THE EFFECT OF INCREASED PUBLIC INVESTMENT IN TRANSPORTATION INFRASTRUCTURE ON OKLAHOMA'S ECONOMIC DEVELOPMENT

BY

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INTRODUCTION

1.1 The Problem Statement

One third of the nation's infrastructure is provided by the public, and highway construction and maintenance dominate transport infrastructure spending. Public infrastructure would include government spending on sewer and waste, transportation facilities and services, education, and water services. Private infrastructure might include services such as banking, finance, management and accounting services (Maki and Lichty). Literature on public infrastructure investment to this point has primarily focused on its productivity, measured by growth in income, employment, and output (Babcock, Emerson, and Prater). While improvements may make a region more attractive to industry, they may also make transport easier, lessening the need for firms to move (Kilkenny). Some discrepancy exists as to whether increased infrastructure investment hinders or helps economic development (Vickerman, Spiekermann, and Wegener). Also, though some studies have estimated the relationship between public infrastructure investment and private infrastructure investment (Eberts; Khanam; Aschauer), I know of no studies that have calculated an elasticity of substitution of public investment in road systems for private investment in transport services. When the state invests in constructing a new road, private industry can invest less money in vehicles and other transportation services because transport cost is reduced. The public investment is substituted for the private investment.

The purpose of this research is to determine how gross state product and other measures of welfare change when public investment in highway infrastructure is increased. Policymakers need to know how improvements in the road system affect the economy. This leads to the ultimate research question: how do improvements in road infrastructure affect regional economic development? Answering this question could provide policymakers with better information for deciding whether to improve the road system.

1.2 Literature Review

Several authors have looked at public infrastructure and its effect on development. Vickerman, Spiekermann, and Wegener claim wide agreement that transportation infrastructure investment is important for economic development in disadvantaged regions. Kilkenny suggests that improvements in transportation and innovations in communication help to overcome rural remoteness. Yamano and Ohkawara found that the allocation of public investment influences regional economies, and Gillen found evidence that infrastructure attracts private investment. While there is wide agreement that infrastructure investment does affect development, analysts disagree about the direction of the impact of transportation. Some analysts claim that infrastructure investment has not reduced regional inequality while others maintain that more time must pass before such a conclusion can be reached (Vickerman, Spiekermann, and Wegener). In their review of public capital literature, Mikelbank and Jackson found public capital studies varied in their conclusions: some studies claimed almost no role in the economy for public capital, while others found a strong role for public capital.

Several models have estimated the impact of infrastructure on regional development. Talley presents a model that describes the complex linkages between a region's transportation infrastructure and its economic production by asserting a circular flow between transportation and economic production. Talley's model suggests two impacts of transportation infrastructure: an impact on spatial accessibility and an impact on quality of service for transportation. Babcock, Emerson, and Prater model the economic impacts of highway programs through the use of an input-output (I/O) model. Most studies of transportation infrastructure have been of this type, examining the land-use effects (output, income, employment) of highway construction. These effects last only during the time that the new highway is built.

Kilkenny's study showed that reduced transport costs, in combination with lower costs of supporting a rural workforce, make rural regions more attractive to industries. She maintained that the lower transport costs are reflected in nominal wages required to retain labor in a region and concluded that lower transport cost attracts firms to a region. This paper follows that claim, but rather than having the effects of improved transportation infrastructure show up in the wages of the mobile labor force, this research maintains that public infrastructure investment serves as a substitute for private investment in transport services. The effects of public infrastructure investment will show in household income, state employment and output levels, as well as rental rates of private capital.

Seung and Kraybill created a two-sector regional computable general equilibrium model for the state of Ohio. They used a dynamic model structure because the economic policies, especially public capital investment, have permanent effects once they are in place. The authors found that public capital investment affects the growth of the economy, but the magnitude of the effect depends on the public capital elasticity. Seung and Kraybill also found that once public capital investment reaches a certain level, additional investment may actually hurt household welfare.

In the literature, there is a consensus that transportation infrastructure has an effect on regional economic development; however, there is some debate as to whether improvements in such infrastructure will help regional development or increase the concentration of industry and private business in urban, heavily populated areas. This research will further examine the impact of improving transportation infrastructure on regional development in Oklahoma.

1.3 Objectives

General Objective:

Determine changes in Oklahoma's gross state product and other measures of welfare when public investment in highway infratructure systems is increased.

Specific objectives:

1. Create a public highway capital stock panel data set for the 48 contiguous states in the U.S.
2. Estimate elasticities of substitution between public investment in roads and private investment in transport services in the United States.
3. Determine economic development impacts in Oklahoma from different exogenous levels of public investment in road infrastructure measured through changes in gross state product, household income levels, state employment, and rental rates of private capital.

CHAPTER II
CONSTRUCTION OF A STATE LEVEL PUBLIC HIGHWAY CAPITAL STOCK

2.1 Introduction

The public provides one third of the nation's infrastructure, and highway construction and highway maintenance dominate transportation infrastructure spending (Maki and Lichty). Literature has focused primarily on the productivity of infrastructure, measured by growth in income, employment and output (Babcock, Emerson, and Prater 1997), but studies are difficult to compare because of differences in the definition of capital stock (Maki and Lichty). According to Maki and Lichty, assessment of depreciation represents the main difficulty of capital measurement. In a project for the Federal Highway Administration, Barbara M. Fraumeni outlined a procedure for building a national public highway capital stock, with procedures for the depreciation of assets.

While Fraumeni constructed a national public highway capital stock series spanning 1921 to 1995, this study extends her work to entail a set of panel data for the forty-eight contiguous U.S. states from 1980 to 2000. Fraumeni's paper gives details on how to construct a reasonable public highway capital stock series. The next section describes how, using Fraumeni's capital stock data as a benchmark, a set of panel data for highway capital stock is constructed for 1980 to 2000. I have followed Fraumeni's process, and the end result is a set of panel data (cross-section time-series) of public highway capital stock for the forty-eight states in the continental U.S. for 1980 to 2000.

2.2 Methods and Procedures

Fraumeni's capital stock data go back to 1921 to capture highway infrastructure investment before construction on the interstate highway system began in 1956. Her study improves upon previous capital stock series in several ways. First, her methods account for depreciation and quality change in highway capital stock by adjusting the capital stock for current and past declines in efficiency. In addition, she suggests that the greater the detail on highway investment the greater the quality of the capital stock estimates. Thus, she classifies expenditures by functional category or administrative class. Further, she differentiates expenditures between new construction, reconstruction, right-of-way (ROW) and structures, which allows one to assume that composition of highway investment is fixed over time. Finally, Fraumeni suggests that two major shortcomings of current public capital stock series come from benchmarking to the wrong capital stock or failure to benchmark at all.

In her paper, Fraumeni gives an extended review of the public capital stock literature and identifies studies with benchmarked capital stock and what method was used for benchmarking. Failure to benchmark implies that, for the initial investment year, no productive capital stock previously existed. Fraumeni says this is not problematic if any pre-existing stock was retired from service before the initial year of analysis. To disregard such pre-existing capital stock leads to a faulty capital stock series. Fraumeni declares that unbenchmarked capital stock series should not be used for economic analysis for up to 80 years after the initial investment year for investment data, because estimates of public capital service lives range from ten to eighty years. In addition, Fraumeni notes that many previous capital stock estimates benchmarked their capital stock series to the wrong capital stock. The Bureau of Economic analysis, for example, benchmarks its capital stock estimates to wealth capital stock. Fraumeni says that wealth stock is inappropriate for measuring productivity or for economic growth analysis. She discusses the difference between wealth capital stock (WCS) and productive capital stock (PCS):

- PCS estimates productivity or contribution to economic growth, while WCS measures the market value of capital
- PCS adjusts for current/past efficiency decline, whereas WCS adjusts for current/future efficiency decline

To alleviate these issues, Fraumeni used highway capital expenditures going all the way back to 1921. This takes care of her need for a benchmark.

For this study, the benchmarking process becomes important. In most cases, a capital stock series is benchmarked to another stock. In this case, Fraumeni's capital stock series is used as a benchmark. To create a benchmark, I followed the method of Garcia-Mila and McGuire. In their study, they benchmarked highway capital stock by using each U.S. state's share of total highway mileage. This study uses Table HM-220, Public Road and Street Length, 1980, Miles by Functional System from the *Highway Statistics Summary to 1995*. This table contains the existing highway mileage in 1980 for each of the U.S. states by functional system (i.e., interstate, arterial, and collector). Each state's share of highway mileage derives from dividing the total highway mileage for all systems for each state by the total highway mileage for the U.S. (for the forty-eight contiguous states). This share is then applied to the total productive highway capital stock from Fraumeni to get each state's base-year capital stock. For example, the total highway mileage for Alabama equals 87,160 miles and the total for the U.S. equals 3,844,424 miles. Dividing Alabama's total by the U.S. total results in a share of approximately 0.023. Multiplying this share by the total state and local capital stock for 1980 from Fraumeni results in Alabama's total highway capital stock for 1980, the initial investment year.

Once the initial year has been benchmarked, the creation of the capital stock series follows. First, the data for capital expenditures come from the *U.S. Highway Statistics Annual Series*, from 1981-2000. The data come from Table SF-12, State Highway Agency Capital Outlay and Maintenance, in the years 1981-1983, and from SF-12a, State Highway Agency Capital Outlay, in the remaining years. These data conform to Fraumeni's requirement that the data on expenditures be divided by functional system or administrative class. According to the preface section of the publication, the data in these tables include federal payments to states for highways in the states' expenditures on highways. In her paper, Fraumeni says that expenditures should be further classified by improvement type: right-of-way (ROW), new construction, reconstruction, and other (a category that includes expenditures on bridges, major widening, safety, etc.). This stems from the reality that new construction and reconstruction have different combinations of pavement, grading, and structures, which all deteriorate at different rates. Fortunately, the SF-12a tables disaggregate capital outlays for each state into just such categories (ROW, new construction, reconstruction, and several other categories summed up to become "other").

Unfortunately, the SF-12 tables in the earliest years do not disaggregate data in such a manner; instead, the data exist in the functional categories (interstate, arterial, and collector). It took a few steps to divide these early years into the appropriate categories. First, in the years 1984 through 1986, in the SF-12a tables, the percentage of total capital outlay for each category (ROW, new and reconstruction, other) was calculated for each state. Then these percentages were averaged over the three years and applied to the functional categories in the SF-12 tables for each state. For example, for the state of Alabama, the total ROW outlay for the state from 1984 through 1986, divided by the total capital outlay for the state for those three years, results in the percent of total outlay that is ROW in each year for Alabama. The percentage for ROW is summed for the three years and divided by three, to give the average ROW percentage for Alabama. Multiplying this percentage by the capital outlay for Alabama interstate in 1981 gives the outlay for interstate ROW in Alabama in 1981. The method is the same for each of the other improvement types (new and reconstruction, other) in each of the functional categories and for each state.

In some cases, states did not report capital outlay by functional system in certain years. In these cases, the total capital outlay for each state in the appropriate year came from Table SF-202c in *Highway Statistics Summary to 1995*. Applying the average of the percentages of improvement types for the nearest three years to the total capital outlay provided an estimate of the capital outlay for each improvement type. For example, in 1988, Arizona did not provide capital outlay by functional system. To fill in the gap, the average percent of ROW of total capital outlay for the years 1987, 1989, and 1990 was applied to the total capital outlay for 1988 to get the ROW capital outlay expenditures for Arizona in 1988. The same process resulted in capital outlay for each of the other three improvement types. Twenty-three states in all did not provide data by functional system for at least one year, and the same procedure provided disaggregated estimates of capital outlay by improvement type for each of those states in each of those years.

Getting the splits of pavement, grading and structures requires using the percentages derived by Fraumeni. According to Fraumeni, grading equals 23.1% of outlays for pavement plus grading plus structures, and structures equal 14.5% of outlays for pavement plus grading plus structures. To get the percentage for pavement, she subtracts from 100% the sum of the structure and grading percentages, which puts the pavement percentage at 62.4%. These percentages, applied to the new construction and reconstruction and other categories, provide the amount of capital outlays for each state and for each year that will be added to the initial year capital stock and depreciated.

As in Fraumeni, before construction of the capital stock, the data must first be converted to constant dollars. Fraumeni converted her national capital stock data to 1992 constant billion dollars, and this study follows suit. To create deflators, Fraumeni used data from the BEA's Fixed Assets Tables 7.5, Historical-Cost Investment in Government Fixed Assets, and 7.6, Chain-Type Quantity Indexes for Investment in Government Fixed Assets. From both tables, she used the total for highways and streets in the federal and state categories. She divided the historical-cost number by the chain-type index number; she then indexed the deflators to 1992. Fraumeni's data covers 1921 to 1995, so this study extended her deflators through 2000, following the same procedure and indexing to 1992, as she did. Multiplying the deflator in the appropriate year by the capital stock in the appropriate year yields the capital stock in constant dollars. In addition, the source data were in thousands of dollars and were converted to billions to match Fraumeni's data, which were in billions.

Fraumeni makes recommendations for depreciating each category of capital stock (ROW, pavement, grading, and structures). Fraumeni assumes that pavement has a 20-year service life, and she uses an elaborate method to determine pavement efficiency loss. Fraumeni says that geometric rates of depreciation capture the effects of retirement and efficiency loss, thus this paper uses a simple geometric depreciation rate. Garcia-Mila and McGuire (1992) use a 0.03 depreciation rate for their capital stock series, and this study uses their depreciation rate.

Fraumeni assumes that grading has an 80-year service life and is 100% efficient until retirement. Because Fraumeni traces highway capital back to 1921, any grading will not be retired until after 2000; therefore, depreciation will not apply to grading. Similarly, ROW also assumes 100% efficiency under Fraumeni's criteria and thus also faces no depreciation. In the case of structures, Fraumeni states that although she assumes a 50-year service life for structures, little is known about the way structures deteriorate. Following her study, structures deteriorate at her recommended rate of 1.82%.

For this paper, the depreciation of the capital outlays follows a general formula.

(1) $CapStock_{state,year} = CapOutlay_{state,year} + (1-d)CapStock_{state,year-1}$

CapStock represents the capital stock for the appropriate state, in the appropriate year; *CapOutlay* represents the new expenditure (or outlay) from each state in the current year. As before, d represents the rate of depreciation, as indicated above. This formula builds the stock in the pavement category and the structures category, and the ROW and grading categories keep their 100% efficiency. The benchmark year, 1980, is depreciated to represent prior existing capital stock in each component category then added to the new outlays in 1981. Each prior year faces the depreciation, and then the new year's outlays are added. In the cases of ROW and structures, the new year's outlays simply add to the previous year's outlays. Upon construction of each capital stock component (ROW, pavement, grading, structures), all the components sum up to become the total capital stock in each year, for each state.

2.3 Results

Table 2.1 compares Fraumeni's national capital stock estimates with the national totals of the capital stock estimates of the 48 states from this study, for 1980 through 1995. The data include federal and state expenditures. Because 1980 represents the benchmark year, the estimates from each study are equal for that year. In 1981 and 1982, the Lusby estimates fall slightly below those of Fraumeni, but in 1983, the Lusby estimate is greater than the Fraumeni estimate. For the next two years, Fraumeni's estimates stay above the Lusby estimates, but from 1986 on, the Lusby estimates overtake the previous study's estimates. As the estimates approach 1995, the final year of Fraumeni's series, the Lusby estimates rise much faster than the Fraumeni estimates.

One reason for this difference could be the different sources of data for each study. Fraumeni had to calculate the splits between new construction and reconstruction from total outlays in the summary publications put out by the Federal Highway Administration (FHWA) (e.g., *Highway Statistics Summary to 1995*), whereas most of the state data used here was submitted in such categories in the annual reports. Secondly, the methods used here differ slightly from Fraumeni's methods. She builds a more complicated capital stock series, with efficiency curves and distribution of retirements across the eighty years of data for the pavement component of capital stock. This study uses a simple geometric depreciation rate that includes retirements and efficiency loss. The geometric rate applies higher depreciation in early years than in later years, so later values of the Lusby capital stock may include more value from the previous year than Fraumeni's estimates, which may also explain the difference.

Table 2.2 shows capital to output ratios for both the Fraumeni and Lusby capital stock estimates. The first two columns show each national series in a capital-output ratio with total gross state product (GSP) for the United States from 1980 to 1995. When comparing the two capital series, the data in Table 2.2 follow the same pattern as in Table 2.1, with the Lusby data eventually overtaking the Fraumeni data. However, in terms of the ratio, the Fraumeni ratio and the Lusby ratio remain relatively close. The same follows for the second two columns of Table 2.2. In these two columns, the two national capital stock estimates form a capital-output ratio with total U.S. GSP for the transportation industry. The pattern is the same as the first two columns, though capital stock plays a much larger role in the transportation industry than it does for total GSP. In both ratios, the role of capital stock in output diminishes as the years progress. This fits the assumption that technology use becomes more efficient over time.

Table 2.3 gives a sample of the state-by-state capital-output ratio with total gross state product for each state, for selected years 1980, 1987, and 2000. The overall trend matches that of the national capital-output ratio, where the role of capital stock in output diminishes as the years progress. In states with high population, such as California and New York, capital makes up a small part of output in all years. However, in states with small population, such as Idaho, North Dakota, South Dakota, highway capital makes up a large part of output in the initial year with ratios greater than one (in the case of the Dakotas, greater than two).

Table 2.4 gives a sample of the state-by-state capital stock series, with selected years 1980, 1987, and 2000. Once again, 1980 represents the Fraumeni benchmark for each state. For thirty states, the amount of capital stock gradually increases from 1980 to 2000. Eight states (Georgia, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Virginia and West Virginia) either doubled or more than doubled their capital stock by the year 2000. Another eight states (Iowa, Kansas, Missouri, Montana, Nebraska, Oklahoma, Oregon and South Dakota) showed a decrease in the years between 1980 and 1987, followed by an increase in the years between 1987 and 2000. For Idaho and North Dakota, the amount of capital stock decreased from 1980 to 2000.

2.4 Conclusions

Though the methods vary somewhat, this study follows Fraumeni's suggestions that expenditures be disaggregated by functional category and that those expenditures be separated into the four highway capital stock components: ROW, new construction and reconstruction, and structures. The series is benchmarked to a productive capital stock series, not a wealth capital stock series, as Fraumeni recommends.

Though the Lusby capital stock series grows apart from the Fraumeni capital stock series in the later years of Fraumeni's study, the closeness of the capital-output ratios in Table 2.2 indicate that the Lusby capital stock estimate is reasonable. While not perfect, this capital stock series adds to the literature by providing a state by state panel data set. Further research on construction of highway capital stock would be to try to apply the efficiency curves in Fraumeni's national series to the pavement component of the state series. In addition, the state stock series could be improved by extending the set to 1921. Researchers can use this capital stock series to perform productivity analysis and economic growth analysis on a state basis. In addition, researchers interested in regional analysis could build regional stock series with the state data in states that have geographical links.

Table 2.1 Comparison of Fraumeni Capital Stock to Lusby Capital Stock

Year	Fraumeni	Lusby
1980	572.7061	572.7061
1981	574.0504	572.3997
1982	573.5436	573.2735
1983	574.1917	574.7542
1984	577.8888	576.5542
1985	584.7298	582.7505
1986	591.3920	591.9779
1987	597.6249	602.3335
1988	605.0608	613.7466
1989	611.8698	625.5393
1990	619.0294	639.5989
1991	627.3953	655.9495
1992	637.9468	671.6262
1993	650.1465	688.8174
1994	663.9794	708.2198
1995	677.0828	729.4596
1996	NA*	752.9747
1997	NA	778.9167
1998	NA	801.7273
1999	NA	836.2097
2000	NA	878.3823

Data are in billions of 1992 dollars. *Fraumeni's study ended with 1995 data.

Table 2.2 Capital-Output Ratios with total U.S. GSP and total U.S. Transportation GSP

	Total GSP		Transportation GSP	
Year	Fraumeni	Lusby	Fraumeni	Lusby
1980	0.3090	0.3090	8.4579	8.4579
1981	0.2356	0.2349	6.7190	6.6997
1982	0.2048	0.2047	6.2736	6.2707
1983	0.1947	0.1949	5.7963	5.8020
1984	0.1810	0.1806	5.3469	5.3346
1985	0.1692	0.1687	5.1690	5.1515
1986	0.1558	0.1560	4.6853	4.6899
1987	0.1381	0.1392	4.1971	4.2302
1988	0.1264	0.1282	3.8981	3.9541
1989	0.1193	0.1220	3.8486	3.9346
1990	0.1105	0.1141	3.6506	3.7720
1991	0.1065	0.1114	3.4557	3.6130
1992	0.1027	0.1082	3.3797	3.5582
1993	0.0987	0.1046	3.1946	3.3846
1994	0.0922	0.0984	2.9317	3.1271
1995	0.0846	0.0911	2.7104	2.9200
1996	NA	0.0861	NA	2.7877
1997	NA	0.0804	NA	2.5795
1998	NA	0.0763	NA	2.3593
1999	NA	0.0726	NA	2.2666
2000	NA	0.0677	NA	2.1866

Total GSP is total gross state product for all industries for the United States from BEA. Transportation GSP is total gross state product from the transportation industry for the U.S. from BEA. The Fraumeni study ends with the 1995 data.

Table 2.3 State Capital-Output Ratios with Total Gross State Product, for selected years

State	1980	1987	2000
Alabama	0.5303	0.2395	0.1022
Arizona	0.5455	0.2187	0.0871
Arkansas	0.8247	0.3695	0.1520
California	0.1196	0.0520	0.0311
Colorado	0.4279	0.1936	0.0678
Connecticut	0.1049	0.0541	0.0513
Delaware	0.1475	0.0771	0.0618
Florida	0.2161	0.0942	0.0623
Georgia	0.4023	0.1566	0.0650
Idaho	1.5057	0.7508	0.2022
Illinois	0.2023	0.1068	0.0592
Indiana	0.3440	0.1593	0.0749
Iowa	0.7234	0.3803	0.1556
Kansas	1.0596	0.4673	0.1946
Kentucky	0.4085	0.2184	0.1080
Louisiana	0.1924	0.1465	0.0855
Maine	0.4719	0.1884	0.0989
Maryland	0.1245	0.0676	0.0498
Massachusetts	0.1088	0.0436	0.0561
Michigan	0.2502	0.1118	0.0531
Minnesota	0.5742	0.2457	0.0898
Mississippi	0.7121	0.3430	0.1647
Missouri	0.4839	0.2059	0.0937
Montana	1.7483	0.9612	0.3808
Nebraska	1.1816	0.5444	0.1978
Nevada	0.7904	0.3179	0.0866
New Hampshire	0.3341	0.1142	0.0538
New Jersey	0.0812	0.0442	0.0364
New Mexico	0.7347	0.3846	0.1433
New York	0.1025	0.0492	0.0382
North Carolina	0.3398	0.1338	0.0590
North Dakota	2.4698	1.2468	0.4699
Ohio	0.1965	0.0981	0.0561
Oklahoma	0.6400	0.3484	0.1427
Oregon	0.8677	0.4160	0.1185
Pennsylvania	0.1976	0.1077	0.0658
Rhode Island	0.1444	0.0787	0.0569
South Carolina	0.4871	0.1883	0.0825
South Dakota	2.3675	1.0114	0.3432
Tennessee	0.4049	0.1744	0.0810
Texas	0.2827	0.1512	0.0630
Utah	0.6593	0.3088	0.1228
Vermont	0.6265	0.2527	0.1157
Virginia	0.2378	0.1026	0.0583
Washington	0.3518	0.1674	0.0678
West Virginia	0.4050	0.2753	0.1845
Wisconsin	0.4404	0.2050	0.0901
Wyoming	0.7378	0.5503	0.2719

Total Gross State Product is for all industries for each state.

Table 2.4 Highway Capital Stock Data Series, for selected years

State	1980	1987	2000
Alabama	12.9843	13.4462	15.9815
Arizona	11.2001	11.9324	17.7676
Arkansas	11.2395	11.0408	13.4262
California	26.6219	29.9793	54.4783
Colorado	11.1615	11.3300	14.8490
Connecticut	2.8872	4.0700	10.6553
Delaware	0.7796	1.1231	2.9308
Florida	14.8699	18.0394	38.3477
Georgia	15.5423	17.0584	25.0995
Idaho	10.0192	9.5803	9.7693
Illinois	20.1034	22.8593	36.1050
Indiana	13.6262	13.5325	18.7823
Iowa	16.6353	15.8865	18.1884
Kansas	20.1629	19.0129	21.5899
Kentucky	10.1656	11.4646	16.6998
Louisiana	8.3510	10.4265	15.3628
Maine	3.2628	3.3698	4.6421
Maryland	3.9945	5.7804	12.1017
Massachusetts	5.0318	5.6165	20.8403
Michigan	17.4647	17.3133	22.5508
Minnesota	19.3620	19.0647	21.6411
Mississippi	10.4119	10.7248	14.4661
Missouri	17.6137	17.1884	21.8565
Montana	10.6778	10.2983	10.8165
Nebraska	14.3474	13.4789	14.4661
Nevada	6.6431	6.5090	8.4429
New Hampshire	2.1368	2.2710	3.3475
New Jersey	4.9813	7.1947	17.2542
New Mexico	8.0727	8.2296	10.1635
New York	16.2951	19.3301	39.8195
North Carolina	13.7759	14.1788	21.6905
North Dakota	12.7783	11.7406	11.2075
Ohio	16.4951	17.5605	27.2911
Oklahoma	16.3532	15.7259	17.0801
Oregon	18.0947	17.3005	18.3346
Pennsylvania	17.5052	20.5668	34.7005
Rhode Island	0.9528	1.2981	2.7053
South Carolina	9.3047	9.2722	12.2027
South Dakota	10.8918	10.1152	10.3827
Tennessee	12.4589	13.1235	18.8359
Texas	39.7933	42.5463	61.0224
Utah	6.9306	7.1893	10.9808
Vermont	2.0954	2.1724	2.7792
Virginia	9.7583	11.4757	19.8664
Washington	12.4078	13.4356	19.4521
West Virginia	5.2396	6.2433	10.1746
Wisconsin	15.9475	15.5990	20.3907
Wyoming	5.3978	5.6384	6.8429

Data are in billions of 1992 dollars.

CHAPTER III
THE ELASTICITY OF SUBSTITUTION

3.1 Introduction

Policymakers and researchers of regional issues have long claimed that public infrastructure investment is a primary factor for regional growth (Eberts 1990). Vickerman, Spiekermann and Wegener claim wide agreement that transportation infrastructure is important for economic development in disadvantaged regions. Kilkenny states that improvements in transportation and innovations in communication help to overcome rural remoteness. Yamano and Ohkawara found that the allocation of public investment influences regional economies, and Gillen found evidence that infrastructure attracts private investment. Despite all of this attention, the most basic relationships between public and private investment remain unclear (Eberts 1990).

Eberts states that one of these basic relationships is the propensity to substitute between public and private capital. This chapter estimates an elasticity of substitution between public investment in highway infrastructure capital and private investment in transportation services. Section 2 briefly examines the literature on public infrastructure investment, while Section 3 outlines the data and methods used to estimate the elasticity of substitution. Section 4 describes the results, and Section 5 presents conclusions and suggestions for further research.

3.2 Literature Review

The previous literature on public infrastructure investment has focused mainly on the productivity of public infrastructure capital, with public capital serving as an input in production. In Eberts' 1986 study, he used a translog production function with cross-section time-series data to estimate the technical relationships between public and private capital for thirty-eight standard metropolitan statistical areas (SMSA) during a period from 1958 through 1978. His production function used value-added from the manufacturing sector as output; hours of production and non-production workers as a labor input; a value measure of private manufacturing capital as a private capital stock input; and public capital stock consisting of highways, sewage treatment facilities and water distribution facilities as his public capital input. Eberts found that public capital and private capital were complements, while public capital and labor were substitutes, and private capital and labor were substitutes.

Costa, Ellson and Martin also used a translog production function to examine the role of public infrastructure. They used cross-section data from 1972. They constructed their public capital data from annual capital outlays from state and local governments, 1937-1972, weighted by the average asset lives of each type of public capital (public structures and public equipment). For private capital, they distributed BEA estimates of gross book value of fixed assets among the states. Labor represented the final input, and they used value added from manufacturing for each state to represent output. Costa, Ellson and Martin determined that public capital and private capital were substitutes and public capital and labor were complements, the opposite finding of Eberts.

In a 1992 study, Garcia-Mila and McGuire used panel data in a Cobb-Douglas function to evaluate the contribution of public capital to state's economies. They used the number of state employees as a labor input, two forms of private capital (structures and equipment), highway capital and education as public inputs, and gross state product (GSP) as output for fourteen years and forty-eight states. They added three variables to account for differences across states: population, industrial mix, and median years of schooling. They determined that highway capital had a small effect on output, but they did not examine whether public and private capital were substitutes.

Khanam's 1996 Canadian study also examined the relationship between highway infrastructure capital and productivity growth. Khanam used pooled cross-section data for ten Canadian provinces during the period from 1961 to 1994. Gross provincial product served as output, while total goods-producing employment served as the labor input. Khanam included a public capital input, highway capital stock, and a private capital input, fixed stocks and flows, from Statistics Canada. Khanam estimated the relationship with a generalized Cobb-Douglas form with first differences and a translog form with variables expressed as deviations from their means. In addition, Khanam controlled for province and time effects. The results of Khanam's study indicated that highway and private capital were substitutes, and highway capital and labor were complements.

Bell and McGuire and Garcia-Mila, McGuire and Porter examined the impact of highway capital with alternative specifications. Bell and McGuire used a Cobb-Douglas with only annual time dummies, a Cobb-Douglas with state and time dummies, and a Cobb-Douglas (CD) with first differences and state and time dummies. They found highway capital's contribution to output to be insignificant when estimated with the third specification. Garcia-Mila, McGuire and Porter also examined three specifications: CD with no state effects, with random state effects, and with fixed state effects. They also estimated a second-order translog production function with first differences and fixed state effects. Their results indicated that a model with a translog production function and fixed state and time effects and first differences best estimated the relationship. They did not evaluate the relationship between public and private inputs. Fraumeni suggests that many previous studies of highway infrastructure were flawed because of faulty highway capital stock. For this study a highway capital stock series that fits the criteria outlined by Fraumeni for a proper capital stock series was created.

This study improves upon previous studies because the measure of public highway capital stock is more detailed than in previous analyses. It disaggregates according to pavement, grading, structures and right-of-way (ROW) outlined by Fraumeni. In addition, the capital stock is benchmarked to a productive capital stock series, rather than a wealth capital stock series, which Fraumeni says is inappropriate for productivity analysis. In addition, this study narrows its focus to the transportation sector only, with a physical measure of transportation output, rather than using total gross state product as a measure of output.

3.3 Methods and Data

3.3.1 Theory

Highway capital becomes important because it facilitates transportation of intermediate and finished goods and facilitates commuting to work. When public investment in road systems increases, it reduces transportation cost because the roads have better surfaces or a new road has been constructed. Because of lower transportation costs, a business can invest less in equipment required for the transport of product. In other words, if a new layer of blacktop is laid on an old highway, then a truck traveling on that highway will not need new tires as frequently because of reduced wear. There is a tradeoff or substitution of public investment (improving the road) for private investment (buying more equipment for transport). Viewing public investment in roads and private investment in transportation services as factors of production for transportation output, an elasticity of substitution can be calculated. Working from this framework, the following hypothesis can be tested: an increase in public investment in transportation infrastructure will substitute for private investment in transportation services. The larger the elasticity of substitution, the greater the degree of substitutability between the two inputs (Beattie and Taylor).

3.3.2 Data

Each of the variables expresses the data in natural log form. The variable *ytrans* represents annual vehicle miles traveled (VMT) for each of the 48 contiguous states from 1980 to 2000 and is a physical measure of transportation output. It includes all vehicular travel on state highways except for farm equipment (e.g., tractors). These data come from the *Highway Statistics Series* published by Federal Highway Administration. While a ton-mile accounting would have been desirable as a measure of output, one was not available by state through time. Furthermore, ton-miles would only capture freight output and not commuter travel or other vehicular output. The variable *hicap* is a public highway capital stock variable constructed in chapter two, using federal and state capital outlays from data in the *Highway Statistics Series*. This variable represents the public's (i.e., the government's) investment in transportation infrastructure in billions of constant 1992 dollars during the period 1980 to 2000. The variable *gsptrans* is the returns to private investment, used as a surrogate for private capital stock, calculated as total gross state product minus indirect business taxes and employee compensation, all from the transportation industry, in billions of constant 1992 dollars, for each state from the same time frame. Assuming that transportation services is a competitive sector, the remaining gross state product in the transportation sector represents the value of private resources used in transportation, thus representing private investment in transport services. Private capital stock is not available for the transportation sector. Number of vehicles provides a physical measure but represents only a part of plant and equipment for the transport industry. Besides, number of vehicles could be highly correlated with the method used to calculate vehicle miles traveled. The data for *gsptrans* come from the Bureau of Economic Analysis Regional Accounts Data, 1980 – 2000. The *labor* variable consists of number of employees for the transportation and public utilities sector, for all forty-eight states during the same time frame. The data come from the Bureau of Labor Statistics publication. Labor data were not available at the transportation services level, and hours worked were not reported at either the transportation services level or the transportation and public utilities level.

All data were converted to billions and taken as per capita for each state. Taking each variable as per capita accounts for differences in population size among states. Following Khanam, the pooled data set will estimate the production function. Pooling data reduces the possibility of nonstationarity. The estimation will also follow Khanam's assumption and the recommendation of several studies that the time and state effects are fixed.

3.3.3 Equations

The estimation of the elasticity of substitution involves a production function that has as its output a physical measure of transportation. The chosen form for the production function comes from Khanam and is a second order Taylor series approximation of a translog production function:

$$\begin{aligned} & ytrans_{st} = a_0 + a_1 Tlabor_{st} + a_2 Tgsptrans_{st} + a_3 Thicap_{st} + \frac{1}{2} b_1 (Tlabor_{st})^2 \\ (3.1)\ & + \frac{1}{2} b_2 (Tgsptrans_{st})^2 + \frac{1}{2} b_3 (Thicap_{st})^2 + c_1 (Tlabor_{st})(Tgsptrans_{st}) \\ & + c_2 (Tlabor_{st})(Thicap_{st}) + c_3 (Tgsptrans_{st})(Thicap_{st}) + u_s + v_t + e_{st} \end{aligned}$$

This form allows input substitutability to vary, has a non-linear relationship between output and the inputs, and includes a cross-product term, which indicates whether the inputs are substitutes or complements. The subscripts s and t stand for state and time period respectively. T represents a Hicks-neutral technological progress variable (Jones). The coefficient on the cross-product term, c_i, will indicate whether the inputs are substitutes or complements in production. The term u_s captures effects that vary by state but not over time, whereas v_t captures the effects that are common from state to state but vary over time, and e_{st} is the random error for both dimensions. The state and time dummies will be fixed effects, as recommend by Garcia-Mila, McGuire and Porter and by Khanam. The elasticity of substitution follows from Beattie and Taylor:

$$(3.2)\ \sigma = \frac{f_{gsptrans} f_{hicap} (f_{gsptrans} gsptrans_{st} + f_{hicap} hicap_{st})}{gsptrans_{st} hicap_{st} (2 f_{gsptrans} f_{hicap} f_{gsptrans,hicap} - f_{gsptrans}^2 f_{hicap,hicap} - f_{gsptrans,gsptrans}^2)}$$

where $f_{gsptrans}$ comes from the derivative of (3.1) with respect to *gsptrans*. f_{hicap} is the derivative of (3.1) with respect to *hicap*. $f_{gsptrans,gsptrans}$, $f_{hicap,hicap}$, and $f_{gsptrans,hicap}$ represent second derivatives.

