Section 2

Economic Impact of Growth

6.0 The Benefits of Growth to the Bernalillo County Economy, 2000-2020

6.1 Executive Summary

This report is a companion to the study of infrastructure needs conducted by the Parsons Brinckerhoff team. Section 1 of this Planned Growth Strategy, Part 1 – Findings Report focused on the infrastructure additions and refurbishing needed to support a general growth scenario for Bernalillo County. Parsons Brinckerhoff assessed the current conditions and needed expansion of five classes of infrastructure: water delivery system, sewage treatment, transportation, public transit, and drainage (hydrology).

The present study reports estimates of the net pecuniary benefits associated with economic growth in the region. The benefits that will be measured are the growth in output, employment, incomes, and local tax revenues associated with the growth projected for the regional economy. To calculate the net effects of growth, a multisector model of the economy of Bernalillo County was constructed. The basis of this model is an input-output (I-O) model in which the growth scenarios presented in Section 1 are projected as impacts to the local economy. The present study begins with the following premise:

> *Growth of the regional economy requires the existence of a viable houing market. Such housing growth depends on the presence of sound infrastructure in areas such as water delivery, sewage, and transportation. That is, infrastructure development is properly viewed as an investment in the local economy.*

The results are as follows.

- A Slow Growth Scenario represents a baseline or counterfactual projection for the region absent the investment in infrastructure.
- Four growth scenarios are analyzed. These are Balanced A, Balanced B, Balanced C, and Trend
- Balanced A, B, and C use the same spatial development and infrastructure investment projections but differ according to the assumptions concerning how the investment is to be funded. Trend is the spatially diffuse scenario with considerable residential development in the outlying areas.
- For the Balanced A Scenario the infrastructure investment is financed through increased gross receipts tax. The result is that gross output for the local economy is $6.04 billion higher annually than under the Slow Growth Scenario by 2020. Earnings are $2.48 billion higher.
- For Balanced B Scenario the road construction on federal and state roads is financed through transfers from these senior governments, and it is assumed that none of the taxes are raised locally. The result is that gross output is $6.09 billion higher annually by 2020. Total employment is 100,680 jobs higher than the Slow Growth Scenario by 2020.

- For the Balanced C Scenario the infrastructure investment is all financed from local residents. Part of the investment is financed through increased impact fees and the rest is obtained through gross receipts tax increases. The result is that gross output is $6.15 billion higher annually by 2020. Earnings are higher by $2.52 billion in 2020.

- For the Trend Scenario the same structure as Balanced A is adopted, but the spatial distribution is more dispersed . The result is that gross output is $6.00 billion higher by 2020. Employment is 99,214 higher.

It is important to recognize that the differences in the value of output or earnings or employment between the Slow Growth and the growth related scenarios constitute the opportunity cost of foregoing the investment in infrastructure. The proposed investments in infrastructure rehabilitation and extension will yield output increases and subsequent tax revenues that will exceed the costs of the infrastructure itself. That is, the infrastructure is both a necessary and justifiable investment.

6.2 Introduction

This report is a companion to the study of infrastructure needs analysis conducted by the Parsons Brinckerhoff team. Section 1 of the Planned Growth Strategy, Part 1 – Findings Report focused on the identification and costs of infrastructure additions and refurbishing needed to support a general growth scenario for Bernalillo County. Parsons Brinckerhoff assessed the current conditions and needed expansion of five classes of infrastructure: water delivery system, sewage treatment, transportation, public transit, and drainage. Three spatially differentiated growth scenarios were addressed in Section 1. These were labeled the Downtown Scenario, Trend Scenario, and Balanced Scenario. The scenarios will be defined later in this report. Because the required infrastructure additions depend on the spatial distribution of the population, the costs associated with each growth scenario differ.[1] The analysis in this report focuses on the Balanced Scenario under different assumptions regarding the incidence of the taxation to finance the costs of the growth and different methods of financing the growth related infrastructure, correcting deficiencies, and rehabilitating existing infrastructure. For comparison, the present study compares the Trend Scenario and the Balanced Scenario to demonstrate the effect of the spatial distribution of growth.

The present study reports projections of the net pecuniary benefits associated with economic growth in the region. The benefits that will be measured are the growth in output, employment, incomes, and local tax revenues associated with the growth projected for the regional economy. There are other benefits (and costs) associated with economic growth that are not addressed quantitatively here. These include social costs such as congestion and pollution as well as social benefits such as those associated with a local labor market that offers a sufficient range of jobs to retain highly qualified workers in the region. A brief discussion will be presented in the concluding section of this report.

The present study begins with the following premise. Growth of the regional economy requires the existence of a viable housing market. Such housing growth depends on the presence of sound infrastructure in areas such as water delivery, sewage, and transportation. Of course, other components of infrastructure, such as police and fire services, and education, are required to support population growth, but these are not addressed in Section 1 by the terms of the contract.

A primary role of the housing market in the growth of a region is the support of the growth of the labor force. Many major urban areas have seen their growth limited by slowly responding housing markets that have the effect of causing housing prices to rise in response to population growth.[2] Current estimates (first two quarters of 2000) show the housing cost index in the Albuquerque Metropolitan Statistical Area at 100.3. At the same time, however, the earnings index is approximately 91 making the earnings approximately 9% below the average. Clearly, there is a housing affordability issue for the Metropolitan Statistical Area (and for Bernalillo County). Any delays in constructing infrastructure will impose delays on housing construction and will exacerbate this situation. The analysis conducted for this report rests on an assumption that housing construction will keep pace with the projected labor force growth, but this will require that most of the infrastructure issues raised in Section 1 be addressed. Other assumptions will be described later in this report.

6.3 Section 1 of the Planned Growth Strategy, Part 1 – Findings Report

Since it forms the background for the present study, Section 1 of the Planned Growth Strategy, Part 1 – Findings Report will be briefly summarized here.[3] The report describes three categories of infrastructure development for the Albuquerque/Bernalillo County economy. These are rehabilitation (i.e., improving condition without expanding capacity), correcting deficiencies (i.e., adding to infrastructure capacity consistent with engineering standards), and growth. Parsons Brinckerhoff provides an analysis of five components of the physical infrastructure within Bernalillo County: the water delivery system, the sewage system, the transportation infrastructure (primarily roads), public transit, and the drainage (hydrology) system. The study was largely an engineering analysis, and the focus was on the cost of correcting existing deficiencies and rehabilitation, and on the costs associated with the extension of the infrastructure to accommodate future growth. Three spatially differentiated growth scenarios were analyzed, and the difference in the costs of expanding the infrastructure to accommodate each is estimated.

6.3.1 Trend Scenario

A growth scenario based on the current pattern of land use is termed the Trend Scenario. Growth is projected to continue in a spatially diffuse manner. Much of the future development is projected to occur outside of the historic boundaries of Albuquerque. Residential development is projected to occur mainly in the following areas: West Mesa, Southwest Mesa, Quail Ranch, Mesa del Sol, and the East Mountain Area. Employment growth is similarly projected to be widespread. Major concentrations of new employment are projected to be in the Westland Area, Seven Bar Area, Mesa del Sol, Quail Ranch, and areas along the North I–25 corridor.

6.3.2 Downtown Scenario

This scenario is characterized by a greater concentration of population and employment in the Downtown, University of New Mexico, and Uptown areas. Unlike the Trend Scenario, the employment growth under this scenario is projected to occur largely within the existing built-up areas. Population growth is also less dispersed under this scenario. In addition to the above, major concentrations occur along I–25 north of San Antonio, and along Coors Road to the Northwest.

