakages corresponding to different types of regional output clearly requires a sectoral analysis.

Referring to equation (2), let us determine how much of a change in Area Income, $\triangle Y$, flows to area households in the form of Personal Income. In the last section, we assumed that transfer payments to households in the region remain constant for the multiplier analysis, and would increase secularly for a growth analysis. If we further assume that the flow of transfer payments outside the region remains constant, then government transfers, business transfers, and transfer payments to the "rest-of-the-world" drop out in equation (2), leaving

$$(25) \qquad \triangle Y_v = \triangle Y_e + \triangle P_r + \triangle T_b + \triangle R_e + \triangle CCA$$

where $\triangle Y_e$ = the change in Personal Income earned by area residents, and $\triangle R_e$ = net earned income accruing to the "rest-of-the-world."

This last variable depends primarily both in sign and magnitude on the growth rates of areas other than the one under study. Since it depends on exogenous influences, let us assume that on the average its net change is zero.

16/ By processing leakages we mean any leakages out of the flow of Area Income going through regional businesses or government agencies. The income flows used in this definition must, however, originate in the region. Hence, all leakages from purely exogenous activities are excluded.

We are then left with the terms $\triangle P_r + \triangle T_b + \triangle CCA$, separating total value added from earned personal income. Capital consumption expenditures are difficult to relate to total economic activity since they depend on many factors including the age distribution of existing capital stock, the size of such stock, etc. Thus, let us assume that this quantity will tend to grow proportionately with total area business product.[17/]

The other quantities, $\triangle P_r$ and $\triangle T_b$, may be assumed to expand proportionately to total business output which is comprised primarily of area consumption (neglecting inventories). This proportionality assumption is necessary because of the inadequacy of time series data. A preferable method would be to estimate the rate of change of value added with respect to earned personal income from establishment scatter diagrams of each sector similar to the estimation procedure used to determine sector employment functions in Part I. But data were not available to do this. Therefore, let k' denote the ratio of capital consumption expenditures in the base year to total business output,

$$(26)^{18/} \qquad k' = \frac{CCA_o}{C_o + I_o + \triangle Inv_o + E_o}$$

and let k'' denote the ratio of the sum of retained corporate profits plus business taxes in the base year to total business output, or

$$(27) \qquad k'' = \frac{P_{r_o} + T_{b_o}}{C_o + \triangle Inv_o + I_o + E_o}$$

Combining equations (26) and (27), we obtain total business leakages by the equation,

$$(28) \qquad k_b = \frac{P_{r_o} + T_{b_o} + CCA_o}{C_o + I_o + \triangle Inv_o + E_o}$$

17/ This assumption is consistent with the assumptions made in regard to probable investment relationships considered in the next section. Total area business product refers to total area consumption and investment.

18/ $\triangle Inv_o$ is the net change in business inventories over the base period. This quantity is lumped in with investment in equation (1).

Perhaps the largest processing leakage in a change of area output, $\triangle Y$, is the total indirect import leakage consisting of all business and local government purchases outside the region. This leakage separates total area output from total value added according to the relation,

$$\triangle Y = \triangle Y_v - \triangle M_r \tag{29}$$

Assuming that indirect imports vary proportionately with total area output, we have an import leakage coefficient,

$$k_m = \frac{Mr_o}{Y_o} \tag{30}$$

The symbol Y_o refers to total business and government output during the base period. Government import leakages are included since we wish this leakage coefficient to reflect an average flow of income out of the region for all goods and services that undergo processing by either businesses or government agencies.[19/]

Estimating this leakage by equation (30), of course, assumes a linear, homogeneous production function for all regional business and government establishments.

Combining the results in equations (25), (28), (29), and (30), we obtain

$$(Y - Y_o) - k_b (Y_b - Y_{b_o}) - k_m (Y - Y_o) = Y_e - Y_{e_o} \tag{31}$$

where $Y_b = C + I + \triangle Inv$ is total area business output. The change in earned personal income will equal the change in Personal Income under the assumption that transfer payments (for the purpose of a multiplier analysis) remain constant. Thus, equation (31) becomes

$$\begin{aligned} Y_p - Y_{p_o} &= (Y - Y_o) - k_b (Y_b - Y_{b_o}) - k_m (Y - Y_o) \\ &= (1 - k_m) (Y - Y_o) - k_b (Y_b - Y_{b_o}) \end{aligned} \tag{32}$$

[19/] For the purpose of determining business leakages, no distinction is made between export firms and locally-oriented firms because we wish to establish a a reasonable average estimate of ($\triangle Y - \triangle Y_p$) even when $\triangle Y$ includes purely exogenous spending.

This expression describes the average leakage expected per dollar from the time it first enters the flow of area expenditure to the time it reaches an area consumer. The derived relationship is linear, but not homogeneous since Y and Y_b can change at different rates.

However, in order to explicitly derive area consumption functions, let us for the moment assume homogeneity in the above relationship. That is, suppose that Y and Y_b change proportionately so that a single average leakage coefficient,

$$(33) \qquad \ell = \frac{P_{r_o} + T_{b_o} + CCA_o + M_{r_o}}{Y_o}$$

will adequately describe the total processing leakage out of a change in area product. Under this assumption, equation (32) reduces to

$$(34) \qquad Y_p - Y_{p_o} = Y - Y_o - \ell (Y - Y_o) = (1 - \ell)(Y - Y_o)$$

This result will be used in the next section for the derivation of area consumption functions although equation (32) will be used in the final formulation.

Personal tax leakages -- In this section, leakages from Personal Income due to personal taxes are investigated. We will then be in a position to complete consumption functions begun earlier for the student population, the resident population, and the area population.

Because students' taxes differ considerably from those of residents, separate tax estimates should be made for the two populations. In both cases, the ultimate problem is to determine the difference between Personal Income and Disposable Personal Income.

The fundamental assumption underlying this section is that personal taxes are a function of Personal Income:

$$(35) \qquad T = f(Y_p)$$

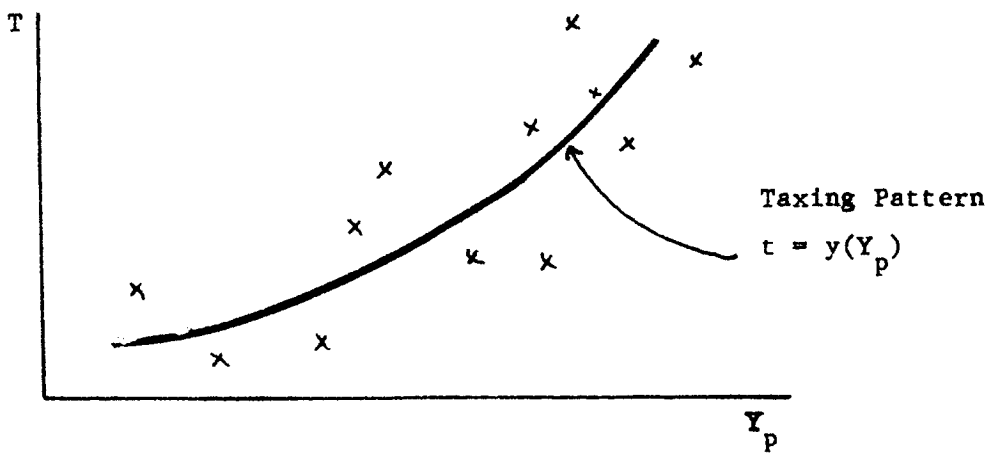
This is clearly the case with personal income taxes, Federal, State, and local. However, the connection with Personal Income is weaker in the case of property taxes, fines, licenses and other nontax payments. Property taxes, nevertheless,

have at least an indirect connection with Personal Income since higher income families tend to concentrate in higher-priced residential districts having higher assessed property values.

The preferable manner of deriving a taxing function would be to divide total personal taxes into two categories: (1) taxes directly related to income, and (2) all other taxes and non-tax liabilities. The first category could then be correlated with Personal Income and the second category could be related exclusively to population growth -- a more realistic procedure.

Reasonable taxing functions for both the student and resident populations can be derived on the basis of a cross-section analysis of the two groups. Suppose that for each group we have a scatter diagram of personal taxes plotted against Personal Income for all households in the group (see Figure X-5). Then a taxing pattern for each group can be determined from the trend of points in their respective scatter diagrams in a manner similar to the determination of group spending patterns. Using a linear approximation of this pattern, we obtain an average slope $\underline{t}$ which is an estimate of the percentage of Personal Income taken for taxes, assuming that the size of the population does not change. This coefficient is best estimated in a manner similar to that used to estimate the constant MPC in equation (14) since the progressive income tax causes the trend in Figure X-5 to be non-linear.

FIGURE X-5



For the student population, the taxing function becomes

$$(36) \qquad T_s = T_{s_o} + t_s \left(Y_{p_s} - Y_{p_{so}}\right)$$

The resident population will experience a population effect with respect to taxation. If we have an aggregate change in income, $Y - Y_o$, and an associated change in Personal Income, $Y'_p - Y'_{p_o}$, as represented in equation (21), the amount of $Y_p - Y_{p_o}$ taken in taxes is given by

$$(37) \qquad \triangle T'_n = \bar{t}_{no} r \bar{Y}_{no} \left(Y - Y_o\right)$$

where $\bar{t}_{no} = \dfrac{T_{no}}{Y_{p_{no}}}$. The remaining change in Personal Income is taxed according to

$$(38) \qquad \triangle T''_n = t_n \left(Y''_{p_n} - Y''_{p_{no}}\right)$$

where t_n is a taxing slope similar to t_s above and $(Y''_{p_n} - Y''_{p_{no}})$ is the change in Personal Income going to households residing in the region prior to the change, $Y - Y_o$ (see equation (24)).

Combining equations (36) and (23), we have for the student population,

$$(39) \qquad T_s - T_{s_o} = t_s p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no} \left(Y - Y_o\right)\right]$$

where $p_s = \dfrac{Y_{p_{so}}}{Y_{p_o}}$.

Combining equation (24) with equations (37) and (38), the taxing function for the resident population is

$$(40) \qquad T_n - T_{no} = t_n p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no} \left(Y - Y_o\right)\right]$$

$$+ \bar{t}_{no} r \bar{Y}_{no} \left(Y - Y_o\right)$$

where $p_n = \frac{Y_{p_{no}}}{Y_{p_o}}$.