This study also calculates elasticities of output for each of the inputs. The formula for calculating the factor elasticity comes from Beattie and Taylor:

$$(3.3)\quad E_{hicap} = \frac{a_3 hicap + b_3 hicap^2 + c_2(labor)(hicap) + c_3(gsptrans)(hicap)}{(3.1)}$$

E_{hicap} represents the factor elasticity for highway capital, and equation (3.1) is the denominator.

3.3.4 Specification Tests

In SAS, the PROC AUTOREG program conducts a Jarque-Bera test of normality. Under the hypothesis of normality, the test statistic generated is 8.4274. At the $\alpha = 0.010$ significance level, the test fails to reject the null hypothesis of normality. Because the higher power terms and cross-product terms of (3.1) are created from relationships of the first three terms, only the first three terms are included in the test for multicollinearity. The determinant of **X`X** equals approximately $9.61 \times 10^{-9}$, which is small and close to zero and could possibly indicate multicollinearity. However, the diagonal elements of $(\mathbf{X`X})^{-1}$, also called variance inflation factors (Tilley) range from 0.001 to 1.87. An inflation factor with a value of five or greater would indicate multicollinearity. The data sample for this study contains 960 observations, rather large, and the inconclusive results of the two multicollinearity tests suggest that multicollinearity is not a problem.

Garcia-Mila, McGuire and Porter suggest a battery of tests for panel data. First, a test for serial correlation from Bhargava, Franzini and Narendranathan was conducted. The test modifies the Durbin-Watson statistic to fit panel data. The test statistic equals 0.22, which implies positive autocorrelation. Garcia-Mila, McGuire and Porter suggest converting the data to first differences because of autocorrelation. PROC AUTOREG provides a test for autoregressive conditional heteroskedasticity (ARCH). Table 3.1 displays the results of the ARCH Lagrange multiplier test. For the data without first differences, the results indicate that the data suffer from an ARCH process out to the twelfth order. Following the suggestion of Garcia-Mila, McGuire and Porter, the data are converted to first differences. A second regression in PROC AUTOREG with first differences shows that the ARCH issue is reduced. The test statistic is chi-squared with one degree of freedom (Greene), with a critical value of 6.349 at the one percent level. The results indicate a failure to reject the null hypothesis of conditional homoskedasticity. In addition, the Durbin-Watson statistic grows to a value of 1.95, and a value close to two suggest no autocorellation (Tilley). Garcia-Mila, McGuire and Porter also suggest testing the data for measurement error and endogeneity. Following the example set by the authors, the test of measurement error involves estimating the regression with two period differences and three period differences and comparing those estimates with the one period estimates. The estimates for each model, given in Table 3.2, show that possible measurement error exists in the labor and private capital variables, where the magnitudes are similar, but the sign changes on the coefficients between the three models. Measurement error does not seem to represent a major problem for the public capital variable. The test for endogeniety involves using instruments of the independent variables. The instruments for this estimation are the two-period differences of the independent variables. Garcia-Mila, McGuire and Porter conduct joint F-tests on the instruments. The SAS-calculated F-tests equals 2.44 on the private capital variables and 7.80 on the labor variables, with a critical value of 4.61 at the one percent level of significance. The null hypothesis of exogeneity is not rejected for the private capital variable, but the significance on the labor variable rejects the null hypothesis. This indicates possible endogeneity in the labor variable, but with almost 1,000 observations, asymptotic properties remain intact.

The next set of tests determines whether a fixed effects or random effects estimator is appropriate. In PROC TSCSREG, SAS generates a Hausman test for random effects. The null hypothesis states that the u_s are uncorrelated with the independent variables, which would imply that the random effects estimator is efficient. The alternative states that the state effects are correlated with the independent variables, which would make the fixed effects estimator consistent, but not efficient. The statistic, m, is distributed chi-square with nine degrees of freedom. SAS returns an m statistic of 7.13, which results in a rejection of the null hypothesis. However, SAS also generates an F test under the null hypothesis of no fixed effects. In this case, the F test returns an F value of 13.79, which fails to reject the null hypothesis of no fixed effects. With conflicting results of the two tests, this paper retains the assumption of fixed state and time effects recommended by previous studies. Table 3.3 displays the results of the regressions with fixed state and time effects and with random state and time effects. Between the two models, the estimates of coefficients are close, with only the intercept having a different sign. The fixed effects model has a higher R-square.

3.4 Results

3.4.1 Comparison with Previous Studies

Table 3.4 gives the results of the fixed effects estimates of the coefficients and their t-values, along with the estimates of several other studies. The coefficients for the highway capital term, the squared terms and the cross-product terms have significant t-values. The signs of the coefficients on the cross-product terms indicate whether the inputs are substitutes or complements. A positive sign on the coefficient implies that the inputs are complements, which is the case for two of the cross-input relationships – labor-private capital and labor-public capital. This means that the marginal productivity of labor increases with increased levels of private capital (as represented here by returns to private investment) and with increased levels of public highway capital.

In addition, private capital and public capital prove to have a competitive relationship, implying that the marginal productivity of private capital decreases as levels of public highway investment increase (Beattie and Taylor). This relationship between highway capital and private capital supports the theory expressed above, that public highway capital investment would substitute for private investment and make Oklahoma more attractive to firms from outside the state. If the results indicate the true relationship, firms will need to investment less in private transportation services when the state increases its investment in the highway system. The improved roads reduce the level of investment in new tires because the previous set of tires lasts longer. This effect gives firms in Oklahoma a competitive advantage over firms outside the state, where road conditions may be worse. Thus, Oklahoma becomes more attractive to outside firms when compared with other states.

Table 3.4 shows how the Lusby results differ from those of previous studies. The intercept shows the same sign (negative) but with less significance as the Khanam study. For the coefficient on labor, the Lusby estimate carries the same positive sign as the other three studies, but the Lusby estimate has less significance than the other three studies. On the private capital input, the Lusby estimate has a negative sign with low significance, while the other studies have a coefficient with positive sign and high significance on private capital. For the estimate of the public capital coefficient, the Lusby estimate shares the same positive sign as the Khanam estimate and the Bell and McGuire estimate, while the other study has a negative sign on public capital. The Lusby estimate on public capital has much greater statistical significance than Bell and McGuire but slightly less than Khanam. For the higher power terms, the Lusby estimates share the same sign as the estimates of the Khanam study, with higher significance levels on all three terms. On the labor-private capital cross-product term, the Lusby estimate has a positive sign and and significant t-value while the Khanam estimate has negative sign and a low t-value. The Lusby and Khanam estimates share the same positive sign on the labor-public capital term, but the Lusby estimate has a much higher level of significance. Finally, on the private-public capital term, the Lusby and Khanam estimates share the same negative sign, but again, the Lusby estimate has higher significance.

Possible reasons for the differences in results follow. First, the dependent variable differs among the four studies. The Lusby study uses a physical measure, vehicle miles traveled, as its dependent variable. The remaining three studies use some form of gross state product for the dependent variable. This author feels that a physical measure better represents transportation output. Secondly, the variable representing private capital differs among the four studies. The Lusby study uses returns to private investment in the transportation industry (gross state product minus indirect business taxes minus employee compensation) to represent private capital. The Khanam study uses fixed capital stocks for private capital, while Garcia-Mila, McGuire and Porter use private structures and equipment for private capital. Furthermore, the Lusby data concern only transportation industry data, whereas the Khanam and Garcia-Mila, McGuire and Porter studies focus on all industries. Third, the estimates of highway capital stock differ among the studies. Khanam and Bell and McGuire do not provide detail on the construction of their highway capital stock, while Garcia-Mila, McGuire and Porter use another author's highway capital stock series. Thus, it is unclear whether these capital stock series fall victim to the pitfalls of capital stock construction detailed in Fraumeni. The Lusby highway capital stock follows the procedures of Fraumeni and so may represent a better public highway capital stock series.

3.4.2 Factor Elasticities and Elasticity of Substitution

To determine each input's effect on the output (represented by vehicle miles traveled per capita), this study calculates factor elasticities for each of the forty-eight states. Table 3.5 displays factor elasticities and elasticities of substitution for each state for selected years. The factor elasticities for labor range in value from 0.2195 to 0.3844. The factor elasticities for private capital range in value from 0.1654 to 0.3465, and the factor elasticities for highway capital range in value from 0.7791 to 0.9202. Finally, the substitution elasticities range in value from 3.855 to 8.104. In 1981, Connecticut had a negative value for returns to private capital, which may cause the extreme values for those elasticities; thus, I do not include the 1981 Connecticut values in the above ranges, as these may be outliers. By comparison, the elasticities of output for highway capital for the ten Canadian provinces in Khanam's study ranged in value from –0.005 to 0.624, and the output elasticity from Bell and McGuire's Cobb-Douglas functioni equals 0.076.

3.5 Conclusions

This study uses a second order Taylor series approximation to a translog production function to estimate an elasticity of substitution between public highway capital investment and private capital investment in transportation services. The study finds that the two inputs have a competitive relationship, supporting the hypothesis that increased investment in highway capital would make the state more attractive by reducing private cost of transportation. An increase in public capital investment may make the state more attractive because the investment in infrastructure substitutes for private investment in transportation services. This represents a competitive advantage for the transport industry, making the state attractive to outside firms.

Public highway capital appears to have a large, positive impact on transportation output. This result differs from the studies by Garcia-Mila, McGuire and Porter, who found no significant contribution from public capital, but falls in line with the studies by Khanam and Bell and McGuire, who found positive, significant relationships between public capital and output. The elasticities of substitution for each state seem to indicate that public highway capital readily substitutes for private investment in transportation services, at least in this framework, which focuses on physical miles traveled as output.

This study improves upon previous studies in several ways. It makes use of a more detailed, more appropriate public highway capital stock series than previous studies. It uses a physical measure of transportation output, thereby obtaining a truer estimate of the relationship between public and private transportation capital. Several misspecification tests also lend toward the appropriateness of the estimates. However, the ambiguity of the multicollinearity tests and the possibility of measurement error in the labor and private capital variables do suggest some caution in the use of these estimates.

Table 3.1 Results of the LM Test for Conditional Heteroskedasticity and Autocorrelation

	Without 1st Differences (dependent variable: ytrans)		With 1st Differences (dependent variable: $ytrans_{t-1}$)	
Order	LM statistic	p value	LM statistic	p value
1	475.2179	<.0001	0.0538	0.8166
2	494.1226	<.0001	0.1954	0.9069
3	499.6094	<.0001	0.7573	0.8596
4	500.7529	<.0001	1.6993	0.7908
5	501.8168	<.0001	2.4056	0.7906
6	502.2264	<.0001	3.2770	0.7734
7	503.4835	<.0001	3.8169	0.8006
8	503.7447	<.0001	4.1552	0.8429
9	504.1617	<.0001	4.7289	0.8573
10	504.3525	<.0001	5.4423	0.8597
11	504.3571	<.0001	6.0214	0.8719
12	504.3587	<.0001	6.1321	0.9093
DW statistic:	0.22		1.95	

LM statistic is chi-square (1), 6.6349 at 1% level of significance.

Table 3.2 Comparison of Models for Measurement Error
(dependent variable: y_{t-1}, y_{t-2}, y_{t-3} respectively)

Independent Variable	First Difference	Second Difference	Third Difference
labor	0.0086	-0.0093	-0.0051
	(1.11)	(-1.18)	(-0.76)
gsptrans	-0.0015	0.0010	0.0015
	(-0.83)	(0.70)	(0.95)
hicap	0.0199	0.0320	0.0234
	(2.99)	(8.66)	(8.94)
R-square	0.7356	0.7724	0.7791

Estimates come from the cross section time series regression with fixed state and time effects. Numbers in parentheses indicate t-values.

Table 3.3 Comparison of Fixed Effects and Random Effects Models with 1st Differences (dependent variable: $ytrans_{t-1}$)

Variable	Fixed Effects Model	Random Effects Model
Intercept	-0.0006	0.00099
	(-0.054)	(0.06)
Labor	0.0086	0.0105
	(1.11)	(1.45)
Priv. Capital	-0.0015	-0.0017
	(-0.83)	(-0.95)
Pub. Capital	0.01995	0.0141
	(2.99)	(2.91)
$Labor^2$	-0.2476	-0.2845
	(-1.75)	(-2.12)
Priv. $Capital^2$	0.0003	0.0003
	(1.58)	(1.68)
Pub. $Capital^2$	-0.0427	-0.0480
	(-2.74)	(-3.24)
Labor-	0.0838	0.0923
Priv. Capital	(4.76)	(5.92)
Labor-	0.2049	0.2065
Public Capital	(6.31)	(6.60)
Priv. Capital-	-0.0457	-0.0502
Public Capital	(-5.90)	(-7.62)
SSE	2.5041	2.6420
R-square	0.7356	0.1596

Table 3.4 Fixed Effects Estimates Compared to Previous Studies
(dependent variable: ytrans)

Independent Variables	Lusby (translog)	Khanam (translog)	Garcia-Mila, McGuire, and Porter (translog)	Bell and McGuire (Cobb-Douglas)
Intercept	-0.0006	-0.11	N/A	N/A
	(-0.054)	(-0.846)		
Labor	0.0086	0.60	0.985	0.833
	(1.11)	(6.66)	(16.34)	(19.42)
Priv. Capital	-0.0015	0.19	0.348	N/A
	(-0.83)	(3.16)	(3.30)	
Pub. Capital	0.01995	0.36	-0.058	0.076
	(2.99)	(3.60)	(0.77)	(1.68)
$Labor^2$	-0.2476	-0.13	N/A	N/A
	(-1.75)	(-1.30)		
$Priv. Capital^2$	0.0003	0.04	N/A	N/A
	(1.58)	(1.33)		
$Pub. Capital^2$	-0.0427	-0.10	N/A	N/A
	(-2.74)	(-0.526)		
Labor-Priv. Capital	0.0838	-0.01	N/A	N/A
	(4.76)	(-0.10)		
Labor-Pub. Capital	0.2049	0.43	N/A	N/A
	(6.31)	(1.59)		
Priv. Capital-Pub. Capital	-0.0457	-0.12	N/A	N/A
	(-5.90)	(-1.09)		
SSE	2.5041			
R-square	0.7356			

The Lusby estimates use all data in log form with first differences, gross state product as private capital and vehicle miles traveled for the dependent variable. Numbers in parentheses are t-values. The Khanam estimates use data in log form as deviations from the mean, with gross state product as dependent variable and fixed capital stocks as private capital. The Garcia-Mila, McGuire and Porter estimates use gross state product for the dependent variable and private structures and equipment for private capital. Bell and McGuire use gross state product from Transportation, Communication and Public utilities as the dependent variable and no private capital stock variable. All studies use fixed state and time effects. N/A indicates information not available.

Table 3.5 Elasticities for Each State, Selected Years

		Factor Elasticities			Substitution
State	Year	Elabor	Egsptrans	Ehicap	Elasticity
Alabama	1981	0.3052	0.2329	0.8418	5.7768
Alabama	1990	0.3027	0.2635	0.8376	5.1298
Alabama	2000	0.3062	0.3024	0.8263	4.5003
Arizona	1981	0.2944	0.2415	0.8498	5.5632
Arizona	1990	0.2933	0.2670	0.8456	5.0498
Arizona	2000	0.3068	0.2955	0.8272	4.6025
Arkansas	1981	0.2882	0.2424	0.8553	5.5315
Arkansas	1990	0.2793	0.2823	0.8558	4.7653
Arkansas	2000	0.2770	0.3136	0.8520	4.3019
California	1981	0.3437	0.2591	0.8021	5.2901
California	1990	0.3606	0.2830	0.7823	4.8968
California	2000	0.3435	0.3159	0.7897	4.3808
Colorado	1981	0.2722	0.2706	0.8650	4.9540
Colorado	1990	0.2740	0.2852	0.8605	4.7123
Colorado	2000	0.2728	0.3238	0.8543	4.1651
Connecticut	1981	0.8800	2.9346	-0.2896	-1.4385
Connecticut	1990	0.3295	0.2561	0.8152	5.3214
Connecticut	2000	0.3026	0.2949	0.8312	4.6061
Delaware	1981	0.3477	0.2684	0.7966	5.1218
Delaware	1990	0.3149	0.2626	0.8267	5.1696
Delaware	2000	0.2994	0.2898	0.8352	4.6773
Florida	1981	0.3283	0.2495	0.8177	5.4516
Florida	1990	0.3365	0.2735	0.8051	5.0101
Florida	2000	0.3209	0.3049	0.8123	4.4906
Georgia	1981	0.2852	0.2504	0.8567	5.3590
Georgia	1990	0.2791	0.2843	0.8557	4.7349
Georgia	2000	0.2831	0.3303	0.8428	4.0994
Idaho	1981	0.2544	0.2518	0.8861	5.2827
Idaho	1990	0.2673	0.2692	0.8700	4.9698
Idaho	2000	0.2748	0.2983	0.8571	4.5116
Illinois	1981	0.3144	0.2725	0.8251	4.9886
Illinois	1990	0.3046	0.2983	0.8286	4.5593
Illinois	2000	0.2950	0.3263	0.8321	4.1667
Indiana	1981	0.3163	0.2522	0.8276	5.3736
Indiana	1990	0.3064	0.2884	0.8290	4.7108

Table 3.5 continued

		Factor Elasticities			Subtitution
State	Year	Elabor	Egsptrans	Ehicap	Elasticity
Indiana	2000	0.3036	0.3163	0.8258	4.3062
Iowa	1981	0.2855	0.2581	0.8547	5.2035
Iowa	1990	0.2832	0.2712	0.8542	4.9596
Iowa	2000	0.2745	0.3150	0.8542	4.2789
Kansas	1981	0.2475	0.2740	0.8890	4.8614
Kansas	1990	0.2544	0.2920	0.8787	4.5779
Kansas	2000	0.2442	0.3175	0.8847	4.2073
Kentucky	1981	0.3159	0.2475	0.8290	5.4699
Kentucky	1990	0.3004	0.2754	0.8372	4.9137
Kentucky	2000	0.2820	0.3108	0.8476	4.3467
Louisiana	1981	0.2941	0.2920	0.8399	4.6370
Louisiana	1990	0.2972	0.2928	0.8367	4.6286
Louisiana	2000	0.2957	0.3176	0.8331	4.2767
Maine	1981	0.3219	0.2388	0.8256	5.6708
Maine	1990	0.3201	0.2625	0.8220	5.1797
Maine	2000	0.3116	0.2914	0.8236	4.6726
Maryland	1981	0.3565	0.2333	0.7973	5.8683
Maryland	1990	0.3388	0.2673	0.8046	5.1253
Maryland	2000	0.3226	0.2972	0.8123	4.6054
Massachusetts	1981	0.3595	0.2305	0.7954	5.9414
Massachusetts	1990	0.3528	0.2666	0.7927	5.1662
Massachusetts	2000	0.3065	0.2971	0.8271	4.5795
Michigan	1981	0.3401	0.2190	0.8143	6.1928
Michigan	1990	0.3433	0.2580	0.8027	5.3079
Michigan	2000	0.3388	0.2983	0.7977	4.6175
Minnesota	1981	0.2738	0.2571	0.8661	5.2066
Minnesota	1990	0.2783	0.2844	0.8564	4.7313
Minnesota	2000	0.2799	0.3219	0.8476	4.1978
Mississippi	1981	0.3158	0.2688	0.8245	5.0545
Mississippi	1990	0.3074	0.2730	0.8313	4.9665
Mississippi	2000	0.2953	0.2951	0.8380	4.5896
Missouri	1981	0.2738	0.2711	0.8634	4.9474
Missouri	1990	0.2752	0.2971	0.8570	4.5315
Missouri	2000	0.2724	0.3243	0.8545	4.1577
Montana	1981	0.2276	0.2800	0.9088	4.7363
Montana	1990	0.2407	0.2855	0.8940	4.6611
Montana	2000	0.2514	0.3108	0.8783	4.3039

Table 3.5 continued

		Factor Elasticities			Substitution
State	Year	Elabor	Egsptrans	Ehicap	Elasticity
Nebraska	1981	0.2371	0.2866	0.8976	4.6412
Nebraska	1990	0.2445	0.2985	0.8877	4.4683
Nebraska	2000	0.2437	0.3429	0.8809	3.9005
Nevada	1981	0.2406	0.2722	0.8965	4.8837
Nevada	1990	0.2645	0.2817	0.8704	4.7554
Nevada	2000	0.2809	0.3218	0.8466	4.2006
New Hampshire	1981	0.3348	0.2183	0.8190	6.2005
New Hampshire	1990	0.3389	0.2435	0.8098	5.5999
New Hampshire	2000	0.3316	0.2867	0.8065	4.7818
New Jersey	1981	0.3559	0.2592	0.7917	5.3128
New Jersey	1990	0.3283	0.3040	0.8058	4.5172
New Jersey	2000	0.3026	0.3329	0.8235	4.0988
New Mexico	1981	0.2720	0.2622	0.8668	5.1063
New Mexico	1990	0.2892	0.2732	0.8482	4.9324
New Mexico	2000	0.2906	0.2927	0.8429	4.6182
New York	1981	0.3452	0.2550	0.8018	5.3721
New York	1990	0.3390	0.2744	0.8028	5.0010
New York	2000	0.3240	0.2991	0.8107	4.5788
North Carolina	1981	0.3142	0.2272	0.8350	5.9319
North Carolina	1990	0.3122	0.2720	0.8272	4.9940
North Carolina	2000	0.3133	0.2988	0.8205	4.5655
North Dakota	1981	0.2195	0.2643	0.9202	5.0006
North Dakota	1990	0.2226	0.2777	0.9146	4.7676
North Dakota	2000	0.2271	0.3202	0.9026	4.1521
Ohio	1981	0.3383	0.2580	0.8070	5.3005
Ohio	1990	0.3385	0.2800	0.8020	4.9034
Ohio	2000	0.3225	0.3091	0.8099	4.4346
Oklahoma	1981	0.2739	0.2603	0.8654	5.1439
Oklahoma	1990	0.2812	0.2688	0.8566	4.9983
Oklahoma	2000	0.2804	0.3068	0.8500	4.3994
Oregon	1981	0.2623	0.2451	0.8796	5.4339
Oregon	1990	0.2729	0.2762	0.8632	4.8568
Oregon	2000	0.2817	0.3035	0.8494	4.4474
Pennsylvania	1981	0.3329	0.2593	0.8114	5.2641
Pennsylvania	1990	0.3238	0.2804	0.8149	4.8700
Pennsylvania	2000	0.3059	0.3086	0.8253	4.4138
Rhode Island	1981	0.3844	0.1931	0.7843	7.0810

Table 3.5 continued

		Factor Elasticities			Substitution
State	Year	Elabor	Egsptrans	Ehicap	Elasticity
Rhode Island	1990	0.3579	0.2207	0.7991	6.1866
Rhode Island	2000	0.3383	0.2707	0.8042	5.0616
South Carolina	1981	0.3131	0.2125	0.8392	6.3204
South Carolina	1990	0.3151	0.2521	0.8288	5.3734
South Carolina	2000	0.3019	0.2942	0.8320	4.6147
South Dakota	1981	0.2508	0.2573	0.8887	5.1689
South Dakota	1990	0.2552	0.2725	0.8814	4.8947
South Dakota	2000	0.2526	0.3060	0.8779	4.3704
Tennessee	1981	0.3158	0.2480	0.8290	5.4593
Tennessee	1990	0.3019	0.2869	0.8335	4.7274
Tennessee	2000	0.2832	0.3353	0.8418	4.0407
Texas	1981	0.2947	0.2841	0.8409	4.7615
Texas	1990	0.3016	0.2926	0.8326	4.6388
Texas	2000	0.2981	0.3338	0.8276	4.0800
Utah	1981	0.2792	0.2576	0.8608	5.2050
Utah	1990	0.2798	0.2793	0.8559	4.8164
Utah	2000	0.2765	0.3138	0.8525	4.2984
Vermont	1981	0.3038	0.2313	0.8434	5.8130
Vermont	1990	0.2971	0.2534	0.8448	5.3168
Vermont	2000	0.2971	0.2887	0.8376	4.6905
Virginia	1981	0.3209	0.2433	0.8256	5.5709
Virginia	1990	0.3117	0.2734	0.8273	4.9689
Virginia	2000	0.3000	0.3095	0.8307	4.3922
Washington	1981	0.2996	0.2433	0.8447	5.5323
Washington	1990	0.3023	0.2799	0.8346	4.8422
Washington	2000	0.2976	0.3088	0.8331	4.3977
West Virginia	1981	0.3014	0.2368	0.8444	5.6801
West Virginia	1990	0.2969	0.2639	0.8428	5.1128
West Virginia	2000	0.2882	0.2894	0.8458	4.6662
Wisconsin	1981	0.3018	0.2464	0.8420	5.4678
Wisconsin	1990	0.3009	0.2751	0.8368	4.9198
Wisconsin	2000	0.2928	0.3132	0.8367	4.3304
Wyoming	1981	0.2221	0.3221	0.9079	4.1237
Wyoming	1990	0.2288	0.3155	0.9016	4.2158
Wyoming	2000	0.2417	0.3452	0.8826	3.8716

Substitution Elasticity for private capital and public capital from equation (3.2)

CHAPTER IV

A DYNAMIC COMPUTABLE GENERAL EQUILIBRIUM MODEL OF OKLAHOMA

4.1 Introduction

While a variety of models have examined the effects of transportation infrastructure, a regional computable general equilibrium (RCGE) model will give the best picture of all markets, from factor resources (including migration) to commodities (including trade). Results may also be used to trace distribution effects from economic sectors to households. This picture could then be used to estimate returns to private investment from decreased transport cost, which might be a better determination of what attracts private industry to a region. In addition, the RCGE model will examine the effect of different levels of public investment in highway infrastructure because such changes can be exogenously introduced into the model. These functions of CGE modeling make it an asset to this research; however, the criticisms of CGE modeling detailed in Partridge and Rickman will have to be addressed in order to make the research stand up to scrutiny. These criticisms include use of Cobb-Douglas and CES functional forms, seen as too restrictive and arbitrarily imposed on the economy; calibration rather than econometric estimation of some parameters in the model's equation system; use of a benchmark data set, which may underidentify the system; and too much reliance on external sources for elasticities and other parameters. Additional problems may come from the scarcity of regional data and structural features of the model that tend to be based more on convenience than knowledge of the region in question (Partridge and Rickman).

4.2 Theory

Assuming the substitutability of public and private investment, an exogenous shock of increased public investment in highway infrastructure lowers the cost of transportation in the region. Once the exogenous change is made, the system of equations is solved for the new equilibrium. The lowered transport cost attracts firms to a region, and they increase the demand for local resources. The new equilibrium solution provides the increased levels of output, employment, household income and factor prices (rental rates of private capital). The difference between the new equilibrium solutions and the benchmark equilibrium solutions represent the effects of the change in public investment.

The benefit from using a CGE model in this study stems from the difference between partial equilibrium studies and general equilibrium studies. In a partial equilibrium study, one good's price is examined while the prices of all other goods are treated as fixed. Partial equilibrium only examines one market. However, a change in one market may affect other markets in an economy. General equilibrium analysis captures these effects by representing an economy as a set of equations, thereby examining effects of a change on all the markets in an economy (Nicholson).

A general equilibrium solution requires that several conditions be met. Consumers maximize utility subject to a budget constraint of initial commodity endowments and producers maximize profits. All demand functions must be homogeneous of degree zero in prices, meaning that if all prices (including wages) double, then the quantity demanded of each good remains the same. All demand functions must also be continuous, implying that if prices change by a small amount then the quantity demanded also changes by a small amount. Finally, at the equilibrium set of prices, excess demand equals zero in all markets; this stems from Walras' law that the total value of excess demand at any set of prices equals zero (Nicholson).

Regional CGE modeling gets its foundation from national CGE modeling. Assumptions include firms that maximize profits (minimize costs), with factor markets that are perfectly competitive and factor demands responsive to factor prices. Also, households maximize utility when making consumption decisions, responding to price differences among goods and services. Prices are assumed to adjust in goods and services markets and in factor markets to equate supply and demand (Partridge and Rickman).

In their paper on basic CGE modeling, Robinson, Kilkenny, and Hanson outline the major features of a CGE model. Such a model simulates how a market economy works by specifying behavior of consumers and producers as optimizers, by including government not as an optimizer but as an "explicit agent," and by depicting all market transactions with a circular flow of income. Their national model focuses on international trade issues, incorporating imperfect substitution between demand for imported and domestic goods, and includes a parallel treatment of export supply, incorporating imperfect transformability between production for foreign markets and domestic markets at the sector level. The model, with the above treatment of exports and imports, insulates the domestic price system from changes in world prices of sector substitutes and also assumes that the U.S. cannot affect the world prices of goods and services it imports (the "small country" assumption). The model also assumes downward sloping world demand for some U.S. agricultural commodities, with all other exports having fixed world prices. Each sector produces a composite commodity that can be sold in domestic markets or transformed to the export market, and each industry produces output according to a production function that uses primary and intermediate inputs. Government spending is considered exogenously. A social accounting matrix (SAM) depicts the economy at a point in time, showing the transactions of the CGE model's economy (Robinson, Kilkenny, and Hanson).

Schreiner et al gives a procedure for constructing a SAM at the state and regional levels. SAMs capture the circular flow of goods and services from firms to households and the factor market flows from households to firms. With SAM accounts constructed to balance inputs and outputs, the row and column totals in a social accounting matrix are equal, and so they represent a regional economy in equilibrium. The type of data included in a SAM depends on the region in question and the type of questions being studied. As an illustration, the authors construct a simplified SAM for the state of Oklahoma (Schreiner et al).

The model must be calibrated, and Robinson, Kilkenny, and Hanson outline a procedure for doing so. A base year, or benchmark year, SAM must be constructed, and the authors used one for the U.S. in 1982 plus some additional estimated parameters such as certain elasticities. The authors state that common calibrating practice assumes that the chosen base year for the model also serves as the base year for price indices. Prices are then normalized to one, and thus the SAM's sectoral flows measure real as well as nominal magnitudes. Solving the model's equations in reverse, parameters are derived from the equations given the base year variable values. If the model is working properly, the base year SAM values will be reproduced (Robinson, Kilkenny, and Hanson).

Regional economies have greater openness than national economies, complicating regional CGE modeling (Partridge and Rickman). Regions trade with foreign countries as well as other regions, and labor moves more easily between regions than between countries. Savings of regional residents have less influence on regional investments, creating a divergence between the place of factor employment and place of factor income expenditure. Interaction between regional and federal government levels with regard to expenditure, tax and transfer policies are further nuances. Some regional CGE models try to incorporate these elements, and other models simply ignore the greater openness of regional economies and follow the national CGE model framework (Partridge and Rickman).

Regional CGE models differ from input-output models because the RCGE models are guided by neoclassical theory. They show the complete circular flow of income and expenditures in a region by including household, government, and industrial sectors, whereas I/O models mostly focus on the intermediate flows between industrial sectors (Partridge and Rickman). In RCGE, factor demands depend on output and relative factor prices rather than depending linearly on output. Because regional CGE models usually include intermediate inputs, a nesting procedure allows for intermediate goods to be treated differently than value added factors. At the lowest level of this nest, intermediate inputs can either be imported or purchased domestically. RCGE modeling makes use of the classic Armington assumption, that goods produced in different regions are imperfect substitutes and usually specified by a constant-elasticities-of-substitution (CES) function. These intermediate goods combine to form composite intermediate goods for the next level of production. Reinert and Roland-Holst use econometric methods to estimate

Armington elasticities for mining and manufacturing sectors of the U.S. economy. Using government sources for their data, the authors found statistically significant CES elasticities for most of the mining and manufacturing sectors. Partridge and Rickman give an advantage of RCGE modeling with regard to transportation; RCGE incorporates transportation costs and production costs into the determination of regional location of economic activity.

Partridge and Rickman list some potential problems and further areas of research concerning regional computable general equilibrium modeling. RCGE models are frequently criticized for using Cobb-Douglas and CES functional forms, seen as too restrictive and arbitrarily imposed on the economy. Alternatives to the Cobb-Douglas and CES functions include flexible functional forms such as the Translog and Generalized Leontief. Much criticism and debate stems from the calibration procedure. Some critics say that relying on one benchmark year underidentifies the system, with too much reliance on external sources for elasticities and other parameters. Problems arise if elasticities in the literature were estimated with procedures inconsistent with the CGE model in which they will be used. Final problems concerning CGE modeling include the scarcity of regional data and structural features of the model that tend to be based more on convenience than knowledge of the region in question (Partridge and Rickman).

4.3 The Oklahoma CGE Model

Based on Schreiner et al's 1993 Oklahoma CGE model, this model includes four sectors: agriculture, mining, manufacturing and services. The model contains one aggregate household and one aggregate government sector. While the Schreiner model represents a static solution for one year, the inclusion of a time dimension converts it to a dynamic model. The model has a baseline, benchmark year, and then a one-time shock of public highway capital and its effects during a twenty year period are examined.

Households consume regional commodities in two levels (Schreiner et al). First, they maximize utility from leisure and consumption of a composite commodity subject to work and leisure time, budget constraints and prices. Second, they choose an optimal combination of imported and locally produced commodities. The level of demand for local and imported goods depends on the minimum cost combination of the two. The first level (4.1) derives from a Linear Expenditure System (LES), and the second level (4.2) is modeled by a Constant Elasticity of Substitution (CES) function.

$$(4.1)\quad Q_{ih} = \mathrm{B}_{ih}\frac{HE_h}{P_i}$$

$$(4.2)\quad Q_{ih} = \phi_i^Q\left[\delta_i^Q QM_{ih}^{\rho_i^Q} + (1-\delta_i^Q)QR_{ih}^{\rho_i^Q}\right]^{\frac{1}{\rho_i^Q}}$$

In (4.1) B_{ih} is the marginal budget share, P_i is the price of commodity i, and HE_h represents household expenditures. Q_{ih} represents household demand for the commodity. In (4.2), ϕ_i^Q is the household consumption efficiency parameter, δ_i^Q is the share parameter, and QM_{ih} and QR_{ih} represent household demand for imported and regionally produced goods, respectively. The substitution parameter, ρ_i^Q, is calculated as follows:

$$(4.2a)\quad \rho_i^Q = \frac{\sigma_i^Q - 1}{\sigma_i^Q}$$

where σ_i^Q represents the elasticity of substitution between goods.

The government and capital formation sectors face a CES function for commodity demand similar to that of households. As with household demand, imported and regionally produced commodities are imperfect substitutes (Schreiner et al).

On the production side, the model follows Schreiner et al, but also incorporates the public highway capital as an input in production, following Seung and Kraybill. For each of the industrial sectors (agriculture, mining, manufacturing and services), a Cobb-Douglas (CD) function represents substitution among the primary factors of production (land, labor, capital). The services sector adds the public capital input to the production function. The assumption is that the public highway capital input reduces costs in the transportation services sector; the effect of that reduced cost reflects in the input decisions of firms in the other sectors of the economy.

(4.3) $VA_i = \phi_i^{VA} LAB_i^{\alpha_i^L} CAP_i^{\alpha_i^K} LAND_i^{\alpha_i^T} G^{\alpha_g}$

VA_i represents composite factor value added, ϕ_i^{VA} is the factor efficiency parameter, and *LAB*, *CAP*, *LAND* represent labor, private capital, and land inputs for industry *i,* respectively. *G* represents the public capital input. The α s represent production elasticities for each industry. The model assumes constant returns to scale among the primary inputs by imposing the restriction that the production elasticities on each input sum to one. The public capital input, as an unpaid factor of production, is assigned the elasticity of 0.855, estimated in chapter two. The factor elasticities on the primary inputs become the factor shares, calibrated by the model.

Each industry also has a choice whether to export their commodity or sell it in the regional market. CGE analysis assumes exports and regionally sold products are differentiated by market, and a constant elasticity of transformation (CET) function represents the relationship between them(Schreiner et al).