6.3.3 Balanced Scenario

This scenario is a blend of the two previous scenarios. Employment growth is projected to occur in the nearer West Side sections including the Atrisco Business Park, the East Central area, and Mesa del Sol. Population growth is projected to occur in Mesa del Sol, and along the Central and North Fourth Street Corridors. This Scenario was designed, in part, to achieve greater jobs-housing balance.

Within each of these scenarios, a set of cost estimates is developed for the expansion of the infrastructure components, rehabilitation, and addressing existing deficiencies. The aggregate growth in employment and population is projected to be similar across the three scenarios, and this growth is projected to occur in a linear pattern over time.

The Section 1 reports the costs associated with infrastructure development through 2020 for each scenario. These costs are estimated at $3.63 billion for the Trend Scenario, $3.38 for the Downtown Scenario, and $3.44 for the Balanced Scenario. The differences are largely due to growth related considerations concerning extension of services to far-flung areas in the less dense scenarios. Thus, the Downtown Scenario has the lowest costs while the Trend Scenario is the most expensive. While the cost differences may appear to be small ($0.19 billion for the difference between the Trend and Balanced Scenarios) relative to the total costs, they are significant and demonstrate the payoffs to planning for growth.

Parsons Brinckerhoff does supply a timeline for *some* of the infrastructure expenditures. For example, the road construction projects are meticulously described in Section 1. However, in aggregate terms, it is implicitly assumed that the employment and population growth is linear and thus, the infrastructure expenditures will follow that path also. However, this will have implications for financing the infrastructure and for the capacity to pre-build some of it to reduce disruptions to existing areas of development as future expansions are undertaken. I would argue that the timing of the growth as well as the spatial order is something that should be addressed in subsequent analyses.

Since it is primarily an engineering analysis, Section 1 addresses only the costs (actually a subset of these costs) associated with growth, and it does not *quantify* the benefits that may be associated with the growth. Consequently, the present study will address this by reporting on projections of the pecuniary benefits of growth. As stated earlier, the infrastructure is an essential input to the housing sector, and it is in this context that the benefits from growth will be assessed.

Parsons Brinckerhoff did address some additional consequences of the different spatial distributions of the population. For example, the costs of private transportation will vary by the spatial distribution of growth. The key variable that determines these costs is vehicle miles traveled. Based on the MRGCOG metropolitan transportation study, Parsons Brinckerhoff reported the vehicle miles traveled and associated annual costs for the three scenarios. The differences are as high as $130 million per year in 2020 between the Balanced and Trend scenarios when all costs (including travel time) are incorporated. An additional factor that will likely vary by scenario is the mix of employment opportunities. If a growth strategy is successful in directing non-residential development toward the Downtown or Balanced Scenarios, the types of occupations will be more concentrated in the areas of Business Services than under the Trend Scenario. The relatively constant populations and employment projections provided by MRGCOG do not take account of the effect of the spatial distribution on the mix of employment and the impact on which sectors would be encouraged to grow under each spatial scenario.[4] This was done in the Planned Growth Strategy study to isolate the infrastructure related costs associated with the different urban growth Scenarios.

The cost data used for this present study are those provided in Section 1 of the Planned Growth Strategy, Part 1 – Findings Report. The Balanced Scenario is analyzed in some detail because it constitutes a middle ground between the Trend and the Downtown Scenarios. In particular, the Balanced Scenario is investigated under different fiscal assumptions concerning the structure of the revenue sources to finance the infrastructure. The public sector data were provided by the City and are derived from analysis using the FISCALS model.[5]

6.4 Methodology of the Projection of Economic Growth

To calculate the net effects of growth, a multisector model of the economy of Bernalillo County was constructed. The basis of this model is an input-output (I-O) model that relates the linkages in the local economy. A brief overview of the I-O methodology is provided in Appendix B, and the economic aggregation sectors are set forth in Appendix C. The growth scenarios presented in Section 1 are projected via impacts to the local economy. The results of the present study quantify the economic benefits of growth as measured by the increase in the level of economic activity in the regional economy. Much of Section 1 focuses on the provision of infrastructure required to support the housing market. It is clear that a healthy housing market is an important input to the economic growth of the area. The local economic benefits of this infrastructure rehabilitation and expansion are measured as the increased economic activity made possible by the growth in the labor force served by the housing market.[6]

The data set to construct the I-O model of Bernalillo County was derived from the IMPLAN database. This database provides information on interindustry transactions, employment, output, employee earnings, indirect taxes, and payments to capital for

Table 90 Economic Sectors Represented in I-O Model

Sector No.	Sector Name
1	Agriculture
2	Mining
3	Construction
4	Food Processing
5	Textiles
6	Wood Processing
7	Print and Publishing
8	Chemical and Drugs
9	Miscellaneous Manufacturing
10	Building Materials
11	Heavy Manufacturing
12	Technical Manufacturing
13	Light Manufacturing
14	Transportation, Communications, and Utilities
15	Personal Services
16	Wholesale and Retail Trade
17	Recreation Services
18	Finance, Insurance, and Real Estate
19	Business Services
20	Medical, Legal, and Educational Services
21	State and Local Government
22	Federal Government

all of the firms in the County. In the full database, the economic activities are grouped together (aggregated) into approximately 300 industrial categories.[7] For the purposes of analysis, these are further aggregated into 22 economic activities. The 22 sectors are reported in Table 90 (pg. 323). In economic analysis, aggregation is done for several reasons. First, many of the sectors in the regional economy are small and models are poorly behaved when small sectors are included. Second, it is extremely difficult to analyze the sector level changes associated with an impact, such as growth in the economy, with many economic sectors depicted. For this reason, most regional analysis is conducted with aggregated models. A third reason for aggregation is that it allows the analysis to focus on key sectors of concern to the question at hand. Appendix C presents a brief discussion of the aggregation scheme.

Once the aggregation was completed some further adjustments to the database were made to reflect local information. The IMPLAN database is constructed by applying some local data (primarily employment levels available from the Bureau of Labor Statistics) to national data to derive local I-O coefficients and also earnings data, and so on. For areas in which New Mexico is unique, the database needs to be modified based on local data. There are two differences between the local Bernalillo County data and what IMPLAN reports. The first concerns the measurement of employment. IMPLAN records all jobs rather than reporting full-time equivalent positions as are reported in Section 1. This will lead to higher employment levels being reported in the current study, and the differences will be greatest in those sectors characterized by a greater incidence of part-time employment (such as Retail Trade, Agriculture, and Recreation Services). The average earnings per job are, consequently slightly reduced by the inclusion of part-time workers in the analysis, but the total earnings are consistent with the Bureau of Labor Statistics data in use by others doing analysis of the labor market in New Mexico. Since reliable data on part-time jobs are not readily available, the IMPLAN employment levels were utilized for the analysis reported here, and the interpretation of the results incorporates the differences.