Let us now use equations (39) and (40) to determine an aggregate change in Disposable Personal Income for the two populations. Since $Y_d - Y_{d_o} = (Y_p - Y_{p_o}) - (T - T_o)$, we have for the student and resident populations respectively,

$$(41) \qquad Y_{d_s} - Y_{d_{so}} = (1 - t_s)\, p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

and

$$(42) \qquad Y_{d_n} - Y_{d_{no}} = (1 - t_n)\, p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$+ (1 - \bar{t}_{no})\, r\bar{Y}_{no} (Y - Y_o) .$$

Equations (39) and (40) determine the personal taxing leakage for the student and resident populations respectively. The total taxing leakage is given by

$$(43) \qquad T - T_o = (t_s p_s + t_n p_n) \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$+ \bar{t}_{no}\, r\bar{Y}_{no} (Y - Y_o)$$

We are now in a position to derive the general form of an area consumption function. If we let $\bar{a}$ denote an average propensity to consume and b denote the average slope of the corresponding spending pattern, then

$$(44) \qquad C - C_o = \bar{a} \times \left[\text{population effect of } (Y - Y_o) \right]$$

$$+ b \times \left[\text{constant population MPC effect of } (Y - Y_o) \right] .\underline{20/}$$

20/ The constants $\bar{a}$ and b can represent average and marginal propensities respectively of total consumption, local consumption, direct imports, saving, or some sectoral category of consumption for either the student or resident populations.

Equation (44) then can be used in conjunction with equations (41) and (42) to derive all of the required consumption functions. If $\bar{a} = \bar{c}_t$ denotes total consumption and $b = c_t$, then total consumption functions for the student and resident populations respectively are

$$(45) \qquad C_{t_s} = C_{t_{so}} + c_{t_s} (1 - t_s) p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$(46) \qquad C_{t_n} = C_{t_{no}} + c_{t_n} (1 - t_n) p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$+ \bar{c}_{t_n} (1 - \bar{t}_{no}) r\bar{Y}_{no} (Y - Y_o)$$

and total consumption by both populations is given by

$$(47) \qquad C_t = C_{t_o} + \left[c_{t_s} (1 - t_s) p_s + c_{t_n} (1 - t_n) p_n \right] \cdot$$

$$\left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right] + \bar{c}_{t_n} (1 - \bar{t}_{no}) r\bar{Y}_{no} (Y - Y_o)$$

If c and $\bar{c}$ denote marginal and average propensities to consume locally, then consumption functions analogous to equations (45), (46) and (47) can be readily obtained. Substituting equation (34), however, we find that approximate consumption functions in terms of Disposable Personal Income are

$$(48) \qquad C_s = C_{s_o} + \left(c_s \frac{B}{A} \right) (Y_d - Y_{d_o}) ,$$

$$(49) \qquad C_n = C_{n_o} + \left(c_n \cdot \frac{D}{A} + \bar{c}_n \frac{F}{A} \right) (Y_d - Y_{d_o}) , \text{ and}$$

$$(50) \qquad C = C_o + \left(\frac{c_s B + c_n D + \bar{c}_n F}{A} \right) (Y_d - Y_{d_o})$$

where $$D = (1 - t_n)\, p_n \left[1 - \frac{r\bar{Y}_{no}}{1 - \ell}\right],$$

$$B = (1 - t_s)\, p_s \left[1 - \frac{r\bar{Y}_{no}}{1 - \ell}\right],$$

$$F = \frac{(1 - \bar{t}_{no})\, r\bar{Y}_{no}}{1 - \ell} \quad , \text{ and}$$

$$A = \left\{ \left[(1 - t_s)\, p_s + (1 - t_n)\, p_n \right] \left[1 - \frac{r\bar{Y}_{no}}{1 - \ell}\right] + \frac{1 - \bar{t}_{no}}{1 - \ell}\, r\bar{Y}_{no} \right\}.$$

The coefficients of $(Y_d - Y_{d_o})$ in the above equations are approximate marginal propensities to consume locally for the two populations, and for the entire region.

Similar expressions can be derived for total consumption (local consumption and direct imports). Expressions (48), (49) and (50), however, depend on the assumption of a linear homogeneous production function for the region. Utilizing the better processing leakage relationship represented in equation (32), we obtain a local consumption function having the following form:

(51) $$C = C_o + C_a\,(Y - Y_o) + C_b\,(Y_b - Y_{b_o})$$

where $$C_a = \left\{ \left[c_s (1 - t_s) p_s + c_n (1 - t_n) p_n \right] \left[(1 - k_m) - r\bar{Y}_{no} \right] + \bar{c}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\}$$, and

$$C_b = k_b \left[c_s (1 - t_s) p_s + c_n (1 - t_n) p_n \right] .$$

This equation will form the basis of the multiplier analysis to be developed in the last section.

An approximate relationship between local consumption and Area Income can be derived by substituting equation (34) into equation (47). Making the necessary exchange of subscripts, we have

(52) $$C = C_o + C_y (Y - Y_o)$$

where $$C_y = \left\{ \left[c_s (1 - t_s) p_s + c_n (1 - t_n) p_n \right] \left[1 - \ell - r\bar{Y}_{no} \right] + \bar{c}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\}.$$

Direct imports -- Following the same basic procedures (all of which are based primarily on equation (44) used in the last section, we obtain the following direct import function:

(53) $$M = M_o + m_a (Y - Y_o) + m_b (Y_b - Y_{b_o})$$

where $$m_a = \left\{ \left[m_s (1 - t_s) p_s + m_n (1 - t_n) p_n \right] \left[(1 - k_m) - r\bar{Y}_{no} \right] + \bar{m}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\}$$

$$m_b = k_b \left[m_s (1 - t_s) p_s + m_n (1 - t_n) p_n \right]$$

and the m's and $\bar{m}$'s have the same meaning for import spending that the c's and $\bar{c}$'s have for local spending. Approximate relations analogous to (48), (49) and (50) are

(54) $$M_s = M_{s_o} + \left(m_s \frac{B}{A} \right) (Y_d - Y_{d_o})$$

(55) $$M_n = M_{n_o} + \left(\frac{m_n D + \bar{m}_n F}{A} \right) (Y_d - Y_{d_o}) , \text{ and}$$

(56) $$M = M_o + \left(\frac{m_s B + m_n D + \bar{m}_n F}{A} \right) (Y_d - Y_{d_o})$$

giving approximate marginal propensities to import directly for the student and resident populations and for the entire area.

In terms of Area Income, an approximate direct import function is

(57) $$M = M_o + m_y (Y - Y_o)$$

where $$m_y = \left\{ \left[m_s (1 - t_s) p_s + m_n (1 - t_n) p_n \right] \left[(1 - \ell) - r\bar{Y}_{no} \right] + \bar{m}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\}$$

Personal saving -- If $s = 1 - c$ and $\bar{s} = 1 - \bar{c}$ for both the student and resident populations, the following personal savings functions are obtained:

(58) $$S = S_o + s_a (Y - Y_o) + s_b (Y_b - Y_{b_o})$$

(59) $$S_s = S_{s_o} + \left(s_s \frac{B}{A} \right) (Y_d - Y_{d_o})$$

(60) $$S_n = S_{n_o} + \left(\frac{s_n D + \bar{s}_n F}{A} \right) (Y_d - Y_{d_o})$$

(61) $$S = S_o + \left(\frac{s_s B + s_n D + \bar{s}_n F}{A} \right) (Y_d - Y_{d_o}) , \text{ and}$$

(62) $$S = S_o + s_y (Y - Y_o)$$

where s_a, s_b and s_y are defined in an analogous way to the corresponding parameters in the previous two sections. The linear homogeneous assumption mentioned earlier carries over to the last four of the five equations stated above.

Investment Analysis

The present analysis can be separated into the following phases: (1) analysis of business investment, (2) analysis of investment in space activities, (3) analysis of investment in the University, (4) analysis of investment by local government, and (5) integration of investment categories.

The basic approach will be to separate total investment in the area into a number of categories corresponding to different types of investment. These types differ to the extent that they are motivated by different economic forces and hence have different relationships with other economic variables in the analysis.

All relationships will of necessity be linear and homogeneous since the capital data available in the business survey cover only one year's activity. However, the process of relating each investment type to its primary determinants should enable us to determine reasonably realistic investment relationships which will be incorporated into the general model for the final multiplier analyses.

Business investment -- In this section we consider capital expenditures by some businesses in the area with others also in the region. Purchases of investment goods from outside the region are assumed to be closely correlated with total investment purchases. This assumption is based upon the stability observed in the marketing patterns of durable producers' goods and construction, and the associated contractual arrangements involved with these durable purchases.

In most accelerator models, it is assumed that investment expenditures vary proportionately with changes in aggregate demand. But both residential and commercial construction expenditures may vary in a cyclical pattern independent of the national business cycle, and expenditures for producers' durable equipment may vary according to autonomous factors such as businessmen's anticipations, age of existing durables, etc. Nevertheless, investment does respond to a sustained increase in consumer demand as can be seen in the national accounts. Normally this investment expenditure will reach its height at the peak of a long expansion of the business cycle.

Although aggregate investment expenditure in producers' durables vary widely in the short run because of factors other than the current rate of change of consumer demand, average investment over two or three-year periods will normally show a correlation with aggregate changes in consumer demand over those periods. Hence for the purpose of a multiplier analysis, let us assume that average investment is proportional to the change in consumer demand. Thus, over two or three successive periods, investment may fluctuate widely, but over an extended period the average investment per period is assumed to be determined by the aggregate change in consumer demand.

Let I_{b_L} denote total investment expenditures on both producers' durable equipment and commercial construction made by all businesses in the area except local establishments in the space and space-related sectors. Further, let us

designate the aggregate purchases of such investment goods by I_{b_p}. Then total investment goods purchased by businesses in the area are distributed according to

$$(63) \qquad I_{b_p} = I_{b_L} + I_{b_m}$$

where I_{b_m} denotes investment goods purchased from the "rest-of-the-world."

We can now subdivide I_{b_L} into investment goods purchased by establishments controlled by factors exogenous to the region. As was discussed earlier in connection with the construction of the business income and product account, establishments controlled from outside the area will plan further investments in the area in response to variables other than the rate of change of consumer demand in the area. This is particularly true in the case of large corporations having large extra-regional markets. This, of course, is not to say that such investment plans are made completely independently of regional consumer demand. However, any response to consumer demand can reasonably be assumed to be a prominent factor in expansion by such firms only after a sustained growth of regional demand over a relatively long period. Hence, from the perspective of a multiplier analysis such expansion can safely be assumed to be autonomous in nature.