(4.4) $X_i = \phi_i^X \left[\delta_i^X EXP_i^{\rho_i^X} + \left(1 - \delta_i^X\right) R_i^{\rho_i^X} \right]^{\frac{1}{\rho_i^X}}$

$$(4.4a)\quad \rho_i^X = \frac{\sigma_i^X + 1}{\sigma_i^X}$$

In (4.4), X_i represents total output for each industry, ϕ_i^X represents the output efficiency parameter, and δ_i^X is the share parameter. EXP_i and R_i represent sector supply for export and for regional markets, respectively. The symbol σ_i^X represents the elasticity of transformation for each industry, with ρ_i^X, in (4.4a) being the output substitution parameter. Each firm allocates output between the region and export markets so as to maximize revenue subject to the CET function (Schreiner et al).

The public capital input consists of government expenditures on highway infrastructure. Public capital is accumulated as follows, adapted from Seung and Kraybill:

$$(4.5)\quad G_t = (1-d)G_{t-1}$$

In year t, the level of public capital equals the amount of public capital in the previous year minus the amount of capital depreciated during the course of the year. The parameter d represents the depreciation rate, taken as equal to 0.03 from Garcia-Mila and McGuire. The model assumes a one time public capital expenditure in year one, and the amount of that expenditure depreciates in each successive year.

In year zero, the benchmark year, the effect of public capital expenditure is assumed to be reflected in the efficiency parameter. G_t is the increase in public capital above the benchmark year. To offset the increase in government expenditure, a tax is added to the model, in addition to the taxes paid by both households and firms. The additional tax is equal to the total additional highway capital expenditure divided by the twenty-year lifetime of the investment, compounded at 0.03% interest. The amount of highway capital expenditure is based on the public highway capital stock data series created in chapter two. The change in the level of public highway capital stock in Oklahoma from 1999 to 2000 equals \$637 million dollars. Assuming the government chooses to increase its public highway capital expenditure by ten percent, the increase in expenditure equals \$63.7 million dollars. Dividing that number by twenty results in the annual value of \$3.185 million, compounded in (4.6).

$$(4.6)\quad 3.185(1+0.03)^t$$

In (4.6), t represents the year. The tax level, from (4.6), in each year is subtracted from household income.

The model assumes mobile private capital and mobile labor. Labor and private capital migration happens when prices between the region and the rest of the world differ. The Schreiner et al model employs functions that model the migration of labor and private capital.

$$(4.7)\quad LMIG = LS0 * \varepsilon^L * \log\left(\frac{P_L}{P_{LE}}\right)$$

$$(4.8)\quad KMIG = \sum_{i=1}^{n} KS0_i * \varepsilon^K * \log\left(\frac{P_K}{P_{KE}}\right)$$

In (4.7), *LMIG* represents labor migration, while *LS0* represents initial labor supply. P_L and P_{LE} represent local labor wage and rest-of-world labor wage, respectively. The nomenclature is similar for (4.8), with labels for private capital and private capital prices. The ε symbols represent the labor and private capital migration elasticities, which must come from the literature.

To simulate dynamics, the model sequences static equilibria through time, producing changes in stocks of labor, private capital, and public capital through migration of labor and private capital, and depreciation of the public highway capital stock (Seung and Kraybill). From the base year, the highway capital increases the government expenditures and the model is run, generating a new equilibrium. The new equilibrium, with its changes in labor and capital stocks, then has a new depreciated level of public capital introduced, producing the next equilibrium solution. This sequencing continues for twenty years, which Fraumeni assumes to be the service life of pavement on highways. The changes in labor, private capital, gross regional product, and household and enterprise income represent the effects of the initial investment in highway capital.

4.4 Data

Schreiner et al construct a benchmark data set using a social accounting matrix (SAM) from the Minnesota IMPLAN Group (MIG). MIG created the Oklahoma SAM using secondary data from BEA REIS, BLS ES202 and several other sources. The SAM incorporates national income and product accounts, household transfer payments and distributions from the Census of Population, BEA REIS and BLS Consumer Expenditure Survey, plus government data from the Annual Survey of State and Local Government Expenditures (Schreiner et al). This model uses the Schreiner et al SAM for the benchmark year.

The public highway capital expenditure is calculated in a manner following Seung and Kraybill. For their study, they implemented public capital expenditures by calculating public capital as a percentage of benchmark year GRP. For the Oklahoma model, the public highway capital level is calculated as ten percent of the increase in the total public highway capital stock level for Oklahoma from 1999 to 2000 (see chapter two).

Certain parameters in the algebraic equations of the model must be calibrated, such as the efficiency parameter in (4.3). The calibration process determines the values for these parameters by using the data on exogenous and endogenous variables in the benchmark equilibrium. The calibration process replicates the SAM's flow values and determines the values of the parameters.

Only relative prices matter in CGE analysis, so all prices and factor rents are normalized to unity for the benchmark equilibrium. Normalizing prices to one allows the flow values in the SAM to be interpreted as physical quantity indexes for the commodity and factor markets. With the calibrated parameters attached to the equations in the CGE model, the benchmark equilibrium flows should be replicated.

Because the model uses flexible functional forms such as the CET and CES functions, the calibration process must be supplemented by parameters obtained from economic literature. These parameters include migration elasticities for private capital and labor and price elasticities of export demand (Plaut, Schreiner et al). Table 4.1 displays a list of elasticities for this model.

4.5 Results

The simulation is carried out over a period of twenty years, representing the service life of the new pavement installed with the additional highway capital expenditure. The benchmark year serves as a baseline, assuming that the equilibrium solution in the benchmark year would remain unchanged without the increase in government expenditures. The simulation introduces the highway capital in year one, and every year after that, the capital depreciates at a rate of 0.03 percent per year, assuming no new public highway capital outlays in each successive year. The model assumes a one-time highway project.

Table 4.2 best shows the effects of the public highway capital investment, given by changes in private capital income, gross regional product, household disposable income, and adjusted labor income. For each year, the data are indexed to the benchmark year, as a percentage of benchmark year levels. For example, the level of gross regional product in year twenty is divided by the level of gross regional product in year zero (the benchmark year), resulting in an index number of 0.9985, meaning that in year twenty, gross regional product is at 99.85 percent of its benchmark level. Figure 4.1 shows the results graphically.

Private capital income rises above benchmark year levels in year one and remains above benchmark levels out to year twenty, where it stays at approximately 1.001. Gross regional product rises above 1.00 in year one then begins to fall to just above 0.998 in year twenty. Disposable household income and labor income show the greatest improvement over the service life of the highway project, rising above 1.001 by the end of the simulation.

Table 4.3 displays the effects of the public highway capital on capital and labor migration into and out of the region. In year one, both private capital and labor experience in-migration into Oklahoma. In subsequent years, labor migration stays at near zero levels, while private capital experiences out-migration. Beginning in year sixteen, both labor and private capital show a rise in in-migration until year twenty. Both capital and labor migration show a downward trend as the end of the simulation approaches, but, on net, the region received a growth in workers and in private capital by the end of the simulation. Figure 4.2 graphically shows the year by year changes in migration of private capital and labor.

Figures 4.3 through 4.6 show the effects of public capital on production in each of the four sectors, relative to the base year levels. In Figure 4.3, agriculture shows an increase in imports and exports until year two, while regional production falls below initial levels. Imports and regional production follow the same pattern, staying below initial levels but increasing throughout the twenty year period. Exports climb back above initial levels in year eight then fall below the benchmark level in year thirteen. In Figure 4.4, the mining sector experiences a rise in exports from year three to year eight, when exports fall below the benchmark level. Imports and regional production fall below benchmark levels and remain there throughout the study. In Figure 4.5, the manufacturing sector shows an increase in exports through year two, a dip in exports until year twelve, then a rise in exports until the end of the study. Imports and regional production fall just below benchmark levels and remain there. In Figure 4.6, the services sector shows a brief rise in imports in the first few years then a general downward trend in imports, exports and regional production.

Table 4.3 shows the effects of public capital on prices in the region, including the labor wage, the land rent, private capital rents and the prices faced by consumers and producers in the state. In the case of services, prices rose above 1.00 which may have led to the decline in production in that sector. In the mining and maufacturing sectors, exports rose when prices fell below 1.00 and fell when prices returned to 1.00 or rose higher than 1.00. The prices in the agriculture sector in Table 4.3 maintain at 1.00, even though the production in the agriculture sector fluctuates in Figure 4.3. At three decimal places, the changes in agriculture prices were probably too small to appear in the table. The price increase in the services sector seems to contradict the assumption that the public capital would reduce costs in the transportation sector; this may be due to the high aggregation of the services sector. The public capital input only applies to the transportation services sector but by default applies to all industries in the services sector in this model.

4.6 Summary and Conclusions

The CGE model constructed here is a dynamic model examining the effects of an investment in public highway capital over a period of twenty years. The public capital depreciates at 0.03 percent per year. A tax on households offsets the extra government expenditures. Over the course of the twenty years, gross regional product rises above initially then falls below benchmark level. However, labor income, private capital income, and disposable household income rise above benchmark levels. Labor and private capital migration fluctuate during the period in sync with changes in the wage rate and private capital price, and, when summed over the twenty-year period, results indicate a net gain for the state in terms of labor migration and private capital migration. These changes are relatively small (less than one percent), which may be due in part to the relatively small increase highway infrastructure spending; however, the small changes may also indicate that public capital spending has a smaller role in Oklahoma's economy than hypothesized.

Some issues with the model should be resolved in further research before publication. Private capital should be subject to a depreciation scheme to more accurately reflect producers' choices regarding that input in future years. As well, Schreiner et al say that the household consumption function derived from the LES is not appropriate for dynamic analysis. Seung and Kraybill used a CES function for a representative consumer, and such a function might be appropriate here; of course, a CES function would require an elasticity parameter from the literature. As well, the formulation of the services sector assumes that all industries in the services sector receive the public capital input. It would be beneficial to disaggregate the services sector so that only the transportation services sector receives the public capital input.

The early gains in labor and capital migration, plus an early GRP gain, seem to indicate that a continuous investment in public highway capital would be beneficial to the state. Further experiments would include an additional government investment in highway capital each year, added to the leftover effect of the public capital from the previous year. Another appropriate experiment would examine any possible utility effects for individuals resulting from the highway capital investment. For example, a smoother ride to work affects an individual's welfare, though such an effect is difficult to quantify. While this model leaves room for improvement, it does show that investing in public highway capital can have a positive effect on portions of the economy.

Table 4.1 Elasticities for the Oklahoma CGE Model

Elasticities of Commodity and Intermediate Input Import Substitution[a]	
Agriculture	1.47
Mining	1.84
Manufacturing	1.75
Services	0.60
Elasticities of Transformation[b]	
Agriculture	3.90
Mining	2.90
Manufacturing	2.90
Services	0.70
Elasticities of Migration[c]	
Private Capital Migration	0.92
Labor Migration	0.92
Elasticity of Output for Transportation Infrastructure[d]	0.855

[a]From Bilgic, King, Lusby, and Schreiner.
[b]From Schreiner et al.
[c]From Plaut.
[d]Estimated in chapter two.

Table 4.2 Effects on Income and Gross Regional Product Relative to Base Year

Year	KY	GRP	DYH	ALY
0	1.0000	1.0000	1.0000	1.0000
1	1.0004	1.0007	1.0007	1.0010
2	1.0004	1.0004	1.0006	1.0010
3	1.0006	1.0003	1.0007	1.0010
4	1.0006	1.0001	1.0007	1.0010
5	1.0006	0.9999	1.0007	1.0011
6	1.0005	0.9999	1.0007	1.0011
7	1.0005	0.9999	1.0008	1.0012
8	1.0005	0.9998	1.0008	1.0012
9	1.0004	0.9996	1.0008	1.0012
10	1.0003	0.9994	1.0008	1.0012
11	1.0002	0.9992	1.0008	1.0012
12	1.0003	0.9992	1.0008	1.0012
13	1.0006	0.9992	1.0009	1.0012
14	1.0006	0.9991	1.0009	1.0012
15	1.0006	0.9989	1.0009	1.0012
16	1.0006	0.9988	1.0009	1.0012
17	1.0006	0.9987	1.0010	1.0012
18	1.0006	0.9987	1.0011	1.0014
19	1.0007	0.9986	1.0012	1.0015
20	1.0007	0.9985	1.0013	1.0015

Year zero is the benchmark year, to which the variables are indexed.
ALY is adjusted labor income; KY is private capital income; GRP is gross regional product; DYH is disposable household income.

Table 4.3 Effects on Migration of Private Capital and Labor (millions)

Year	LMIG	KMIG
0	0.000	0.000
1	18.408	9.564
2	0.120	-1.186
3	0.000	2.328
4	0.000	0.002
5	1.297	0.023
6	-0.001	-0.786
7	1.958	0.150
8	0.004	-0.792
9	0.000	-1.466
10	-0.344	-1.446
11	0.000	-1.878
12	0.001	0.350
13	0.001	0.288
14	0.003	0.117
15	0.000	-0.413
16	-0.374	-0.119
17	1.586	0.689
18	2.030	0.897
19	2.027	0.888
20	0.829	0.320
Total	27.185	7.530

LMIG is labor migration; KMIG is private capital migration.

Table 4.4 Effects on Regional Prices

				PR				PX			
Year	PT	PL	PK	Agr	Min	Man	Ser	Agr	Min	Man	Ser
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	1.000	1.001	1.00004	1.000	1.000	0.999	1.001	1.000	1.000	0.999	1.001
2	0.999	1.000	0.9999	1.000	1.000	0.999	1.003	1.000	1.000	1.000	1.003
3	1.000	1.000	1.00001	1.000	0.999	0.999	1.003	1.000	1.000	1.000	1.003
4	1.000	1.000	1.000	1.000	0.999	0.999	1.003	1.000	0.999	1.000	1.002
5	1.000	1.000	1.000	1.000	0.999	0.999	1.003	1.000	1.000	1.000	1.002
6	1.000	1.000	0.9999	1.000	0.999	0.999	1.002	1.000	1.000	1.000	1.002
7	1.000	1.000	1.0000	1.000	0.999	0.999	1.002	1.000	1.000	0.999	1.002
8	1.000	1.000	0.9999	1.000	0.999	0.999	1.002	1.000	1.000	0.999	1.001
9	1.000	1.000	0.9999	1.000	0.999	0.999	1.002	1.000	1.000	0.999	1.002
10	1.000	1.000	0.9999	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
11	1.000	1.000	0.9999	1.000	1.000	0.999	1.001	1.000	1.000	0.999	1.001
12	1.000	1.000	1.0000	1.000	1.000	0.999	1.001	1.000	1.000	0.999	1.001
13	1.000	1.000	1.0000	1.000	1.000	0.999	1.001	1.000	1.000	0.999	1.001
14	1.000	1.000	1.0000	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
15	1.000	1.000	0.9999	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.002
16	1.000	1.000	0.9999	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
17	1.000	1.000	1.0000	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
18	1.000	1.000	1.0000	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
19	1.000	1.000	1.0000	1.000	1.000	0.999	1.002	1.000	1.000	0.999	1.001
20	1.000	1.000	1.0000	1.000	1.000	0.999	1.002	1.000	1.000	1.000	1.001

PT is price of land, PL is labor wage, PR is regional price, PK is private capital price, and PX is price faced by producers. Import price and export price, which are exogenously controlled, remained at 1.00 throughout the simulation. In some years, the changes in prices were so small that they do not appear in the table due to rounding.

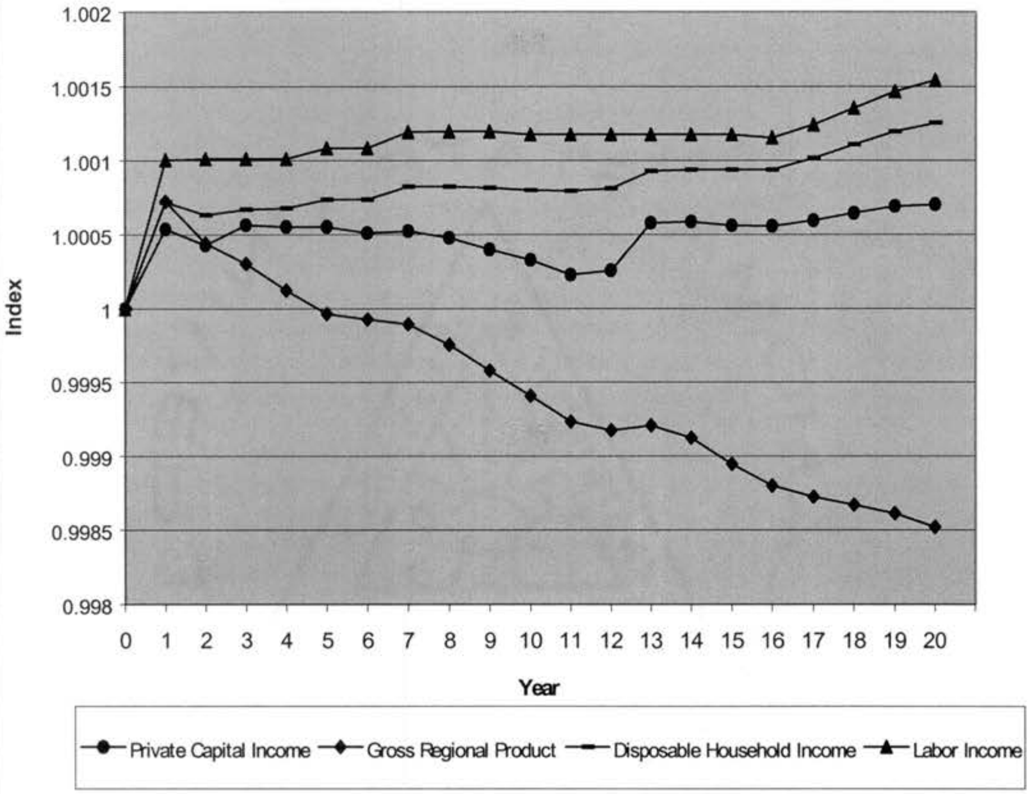

Figure 4.1 Changes in Income and GRP Relative to Base Year

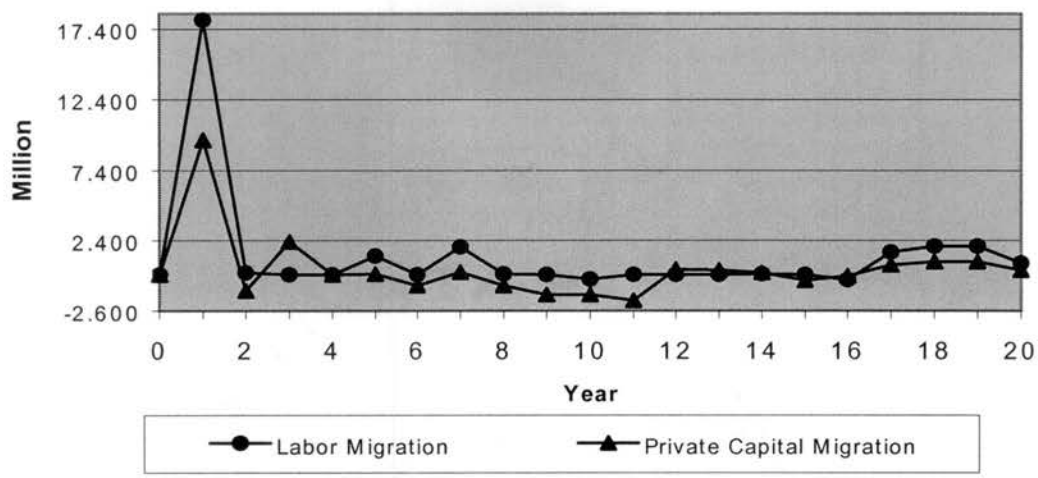

Figure 4.2 Effects on Labor and Capital Migration

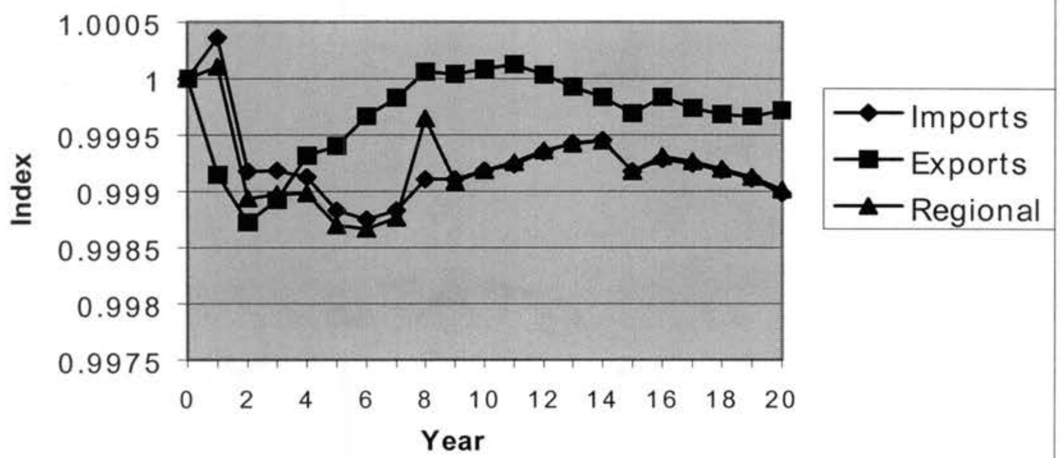

Figure 4.3 Public Capital Effects on Agricultural Production

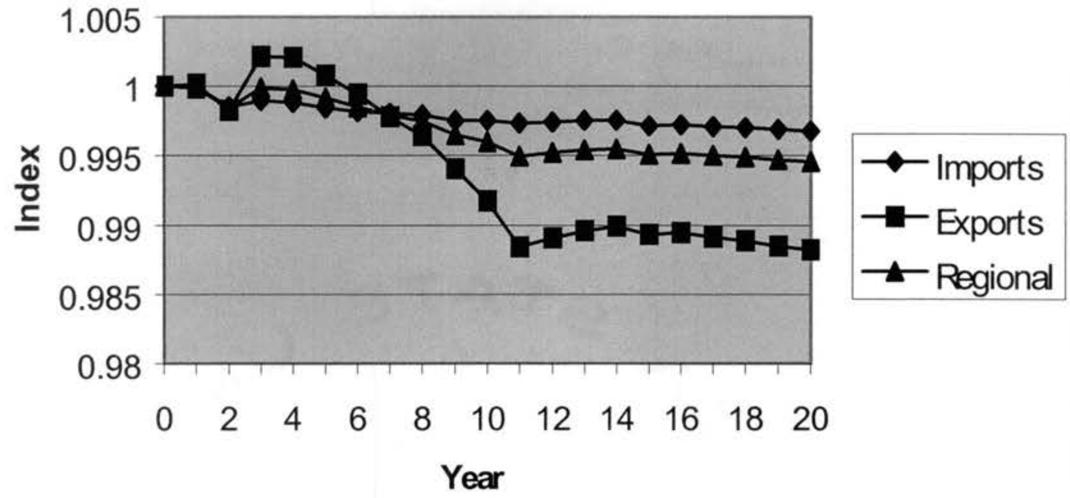

Figure 4.4 Public Capital Effects on Mining Production

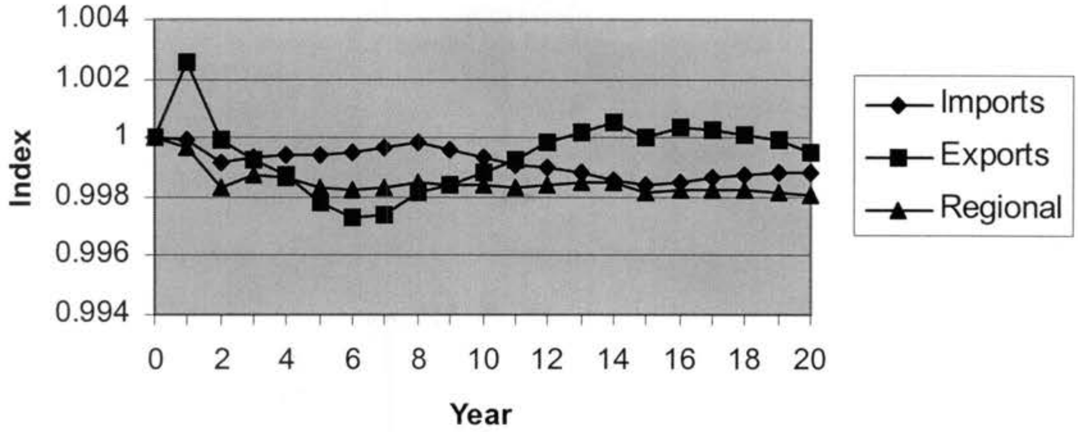

Figure 4.5 Public Capital Effects on Manufacturing Production

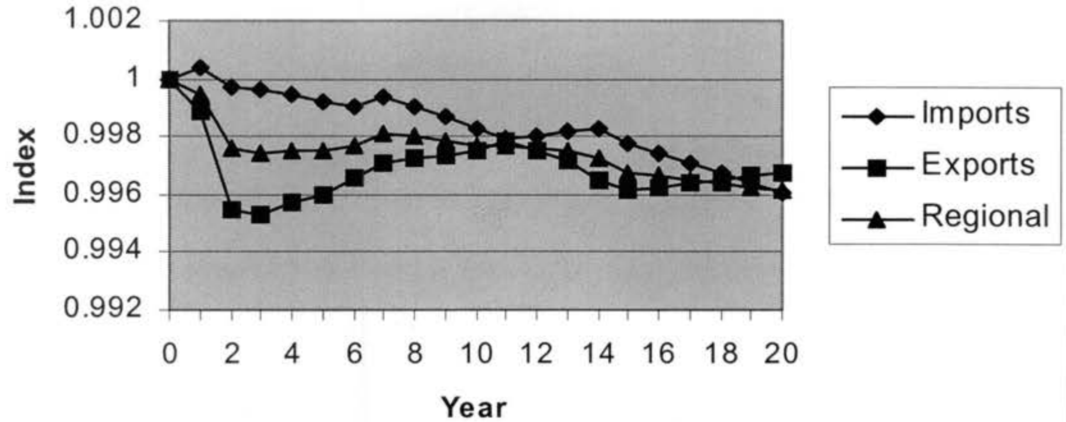

Figure 4.6 Public Capital Effects on Services Production

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this research was to determine changes in Oklahoma's gross state product and other welfare measures when public investment in highway infrastructure increased. To accomplish this goal, the research first examines the relationship between public investment in transportation infrastructure and private investment in transportation services. The hypothesis is that, if public investment in highways and private investment in transportation services are inputs in transportation production, they have a competitive relationship. By extension, if public investment and private investment have a competitive relationship, an increase in public investment will substitute for investment in transportation services. In other words, a new layer of blacktop reduces wear on tires, so the tires are replaced less frequently. The ultimate research question then becomes: how do improvements in highway infrastructure affect economic development? The research examines this through a regional computable general equilibrium model, which can generate the changes in welfare measures, including gross state product, household income, employment, and so on.

Chapter two created a panel data set of public highway capital investment. The set created improves upon previous studies by providing a higher level of detail. Based on Fraumeni's methods for constructing a national highway capital set, the Lusby set benchmarks to a productive capital stock, goes into the level of detail recommended (pavement, grading, structures, and right-of-way), but the Lusby set uses a geometric depreciation formula rather than using the efficiency curves constructed by Fraumeni.

Comparison of the Lusby set to the Fraumeni set shows that the two data sets remain fairly close.

Chapter three used the public highway capital stock data set from chapter two to estimate an output elasticity for public highway capital in the transportation sector and estimate an elasticity of substitution between highway capital and private investment in transportation services. The estimates showed that highway capital had an output elasticity for Oklahoma of 0.855 in the transportation sector. The high value of the elasticity may reflect the fact that the study narrowed its scope to the physical transportation output of vehicle miles traveled, rather than gross state product as other studies have done. The study in chapter three also determined that public highway capital and private investment in transportation services were substitutes. The work in chapter three improves upon previous studies because of the more detailed public highway capital stock data.

Chapter four creates a regional computable general equilibrium model for the state of Oklahoma. The dynamic model examines the effects, during a twenty-year period, of a one-time increase in public highway capital. The model assigns the output elasticity of 0.855, estimated in chapter three, to public highway capital, which is formulated as an input in production in the four sectors of the model. Over the twenty years, gross regional product and private capital income declined relative to benchmark levels, while labor income, enterprise income, and disposable household income rose above benchmark levels. At the end of the period, the state experiences a net gain in labor and private capital, as workers and private capital migrated into the state. While the model could be improved, results indicate that investment in transportation infrastructure has a small, beneficial effect on the economy for workers, firms and households.

The policy implications of this study show that policymakers must decide if the income benefits to households, workers and industry outweigh the loss in gross regional product. The loss in private capital income suggests that the public capital substitutes for the private investment in transport services, as industries have reduced cost in transport services. At the same time, the increase in labor income may indicate that the complementary relationship between public capital and labor, evidenced in chapter three, also holds. The increase in labor and private capital in-migration in early years, coupled with an initial rise in GRP, may indicate that continuous investment in transportation infrastructure could not only improve incomes but also regional output. Whether this is the case will remain for further study.

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APPENDIXES

APPENDIX A
FULL DATA SET FOR PUBLIC HIGHWAY CAPITAL STOCK

Table A.1 Full Highway Capital Stock Data Set ($billion)

State	Year	Pavement	Grading	Structures	ROW	Total
Alabama	1980	0.547	0.203	0.127	0.123	12.984
Alabama	1981	7.027	2.680	1.652	1.629	12.989
Alabama	1982	6.948	2.729	1.653	1.658	12.989
Alabama	1983	6.897	2.787	1.659	1.694	13.037
Alabama	1984	6.831	2.840	1.662	1.729	13.062
Alabama	1985	6.848	2.922	1.683	1.780	13.234
Alabama	1986	6.846	2.997	1.700	1.826	13.369
Alabama	1987	6.815	3.062	1.710	1.860	13.446
Alabama	1988	6.812	3.136	1.725	1.899	13.571
Alabama	1989	6.801	3.208	1.739	1.923	13.671
Alabama	1990	6.793	3.280	1.753	1.964	13.790
Alabama	1991	6.802	3.359	1.770	2.002	13.934
Alabama	1992	6.779	3.426	1.780	2.041	14.025
Alabama	1993	6.839	3.524	1.809	2.093	14.265
Alabama	1994	6.850	3.604	1.826	2.099	14.379
Alabama	1995	6.885	3.693	1.849	2.131	14.558
Alabama	1996	6.928	3.785	1.873	2.163	14.750
Alabama	1997	6.926	3.861	1.887	2.228	14.901
Alabama	1998	6.914	3.934	1.898	2.285	15.031
Alabama	1999	7.013	4.047	1.935	2.363	15.357
Alabama	2000	7.271	4.220	2.008	2.482	15.981
Arizona	1980	0.449	0.166	0.104	0.280	11.200
Arizona	1981	4.954	1.890	1.165	3.182	11.191
Arizona	1982	4.857	1.909	1.156	3.215	11.137
Arizona	1983	4.777	1.933	1.150	3.256	11.116
Arizona	1984	4.729	1.969	1.151	3.293	11.142
Arizona	1985	4.734	2.023	1.164	3.350	11.272
Arizona	1986	4.806	2.102	1.193	3.483	11.585
Arizona	1987	4.839	2.168	1.212	3.714	11.932
Arizona	1988	4.919	2.251	1.243	3.992	12.405
Arizona	1989	5.031	2.347	1.280	4.218	12.876
Arizona	1990	5.125	2.438	1.314	4.616	13.493
Arizona	1991	5.221	2.530	1.348	4.856	13.956
Arizona	1992	5.268	2.606	1.371	4.972	14.217
Arizona	1993	5.310	2.680	1.392	5.066	14.449
Arizona	1994	5.457	2.793	1.438	5.137	14.826
Arizona	1995	5.510	2.873	1.462	5.209	15.055
Arizona	1996	5.634	2.980	1.503	5.323	15.439
Arizona	1997	5.737	3.081	1.539	5.449	15.806
Arizona	1998	5.779	3.160	1.561	5.575	16.075
Arizona	1999	6.202	3.381	1.671	5.687	16.941
Arizona	2000	6.540	3.575	1.762	5.890	17.768
Arkansas	1980	0.526	0.195	0.122	0.157	11.240
Arkansas	1981	5.796	2.211	1.363	1.786	11.157
Arkansas	1982	5.688	2.236	1.353	1.805	11.082

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Arkansas	1983	5.580	2.259	1.343	1.824	11.006
Arkansas	1984	5.465	2.278	1.331	1.840	10.914
Arkansas	1985	5.410	2.318	1.332	1.869	10.929
Arkansas	1986	5.385	2.369	1.340	1.910	11.004
Arkansas	1987	5.339	2.412	1.342	1.948	11.041
Arkansas	1988	5.288	2.452	1.343	1.986	11.069
Arkansas	1989	5.224	2.487	1.341	2.023	11.074
Arkansas	1990	5.168	2.525	1.340	2.032	11.065
Arkansas	1991	5.158	2.579	1.349	2.071	11.157
Arkansas	1992	5.165	2.639	1.362	2.130	11.296
Arkansas	1993	5.165	2.696	1.374	2.196	11.431
Arkansas	1994	5.181	2.759	1.388	2.255	11.583
Arkansas	1995	5.230	2.835	1.410	2.317	11.792
Arkansas	1996	5.341	2.934	1.447	2.387	12.108
Arkansas	1997	5.503	3.053	1.495	2.468	12.519
Arkansas	1998	5.630	3.161	1.536	2.541	12.869
Arkansas	1999	5.650	3.231	1.552	2.615	13.048
Arkansas	2000	5.785	3.344	1.595	2.702	13.426
California	1980	0.347	0.128	0.081	0.444	26.622
California	1981	9.198	3.508	2.163	12.128	26.996
California	1982	9.112	3.578	2.168	12.372	27.230
California	1983	9.027	3.648	2.172	12.612	27.458
California	1984	9.014	3.743	2.192	12.942	27.891
California	1985	9.024	3.847	2.217	13.369	28.457
California	1986	9.094	3.973	2.256	13.805	29.128
California	1987	9.240	4.128	2.312	14.299	29.979
California	1988	9.421	4.298	2.377	14.833	30.928
California	1989	9.637	4.482	2.450	15.442	32.011
California	1990	10.062	4.746	2.571	16.245	33.623
California	1991	10.504	5.022	2.697	17.069	35.292
California	1992	10.910	5.289	2.815	17.785	36.799
California	1993	11.353	5.574	2.943	18.525	38.396
California	1994	12.016	5.946	3.123	19.395	40.479
California	1995	12.587	6.290	3.282	20.194	42.354
California	1996	13.322	6.702	3.481	21.040	44.545
California	1997	14.312	7.217	3.741	21.828	47.098
California	1998	14.808	7.559	3.888	22.695	48.950
California	1999	15.692	8.051	4.126	23.789	51.657
California	2000	16.781	8.628	4.413	24.656	54.478
Colorado	1980	0.467	0.173	0.109	0.251	11.161
Colorado	1981	5.112	1.950	1.202	2.827	11.091
Colorado	1982	5.042	1.981	1.200	2.872	11.095
Colorado	1983	4.972	2.011	1.197	2.916	11.095
Colorado	1984	4.902	2.041	1.193	2.962	11.098
Colorado	1985	4.859	2.079	1.196	3.012	11.147
Colorado	1986	4.842	2.127	1.204	3.081	11.255
Colorado	1987	4.810	2.169	1.208	3.143	11.330