The second major adjustment concerns the computation of indirect business taxes. New Mexico is unique among the states in its reliance on the gross receipts tax, which has a much broader coverage than the retails sales tax that is more typical of state revenue structures. The gross receipts tax is imposed "for the privilege of doing business in New Mexico," and its coverage includes services, construction, and many other activities not typically covered by sales tax. Further, New Mexico relies very little on property taxation and somewhat less than other states on the corporate income tax. The net effect is that the IMPLAN database (which employs national averages) reports low indirect tax levels for sectors such as Business Services and Medical, Legal, and Educational Services while reporting very high property tax levels for Finance, Insurance, and Real Estate. In some earlier work done with the state Government (Clifford and McKee 1996; McKee et al. 1995) we developed effective indirect tax rates for many sectors of the economy. These rates are used for the present study.

6.5 Growth Analyses

Once the aggregated and updated I-O model is constructed, it is ready for use in analysis.[8] The first step in the analysis was to construct a Slow Growth Scenario. This represents a growth pattern that would result if no infrastructure deficiencies were corrected and no expansions of the infrastructure were undertaken. Under this scenario, the housing market would constrain future growth in the region. The next step was to construct growth scenarios assuming that the infrastructure developed to support such growth.

The employment and population growth figures are assumed (under the MRGCOG projection) to be linear, and Section 1 reports the level for the current year and for 2020. However, it may be useful to have the capability of investigating alternative timelines for the projected growth. Accordingly, the I-O model results are projected through 2020 in five-year intervals. This would permit investigation of the financial implications of alternative programs of infrastructure development. The costs of the infrastructure development and rehabilitation may vary depending on the timing of the projects. Certainly, the City and County financing capacity is limited at a given time, and this may necessitate scheduling the projects. Thus, while the current analysis assumes a linear time path, the model and method are capable of analyzing different programs of development and growth.

The underlying mechanism of growth is the projected increase in population and labor supply that is supported by the infrastructure development and housing expansion. In I-O models one can introduce an exogenous shock as a change in final demand or as a change in the supply of a productive input. Exogenous shocks are impacts generated by forces outside the local economy. The exogenous shock is the population growth projected for the local economy. In this case, the labor growth is generated by the policy decision to invest in the local infrastructure. Thus, for the purposes of this study, I treat the labor growth as an exogenous supply-side effect. I assume the demand side of the local economy will accommodate this supply effect subject to the caveat that the tax structure is altered to meet the fiscal requirements of the infrastructure development in Section 1.

The three spatial development scenarios evaluated by Parsons Brinckerhoff generate similar aggregate growth levels in the labor market since they are based on the growth projections conducted by MRGCOG. The spatial patterns of growth suggest that the sector distribution of the growth in jobs will be different for the scenarios. At this time, the employment projections do not permit such differentiation, and this could be a useful avenue for further evaluation of the growth strategies. To evaluate the economic benefits from the planned growth, the Balanced Scenario is analyzed in depth since it represents a middle ground. Within this Balanced Scenario there are some policy options on the government revenue side that can be evaluated. As well, the model can be used to compare the effects of intergovernmental fiscal relations in the funding of some of the public sector infrastructure projects.

Demand side impacts arise through the effects of the taxation required to cover the cost of the infrastructure rehabilitation and expansion. The mechanism for introducing the tax effects is described below. The key point here is that increased tax levels are applied to finance the infrastructure needs identified in Section 1. The existence of substantial deficiencies and rehabilitation back-logs is prima facie evidence that historic tax levels have been inadequate to fund the infrastructure needs of the City and County. The growth projections reported here do account for the public and private sector financial costs necessary to fund the growth, including the infrastructure requirements identified by Parsons Brinckerhoff. The scenarios differ by the revenue mix applied and by assumptions concerning the level of state and federal government participation in the funding of rehabilitation for roadways under their jurisdiction.

The scenarios investigated are presented in Table 91. The Slow Growth Scenario provides a baseline or counterfactual for comparison. Absent the infrastructure development presented in Section 1, the housing market in the Bernalillo County may be expected to stagnate and to constrain the overall growth of the economy. That is, infrastructure such as roads, water delivery systems, and sewage systems are seen as essential inputs into the housing market development. Although developers will be providing the local infrastructure (local streets, curbs, etc) within new developments, they cannot be expected to undertake the provision at the regional level, such as major arterial roads, major water facilities, and large scale hydrology projects. Failure to construct such infrastructure, to remedy deficiencies, and to perform needed rehabilitation will curtail future growth in employment and result in the output projections derived for the Slow Growth Scenario. Section 1 provides estimates of some of the financial costs of growth. The financial benefits of the growth are provided in this study by comparing the various measures of economic activity (output, earnings, and tax revenues) between the Slow Growth Scenario and the growth scenarios.

Table 91 Growth Scenarios Analyzed

	Scenario			
Attributes	**Balanced A**	**Balanced B**	**Balanced C**	**Trend**
Spatial Configuration	Balanced	Balanced	Balanced	Trend
Infrastructure Finance	Increase in gross receipts tax	Increase in gross receipts tax	Increase in gross receipts tax plus impact fee increase by 50%	Increase in gross receipts tax
City/County Funding Responsibility	City and County responsible for all local expenditures	State and federal governments pay for roads under their jurisdiction	City and County responsible for all local expenditures	City and County responsible for all local expenditures
Private Transportation Costs				Higher vehicle miles traveled result in households shifting expenditures to transportation

Balanced A Scenario has all of the infrastructure construction financed through higher gross receipts tax. The incidence of the tax (who pays it) is on the households and the result is a crowding out of local consumption. This reduces final demand in the local economy. Under Balanced A, the City and County residents pay for road rehabilitation, deficiencies, and expansion including roads under federal and state jurisdiction. Although the senior government levels "write the checks," this scenario assumes that the taxes to pay for these infrastructure investments are collected locally (income and excise taxes). The household consumption impacts due to the taxation are assigned to those sectors whose output is most directly affected by the level of household demand. These sectors are: Wholesale and Retail Trade; Personal Services; Business Services; Transportation, Communications, and Utilities; and Recreation Services.

Under Balanced B Scenario, the infrastructure is financed through the gross receipts tax but the financing for the state and federal road construction is assumed to be outside the region. In effect, this funding is treated as a transfer to the region. I do not think this is a totally realistic scenario. New Mexico residents pay a relatively larger share of the federal excise taxes on gasoline (due to distances and a relatively high proportion of larger vehicles). Bernalillo County has higher per capita incomes than all but Santa Fe and Los Alamos Counties so our share of state income tax payments is above the state average. Thus, it is unlikely that the region will be able to transfer the costs of infrastructure investments to senior governments.

Balanced C Scenario funds the infrastructure investment through a 50% increase in the current impact fees on new residential construction with the remainder being made up through higher gross receipts tax revenues. This raises the question of the incidence of impact fees. The literature supports the position that property taxes are capitalized into the price of the property. That is, purchasers reduce or discount their bid price for property because they recognize the tax liability that accompanies the property. Thus, the incidence of such taxes is on the owners of the property at the time the tax is imposed or increased. Impact fees work much the same way with an important extension. Since they apply only to new properties and there are substitutes (existing properties), the incidence of impact fees will be on the property developers. That is, the developers will not be able to easily pass these fees on to purchasers. Thus, the effect of the fees is to lower the return on property development, and this would dampen the growth in the supply of housing. It is an empirical issue as to how large this effect may be. For this analysis, I have assumed the effect on the stock of housing is negligible. Under the Balanced C Scenario, the increases in the gross receipts tax are lower than under the Balanced A Scenario. The total Scenario revenues generated through increased impact fees are based on the projected additions to dwelling units only, based on the population growth assumptions.