The method of subdividing establishments into locally-oriented and outside-controlled will, of course, vary with the region under study. A reasonable criterion for the Boulder area would be to include all unincorporated firms in the locally-oriented category and divide corporations according to whether they have main offices inside the region or out -- that is, include corporations having only branches in the region as outside-controlled with regard to investment planning.

Denote investment purchases by locally-oriented establishments (induced business investment) by I_{b_i}, and purchases by outside-controlled local firms, I_{b_x}, indicating exogenous expenditures.[21/] Then

$$(64) \qquad I_{b_L} = I_{b_i} + I_{b_x}$$

21/ It should be pointed out that space and space-related firms are excluded from this discussion because their activities are relatively independent of consumer demand.

Now suppose that $\bar{I}_{b_i}$ is the average investment per year (averaged over three year periods) beginning with the initial impact of space activities. Then we postulate that $\bar{I}_{b_i}$ is proportional to the total change in aggregate consumer demand over these three year intervals. That is,

$$(65) \qquad (\bar{I}_{b_i})_r = i'_b \, (C_{d_{r+1}} - C_{d_{r-1}}) \, .$$

Consumer demand is here interpreted in the broadest sense to include total consumption expenditures purchased in the region plus any other transactions between local consumers and local businesses. Included in consumer demand would be new house purchases, premium payments to insurance companies, payments to real estate companies, etc. Pure transfers such as the purchase of used assets would not be included except for the marginal payments to local retail and wholesale firms. Thus, in our accounting system,

$$(66) \qquad C_d = C + I_r \, ,$$

that is, consumer demand is equal to total consumption expenditures plus purchases of new houses.

Unfortunately, the parameter, k_{b_i}, cannot be numerically estimated on the basis of a one-year business survey. However, the following inequality will hold for all areas except those undergoing vast expansions:

$$(67)^{22/} \qquad \frac{(\bar{I}_{b_i})_r}{C_{d_{r+1}} - C_{d_{r-1}}} > \frac{(\bar{I}_{b_i})_r}{C_{d_r}} \, ,$$

22/ Since $(\bar{I}_{b_i})_r$ is I_{b_i} averaged over periods r-1, r and r+1, this average investment can be computed for overlapping periods to yield expected investment purchases for each period. That is,

$$E\,(I_{b_i})_{r+1} = \frac{1}{3}\left[(I_{b_i})_r + (I_{b_i})_{r+1} + (I_{b_i})_{r+2}\right]$$

for r = 1, 2, . . ., k. This comprises a moving average over k periods.

where C_d can be any level of total consumer demand, $C_{d_{r-1}}$, C_{d_r}, and $C_{d_{r+1}}$. Hence a relationship of the form,

$$(68) \qquad \bar{I}_{b_i} = i_{b_i} (C_d - C_{d_o}) + I_{b_{io}}$$

where $i_{b_i} = \frac{I_{b_{io}}}{C_{d_o}}$, the ratio of total induced investment to local consumer demand in the base period, should be a lower limit for the postulated true relationship represented by equation (65).

For a multiplier analysis, it is sufficient to determine the cumulative effect of <u>average</u> (as defined above) induced investment. Further, relationship (67) can be utilized to calculate meaningful multipliers because it can safely be assumed that these multipliers will not be over-estimated. Therefore, we let equation (68) represent a conservative estimate of induced business investment purchases and allocate the remainder of I_{b_L} into an autonomous category.

<u>Residential construction</u> -- Another category of investment goods produced in the region and motivated by endogenous forces is residential construction. This investment type varies with the net rate of change in the formation of new households. Of course, many other factors enter in, such as the age composition of residential dwellings in the area, the extent of overbuilding in recent years, etc. However, a relationship analogous to equation (65) can be formulated as follows:

$$(69) \qquad \bar{I}_r = i'_r (Y'_{d_{r+1}} - Y'_{d_{r-1}})$$

where $(Y'_{d_{r+1}} - Y'_{d_{r-1}})$ is the change in Disposable Personal Income over the periods r-1, r, and r+1, resulting from an increase in population and i'_r is the ratio of total purchases of new homes by such persons to their disposable incomes.[23/]

A conservative estimate of this relationship, analogous to equation (68), would be

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[23/] This ratio, which is an average propensity to invest in residential construction, is assumed to be stable throughout the analysis.

$$(70) \qquad I_r = i_{c_r} (1 - \bar{t}_{no}) (r\bar{Y}_{no}) (Y - Y_o) + I_{r_o}$$

where i_r now refers to the ratio of total purchases of new houses to disposable income for all residents.

Space and space-related activities -- Investment purchases by the space and space-related sector will be considered autonomous for the multiplier analysis. However, certain activities in these sectors, particularly in the National Bureau of Standards, tend to be self-sustaining. If we let S(t) denote the rate of growth of this agency's current output, then

$$(71) \qquad \bar{I}_{s_r} = i_s S(t) E_{s_r}$$

where $\bar{I}_{s_r}$ and E_{s_r} denote average investment purchases from local businesses and current output respectively in the space-related sector and $i_s = \frac{I_{s_{ro}}}{E_{s_{ro}}}$.

Total output in the space-related sector can then be formulated as

$$Y_{s_r} = E_{s_r} + I_{s_r} = E_{s_r} + i_s S(t) E_{s_r},$$

or

$$(72) \qquad Y_{s_r} = \left[1 + S(t)\right] \left[E_{s_{ro}} + i_s S(t)\right] \left[1 + S(t)\right] E_{s_{ro}}$$

$$= \left[1 + S(t)\right] \left[1 + i_s S(t)\right] E_{s_{ro}}$$

Local government activities -- All government spending except spending by local government will be considered exogenous to the regional economy. Expenditures by local government tend to vary according to the tax base of the community. Hence, we assume that a change in current government spending denoted by G_{L_c} is proportionately related to a change in Personal Income. That is,

$$(73) \qquad G_{L_c} = g_c (Y_p - Y_{p_o}) + G_{L_{co}}$$

where $g_c = \frac{G_{L_{co}}}{Y_{p_o}}$. Substituting $Y_p - Y_{p_o}$ from equation (32), we obtain

$$(74) \qquad G_{L_c} = g_c (1 - k_m) (Y - Y_o) - k_b (Y_b - Y_{b_o})$$

Now average local government investment is related to the change in local government current expenditures as in the case of local business investment purchases. Then a conservative estimate of such investment is given by

$$(75) \qquad I_{L_g} = I_{L_{go}} + i_g (G_{L_c} - G_{L_{co}})$$

$$= I_{L_{go}} + i_y g_c (Y_p - Y_{p_o})$$

where $i_y = \frac{I_{L_{go}}}{G_{L_{co}}}$.

Area output by local government is equal to total current expenditures plus total investment spending in the area. Hence, if G_L denotes total area product by local government,

$$(76) \qquad G_L = G_{L_c} + I_{L_g} = G_{L_o} + g_c (1 + i_g) (Y_p - Y_{p_o})$$

$$(77) \qquad = G_{L_o} + g_c (1 + i_g) \left[(1 - k_m) (Y - Y_o) - k_b (Y_b - Y_{b_o}) \right]$$

Purchases outside the region by local government will, of course, be a component of indirect imports.

The University of Colorado -- Throughout this analysis, activities of the University of Colorado have been considered to be influenced by exogenous forces such as state population growth and state policies related to higher education.

Thus, for a multiplier analysis primarily concerned with the impact of some type of exogenous expenditure, both current and capital spending by the University should be combined into autonomous expenditure. Because time series data are available from the University the approach can be varied from that followed in sectors where only cross-section data are available.

Suppose that we find an average growth rate for the University's current expenditures over some period prior to the base year.[24/] Let u(t) denote this rate which will correspond closely to the average rate of growth of the University's total student enrollment. Then proceeding in a manner similar to that followed in the space sector, let $\bar{I}_u$ denote average investment expenditures by the University in the region and U_c denote expenditures on current activities. Then

$$(78) \qquad \bar{I}_u = i_u \cdot u(t) \cdot U_c$$

where $i_u = \frac{I_{u_o}}{U_{c_o}}$. Total University product in the region (Y_u) is given by

$$(79) \qquad Y_u = U_c + I_u$$

$$= \left[1 + u(t)\right] U_{c_o} + i_u \cdot u(t) \left[1 + u(t)\right] U_{c_o}$$

$$= \left[1 + u(t)\right] \left[1 + i_u \cdot u(t)\right] U_{c_o}$$

University purchases outside the area, of course, are indirect imports.[25/]

[24/] The length of this period depends on the long-run growth pattern of the University. This period should not include a period of radical transition in the University's activities.

[25/] Investment purchases outside the region will not be included in M_r because only intermediate purchases from the "rest-of-the-world" for production on current account determine M_r.

Production of Investment Goods

The previous five sections have considered investment goods produced in the region strictly from the "buyer" point of view. This approach is necessary for a proper identification of induced investment since all investment goods sold to persons or organizations outside the region are exogenously determined. Hence, all such export investment goods will be considered a type of autonomous expenditure.

If I denotes total gross investment goods produced in the region and I_e denotes total investment goods sold to the "rest-of-the-world," then

$$(80) \qquad I = I_{b_i} + I_r + I_{g_L} + I_e + I_a$$

where I_a is a residual category combining all remaining forms of autonomous investment. This category includes the following types of investment spending: (1) all investment goods purchased by outside-controlled firms in the region, (2) investment purchases by all establishments in the space and space-related sectors, (3) investment purchases by all government agencies except local government, and (4) investment spending by the University.

Combining equations (64), (66), (68), (70) and (80) we obtain

$$(81) \quad I = i_b (C_d - C_{d_o}) + I_{b_{io}} + i_r (1 - \bar{t}_{no}) (r\bar{Y}_{no}) (Y - Y_o) + I_{r_c}$$

$$+ i_g G_c (Y_p - Y_{p_o}) + I_{L_{go}} + I_e + I_a ,$$

or

$$I = i_b (C - C_o) + (1 + i_b) i_r (1 - \bar{t}_{no}) (r\bar{Y}_{no}) (Y - Y_o)$$

$$+ i_g G_c (Y_p - Y_{p_o}) + (I_e - I_{e_o}) + (I_a - I_{a_o}) + I_c$$

where $I_c = I_{b_{io}} + I_{r_o} + I_{L_{go}} + I_{e_o} + I_{a_o}$.