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Colorado	1988	4.791	2.215	1.215	3.220	11.441
Colorado	1989	4.763	2.258	1.220	3.298	11.539
Colorado	1990	4.799	2.324	1.240	3.389	11.752
Colorado	1991	4.838	2.392	1.260	3.489	11.979
Colorado	1992	4.821	2.439	1.266	3.548	12.074
Colorado	1993	4.853	2.505	1.284	3.609	12.251
Colorado	1994	4.933	2.588	1.314	3.671	12.506
Colorado	1995	4.972	2.657	1.333	3.740	12.702
Colorado	1996	4.942	2.701	1.336	3.870	12.850
Colorado	1997	4.998	2.777	1.360	4.016	13.151
Colorado	1998	5.065	2.857	1.385	4.206	13.513
Colorado	1999	5.292	2.998	1.448	4.409	14.147
Colorado	2000	5.526	3.143	1.513	4.666	14.849
Connecticut	1980	0.495	0.183	0.115	0.207	2.887
Connecticut	1981	1.449	0.552	0.341	0.624	2.966
Connecticut	1982	1.468	0.576	0.349	0.650	3.043
Connecticut	1983	1.507	0.606	0.362	0.684	3.160
Connecticut	1984	1.535	0.633	0.372	0.722	3.262
Connecticut	1985	1.605	0.676	0.392	0.779	3.453
Connecticut	1986	1.728	0.740	0.425	0.851	3.744
Connecticut	1987	1.883	0.816	0.465	0.905	4.070
Connecticut	1988	2.081	0.910	0.516	0.975	4.483
Connecticut	1989	2.377	1.043	0.590	1.034	5.044
Connecticut	1990	2.690	1.185	0.669	1.215	5.759
Connecticut	1991	3.044	1.346	0.757	1.366	6.513
Connecticut	1992	3.214	1.443	0.804	1.480	6.941
Connecticut	1993	3.345	1.527	0.843	1.568	7.283
Connecticut	1994	3.520	1.629	0.891	1.764	7.803
Connecticut	1995	3.670	1.724	0.934	2.003	8.331
Connecticut	1996	3.800	1.812	0.973	2.211	8.796
Connecticut	1997	3.940	1.906	1.014	2.464	9.324
Connecticut	1998	4.008	1.975	1.039	2.605	9.627
Connecticut	1999	4.169	2.080	1.086	2.766	10.100
Connecticut	2000	4.352	2.194	1.137	2.973	10.655
Delaware	1980	0.484	0.179	0.112	0.225	0.780
Delaware	1981	0.372	0.142	0.087	0.178	0.779
Delaware	1982	0.387	0.151	0.092	0.190	0.820
Delaware	1983	0.403	0.162	0.097	0.203	0.864
Delaware	1984	0.420	0.173	0.102	0.216	0.910
Delaware	1985	0.444	0.186	0.108	0.229	0.967
Delaware	1986	0.472	0.201	0.116	0.248	1.038
Delaware	1987	0.507	0.220	0.125	0.271	1.123
Delaware	1988	0.551	0.242	0.137	0.307	1.238
Delaware	1989	0.585	0.260	0.146	0.354	1.345
Delaware	1990	0.629	0.283	0.158	0.397	1.467
Delaware	1991	0.701	0.317	0.176	0.459	1.653
Delaware	1992	0.759	0.346	0.191	0.501	1.797

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Delaware	1993	0.824	0.378	0.208	0.548	1.958
Delaware	1994	0.886	0.411	0.224	0.592	2.113
Delaware	1995	0.942	0.441	0.239	0.620	2.242
Delaware	1996	0.978	0.465	0.250	0.665	2.358
Delaware	1997	1.016	0.490	0.261	0.711	2.479
Delaware	1998	1.075	0.523	0.277	0.755	2.630
Delaware	1999	1.108	0.547	0.287	0.787	2.729
Delaware	2000	1.206	0.596	0.312	0.817	2.931
Florida	1980	0.446	0.165	0.104	0.285	14.870
Florida	1981	6.635	2.530	1.560	4.365	15.089
Florida	1982	6.678	2.619	1.588	4.519	15.404
Florida	1983	6.692	2.699	1.609	4.657	15.656
Florida	1984	6.711	2.780	1.631	4.837	15.959
Florida	1985	6.869	2.913	1.684	5.030	16.497
Florida	1986	7.058	3.060	1.746	5.282	17.146
Florida	1987	7.368	3.253	1.835	5.584	18.039
Florida	1988	7.603	3.421	1.907	5.995	18.926
Florida	1989	7.833	3.591	1.979	6.307	19.710
Florida	1990	7.962	3.726	2.028	6.627	20.342
Florida	1991	8.219	3.910	2.106	6.991	21.227
Florida	1992	8.595	4.140	2.212	7.401	22.348
Florida	1993	8.911	4.352	2.305	8.163	23.731
Florida	1994	9.387	4.627	2.436	8.817	25.268
Florida	1995	9.956	4.942	2.590	9.729	27.216
Florida	1996	10.531	5.266	2.746	10.511	29.054
Florida	1997	11.050	5.575	2.890	11.647	31.161
Florida	1998	11.414	5.832	2.999	13.072	33.317
Florida	1999	12.156	6.234	3.196	14.069	35.655
Florida	2000	13.057	6.702	3.432	15.156	38.348
Georgia	1980	0.498	0.184	0.116	0.202	15.542
Georgia	1981	7.680	2.929	1.806	3.202	15.618
Georgia	1982	7.604	2.986	1.809	3.265	15.664
Georgia	1983	7.633	3.081	1.836	3.369	15.918
Georgia	1984	7.571	3.143	1.841	3.461	16.016
Georgia	1985	7.705	3.277	1.892	3.553	16.427
Georgia	1986	7.741	3.376	1.919	3.662	16.698
Georgia	1987	7.818	3.490	1.956	3.794	17.058
Georgia	1988	7.864	3.594	1.986	3.941	17.385
Georgia	1989	7.953	3.714	2.025	4.095	17.787
Georgia	1990	8.081	3.850	2.073	4.259	18.263
Georgia	1991	8.230	3.995	2.127	4.422	18.774
Georgia	1992	8.343	4.128	2.172	4.544	19.187
Georgia	1993	8.477	4.270	2.221	4.675	19.643
Georgia	1994	8.608	4.413	2.270	4.815	20.107
Georgia	1995	8.844	4.596	2.344	4.989	20.772
Georgia	1996	9.236	4.839	2.454	5.145	21.674
Georgia	1997	9.354	4.986	2.501	5.221	22.062

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Georgia	1998	9.583	5.175	2.574	5.472	22.804
Georgia	1999	10.067	5.460	2.707	5.774	24.008
Georgia	2000	10.526	5.742	2.834	5.998	25.100
Idaho	1980	0.531	0.197	0.123	0.148	10.019
Idaho	1981	5.191	1.981	1.221	1.494	9.886
Idaho	1982	5.063	1.991	1.205	1.502	9.762
Idaho	1983	4.947	2.004	1.191	1.512	9.654
Idaho	1984	4.830	2.016	1.177	1.523	9.546
Idaho	1985	4.736	2.035	1.167	1.540	9.478
Idaho	1986	4.644	2.053	1.158	1.554	9.409
Idaho	1987	4.692	2.123	1.180	1.585	9.580
Idaho	1988	4.612	2.145	1.173	1.602	9.532
Idaho	1989	4.530	2.166	1.165	1.625	9.485
Idaho	1990	4.461	2.191	1.159	1.643	9.455
Idaho	1991	4.389	2.214	1.152	1.667	9.422
Idaho	1992	4.312	2.234	1.144	1.692	9.381
Idaho	1993	4.241	2.256	1.137	1.717	9.350
Idaho	1994	4.192	2.285	1.134	1.749	9.360
Idaho	1995	4.144	2.313	1.132	1.781	9.370
Idaho	1996	4.106	2.345	1.131	1.816	9.398
Idaho	1997	4.087	2.384	1.135	1.856	9.461
Idaho	1998	4.064	2.421	1.137	1.894	9.517
Idaho	1999	4.069	2.468	1.146	1.938	9.620
Idaho	2000	4.085	2.519	1.157	2.009	9.769
Illinois	1980	0.561	0.208	0.130	0.101	20.103
Illinois	1981	11.281	4.301	2.652	2.091	20.325
Illinois	1982	11.226	4.406	2.670	2.142	20.445
Illinois	1983	11.205	4.523	2.695	2.199	20.621
Illinois	1984	11.319	4.690	2.750	2.283	21.041
Illinois	1985	11.582	4.913	2.840	2.283	21.618
Illinois	1986	11.784	5.116	2.916	2.382	22.199
Illinois	1987	11.964	5.314	2.987	2.594	22.859
Illinois	1988	12.231	5.546	3.078	2.762	23.617
Illinois	1989	12.523	5.790	3.175	2.926	24.415
Illinois	1990	12.874	6.058	3.286	3.110	25.328
Illinois	1991	13.309	6.363	3.417	3.307	26.397
Illinois	1992	13.732	6.667	3.546	3.488	27.433
Illinois	1993	14.093	6.953	3.661	3.692	28.399
Illinois	1994	14.223	7.158	3.723	3.924	29.028
Illinois	1995	14.683	7.486	3.861	4.152	30.182
Illinois	1996	15.103	7.804	3.991	4.336	31.234
Illinois	1997	15.492	8.116	4.114	4.573	32.296
Illinois	1998	15.723	8.374	4.201	4.806	33.104
Illinois	1999	16.167	8.713	4.337	5.060	34.276
Illinois	2000	16.936	9.177	4.550	5.443	36.105
Indiana	1980	0.544	0.201	0.126	0.128	13.626
Indiana	1981	7.266	2.772	1.709	1.765	13.512

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Indiana	1982	7.182	2.822	1.709	1.797	13.509
Indiana	1983	7.034	2.847	1.693	1.813	13.387
Indiana	1984	6.932	2.887	1.688	1.840	13.346
Indiana	1985	6.908	2.955	1.700	1.877	13.439
Indiana	1986	6.924	3.038	1.721	1.930	13.612
Indiana	1987	6.802	3.070	1.709	1.952	13.533
Indiana	1988	6.835	3.157	1.733	1.977	13.703
Indiana	1989	6.860	3.243	1.755	2.015	13.873
Indiana	1990	6.971	3.360	1.797	2.070	14.197
Indiana	1991	7.125	3.494	1.849	2.129	14.598
Indiana	1992	7.289	3.634	1.903	2.185	15.011
Indiana	1993	7.372	3.746	1.938	2.235	15.292
Indiana	1994	7.503	3.876	1.985	2.295	15.659
Indiana	1995	7.589	3.991	2.021	2.338	15.940
Indiana	1996	7.689	4.113	2.060	2.395	16.258
Indiana	1997	7.819	4.246	2.107	2.440	16.611
Indiana	1998	8.042	4.416	2.175	2.510	17.142
Indiana	1999	8.332	4.612	2.258	2.597	17.799
Indiana	2000	8.805	4.880	2.386	2.711	18.782
Iowa	1980	0.573	0.212	0.133	0.082	16.695
Iowa	1981	9.357	3.570	2.200	1.377	16.505
Iowa	1982	9.154	3.599	2.179	1.388	16.320
Iowa	1983	8.964	3.630	2.159	1.400	16.153
Iowa	1984	8.837	3.683	2.152	1.410	16.081
Iowa	1985	8.722	3.738	2.148	1.417	16.025
Iowa	1986	8.593	3.787	2.140	1.436	15.956
Iowa	1987	8.452	3.831	2.128	1.476	15.887
Iowa	1988	8.341	3.883	2.122	1.509	15.855
Iowa	1989	8.218	3.931	2.113	1.542	15.804
Iowa	1990	8.146	3.995	2.115	1.584	15.841
Iowa	1991	8.121	4.077	2.128	1.631	15.957
Iowa	1992	8.107	4.161	2.142	1.665	16.075
Iowa	1993	8.082	4.242	2.154	1.731	16.209
Iowa	1994	8.066	4.326	2.167	1.798	16.357
Iowa	1995	8.052	4.410	2.181	1.899	16.542
Iowa	1996	8.052	4.500	2.198	2.003	16.752
Iowa	1997	8.074	4.597	2.219	2.110	17.000
Iowa	1998	8.097	4.695	2.240	2.223	17.255
Iowa	1999	8.142	4.802	2.266	2.364	17.575
Iowa	2000	8.346	4.968	2.329	2.546	18.188
Kansas	1980	0.561	0.208	0.130	0.100	20.163
Kansas	1981	11.074	4.225	2.604	2.039	19.942
Kansas	1982	10.805	4.248	2.572	2.051	19.675
Kansas	1983	10.562	4.279	2.544	2.065	19.450
Kansas	1984	10.337	4.313	2.519	2.081	19.249
Kansas	1985	10.169	4.365	2.506	2.111	19.151
Kansas	1986	10.023	4.424	2.497	2.139	19.085

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Kansas	1987	9.879	4.482	2.488	2.164	19.013
Kansas	1988	9.715	4.531	2.474	2.189	18.910
Kansas	1989	9.561	4.582	2.461	2.213	18.817
Kansas	1990	9.463	4.652	2.460	2.250	18.825
Kansas	1991	9.379	4.726	2.461	2.295	18.861
Kansas	1992	9.293	4.798	2.462	2.355	18.908
Kansas	1993	9.237	4.881	2.469	2.411	18.997
Kansas	1994	9.278	4.998	2.498	2.494	19.268
Kansas	1995	9.373	5.137	2.539	2.591	19.641
Kansas	1996	9.523	5.296	2.593	2.677	20.089
Kansas	1997	9.638	5.445	2.639	2.752	20.474
Kansas	1998	9.665	5.562	2.664	2.832	20.722
Kansas	1999	9.783	5.713	2.711	2.927	21.133
Kansas	2000	9.934	5.877	2.765	3.014	21.590
Kentucky	1980	0.485	0.180	0.113	0.223	10.166
Kentucky	1981	4.930	1.880	1.159	2.333	10.302
Kentucky	1982	4.924	1.932	1.171	2.398	10.425
Kentucky	1983	4.929	1.989	1.185	2.468	10.571
Kentucky	1984	4.919	2.040	1.196	2.521	10.675
Kentucky	1985	4.916	2.093	1.207	2.594	10.811
Kentucky	1986	4.969	2.168	1.232	2.686	11.055
Kentucky	1987	5.097	2.270	1.274	2.823	11.465
Kentucky	1988	5.188	2.360	1.307	2.924	11.779
Kentucky	1989	5.287	2.455	1.343	3.007	12.092
Kentucky	1990	5.329	2.529	1.365	3.100	12.323
Kentucky	1991	5.416	2.620	1.398	3.199	12.633
Kentucky	1992	5.493	2.709	1.428	3.298	12.927
Kentucky	1993	5.604	2.811	1.466	3.417	13.299
Kentucky	1994	5.704	2.910	1.501	3.525	13.640
Kentucky	1995	5.781	3.002	1.532	3.643	13.958
Kentucky	1996	5.920	3.118	1.576	3.782	14.396
Kentucky	1997	6.079	3.243	1.626	3.890	14.837
Kentucky	1998	6.252	3.374	1.679	4.018	15.323
Kentucky	1999	6.459	3.520	1.740	4.194	15.914
Kentucky	2000	6.880	3.748	1.851	4.221	16.700
Louisiana	1980	0.575	0.213	0.134	0.079	8.351
Louisiana	1981	4.914	1.872	1.155	0.693	8.635
Louisiana	1982	5.053	1.979	1.201	0.733	8.965
Louisiana	1983	5.196	2.088	1.247	0.773	9.304
Louisiana	1984	5.280	2.176	1.280	0.806	9.543
Louisiana	1985	5.339	2.257	1.307	0.898	9.802
Louisiana	1986	5.505	2.378	1.360	0.943	10.185
Louisiana	1987	5.588	2.469	1.392	0.977	10.426
Louisiana	1988	5.665	2.560	1.424	1.002	10.650
Louisiana	1989	5.750	2.654	1.457	1.009	10.871
Louisiana	1990	5.869	2.762	1.498	1.014	11.144
Louisiana	1991	6.058	2.897	1.556	1.051	11.562

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Louisiana	1992	6.220	3.024	1.607	1.152	12.003
Louisiana	1993	6.349	3.142	1.652	1.217	12.359
Louisiana	1994	6.477	3.260	1.696	1.318	12.751
Louisiana	1995	6.594	3.375	1.737	1.415	13.121
Louisiana	1996	6.713	3.492	1.779	1.476	13.460
Louisiana	1997	6.791	3.595	1.812	1.536	13.734
Louisiana	1998	6.924	3.720	1.857	1.611	14.111
Louisiana	1999	7.178	3.891	1.930	1.683	14.683
Louisiana	2000	7.480	4.082	2.015	1.786	15.363
Maine	1980	0.500	0.185	0.116	0.198	3.263
Maine	1981	1.610	0.614	0.379	0.657	3.260
Maine	1982	1.593	0.626	0.379	0.670	3.268
Maine	1983	1.575	0.637	0.379	0.682	3.273
Maine	1984	1.556	0.647	0.379	0.690	3.272
Maine	1985	1.551	0.663	0.382	0.713	3.308
Maine	1986	1.545	0.678	0.384	0.729	3.336
Maine	1987	1.543	0.694	0.387	0.745	3.370
Maine	1988	1.538	0.709	0.390	0.762	3.400
Maine	1989	1.539	0.727	0.394	0.784	3.445
Maine	1990	1.553	0.749	0.400	0.819	3.522
Maine	1991	1.585	0.778	0.411	0.859	3.633
Maine	1992	1.602	0.802	0.419	0.889	3.712
Maine	1993	1.609	0.822	0.424	0.920	3.775
Maine	1994	1.628	0.847	0.432	0.950	3.858
Maine	1995	1.662	0.878	0.444	0.988	3.972
Maine	1996	1.729	0.921	0.463	1.020	4.132
Maine	1997	1.789	0.963	0.480	1.047	4.279
Maine	1998	1.810	0.990	0.489	1.075	4.363
Maine	1999	1.874	1.034	0.507	1.100	4.515
Maine	2000	1.921	1.072	0.522	1.127	4.642
Maryland	1980	0.492	0.182	0.114	0.211	3.994
Maryland	1981	1.978	0.754	0.465	0.872	4.069
Maryland	1982	2.016	0.790	0.479	0.914	4.199
Maryland	1983	2.071	0.833	0.497	0.964	4.364
Maryland	1984	2.171	0.893	0.526	1.033	4.623
Maryland	1985	2.299	0.964	0.561	1.116	4.940
Maryland	1986	2.441	1.043	0.600	1.206	5.290
Maryland	1987	2.651	1.147	0.655	1.328	5.780
Maryland	1988	2.831	1.243	0.703	1.482	6.260
Maryland	1989	3.128	1.385	0.779	1.609	6.902
Maryland	1990	3.417	1.526	0.854	1.753	7.551
Maryland	1991	3.581	1.625	0.900	1.856	7.963
Maryland	1992	3.722	1.717	0.942	1.970	8.351
Maryland	1993	3.842	1.803	0.979	2.074	8.698
Maryland	1994	3.923	1.876	1.006	2.183	8.989
Maryland	1995	4.054	1.968	1.046	2.300	9.367
Maryland	1996	4.246	2.084	1.100	2.490	9.919

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Maryland	1997	4.508	2.228	1.170	2.634	10.539
Maryland	1998	4.652	2.331	1.214	2.760	10.957
Maryland	1999	4.843	2.454	1.268	2.967	11.532
Maryland	2000	5.032	2.577	1.323	3.170	12.102
Massachusetts	1980	0.574	0.213	0.133	0.079	5.032
Massachusetts	1981	2.834	1.081	0.666	0.403	4.985
Massachusetts	1982	2.843	1.116	0.676	0.416	5.051
Massachusetts	1983	2.827	1.142	0.680	0.426	5.075
Massachusetts	1984	2.807	1.166	0.683	0.426	5.082
Massachusetts	1985	2.876	1.222	0.706	0.426	5.230
Massachusetts	1986	2.942	1.279	0.728	0.447	5.396
Massachusetts	1987	3.007	1.335	0.751	0.524	5.617
Massachusetts	1988	3.197	1.439	0.802	0.750	6.189
Massachusetts	1989	3.216	1.482	0.814	0.844	6.356
Massachusetts	1990	3.239	1.526	0.827	0.989	6.582
Massachusetts	1991	3.376	1.613	0.867	1.247	7.102
Massachusetts	1992	3.581	1.726	0.922	1.658	7.887
Massachusetts	1993	3.808	1.850	0.983	2.029	8.669
Massachusetts	1994	4.215	2.043	1.086	2.505	9.849
Massachusetts	1995	4.686	2.264	1.205	3.018	11.173
Massachusetts	1996	5.239	2.521	1.344	3.520	12.623
Massachusetts	1997	5.660	2.735	1.454	4.056	13.905
Massachusetts	1998	6.266	3.022	1.608	4.599	15.495
Massachusetts	1999	7.762	3.646	1.970	5.080	18.458
Massachusetts	2000	9.006	4.192	2.278	5.364	20.840
Michigan	1980	0.564	0.209	0.131	0.096	17.465
Michigan	1981	9.655	3.684	2.271	1.699	17.309
Michigan	1982	9.488	3.729	2.258	1.720	17.195
Michigan	1983	9.319	3.772	2.244	1.740	17.074
Michigan	1984	9.206	3.834	2.241	1.769	17.051
Michigan	1985	9.113	3.901	2.243	1.800	17.057
Michigan	1986	9.081	3.991	2.259	1.842	17.172
Michigan	1987	9.046	4.079	2.272	1.916	17.313
Michigan	1988	9.037	4.175	2.292	1.927	17.431
Michigan	1989	8.984	4.256	2.301	2.021	17.562
Michigan	1990	9.002	4.363	2.326	2.035	17.727
Michigan	1991	9.008	4.465	2.348	2.126	17.947
Michigan	1992	8.988	4.558	2.363	2.272	18.180
Michigan	1993	8.976	4.653	2.380	2.420	18.430
Michigan	1994	8.982	4.755	2.401	2.610	18.748
Michigan	1995	9.072	4.888	2.441	2.819	19.219
Michigan	1996	9.191	5.033	2.487	2.972	19.682
Michigan	1997	9.292	5.172	2.529	3.086	20.079
Michigan	1998	9.431	5.327	2.580	3.242	20.581
Michigan	1999	9.817	5.574	2.689	3.466	21.546
Michigan	2000	10.216	5.831	2.801	3.702	22.551
Minnesota	1980	0.527	0.195	0.122	0.156	19.362

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Minnesota	1981	9.993	3.813	2.350	3.051	19.207
Minnesota	1982	9.808	3.855	2.334	3.085	19.081
Minnesota	1983	9.636	3.900	2.320	3.121	18.977
Minnesota	1984	9.489	3.953	2.311	3.153	18.905
Minnesota	1985	9.381	4.018	2.310	3.218	18.927
Minnesota	1986	9.331	4.104	2.321	3.286	19.043
Minnesota	1987	9.232	4.171	2.321	3.341	19.065
Minnesota	1988	9.189	4.257	2.333	3.412	19.192
Minnesota	1989	9.136	4.340	2.343	3.484	19.303
Minnesota	1990	9.134	4.441	2.363	3.566	19.504
Minnesota	1991	9.129	4.540	2.383	3.720	19.772
Minnesota	1992	9.158	4.652	2.410	3.892	20.112
Minnesota	1993	9.017	4.702	2.397	4.022	20.137
Minnesota	1994	8.944	4.775	2.399	4.128	20.247
Minnesota	1995	8.881	4.851	2.403	4.229	20.364
Minnesota	1996	8.849	4.938	2.414	4.303	20.504
Minnesota	1997	8.842	5.033	2.430	4.437	20.742
Minnesota	1998	8.771	5.106	2.431	4.582	20.890
Minnesota	1999	8.823	5.222	2.460	4.704	21.208
Minnesota	2000	8.911	5.353	2.497	4.881	21.641
Mississippi	1980	0.510	0.189	0.118	0.183	10.412
Mississippi	1981	5.258	2.005	1.236	1.951	10.450
Mississippi	1982	5.216	2.048	1.241	1.993	10.498
Mississippi	1983	5.167	2.088	1.243	2.031	10.529
Mississippi	1984	5.083	2.114	1.237	2.065	10.500
Mississippi	1985	5.039	2.155	1.240	2.099	10.532
Mississippi	1986	5.040	2.211	1.253	2.153	10.657
Mississippi	1987	5.016	2.258	1.259	2.192	10.725
Mississippi	1988	4.998	2.307	1.267	2.233	10.806
Mississippi	1989	4.980	2.356	1.275	2.287	10.898
Mississippi	1990	4.993	2.416	1.289	2.348	11.046
Mississippi	1991	5.046	2.491	1.313	2.424	11.273
Mississippi	1992	5.080	2.560	1.332	2.490	11.462
Mississippi	1993	5.114	2.629	1.351	2.559	11.653
Mississippi	1994	5.144	2.696	1.369	2.629	11.839
Mississippi	1995	5.199	2.774	1.393	2.709	12.075
Mississippi	1996	5.292	2.866	1.426	2.823	12.407
Mississippi	1997	5.436	2.978	1.470	2.945	12.828
Mississippi	1998	5.549	3.080	1.507	3.107	13.244
Mississippi	1999	5.770	3.224	1.570	3.263	13.827
Mississippi	2000	6.019	3.380	1.639	3.427	14.466
Missouri	1980	0.545	0.202	0.127	0.126	17.614
Missouri	1981	9.402	3.587	2.211	2.243	17.443
Missouri	1982	9.217	3.623	2.193	2.266	17.299
Missouri	1983	9.045	3.662	2.178	2.290	17.174
Missouri	1984	8.910	3.712	2.170	2.308	17.101
Missouri	1985	8.832	3.782	2.174	2.344	17.132

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Missouri	1986	8.772	3.858	2.182	2.391	17.204
Missouri	1987	8.653	3.912	2.176	2.448	17.188
Missouri	1988	8.597	3.987	2.184	2.507	17.275
Missouri	1989	8.493	4.044	2.180	2.571	17.288
Missouri	1990	8.398	4.103	2.177	2.631	17.309
Missouri	1991	8.331	4.172	2.181	2.707	17.390
Missouri	1992	8.307	4.255	2.193	2.805	17.561
Missouri	1993	8.296	4.343	2.209	2.929	17.777
Missouri	1994	8.361	4.460	2.242	3.072	18.135
Missouri	1995	8.442	4.583	2.278	3.231	18.534
Missouri	1996	8.570	4.723	2.325	3.416	19.034
Missouri	1997	8.780	4.896	2.391	3.606	19.673
Missouri	1998	8.892	5.036	2.435	3.861	20.224
Missouri	1999	9.136	5.225	2.509	4.067	20.937
Missouri	2000	9.479	5.453	2.607	4.318	21.857
Montana	1980	0.524	0.194	0.122	0.161	10.678
Montana	1981	5.475	2.089	1.288	1.735	10.586
Montana	1982	5.350	2.103	1.273	1.747	10.473
Montana	1983	5.251	2.126	1.264	1.766	10.408
Montana	1984	5.162	2.151	1.257	1.790	10.360
Montana	1985	5.084	2.180	1.252	1.824	10.341
Montana	1986	5.023	2.214	1.251	1.852	10.340
Montana	1987	4.948	2.242	1.245	1.864	10.298
Montana	1988	4.863	2.265	1.238	1.877	10.243
Montana	1989	4.769	2.284	1.227	1.886	10.166
Montana	1990	4.714	2.317	1.225	1.909	10.166
Montana	1991	4.666	2.352	1.225	1.936	10.178
Montana	1992	4.610	2.383	1.222	1.973	10.187
Montana	1993	4.558	2.415	1.220	2.006	10.197
Montana	1994	4.511	2.448	1.218	2.044	10.221
Montana	1995	4.472	2.484	1.219	2.085	10.259
Montana	1996	4.459	2.528	1.225	2.127	10.339
Montana	1997	4.445	2.573	1.230	2.169	10.417
Montana	1998	4.430	2.617	1.235	2.213	10.494
Montana	1999	4.448	2.672	1.248	2.267	10.635
Montana	2000	4.476	2.732	1.263	2.346	10.817
Nebraska	1980	0.517	0.192	0.120	0.171	14.347
Nebraska	1981	7.235	2.761	1.702	2.461	14.159
Nebraska	1982	7.064	2.778	1.681	2.476	13.999
Nebraska	1983	6.915	2.801	1.665	2.497	13.879
Nebraska	1984	6.770	2.824	1.650	2.516	13.760
Nebraska	1985	6.639	2.851	1.636	2.537	13.663
Nebraska	1986	6.521	2.881	1.625	2.564	13.590
Nebraska	1987	6.382	2.902	1.609	2.586	13.479
Nebraska	1988	6.287	2.938	1.602	2.612	13.438
Nebraska	1989	6.192	2.972	1.595	2.641	13.401
Nebraska	1990	6.121	3.015	1.592	2.673	13.402

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Nebraska	1991	6.068	3.063	1.594	2.712	13.436
Nebraska	1992	6.008	3.108	1.593	2.748	13.457
Nebraska	1993	5.966	3.159	1.596	2.793	13.514
Nebraska	1994	5.906	3.204	1.595	2.827	13.532
Nebraska	1995	5.884	3.261	1.602	2.876	13.623
Nebraska	1996	5.880	3.325	1.613	2.921	13.738
Nebraska	1997	5.895	3.396	1.628	2.977	13.895
Nebraska	1998	5.875	3.454	1.635	3.033	13.996
Nebraska	1999	5.901	3.529	1.652	3.105	14.187
Nebraska	2000	5.989	3.627	1.683	3.167	14.466
Nevada	1980	0.455	0.168	0.106	0.271	6.463
Nevada	1981	2.886	1.101	0.679	1.771	6.437
Nevada	1982	2.840	1.116	0.676	1.795	6.427
Nevada	1983	2.797	1.132	0.673	1.820	6.422
Nevada	1984	2.751	1.146	0.670	1.846	6.412
Nevada	1985	2.726	1.167	0.671	1.882	6.447
Nevada	1986	2.710	1.191	0.674	1.921	6.496
Nevada	1987	2.680	1.210	0.674	1.946	6.509
Nevada	1988	2.671	1.237	0.678	1.975	6.560
Nevada	1989	2.679	1.270	0.686	2.009	6.644
Nevada	1990	2.671	1.296	0.691	2.055	6.713
Nevada	1991	2.641	1.315	0.690	2.077	6.722
Nevada	1992	2.648	1.347	0.697	2.107	6.798
Nevada	1993	2.661	1.381	0.706	2.148	6.896
Nevada	1994	2.719	1.432	0.725	2.210	7.086
Nevada	1995	2.794	1.490	0.748	2.280	7.312
Nevada	1996	2.838	1.537	0.764	2.371	7.510
Nevada	1997	2.861	1.577	0.775	2.463	7.676
Nevada	1998	2.881	1.616	0.786	2.548	7.831
Nevada	1999	2.996	1.691	0.819	2.632	8.137
Nevada	2000	3.144	1.779	0.859	2.661	8.443
New Hampshire	1980	0.538	0.199	0.125	0.138	2.137
New Hampshire	1981	1.129	0.431	0.266	0.299	2.125
New Hampshire	1982	1.135	0.445	0.270	0.310	2.159
New Hampshire	1983	1.127	0.455	0.271	0.316	2.170
New Hampshire	1984	1.118	0.464	0.272	0.326	2.180
New Hampshire	1985	1.126	0.480	0.277	0.326	2.208
New Hampshire	1986	1.128	0.493	0.280	0.335	2.235
New Hampshire	1987	1.130	0.506	0.283	0.352	2.271
New Hampshire	1988	1.131	0.519	0.286	0.375	2.312
New Hampshire	1989	1.151	0.539	0.293	0.397	2.381
New Hampshire	1990	1.155	0.554	0.297	0.418	2.424
New Hampshire	1991	1.157	0.567	0.300	0.435	2.460
New Hampshire	1992	1.167	0.583	0.305	0.457	2.512
New Hampshire	1993	1.207	0.611	0.317	0.506	2.641
New Hampshire	1994	1.214	0.627	0.321	0.533	2.695
New Hampshire	1995	1.238	0.650	0.329	0.573	2.790

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
New Hampshire	1996	1.249	0.667	0.335	0.617	2.868
New Hampshire	1997	1.274	0.691	0.343	0.653	2.961
New Hampshire	1998	1.296	0.713	0.351	0.691	3.050
New Hampshire	1999	1.329	0.740	0.361	0.741	3.171
New Hampshire	2000	1.391	0.777	0.378	0.802	3.348
New Jersey	1980	0.534	0.198	0.124	0.143	4.981
New Jersey	1981	2.673	1.019	0.628	0.739	5.060
New Jersey	1982	2.706	1.061	0.643	0.769	5.180
New Jersey	1983	2.712	1.093	0.652	0.793	5.249
New Jersey	1984	2.791	1.153	0.677	0.841	5.462
New Jersey	1985	2.964	1.248	0.725	0.922	5.859
New Jersey	1986	3.250	1.386	0.799	1.023	6.458
New Jersey	1987	3.625	1.561	0.894	1.114	7.195
New Jersey	1988	3.787	1.662	0.941	1.253	7.642
New Jersey	1989	4.123	1.828	1.028	1.327	8.306
New Jersey	1990	4.394	1.974	1.101	1.388	8.857
New Jersey	1991	4.548	2.080	1.147	1.505	9.280
New Jersey	1992	4.859	2.246	1.230	2.037	10.372
New Jersey	1993	5.205	2.428	1.322	2.212	11.167
New Jersey	1994	5.497	2.594	1.402	2.412	11.905
New Jersey	1995	5.745	2.746	1.473	2.549	12.513
New Jersey	1996	5.946	2.885	1.533	2.719	13.083
New Jersey	1997	6.185	3.039	1.602	2.910	13.736
New Jersey	1998	6.228	3.124	1.626	3.157	14.134
New Jersey	1999	6.720	3.375	1.754	3.479	15.328
New Jersey	2000	7.517	3.745	1.954	4.039	17.254
New Mexico	1980	0.511	0.189	0.119	0.181	8.073
New Mexico	1981	4.069	1.552	0.957	1.481	8.059
New Mexico	1982	4.017	1.578	0.956	1.506	8.056
New Mexico	1983	3.975	1.607	0.957	1.534	8.072
New Mexico	1984	3.944	1.640	0.960	1.549	8.093
New Mexico	1985	3.892	1.665	0.958	1.600	8.115
New Mexico	1986	3.874	1.701	0.963	1.635	8.174
New Mexico	1987	3.862	1.740	0.970	1.658	8.230
New Mexico	1988	3.867	1.784	0.980	1.686	8.317
New Mexico	1989	3.886	1.834	0.994	1.715	8.430
New Mexico	1990	3.899	1.882	1.006	1.740	8.526
New Mexico	1991	3.917	1.932	1.019	1.765	8.634
New Mexico	1992	3.939	1.984	1.033	1.789	8.745
New Mexico	1993	4.009	2.054	1.058	1.807	8.928
New Mexico	1994	4.028	2.105	1.071	1.819	9.023
New Mexico	1995	4.052	2.159	1.085	1.855	9.150
New Mexico	1996	4.038	2.198	1.090	1.874	9.200
New Mexico	1997	4.099	2.266	1.113	1.909	9.387
New Mexico	1998	4.117	2.318	1.125	1.935	9.495
New Mexico	1999	4.221	2.402	1.158	1.957	9.739
New Mexico	2000	4.400	2.516	1.208	2.040	10.164