Trend copies the fiscal elements of the Balanced A Scenario but imposes the diffuse spatial distribution with the resulting higher vehicle miles traveled and transportation expenses for households. Based on the MRGCOG transportation analysis, the additional vehicle miles traveled required by the Trend Scenario impose additional *direct* costs of $124,830–$241,190 per day depending on the vehicle operating costs estimate.[9] Based on the Parsons Brinckerhoff assumptions of travel days per year, this translates into a saving of approximately $37.5–$66.3 million per year if the Balanced Scenario plan is adopted versus the Trend Scenario. Since households will be spending these additional amounts on transportation, the moneys will not be available for other purchases. While some of these expenditures will flow onto the local economy (e.g., gasoline, repairs, and commission on insurance premiums) much of it will not (e.g., tires, insurance premiums, and automobile production). For the present analysis, it is assumed that one-half of the costs are leakage from the local economy. Taking the midpoint between the high and low vehicle cost numbers and then taking one half of this yields a cost saving of $25.45 million per year under the Balanced Scenario. This estimate omits many public and private costs that may be attributed to commuting travel. Additional garage space at home, parking spaces at place of work, and so on may be attributable to a more spatially diffuse development pattern. However, these expenditures would represent considerable changes in behavior and may not be attributable solely to changes in travel patterns. For example, a two-car garage is typically bundled with houses of a certain square footage. For builders to change this formula would take considerable time and likely not occur to any significant extent during the time period of this study. Thus, only the direct costs associated with commuting are included in this analysis.

All growth scenarios incorporate the assumption that the deficiencies, rehabilitation, and growth related expenses are to be paid out of the City and County operating budgets. Hence these expenses are attributed to the gross receipts tax, impact fees, and transfer payments depending on the specific scenario.

Section 1 enumerated the extent of the infrastructure deficiencies and rehabilitation in the region. One cause of this has been the method of financing such investments. To reflect the consequences of the growth projections, the costs of remediation and new infrastructure are assumed to be met from revenues generated in the City and County. To reflect this issue in the growth projections, I assumed that in the future such deficiencies would not arise and that the present deficiencies would be fully remedied over the next 20 years.[10] This is the basis for the taxation assumptions embodied in the Balanced and Trend Scenarios.

6.6 Results

The aggregate results are presented in Tables 92, 93 and 94. Table 92 reports the results for employment projections. The growth scenarios all result in considerably higher employment over the time period. Balanced A Scenario results in a projected employment level of 451,373 by 2020 while Balance B and C yield 452,150 and 453,178, respectively. The Trend Scenario, with its increased transportation costs yields a lower level of employment (450,684) than the other growth scenarios.

Table 92 Employment Projections (Jobs)

	Scenario				
Year	**Slow Growth**	**Balanced A**	**Balanced B**	**Balanced C**	**Trend**
2000	340,444	345,051	345,645	346,431	344,588
2005	343,168	379,433	380,087	380,950	378,925
2010	345,913	401,702	402,387	403,309	401,125
2015	348,681	426,411	427,158	428,116	425,790
2020	351,470	451,373	452,150	453,178	450,684

Table 93 Aggregate Output and Earnings Projections (Million 1999$)

Year	Scenario				
	Slow Growth	Balanced A	Balanced B	Balanced C	Trend
Output					
2000	$20,899.79	$21,161.84	$21,198.89	$21,245.64	$21,132.95
2005	$21,067.09	$23,254.44	$23,295.19	$23,347.02	$23,222.74
2010	$21,235.67	$24,604.31	$24,646.44	$24,702.12	$24,568.36
2015	$21,405.20	$26,104.29	$26,151.50	$26,208.42	$26,065.55
2020	$21,576.44	$27,620.40	$27,668.87	$27,730.48	$27,577.44
Earnings					
2000	$8,433.50	$8,560.48	$8,571.66	$8,594.24	$8,551.76
2005	$8,500.95	$9,409.46	$9,421.75	$9,446.65	$9,399.90
2010	$8,568.98	$9,958.04	$9,971.11	$9,997.87	$9,947.53
2015	$8,637.51	$10,567.26	$10,581.33	$10,609.27	$10,555.56
2020	$8,706.62	$11,182.81	$11,197.42	$11,226.72	$11,169.85

Table 93 reports the aggregate results for output and labor earnings. At this aggregate level, there is little difference across the three versions of the growth projections. Under the Slow Growth Scenario, output increases from $20.899 billion in 2000 to only $21.576 by 2020. Under Balanced A the County output grows to $27.620 billion annually by 2020. Under Balanced B and C the output levels reach $27.669 billion and $27.730 billion annually, respectively. The Trend Scenario projection is for output to equal $27.577 annually by 2020. Earnings growth parallels the output growth projections.

It is clear from Tables 92 and 93 that there is substantial growth for the local economy under all of the growth scenarios. The difference between the Slow Growth projections and those of the Balanced Scenarios and the Trend Scenario provide a measure of the financial benefits of growth. Thus, the gain in output by 2020 under Balanced A is projected to be $6.04 billion. Absent the investment in infrastructure. such growth is unlikely to be possible. Over the forecast period, the cumulative gain in output under the

Table 94 Projected Tax Revenues to Bernalillo County, Balanced Scenario A

(Million 1999$)

Year	GRT Revenues Total	GRT Revenue County	All Tax Revenues
2000	$1,051.14	158.73	$407.34
2001	$1,072.15	161.67	$419.38
2002	$1,091.69	164.43	$429.71
2003	$1,110.11	167.06	$438.77
2004	$1,127.66	169.58	$446.92
2005	$1,156.79	173.43	$467.50
2006	$1,169.83	$175.47	$471.02
2007	$1,183.76	$177.57	$475.05
2008	$1,197.91	$179.68	$479.49
2009	$1,212.28	$181.81	$484.24
2010	$1,224.35	$183.65	$485.09
2011	$1,239.44	$185.91	$491.19
2012	$1,254.57	$188.14	$497.23
2013	$1,269.72	$190.33	$503.25
2014	$1,284.90	$192.49	$509.21
2015	$1,299.83	$194.97	$515.56
2016	$1,315.09	$197.04	$521.42
2017	$1,330.35	$199.09	$527.27
2018	$1,345.61	$201.15	$533.12
2019	$1,360.87	$203.20	$538.96
2020	$1,376.14	$205.26	$544.81
Total Revenue	**$25,674.18**	**$3,850.65**	**$10,186.54**

Note: All Tax Revenues are estimated from the I-O model results using factors in the FISCALS Model of the City of Albuquerque. All three of the growth scenarios yield similar results for Albuquerque, and the values in the table are for the Balanced A Scenario. Values reported in millions of $1990. The GRT Revenues Total column reports the entire gross receipts tax revenue generated from economic activity within Bernalillo County. The GRT Revenue County column reports the estimated gross receipts tax revenues accruing to the City and County governments. The All Tax Revenues column reports the total revenues estimated from I-O model results using factors in the FISCALS Model of the City of Albuquerque.

Balanced A Scenario is more than $60 billion. Thus, the cost of foregoing this investment is a substantial loss of output, earnings, and employment.

Tax revenues for the period are reported in Table 94 (pg.329). These data were derived from the I-O model's projections of employment and earnings by sector and applying the coefficients imputed from the City of Albuquerque's FISCALS model. (The results are likely an underestimate since the County data are only approximated. Further, the results need to be compared with those produced by the more disaggregate FISCALS model.) The stream of *net* revenues that would arise from the year 2000 through 2020 totals $1.654 billion in 1999 dollars (Balanced A). It is important to realize that these revenues are net of those that are required to fund the infrastructure requirements of Section 1. However, they do not incorporate the growth related expenditures in areas of social infrastructure, such as police and fire protection. The growth related impacts are summarized in Figures 44 and 45.