Substituting equation (77) for I_{L_g} gives us

$$(82) \quad I = i_b (C - C_o) + \left[(1 + i_b)\, i_r (1 - \bar{t}_{no})\, (r\bar{Y}_{no}) + g_c (H_{i_g}) (1 - k_m)\right]\left[Y - Y_o\right]$$

$$- k_b g_c (1 + i_g) (Y_b - Y_{b_o}) + (I_e - I_{e_o}) + (I_a - I_{a_o}) + I_o$$

Integration of the Model

The separate relationships developed in previous sections are integrated into a complete model in this section. Aggregate income and employment multipliers are then developed from the integrated model.

Let us begin by rearranging equation (1) in the following manner:

$$(83) \quad Y = C + E + (G_{L_c} + G_a) + (I_{b_i} + I_r + I_{L_g} + I_a)$$

where total government spending on current account, $\sum G_{c_i}$, is incorporated into induced government spending by local government in the region, G_{L_c}, and all other government spending, G_a. The subscript a indicates that all government current expenditure except that of local government is a form of autonomous expenditure.

Total investment by both area businesses and government agencies, $\sum IB_i + \sum IG_i$, is broken down into three categories of induced investment (I_{b_i}, I_r, and I_{L_g}), and a residual category which will be considered autonomous in character (I_a).

Let us first derive multipliers excluding induced investment of all types. Combining all types of investment, government current expenditures (including local government), and total exports into an autonomous category, Y_a, we have

$$Y - Y_o = (C - C_o) + (Y_a - Y_{a_o}) \text{ , or}$$

$$(84) \quad \Delta Y = \Delta C + \Delta Y_a$$

Substituting equation (52) into (84), we have

$$\triangle Y = C_y \triangle Y + \triangle Y_a ,$$

$$\triangle Y (1 - C_y) = \triangle Y_a , \text{ and}$$

$$(85) \qquad \frac{\triangle Y}{\triangle Y_a} = \frac{1}{1 - C_y}$$

The latter is an aggregate income multiplier for the region assuming that all investment and government activity is autonomous and that earned income has a linear, homogeneous relationship to Area Income.

From equation (18),

$$(86) \qquad \triangle E = \mathcal{E} \triangle Y$$

where $\mathcal{E} = e \frac{X_o}{D_o} = e \frac{X_o}{Y_o}$.

Then substituting equation (84) into (86), we have

$$\triangle E = \mathcal{E}\left[C_y \triangle Y + \triangle Y_a\right]$$

$$\triangle E = \mathcal{E}\left[C_y \frac{\triangle E}{\mathcal{E}} + \triangle Y_a\right]$$

$$\triangle E (1 - C_y) = \mathcal{E} \triangle Y_a , \text{ then}$$

$$(87) \qquad \frac{\triangle E}{\triangle Y_a} = \frac{\mathcal{E}}{1 - C_y}$$

is an aggregate employment multiplier based on the above assumptions.

Let us now estimate multipliers assuming the types of induced investment indicated in equation (83). We will use the non-homogeneous leakage relation implicit in equation (51). Substituting equation (51) into equation (83) we have

$$(88) \quad \triangle Y = \triangle C + \triangle G_{L_c} + \triangle G_a + \triangle I_{b_i} + \triangle I_r + \triangle I_{L_g} + \triangle I_a + \triangle E$$

$$= C_a \triangle Y - C_b \triangle Y_b + \triangle G_{L_c} + \triangle G_a + \triangle I_{b_i} + \triangle I_r + \triangle I_{L_g}$$

$$+ \triangle I_a + \triangle E$$

Now substitute equations (82), (83) and (74) into (88),

$$(89) \quad \triangle Y = (C_a \triangle Y - C_b \triangle Y_b) + \left[g_c (1 - k_m) \triangle Y - k_b \triangle Y_b \right]$$

$$+ \triangle G_a + (\triangle I_{b_i} + \triangle I_r + \triangle I_{L_g}) + \triangle I_a + \triangle E$$

$$= (C_a \triangle Y - C_b \triangle Y_b) + \left[g_c (1 - k_m) \triangle Y - k_b \triangle Y_b \right]$$

$$+ \triangle G_a + i_b \triangle C + i_z \triangle Y - i_w \triangle Y_b + \triangle I_a + \triangle E$$

$$= (C_a \triangle Y - C_b \triangle Y_b) + \left[g_c (1 - k_m) \triangle Y - k_b \triangle Y_b \right]$$

$$+ \triangle G_a + i_b (C_a \triangle Y - C_b \triangle Y_b) + i_z \triangle Y - i_w \triangle Y_b + \triangle I_a + \triangle E$$

$$= \left[C_a + g_c (1 - k_m) + C_a i_b + i_z \right] \triangle Y$$

$$- \left[C_b + k_b + C_b i_b + i_w \right] \triangle Y_b + \triangle G_a + \triangle I_a + \triangle E ,$$

or

$$\triangle Y = \left[(1 + i_b)\, C_a + g_c\,(1 - k_m) + i_z\right] \triangle Y$$

$$- \left[(1 + i_b)\, C_b + k_b + i_w\right] \triangle Y_b + \triangle G_a + \triangle I_a + \triangle E$$

where $i_z = (1 + i_b)\, i_r\, (1 - \bar{t}_{no})\, (r\bar{Y}_{no}) + g_c\, (i_g)\, (1 - k_m)$ and $i_w = k_b\, g_c\, (i_g)$. Also, $\triangle I_e$ in equation (82) is combined into $\triangle E$ in (89). For the calculation of multipliers, let

$$(90) \qquad \triangle Y_a = \triangle G_a + \triangle I_a + \triangle E$$

Now from equation (31),

$$(91) \qquad \triangle Y_b = \triangle C + \triangle I + \triangle E$$

$$= \triangle Y - \triangle G_a - \triangle G_{L_c} \ .$$

However, from equation (74),

$$(92) \qquad \triangle G_{L_c} = g_c\,(1 - k_m)\, \triangle Y - k_b\, \triangle Y_b \ .$$

$\triangle Y_b$ was disaggregated from $\triangle Y$ because the major processing leakages separating earned personal income from area value added were corporate undistributed profits, total business taxes (corporate and indirect), and capital consumption allowances -- all of which derive primarily from the flow of income through the business sector.

Therefore, substituting equation (92) into equation (91), we obtain

$$(93) \qquad \triangle Y_b = \left[1 - g_c\,(1 - k_m)\right] \triangle Y + k_b\, \triangle Y_b - \triangle G_a \ ,$$

$$\Delta Y_b \left[1 - k_b\right] = \left[1 - g_c\ (1 - k_m)\right] \Delta Y - \Delta G_a \ ,$$

or

$$\Delta Y_b = \left[\frac{1 - g_c\ (1 - k_m)}{1 - k_b}\right] \Delta Y - \left[\frac{1}{1 - k_b}\right] \Delta G_a$$

$$= a_y \Delta Y - b_g \Delta G_a$$

where $a_y = \left[\frac{1 - g_c\ (1 - k_m)}{1 - k_b}\right]$ and $b_g = \left[\frac{1}{1 - k_b}\right]$.

Equation (93) then represents the non-homogeneous relationship between total area business income and Area Income.

Substituting equation (93) into equation (89) we obtain

(94)
$$\Delta Y = \left[(1 + i_b)\ C_a + g_c\ (1 - k_m) + i_z\right] \Delta Y$$
$$- \left[(1 + i_b)\ C_b + k_b + i_w\right] \left[a_y \Delta Y - b_g \Delta G_a\right]$$
$$+ \Delta G_a + \Delta I_a + \Delta E \ ,$$

or

$$\Delta Y = \alpha \Delta Y + (1 + B) \Delta G_a + \Delta I_a + \Delta E$$

where $\alpha = (1 + i_b)\ (C_a - C_b a_y) + g_c\ (1 - k_m) + i_z - a_y\ (k_b + i_w)$,

and
$$B = b_g \left[(1 + i_b)\ C_b + k_b + i_w\right]$$

Relation (94) can then be used to find two types of multipliers. First, assume that we have a change in autonomous government expenditure, $\triangle G_a$. Then the income multiplier derived from equation (94) is

$$(95) \qquad M_g = \frac{\triangle Y}{\triangle G_a} = \frac{1 + B}{1 - \alpha}$$

This is the government expenditure multiplier.

If there is a change in autonomous business expenditures, call it $\triangle B_a$ where

$$(96) \qquad \triangle B_a = \triangle I_a + \triangle E \text{ ,}^{26/}$$

then from equation (94) we obtain a business sector multiplier given by

$$(97) \qquad M_b = \frac{\triangle Y}{\triangle B_a} = \frac{1}{1 - \alpha} \text{ .}$$

The difference between these two multipliers derives from the initial processing leakage of any form of business expenditure. For example, if a firm in the space sector receives a government contract of, say, $1 million, employees of the firm will receive only a fraction of this amount because a considerable portion will be spent on imported materials and supplies, some will be taken in the form of business taxes, and some will go into the retained earnings of the corporation. However, in the case of government expenditure, nothing is deducted in the form of taxes or profits; hence, a larger part of the initial expenditure is on wages and salaries.

From equation (86), employment multipliers corresponding to (95) and (97) are

$$(98) \qquad P_g = \frac{\triangle E}{\triangle G_a} = \frac{\varepsilon (1 + B)}{1 - \alpha} \text{ , and}$$

26/ This will include autonomous government investment because the investment expenditure flows through the business sector even though the source of the expenditure is some level of government.

$$(99) \qquad P_b = \frac{\Delta E}{\Delta B_a} = \frac{\mathcal{E}}{1 - \alpha}$$

Implementation of the Multiplier Models

Tables X-1 and X-2 apply the data from the regional income and product accounts to the multiplier models developed in this chapter. In some instances there are slight discrepancies between the data in Chapter VIII and the values used in Tables X-1 and X-2. These discrepancies grew out of refinements made in the income and product accounts after the tables had been completed, and time constraints did not permit reconciliations. The discrepancies are not large enough to be significant, however.