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
New York	1980	0.541	0.200	0.126	0.132	16.295
New York	1981	8.810	3.359	2.071	2.220	16.461
New York	1982	8.916	3.496	2.120	2.311	16.843
New York	1983	8.999	3.626	2.163	2.397	17.186
New York	1984	9.033	3.739	2.194	2.491	17.457
New York	1985	9.191	3.898	2.254	2.611	17.953
New York	1986	9.433	4.089	2.333	2.737	18.592
New York	1987	9.756	4.313	2.431	2.830	19.330
New York	1988	9.995	4.510	2.511	2.913	19.929
New York	1989	10.506	4.810	2.653	3.033	21.003
New York	1990	11.018	5.117	2.797	3.166	22.098
New York	1991	11.411	5.385	2.914	3.298	23.008
New York	1992	11.744	5.635	3.018	3.458	23.855
New York	1993	12.611	6.086	3.247	3.694	25.638
New York	1994	13.495	6.553	3.481	3.974	27.503
New York	1995	14.395	7.036	3.721	4.171	29.323
New York	1996	15.195	7.492	3.939	4.454	31.080
New York	1997	15.978	7.951	4.156	4.992	33.077
New York	1998	16.453	8.304	4.302	5.653	34.711
New York	1999	17.474	8.865	4.575	6.404	37.319
New York	2000	18.482	9.432	4.848	7.057	39.820
North Carolina	1980	0.500	0.185	0.116	0.199	13.776
North Carolina	1981	6.805	2.596	1.600	2.787	13.788
North Carolina	1982	6.712	2.637	1.597	2.831	13.776
North Carolina	1983	6.631	2.681	1.596	2.879	13.788
North Carolina	1984	6.523	2.715	1.588	2.934	13.760
North Carolina	1985	6.476	2.770	1.593	3.004	13.844
North Carolina	1986	6.460	2.836	1.606	3.075	13.977
North Carolina	1987	6.506	2.925	1.632	3.115	14.179
North Carolina	1988	6.548	3.013	1.658	3.190	14.409
North Carolina	1989	6.564	3.091	1.677	3.316	14.649
North Carolina	1990	6.612	3.182	1.704	3.502	14.999
North Carolina	1991	6.744	3.304	1.749	3.735	15.533
North Carolina	1992	6.853	3.419	1.790	3.977	16.038
North Carolina	1993	6.955	3.533	1.829	4.185	16.502
North Carolina	1994	7.080	3.657	1.873	4.467	17.078
North Carolina	1995	7.166	3.767	1.908	4.734	17.575
North Carolina	1996	7.272	3.886	1.948	5.092	18.198
North Carolina	1997	7.394	4.012	1.992	5.553	18.951
North Carolina	1998	7.412	4.101	2.011	6.084	19.608
North Carolina	1999	7.476	4.207	2.041	6.714	20.437
North Carolina	2000	7.785	4.404	2.128	7.373	21.690
North Dakota	1980	0.555	0.205	0.129	0.111	12.778
North Dakota	1981	6.911	2.637	1.625	1.428	12.602
North Dakota	1982	6.734	2.648	1.603	1.434	12.419
North Dakota	1983	6.583	2.667	1.585	1.444	12.280
North Dakota	1984	6.424	2.682	1.566	1.452	12.124

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
North Dakota	1985	6.285	2.701	1.550	1.462	11.998
North Dakota	1986	6.144	2.719	1.532	1.472	11.866
North Dakota	1987	6.007	2.736	1.516	1.482	11.741
North Dakota	1988	5.880	2.756	1.500	1.489	11.625
North Dakota	1989	5.748	2.773	1.483	1.500	11.504
North Dakota	1990	5.624	2.791	1.468	1.509	11.392
North Dakota	1991	5.529	2.818	1.458	1.525	11.329
North Dakota	1992	5.422	2.840	1.445	1.537	11.244
North Dakota	1993	5.325	2.864	1.434	1.549	11.172
North Dakota	1994	5.249	2.895	1.427	1.563	11.134
North Dakota	1995	5.181	2.928	1.422	1.577	11.109
North Dakota	1996	5.114	2.961	1.417	1.593	11.084
North Dakota	1997	5.086	3.007	1.420	1.607	11.120
North Dakota	1998	5.040	3.047	1.419	1.622	11.128
North Dakota	1999	5.008	3.091	1.421	1.639	11.159
North Dakota	2000	4.984	3.137	1.424	1.662	11.208
Ohio	1980	0.558	0.206	0.130	0.106	16.495
Ohio	1981	9.079	3.463	2.135	1.784	16.462
Ohio	1982	9.021	3.542	2.146	1.825	16.534
Ohio	1983	8.957	3.619	2.155	1.864	16.594
Ohio	1984	8.895	3.695	2.164	1.912	16.666
Ohio	1985	8.970	3.822	2.204	1.964	16.960
Ohio	1986	9.020	3.940	2.238	2.025	17.223
Ohio	1987	9.111	4.074	2.281	2.094	17.561
Ohio	1988	9.224	4.217	2.329	2.165	17.936
Ohio	1989	9.260	4.333	2.359	2.240	18.191
Ohio	1990	9.385	4.482	2.410	2.330	18.608
Ohio	1991	9.650	4.684	2.493	2.460	19.289
Ohio	1992	9.760	4.832	2.541	2.561	19.693
Ohio	1993	9.875	4.983	2.589	2.723	20.171
Ohio	1994	10.056	5.160	2.653	2.833	20.703
Ohio	1995	10.306	5.364	2.733	3.077	21.480
Ohio	1996	10.586	5.582	2.820	3.325	22.313
Ohio	1997	11.048	5.871	2.950	3.523	23.391
Ohio	1998	11.521	6.169	3.083	3.686	24.459
Ohio	1999	12.118	6.517	3.246	3.904	25.786
Ohio	2000	12.818	6.911	3.434	4.128	27.291
Oklahoma	1980	0.556	0.206	0.129	0.109	16.353
Oklahoma	1981	8.898	3.395	2.093	1.803	16.189
Oklahoma	1982	8.737	3.434	2.079	1.824	16.075
Oklahoma	1983	8.584	3.474	2.067	1.846	15.970
Oklahoma	1984	8.411	3.506	2.049	1.858	15.823
Oklahoma	1985	8.279	3.550	2.039	1.888	15.756
Oklahoma	1986	8.179	3.605	2.037	1.917	15.738
Oklahoma	1987	8.084	3.661	2.034	1.947	15.726
Oklahoma	1988	8.007	3.722	2.036	1.979	15.745
Oklahoma	1989	7.917	3.778	2.034	2.019	15.748

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Oklahoma	1990	7.877	3.851	2.043	2.090	15.861
Oklahoma	1991	7.872	3.937	2.059	2.162	16.030
Oklahoma	1992	7.786	3.992	2.057	2.209	16.044
Oklahoma	1993	7.684	4.041	2.050	2.223	15.998
Oklahoma	1994	7.574	4.086	2.041	2.248	15.948
Oklahoma	1995	7.504	4.144	2.040	2.277	15.965
Oklahoma	1996	7.467	4.214	2.047	2.319	16.047
Oklahoma	1997	7.416	4.277	2.050	2.357	16.101
Oklahoma	1998	7.356	4.338	2.050	2.458	16.202
Oklahoma	1999	7.373	4.425	2.068	2.578	16.443
Oklahoma	2000	7.629	4.602	2.141	2.708	17.080
Oregon	1980	0.501	0.185	0.116	0.197	18.095
Oregon	1981	8.872	3.385	2.087	3.601	17.945
Oregon	1982	8.683	3.413	2.066	3.631	17.794
Oregon	1983	8.502	3.443	2.047	3.663	17.655
Oregon	1984	8.313	3.468	2.025	3.703	17.509
Oregon	1985	8.164	3.505	2.012	3.728	17.408
Oregon	1986	8.026	3.544	2.000	3.770	17.340
Oregon	1987	7.906	3.589	1.992	3.813	17.301
Oregon	1988	7.800	3.638	1.986	3.857	17.281
Oregon	1989	7.705	3.689	1.982	3.914	17.290
Oregon	1990	7.603	3.737	1.976	3.987	17.302
Oregon	1991	7.531	3.795	1.976	4.064	17.366
Oregon	1992	7.477	3.858	1.980	4.150	17.465
Oregon	1993	7.408	3.916	1.980	4.182	17.486
Oregon	1994	7.362	3.981	1.985	4.241	17.569
Oregon	1995	7.306	4.042	1.987	4.295	17.631
Oregon	1996	7.283	4.115	1.997	4.356	17.750
Oregon	1997	7.263	4.188	2.007	4.425	17.882
Oregon	1998	7.243	4.261	2.016	4.492	18.013
Oregon	1999	7.263	4.349	2.035	4.527	18.175
Oregon	2000	7.277	4.435	2.051	4.571	18.335
Pennsylvania	1980	0.556	0.206	0.129	0.110	17.505
Pennsylvania	1981	9.627	3.672	2.264	1.957	17.520
Pennsylvania	1982	9.668	3.794	2.299	2.022	17.783
Pennsylvania	1983	9.680	3.906	2.328	2.082	17.996
Pennsylvania	1984	9.719	4.028	2.362	2.156	18.264
Pennsylvania	1985	9.949	4.221	2.440	2.255	18.865
Pennsylvania	1986	10.279	4.453	2.542	2.378	19.652
Pennsylvania	1987	10.683	4.717	2.661	2.506	20.567
Pennsylvania	1988	11.070	4.979	2.777	2.630	21.456
Pennsylvania	1989	11.411	5.228	2.883	2.758	22.280
Pennsylvania	1990	11.751	5.481	2.989	2.908	23.128
Pennsylvania	1991	12.137	5.754	3.106	3.066	24.064
Pennsylvania	1992	12.441	6.001	3.205	3.220	24.866
Pennsylvania	1993	12.743	6.251	3.303	3.436	25.734
Pennsylvania	1994	13.146	6.542	3.426	3.664	26.778

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Pennsylvania	1995	13.521	6.827	3.542	3.873	27.763
Pennsylvania	1996	13.844	7.097	3.647	4.100	28.688
Pennsylvania	1997	14.420	7.464	3.811	4.425	30.120
Pennsylvania	1998	14.711	7.732	3.910	4.714	31.066
Pennsylvania	1999	15.276	8.104	4.072	5.102	32.556
Pennsylvania	2000	16.136	8.592	4.305	5.667	34.701
Rhode Island	1980	0.572	0.212	0.133	0.084	0.953
Rhode Island	1981	0.543	0.207	0.128	0.080	0.957
Rhode Island	1982	0.547	0.214	0.130	0.080	0.971
Rhode Island	1983	0.555	0.224	0.133	0.080	0.992
Rhode Island	1984	0.577	0.238	0.140	0.085	1.040
Rhode Island	1985	0.612	0.257	0.150	0.093	1.112
Rhode Island	1986	0.660	0.282	0.162	0.094	1.198
Rhode Island	1987	0.716	0.310	0.177	0.095	1.298
Rhode Island	1988	0.784	0.343	0.195	0.095	1.416
Rhode Island	1989	0.784	0.352	0.196	0.095	1.427
Rhode Island	1990	0.771	0.355	0.195	0.095	1.416
Rhode Island	1991	0.851	0.394	0.216	0.095	1.555
Rhode Island	1992	0.876	0.413	0.224	0.095	1.607
Rhode Island	1993	0.954	0.451	0.244	0.150	1.798
Rhode Island	1994	1.043	0.495	0.266	0.216	2.020
Rhode Island	1995	1.097	0.526	0.282	0.298	2.203
Rhode Island	1996	1.118	0.546	0.289	0.336	2.289
Rhode Island	1997	1.132	0.564	0.295	0.394	2.385
Rhode Island	1998	1.152	0.584	0.302	0.439	2.476
Rhode Island	1999	1.193	0.612	0.314	0.487	2.605
Rhode Island	2000	1.215	0.633	0.322	0.535	2.705
South Carolina	1980	0.493	0.183	0.115	0.209	9.305
South Carolina	1981	4.498	1.716	1.058	1.966	9.237
South Carolina	1982	4.410	1.733	1.049	1.986	9.179
South Carolina	1983	4.332	1.754	1.043	2.009	9.137
South Carolina	1984	4.255	1.773	1.036	2.048	9.112
South Carolina	1985	4.207	1.803	1.036	2.072	9.117
South Carolina	1986	4.181	1.840	1.040	2.115	9.176
South Carolina	1987	4.183	1.887	1.051	2.152	9.272
South Carolina	1988	4.171	1.929	1.058	2.195	9.353
South Carolina	1989	4.121	1.957	1.057	2.249	9.384
South Carolina	1990	4.138	2.009	1.070	2.306	9.523
South Carolina	1991	4.158	2.062	1.084	2.376	9.680
South Carolina	1992	4.178	2.116	1.098	2.429	9.821
South Carolina	1993	4.214	2.176	1.115	2.512	10.017
South Carolina	1994	4.249	2.235	1.133	2.592	10.209
South Carolina	1995	4.284	2.295	1.150	2.683	10.412
South Carolina	1996	4.335	2.362	1.170	2.802	10.669
South Carolina	1997	4.445	2.451	1.205	2.924	11.025
South Carolina	1998	4.512	2.525	1.230	3.039	11.305
South Carolina	1999	4.652	2.627	1.271	3.211	11.761

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
South Carolina	2000	4.782	2.726	1.311	3.384	12.203
South Dakota	1980	0.559	0.207	0.130	0.103	10.892
South Dakota	1981	5.951	2.271	1.400	1.134	10.756
South Dakota	1982	5.809	2.284	1.383	1.141	10.617
South Dakota	1983	5.680	2.301	1.368	1.149	10.499
South Dakota	1984	5.554	2.317	1.353	1.160	10.384
South Dakota	1985	5.449	2.340	1.343	1.168	10.300
South Dakota	1986	5.337	2.359	1.331	1.178	10.205
South Dakota	1987	5.230	2.379	1.319	1.188	10.115
South Dakota	1988	5.145	2.406	1.311	1.200	10.062
South Dakota	1989	5.056	2.430	1.303	1.212	10.001
South Dakota	1990	4.982	2.459	1.297	1.229	9.967
South Dakota	1991	4.906	2.486	1.291	1.244	9.927
South Dakota	1992	4.858	2.522	1.290	1.266	9.937
South Dakota	1993	4.793	2.552	1.285	1.293	9.924
South Dakota	1994	4.740	2.586	1.283	1.324	9.932
South Dakota	1995	4.692	2.621	1.282	1.345	9.940
South Dakota	1996	4.643	2.655	1.279	1.388	9.964
South Dakota	1997	4.624	2.699	1.284	1.405	10.013
South Dakota	1998	4.590	2.738	1.285	1.429	10.043
South Dakota	1999	4.583	2.786	1.292	1.497	10.159
South Dakota	2000	4.617	2.850	1.309	1.607	10.383
Tennessee	1980	0.491	0.182	0.114	0.213	12.459
Tennessee	1981	6.058	2.311	1.425	2.713	12.506
Tennessee	1982	5.996	2.355	1.426	2.765	12.543
Tennessee	1983	5.966	2.410	1.435	2.830	12.641
Tennessee	1984	5.895	2.450	1.434	2.882	12.661
Tennessee	1985	5.880	2.510	1.446	2.943	12.778
Tennessee	1986	5.890	2.579	1.463	3.023	12.955
Tennessee	1987	5.894	2.646	1.478	3.105	13.123
Tennessee	1988	5.952	2.733	1.506	3.160	13.351
Tennessee	1989	5.971	2.806	1.524	3.255	13.557
Tennessee	1990	6.009	2.887	1.547	3.426	13.869
Tennessee	1991	6.074	2.978	1.576	3.589	14.217
Tennessee	1992	6.152	3.074	1.608	3.783	14.616
Tennessee	1993	6.209	3.163	1.634	3.950	14.956
Tennessee	1994	6.284	3.260	1.665	4.116	15.326
Tennessee	1995	6.381	3.366	1.701	4.302	15.750
Tennessee	1996	6.500	3.480	1.743	4.515	16.238
Tennessee	1997	6.647	3.607	1.790	4.749	16.794
Tennessee	1998	6.824	3.746	1.845	4.988	17.403
Tennessee	1999	7.001	3.888	1.900	5.244	18.032
Tennessee	2000	7.247	4.056	1.972	5.561	18.836
Texas	1980	0.493	0.183	0.115	0.210	39.793
Texas	1981	19.480	7.429	4.580	8.526	40.015
Texas	1982	19.300	7.579	4.591	8.698	40.169
Texas	1983	19.142	7.735	4.605	8.877	40.359

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Texas	1984	18.898	7.857	4.598	9.032	40.385
Texas	1985	18.728	8.004	4.607	9.210	40.550
Texas	1986	18.970	8.301	4.710	9.552	41.532
Texas	1987	19.251	8.616	4.822	9.858	42.546
Texas	1988	19.649	8.978	4.961	10.174	43.761
Texas	1989	19.998	9.325	5.088	10.578	44.988
Texas	1990	20.203	9.623	5.183	11.052	46.061
Texas	1991	20.452	9.939	5.287	11.505	47.183
Texas	1992	20.617	10.228	5.372	11.958	48.175
Texas	1993	20.904	10.563	5.484	12.468	49.419
Texas	1994	21.193	10.902	5.597	12.964	50.657
Texas	1995	21.530	11.262	5.722	13.379	51.893
Texas	1996	22.229	11.760	5.930	13.848	53.768
Texas	1997	22.664	12.168	6.078	14.409	55.319
Texas	1998	22.473	12.349	6.081	14.984	55.887
Texas	1999	22.826	12.729	6.209	15.692	57.456
Texas	2000	24.282	13.522	6.594	16.625	61.022
Utah	1980	0.503	0.186	0.117	0.194	6.931
Utah	1981	3.438	1.312	0.809	1.370	6.928
Utah	1982	3.387	1.331	0.806	1.390	6.914
Utah	1983	3.356	1.357	0.808	1.417	6.938
Utah	1984	3.329	1.384	0.810	1.446	6.969
Utah	1985	3.339	1.425	0.821	1.484	7.069
Utah	1986	3.331	1.459	0.827	1.520	7.136
Utah	1987	3.314	1.490	0.831	1.554	7.189
Utah	1988	3.324	1.530	0.842	1.590	7.287
Utah	1989	3.368	1.583	0.860	1.630	7.441
Utah	1990	3.366	1.620	0.867	1.663	7.516
Utah	1991	3.357	1.654	0.873	1.696	7.580
Utah	1992	3.352	1.689	0.879	1.742	7.662
Utah	1993	3.365	1.731	0.890	1.793	7.779
Utah	1994	3.374	1.772	0.899	1.840	7.885
Utah	1995	3.393	1.817	0.910	1.902	8.022
Utah	1996	3.424	1.866	0.925	1.972	8.186
Utah	1997	3.646	1.986	0.983	2.114	8.730
Utah	1998	3.997	2.156	1.072	2.254	9.480
Utah	1999	4.356	2.334	1.164	2.383	10.236
Utah	2000	4.729	2.520	1.260	2.471	10.981
Vermont	1980	0.518	0.192	0.120	0.170	2.095
Vermont	1981	1.073	0.409	0.252	0.363	2.098
Vermont	1982	1.067	0.419	0.254	0.371	2.111
Vermont	1983	1.053	0.426	0.253	0.377	2.109
Vermont	1984	1.038	0.432	0.253	0.382	2.104
Vermont	1985	1.030	0.440	0.253	0.389	2.113
Vermont	1986	1.038	0.455	0.258	0.401	2.151
Vermont	1987	1.035	0.465	0.260	0.413	2.172
Vermont	1988	1.033	0.476	0.262	0.426	2.197

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Vermont	1989	1.026	0.485	0.262	0.436	2.208
Vermont	1990	1.020	0.494	0.263	0.447	2.225
Vermont	1991	1.031	0.509	0.268	0.468	2.277
Vermont	1992	1.052	0.528	0.275	0.484	2.339
Vermont	1993	1.059	0.543	0.280	0.515	2.397
Vermont	1994	1.058	0.554	0.281	0.527	2.420
Vermont	1995	1.064	0.568	0.285	0.541	2.459
Vermont	1996	1.070	0.582	0.289	0.553	2.494
Vermont	1997	1.087	0.600	0.295	0.569	2.552
Vermont	1998	1.095	0.616	0.299	0.588	2.598
Vermont	1999	1.125	0.639	0.308	0.611	2.683
Vermont	2000	1.158	0.663	0.318	0.640	2.779
Virginia	1980	0.476	0.176	0.111	0.238	9.758
Virginia	1981	4.625	1.764	1.087	2.382	9.857
Virginia	1982	4.611	1.810	1.097	2.444	9.961
Virginia	1983	4.634	1.869	1.114	2.525	10.142
Virginia	1984	4.622	1.917	1.123	2.589	10.252
Virginia	1985	4.686	1.992	1.150	2.683	10.511
Virginia	1986	4.826	2.096	1.194	2.824	10.940
Virginia	1987	5.011	2.217	1.249	2.999	11.476
Virginia	1988	5.161	2.329	1.296	3.234	12.020
Virginia	1989	5.331	2.449	1.348	3.450	12.579
Virginia	1990	5.494	2.569	1.399	3.760	13.222
Virginia	1991	5.681	2.699	1.455	4.019	13.853
Virginia	1992	5.768	2.794	1.488	4.179	14.229
Virginia	1993	5.807	2.873	1.511	4.371	14.561
Virginia	1994	5.935	2.985	1.553	4.577	15.050
Virginia	1995	6.102	3.112	1.605	4.808	15.626
Virginia	1996	6.286	3.248	1.661	5.111	16.306
Virginia	1997	6.514	3.402	1.728	5.472	17.115
Virginia	1998	6.664	3.530	1.777	5.879	17.849
Virginia	1999	7.006	3.731	1.870	6.299	18.906
Virginia	2000	7.329	3.928	1.960	6.650	19.866
Washington	1980	0.460	0.170	0.107	0.263	12.408
Washington	1981	5.618	2.143	1.321	3.312	12.394
Washington	1982	5.591	2.196	1.330	3.393	12.510
Washington	1983	5.570	2.250	1.340	3.476	12.635
Washington	1984	5.538	2.300	1.347	3.575	12.760
Washington	1985	5.557	2.369	1.365	3.679	12.971
Washington	1986	5.585	2.441	1.386	3.791	13.203
Washington	1987	5.626	2.518	1.409	3.883	13.436
Washington	1988	5.649	2.589	1.428	3.976	13.642
Washington	1989	5.674	2.661	1.447	4.061	13.843
Washington	1990	5.744	2.749	1.477	4.163	14.132
Washington	1991	5.804	2.836	1.504	4.291	14.434
Washington	1992	5.840	2.913	1.525	4.469	14.748
Washington	1993	5.944	3.017	1.562	4.705	15.228

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Washington	1994	6.097	3.139	1.611	4.903	15.750
Washington	1995	6.308	3.285	1.673	5.113	16.379
Washington	1996	6.493	3.424	1.729	5.333	16.979
Washington	1997	6.713	3.577	1.795	5.584	17.669
Washington	1998	6.811	3.688	1.831	5.833	18.164
Washington	1999	6.947	3.814	1.877	6.154	18.793
Washington	2000	7.119	3.955	1.931	6.447	19.452
West Virginia	1980	0.571	0.211	0.133	0.085	5.240
West Virginia	1981	3.041	1.159	0.715	0.464	5.379
West Virginia	1982	3.109	1.218	0.739	0.488	5.553
West Virginia	1983	3.128	1.260	0.752	0.505	5.644
West Virginia	1984	3.134	1.296	0.761	0.522	5.713
West Virginia	1985	3.217	1.362	0.788	0.545	5.912
West Virginia	1986	3.281	1.421	0.811	0.568	6.082
West Virginia	1987	3.340	1.480	0.833	0.591	6.243
West Virginia	1988	3.365	1.526	0.847	0.618	6.356
West Virginia	1989	3.351	1.558	0.852	0.619	6.380
West Virginia	1990	3.357	1.598	0.861	0.646	6.462
West Virginia	1991	3.449	1.669	0.890	0.679	6.687
West Virginia	1992	3.519	1.733	0.914	0.724	6.891
West Virginia	1993	3.645	1.819	0.951	0.785	7.200
West Virginia	1994	3.768	1.905	0.988	0.850	7.511
West Virginia	1995	3.898	1.995	1.027	0.946	7.866
West Virginia	1996	4.121	2.121	1.087	1.030	8.359
West Virginia	1997	4.275	2.224	1.132	1.115	8.745
West Virginia	1998	4.419	2.324	1.174	1.207	9.124
West Virginia	1999	4.600	2.440	1.226	1.322	9.587
West Virginia	2000	4.781	2.558	1.278	1.558	10.175
Wisconsin	1980	0.538	0.199	0.125	0.138	15.947
Wisconsin	1981	8.388	3.201	1.973	2.216	15.778
Wisconsin	1982	8.232	3.236	1.959	2.240	15.666
Wisconsin	1983	8.116	3.284	1.954	2.274	15.628
Wisconsin	1984	7.996	3.330	1.947	2.300	15.572
Wisconsin	1985	7.882	3.376	1.941	2.333	15.531
Wisconsin	1986	7.805	3.436	1.942	2.374	15.556
Wisconsin	1987	7.735	3.496	1.945	2.422	15.599
Wisconsin	1988	7.692	3.566	1.954	2.473	15.685
Wisconsin	1989	7.693	3.652	1.972	2.534	15.850
Wisconsin	1990	7.678	3.732	1.986	2.618	16.014
Wisconsin	1991	7.727	3.836	2.015	2.727	16.305
Wisconsin	1992	7.786	3.943	2.046	2.886	16.661
Wisconsin	1993	7.831	4.046	2.074	3.065	17.017
Wisconsin	1994	7.893	4.156	2.105	3.241	17.395
Wisconsin	1995	7.950	4.265	2.135	3.423	17.772
Wisconsin	1996	7.987	4.367	2.160	3.603	18.116
Wisconsin	1997	8.133	4.510	2.210	3.702	18.555
Wisconsin	1998	8.242	4.640	2.252	3.867	19.001

Table A.1 continued

State	Year	Pavement	Grading	Structures	ROW	Total
Wisconsin	1999	8.441	4.806	2.315	4.044	19.606
Wisconsin	2000	8.729	5.006	2.398	4.258	20.391
Wyoming	1980	0.539	0.200	0.125	0.136	5.398
Wyoming	1981	2.877	1.097	0.677	0.746	5.397
Wyoming	1982	2.848	1.119	0.678	0.761	5.406
Wyoming	1983	2.834	1.145	0.682	0.779	5.439
Wyoming	1984	2.814	1.169	0.684	0.794	5.461
Wyoming	1985	2.823	1.204	0.694	0.818	5.538
Wyoming	1986	2.822	1.235	0.701	0.839	5.595
Wyoming	1987	2.812	1.262	0.705	0.859	5.638
Wyoming	1988	2.800	1.289	0.709	0.880	5.678
Wyoming	1989	2.788	1.316	0.713	0.904	5.720
Wyoming	1990	2.800	1.351	0.722	0.934	5.807
Wyoming	1991	2.829	1.393	0.735	0.972	5.929
Wyoming	1992	2.817	1.420	0.739	1.000	5.976
Wyoming	1993	2.807	1.447	0.743	1.029	6.026
Wyoming	1994	2.812	1.480	0.750	1.058	6.100
Wyoming	1995	2.807	1.510	0.755	1.093	6.164
Wyoming	1996	2.810	1.542	0.761	1.130	6.243
Wyoming	1997	2.823	1.578	0.770	1.169	6.341
Wyoming	1998	2.848	1.619	0.782	1.215	6.464
Wyoming	1999	2.909	1.673	0.801	1.266	6.649
Wyoming	2000	2.974	1.729	0.822	1.317	6.843

APPENDIX B
DATA SET FOR ESTIMATION OF ELASTICITIES

Table B.1 Data Set for Elasticity Estimation

State	year	Technology	intercept	ytrans	labor	gsptrans	hicap
Alabama	1981	1	1	8.869	-4.000	4.261	8.106
Alabama	1982	2	1	8.937	-3.997	4.323	8.104
Alabama	1983	3	1	8.973	-4.014	4.508	8.102
Alabama	1984	4	1	9.029	-4.037	4.637	8.101
Alabama	1985	5	1	9.086	-4.009	4.646	8.098
Alabama	1986	6	1	9.050	-4.006	4.757	8.106
Alabama	1987	7	1	9.140	-4.025	4.830	8.111
Alabama	1988	8	1	9.196	-4.006	5.021	8.114
Alabama	1989	9	1	9.222	-3.925	4.924	8.122
Alabama	1990	10	1	9.255	-3.902	4.955	8.125
Alabama	1991	11	1	9.258	-3.892	5.217	8.123
Alabama	1992	12	1	9.311	-3.906	5.132	8.122
Alabama	1993	13	1	9.329	-3.923	5.251	8.115
Alabama	1994	14	1	9.356	-3.907	5.383	8.123
Alabama	1995	15	1	9.382	-3.890	5.442	8.124
Alabama	1996	16	1	9.392	-3.869	5.515	8.130
Alabama	1997	17	1	9.423	-3.862	5.598	8.136
Alabama	1998	18	1	9.448	-3.865	5.849	8.139
Alabama	1999	19	1	9.461	-3.856	5.983	8.143
Alabama	2000	20	1	9.449	-3.851	5.968	8.146
Arizona	1981	1	1	8.847	-3.944	4.473	8.290
Arizona	1982	2	1	8.862	-3.933	4.420	8.262
Arizona	1983	3	1	8.843	-3.950	4.672	8.230
Arizona	1984	4	1	8.828	-3.937	4.853	8.195
Arizona	1985	5	1	8.822	-3.923	4.770	8.161
Arizona	1986	6	1	8.832	-3.917	4.904	8.134
Arizona	1987	7	1	9.130	-3.870	4.981	8.123
Arizona	1988	8	1	9.179	-3.866	5.175	8.124
Arizona	1989	9	1	9.171	-3.854	5.048	8.139
Arizona	1990	10	1	9.173	-3.803	4.978	8.160
Arizona	1991	11	1	9.136	-3.840	5.104	8.185
Arizona	1992	12	1	9.112	-3.868	5.017	8.191
Arizona	1993	13	1	9.152	-4.007	5.246	8.178
Arizona	1994	14	1	9.143	-3.909	5.237	8.156
Arizona	1995	15	1	9.128	-3.900	5.446	8.144
Arizona	1996	16	1	9.159	-3.877	5.497	8.131
Arizona	1997	17	1	9.165	-3.852	5.665	8.129
Arizona	1998	18	1	9.177	-3.834	5.783	8.128
Arizona	1999	19	1	9.190	-3.825	5.813	8.121
Arizona	2000	20	1	9.173	-3.852	5.758	8.095
Arkansas	1981	1	1	8.882	-3.969	4.560	8.497
Arkansas	1982	2	1	8.889	-3.985	4.548	8.489
Arkansas	1983	3	1	8.887	-3.989	4.793	8.478
Arkansas	1984	4	1	8.877	-3.933	4.973	8.465
Arkansas	1985	5	1	8.903	-3.899	5.047	8.453
Arkansas	1986	6	1	8.926	-3.875	5.254	8.452

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Arkansas	1987	7	1	8.964	-3.821	5.308	8.455
Arkansas	1988	8	1	9.012	-3.804	5.472	8.458
Arkansas	1989	9	1	9.071	-3.762	5.398	8.459
Arkansas	1990	10	1	9.097	-3.738	5.402	8.456
Arkansas	1991	11	1	9.133	-3.748	5.435	8.448
Arkansas	1992	12	1	9.174	-3.757	5.474	8.447
Arkansas	1993	13	1	9.200	-3.750	5.554	8.447
Arkansas	1994	14	1	9.228	-3.720	5.754	8.448
Arkansas	1995	15	1	9.282	-3.664	5.796	8.449
Arkansas	1996	16	1	9.315	-3.655	5.851	8.457
Arkansas	1997	17	1	9.317	-3.649	5.913	8.476
Arkansas	1998	18	1	9.321	-3.624	6.083	8.504
Arkansas	1999	19	1	9.347	-3.606	6.182	8.526
Arkansas	2000	20	1	9.295	-3.641	6.190	8.491
California	1981	1	1	8.792	-3.779	4.466	7.000
California	1982	2	1	8.832	-3.823	4.486	6.992
California	1983	3	1	8.882	-3.864	4.693	6.979
California	1984	4	1	8.937	-3.868	4.857	6.968
California	1985	5	1	8.968	-3.866	4.866	6.961
California	1986	6	1	8.978	-3.864	4.986	6.957
California	1987	7	1	9.005	-3.863	5.112	6.955
California	1988	8	1	9.046	-3.879	5.210	6.960
California	1989	9	1	9.060	-3.889	5.167	6.965
California	1990	10	1	9.065	-3.890	5.127	6.974
California	1991	11	1	9.046	-3.904	5.206	7.008
California	1992	12	1	9.048	-3.929	5.186	7.041
California	1993	13	1	9.054	-3.932	5.341	7.075
California	1994	14	1	9.069	-3.924	5.460	7.112
California	1995	15	1	9.080	-3.912	5.565	7.159
California	1996	16	1	9.077	-3.903	5.698	7.195
California	1997	17	1	9.090	-3.881	5.830	7.232
California	1998	18	1	9.093	-3.851	5.943	7.273
California	1999	19	1	9.111	-3.831	6.010	7.298
California	2000	20	1	9.107	-3.824	6.058	7.326
Colorado	1981	1	1	8.953	-3.587	4.914	8.229
Colorado	1982	2	1	8.983	-3.579	4.650	8.195
Colorado	1983	3	1	8.978	-3.623	4.857	8.172
Colorado	1984	4	1	9.018	-3.594	5.037	8.161
Colorado	1985	5	1	9.006	-3.590	4.940	8.149
Colorado	1986	6	1	9.006	-3.616	5.024	8.144
Colorado	1987	7	1	9.021	-3.609	5.149	8.147
Colorado	1988	8	1	9.045	-3.575	5.418	8.153
Colorado	1989	9	1	9.038	-3.554	5.247	8.158
Colorado	1990	10	1	9.015	-3.538	5.223	8.158
Colorado	1991	11	1	9.017	-3.539	5.131	8.158
Colorado	1992	12	1	9.094	-3.546	5.225	8.150
Colorado	1993	13	1	9.126	-3.530	5.360	8.129

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Colorado	1994	14	1	9.130	-3.518	5.677	8.118
Colorado	1995	15	1	9.146	-3.460	5.837	8.115
Colorado	1996	16	1	9.157	-3.449	5.980	8.111
Colorado	1997	17	1	9.180	-3.448	6.091	8.102
Colorado	1998	18	1	9.200	-3.418	6.124	8.106
Colorado	1999	19	1	9.215	-3.368	6.210	8.111
Colorado	2000	20	1	9.175	-3.394	6.101	8.092
Connecticut	1981	1	1	8.731	-3.933	-19.561	6.827
Connecticut	1982	2	1	8.766	-3.928	2.567	6.851
Connecticut	1983	3	1	8.783	-3.937	2.912	6.869
Connecticut	1984	4	1	8.799	-3.866	3.745	6.901
Connecticut	1985	5	1	8.853	-3.848	4.064	6.927
Connecticut	1986	6	1	8.918	-3.847	4.221	6.976
Connecticut	1987	7	1	8.949	-3.813	4.443	7.050
Connecticut	1988	8	1	8.983	-3.805	4.669	7.126
Connecticut	1989	9	1	8.984	-3.815	4.532	7.219
Connecticut	1990	10	1	8.987	-3.816	4.508	7.335
Connecticut	1991	11	1	8.999	-3.850	4.611	7.468
Connecticut	1992	12	1	8.997	-3.875	4.619	7.595
Connecticut	1993	13	1	9.019	-3.851	4.910	7.660
Connecticut	1994	14	1	9.024	-3.837	5.002	7.709
Connecticut	1995	15	1	9.058	-3.825	5.144	7.779
Connecticut	1996	16	1	9.061	-3.793	5.262	7.844
Connecticut	1997	17	1	9.075	-3.775	5.462	7.898
Connecticut	1998	18	1	9.101	-3.765	5.576	7.955
Connecticut	1999	19	1	9.118	-3.746	5.620	7.984
Connecticut	2000	20	1	9.107	-3.757	5.625	7.993
Delaware	1981	1	1	9.366	-3.897	4.825	7.176
Delaware	1982	2	1	8.944	-3.939	4.820	7.170
Delaware	1983	3	1	8.996	-3.929	4.810	7.211
Delaware	1984	4	1	9.036	-3.935	4.800	7.253
Delaware	1985	5	1	9.068	-3.941	4.789	7.294
Delaware	1986	6	1	9.125	-3.900	4.774	7.340
Delaware	1987	7	1	9.165	-3.860	4.759	7.396
Delaware	1988	8	1	9.199	-3.812	4.742	7.458
Delaware	1989	9	1	9.194	-3.765	4.726	7.539
Delaware	1990	10	1	9.189	-3.784	4.710	7.606
Delaware	1991	11	1	9.198	-3.819	4.753	7.676
Delaware	1992	12	1	9.209	-3.858	4.859	7.781
Delaware	1993	13	1	9.196	-3.850	4.879	7.851
Delaware	1994	14	1	9.202	-3.839	4.825	7.925
Delaware	1995	15	1	9.256	-3.828	4.910	7.987
Delaware	1996	16	1	9.263	-3.840	4.847	8.034
Delaware	1997	17	1	9.296	-3.845	4.836	8.074
Delaware	1998	18	1	9.308	-3.825	5.495	8.111
Delaware	1999	19	1	9.336	-3.784	5.510	8.158
Delaware	2000	20	1	9.257	-3.809	5.581	8.152