Figure 44 Output Effects of the Planned Growth Strategy (Balanced Scenario A)

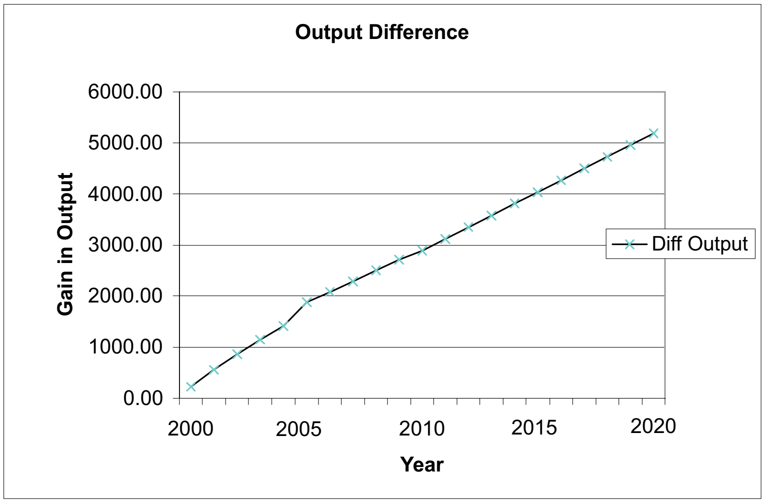
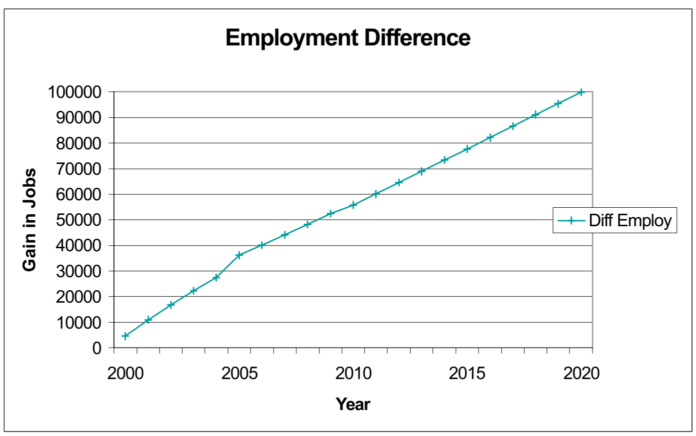


Figure 45 Employment Effects of the Planned Growth Strategy (Balanced Scenario A)



The net tax revenue return to growth is projected to be approximately $1.654 billion over the entire period. It is important to understand the assumptions that generate this positive net revenue flow. The FISCALS model analysis performed by the City and County is reported in Table 95. The rehabilitation expenditures are estimated at $1.8 billion in 1999 dollars, and the deficiency and growth capital expenditures are $.46 billion and $1.16 billion, respectively. Taken together, these total $3.42 billion over the forecast period. These costs were allocated as increases in gross receipts tax revenues to the sectors directly affected by household consumption.[11] For the analysis, I assume that City and County operating costs are covered by the existing revenue structure (that is, require no additional revenues) including those that are due to growth. These growth-related *operating* costs sum to $1.53 billion over the forecast period. However, the existing tax structure is assumed to cover this expenditure.

Table 95 Public Sector Cost Estimate – FISCALS Model

		Balanced Scenario (A) (000$)
City Operating (GF-Transit)	Subtotal Growth	$965,911
	Base	$5,824,917
	Total	$6,790,828
City Operating (Transit)	Total	$615,225
City Operating (Water and WW)	Subtotal Growth	$406,496
	Base	$1,233,918
	Total	$1,640,414
City Capital (Non-infrastructure)	Subtotal Growth	$161,460
	Base	$2,035,296
	Total	$2,196,756
City/County Capital (PGS) (Infrastructure)	Rehabilitation	$1,800,000
	Deficiency	$464,600
	Growth	$1,000,200
	Total	$3,264,800
County Operating	Total	$3,686,700
County Capital	Total	$325,780

Note: These costs are in 1999 dollars and represent cumulative costs over the period 2000–2020.

A property of I-O models is that they are based on linear expansion functions. That is, they assume constant returns to scale. What *could* differentiate the alternate growth scenarios (Downtown, Balanced, and Trend) is that each would be characterized by a different employment mix. The Downtown Scenario would have more employment growth in the Business Services sector while the Trend Scenario would have more employment growth in the Wholesale and Retail Trade sector. However, the employment growth scenario utilized in the MRGCOG projections does not account for this. Thus, the major measures of economic activity such as output per capita and earning per capita will be the same across the alternate growth scenarios. This point as well as the non-pecuniary aspects of growth will be discussed in the next section.

As the results reported in Tables 92 (pg.328) and 93 (pg.329) demonstrate, the financial returns to the infrastructure investment are positive. This investment would pass a benefit-cost criterion. The analysis also provides some information to the debate of the "best" growth path for the region. The Trend Scenario imposes higher costs on the local economy through transportation costs. However, we cannot make comparisons of individual levels of satisfaction. While commuting is costly, the evidence from much larger cities is that people are willing to incur these costs to enjoy more space or other amenities associated with living in a more rural setting. Among the Balanced Scenarios, Balanced C yields the highest levels of output, employment, and earnings. By imposing higher impact fees, the costs of the infrastructure investment are concentrated in a single sector, so there is a smaller overall impact on household consumption and on local economic activity.

6.7 Discussion Points

In the previous section, only the financial impacts were presented as benefits. Other categories of benefits are relevant and should be included in the analysis of whether the infrastructure costs to support growth are justified.

The study conducted by Parsons Brinckerhoff omits, as per the terms of the contract, several categories of infrastructure that require capital expenditures. For example, school construction, and police and fire facilities are both omitted. The costs associated with these types of infrastructure will be sensitive to the spatial distribution of the growth. Inclusion of these costs would likely make the Trend Scenario perform more poorly and further demonstrate the benefits to a more compact development pattern.

The spatial distribution of the growth (Balanced vs. Downtown vs. Trend) will have a substantial effect on the pattern of employment growth. As discussed earlier, it is likely that the spatial distribution of employment and the sector pattern of growth will be related. While the overall impacts on the economic growth of the spatial distribution is small, the issue raises concerns for the planned growth scenario. It is not possible to separate the spatial and sector distribution of the growth of the regional economy. A planned growth strategy should take account of the job mix implied by the spatial pattern of growth.

The reliance on gross receipts tax implies that the central city is not depleted financially by the suburban flight, as urban areas more dependent on the property tax for revenues and with a less aggressive annexation history have been. Thus, the Albuquerque revenue projections do not vary significantly across the growth scenarios. However, the outlying areas of the County will be required to incur expenditures to maintain and expand infrastructure (roads, water, etc) to support growth.

There are several non-pecuniary costs and benefits associated with growth that have not been addressed in this study. Benefits, such as job availability and the retention of qualified workers, are not included, and neither are the values individuals place on the amenities associated with larger urban areas (arts, recreation, etc). On the other hand, there are costs associated with growth that have not been explicitly incorporated as yet. Environmental issues, such as water and air quality, and the level of congestion, need to be considered before a growth plan is adopted.