TABLE X-1

PARAMETERS FOR STATISTICAL IMPLEMENTATION
OF THE AGGREGATE INCOME ANALYSIS

Description of parameters	Numerical value
APC's for the student and resident populations	
C_{so} = aggregate Boulder consumption by students	$ 32,796,095
C_{no} = aggregate Boulder consumption by residents	86,334,300
$Y_{d_{so}}$ = disposable income of students	37,329,069
$Y_{d_{no}}$ = disposable income of residents	119,353,319
$APC_s = C_s/Y_{d_s} = \bar{c}_s$	.879
$APC_n = C_n/Y_{d_n} = \bar{c}_n$	.723
Aggregation of sectoral employment functions	
Aggregate slope	0.00002256
$e = 1/x \sum x_j e_j$	
Aggregate intercept, E_o	17,500
New household migration propensity	
Total gross output, X_o	664,465,000
Gross area product plus imports (final demand), Y_o	271,159,582
Average number of employees per household, h	1.34
Migration propensity	
$r = eX_o/hY_o$	0.00004124

(continued)

TABLE X-1 (cont.)

Description of parameters	Numerical value
Average household personal income for the resident population, $\bar{Y}_{no}$	$ 9,543
Business leakages	
Total product generated in the business sector plus business imports, Y_{b_o}	219,649,652
Undistributed corporate profits, P_{r_o}	2,581,345
Total business taxes (indirect business taxes plus corporate taxes), T_{b_o}	11,335,708
Capital consumption allowances, CCA_o	9,563,045
Business leakage factor, k_b	
$k_b = (P_{r_o} + T_{b_o} + CCA_o)/Y_{b_o}$	.107
Indirect import leakage	
Total imports of business and government, M_{r_o}	130,634,510
Total output of business and government plus imports, Y_o	271,159,582
Import leakage factor,	
$k_m = M_{r_o}/Y_o$	.482
Allocation of personal income between students and residents	
Personal income of the student population, $Y_{p_{so}}$	37,951,024
Personal income of the resident population, $Y_{p_{no}}$	147,525,597

(continued)

TABLE X-1 (cont.)

Description of parameters	Numerical value
Total area personal income, Y_{p_o}	$185,476,621
Average leakage factor, $\ell = (P_{r_o} + T_{b_o} + CCA_o + M_{r_o})/Y_o$	.5684
Average propensity to tax	28,794,233
Total personal taxes of residents, T_{no}	28,172,278
Total personal taxes of students, T_{so}	621,955
Non-student APT, $\bar{t}_{no}$	
$\bar{t}_{no} = T_{no}/Y_{p_{no}}$	.191
Student APT, $\bar{t}_{so}$	
$\bar{t}_{so} = T_{so}/Y_{p_{so}}$	.0164
Total government wages and salaries in Boulder	40,204,016
Percentage distribution of income between students and residents	
$p_n = Y_{p_{no}}/Y_{p_o}$ (residents)	.795
$p_s = Y_{p_{so}}/Y_{p_o}$ (students)	.205
Benchmarks for aggregate consumption	
Total consumption including direct imports, C_{t_o}	135,138,064

(continued)

Table X-1 (cont.)

Description of parameters	Numerical value
Total resident consumption, $C_{t_{no}}$	$ 95,815,024
Total student consumption, $C_{t_{so}}$	39,323,040
Local consumption, C_o	119,130,395
Students, C_{so}	32,796,095
Residents, C_{no}	86,334,300
Direct imports, M_o	16,007,669
Students, M_{so}	6,526,945
Residents, M_{no}	9,480,724
Disposable income	
Entire population, Y_{d_o}	156,682,388
Students, $Y_{d_{so}}$	37,329,069
Residents, $Y_{d_{no}}$	119,353,319
Regression slopes of spending patterns	
Average slope of spending pattern weighted by the income frequencies in the income brackets.	
Residents: $c_n = 1/n \sum f_i b_i$	.3548
Students: $c_s = b_i$, or the regression slope of the lowest income bracket	.4847

(continued)

TABLE X-1 (cont.)

Description of parameters	Numerical value
$\frac{r\bar{Y}_{no}}{1-\ell} = 0.912$	
$\varepsilon = \frac{eX_o}{Y_o} = 0.00005527$	
Total business final demand (including imports), Y_{b_o}	$208,544,753
Average propensities to import	
Students: $\bar{m}_s = M_{so}/Y_{d_{so}}$	.1748
Residents: $\bar{m}_n = M_{no}/Y_{d_{no}}$	.0794
Average propensities to save:	
Student personal saving, S_{so}	- 1,993,971
Resident personal saving, S_{no}	+23,538,295
Total personal saving, S_o	+21,544,324
Student average propensity to save, $\bar{s}_{so} = S_{so}/Y_{d_o}$	- .013
Residents average propensity to save, $\bar{s}_{no} = S_{no}/Y_{d_o}$	+ .150
Total propensity to save, $\bar{s}_o = S_o/Y_{d_o}$	+ .138
Propensity to invest by locally-oriented firms	
Total investment expenditures in the region by locally-oriented firms, $(I_{b_i})_o$	15,965,664

(continued)

TABLE X-1 (cont.)

Description of parameters	Numerical value
Expenditures for residential construction, I_{r_o}	$ 10,874,908
Total consumer demand in the area, $C_{d_o} = C_o + I_{r_o}$	130,005,303
Propensity to invest, $i_b = (I_{b_{i\,o}}) / C_{d_o}$	.123
Migration effect on residential construction	
Propensity to invest, $i_r = I_{r_o} / Y_{d_{no}}$	.091
Induced expenditure by local government	
Current expenditure by local government in the base year, $G_{L_{co}}$	8,645,812
Induced expenditure by local government, $g_c = G_{L_{co}} / Y_{p_o}$	.047
Local government expenditures on capital account, $I_{L_{go}}$	1,770,456
Induced investment by local government, $i_g = I_{L_{go}} / G_{L_{co}}$	.205
Autonomous investment expenditures	
Total export investment goods, I_{e_o}	9,641,228
Total investment expenditures inside the region by non-locally-oriented firms, I_{a_o}	2,072,089

TABLE X-2

COMPUTATIONAL OUTLINE FOR IMPLEMENTATION OF THE AGGREGATE INCOME ANALYSIS

I. Allocation of personal income between students and residents

A. Students:

$$Y_{p_s} - Y_{p_{so}} = \frac{Y_{p_{so}}}{Y_{p_o}} \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$Y_{p_s} = 60,473,873 + 205\ Y_p - 0.0807\ Y$$

B. Residents:

$$Y_{p_n} - Y_{p_{no}} = \frac{Y_{p_{no}}}{Y_{p_o}} \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right] + r\bar{Y}_{no} (Y - Y_o)$$

$$Y_{p_n} = -60,473,873 + .795\ Y_p + 0,0807\ Y$$

II. Processing leakages in Personal Income

A. Average leakage factor

1. Non-homogeneous approximation:

$$Y_p - Y_{p_o} = (1 - k_m) (Y - Y_o) - k_b (Y_b - Y_{b_o})$$

$$Y_p = .518\ Y - 0.107\ Y_b - 116,958,150$$

(continued)

TABLE X-2 (cont.)

2. Homogeneous approximation:

$$Y_p - Y_{p_o} = (1 - \ell)\ (Y - Y_o)$$

$$Y_p = 68{,}444{,}145 + .4316\ Y$$

III. Tax leakages

A. Students:

$$T_s - T_{so} = \bar{t}_{so} p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\ (Y - Y_o) \right]$$

$$T_s = 0.00336\ Y_p - 0.001323 Y + 357{,}315$$

B. Residents:

$$T_n - T_{no} = \bar{t}_{no} p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\ (Y - Y_o) \right] + \bar{t}_{no} r\bar{Y}_{no}\ (Y - Y_o)$$

$$T_n = 0.15184\ Y_p - 0.01543\ Y - 11{,}554{,}995$$

C. Entire population:

$$T - T_o = (\bar{t}_{so} p_s + \bar{t}_{no} p_n) \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\ (Y - Y_o) \right] + \bar{t}_{no} r\bar{Y}_{no}\ (Y - Y_o)$$

$$T = 0.15520\ Y_p - 0.016753\ Y - 11{,}197{,}680$$

(continued)

TABLE X-2 (cont.)

IV. Disposable income

A. Students:

$$Y_{d_s} - Y_{d_{so}} = (1 - \bar{t}_{so})\, p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\,(Y - Y_o)\right]$$

$$Y_{d_s} = 0.2016\, Y_p - 0.07935\, Y + 21{,}516{,}448$$

B. Residents:

$$Y_{d_n} - Y_{d_{no}} = (1 - \bar{t}_{no})\, p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\,(Y - Y_o)\right]$$

$$+ (1 - \bar{t}_{no})\, r\bar{Y}_{no}\,(Y - Y_o)$$

$$Y_{d_n} = 0.643\, Y_p + 0.0654\, Y - 17{,}710{,}843$$

V. Local consumption

A. Local consumption as a function of personal and gross area income

1. Students:

$$C_s = C_{s_o} + c_s\,(1 - \bar{t}_{so})\, p_s \left[Y_p - Y_{p_o} - r\bar{Y}_{no}\,(Y - Y_o)\right]$$

$$C_s = 0.09773\, Y_p - 0.3936\, Y + 121{,}397{,}876$$

(continued)

TABLE X-2 (cont.)

2. Residents:

$$C_n = C_{no} + c_n (1 - \bar{t}_{no}) p_n \left[Y_p - Y_{p_o} - r\bar{Y}_{no} (Y - Y_o) \right]$$

$$+ \bar{c}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} (Y - Y_o)$$

$$C_n = 0.2282\ Y_p + 0.14038\ Y + 9,216,680$$

3. Entire population:

$$C = C_o + c_a (Y - Y_o) - c_b (Y - Y_{b_o})$$

a. $$c_a = \left\{ \left[c_s (1 - \bar{t}_{so}) p_s + c_n (1 - \bar{t}_{no}) p_n \right] \left[1 - k_m - r\bar{Y}_{no} \right] + \bar{c}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\}$$

$$c_a = .27074$$

b. $$c_b = k_b \left[c_s (1 - \bar{t}_{so}) p_s + c_n (1 - \bar{t}_{no}) p_n \right]$$

$$c_b = .03487$$

$$C = 152,988,606 + .27074\ Y - 0.03487\ Y_b$$

(continued)

TABLE X-2 (cont.)