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Florida	1981	1	1	8.919	-3.792	4.326	7.285
Florida	1982	2	1	8.935	-3.819	4.269	7.273
Florida	1983	3	1	8.937	-3.838	4.490	7.268
Florida	1984	4	1	8.954	-3.824	4.665	7.257
Florida	1985	5	1	8.956	-3.844	4.609	7.248
Florida	1986	6	1	8.922	-3.854	4.740	7.254
Florida	1987	7	1	8.954	-3.852	4.866	7.265
Florida	1988	8	1	9.056	-3.854	5.042	7.290
Florida	1989	9	1	9.061	-3.860	4.980	7.312
Florida	1990	10	1	9.042	-3.845	4.952	7.323
Florida	1991	11	1	9.051	-3.878	5.026	7.333
Florida	1992	12	1	9.091	-3.891	4.966	7.360
Florida	1993	13	1	9.081	-3.866	5.180	7.396
Florida	1994	14	1	9.075	-3.852	5.308	7.438
Florida	1995	15	1	9.106	-3.838	5.475	7.485
Florida	1996	16	1	9.106	-3.826	5.626	7.542
Florida	1997	17	1	9.119	-3.804	5.771	7.590
Florida	1998	18	1	9.129	-3.789	5.908	7.645
Florida	1999	19	1	9.147	-3.769	5.891	7.698
Florida	2000	20	1	9.157	-3.796	5.849	7.706
Georgia	1981	1	1	8.994	-3.649	4.399	7.934
Georgia	1982	2	1	9.063	-3.653	4.393	7.925
Georgia	1983	3	1	9.051	-3.658	4.664	7.914
Georgia	1984	4	1	9.066	-3.619	4.878	7.911
Georgia	1985	5	1	9.106	-3.599	4.827	7.896
Georgia	1986	6	1	9.142	-3.588	4.970	7.901
Georgia	1987	7	1	9.181	-3.567	5.183	7.897
Georgia	1988	8	1	9.196	-3.545	5.267	7.901
Georgia	1989	9	1	9.270	-3.526	5.073	7.905
Georgia	1990	10	1	9.287	-3.487	5.089	7.913
Georgia	1991	11	1	9.308	-3.529	5.257	7.922
Georgia	1992	12	1	9.352	-3.532	5.197	7.929
Georgia	1993	13	1	9.339	-3.524	5.405	7.931
Georgia	1994	14	1	9.372	-3.506	5.590	7.933
Georgia	1995	15	1	9.382	-3.504	5.862	7.936
Georgia	1996	16	1	9.406	-3.492	5.964	7.949
Georgia	1997	17	1	9.436	-3.479	6.133	7.971
Georgia	1998	18	1	9.450	-3.444	6.283	7.969
Georgia	1999	19	1	9.449	-3.409	6.360	7.982
Georgia	2000	20	1	9.453	-3.441	6.298	7.978
Idaho	1981	1	1	8.889	-3.873	4.901	9.251
Idaho	1982	2	1	8.996	-3.934	4.815	9.226
Idaho	1983	3	1	9.041	-3.938	5.099	9.205
Idaho	1984	4	1	8.967	-3.950	5.256	9.184
Idaho	1985	5	1	8.956	-3.946	5.278	9.170
Idaho	1986	6	1	8.969	-3.992	5.377	9.167
Idaho	1987	7	1	9.017	-4.006	5.297	9.165

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Idaho	1988	8	1	9.017	-3.973	5.536	9.182
Idaho	1989	9	1	9.044	-3.946	5.350	9.168
Idaho	1990	10	1	9.183	-3.936	5.391	9.146
Idaho	1991	11	1	9.203	-3.948	5.429	9.116
Idaho	1992	12	1	9.220	-3.959	5.508	9.086
Idaho	1993	13	1	9.236	-3.965	5.595	9.050
Idaho	1994	14	1	9.236	-3.952	5.763	9.016
Idaho	1995	15	1	9.264	-3.938	5.830	8.991
Idaho	1996	16	1	9.298	-3.926	5.808	8.973
Idaho	1997	17	1	9.272	-3.909	5.888	8.957
Idaho	1998	18	1	9.297	-3.879	5.986	8.947
Idaho	1999	19	1	9.321	-3.844	6.063	8.936
Idaho	2000	20	1	9.251	-3.840	6.065	8.909
Illinois	1981	1	1	8.658	-3.687	4.843	7.471
Illinois	1982	2	1	8.659	-3.729	4.764	7.484
Illinois	1983	3	1	8.684	-3.764	5.044	7.491
Illinois	1984	4	1	8.720	-3.714	5.252	7.499
Illinois	1985	5	1	8.735	-3.703	5.236	7.521
Illinois	1986	6	1	8.781	-3.701	5.439	7.549
Illinois	1987	7	1	8.802	-3.652	5.549	7.575
Illinois	1988	8	1	8.838	-3.641	5.664	7.604
Illinois	1989	9	1	8.871	-3.621	5.533	7.635
Illinois	1990	10	1	8.893	-3.614	5.491	7.665
Illinois	1991	11	1	8.910	-3.635	5.531	7.694
Illinois	1992	12	1	8.927	-3.649	5.554	7.727
Illinois	1993	13	1	8.942	-3.631	5.759	7.758
Illinois	1994	14	1	8.964	-3.614	5.834	7.786
Illinois	1995	15	1	8.978	-3.602	5.882	7.801
Illinois	1996	16	1	8.995	-3.582	6.021	7.834
Illinois	1997	17	1	9.020	-3.569	6.165	7.863
Illinois	1998	18	1	9.035	-3.548	6.277	7.892
Illinois	1999	19	1	9.041	-3.552	6.305	7.912
Illinois	2000	20	1	9.020	-3.558	6.286	7.921
Indiana	1981	1	1	8.867	-3.932	4.618	7.819
Indiana	1982	2	1	8.878	-3.968	4.593	7.812
Indiana	1983	3	1	8.897	-3.973	4.783	7.815
Indiana	1984	4	1	8.926	-3.945	4.957	7.805
Indiana	1985	5	1	8.919	-3.911	5.017	7.802
Indiana	1986	6	1	8.920	-3.877	5.211	7.810
Indiana	1987	7	1	8.984	-3.832	5.323	7.819
Indiana	1988	8	1	9.139	-3.792	5.397	7.810
Indiana	1989	9	1	9.227	-3.751	5.366	7.816
Indiana	1990	10	1	9.176	-3.734	5.384	7.823
Indiana	1991	11	1	9.179	-3.755	5.408	7.838
Indiana	1992	12	1	9.221	-3.750	5.485	7.857
Indiana	1993	13	1	9.269	-3.743	5.625	7.876
Indiana	1994	14	1	9.272	-3.730	5.708	7.887

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Indiana	1995	15	1	9.319	-3.715	5.743	7.902
Indiana	1996	16	1	9.337	-3.731	5.827	7.913
Indiana	1997	17	1	9.366	-3.735	5.927	7.926
Indiana	1998	18	1	9.367	-3.709	6.091	7.942
Indiana	1999	19	1	9.375	-3.695	6.176	7.967
Indiana	2000	20	1	9.362	-3.707	6.174	7.980
Iowa	1981	1	1	8.791	-3.968	4.997	8.655
Iowa	1982	2	1	8.809	-4.003	4.999	8.651
Iowa	1983	3	1	8.832	-4.025	5.096	8.646
Iowa	1984	4	1	8.878	-4.016	5.181	8.640
Iowa	1985	5	1	8.873	-3.996	5.149	8.645
Iowa	1986	6	1	8.897	-3.992	5.236	8.655
Iowa	1987	7	1	8.925	-3.961	5.271	8.660
Iowa	1988	8	1	8.976	-3.934	5.341	8.655
Iowa	1989	9	1	9.005	-3.902	5.242	8.652
Iowa	1990	10	1	9.021	-3.900	5.287	8.646
Iowa	1991	11	1	9.018	-3.928	5.450	8.644
Iowa	1992	12	1	9.051	-3.931	5.536	8.646
Iowa	1993	13	1	9.094	-3.900	5.624	8.648
Iowa	1994	14	1	9.116	-3.868	5.679	8.653
Iowa	1995	15	1	9.121	-3.834	5.846	8.658
Iowa	1996	16	1	9.152	-3.806	5.904	8.667
Iowa	1997	17	1	9.191	-3.772	6.040	8.677
Iowa	1998	18	1	9.221	-3.724	6.220	8.690
Iowa	1999	19	1	9.226	-3.685	6.302	8.702
Iowa	2000	20	1	9.215	-3.697	6.354	8.700
Kansas	1981	1	1	8.899	-3.639	5.247	9.042
Kansas	1982	2	1	8.903	-3.667	5.245	9.025
Kansas	1983	3	1	8.925	-3.661	5.473	9.005
Kansas	1984	4	1	8.952	-3.633	5.539	8.990
Kansas	1985	5	1	8.980	-3.638	5.481	8.978
Kansas	1986	6	1	9.006	-3.659	5.597	8.971
Kansas	1987	7	1	9.037	-3.665	5.579	8.962
Kansas	1988	8	1	9.059	-3.649	5.855	8.952
Kansas	1989	9	1	9.089	-3.613	5.649	8.942
Kansas	1990	10	1	9.128	-3.623	5.693	8.934
Kansas	1991	11	1	9.137	-3.642	5.757	8.929
Kansas	1992	12	1	9.166	-3.665	5.718	8.918
Kansas	1993	13	1	9.155	-3.656	5.757	8.912
Kansas	1994	14	1	9.170	-3.641	5.897	8.908
Kansas	1995	15	1	9.182	-3.635	5.917	8.916
Kansas	1996	16	1	9.209	-3.614	5.961	8.931
Kansas	1997	17	1	9.224	-3.590	6.015	8.946
Kansas	1998	18	1	9.237	-3.567	6.050	8.957
Kansas	1999	19	1	9.253	-3.522	6.150	8.963
Kansas	2000	20	1	9.254	-3.442	6.246	8.968
Kentucky	1981	1	1	8.834	-3.994	4.571	7.926

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Kentucky	1982	2	1	8.848	-4.028	4.533	7.936
Kentucky	1983	3	1	8.886	-4.077	4.705	7.945
Kentucky	1984	4	1	8.931	-4.037	4.882	7.959
Kentucky	1985	5	1	8.951	-4.017	4.901	7.969
Kentucky	1986	6	1	8.979	-4.026	5.065	7.983
Kentucky	1987	7	1	9.016	-3.962	5.071	8.007
Kentucky	1988	8	1	9.058	-3.904	5.166	8.044
Kentucky	1989	9	1	9.076	-3.863	5.195	8.072
Kentucky	1990	10	1	9.117	-3.831	5.199	8.094
Kentucky	1991	11	1	9.157	-3.832	5.366	8.107
Kentucky	1992	12	1	9.224	-3.829	5.206	8.121
Kentucky	1993	13	1	9.254	-3.808	5.336	8.134
Kentucky	1994	14	1	9.251	-3.771	5.440	8.154
Kentucky	1995	15	1	9.274	-3.742	5.501	8.171
Kentucky	1996	16	1	9.303	-3.720	5.551	8.188
Kentucky	1997	17	1	9.346	-3.696	5.744	8.212
Kentucky	1998	18	1	9.379	-3.651	5.927	8.235
Kentucky	1999	19	1	9.399	-3.630	5.981	8.261
Kentucky	2000	20	1	9.355	-3.612	6.017	8.276
Louisiana	1981	1	1	8.670	-3.474	5.177	7.575
Louisiana	1982	2	1	8.729	-3.522	5.042	7.593
Louisiana	1983	3	1	8.842	-3.616	5.307	7.621
Louisiana	1984	4	1	8.911	-3.614	5.351	7.656
Louisiana	1985	5	1	8.932	-3.638	5.316	7.680
Louisiana	1986	6	1	8.821	-3.716	5.332	7.707
Louisiana	1987	7	1	8.849	-3.726	5.348	7.760
Louisiana	1988	8	1	8.998	-3.690	5.463	7.796
Louisiana	1989	9	1	9.033	-3.671	5.448	7.826
Louisiana	1990	10	1	9.105	-3.636	5.423	7.854
Louisiana	1991	11	1	9.010	-3.655	5.526	7.874
Louisiana	1992	12	1	8.978	-3.701	5.438	7.904
Louisiana	1993	13	1	9.046	-3.687	5.470	7.938
Louisiana	1994	14	1	9.070	-3.668	5.625	7.962
Louisiana	1995	15	1	9.097	-3.693	5.732	7.988
Louisiana	1996	16	1	9.080	-3.689	5.840	8.014
Louisiana	1997	17	1	9.097	-3.675	6.028	8.037
Louisiana	1998	18	1	9.132	-3.655	6.117	8.055
Louisiana	1999	19	1	9.151	-3.663	6.142	8.079
Louisiana	2000	20	1	9.120	-3.669	6.210	8.097
Maine	1981	1	1	8.789	-4.104	4.440	7.965
Maine	1982	2	1	8.814	-4.116	4.442	7.961
Maine	1983	3	1	8.815	-4.128	4.636	7.957
Maine	1984	4	1	8.921	-4.101	4.752	7.949
Maine	1985	5	1	8.984	-4.099	4.759	7.942
Maine	1986	6	1	9.055	-4.099	4.876	7.947
Maine	1987	7	1	9.115	-4.057	4.988	7.943
Maine	1988	8	1	9.156	-4.041	5.095	7.937

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Maine	1989	9	1	9.172	-4.017	5.020	7.933
Maine	1990	10	1	9.174	-4.010	4.961	7.936
Maine	1991	11	1	9.169	-4.031	4.952	7.955
Maine	1992	12	1	9.193	-4.050	4.976	7.986
Maine	1993	13	1	9.194	-4.022	5.012	8.006
Maine	1994	14	1	9.218	-4.003	5.113	8.023
Maine	1995	15	1	9.228	-4.015	5.166	8.045
Maine	1996	16	1	9.242	-4.004	5.251	8.071
Maine	1997	17	1	9.272	-3.985	5.404	8.107
Maine	1998	18	1	9.292	-3.968	5.682	8.140
Maine	1999	19	1	9.331	-3.951	5.728	8.155
Maine	2000	20	1	9.316	-3.955	5.758	8.171
Maryland	1981	1	1	8.812	-3.877	3.910	6.843
Maryland	1982	2	1	8.818	-3.885	3.870	6.857
Maryland	1983	3	1	8.884	-3.902	4.172	6.881
Maryland	1984	4	1	8.890	-3.891	4.370	6.907
Maryland	1985	5	1	8.930	-3.887	4.456	6.954
Maryland	1986	6	1	8.968	-3.896	4.707	7.004
Maryland	1987	7	1	8.986	-3.893	4.848	7.055
Maryland	1988	8	1	8.993	-3.874	4.877	7.124
Maryland	1989	9	1	9.016	-3.847	4.880	7.189
Maryland	1990	10	1	9.042	-3.856	4.792	7.271
Maryland	1991	11	1	9.050	-3.878	4.829	7.349
Maryland	1992	12	1	9.053	-3.905	4.792	7.393
Maryland	1993	13	1	9.078	-3.906	4.867	7.432
Maryland	1994	14	1	9.089	-3.871	4.905	7.464
Maryland	1995	15	1	9.098	-3.863	5.089	7.490
Maryland	1996	16	1	9.116	-3.862	5.214	7.524
Maryland	1997	17	1	9.126	-3.860	5.400	7.574
Maryland	1998	18	1	9.151	-3.860	5.550	7.628
Maryland	1999	19	1	9.159	-3.829	5.617	7.659
Maryland	2000	20	1	9.153	-3.824	5.655	7.683
Massachusetts	1981	1	1	8.737	-3.872	3.831	6.771
Massachusetts	1982	2	1	8.757	-3.873	3.867	6.761
Massachusetts	1983	3	1	8.776	-3.893	4.150	6.770
Massachusetts	1984	4	1	8.795	-3.858	4.407	6.767
Massachusetts	1985	5	1	8.817	-3.848	4.435	6.762
Massachusetts	1986	6	1	8.844	-3.847	4.606	6.787
Massachusetts	1987	7	1	8.872	-3.814	4.756	6.812
Massachusetts	1988	8	1	8.888	-3.801	4.839	6.845
Massachusetts	1989	9	1	8.947	-3.848	4.753	6.936
Massachusetts	1990	10	1	8.945	-3.836	4.676	6.962
Massachusetts	1991	11	1	8.956	-3.884	4.671	7.001
Massachusetts	1992	12	1	8.975	-3.899	4.742	7.077
Massachusetts	1993	13	1	8.958	-3.881	4.930	7.179
Massachusetts	1994	14	1	8.961	-3.857	5.006	7.271
Massachusetts	1995	15	1	8.978	-3.865	5.135	7.393

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Massachusetts	1996	16	1	9.013	-3.853	5.325	7.515
Massachusetts	1997	17	1	9.018	-3.829	5.521	7.632
Massachusetts	1998	18	1	9.040	-3.807	5.648	7.724
Massachusetts	1999	19	1	9.035	-3.788	5.667	7.828
Massachusetts	2000	20	1	9.024	-3.786	5.706	7.973
Michigan	1981	1	1	8.816	-4.131	3.898	7.548
Michigan	1982	2	1	8.812	-4.153	3.968	7.549
Michigan	1983	3	1	8.814	-4.173	4.220	7.550
Michigan	1984	4	1	8.858	-4.168	4.416	7.543
Michigan	1985	5	1	8.913	-4.131	4.495	7.538
Michigan	1986	6	1	8.973	-4.115	4.663	7.533
Michigan	1987	7	1	9.017	-4.100	4.791	7.533
Michigan	1988	8	1	9.042	-4.094	4.818	7.538
Michigan	1989	9	1	9.063	-4.087	4.873	7.541
Michigan	1990	10	1	9.072	-4.074	4.794	7.542
Michigan	1991	11	1	9.074	-4.110	4.791	7.543
Michigan	1992	12	1	9.093	-4.117	4.731	7.547
Michigan	1993	13	1	9.104	-4.108	5.065	7.554
Michigan	1994	14	1	9.092	-4.075	5.310	7.562
Michigan	1995	15	1	9.091	-4.057	5.318	7.571
Michigan	1996	16	1	9.134	-4.046	5.524	7.587
Michigan	1997	17	1	9.146	-4.032	5.640	7.607
Michigan	1998	18	1	9.166	-4.013	5.637	7.623
Michigan	1999	19	1	9.180	-4.010	5.806	7.643
Michigan	2000	20	1	9.192	-4.001	5.842	7.680
Minnesota	1981	1	1	8.850	-3.743	4.754	8.457
Minnesota	1982	2	1	8.862	-3.793	4.734	8.444
Minnesota	1983	3	1	8.923	-3.798	4.947	8.435
Minnesota	1984	4	1	8.945	-3.759	5.119	8.426
Minnesota	1985	5	1	8.963	-3.751	5.112	8.416
Minnesota	1986	6	1	8.992	-3.759	5.254	8.412
Minnesota	1987	7	1	9.024	-3.747	5.352	8.411
Minnesota	1988	8	1	9.046	-3.743	5.382	8.398
Minnesota	1989	9	1	9.062	-3.719	5.426	8.395
Minnesota	1990	10	1	9.091	-3.691	5.397	8.389
Minnesota	1991	11	1	9.090	-3.697	5.474	8.391
Minnesota	1992	12	1	9.128	-3.706	5.436	8.394
Minnesota	1993	13	1	9.142	-3.715	5.680	8.400
Minnesota	1994	14	1	9.158	-3.693	5.892	8.392
Minnesota	1995	15	1	9.166	-3.667	5.936	8.389
Minnesota	1996	16	1	9.166	-3.654	6.105	8.385
Minnesota	1997	17	1	9.256	-3.632	6.205	8.383
Minnesota	1998	18	1	9.259	-3.614	6.146	8.387
Minnesota	1999	19	1	9.284	-3.589	6.285	8.384
Minnesota	2000	20	1	9.274	-3.597	6.348	8.366
Mississippi	1981	1	1	8.804	-4.138	5.327	8.319
Mississippi	1982	2	1	8.811	-4.168	5.077	8.316

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Mississippi	1983	3	1	8.844	-4.198	5.324	8.316
Mississippi	1984	4	1	8.875	-4.189	5.384	8.315
Mississippi	1985	5	1	8.910	-4.179	5.374	8.308
Mississippi	1986	6	1	8.911	-4.179	5.523	8.309
Mississippi	1987	7	1	8.961	-4.111	5.450	8.323
Mississippi	1988	8	1	9.053	-4.067	5.438	8.332
Mississippi	1989	9	1	9.093	-4.044	5.394	8.342
Mississippi	1990	10	1	9.155	-4.042	5.372	8.350
Mississippi	1991	11	1	9.170	-4.053	5.470	8.358
Mississippi	1992	12	1	9.216	-4.061	5.156	8.371
Mississippi	1993	13	1	9.229	-4.041	5.222	8.378
Mississippi	1994	14	1	9.280	-4.004	5.374	8.384
Mississippi	1995	15	1	9.304	-3.963	5.493	8.389
Mississippi	1996	16	1	9.331	-3.938	5.537	8.402
Mississippi	1997	17	1	9.353	-3.943	5.604	8.421
Mississippi	1998	18	1	9.428	-3.935	5.761	8.447
Mississippi	1999	19	1	9.441	-3.905	5.851	8.473
Mississippi	2000	20	1	9.431	-3.904	5.910	8.487
Missouri	1981	1	1	8.872	-3.582	4.910	8.181
Missouri	1982	2	1	8.868	-3.611	4.945	8.171
Missouri	1983	3	1	8.908	-3.618	5.167	8.160
Missouri	1984	4	1	8.955	-3.595	5.345	8.147
Missouri	1985	5	1	8.969	-3.582	5.320	8.137
Missouri	1986	6	1	9.021	-3.579	5.440	8.135
Missouri	1987	7	1	9.057	-3.567	5.588	8.132
Missouri	1988	8	1	9.101	-3.538	5.722	8.126
Missouri	1989	9	1	9.152	-3.512	5.548	8.129
Missouri	1990	10	1	9.203	-3.505	5.493	8.123
Missouri	1991	11	1	9.199	-3.522	5.628	8.118
Missouri	1992	12	1	9.235	-3.537	5.542	8.116
Missouri	1993	13	1	9.256	-3.539	5.601	8.118
Missouri	1994	14	1	9.292	-3.523	5.733	8.121
Missouri	1995	15	1	9.319	-3.519	5.806	8.133
Missouri	1996	16	1	9.341	-3.512	5.878	8.147
Missouri	1997	17	1	9.363	-3.487	6.032	8.166
Missouri	1998	18	1	9.382	-3.475	6.182	8.194
Missouri	1999	19	1	9.410	-3.458	6.154	8.216
Missouri	2000	20	1	9.390	-3.445	6.213	8.226
Montana	1981	1	1	9.083	-3.561	5.458	9.505
Montana	1982	2	1	9.023	-3.597	5.412	9.485
Montana	1983	3	1	9.085	-3.689	5.567	9.462
Montana	1984	4	1	9.105	-3.676	5.706	9.448
Montana	1985	5	1	9.101	-3.681	5.699	9.441
Montana	1986	6	1	9.160	-3.687	5.765	9.450
Montana	1987	7	1	9.213	-3.719	5.691	9.461
Montana	1988	8	1	9.227	-3.712	5.799	9.463
Montana	1989	9	1	9.242	-3.688	5.646	9.458

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Montana	1990	10	1	9.251	-3.684	5.706	9.450
Montana	1991	11	1	9.239	-3.685	5.659	9.440
Montana	1992	12	1	9.246	-3.710	5.837	9.423
Montana	1993	13	1	9.246	-3.725	5.935	9.403
Montana	1994	14	1	9.275	-3.721	6.218	9.387
Montana	1995	15	1	9.294	-3.729	6.255	9.373
Montana	1996	16	1	9.285	-3.742	6.197	9.368
Montana	1997	17	1	9.277	-3.727	6.287	9.373
Montana	1998	18	1	9.297	-3.699	6.427	9.380
Montana	1999	19	1	9.318	-3.687	6.435	9.383
Montana	2000	20	1	9.300	-3.709	6.445	9.373
Nebraska	1981	1	1	8.894	-3.506	5.486	9.115
Nebraska	1982	2	1	8.886	-3.569	5.421	9.100
Nebraska	1983	3	1	8.893	-3.603	5.562	9.087
Nebraska	1984	4	1	8.927	-3.604	5.668	9.075
Nebraska	1985	5	1	8.937	-3.587	5.636	9.069
Nebraska	1986	6	1	8.990	-3.608	5.805	9.069
Nebraska	1987	7	1	9.031	-3.595	5.796	9.068
Nebraska	1988	8	1	9.052	-3.568	6.005	9.057
Nebraska	1989	9	1	9.077	-3.544	5.787	9.052
Nebraska	1990	10	1	9.086	-3.531	5.819	9.045
Nebraska	1991	11	1	9.089	-3.513	6.021	9.039
Nebraska	1992	12	1	9.119	-3.526	6.177	9.034
Nebraska	1993	13	1	9.123	-3.528	6.309	9.030
Nebraska	1994	14	1	9.163	-3.511	6.634	9.028
Nebraska	1995	15	1	9.176	-3.496	6.694	9.021
Nebraska	1996	16	1	9.196	-3.492	6.671	9.020
Nebraska	1997	17	1	9.241	-3.432	6.746	9.024
Nebraska	1998	18	1	9.266	-3.391	6.898	9.032
Nebraska	1999	19	1	9.288	-3.358	6.963	9.036
Nebraska	2000	20	1	9.264	-3.382	6.956	9.022
Nevada	1981	1	1	8.947	-3.520	5.076	8.939
Nevada	1982	2	1	8.892	-3.566	4.991	8.896
Nevada	1983	3	1	8.938	-3.605	5.275	8.871
Nevada	1984	4	1	8.978	-3.614	5.420	8.846
Nevada	1985	5	1	8.982	-3.628	5.300	8.816
Nevada	1986	6	1	9.005	-3.610	5.379	8.791
Nevada	1987	7	1	9.012	-3.606	5.423	8.756
Nevada	1988	8	1	9.031	-3.611	5.715	8.709
Nevada	1989	9	1	9.019	-3.615	5.531	8.660
Nevada	1990	10	1	9.033	-3.633	5.333	8.604
Nevada	1991	11	1	9.009	-3.669	5.274	8.561
Nevada	1992	12	1	9.011	-3.697	5.606	8.527
Nevada	1993	13	1	9.039	-3.675	5.712	8.502
Nevada	1994	14	1	9.098	-3.641	5.746	8.463
Nevada	1995	15	1	9.122	-3.632	5.984	8.443
Nevada	1996	16	1	9.212	-3.621	6.148	8.429

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Nevada	1997	17	1	9.183	-3.603	6.313	8.408
Nevada	1998	18	1	9.202	-3.589	6.337	8.390
Nevada	1999	19	1	9.171	-3.549	6.369	8.373
Nevada	2000	20	1	9.075	-3.580	6.307	8.302
New Hampshire	1981	1	1	8.856	-4.175	3.946	7.733
New Hampshire	1982	2	1	8.903	-4.169	4.009	7.715
New Hampshire	1983	3	1	8.922	-4.156	4.191	7.720
New Hampshire	1984	4	1	8.918	-4.139	4.365	7.706
New Hampshire	1985	5	1	8.931	-4.147	4.384	7.691
New Hampshire	1986	6	1	8.952	-4.129	4.556	7.675
New Hampshire	1987	7	1	9.070	-4.112	4.586	7.659
New Hampshire	1988	8	1	9.088	-4.076	4.559	7.649
New Hampshire	1989	9	1	9.093	-4.105	4.538	7.646
New Hampshire	1990	10	1	9.089	-4.128	4.501	7.669
New Hampshire	1991	11	1	9.102	-4.180	4.522	7.692
New Hampshire	1992	12	1	9.110	-4.167	4.647	7.701
New Hampshire	1993	13	1	9.128	-4.129	4.732	7.714
New Hampshire	1994	14	1	9.134	-4.089	4.826	7.754
New Hampshire	1995	15	1	9.137	-4.074	4.932	7.763
New Hampshire	1996	16	1	9.155	-4.100	5.019	7.785
New Hampshire	1997	17	1	9.164	-4.105	5.202	7.801
New Hampshire	1998	18	1	9.186	-4.060	5.428	7.823
New Hampshire	1999	19	1	9.201	-4.024	5.547	7.840
New Hampshire	2000	20	1	9.179	-4.035	5.599	7.846
New Jersey	1981	1	1	8.844	-3.630	4.234	6.511
New Jersey	1982	2	1	8.852	-3.650	4.256	6.523
New Jersey	1983	3	1	8.853	-3.629	4.569	6.542
New Jersey	1984	4	1	8.848	-3.554	4.793	6.549
New Jersey	1985	5	1	8.849	-3.533	4.917	6.582
New Jersey	1986	6	1	8.895	-3.517	5.126	6.645
New Jersey	1987	7	1	8.915	-3.491	5.249	6.736
New Jersey	1988	8	1	8.937	-3.482	5.386	6.838
New Jersey	1989	9	1	8.956	-3.490	5.396	6.897
New Jersey	1990	10	1	8.935	-3.509	5.331	6.976
New Jersey	1991	11	1	8.938	-3.530	5.361	7.037
New Jersey	1992	12	1	8.935	-3.535	5.391	7.078
New Jersey	1993	13	1	8.934	-3.510	5.404	7.183
New Jersey	1994	14	1	8.941	-3.483	5.509	7.252
New Jersey	1995	15	1	8.944	-3.470	5.669	7.310
New Jersey	1996	16	1	8.960	-3.467	5.817	7.354
New Jersey	1997	17	1	8.970	-3.448	5.979	7.393
New Jersey	1998	18	1	8.983	-3.433	6.124	7.436
New Jersey	1999	19	1	8.993	-3.412	6.170	7.459
New Jersey	2000	20	1	8.987	-3.432	6.199	7.505
New Mexico	1981	1	1	9.060	-3.821	5.003	8.709
New Mexico	1982	2	1	9.070	-3.822	4.984	8.684
New Mexico	1983	3	1	9.033	-3.857	5.242	8.662

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
New Mexico	1984	4	1	9.116	-3.857	5.366	8.648
New Mexico	1985	5	1	9.130	-3.870	5.279	8.635
New Mexico	1986	6	1	9.105	-3.907	5.427	8.621
New Mexico	1987	7	1	9.232	-3.939	5.430	8.618
New Mexico	1988	8	1	9.235	-3.941	5.637	8.616
New Mexico	1989	9	1	9.262	-3.952	5.438	8.618
New Mexico	1990	10	1	9.271	-3.954	5.380	8.621
New Mexico	1991	11	1	9.291	-3.986	5.672	8.615
New Mexico	1992	12	1	9.365	-4.004	5.275	8.606
New Mexico	1993	13	1	9.370	-4.013	5.390	8.597
New Mexico	1994	14	1	9.424	-4.017	5.534	8.594
New Mexico	1995	15	1	9.439	-3.994	5.574	8.587
New Mexico	1996	16	1	9.442	-3.989	5.597	8.587
New Mexico	1997	17	1	9.452	-3.984	5.671	8.583
New Mexico	1998	18	1	9.457	-3.940	5.806	8.597
New Mexico	1999	19	1	9.461	-3.892	5.847	8.605
New Mexico	2000	20	1	9.433	-3.900	5.867	8.584
New York	1981	1	1	8.413	-3.711	4.283	6.833
New York	1982	2	1	8.428	-3.730	4.192	6.841
New York	1983	3	1	8.463	-3.773	4.353	6.859
New York	1984	4	1	8.501	-3.747	4.584	6.876
New York	1985	5	1	8.535	-3.756	4.563	6.889
New York	1986	6	1	8.578	-3.792	4.724	6.914
New York	1987	7	1	8.610	-3.786	4.872	6.947
New York	1988	8	1	8.662	-3.770	4.934	6.982
New York	1989	9	1	8.682	-3.774	4.861	7.011
New York	1990	10	1	8.689	-3.730	4.810	7.062
New York	1991	11	1	8.695	-3.766	4.889	7.111
New York	1992	12	1	8.712	-3.812	4.961	7.149
New York	1993	13	1	8.730	-3.810	4.990	7.182
New York	1994	14	1	8.736	-3.811	4.978	7.253
New York	1995	15	1	8.755	-3.810	5.172	7.323
New York	1996	16	1	8.786	-3.806	5.286	7.388
New York	1997	17	1	8.803	-3.796	5.457	7.446
New York	1998	18	1	8.824	-3.784	5.662	7.507
New York	1999	19	1	8.847	-3.766	5.655	7.554
New York	2000	20	1	8.824	-3.783	5.641	7.583
North Carolina	1981	1	1	8.862	-3.932	4.008	7.746
North Carolina	1982	2	1	8.876	-3.961	4.072	7.737
North Carolina	1983	3	1	8.911	-3.920	4.366	7.726
North Carolina	1984	4	1	8.964	-3.885	4.557	7.713
North Carolina	1985	5	1	8.985	-3.869	4.598	7.696
North Carolina	1986	6	1	9.032	-3.856	4.781	7.692
North Carolina	1987	7	1	9.051	-3.816	4.938	7.688
North Carolina	1988	8	1	9.098	-3.780	5.101	7.691
North Carolina	1989	9	1	9.141	-3.772	5.021	7.694
North Carolina	1990	10	1	9.151	-3.777	4.960	7.696