6.8 Conclusions

An efficient housing and land development market is essential for the economic growth of a region. In many parts of the country growth has been constrained by the inadequate response of the housing market to the changing employment conditions. Consequently housing prices rise rapidly and employers find it difficult to hire new workers since housing costs are a significant determinant of household location decisions.

The municipal government may encourage the development of an efficient housing market through the construction of appropriate infrastructure, such as water delivery systems, waste water systems, and public transportation. This study has presented estimates of measures of the pecuniary benefits of economic growth associated with the rehabilitation and construction of local infrastructure in the Albuquerque/ Bernalillo County area. The pecuniary net benefits of such construction are estimated to be positive.

Further work towards a planned growth strategy should address the issues associated with sprawl and the linkage between the spatial distribution of growth of employment centers and the nature of the employment associated with such growth. To the extent the local governments can affect the spatial distribution, they will also be able to affect the mix of employment in the region. This may have the greatest long-term effects on the economic vitality of the region.

Table 96 Bernalillo County Multipliers by Sector

Sector	Type I Output	Type II Output	Type I Employment	Type II Employment	Type I Income	Type II Income
Agriculture	1.26	1.42	1.25	1.42	1.40	1.67
Mining	1.09	1.16	1.42	1.83	1.27	1.52
Construction	1.28	1.47	1.42	1.70	1.43	1.70
Food Processing	1.27	1.38	1.85	2.25	1.76	2.10
Textiles	1.23	1.43	1.23	1.45	1.29	1.53
Wood Processing	1.30	1.48	1.48	1.81	1.46	1.73
Print and Publishing	1.23	1.44	1.31	1.58	1.33	1.58
Chemical and Drugs	1.25	1.38	1.68	2.09	1.57	1.86
Miscellaneous Mfg.	1.19	1.51	1.17	1.40	1.17	1.40
Build Materials	1.17	1.33	1.26	1.60	1.22	1.46
Heavy Mfg.	1.24	1.44	1.41	1.83	1.28	1.53
Technical Mfg.	1.30	1.52	1.51	1.98	1.34	1.60
Light Mfg.	1.18	1.41	1.20	1.43	1.22	1.45
Transportation, Communications, and Utilities	1.25	1.44	1.48	1.89	1.31	1.56
Personal Services	1.29	1.47	1.25	1.40	1.51	1.79
Wholesale and Retail Trade	1.11	1.43	1.07	1.26	1.07	1.27
Recreation Services	1.27	1.52	1.13	1.25	1.25	1.49
Finance, Insurance, and Real Estate	1.22	1.34	1.37	1.60	1.42	1.69
Business Services	1.24	1.56	1.21	1.47	1.20	1.43
Medical, Legal, and Educational Services	1.28	1.60	1.21	1.50	1.19	1.41
State and Local Govt.	1.08	1.58	1.03	1.27	1.03	1.22
Federal Govt.	1.01	1.55	1.01	1.45	1.00	1.19

The Input - Output Method

Input-output models are a device for organizing the basic accounting relations that describe the production sector of the economy. The input-output method starts with a very simple idea. All the sectors of the economy are tied together by virtue of economic relations called "linkages," and the production of a good or service can be described by a "recipe." The ingredients of this recipe are the outputs of the other sectors of the economy as well as the primary inputs such as labor, capital, and other raw resources. A simple example will serve to demonstrate. Consider a commodity such as steel. A particular economy with a given technology will allocate the steel it produces in a unique way. Some of the steel will be used to make equipment for making more steel (e.g., rolling mill equipment), some will be exported (or some will be imported), and some will be used in the manufacture of cars, buildings, bridges, etc. Obviously, all of the steel that is allocated or used up must add up to all of the steel made. If the total amount of steel made is 1,000,000 tons an allocation might be as follows:

Steel used to make steel	100,000 tons
Steel used to make cars	500,000 tons
Steel used to make bridges	100,000 tons
Steel used to make buildings	290,000 tons
Steel sold to households	10,000 tons
TOTAL steel production/allocation	1,000,000 tons

The steel used to produce other commodities in the economy reflects the "linkages" mentioned above. The extent to which the economy is an integrated whole depends on the strength of these linkages. Linkages that tie steel to the output of more finished products are known as forward linkages while those (not shown in this example) that relate steel to basic raw materials and labor are known as backward linkages. A similar table could be constructed for every commodity in the economy and, taken together, these would describe the entire economy. A common unit of measurement is necessary if the sectors are to be linked into a single model of the economy. Thus, all inputs and outputs are measured in dollar units rather than physical units. To make use of all of these tables for the various commodities in the economy requires an analytical device that relates all of the backward and forward linkages in the economy in a manner that permits investigation of "what if" scenarios. This analytical device is the input-output table.

A schematic representation of an input-output model is represented in Table B.1. This figure shows the economy organized into several key blocks for presentation.

The shaded area is the production sector of the economy. The Final Demand for the products is broken down into Consumption, Investment, Government, and Export. Total Output is the sum of the Intermediate Production (what is sold by Sector A to Sector A and to Sector B) and the Final Demand. A simple numerical example is represented in Table B.2. The row sums of the matrix denote the intermediate demands for the outputs of each sector-thus, the row sum for sector 1 denotes the output of this sector that is required as inputs to sector 1 and the other sectors. The column sums denote the payments for intermediate goods used in the production of the output of sector 1. In addition to the intermediate demand, there are several categories of final demand illustrated in the figure. Household consumption, investment, and government expenditures are all final demands in that they use the output of a sector directly and not as an input to another product. In addition to the payments for intermediate inputs, there are several categories of primary inputs such as payments for labor and other value added components. Finally, exports (E_i) and imports (M_i) appear in the model. Total gross output is the sum of intermediate demand, final demand, and exports. Total gross outlay is the sum of payments for intermediate inputs, labor, other value added components, and imports.

Table B.1 A Stylized Input-Output Model of a Regional Economy

	Sector A	Sector B	Consumption	Investment	Gov't	Exports	Total Output
Sector A							
Sector B							
Wages							
Return to Capital							
Indirect Taxes							
Imports							
Total Payments							

Table B.2 A Simple Numerical Example*

	Sector A	Sector B	Consumption	Other Final Demand	Total Output
Sector A	150	500	50	300	1000
Sector B	200	100	400	1300	2000
Wages	300	500	50	150	1000
Other Value Added	350	900	500	400	2150
Total Payments	1,000	2,000	1,000	2,150	6,150

* All values are in millions of dollars.

As noted, input-output models are a description of the interindustry flows in the economy. A table is created (see Tables B.1 and B.2) that is based on the fundamental accounting relationships linking intermediate and final demands to gross outputs. These yield the following system of equations:

$$X_1 - a_{11}X_1 - a_{12}X_2 - \ldots - a_{1n}X_n = Y_1$$

$$X_2 - a_{21}X_1 - a_{22}X2 - \ldots - a_{2n}X_n = Y_2$$

.
.
.

$X_n - a_{n1}X_1 - a_{n2}X_2 - . . . - a_{nn}X_n = Y_n$

which may be rearranged to yield:

$(1-a_{11})X_1 - a_{12}X_2 - . . . - a_{1n}X_n = Y_1$

$- a_{21}X_2 + (1-a_{22})X_2 - . . . - a_{2n}X_n = Y_2$
.
.
.