B. Local consumption as a function of gross area income assuming linear homogeneous leakage relationships

1.

$$C = C_o + C_y (Y - Y_o)$$

a. $$C_y = \left\{ \left[c_s (1 - \bar{t}_{so}) p_s + c_n (1 - \bar{t}_{no}) p_n \right] \left[1 - \ell - r\bar{Y}_{no} \right] + \bar{c}_n (1 - \bar{t}_{no}) r\bar{Y}_{no} \right\} = 0.24258$$

$$C = 53,352,504 + 0.24258\ Y$$

C. Local consumption as a function of Disposable Personal Income

1. Students:

$$C_s = C_{s_o} + (c_s \cdot \frac{B}{A}) (Y_d - Y_{d_o})$$

$$C_s = 0.013874\ Y_d + 30,622,284$$

2. Residents:

$$C_n = C_{no} + (c_n \cdot \frac{D}{A} + \bar{c}_n \cdot \frac{F}{A}) (Y_d - Y_{d_o})$$

$$C_n = 0.6823\ Y_d - 20,570,093$$

3. Entire population:

$$C = C_o + \left(\frac{c_s B + c_n D + \bar{c}_n F}{A} \right) (Y_d - Y_{d_o})$$

(continued)

TABLE X-2 (cont.)

a. $D = (1 - \bar{t}_{no})\, p_n \cdot \left(\frac{(1 - r\bar{Y}_{no})}{(1 - \ell)}\right) = 0.056597$

b. $B = (1 - \bar{t}_{so})\, p_s \left(\frac{(1 - r\bar{Y}_{no})}{(1 - \ell)}\right) = 0.01774$

c. $F = (1 - \bar{t}_{no}) \cdot \left(\frac{r\bar{Y}_{no}}{(1 - \ell)}\right) = 0.7378$

d. $A = \left\{\left[(1 - \bar{t}_{so})\, p_s + (1 - \bar{t}_{no})\, p_n\right] \cdot \left[\frac{1 - r\bar{Y}_{no}}{(1 - \ell)}\right] + \frac{1 - \bar{t}_{no}}{(1 - \ell)} \left(r\bar{Y}_{no}\right)\right\} = 0.81214$

$C = 0.6962\, Y_d + 10{,}052{,}191$

VI. Direct imports by households

A. Students:

$M_s = M_{s_o} + \bar{m}_s \left(\frac{B}{A}\right) (Y_d - Y_{d_o})$

$M_s = 0.03818\, Y_d + 4{,}362{,}811$

B. Residents:

$M_n = M_{no} + \left(\frac{(\bar{m}_n D + \bar{m}_n F)}{A}\right) (Y_d - Y_{d_o})$

$M_n = 0.07765\, Y_d - 2{,}685{,}663$

TABLE X-2 (cont.)

C. Entire population:

$$M = M_o + \left(\frac{(\bar{m}_s \cdot B + \bar{m}_n \cdot D + \bar{m}_n F)}{A} \right) \cdot (Y_d - Y_{d_o})$$

$$M = 0.1158\ Y_d + 1,677,148$$

D. Total imports by households as a function of gross area income

$$M = M_o + m_y\ (Y - Y_o)$$

$$m_y = \left\{ \left[\bar{m}_s\ (1 - \bar{t}_{so})\ p_s + \bar{m}_n\ (1 - \bar{t}_{no})\ p_n \right] \left[1 - \ell - r\bar{Y}_{no} \right] + m_n\ (1 - \bar{t}_{no})\ r\bar{Y}_{no} \right\} = 0.02527$$

$$M = 8,266,063 + 0.02527\ Y$$

VII. Induced investment expenditures inside Boulder

A. Investment expenditures by locally-oriented firms

$$I_{b_i} = i_b\ (C_d - C_{d_o}) + I_{b_{io}}$$

$$I_{b_i} = 0.123\ C_d$$

B. Expenditures for residential construction inside Boulder

$$I_r = i_r\ (1 - \bar{t}_{no})\ (r\bar{Y}_{no})\ (Y - Y_o) + I_{r_o}$$

$$I_r = 0.029\ Y + 3,011,280$$

(continued)

C. Investment expenditures by local government

1. Current expenditure by local government

$$G\ell_c = g_c (Y_p - Y_{p_o}) + G\ell_{c_o}$$

$$G\ell_c = 0.047\ Y_p$$

2. Investment expenditures

$$I_g = I_{g_o} + i_g g_c (Y_p - Y_{p_o})$$

$$I_g = 0.009635\ Y_p$$

D. Total investment

$$I = i_b (C - C_o) + \Big[(1 + i_b)\ i_r (1 - \bar{t}_{no}) \cdot (r\bar{Y}_{no}) + g_c (1 + i_g)$$

$$(1 - k_m)\Big]\Big[Y - Y_o\Big] - k_b g_c (1 + i_g)(Y_b - Y_{b_o}) + (I_e - I_{e_o}) +$$

$$+ (I_a - I_{a_o}) + I_o$$

$$I = 0.123\ C + 0.0326\ Y - 0.00606\ Y_b - 22{,}161{,}764$$

VIII. Multipliers

A. Simple multiplier assuming no induced investment or local government activity and a linear homogeneous leakage relationship

1. Income multiplier:

$$M_y = \frac{1}{(1 - C_y)} = 1.320$$

(continued)

TABLE X-2 (cont.)

2. Employment multiplier:

$$M_e = \frac{\mathcal{E}}{(1 - C_y)} = 0.000073$$

$$\mathcal{E} = \frac{eX_o}{Y_o} = .000153$$

B. Multipliers assuming induced investment, local government expenditure, and non-homogeneous leakage relationships

1. Necessary parameters:

a. $i_z = (1 + i_b) \cdot i_r \cdot (1 - \bar{t}_{no}) (r\bar{Y}_{no}) + i_g g_c (1 - k_m)$

$= 0.03752$

b. $i_w = k_b g_c i_g = .001031$

c. $a_y = \left[\frac{\left(1 - g_c (1 - k_m)\right)}{(1 - k_b)}\right] = 1.09255$

d. $b_y = \frac{1}{(1 - k_b)} = 1.11982$

e. $\alpha = (1 + i_b) (c_a - c_b a_y) + g_c (1 - k_m) + i_z - a_y$

$(k_b + i_w) = .26926$

f. $\beta = b_y \left[(1 + i_b c_b + k_b + i_w\right] = 0.164826$

(continued)

TABLE X-2 (cont.)

2. Income multipliers

   a. Generated by an autonomous change in government expenditures:

$$M_g = \frac{(1+\beta)}{(1-\alpha)} = 1.594$$

   b. Generated by an autonomous change in business exports or investment expenditure:

$$M_b = \frac{1}{(1-\alpha)} = 1.368$$

3. Employment multipliers

   a. Government induced:

$$P_a = \frac{\varepsilon(1+\beta)}{(1-\alpha)} = 0.0000881$$

   b. Business induced:

$$P_b = \frac{\varepsilon}{(1-\alpha)} = 0.0000756$$

XI

SUMMARY AND CONCLUSIONS

The central objective of this study was the development of estimates of the total impact of space and space-related activities on the Boulder economy. Three separate approaches were followed: (a) the preliminary economic base study, and (b) the input-output analysis contained in Part I of this report; and (c) the income-product accounts developed in Part II.

It is clear that space and space-related activities have been major contributors to the growth of the Boulder economy during the past decade. A first approximation to the employment impact of space and related programs was obtained from the economic base analysis of Chapter I. The preliminary analysis, based entirely upon published data, resulted in an employment multiplier of 2.5. This admittedly crude technique suggested that the employment of an additional worker in space and related activities would result in the eventual employment of an additional 1.5 workers in all other sectors of the Boulder economy. The economic base approach fails to take into account various leakages from the local economy, however, and in the preliminary analysis some non-space activities were aggregated with those subsequently defined as space or space-related. Because of these limitations, the initial employment multiplier was useful only as a suggested upper limit to the multipliers subsequently calculated by more sophisticated techniques.

The detailed input-output analysis, based upon primary data obtained through surveys, produced both income and employment multipliers. Furthermore, both types of multipliers were calculated for all sectors of the local economy. Using a new type of multiplier (referred to as Type III in the report) it was estimated that every additional dollar of direct income generated by the space sector would add $0.43 of indirect and induced income to the community. The comparable multiplier for the space-related sector was 1.29. The Type III employment multiplier for both the space and space-related sectors also came to 1.29. The identity of employment multipliers in the space and space-related sectors is indicative of the similarity of economic structure in the two types of activities which have been separated for analytical purposes in this study. The identity of the employment multiplier in the space and space-related sectors and the income multiplier in the latter is, of course, pure coincidence.

Using the Type III multipliers the implications of a recent $9 million NASA contract award in Boulder were investigated. Assuming that this represented an addition to the output of the space sector, and that no capital expansion is necessary, it was estimated that local production will increase by about $15.5 million. When all direct, indirect and induced effects have worked themselves out, it is estimated that $3.5 million of this total will go to households as additional income payments. It is also estimated that the contract award will generate 678 additional man-years of employment.

The emphasis throughout Part I of the study was on disaggregation; that is, the estimation of income and employment multipliers by sector. Part II is concerned with the development of income and product accounts for the Boulder area, and the estimation of aggregate multipliers. The aggregate multipliers can be used in a number of ways. For example, they can be applied to an increment to household income to estimate the total addition to the Boulder income stream after accounting for import, tax and savings leakages. Aggregate multipliers have also been derived for broad sectors, such as "government." These can be used for estimating the impact of changes within such sectors.

Another type of multiplier developed in Part II is one showing the local impact of exogenous changes in business investment or exports. The value of this multiplier is 1.37 -- slightly lower than the 1.43 income multiplier for the space sector, but higher than the 1.29 income multiplier for the space-related sector.

It is interesting to note, however, that when the investment-export employment multiplier is applied to the space sector the results correspond closely to those derived from the input-output analysis. Using the example of the recent $9 million contract awarded to an establishment in the Boulder space sector, the input-output analysis resulted in an estimated increase in employment of 678 man-years. The aggregate investment-export employment multiplier applied to the same example shows an estimated increase of 684 man-years. The difference (0.9 per cent) is well within the limits of sampling variation. While there are conceptual differences between the two types of multipliers used in this illustration, the similarity of the results given above is encouraging. It suggests that both the sectoral and the aggregate employment multipliers provide reliable estimates of the final impacts of exogenous changes in the system.