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
North Carolina	1991	11	1	9.171	-3.784	5.001	7.707
North Carolina	1992	12	1	9.199	-3.793	4.960	7.729
North Carolina	1993	13	1	9.211	-3.786	5.162	7.744
North Carolina	1994	14	1	9.229	-3.777	5.220	7.757
North Carolina	1995	15	1	9.267	-3.774	5.377	7.773
North Carolina	1996	16	1	9.287	-3.772	5.463	7.785
North Carolina	1997	17	1	9.308	-3.774	5.664	7.804
North Carolina	1998	18	1	9.333	-3.782	5.822	7.829
North Carolina	1999	19	1	9.348	-3.770	5.863	7.849
North Carolina	2000	20	1	9.312	-3.791	5.716	7.835
North Dakota	1981	1	1	9.001	-3.647	5.196	9.872
North Dakota	1982	2	1	8.968	-3.688	5.381	9.844
North Dakota	1983	3	1	8.978	-3.737	5.477	9.818
North Dakota	1984	4	1	8.975	-3.725	5.482	9.801
North Dakota	1985	5	1	9.017	-3.717	5.383	9.793
North Dakota	1986	6	1	9.037	-3.733	5.332	9.794
North Dakota	1987	7	1	9.059	-3.704	5.422	9.795
North Dakota	1988	8	1	9.082	-3.668	5.391	9.793
North Dakota	1989	9	1	9.110	-3.638	5.464	9.797
North Dakota	1990	10	1	9.135	-3.617	5.520	9.801
North Dakota	1991	11	1	9.147	-3.609	5.680	9.796
North Dakota	1992	12	1	9.165	-3.593	5.805	9.789
North Dakota	1993	13	1	9.176	-3.565	5.926	9.778
North Dakota	1994	14	1	9.201	-3.543	6.250	9.768
North Dakota	1995	15	1	9.230	-3.550	6.325	9.762
North Dakota	1996	16	1	9.258	-3.555	6.250	9.757
North Dakota	1997	17	1	9.316	-3.570	6.354	9.758
North Dakota	1998	18	1	9.350	-3.567	6.572	9.766
North Dakota	1999	19	1	9.347	-3.536	6.516	9.773
North Dakota	2000	20	1	9.329	-3.525	6.656	9.765
Ohio	1981	1	1	8.802	-3.905	4.617	7.332
Ohio	1982	2	1	8.805	-3.951	4.517	7.333
Ohio	1983	3	1	8.827	-3.991	4.702	7.339
Ohio	1984	4	1	8.850	-3.964	4.831	7.343
Ohio	1985	5	1	8.859	-3.970	4.834	7.348
Ohio	1986	6	1	8.882	-3.966	4.971	7.366
Ohio	1987	7	1	8.903	-3.947	5.056	7.378
Ohio	1988	8	1	8.935	-3.930	5.178	7.394
Ohio	1989	9	1	8.961	-3.913	5.134	7.412
Ohio	1990	10	1	9.037	-3.905	5.193	7.423
Ohio	1991	11	1	9.049	-3.941	5.188	7.439
Ohio	1992	12	1	9.065	-3.944	5.237	7.469
Ohio	1993	13	1	9.070	-3.940	5.356	7.484
Ohio	1994	14	1	9.087	-3.910	5.483	7.504
Ohio	1995	15	1	9.109	-3.885	5.623	7.526
Ohio	1996	16	1	9.129	-3.877	5.709	7.560
Ohio	1997	17	1	9.132	-3.867	5.846	7.596

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Ohio	1998	18	1	9.142	-3.838	5.974	7.641
Ohio	1999	19	1	9.145	-3.821	6.030	7.684
Ohio	2000	20	1	9.140	-3.815	5.990	7.727
Oklahoma	1981	1	1	9.137	-3.787	4.897	8.572
Oklahoma	1982	2	1	9.144	-3.812	4.868	8.527
Oklahoma	1983	3	1	9.103	-3.905	4.963	8.494
Oklahoma	1984	4	1	9.152	-3.903	4.991	8.489
Oklahoma	1985	5	1	9.162	-3.923	4.936	8.484
Oklahoma	1986	6	1	9.157	-3.926	5.054	8.485
Oklahoma	1987	7	1	9.195	-3.928	5.186	8.498
Oklahoma	1988	8	1	9.233	-3.907	5.285	8.510
Oklahoma	1989	9	1	9.252	-3.872	5.148	8.517
Oklahoma	1990	10	1	9.262	-3.825	5.132	8.518
Oklahoma	1991	11	1	9.289	-3.806	5.203	8.519
Oklahoma	1992	12	1	9.302	-3.815	5.272	8.518
Oklahoma	1993	13	1	9.306	-3.798	5.352	8.511
Oklahoma	1994	14	1	9.302	-3.798	5.523	8.503
Oklahoma	1995	15	1	9.375	-3.787	5.586	8.494
Oklahoma	1996	16	1	9.391	-3.751	5.659	8.487
Oklahoma	1997	17	1	9.433	-3.735	5.779	8.485
Oklahoma	1998	18	1	9.440	-3.707	5.922	8.481
Oklahoma	1999	19	1	9.448	-3.710	5.998	8.482
Oklahoma	2000	20	1	9.438	-3.688	6.035	8.468
Oregon	1981	1	1	8.898	-3.804	4.584	8.822
Oregon	1982	2	1	8.892	-3.849	4.554	8.815
Oregon	1983	3	1	8.927	-3.869	4.809	8.811
Oregon	1984	4	1	8.969	-3.844	4.987	8.798
Oregon	1985	5	1	8.991	-3.842	5.015	8.787
Oregon	1986	6	1	9.045	-3.849	5.165	8.778
Oregon	1987	7	1	9.064	-3.833	5.230	8.767
Oregon	1988	8	1	9.126	-3.814	5.404	8.750
Oregon	1989	9	1	9.133	-3.789	5.372	8.731
Oregon	1990	10	1	9.144	-3.791	5.350	8.708
Oregon	1991	11	1	9.086	-3.801	5.402	8.687
Oregon	1992	12	1	9.147	-3.812	5.337	8.672
Oregon	1993	13	1	9.187	-3.817	5.442	8.658
Oregon	1994	14	1	9.163	-3.804	5.599	8.642
Oregon	1995	15	1	9.165	-3.786	5.657	8.629
Oregon	1996	16	1	9.158	-3.772	5.746	8.616
Oregon	1997	17	1	9.205	-3.766	5.897	8.608
Oregon	1998	18	1	9.226	-3.763	5.996	8.603
Oregon	1999	19	1	9.255	-3.754	6.056	8.600
Oregon	2000	20	1	9.230	-3.760	6.041	8.575
Pennsylvania	1981	1	1	8.705	-3.826	4.583	7.297
Pennsylvania	1982	2	1	8.703	-3.862	4.488	7.299
Pennsylvania	1983	3	1	8.717	-3.900	4.684	7.315
Pennsylvania	1984	4	1	8.746	-3.879	4.845	7.329

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Pennsylvania	1985	5	1	8.765	-3.890	4.845	7.347
Pennsylvania	1986	6	1	8.793	-3.896	5.014	7.378
Pennsylvania	1987	7	1	8.803	-3.867	5.083	7.417
Pennsylvania	1988	8	1	8.833	-3.845	5.143	7.459
Pennsylvania	1989	9	1	8.851	-3.834	5.123	7.500
Pennsylvania	1990	10	1	8.883	-3.802	5.151	7.535
Pennsylvania	1991	11	1	8.897	-3.816	5.174	7.569
Pennsylvania	1992	12	1	8.915	-3.825	5.180	7.605
Pennsylvania	1993	13	1	8.929	-3.803	5.263	7.635
Pennsylvania	1994	14	1	8.945	-3.787	5.325	7.667
Pennsylvania	1995	15	1	8.968	-3.788	5.506	7.707
Pennsylvania	1996	16	1	8.991	-3.784	5.590	7.743
Pennsylvania	1997	17	1	9.007	-3.761	5.769	7.778
Pennsylvania	1998	18	1	9.027	-3.734	5.972	7.828
Pennsylvania	1999	19	1	9.048	-3.709	5.965	7.859
Pennsylvania	2000	20	1	9.028	-3.706	5.923	7.882
Rhode Island	1981	1	1	8.674	-4.288	3.283	6.908
Rhode Island	1982	2	1	8.731	-4.277	3.204	6.911
Rhode Island	1983	3	1	8.644	-4.279	3.444	6.923
Rhode Island	1984	4	1	8.642	-4.266	3.739	6.939
Rhode Island	1985	5	1	8.701	-4.242	3.837	6.978
Rhode Island	1986	6	1	8.622	-4.206	4.075	7.037
Rhode Island	1987	7	1	8.710	-4.151	4.180	7.099
Rhode Island	1988	8	1	8.678	-4.157	4.131	7.172
Rhode Island	1989	9	1	8.815	-4.168	4.104	7.255
Rhode Island	1990	10	1	8.900	-4.158	3.889	7.259
Rhode Island	1991	11	1	8.871	-4.247	3.733	7.251
Rhode Island	1992	12	1	8.930	-4.252	3.713	7.349
Rhode Island	1993	13	1	8.888	-4.240	4.074	7.385
Rhode Island	1994	14	1	8.874	-4.197	4.139	7.501
Rhode Island	1995	15	1	8.850	-4.199	4.336	7.622
Rhode Island	1996	16	1	8.883	-4.183	4.519	7.710
Rhode Island	1997	17	1	8.877	-4.159	4.980	7.749
Rhode Island	1998	18	1	8.997	-4.116	5.289	7.789
Rhode Island	1999	19	1	9.031	-4.106	5.276	7.824
Rhode Island	2000	20	1	8.982	-4.135	5.240	7.816
South Carolina	1981	1	1	8.889	-4.077	3.805	7.982
South Carolina	1982	2	1	8.929	-4.092	3.789	7.965
South Carolina	1983	3	1	8.952	-4.093	4.027	7.951
South Carolina	1984	4	1	8.979	-4.080	4.161	7.935
South Carolina	1985	5	1	8.997	-4.077	4.212	7.922
South Carolina	1986	6	1	9.042	-4.082	4.373	7.911
South Carolina	1987	7	1	9.098	-4.048	4.508	7.906
South Carolina	1988	8	1	9.139	-4.003	4.654	7.907
South Carolina	1989	9	1	9.157	-3.988	4.592	7.903
South Carolina	1990	10	1	9.193	-3.957	4.651	7.894
South Carolina	1991	11	1	9.178	-3.991	4.816	7.892

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
South Carolina	1992	12	1	9.183	-4.013	4.703	7.897
South Carolina	1993	13	1	9.204	-3.995	4.845	7.902
South Carolina	1994	14	1	9.226	-3.974	4.987	7.913
South Carolina	1995	15	1	9.256	-3.944	5.105	7.923
South Carolina	1996	16	1	9.272	-3.927	5.213	7.932
South Carolina	1997	17	1	9.297	-3.918	5.365	7.943
South Carolina	1998	18	1	9.319	-3.918	5.543	7.963
South Carolina	1999	19	1	9.338	-3.768	5.584	7.976
South Carolina	2000	20	1	9.334	-3.744	5.593	7.980
South Dakota	1981	1	1	9.080	-3.987	5.228	9.667
South Dakota	1982	2	1	9.128	-4.009	5.268	9.653
South Dakota	1983	3	1	9.118	-4.033	5.347	9.637
South Dakota	1984	4	1	9.125	-4.036	5.452	9.620
South Dakota	1985	5	1	9.104	-4.005	5.422	9.607
South Dakota	1986	6	1	9.101	-4.099	5.487	9.602
South Dakota	1987	7	1	9.130	-4.083	5.487	9.593
South Dakota	1988	8	1	9.159	-3.945	5.544	9.581
South Dakota	1989	9	1	9.172	-3.941	5.565	9.578
South Dakota	1990	10	1	9.214	-3.956	5.606	9.572
South Dakota	1991	11	1	9.166	-3.939	5.710	9.562
South Dakota	1992	12	1	9.229	-3.883	5.677	9.547
South Dakota	1993	13	1	9.245	-3.870	5.778	9.538
South Dakota	1994	14	1	9.264	-3.841	5.923	9.527
South Dakota	1995	15	1	9.262	-3.818	5.925	9.521
South Dakota	1996	16	1	9.278	-3.801	5.911	9.518
South Dakota	1997	17	1	9.293	-3.802	5.994	9.520
South Dakota	1998	18	1	9.313	-3.788	6.280	9.525
South Dakota	1999	19	1	9.328	-3.777	6.385	9.525
South Dakota	2000	20	1	9.320	-3.793	6.424	9.506
Tennessee	1981	1	1	8.923	-3.977	4.565	7.898
Tennessee	1982	2	1	8.921	-4.013	4.555	7.898
Tennessee	1983	3	1	8.960	-4.020	4.958	7.898
Tennessee	1984	4	1	8.961	-3.963	5.236	7.900
Tennessee	1985	5	1	8.949	-3.926	5.208	7.895
Tennessee	1986	6	1	9.029	-3.883	5.420	7.900
Tennessee	1987	7	1	9.083	-3.834	5.612	7.904
Tennessee	1988	8	1	9.123	-3.788	5.691	7.909
Tennessee	1989	9	1	9.149	-3.736	5.444	7.919
Tennessee	1990	10	1	9.164	-3.738	5.377	7.927
Tennessee	1991	11	1	9.165	-3.741	5.520	7.939
Tennessee	1992	12	1	9.207	-3.728	5.632	7.950
Tennessee	1993	13	1	9.235	-3.692	5.892	7.963
Tennessee	1994	14	1	9.265	-3.654	6.045	7.971
Tennessee	1995	15	1	9.280	-3.633	6.029	7.981
Tennessee	1996	16	1	9.305	-3.601	6.135	7.994
Tennessee	1997	17	1	9.328	-3.574	6.313	8.013
Tennessee	1998	18	1	9.351	-3.510	6.377	8.036

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Tennessee	1999	19	1	9.377	-3.458	6.468	8.063
Tennessee	2000	20	1	9.352	-3.465	6.493	8.059
Texas	1981	1	1	9.000	-3.652	5.222	7.900
Texas	1982	2	1	9.008	-3.683	5.233	7.867
Texas	1983	3	1	9.033	-3.762	5.318	7.844
Texas	1984	4	1	9.060	-3.757	5.331	7.833
Texas	1985	5	1	9.083	-3.755	5.273	7.817
Texas	1986	6	1	9.100	-3.790	5.257	7.803
Texas	1987	7	1	9.116	-3.773	5.387	7.824
Texas	1988	8	1	9.147	-3.757	5.509	7.845
Texas	1989	9	1	9.158	-3.727	5.491	7.865
Texas	1990	10	1	9.125	-3.697	5.478	7.878
Texas	1991	11	1	9.122	-3.689	5.677	7.885
Texas	1992	12	1	9.133	-3.709	5.733	7.891
Texas	1993	13	1	9.139	-3.712	5.792	7.892
Texas	1994	14	1	9.182	-3.689	5.930	7.899
Texas	1995	15	1	9.179	-3.671	6.013	7.905
Texas	1996	16	1	9.185	-3.658	6.209	7.912
Texas	1997	17	1	9.237	-3.630	6.298	7.929
Texas	1998	18	1	9.254	-3.590	6.419	7.940
Texas	1999	19	1	9.261	-3.571	6.477	7.933
Texas	2000	20	1	9.259	-3.571	6.517	7.916
Utah	1981	1	1	8.865	-3.791	4.796	8.428
Utah	1982	2	1	8.855	-3.783	4.764	8.400
Utah	1983	3	1	8.859	-3.792	4.934	8.374
Utah	1984	4	1	8.880	-3.799	5.074	8.361
Utah	1985	5	1	8.899	-3.793	5.034	8.353
Utah	1986	6	1	8.904	-3.789	5.144	8.355
Utah	1987	7	1	8.930	-3.794	5.217	8.355
Utah	1988	8	1	8.968	-3.760	5.440	8.356
Utah	1989	9	1	9.007	-3.732	5.368	8.360
Utah	1990	10	1	9.044	-3.712	5.275	8.367
Utah	1991	11	1	9.069	-3.733	5.173	8.353
Utah	1992	12	1	9.100	-3.723	5.169	8.334
Utah	1993	13	1	9.115	-3.684	5.422	8.315
Utah	1994	14	1	9.145	-3.667	5.599	8.301
Utah	1995	15	1	9.159	-3.647	5.826	8.291
Utah	1996	16	1	9.176	-3.625	5.959	8.286
Utah	1997	17	1	9.200	-3.607	6.136	8.285
Utah	1998	18	1	9.223	-3.582	6.174	8.332
Utah	1999	19	1	9.245	-3.580	6.202	8.401
Utah	2000	20	1	9.218	-3.606	6.141	8.426
Vermont	1981	1	1	8.914	-4.090	4.323	8.310
Vermont	1982	2	1	8.942	-4.093	4.301	8.304
Vermont	1983	3	1	8.979	-4.089	4.586	8.303
Vermont	1984	4	1	9.029	-4.058	4.740	8.295
Vermont	1985	5	1	9.088	-4.030	4.782	8.286

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Vermont	1986	6	1	9.099	-4.012	4.884	8.283
Vermont	1987	7	1	9.141	-3.983	4.854	8.290
Vermont	1988	8	1	9.220	-3.948	4.943	8.282
Vermont	1989	9	1	9.243	-3.990	4.820	8.279
Vermont	1990	10	1	9.244	-3.936	4.758	8.272
Vermont	1991	11	1	9.245	-3.958	4.786	8.275
Vermont	1992	12	1	9.265	-3.963	4.852	8.293
Vermont	1993	13	1	9.251	-3.928	4.936	8.313
Vermont	1994	14	1	9.271	-3.916	4.928	8.329
Vermont	1995	15	1	9.273	-3.893	5.061	8.331
Vermont	1996	16	1	9.294	-3.875	5.202	8.341
Vermont	1997	17	1	9.304	-3.870	5.375	8.351
Vermont	1998	18	1	9.321	-3.858	5.510	8.371
Vermont	1999	19	1	9.356	-3.878	5.651	8.384
Vermont	2000	20	1	9.321	-3.897	5.695	8.389
Virginia	1981	1	1	8.910	-3.835	4.259	7.491
Virginia	1982	2	1	8.928	-3.832	4.244	7.493
Virginia	1983	3	1	8.936	-3.833	4.482	7.490
Virginia	1984	4	1	8.973	-3.793	4.678	7.494
Virginia	1985	5	1	9.034	-3.768	4.661	7.492
Virginia	1986	6	1	9.094	-3.747	4.819	7.500
Virginia	1987	7	1	9.132	-3.728	4.998	7.520
Virginia	1988	8	1	9.161	-3.725	5.230	7.550
Virginia	1989	9	1	9.179	-3.728	4.985	7.583
Virginia	1990	10	1	9.178	-3.727	4.934	7.613
Virginia	1991	11	1	9.182	-3.751	5.172	7.652
Virginia	1992	12	1	9.204	-3.771	5.067	7.683
Virginia	1993	13	1	9.222	-3.767	5.263	7.697
Virginia	1994	14	1	9.244	-3.763	5.353	7.709
Virginia	1995	15	1	9.266	-3.741	5.509	7.732
Virginia	1996	16	1	9.278	-3.716	5.676	7.760
Virginia	1997	17	1	9.254	-3.694	5.828	7.792
Virginia	1998	18	1	9.280	-3.673	5.921	7.832
Virginia	1999	19	1	9.283	-3.651	5.934	7.862
Virginia	2000	20	1	9.262	-3.639	5.885	7.886
Washington	1981	1	1	8.874	-3.849	4.382	7.983
Washington	1982	2	1	8.897	-3.873	4.340	7.972
Washington	1983	3	1	9.037	-3.890	4.580	7.976
Washington	1984	4	1	8.973	-3.867	4.733	7.976
Washington	1985	5	1	8.963	-3.851	4.725	7.972
Washington	1986	6	1	8.998	-3.834	4.816	7.977
Washington	1987	7	1	9.048	-3.829	5.012	7.977
Washington	1988	8	1	9.106	-3.818	5.190	7.971
Washington	1989	9	1	9.117	-3.781	5.220	7.964
Washington	1990	10	1	9.118	-3.770	5.224	7.946
Washington	1991	11	1	9.134	-3.802	5.269	7.944
Washington	1992	12	1	9.171	-3.812	5.268	7.941

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Washington	1993	13	1	9.082	-3.828	5.382	7.941
Washington	1994	14	1	9.093	-3.825	5.567	7.957
Washington	1995	15	1	9.113	-3.816	5.540	7.972
Washington	1996	16	1	9.101	-3.786	5.757	7.997
Washington	1997	17	1	9.117	-3.740	5.856	8.016
Washington	1998	18	1	9.119	-3.736	5.936	8.041
Washington	1999	19	1	9.122	-3.718	5.989	8.057
Washington	2000	20	1	9.107	-3.698	5.978	8.064
West Virginia	1981	1	1	8.583	-3.842	4.205	7.894
West Virginia	1982	2	1	8.632	-3.845	4.163	7.923
West Virginia	1983	3	1	8.702	-3.898	4.372	7.957
West Virginia	1984	4	1	8.791	-3.892	4.475	7.982
West Virginia	1985	5	1	8.801	-3.911	4.464	8.005
West Virginia	1986	6	1	8.854	-3.933	4.637	8.052
West Virginia	1987	7	1	8.909	-3.932	4.748	8.094
West Virginia	1988	8	1	8.934	-3.913	5.004	8.135
West Virginia	1989	9	1	9.020	-3.899	4.793	8.166
West Virginia	1990	10	1	9.060	-3.861	4.947	8.177
West Virginia	1991	11	1	9.095	-3.864	5.220	8.187
West Virginia	1992	12	1	9.119	-3.854	5.214	8.217
West Virginia	1993	13	1	9.131	-3.846	5.286	8.241
West Virginia	1994	14	1	9.150	-3.819	5.444	8.284
West Virginia	1995	15	1	9.166	-3.814	5.515	8.325
West Virginia	1996	16	1	9.183	-3.835	5.614	8.372
West Virginia	1997	17	1	9.220	-3.844	5.663	8.435
West Virginia	1998	18	1	9.240	-3.853	5.745	8.482
West Virginia	1999	19	1	9.262	-3.860	5.730	8.527
West Virginia	2000	20	1	9.273	-3.878	5.749	8.576
Wisconsin	1981	1	1	8.869	-3.936	4.551	8.124
Wisconsin	1982	2	1	8.844	-3.968	4.553	8.113
Wisconsin	1983	3	1	8.885	-3.981	4.754	8.107
Wisconsin	1984	4	1	8.924	-3.942	4.917	8.102
Wisconsin	1985	5	1	8.952	-3.920	4.947	8.096
Wisconsin	1986	6	1	8.997	-3.927	5.105	8.091
Wisconsin	1987	7	1	9.038	-3.917	5.110	8.088
Wisconsin	1988	8	1	9.083	-3.902	5.209	8.082
Wisconsin	1989	9	1	9.091	-3.868	5.170	8.080
Wisconsin	1990	10	1	9.109	-3.831	5.188	8.081
Wisconsin	1991	11	1	9.125	-3.826	5.240	8.081
Wisconsin	1992	12	1	9.161	-3.817	5.308	8.089
Wisconsin	1993	13	1	9.183	-3.794	5.434	8.100
Wisconsin	1994	14	1	9.197	-3.782	5.520	8.114
Wisconsin	1995	15	1	9.211	-3.756	5.641	8.127
Wisconsin	1996	16	1	9.230	-3.749	5.717	8.142
Wisconsin	1997	17	1	9.255	-3.736	5.898	8.156
Wisconsin	1998	18	1	9.292	-3.715	6.061	8.176
Wisconsin	1999	19	1	9.292	-3.690	6.096	8.194

Table B.1 Data Set for Elasticity Estimation

State	Year	Technology	Intercept	Ytrans	Labor	Gsptrans	Hicap
Wisconsin	2000	20	1	9.274	-3.695	6.143	8.202
Wyoming	1981	1	1	9.270	-3.291	6.320	9.304
Wyoming	1982	2	1	9.252	-3.350	6.218	9.274
Wyoming	1983	3	1	9.202	-3.446	6.349	9.268
Wyoming	1984	4	1	9.226	-3.461	6.432	9.285
Wyoming	1985	5	1	9.288	-3.505	6.385	9.299
Wyoming	1986	6	1	9.291	-3.569	6.478	9.321
Wyoming	1987	7	1	9.328	-3.577	6.375	9.370
Wyoming	1988	8	1	9.406	-3.529	6.677	9.403
Wyoming	1989	9	1	9.437	-3.468	6.302	9.424
Wyoming	1990	10	1	9.462	-3.443	6.330	9.443
Wyoming	1991	11	1	9.481	-3.448	6.804	9.448
Wyoming	1992	12	1	9.504	-3.471	6.830	9.457
Wyoming	1993	13	1	9.577	-3.475	6.912	9.453
Wyoming	1994	14	1	9.553	-3.525	7.065	9.448
Wyoming	1995	15	1	9.597	-3.553	7.177	9.453
Wyoming	1996	16	1	9.638	-3.539	7.197	9.460
Wyoming	1997	17	1	9.667	-3.541	7.262	9.473
Wyoming	1998	18	1	9.725	-3.538	7.312	9.489
Wyoming	1999	19	1	9.696	-3.509	7.391	9.509
Wyoming	2000	20	1	9.703	-3.533	7.376	9.507

APPENDIX C
GAMS PROGRAM FOR THE OKLAHOMA CGE MODEL

```
$TITLE REGIONAL CGE MODEL FOR OKLAHOMA (1993)
$OFFSYMLIST OFFSYMXREF OFFUPPER

SETS
i     sectors /Agr  agriculture
              Min  mining
              Man  manufacturing
              Ser  services/
ag(i)  agricultural sectors    /AGR/
nag(i)  nonagricultural sectors /MIN, MAN/
srv(i)  service sector /SER/
f      factors /L labor, K capital, T land/
fl(f)   factors not land /L, K/

ALIAS(i,j);


*####-- DECLARATION OF BASE YEAR VARIABLES (AS PARAMETERS)

PARAMETERS

*@Price block
      PL0     wage rate
      PLROC0  wage rate rest of country
      PKROC0  cap rate rest of country
      PK0(i)  cap rate
      PT0(ag) land rent
      PE0(i)  export price
      PM0(i)  import price
      PR0(i)  reg price
      P0(i)   comoposite price
      PN0     net output price or value added price of sector i
      PX0(i)  composite price face for producers

*@Production block
      L0(i)   labor demand
      LS0     labor supply by housholds
      TLS0    total labor supply
      LHHH0   labor employed by household group
      LGOV0   labor employed by government
      K0(i)   capital demand
      T0(i)   land demand
      KS0     supply of private capital
      TKS0    total private capital supply
      TS0     total supply of land
      VA0(i)  Value added
```

V0(j,i) composite intermediate good demand
TV0(i) total composite intermediate good demand
VR0(j,i) Regional intermediate good demand
VM0(j,i) imported intermediate good demand
TVR0(i) total regional intermediate good demand
TVM0(i) total imported intermediate good demand
IBT0(i) indirect business taxes
X0(i) sector output
E0(i) export of regional product
M0(i) imports
R0(i) regional supply of regional product
GS0 PUBLIC CAPITAL SUPPLY

*@Income block
LY0 labor income
KY0 capital income
TY0 land income
YENT0 gross enterprise income
YH0 household income
DYH0 disposable household income
HSAV0 household saving
SAV0 total saving
ROWSAV0 saving from rest of the world
TRGOV0 government transfer to households
REMIT0 remittance from outside the region to the household
YGOV0 government revenue
ENTY0 enterprise income distributed to households
GOVITR0 intergovernmental transfer
GOVBOR0 government borrowing
GRP0 gross regional product

*@Expenditure block
HEXP0 household expenditures
QR0(i) demand for regional consumption good
QM0(i) demand for imported consumption good
Q0(i) demand for composite consumption good
GOVEXP0 government expenditure
QGOVR0(i) government demand for regional good
QGOVM0(i) government demand for imported good
QGOV0(i) government demand for composite good
QInvR0(i) investment demand for regional good
QInvM0(i) investment demand for imported good
QInv0(i) investment demand for composite good
INV0 total investment