$- a_{n1}X_1 - . . . + (1-a_{nn})X_n = Y_n$

where:

X_i denotes output of sector i
Y_i denotes final demand for output of sector i

and a_{ij} denotes the amount of i used in the production of one dollar's worth of j.

The crucial assumptions for these equations to hold is that the money value of goods and services delivered by an industry i to other producing sectors is a linear and homogenous function of the output level of the purchasing sectors. The specific assumptions are: (1) the linear output function means constant returns to scale and no substitution between inputs; (2) additivity, the total effect of production is the sum of the separate effects (this rules out any external economies or diseconomies); and (3) the system is in equilibrium at given prices.[12]

In matrix notation the above system of equations can be represented as:

$\mathbf{(I-A)X = Y}$

and the outputs necessary to satisfy intermediate and final demand may be solved for as:

$\mathbf{X = (I-A)^{-1}Y}$

where $\mathbf{(I-A)}^{-1}$ is known as the Leontief inverse.

To conduct economic impact analyses, this relation can be used to solve for the changes in gross outputs that must be generated to satisfy changes in final demands due to exogenous shocks to a local economy. Input-output models constructed in this manner are known as "demand side" models because all impacts are applied through changes in the final demand from the baseline data.

It is useful to be able to distinguish **A** and **(I-A)** conveniently in the discussions to follow and so the elements of the **A** matrix are denoted by a_{ij} and those of the Leontief inverse as α_{ij}.

The **A** matrix is derived from the interindustry flow matrix **z** in the following manner:

$$A = z * \hat{q}^{-1}$$

Through its multiplier impact analysis, the input-output model is capable of generating estimates of the changes in output of given commodities, changes in employment, and changes in income so long as one is willing to accept the technical assumptions noted above. How critical are these assumptions to the task; estimation of the economic impacts due to critical habitat designation? To the extent the initial impacts on productive activities are small, the input-output model works quite well in providing estimates of the impacts.

In addition to the interindustry effects captured in the Leontief inverse, special input coefficients can be generated for items of interest such as labor, water, and electric power. The general methodology is as follows, with employment (labor) serving as an example. Construct a vector of the inputs per unit of gross output:

$$E = [e_1, e_2, \ldots , e_n]$$

where ei denotes the employment (labor input) in persons per unit of dollar output for sector i. From this, construct a vector of total employment:

$$\mathcal{E} = \hat{E}\, X \text{ where } \hat{E} = \begin{bmatrix} e_1 & 0 \\ 0 & e_2 \end{bmatrix}. \text{ Thus } \mathcal{E} = \begin{bmatrix} e_1 & X_1 \\ e_2 & X_2 \end{bmatrix}$$

and this final vector is the level of employment in each sector associated with the output levels X1 and X2. A change in these output levels, due to a change in final demand, results in a change in the level of employment based on the coefficients e1 and e2.13

B.1 Multipliers

Multipliers describe the effects of exogenous shocks on the regional economy. In general multipliers capture the indirect effects that arise as well as the direct impacts generated by the exogenous shock. There are several types of multipliers that may be computed depending on the economic measure sought (output, income, or employment) and whether the consequential effects are viewed as important to the analysis. Economic impacts are generated by direct shocks to the economy, and these result in indirect effects through the economic linkages in the economy. There is a further set of economic effects that is generated through household income changes that occur as a result of the initial impact and that lead to changes in consumption and thus to further changes in final demand. These are known as the induced effects of the original impact. There is not much debate concerning the validity of estimating the direct and indirect effects. However, there are differences of opinion concerning what types of effects can be captured under the induced label.

The computational steps to derive the basic multipliers are described below.

B.1.1 Output Multiplier

For a given sector, the output multiplier is defined as the total value of production in all sectors of the economy that is necessary to satisfy one dollar's worth of final demand for the given sector's output. Simple output multipliers capture the direct and indirect effects of the exogenous shock and are computed by taking the column sum of the respective rows of the Leontief inverse matrix. In matrix notation, the simple output multiplier is the row vector O = [O1, . . . ,On] where:

$$\mathbf{O = i'(I\text{-}A)^{-1}}$$

and where i' denotes the unity row.

These are the output multipliers that are reported for the various regions below.

B.1.2 Income Multipliers

These translate the impacts of final demand spending changes into changes in income received by households. These multipliers translate an initial dollar of output for a sector into a direct plus indirect estimate of the value of resulting employment and, in turn, household income. Income multipliers can be computed as "simple income multipliers" or as the Type I and II multipliers often reported in impact studies.

Simple income multipliers are represented by the vector $\mathbf{H} = [H_1, \ldots, H_n]$ and are calculated as:

$$\mathbf{H = H_R(I - A)^{-1}}$$

Where $\mathbf{H_R}$ denotes the household row coefficients that represent the wages and salaries paid to the labor input to the production in each sector.

Income multipliers may be computed as either Type I or Type II. The former capture the direct and indirect effects on the incomes of households while the latter add the induced effects that arise from the employment consequences of the output changes. These employment effects generate household income effects augmented by the direct and indirect effects.

Type I multipliers are computed as:

$$\mathbf{M = H_R(I - A)^{-1}(H_R)^{-1}}$$

The usual Type II multipliers capture the direct and indirect effects of the Type I multipliers as well as the induced effects attributable to consumption effects on final demand. These consumption effects work through the total final demand to increase the level of gross output required to meet the sum of intermediate and final demand. Bradley and Gander (1969) prove that the ratio of Type II to Type I multipliers is a constant for each sector of the economy. This constant is defined as:

$1/b$, where $b = [(1\text{-}h)\mathbf{-H_R}(\mathbf{I\text{-}A})^{-1}\mathbf{HC}]$

where h denotes intersection of the household row and column as shown in Table B.1 above; $\mathbf{H_R}$ is the household row and $\mathbf{H_C}$ is the household (consumption) column in the input-output table in the **A** matrix. Thus, the Type II income multiplier for a given sector i is computed as the Type I multiplier divided by b.

Appendix C

Aggregation Sectors

The Aggregation Scheme—each of the 22 sectors will be briefly described here.

Agriculture: This sector consists of the 2x sectors in the IMPLAN database and covers all cropping, livestock, and agricultural services.

Mining: This sector consists of the sectors in the IMPLAN database related to mining and covers all metallic mining, sand a gravel operations, oil and gas, and non-metallic minerals. Of these sectors, those that are prominent in the Bernalillo County economy are sand and gravel operations.

Construction: All construction activities are included in this sector. These include new building, roads, as well as maintenance of existing structures.

Food Processing: All food production including both human and animal food products. Includes dairy, cereal, and vegetable production.

Textiles: All textiles including clothing, weaving, upholstery, and carpet manufacture.

Wood Processing: All processing of wood products including furniture manufacturing.

Printing and Publishing: Includes all printing production (newspapers, fliers, etc) as well as magazine and book publishing.

Chemical and Drugs: This sector includes chemical processing, drug manufacture, and other primarily chemical oriented manufacturing.

Miscellaneous Manufacturing: This captures all manufacturing not elsewhere noted.

Building Materials: The production of materials used in construction including cement, insulation, and stone products. Excludes wood products.

Heavy Manufacturing: Iron and steel products, metal hardware, sheet metal work, plating and polishing, and so on.

Technical Manufacturing: The “hi-tech” sectors including semiconductor chip manufacture, optical and ceramic materials, lab equipment, and computer manufacture or assembly.