Because of the differences in emphasis, the multipliers derived in Parts I and II of this study are not directly comparable. In Part I an effort was

made to estimate the total changes in income and employment in the community resulting from exogenous changes in a given sector. The aggregative analysis of Part II deals with much broader classifications of economic activity. As noted earlier the two parts of the study are not competitive in any sense; they are complementary. For some purposes it is useful to know the total impact of an exogenous change in a given sector. This is the case, for example, if one is interested in analyzing the local income and employment impacts of changes in the space program. For other purposes, however, such detail is not necessary. If one is interested, for instance, in analyzing the impact of changes in investment or exports in general, the aggregate multipliers of Part II should be used. Similarly, the question might arise: How will a change in the level of government activity affect the local economy? The answer to this question can be obtained by using the aggregate government multiplier. Because there are different patterns of tax, import and savings leakages from sector to sector, the detailed multipliers obtained from the input-output analysis will differ from the aggregate multipliers computed in Part II. Each type of multiplier serves a useful purpose, however, depending upon the objective of a specific analysis.

APPENDIX II-I

APPENDIX II-I

IMPUTED RENT AND INTEREST

Rent

Home ownership in the national income and product accounts is treated as a business, producing house services which are sold to the homeowner in his capacity as a tenant. These sales are estimated in terms of the sum for which the particular type of home could be rented. The expenses of homeowners are then deducted to obtain the imputed net rent of the homeowner. The imputed gross sales becomes a part of sales to persons, or consumer expenditures of household services, and imputed net rent becomes a part of the rental income of persons.[1/]

The specific formulation of the two imputed items considered here is best understood if an outline is given for the estimation of space rent and net rent for nonfarm rented dwellings (as defined in the national accounts). Essentially the procedure is as follows:

(1) An estimate of the number of nonfarm dwellings is made.

(2) An estimate is made for average annual rent of nonfarm dwellings.

(3) The product of (1) and (2) gives a derived estimate of total contract rent.

(4) An estimate of landlords' expenses for facility and utility services included in rent is deducted from (3) to obtain personal consumption expenditure for space rent. These expenses include (a) expenses for the use of cookstoves, refrigerators, and furnishings; and (b) expenses for the use of electricity, fuel, water, gas, and other miscellaneous charges.

(5) The landlords' other expenses are deducted from (4) to obtain net rental income of landlords. These expenses include (a) depreciation charges for property, (b) taxes on property, (c) mortgage interest payments and other charges.[2/]

Since the methods used to estimate the imputed item of rental income as well as the corresponding consumer expenditure closely parallel the methods used for rental housing, a brief description will be given of the procedures used to estimate the items in (1) - (5), with the differences noted for all the imputed items.

[1/] National Income, Office of Business Economics, U. S. Department of Commerce, 1954, p. 46.

[2/] Ibid., p. 87.

(1') The total number of tenant-occupied as well as owner-occupied nonfarm dwelling units are estimated from the decennial Censuses of Population and Housing.

(2') Estimates for the mean rental value of owner-occupied units are based on the 1940 Census of Population and Housing. Enumerators were instructed to base their estimates for owner-occupied dwellings on the basis of actual rents being charged for similar dwellings in the neighborhood. The main criterion for comparison was the market value of the individual dwellings.

(3') The 1940 estimate for mean rental value was extrapolated from 1940, as follows: (a) The mean rental value of all occupied units combined was extrapolated by mean rent for rented units, which in turn had been estimated directly from the decennial censuses and the sample surveys made by the Census Bureau; (b) the means for all occupied units and for rented units were multiplied respectively by the corresponding number of units; and (c) these products were differenced to obtain aggregate rental value of owner-occupied units.

(4') The average cost of providing each type of facility for one dwelling is calculated as the sum of annual depreciation plus maintenance cost. The estimates of average maintenance cost are flat rates based on trade opinion. Depreciation averages are calculated from the estimated original average price of the equipment by straight-line amortization over the estimated useful life of the equipment.

The total expense to be deducted for each item is then estimated by multiplying the average cost of providing the item by an estimate of the number of dwellings for which the item is provided at the landlord's expense.[3/]

The expenses for utilities are estimated in a similar manner.

The imputed expenses for owner-occupied dwellings are based on the estimates for tenant-occupied dwellings; they are merely adjusted proportionately to the ratio -- (number of owner-occupied dwellings)/(number of tenant-occupied dwellings).

(5') Depreciation is derived by applying a flat rate of 2% (this rate is based on several surveys of the average length of the useful life of dwellings) to the estimated original cost value of all nonfarm dwellings. Property taxes

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[3/] The average expense is estimated from a 1950 Survey of Consumer Expenditures, and the total number for which the item is provided at the landlord's expense is estimated from the Financial Survey of Urban Housing.

are estimated from the property tax series, this being based upon a detailed study of State and local government fiscal reports and other data sources. Mortgage interest was estimated primarily on the basis of the Survey of Residential Financing. Other property expense which consists of estimates for repair and maintenance, insurance, and miscellaneous costs are also estimated from various kinds of sample survey data.

Let us now consider what modifications, if any, should be made with respect to the concepts of net rental income, rental expenditure, etc., used in the national income accounts. First, since the net rental income figure determined from the household survey data is net of all expenses on property, including taxes, mortgage interest, etc., then the national income definition of net rental income can be very easily implemented empirically. Also, an estimate of actual rent payments can be obtained from the household data.

Of course these payments will include some utility and all facility expenses which are included in the rent, but charged to the landlord. In fact, it would be very difficult to estimate these expenses without access to very extensive data sources (such as those used in estimating these items for the national accounts). For this reason and also for another reason to be presented shortly, it would be best for us to define the expenditures for space rent as the gross amount received by landlords, including all expenses except utilities and excluding property taxes. Let us designate the expenditure for space rent and the net rental income by R_g and R_n respectively. R_g would be included under consumption of services on the expenditure side. The difference $R_g - R_n$ would be allocated to personal saving (disinvestment) similar to the way in which payments out of current income for residential housing are considered a form of personal saving. This would, of course, be a negative quantity.

The above definitions can be extended to the corresponding imputed items for owner-occupied dwellings in the logical manner. Let us designate these imputed items as R'_g and R'_n. R'_g can be estimated from a list of property value assessments associated with the household survey together with a schedule of rental payments vs. assessed value, obtained from local real estate agencies. R'_n can then be computed as the same percentage of R'_g as R_n was of R_g -- that is, R'_n can be assumed to be in the same proportion to R'_g as Rn is to R_g.

$$\frac{R'_n}{R'_g} = \frac{R_n}{R_g} \Rightarrow R'_n = R'_g \frac{R_n}{R_g}$$

Since we can obtain an estimate for R_n, R_g, and R'_g, we can compute R'_n from the above formula. The assumption implicit in this calculation is that the expenses for the upkeep of owner-occupied property, taxes, etc. is in the same proportion to imputed rent as the expenses for rental property is to actual rent. This assumption may not be very realistic if all rental property in the community is highly concentrated in old buildings needing a great deal of maintenance and improvement compared to all other property.

Estimation of Imputed Rental Income

The following procedure was then used to estimate imputed rental expenditures and income in this study.

(1) Market value of owner-occupied housing is estimated to be $251,489,543 based on a county assessment of $76,726,962 for owner-occupied housing (market value is assumed to be about three times the assessed value).

(2) Interviews with individuals well informed in rental real estate revealed that an average gross rate of return for the area is 8%.

(3) $R'_g = .08\ (251,489,543) = 20,119,163.$

(4) Real rental expenditures and income are $21,931,667 and $11,140,732 respectively (estimated from the business and household survey data).

(5) Therefore,

$$R'_n = R'_g \frac{R_n}{R_g} = (\$20,119,163) \left(\frac{\$11,140,732}{\$21,931,667}\right) = \$10,220,028$$

Interest

In the national accounts, imputed interest paid by financial intermediaries is measured as the excess of property income received over property income actually returned in monetary form to owners of the funds entrusted to the intermediary. This amount is considered part of the personal interest component of national income, and an equivalent amount (imputed service charges) is included in personal consumption expenditures for services.[4/]

For all financial intermediaries except commercial banks, the flows of imputed interest paid by intermediaries are treated as going directly to persons.

[4/] National Income, op. cit., p. 100.

For commercial banks (including Federal Reserve Banks), imputed interest is allocated among the recipients by the use of estimates of the ownership of deposits.[5/]

Since the necessary information for obtaining estimates of the allocation of deposits among persons, business and government is not available in the business survey data, it would probably be best to consider the flows of imputed interest from all financial intermediaries as accruing to persons.

Imputed interest can then be estimated from the business questionnaire by summing the rental income, net interest income, and the net dividends (in most cases a negative item) of all financial intermediaries. The following establishments would be considered financial intermediaries: commercial banks, Federal Reserve banks, finance companies, stock life insurance carriers, mutual savings banks, mutual life insurance carriers, savings and loan associations, credit unions, and investment trusts.

[5/] Ibid., p. 102.

APPENDIX II-II

APPENDIX II-II

AN ALTERNATIVE APPROACH TO THE ALLOCATION OF RENTAL INCOME

A significant part of net rental income in the Personal Income Account accrues to persons using their property in a strictly business sense and it would be helpful, from the perspective of an impact study, to separate rent according to the type of service with which it is associated. Rents could be categorized according to whether they are payments for (1) the use of property by local businesses, or (2) for services provided to households. If this were done the breakdown of rental income in Table VIII-7 would be as follows:

Rental income of persons
- Rental income accruing to area residents
  - For business uses
  - For household uses
- Rental income accruing to non-residents
  - For business uses
  - For household uses

It might also be desirable to further divide resident and non-resident rental income into two more categories: (1) that portion of rental income associated with the "large scale" use of property for rendering household services, and (2) that portion associated with "small scale" rental property. Such a breakdown could be used as a basis for determining the impact of in-migration on the commercial construction of apartment houses, or the impact of an increased student population on residential construction. However, this kind of breakdown would be difficult to implement, not only because of a lack of detailed information on rental property, but also because of the difficulty of determining a good dividing line between "large scale" and "small scale" operations.