Light Manufacturing: Non-technical manufacturing that is not considered under Heavy Manufacturing. Includes electrical components other than listed under Technical Manufacturing, jewelry, musical instruments, games, etc.

Transportation, Communications, and Utilities: This sector consists of all transportation providers (except those that arrange travel), all television and radio, telephone, electrical and other utilities.

Personal Services: This sector consists of those services that are primarily provided to individuals rather than businesses. Included in this sector are hairdressers, laundry, cleaning and shoe repair, and repair facilities.

Wholesale and Retail Trade: All retail establishments and wholesale trade.

Recreation Services: Lodging, restaurants, movies, bowling alleys, golf, racing, and membership sports and clubs.

Finance, Insurance, and Real Estate: This sector includes banking, financial services, insurance carriers, and real estate brokers.

Business Services: R&D, consulting, accounting, advertising, personnel services, and protective services.

Medical, Legal, and Educational Services: Hospitals, nursing homes, legal services, doctors and dentists, and educational services not state provided.

State and Local Government: All state and local government services.

Federal Government: All federal government services including military and the labs.

Appendix D

Steps in the Analysis

1. Choose a study region—Bernalillo County to correspond to Section 1.

2. Construct a baseline I-O data set for 1993 using the IMPLAN database.

3. Aggregate the 300 sectors present in the County economy to 22 sectors. Purpose of aggregation is to reduce the dimensionality to allow us to look at the results and to make some sense of them. and

4. Adjust the data in the IMPLAN database to reflect local economic conditions. This is especially important for the tax structure since IMPLAN utilizes national averages and the Bernalillo County economy (as does New Mexico) has a unique tax structure (little property tax and substantial reliance on the gross receipts tax). For some previous work I had done on the New Mexico Computable General Equilibrium project I had worked up tax rates across sectors that reflect the New Mexico tax structure. I applied those rates to the sectors in the Bernalillo County model to compute tax payments. The total tax revenue on the IMPLAN data set is fairly close to the true levels so this was used to balance the tax levels.

An additional local data issue has to do with employment. The IMPLAN database defines employment as “total wage and salary employees and self-employed jobs in a region. It includes both full-time and part-time workers and is measured in total jobs.” Based on the 1995 IMPLAN values and the data provided in Section 1, Table 38, the IMPLAN levels are approximately 20% higher. This is consistent with part-time employment. However, the distribution of part-time employment is not uniform across sectors, and there is no data consistent with Parsons Brinckerhoff at the level of detail used in the I-O model. Therefore, the analysis is conducted using the IMPLAN database definition of employment. The largest differences are likely in the Retail Trade, Personal Services, and Recreation Services sectors.

Maintained Assumption: The employment growth in Section 1 (the scenarios) incorporates the feedback (induced) effects that may arise from the employment associated with the expansion of the infrastructure.

5. An I-O model programmed in GAUSS was used with the (adjusted) IMPLAN database to construct scenarios for the growth in the County through 2020.

Notes

1. Section 1 demonstrates that much of the required capital expenditure over the next forecast period is needed to correct deficiencies and rehabilitate existing infrastructure. This will have important consequences for the financing of the infrastructure, and this point will be discussed later.

2. In economic terms, we would describe such urban areas as having housing markets with inelastic supply of housing. That is, the housing market is slow to increase the supply of housing in response to an increase in demand.

3. I will refer to the analysis of the costs associated with growth and rehabilitation related infrastructure as Section 1. In fact, Parsons Brinckerhoff assembled some of their data from other sources and the responsibility for these data should not be assigned to Parsons Brinckerhoff. The infrastructure figures came from the engineering sub-consultants including the following: CH2M-Hill supplied the water costs, Camp Dresser McKee the wastewater costs, Wilson & Co. the hydrology costs, while Parsons Brinckerhoff themselves supplied the costs for streets and transit. The street costs were based on MRGCOG's Metropolitan Transportation Program as refined by County of Bernalillo staff. Furthermore, the *non*-Public Works-type infrastructure costs were obtained from City FISCALS and from the County of Bernalillo.

4. Based on the MRGCOG projections, the Planned Growth Strategy study maintained the assumption that the distribution of employment growth would be independent of the spatial distribution of the new jobs. A later analysis varied this assumption by what is known of the location choices of firms in different sectors. Employment growth concentrated in the Downtown and Uptown areas would be more concentrated among Business Services and Legal Services while growth in the Atrisco Park area would be more concentrated in Light Manufacturing and storage or transportation sectors. Thus, the sector distribution of each of the growth scenarios would be expected to be different. For the present study, this enhancement is not included. However, this will be considered in the Planned Growth Strategy, Part 2 – Preferred Alternative.

5. The FISCALS model of the City of Albuquerque was constructed by Paul Tischler and Associates, Bethesda, Maryland. The FISCALS analysis reported here was conducted by Chris Hyer, City of Albuquerque.

6. The actual construction of this infrastructure is not incorporated as a direct impact to the economy since it is assumed to be a component of the growth projection itself.

7. Such aggregation is required to preserve confidentiality among the firms in a region. That is, the firm data are reported by firm category known as Standard Industrial Classification. Each Standard Industrial Classification category must contain enough firms that one would be unable to discern the activities of a particular firm.

8. Although IMPLAN provides software for the purpose of conducting impact analysis it is relatively cumbersome to use in practice. Thus, the analysis reported here is conducted with a model programmed in GAUSS. This software was developed by the author and has been used in several other studies (see, e.g., Berrens et al. 1999).

9. The direct cost does not include the value of time used in travel. This is a real resource cost and should be included in a benefit-cost analysis of transportation projects. The I-O accounts on which the model is based do not account for such costs, however. Thus, for the purposes of the current analysis only the direct costs will be included.

10. It is probably desirable to remedy some deficiencies more quickly that this. While the required taxation would reduce some economic activities in the region temporarily, it is probable that future economic activity would make up for the loss.

11. These are: Wholesale and Retail Trade; Personal Services; Business Services; Recreational Services; and Transportation, Communications, and Utilities.

12. Under some moderately restrictive assumptions, it is possible to express the structure of the economy through the interindustry flows that relate the amount of the output of a sector that is used to produce the output of another sector. The key assumptions have to do with the nature of the production functions and the way that industries producing multiple products are modeled. Input-output models assume that production can be characterized by what is known as a Leontief production function. If the only inputs are labor and capital, the Leontief production function is written as:

$$X = \min\{K/a, L/b\}$$

where X denotes the output of the industry, K is capital, L is labor, and the coefficients a and b denote the exact production relation.
This production function rules out substitutions among the inputs if relative prices of these inputs change. Price changes of inputs occur when there are changes in supply that are not offset by changes in demand and vice versa. If the price changes are small, this aspect of the Leontief production function will not lead to significant biases in the estimation of the overall impacts. However, if the price changes are large, the input-output analysis will tend to overestimate the economic impacts of exogenous shocks to the economy.

13. IMPLAN employs a similar computation to generate some of the induced effects on the economy that arise through changes in employment and thus regional consumption levels. These induced effects are added to those changes in final demand that arise from the direct and indirect effects of the impact to produce total effects. For several reasons, this technique is flawed (see Borgen and Cooke 1991). We report the results that include these additional induced effects to illustrate an “upper bound” on the impacts of critical habitat, but we caution the reader that these measures are controversial.

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