Excluding the last mentioned breakdown, it is still necessary to consider the division of rental income between value added to the business sector and value added to the household sector. To be consistent with the national accounts, however, all actual rental services have been considered in this study as production generated in the business sector.

APPENDIX II-III

APPENDIX II-III

DERIVATION OF THE GROSS SAVINGS AND INVESTMENT ACCOUNT

This appendix contains a derivation of the gross savings and investment account from the four basic sector accounts -- business, personal, "rest-of-the-world," and all of the government accounts (Federal, State, University and local). Also, a short discussion of the differences in personal interest income and the interest component of Area Income will be included.

We begin the derivation by summarizing the business and personal sector accounts as follows:

Business Account

W_b = wages and salaries paid to area residents

$(W_b)_i$ = wages and salaries paid to incommuters

SS_{cb} = total employee and employer contributions to Social Security

PR_c = total employee and employer contributions to private retirement funds

i_b = net interest payments from business to area households and financial intermediaries

$(i_b)_i$ = net interest payments from business to the "rest-of-the-world"

R = net rental income generated in the area including imputed rental income

R_i = net rental payments accruing to the "rest-of-the-world"

UP = unincorporated profits accruing to area residents

UP_i = unincorporated profits accruing to the "rest-of-the-world"

C_b = consumer goods and services sold to area residents

I_b = investment goods sold to businesses in the area

I_r = residential construction in the area

I_g = investment goods sold to government

G = sales to government which are purchased on current account

E = total sales to the "rest-of-the-world"

Impf = imputed product of financial intermediaries

R'_n = imputed net rental income for owner-occupied housing

$\triangle_{inv}$ = change in inventories

Less:

M_i = total imports by business

Equals

Gross Business Product

Business Account (cont.)

D = net dividends accruing to the area

D_i = net dividends accruing to the "rest-of-the-world"

T_b = total business taxes (corporate and indirect business taxes)

S_b = undistributed corporate profits

Tr_b = business transfer payments to the area

$(Tr_b)_i$ = business transfer payments to the "rest-of-the-world"

SD = statistical discrepancy

CCA = capital consumption allowances

Gross Business Product

Personal Account

W_b

W_g = total wages and salaries received by area residents from government

W_o = total outcommuter wages and salaries

R

R_o = net rental income from property outside the region

i_p = personal interest income including imputed interest

D

D_o = dividend receipts from outside the region

UP

UP_o = unincorporated profit accruing to the "rest-of-the-world"

W_h = direct compensation of employees inside the region

C_b

M_d = purchases of consumer goods from outside the area (direct imports)

W_h

i_h = total interest payments inside the area

i_{h_i} = total interest payments to the "rest-of-the-world"

Impf

C_g = purchases from government such as expenditures for water, sewage, University services, etc.

R'_n

T_p = total personal taxes

T_u = tuition payments

S_p = personal saving

Personal Income

Personal Account (cont.)

$(Tr)_b$	=
$(Tr_b)_o$	= business transfer payments from the "rest-of-the-world"
T_{r_g}	= government transfer payments to area residents (excluding Social Security, etc.)
PR_p	= payments from private pension funds to area
SS_p	= Social Security payments to area
GR_p	= payments from government retirement funds
$(gt)_o$	= net gifts from the "rest-of-the-world"
Personal Income	

Consider now a consolidated general government current account balancing total receipts and outlays with the region.

General Government Consolidated Current Account with the Area

$(W_g)_{c_r}$	= total wages and salaries paid to area residents on current account
$(SSc_g)_{c_r}$	= employee and employer contributions to Social Security on current account
G	
Tr_g	
SS_p	
GR_p	
GS	= surplus of government
Total Government Income	

T_b	
T_p	
T_u	
C_g	= government operating income
SS_c	= total Social Security taxes by employees and employers
Total Government Income	

The three accounts above can be written in equation form as follows:

$$(1)\quad W_b + (W_b)_i + SS_{cb} + PR_c + i_b + i_{b_i} + R + R_i + UP + UP_i + D + D_i$$

$$+ T_b + S_b + Tr_b + (Tr_b)_i + SD + CCA = C_b + I_b + I_r + I_g + G + E$$

$$+ Impf + R_n' + \triangle inv - M_i$$

$$(2)\quad W_b + W_g + W_o + R + R_o + i_p + D + D_o + UP + UP_o + W_h + (Tr)_b + (Tr_b)_o$$

$$+ Tr_g + PR_p + SS_p + GR_p + (gt)_o = C_b + M_d + W_h + i_h + i_{h_i} + Impf$$

$$+ C_g + R_n' + T_p + T_u + S_p$$

$$(3)\quad (W_g)_{cr} + (SS_{cg})_{cr} + G + Tr_g + SS_p + GR_p + GS = T_b + T_p + T_u + C_g + SS_c$$

Combining equations (1) - (3), we have

$$(4)\quad W_g - (W_g)_{cr} + W_o - (W_b)_i + \left[SS_c - SS_{cb} - (SS_{cg})_{cr}\right] + R_o - R_i$$

$$+ \left[i_p - i_b - (i_b)_i - i_h - (i_h)_i\right] + UP_o - UP_i + (Tr_b)_o - (Tr_b)_i$$

$$+ PR_p - PR_c + gt_o - S_p - CCA - SD - S_b - GS + I_b + I_r + I_g + \triangle inv$$

$$+ E - M_d - M_i = 0$$

$$\text{Let } (W_g)_{cp} = W_g - (W_g)_{cr}$$

$$(SS_{cg})_{cp} = SS_c - SS_{cb} - (SS_{cg})_{cr}$$

$$d = i_p - i_b - (i_b)_i - i_h - (i_h)_i$$

At this point it is desirable to construct a "rest-of-the-world" account which describes the net flow of funds received by the endogenous sectors of the local economy from the exogenous sectors. Local government will be considered endogenous in this context.

"Rest-of-the-World" Account

$W_o - (W_b)_i - (W_{gL})_{cr_i}$ *	NFF = net flow of funds from all exogenous sectors to the region
$R_o - R_i$	
$i_o - i_i$ = net total interest payments from the "rest-of-the-world"	
$UP_o - UP_i$	

*Incommuter wages and salaries paid by local government on current account.

$(Tr_b)_o - (Tr_b)_i$	
$(gt)_o$	
$E - M_d - M_i$	
GSR_{ex} = net payments by all exogenous levels of government to the region.	
Charges against the "rest-of-the-world"	

The item GSR_{ex} is defined as a residual equal to total current expenditures in the region plus transfers minus total taxes and other receipts of nonlocal government. In equation form,

$$GSR_{ex} = \left[(W_g)'_{cr} + (SS_{cg})'_{cr} + G' + Tr'_g + SS_p + I_g Tr_L + GR'_p\right] - \left[T'_b + T'_p + T_u + C'_g + SS_c\right]$$

where $I_g Tr_L$ = intergovernmental transfers to local government. The primed symbols denote previously defined quantities except that they refer to nonlocal government only.

Writing the "rest-of-the-world" account in equation form, we have

$$(5)\quad W_o - (W_b)_i - (W_{g_L})_{cr_i} + R_o - R_i + i_o - i_i + UP_o - UP_i + (Tr_b)_o - (Tr_b)_i + (gt)_o + E - M_d - M_i + GSR_{ex} = NFF$$

Subtracting equation (5) from equation (4) we obtain

$$(6)\quad (W_g)_{cp} + (SS_{cg})_{cp} + (d - i_o + i_i) + I_b + I_r + I_g + \triangle \text{Inv} = S_b$$

$$+ (PR_c - PR_p) + CCA + SD + S_p + GS + GSR_{ex} - NFF - (W_{gl})_{cr_i}$$

First consider the interest component of the last equation, $d - i_o + i_i$.

$$d - (i_o - i_i) = i_p - i_b - (i_b)_i - (i_h) - (i_h)_i - (i_o - i_i)$$

Now $i_o - i_i = (i_h)_o - (i_h)_i - (i_b)_i$ and $i_p = i_h + i_b + (i_h)_o - (i_h)_i$

Therefore,

$$d - (i_o - i_i) = i_h + i_b + (i_h)_o - (i_h)_i - i_b - (i_b)_i - i_h - (i_h)_i$$

$$- \left[(i_h)_o - (i_h)_i - (i_b)_i\right] = 0.$$

Now consider the terms GS, GSR_{ex} and $(W_{gl})_{cr_i}$.

$$GS + GSR_{ex} - (W_{g_L})_{cr_i} = T_{b_L} + T_{p_L} + C_{g_L} + IGTr_L - G_L - (W_{g_L})_{cr} - (SS_{c_{g_L}})_{cr}$$

$$- Tr_{g_L} - (W_{g_L})_{cr_i} = GS_L \text{, the surplus of local government.}$$

Hence, equation (6) becomes a gross saving and investment account and can be tabulated as follows:

Gross Saving and Investment Account

Business Savings	Business Investment
S_b	I_b
$PR_c - PR_p$	I_r
CCA	$\triangle$ Inv
Personal Savings	Government Investment
S_p	I_g
Savings of local government (GS_L)	$(W_g)_{cp}$
Total taxes	$(SS_{cg})_{cp}$
Operating income	
Intergovernmental transfers	Gross Regional Investment
Minus:	
Expenditures on current account	
Transfer payments (not including payments out of retirement funds)	
Statistical Discrepancy	
Less: NFF	
Gross Regional Saving	

Now consider the interest component of regional income defined as total interest paid inside the region excluding interest payments on government bonds. That is, if i_r denotes the net interest component of area income, then

$$i_r = i_h + i_b + (i_o - i_i) = i_h + i_b + (i_h)_o - (i_h)_i - (i_b)_i$$

An equivalent definition for i_r is total interest received inside the region by households plus net interest received by business from the "rest-of-the-world." Included in personal interest receipts is the imputed product of financial intermediaries. If $(i_h)_b$ denotes monetary interest received by Boulder households from sources in the area, then

$$i_r = (i_h)_b + \text{Impf} - (i_b)_i + (i_h)'_o - (i_h)'_i*$$

Personal interest is defined in the same way as regional interest except that it does not include net interest receipts by business from the "rest-of-the-world."

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*The primes are used to indicate receipts by actual households only. In all the above relations, financial,intermediaries are implicitly included in the term $(i_h)_o - (i_h)_i$.