*LOGICAL VARIABLES

```
*************************
*Regional      x  x  0  0     0=zero, x=not zero
*Import         x  0  x     0
*
*NZV          T  F  F  F     T=TRUE, F=FALSE
*ZVR          F  F  T  F
*ZVM           F  T  F  T
*************************

    ZVM(i,j) non imported intermediate demand with-without regional intermediate
      demand
    ZVR(i,j) only imported intermediate demand
    NZV(i,j) both imported intermediate demand and regional demand
    ZQM(i)   non imported final demand and either none or some regional final demand
    ZQR(i)   only imported final demand
    NZQ(i)   both imported final demand and regional final demand
    ZGOVM(i)
    ZGOVR(i)
    NZGOV(i)
    ZInvM(i)
    ZInvR(i)
    NZInv(i)       ;

*####-- DECLARATION OF PARAMETERS TO BE CALIBRATED

PARAMETERS

*@Production block
    a0(i)   composite value added required per unit of output i
    a(j,i)  requirements of intermediate good j per unit of good i
    Alpha(i,f) value added share parameter
    alphag  public capital share parameter
    Ava(i)  value added shift parameter
    RHOv(i) intermediate input substitution parameter
    deltav1(j,i)
    deltav(j,i) intermediate input share parameter
    Av(j,i) intermediate input shift parameter
    RHOx(i) output transformation parameter
    deltax1(i)
    deltax(i) output share parameter
    Ax(i)   output shift parameter
*@Income block
    ktax    capital tax rate
    sstax   factor income tax rate for labor
    ttax    factor income tax rate for land
    retr    rate of retained earnings from enterprise income
```

```
    et      enterprise income tax rate
    hhtax   income tax rate for households
    ltr     household income transfer coefficient
    mps     saving rate
    ibtax(i) indirect business tax
    beta(i) parameter calculated from elasticity of comm demand wrt income

*@Expenditure block
    RHOq    consumer demand substitution parameter
    deltaq1(i)
    deltaq(i) consumer demand share parameter
    Aq(i)   consumer demand constant efficiency parameter
    RHOgov  government demand substitution parameter
    deltagov1
    deltagov        goverment demand share parameter
    Agov    goverment demand constant efficiency parameter
    RHOinv  investment government demand substitution parameter
    deltainv1
    deltainv        investment goverment demand share parameter
    Ainv    investment government demand constant efficiency parameter
;

*### DATA: SAM data

Table   IOR(i,j)        input-output regional matrix
    AGR     MIN      MAN       SER
AGR  675.798  8.115    863.991   34.800
MIN  123.470  2180.942  1258.117  881.343
MAN  159.671  1390.701  3594.970  3953.200
SER  381.542  1317.332  5272.186  9752.027
;

Table   IOM(i,j)        input-output import matrix
    AGR     MIN      MAN       SER
AGR  579.870  5.160    378.422   41.300
MIN  11.850   1274.869  311.094   385.272
MAN  446.830  450.977   8835.472  2750.345
SER  155.160  458.802   1886.710  4188.764
;

Table VAD(i,f)  value added matrix
    L       K        T
AGR  433.242  571.360  709.066
MIN  1622.806  2713.109
MAN  7577.427  4025.159
SER  20767.388 12042.708
```

```
;


Table HHCONR(i,*)      household consumption demand for regional goods
      HOUSE
AGR    147.210
MIN    1587.998
MAN     2656.085
SER    30727.366
;

TABLE HHCONM(i,*)      household consumption demand for imported goods
      HOUSE
AGR    181.550
MIN    141.622
MAN     5713.705
SER    9510.103
;

Table GOVCONR(i,*)     goverment consumption demand for regional goods
      GOV
AGR    12.863
MIN    231.250
MAN     1854.066
SER    1477.995
;

Table GOVCONM(i,*)     goverment consumption demand for imported goods
      GOV
AGR    20.097
MIN    29.912
MAN     823.846
SER    542.893
;

Table FYDIST(*,f)      factor income distribution to households
      L         K        T
HH     31363.057  0.00      683.300
;

Table ParamA(*,i)      BASE YEAR VALUES FOR INDUSTRY
        AGR       MIN       MAN       SER
PT0      1.000      1.00      1.00      1.00
PK0      1.00       1.00      1.00      1.00
PR0      1.000      1.000     1.000     1.000
```

```
P0       1.000      1.000      1.000      1.000
PM0       1.00       1.00       1.00       1.00
PE0      1.00       1.00       1.00       1.00
X0       4344.160   12089.784  34190.427   59115.190
R0       1752.557   6282.217   18360.150   49486.101
E0       2591.603   5807.567   15830.277   9629.089
M0       1216.846   2170.418   21475.978   16920.731
IBT0     96.301     666.971    186.879     4318.043
QINVR0   9.780      19.097     4751.457    557.653
QINVM0   10.447     15.759     2454.803    178.299
SIGMAv   1.47       1.84       1.75        0.60
SIGMAx   3.90       2.90       2.90        0.70
SIGMAq   1.47       1.84       1.75        0.60
SIGMAgov 1.47       1.84       1.75        0.60
SIGMAinv 1.47       1.84       1.75        0.60
   ;

Table ParamB(f,*)     BASE YEAR VALUES FOR FACTORS
     WAGE0  WAGEROC0   FTAX0     RETENT0    CAP0    CAPROC0
L     1.000  1.0        6126.715  0
K                      -1006.686  9077.096   1       1
T                      25.766     0
;

Table ParamC(*,*)     BASE YEAR VALUES FOR HOUSEHOLD GROUPS
     HTAX0       HSAV0      TRGOV0      REMIT0     ENTYDIS0
HOUSE  6976.571    -3869.320   11490.516   760.824    9582.303
;

Table ParamD(*,*)     BASE YEAR VALUES FOR GOVERNMENTS
     BOR0        GOVDR0      GOVDM0      GS
GOV    0.0         3576.174    1416.748    0.0000001
;

SCALAR LHHH0    labor used by high income household /107.070/;
SCALAR LGOV0    labor used by goverment             /6981.839/;
SCALAR GOVITR0  intergovermental transfer           /8477.813/;
SCALAR YENT0    enterprise income                   /20359.022/;
SCALAR ENTTAX0  enterprise taxes                    /1699.623/;
SCALAR ROWGOV0  rest of world transfer to govt      /4375.094/;
SCALAR ROWSAV0  saving from rest of world           /2789.519/;
SCALAR QINVMSUM0 investment demand for imp. goods   /2659.308/;
SCALAR etaL     labor migration elasticity          /0.92/;
SCALAR etaK     capital migration elasticity        /0.92/;
SCALAR KMobil   capital mobility                    /1.0/;
SCALAR PUB      public capital output elasticity    /0.855/;
```

```
SCALAR depr      depreciation rate of public capital   /.03/;
SCALAR PTAX      public highway investment tax          /0.000/;

*@Production block
L0(i)  =VAD(i,"L");
K0(i)  =VAD(i,"K");
T0(i)  =VAD(i,"T");
VA0(i) =sum(f,VAD(i,f));
V0(j,i) =IOR(j,i)+IOM(j,i);
TV0(i) =sum(j,V0(i,j));
VM0(j,i)=IOM(j,i);
VR0(j,i)=IOR(j,i);
TVM0(i) =sum(j,VM0(i,j));
TVR0(i) =sum(j,VR0(i,j));
LHHH0  =LHHH0;
LGOV0  =LGOV0;
LS0    =sum(i,VAD(i,"L"))+LHHH0+LGOV0;
X0(i)  =ParamA("X0",i);
E0(i)  =ParamA("E0",i);
R0(i)  =ParamA("R0",i);
KS0(i) =VAD(i,"K");
TKS0   =sum(i,KS0(i));
TS0(i) =VAD(i,"T");
IBT0(i) =ParamA("IBT0",i);
GS0 =ParamD("GOV","GS");


*@Income block
TRGOV0 =ParamC("HOUSE","TRGOV0");
LY0    =sum(i,VAD(i,"L"))+LGOV0+LHHH0;
KY0    =sum(i,VAD(i,"K"));
TY0    =sum(i,VAD(i,"T"));
YENT0  =YENT0;
REMIT0 =ParamC("HOUSE","REMIT0");
YH0
        =sum(f,FYDIST("HH",f))+ParamC("HOUSE","ENTYDIS0")+TRGOV0+REMI
        T0;
DYH0   =YH0-ParamC("HOUSE","HTAX0");
HSAV0  =ParamC("HOUSE","HSAV0");
HEXP0  =DYH0-HSAV0-LHHH0;
SAV0   =ParamB("K","RETENT0")+ParamC("HOUSE","HSAV0")+ROWSAV0;
ROWSAV0 =ROWSAV0;
YGOV0
        =sum(i,ParamA("IBT0",i))+sum(f,ParamB(f,"FTAX0"))+ParamC("HOUSE","HT
        AX0")+
      ENTTAX0+ROWGOV0+GOVITR0+ptax;
```

```
ENTY0   =ParamC("HOUSE","ENTYDIS0");
GOVBOR0 =ParaMD("GOV","BOR0");
GRP0    =LY0+KY0+TY0+sum(i,ParamA("IBT0",i));

*@Expenditure block
QR0(i)  =HHCONR(i,"HOUSE");
QM0(i)  =HHCONM(i,"HOUSE");
Q0(i)   =QM0(i)+QR0(i);
GOVEXP0
        =ParamD("GOV","GOVDR0")+ParamD("GOV","GOVDM0")+ParamC("HOUS
        E","TRGOV0")
       +LGOV0+GOVITR0;
QGOVR0(i)=GOVCONR(i,"GOV");
QGOVM0(i)=GOVCONM(i,"GOV");
QGOV0(i) =QGOVM0(i)+QGOVR0(i);
QINVR0(i)=ParamA("QINVR0",i);
QINVM0(i)=ParamA("QINVM0",i);
QINV0(i) =QINVM0(i)+QINVR0(i);
INV0    =sum(i,QINV0(i));
M0(i)   =ParamA("M0",i);

*@Price block
PL0     =ParamB("L","WAGE0");
PK0(i)  =ParamA("PK0",i);
PLROC0  =ParamB("L","WAGEROC0");
PKROC0  =ParamB("K","CAPROC0");
PT0(ag) =ParamA("PT0",ag);
PE0(i)  =ParamA("PE0",i);
PM0(i)  =ParamA("PM0",i);
PR0(i)  =ParamA("PR0",i);
P0(i)   =ParamA("P0",i);
PX0(i)  =(PR0(i)*R0(i)+PM0(i)*M0(i))/(R0(i)+M0(i));

*-------------------------------------------------------------------
* Regional    x    x    0    0     0=zero, x=not zero
* Import      x    0    x    0
*
* NZV         T    F    F    F     T=True, F=False
* ZVR         F    F    T    F
* ZVM         F    T    F    T
*-------------------------------------------------------------------

ZVM(i,j)     =(VM0(i,j) eq 0);
ZVR(i,j)     =(VR0(i,j) eq 0) and (VM0(i,j) ne 0);
NZV(i,j)     =(VR0(i,j) ne 0) and (VM0(i,j) ne 0);
ZQM(i)       =(QM0(i) eq 0);
```

```
ZQR(i)       =(QR0(i) eq 0) and (QM0(i) ne 0);
NZQ(i)       =(QR0(i) ne 0) and (QM0(i) ne 0);

ZGOVM(i)      =(QGOVM0(i) eq 0);
ZGOVR(i)     =(QGOVR0(i) eq 0) and (QGOVM0(i) ne 0);
NZGOV(i)     =(QGOVR0(i) ne 0) and (QGOVM0(i) ne 0);

ZInvM(i)      =(QInvM0(i) eq 0);
ZInvR(i)     =(QInvR0(i) eq 0) and (QInvM0(i) ne 0);
NZInv(i)     =(QInvR0(i) ne 0) and (QInvM0(i) ne 0);

PARAMETER SAM1 SOCIAL ACCOUNTING MATRIX BASE YEAR PRICES;
SAM1(I,"PK")    =PK0(I);
SAM1(ag,"PT")  =PT0(ag);
SAM1(i,"PE0")  =PE0(i);
SAM1(i,"PM0")  =PM0(i);
SAM1(i,"PR0")  =PR0(i);
SAM1(i,"P0")   =P0(i);
SAM1(i,"PR0")  =PR0(i);

PARAMETER SAM2 SOCIAL ACCOUNTING MATRIX BASE YEAR DATA;
SAM2(i,"L0")   =L0(i);
SAM2(i,"K0")  =K0(i);
SAM2(i,"KS0")  =KS0(i);
SAM2(i,"T0")   =T0(i);
SAM2(i,"TS0")  =TS0(i);
SAM2(i,"VA0")  =VA0(i);
SAM2(i,"TVR0") =TVR0(i);
SAM2(i,"TVM0") =TVM0(i);
SAM2(i,"TV0")  =TV0(i);
SAM2(i,"IBT0") =IBT0(i);
SAM2(i,"X0")   =X0(i);
SAM2(i,"M0")   =M0(i);
SAM2(i,"R0")   =R0(i);
SAM2(i,"E0")   =E0(i);
SAM2(i,"Q0")   =Q0(i);
SAM2(i,"QR0")  =QR0(i);
SAM2(i,"QM0")  =QM0(i);
SAM2(i,"QGOV0") =QGOV0(i);
SAM2(i,"QGOVR0")=QGOVR0(i);
SAM2(i,"QGOVM0")=QGOVM0(i);
SAM2(i,"QINV0") =QINV0(i);
SAM2(i,"QINVR0")=QINVR0(i);
SAM2(i,"QINVM0")=QINVM0(i);

OPTION DECIMALS=0;
```

```
DISPLAY SAM1;

OPTION DECIMALS=3;
DISPLAY SAM2;

DISPLAY V0, VM0, VR0, LS0, PL0, PLROC0, LHHH0, LGOV0, LY0, KY0,
     TY0, YENT0, REMIT0, YH0, DYH0, YGOV0, GRP0, HSAV0, HEXP0,
        GOVEXP0, SAV0, ROWSAV0,
     TRGOV0, ENTY0, ENTTAX0, GOVBOR0;

*##############################*
*                    *
* PARAMETER CALIBRATION      *
*                    *
*##############################*

*####-- CALIBRATION

*@Production block
a0(i)          =VA0(i)/X0(i);
a(j,i)         =V0(j,i)/X0(i);
alpha(ag,"K")  =VAD(ag,"K")/VA0(ag);
alpha(ag,"L")  =VAD(ag,"L")/VA0(ag);
alpha(ag,"T")  =1-alpha(ag,"K")-alpha(ag,"L");
alphag         =pub;
alpha(nag,"K") =VAD(nag,"K")/VA0(nag);
alpha(nag,"L") =VAD(nag,"L")/VA0(nag);
alphag         =pub;
alpha(srv,"K") =VAD(srv,"K")/VA0(srv);
alphag         =PUB;
alpha(srv,"L") =1-alpha(srv,"K");
Ava(ag)        =VA0(ag)/Prod(f,VAD(ag,f)**alpha(ag,f));
Ava(nag)       =VA0(nag)/Prod(fl,VAD(nag,fl)**alpha(nag,fl));
Ava(srv)       =VA0(srv)/(Prod(fl,VAD(srv,fl)**alpha(srv,fl))
                *GS0**alphaG);
RHOv(i)        =1-1/ParamA("SIGMAv",i);
deltav1(j,i)
 $(NZV(j,i))   =(VR0(j,i)/VM0(j,i))**(1-RHOv(j))*(PR0(j)/PM0(j));
deltav(j,i)
 $(NZV(j,i))   =1/(1+deltav1(j,i));
Av(j,i)
 $(NZV(j,i))   =V0(j,i)/(deltav(j,i)*VM0(j,i)**RHOv(j)+(1-deltav(j,i))
                *VR0(j,i)**RHOv(j))**(1/RHOv(j));
RHOx(i)        =1+1/ParamA("SIGMAx",i);
deltax1(i)     =(R0(i)/E0(i))**(1-RHOx(i))*(PR0(i)/PE0(i));
deltax(i)      =1/(1+deltax1(i));
```

```
Ax(i)        =X0(i)/(deltax(i)*E0(i)**RHOx(i)+(1-
        deltax(i))*R0(i)**RHOx(i))**(1/RHOx(i));

*@Income block
sstax        =ParamB("L","FTAX0")/LY0;
ktax         =ParamB("K","FTAX0")/KY0;
ttax         =ParamB("T","FTAX0")/TY0;
retr         =ParamB("K","RETENT0")/sum(i,VAD(i,"K"));
ibtax(i)     =ParamA("IBT0",i)/(PR0(i)*X0(i));
et           =ENTTAX0/KY0;
hhtax        =ParamC("HOUSE","HTAX0")/YH0;
ltr          =1;
mps          =ParamC("HOUSE","HSAV0")/YH0;

*@Expenditure Block
RHOq(i)      =1-1/ParamA("SIGMAq",i);
deltaq1(i)
 $NZQ(i)     =(QR0(i)/QM0(i))**(1-RHOq(i))*(PR0(i)/PM0(i));
deltaq(i)
 $NZQ(i)     =1/(1+deltaq1(i));
Aq(i)$NZQ(i)  =Q0(i)/(deltaq(i)*QM0(i)**RHOq(i)+(1-deltaq(i))
           *QR0(i)**RHOq(i))**(1/RHOq(i));
RHOgov(i)    =1-1/ParamA("SIGMAgov",i);
deltagov1(i)
 $NZGOV(i)   =(QGOVR0(i)/QGOVM0(i))**(1-RHOgov(i))*(PR0(i)/PM0(i));
deltagov(i)
 $NZGOV(i)   =1/(1+deltagov1(i));
Agov(i)
 $NZGOV(i)   =QGOV0(i)/(deltagov(i)*QGOVM0(i)**RHOgov(i)+(1-deltagov(i))
           *QGOVR0(i)**RHOgov(i))**(1/RHOgov(i));
RHOinv(i)    =1-1/ParamA("SIGMAinv",i);
deltainv1(i)
 $NZinv(i)   =(QINVR0(i)/QINVM0(i))**(1-RHOinv(i))*(PR0(i)/PM0(i));
deltainv(i)
 $NZInv(i)   =1/(1+deltainv1(i));
Ainv(i)
 $NZInv(i)   =QINV0(i)/(deltainv(i)*QINVM0(i)**RHOinv(i)+(1-deltainv(i))
           *QINVR0(i)**RHOinv(i))**(1/RHOinv(i));
beta(i)      =Q0(i)*P0(i)/HEXP0;

PARAMETER CALIBR PARAMETER CALIBRATED;
CALIBR(i,"A0")  =A0(i);
CALIBR(i,"AVA") =AVA(i);
CALIBR(i,"RHOv")=RHOv(i);
CALIBR(i,"RHOq")=RHOq(i);
CALIBR(i,"deltaq")=deltaq(i);
```

```
CALIBR(i,"AQ") =AQ(i);
CALIBR(i,"IBTAX")=IBTAX(i);
CALIBR(i,"RHOgov")=RHOgov(i);
CALIBR(i,"deltagov")=deltagov(i);
CALIBR(i,"AGOV")=AGOV(i);
CALIBR(i,"RHOinv")=RHOinv(i);
CALIBR(i,"AINV")=AINV(i);
CALIBR(i,"RHOx")=RHOx(i);
CALIBR(i,"deltax")=deltax(i);
CALIBR(i,"AX") =AX(i);
CALIBR(i,"beta")=beta(i);

DISPLAY CALIBR;
DISPLAY a, AV, deltav, alpha,
      ktax, sstax, ttax, retr, et, mps, hhtax;


*####################################################*
*                                    *
*     VARIABLE DECLARATION                   *
*                                    *
*####################################################*

*ENDOGENOUS VARIABLES

VARIABLES
Z      objective function value

*@Price block
PL     wage rate
PK(i)  capital rate
PKL    capital rate in the long run
PT(ag) land rent
PN(i)  net price
PR(i)  regional price
P(i)   composite price
PX(i)  composite price faced by consumers

*@Production block
LAB(i)  labor demand
CAP(i)  capital demand
LAND(i) land demand
TCAP    total capital demand
TLAB    total labor demand
LS      labor supply
LMIG    labor migration
```

KMIG capital migration
VA(i) value added
V(j,i) composite intermediate good demand
VM(j,i) imported intermediate good demand
VR(j,i) regional intermediate good demand
R(i) regional supply
X(i) output
EXP(i) export
M(i) import
TVM(i) imported intermediate good total demand
TVR(i) regional intermediate good total demand
TV(i) composite intermediate good total demand
adjL labor adjustment
GS PUBLIC CAPITAL SUPPLY

*@Income block
LY labor income (original hhs)
ALY adjusted labor income (staying + in-migrating)
KY capital income (original capital stock)
TY land income
YENT enterprise income
RETENT retained earnings by enterprises
YH income of hh staying in the region (including in-migrants)
DYH disposable hh income (staying in the region + in-migrants)
HSAV household saving (staying + in-migrants)
SAV total saving
INV investment
YGOV government revenue
IBTX indirect business tax
GRP gross regional product
HTAX
FTAXT
FTAXL
FTAXK
ENTX
ENTYDIS
LHHH
IBT(i)
TQGOVR
TQGOVM
TQINV
LYDIS
TYDIS

*### Expenditure block

```
AHEXP   adjusted household expenditure (spent within the region)
Q(i)   demand for consumption good
QM(i)   demand for imported consumption good
QR(i)   demand for regionally produced consumption good
GOVEXP  government expenditures
QGOV(i) government demand for composite good
QGOVM(i) government demand for imported good
QGOVR(i) government demand for regional good
QINV(i) investment government demand for composite good
QINVR(i) investment government demand for regional good
QINVM(i) investment government demand for imported good
SLACK(i)
SLACK2(i)

POSITIVE VARIABLE SLACK, SLACK2
;

*###########################################*
*                        *
*    EQUATION DECLARATION          *
*                        *
*###########################################*

EQUATIONS

EQZ          objective function

*@Price block
NETprice(i)    net price
Price(i)       composite price
Price1(i)

*@Production block
Ldemand(i)     labor demand
KdemandSR(i)    capital demand short run
KdemandLR(i)    capital demand long run
Tdemand(ag)    land demand
TLdem          total labor demand
TKdem          total capital demand
VAdemand(i)    value added demand
Vdemand(j,i)   intermediate demand
VAprod1(nag)    value added production function
VAprod2(ag)    value added production function
VAprod3(srv)    value added production function
Vces(j,i)      ces function for intermediate demand
TVdemand(i)    intermediate total demand
```

TVRdemand(i) intermediate regional total demand
TVMdemand(i) intermediate imported total demand
VRdem(j,i) demand for regional intermediate good
VRdem0(j,i) demand for regional intermediate good with zero imports
VMdem0(j,i) demand for imported intermediate good with zero imports
Xcet(i) cet function for regional product
Rsupply(i) regional supply of regional product
Lsupply labor supply
LMIGrat labor migration
adjustL labor migration adjustment
KMIGrat capital migration
KMIGrat1

*@Income block
LYincome labor income
ALYincome adjusted labor income
KYincomeSR capital income short run
KYincomeLR capital income long run
TYincome land income
YENTincome enterprise income
RETearn retained earnings by enterprises
YHincome householed income
DHYincome disposable income
HSAVings household savings
SAVings total savings
INVest total investment
YGOVincome government income
INDtax indirect business tax
GRProduct gross regional product

*@Expenditure block
AHEXPlow adjusted household expenditure
Qces ces function for consumption
Qdemand consumer demand for composite good
QRdem0 consumer demand for regional goods
QRdem1
QRdem2
QMdem1
QMdem2
GOVEXpend government expenditures
QGOVces ces for state and local goverment demand
QGOVdemand state and local government consumption
QGOVRdem0 state and local government regional consumption

```
QGOVRDem1
QGOVRdem2
QGOVMdem1
QGOVMdem2
QINVces        ces for investment government demand
QINVdemand     investment government consumption
QINVRdem0      investment government regional consumption
QINVRdem1
QINVRdem2
QINVMdem1
QINVMdem2
Mimports(i)    import

*@Equilibrium
COMMequil(i)   commodity market equilibrium
Lequil         labor market equilbrium
Kequil(i)      capital market equilibriumj
Kequil1
Tequil(ag)     land market equilibrium
HTX
FTXT
FTXL
FTXK
ETX
ETY
LHH
IDBT(i)
TQGOV1
TQGOV2
TQINV1
LYDIST
TYDIST
;


*################################################*
*                              *
*    EQUATION DEFINITION              *
*################################################*

EQZ..          Z      =e= sum(i,slack(i)+ slack2(i));

*@Price block
NETprice(i)..  PN(i)  =e= PX(i)- sum(j,A(j,i)*P(j))-ibtax(i)*PX(i);
Price(i)..     P(i)   =e= (PR(i)*R(i)+PM0(i)*M(i))/(R(i)+M(i));
Price1(i)..    PX(i)  =e= (PR(i)*R(i)+PE0(i)*Exp(i))/(R(i)+Exp(i));
```

```
*@Production block
Ldemand(i)..   LAB(i)  =e= alpha(i,"L")*PN(i)*X(i)/PL;
KdemandSR(i)
 $(Not Kmobil).. CAP(i) =e= alpha(i,"K")*PN(i)*X(i)/PK(i);
KdemandLR(i)
 $(Kmobil)..    CAP(i) =e= alpha(i,"K")*PN(i)*X(i)/PKL;
Tdemand(ag)..   LAND(ag) =e= alpha(ag,"T")*PN(ag)*X(ag)/PT(ag);
TLdem..        TLAB =e= sum(i,LAB(i));
TKdem..        TCAP =e= sum(i,CAP(i));
Lsupply..      LS =e= LS0;
LMIGrat..      LMIG =e= etaL*LS0*LOG(PL/PLROC0);
adjustL..      adjL =e= (LS0+LMIG)/LS0;
KMIGrat
 $(KMobil)..    KMIG =e= etaK*(sum(i,K0(i))*log(PKL/PKROC0));
KMIGrat1
 $(not KMobil).. KMIG =e= 0;
VAdemand(i)..   VA(i) + SLACK(i)+SLACK2(i) =e= a0(i)*X(i);
VAprod1(nag)..  VA(nag) =e= Ava(nag)*LAB(nag)**alpha(nag,"L")*CAP(nag)
                **alpha(nag,"K");
VAprod2(ag)..   VA(ag) =e= Ava(ag)*LAB(ag)**alpha(ag,"L")*CAP(ag)
                **alpha(ag,"K")*LAND(ag)**alpha(ag,"T")                  ;
VAprod3(srv)..  VA(srv) =e=
        Ava(srv)*LAB(srv)**alpha(srv,"L")*CAP(srv)**alpha(srv,"K")
                  *GS**alphaG;
Vdemand(j,i)..  V(j,i) =e= a(j,i)*X(i);
Vces(j,i)..     V(j,i) =e= Av(j,i)*(deltav(j,i)*VM(j,i)**RHOv(j)
                +(1-deltav(j,i))*VR(j,i)**RHOv(j))**(1/RHOv(j));
TVdemand(i)..   TV(i) =e= sum(j,V(i,j));
VRdem(j,i)
 $NZV(j,i)..    VR(j,i) =e= VM(j,i)*((1-deltav(j,i))/deltav(j,i)*
                 PM0(j)/PR(j))**(1/(1-RHOv(j)));
VRdem0(j,i)
 $ZVM(j,i)..    VR(j,i) =e= V(j,i);
VMdem0(j,i)
 $ZVM(j,i)..    VM(j,i) =e= 0;
TVRdemand(i)..  TVR(i) =e= sum(j,VR(i,j));
TVMdemand(i)..  TVM(i) =e= sum(j,VM(i,j));
Xcet(i)..       X(i) =e= Ax(i)*(deltax(i)*EXP(i)**RHOx(i)+(1-deltax(i))
                *R(i)**RHOx(i))**(1/RHOx(i));
Rsupply(i)..    R(i) =e= EXP(i)*((1-deltax(i))/deltax(i)*PE0(i)/PR(i))
                **(1/(1-RHOx(i)));
INDtax..        IBTX =e= sum(i,ibtax(i)*X(i));
GRProduct..     GRP =e= ALY+KY+TY+IBTX;
```

```
*@Income block

*ALY is defined for all labor; LY is defined for original household
ALYincome..    ALY =e= PL*    (TLAB+LHHH0+LGOV0);
LYincome..     LY =e= ALY+PLROC0*(SQRT(LMIG**2)-LMIG)*0.5-
        PL*(SQRT(LMIG**2)
               +LMIG)*0.5;
KYincomeSR
 $(not Kmobil).. KY =e= sum(i,PK(i)*CAP(i));
KYincomeLR
 $(Kmobil)..    KY =e= sum(i,PKL*CAP(i))+PKROC0*(sqrt(KMIG**2)-KMIG)*0.5-
        PKL
               *(sqrt(KMIG**2)+KMIG)*0.5;
RETearn..      RETENT =e= retr*KY;
TYincome..     TY =e= sum(ag,PT(ag)*LAND(ag));
YENTincome..   YENT =e= KY*(1-ktax);
YHincome..     YH =e= ALY*(1-sstax)+TY*(1-ttax)+(YENT-RETENT-
        et*KY)+REMIT0
               +adjL*TRGOV0-((SQRT((adjL-1)**2)-(adjL-1))*0.5)
               *(TY*(1-ttax)+(YENT-RETENT-et*KY)+REMIT0)-ptax;
DHYincome..    DYH =e= YH*(1-hhtax);
HSAVings..     HSAV =e= mps*YH;
SAVings..      SAV =e= HSAV+RETENT+ROWSAV0;
INVest..       INV =e= sum(i,P(i)*QINV(i));
YGOVincome..   YGOV =e= sum(i,ibtax(i)*PX(i)*X(i))
               +sstax*ALY+ktax*KY+et*KY
               +ttax*TY+hhtax*YH+GOVBOR0+GOVITR0+ptax;

*@Expenditure block
AHEXPLow..     AHEXP =e= DYH-HSAV-PL*LHHH0;
Qdemand(i)..   Q(i) =e= beta(i)*AHEXP/P(i);
Qces(i)$NZQ(i).. Q(i) =e= Aq(i)*(deltaq(i)*QM(i)**RHOq(i)+(1-deltaq(i))*QR(i)
               **RHOq(i))**(1/RHOq(i));
QRdem0(i)
 $NZQ(i)..     QR(i) =e= QM(i)*((1-deltaq(i))/deltaq(i)*PM0(i)/PR(i))
               **(1/(1-RHOq(i)));
QRdem1(i)
 $ZQM(i)..     QM(i) =e= 0;
QMdem1(i)
 $ZQM(i)..     QR(i) =e= Q(i);
QRdem2(i)
 $ZQR(i)..     QR(i) =e= 0;
QMdem2(i)
 $ZQR(i)..     QM(i) =e= Q(i);
```

```
GOVEXPend..     GOVEXP =e=
        sum(i,P(i)*QGOV(i))+adjL*TRGOV0+PL*LGOV0+GOVITR0
                      ;
QGOVdemand(i)..  QGOV(i) =e= QGOV0(i);
QGOVces(i)
 $NZGOV(i)..   QGOV(i) =e= Agov(i)*(deltagov(i)*QGOVM(i)**RHOgov(i)
               +(1-deltagov(i))*qgovr(i)**RHOgov(i))**(1/RHOgov(i));
QGOVRdem0(i)
 $NZGOV(i)..    QGOVR(i) =e= QGOVM(i)*((1-deltagov(i))/deltagov(i)*PM0(i)
               /PR(i))**(1/(1-RHOgov(i)));
QGOVRdem1(i)
 $ZGOVM(i)..    QGOVM(i) =e= 0;
QGOVMdem1(i)
 $ZGOVM(i)..    QGOVR(i) =e= QGOV(i);
QGOVRdem2(i)
 $ZGOVR(i)..   QGOVR(i) =e= 0;
QGOVMdem2(i)
 $ZGOVR(i)..    QGOVM(i) =e= QGOV(i);
QINVdemand(i)..  QINV(i) =e= QINV0(i);
QINVces(i)
 $NZInv(i)..    QINV(i) =e= Ainv(i)*(deltainv(i)*QINVM(i)**RHOinv(i)
               +(1-deltainv(i))*QINVR(i)**RHOinv(i))**(1/RHOinv(i));
QINVRdem0(i)
 $NZInv(i)..    QINVR(i) =e= QINVM(i)*((1-deltainv(i))/deltainv(i)*PM0(i)
               /PR(i))**(1/(1-RHOinv(i)));
QINVRdem1(i)
 $ZInvM(i)..    QinvM(i) =e= 0;
QINVMdem1(i)
 $ZinvM(i)..    QINVR(i) =e= QINV(i);
QINVRdem2(i)
 $ZInvR(i)..    QINVR(i) =e= 0;
QINVMdem2(i)
 $ZInvR(i)..    QINVM(i) =e= QINV(i);
Mimports(i)..   M(i) =e= TVM(i)+QM(i)+QGOVM(i)+QINVM(i);

*@Equilibrium
COMMequil(i)..  X(i)+M(i) =E= TV(i)+Q(i)+QGOV(i)+QINV(i)+EXP(i);
Lequil..        sum(i,LAB(i))+LHHH0+LGOV0 =e= LS0+LMIG;
Kequil1
 $(Kmobil)..    KMIG =e= sum(i,CAP(i)-KS0(i));
Kequil(i)
 $(not Kmobil).. CAP(i) =e= KS0(i);
Tequil(ag)..    LAND(ag) =e= T0(ag);
HTX..           HTAX =E= HHTAX*YH;
FTXT..          FTAXT =E= TTAX*TY;
FTXK..          FTAXK =E= KTAX*KY;
```

```
FTXL..        FTAXL =E= SSTAX*LY;
ETX..         ENTX =E= ET*KY;
ETY..         ENTYDIS =E= YENT-RETENT-ENTX;
LHH..         LHHH =E= ALY-TLAB-LGOV0;
IDBT(i)..     IBT(i) =E= ibtax(i)*X(i);
TQGOV1..      TQGOVR =E= SUM(i,QGOVR(i));
TQGOV2..      TQGOVM =E= SUM(i,QGOVM(i));
TQINV1..      TQINV =E= SUM(i,QINVM(i));
LYDIST..      LYDIS =E= ALY-FTAXL;
TYDIST..      TYDIS =E= TY-FTAXT;

*################################################*
*                                *
*    INITIALIZATION OF STARTING VALUES     *
*                                *
*################################################*

*@Price block                    *@Income block
PL.L    =PL0;
PKL.L   =1;
PK.L(i)    =PK0(i);
PT.L(ag) =PT0(ag);               HSAV.L  =HSAV0;
PR.L(i) =PR0(i);                 YGOV.L  =YGOV0;
P.L(i)     =P0(i);
PX.L(i)     =PX0(i);
PN.L(i)     =PX0(i)-sum(j,A(j,i)*P0(j))
            -ibtax(i)*PX0(i);

*@Production block
SLACK.L(i)      =0;              SLACK2.L(i)    =0;
LAB.L(i)   =L0(i);               INV.L   =INV0;
CAP.L(i)   =K0(i);               GRP.L   =GRP0;
gs.l   =gs0;
*                           *Expenditure block
LAND.L(ag)      =T0(ag);
LS.L    =LS0;
LMIG.L  =0;
KMIG.L   =0000000;
VA.L(i) =VA0(i);
VM.L(j,i)=VM0(j,i);
VR.L(j,i)=VR0(j,i);              QM.L(i) =QM0(i);
V.L(j,i) =V0(j,i);
TVM.L(i) =TVM0(i);
TVR.L(i) =TVR0(i);               GOVEXP.L      =GOVEXP0;
TV.L(i)  =TV0(i);                QGOV.L(i)     =QGOV0(i);
R.L(i)  =R0(i);                  QGOVM.L(i)    =QGOVM0(i);
```

```
X.L(i)  =X0(i);                    QGOVR.L(i)     =QGOVR0(i);
EXP.L(i)   =E0(i);
M.L(i)  =M0(i);
Q.L(i)  =beta(i)*HEXP0/PX0(i);
QR.L(i)  =QR0(i);

*@Income block
LY.L    =LY0;
KY.L    =KY0;
TY.L    =TY0;
adjL.L  =1;
YENT.L   =YENT0;
yH.L    =YH0;
SAV.L   =SAV0;
DYH.L   =DYH0;
QINVM.L(i)      =QINVM0(i);
QINVR.L(i)      =QINVR0(i);
QINV.L(i)       =QINV0(i);

HTAX.L=PARAMC("HOUSE","HTAX0");
FTAXT.L=PARAMB("T","FTAX0");
FTAXK.L=PARAMB("K","FTAX0");
FTAXL.L=PARAMB("L","FTAX0");
ENTX.L=ENTTAX0;
ENTYDIS.L=PARAMC("HOUSE","ENTYDIS0");
LHHH.L=LHHH0;
ibt.l(I)=ibt0(I);


*##################################*
*                  *
*     VARIABLE BOUNDS        *
*                  *
*##################################*

PL.LO   =0.000001;
PT.LO(ag)   =0.000001;
PK.LO(i)   =0.000001;
PR.LO(i)       =  0.000001;
PN.LO(i)   =  0.000001;
P.LO(i)    =0.000001;
R.LO(i)    =0.000001;
PX.LO(i) =0.000001;
QM.LO(i)$(QM0(i) NE 0)   =0.000001;
QR.LO(i)$(QR0(i) NE 0)   =0.000001;
Q.LO(i)$(Q0(i) NE 0)     =0.000001;
```

```
QM.LO(i)$(QM0(i) EQ 0)   =0;
QR.LO(i)$(QR0(i) EQ 0)   =0;
Q.LO(i)$(Q0(i) EQ 0)     =0;
VR.LO(i,j)$(VR0(i,j) NE 0) =0.000001;
VM.LO(i,j)$(VM0(i,j) NE 0) =0.000001;
V.LO(i,j)$(V0(i,j) NE 0) =0.000001;
VR.LO(i,j)$(VR0(i,j) EQ 0)      =0;
VM.LO(i,j)$(VM0(i,j) EQ 0)      =0;
V.LO(i,j)$(V0(i,j) EQ 0) =0;


options iterlim=5000, limrow=0, limcol=0, solprint=off;
*-- MODEL DEFINITION AND SOLVE STATEMENT

MODEL OKLAHOMA/ALL/;
SOLVE OKLAHOMA MINIMIZING Z USING NLP;
*-- SOLUTION DISPLAY STATEMENT
*-- SOLUTION VALUES OF ENDOGENOUS VARIABLES

PARAMETER VALID VARIABLES FOR THE VALIDATION OF THE MODEL;
VALID(i,"SLACK1")      =SLACK.L(i);
VALID(i,"SLACK2")      =SLACK2.L(i);
VALID(i,"PR")  =PR.L(i);
VALID(i,"P")   =P.L(i);
VALID(i,"PN")  =PN.L(i);
VALID(i,"PK")  =PK.L(i);
VALID(ag,"PT")  =PT.L(ag);
VALID(i,"PX")   =PX.L(i);
VALID(i,"PE")  =PE0(i);
VALID(i,"X")   =X.L(i);
VALID(i,"R")   =R.L(i);
VALID(i,"EXP")  =EXP.L(i);
VALID(i,"M")   =M.L(i);
VALID(i,"VA")  =VA.L(i);
VALID(i,"LAB")  =LAB.L(i);
VALID(i,"CAP")  =CAP.L(i);
VALID(ag,"LAND") =LAND.L(ag);
VALID(i,"TVR")  =TVR.L(i);
VALID(i,"TVM")  =TVM.L(i);
VALID(i,"TV")   =TV.L(i);
VALID(i,"Q")    =Q.L(i);
VALID(i,"QR")   =QR.L(i);
VALID(i,"QM")   =QM.L(i);
VALID(i,"QGOV")  =QGOV.L(i);
VALID(i,"QGOVR") =QGOVR.L(i);
VALID(i,"QGOVM") =QGOVM.L(i);
```

```
VALID(i,"QINV") =QINV.L(i);
VALID(i,"QINVR") =QINVR.L(i);
VALID(i,"QINVM") =QINVM.L(i);
VALID(i,"IBTAX")  =IBTAX(i);
valid(i,"ibt") =ibt.l(I);

PARAMETER VALID2 -INTERMEDIATE USE MATRIX-;
VALID2(i,"AGR","V")    =V.L(i,"AGR");
VALID2(i,"MIN","V")    =V.L(i,"MIN");
VALID2(i,"MAN","V")    =V.L(i,"MAN");
VALID2(i,"SER","V")    =V.L(i,"SER");
VALID2(i,"AGR","VR")   =VR.L(i,"AGR");
VALID2(i,"MIN","VR")   =VR.L(i,"MIN");
VALID2(i,"MAN","VR")   =VR.L(i,"MAN");
VALID2(i,"SER","VR")   =VR.L(i,"SER");
VALID2(i,"AGR","VM")   =VM.L(i,"AGR");
VALID2(i,"MIN","VM")   =VM.L(i,"MIN");
VALID2(i,"MAN","VM")   =VM.L(i,"MAN");
VALID2(i,"SER","VM")   =VM.L(i,"SER");

PARAMETER VALID3 -VALIDATION OF THE MODEL-;
VALID3("OBJECTIVE")   =Z.L;
VALID3("PL")   =PL.L;
VALID3("LMIG")  =LMIG.L;
VALID3("KMIG")  =KMIG.L;
VALID3("TCAP")  =TCAP.L;
VALID3("TLAB")  =TLAB.L;
VALID3("LS")   =LS.L;
VALID3("ADJL")  =adjL.L;
VALID3("LY")   =LY.L;
VALID3("ALY")   =ALY.L;
VALID3("KY")   =KY.L;
VALID3("TY")   =TY.L;
VALID3("YENT")  =YENT.L;
VALID3("RETENT") =RETENT.L;
VALID3("YH")   =YH.L;
VALID3("PL")   =PL.L;
VALID3("DYH")   =DYH.L;
VALID3("HSAV")  =HSAV.L;
VALID3("SAV")   =SAV.L;
VALID3("INV")   =INV.L;
VALID3("YGOV")  =YGOV.L;
VALID3("GOVEXP") =GOVEXP.L;
VALID3("IBTX")  =IBTX.L;
VALID3("GRP")   =GRP.L;
VALID3("AHEXP") =AHEXP.L;
```

```
VALID3("HTAX")   =HTAX.L;
VALID3("FTAXT")  =FTAXT.L;
VALID3("FTAXL")  =FTAXL.L;
VALID3("FTAXK")  =FTAXK.L;
VALID3("ENTX")   =ENTX.L;
VALID3("ENTYDIS")=ENTYDIS.L;
VALID3("LHHH")   =LHHH.L;
VALID3("TQGOVR") =TQGOVR.L;
VALID3("TQGOVM") =TQGOVM.L;
VALID3("TQINV")  =TQINV.L;
VALID3("LYDIS")  =LYDIS.L;
VALID3("TYDIS")  =TYDIS.L;

option decimals=3;
DISPLAY VALID, VALID2, VALID3;
```

APPENDIX D
SIMULATION RESULTS FOR THE DYNAMIC CGE MODEL

Year One

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.395
Min	1.000		0.055	1.000	1.000	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.073	1.001	1.001	0.556

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.311	1752.739	2589.389	1217.284
Min	1.000	1.000	12092.600	6281.375	5808.260	2170.301
Man	0.999	1.000	34248.397	18353.847	15870.889	21474.546
Ser	1.001	1.000	59097.454	49460.650	9617.976	16927.228

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.867	432.900	570.901	709.066	1583.018	1005.051
Min	4335.862	1622.800	2713.061		4444.720	1982.923
Man	11614.233	7585.070	4029.163		9107.747	12482.449
Ser	32789.804	20778.141	12048.775		16719.536	6691.280

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2588.069	328.949	147.265	181.684	32.960	12.860
Min	6427.643	1730.980	1589.267	141.712	261.162	231.254
Man	21590.191	8377.691	2660.408	5717.284	2677.912	1855.066
Ser	23410.814	40239.051	30724.589	9514.464	2020.888	1477.777

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.100	20.227	9.778	10.449	96.256
Min	29.908	34.856	19.098	15.758	666.963
Man	822.846	7206.260	4754.295	2451.966	187.067
Ser	543.111	735.952	557.579	178.373	4315.372

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.081	675.369	579.712
Agr.Min	13.275	8.114	5.161
Agr.Man	1243.660	864.763	378.897

Agr.Ser	76.053	34.772	41.281
Min.Agr	135.257	123.414	11.843
Min.Min	3455.768	2181.045	1274.724
Min.Man	1570.786	1259.420	311.366
Min.Ser	1265.832	880.841	384.991
Man.Agr	606.217	159.803	446.415
Man.Min	1841.655	1391.281	450.375
Man.Man	12442.920	3603.066	8839.856
Man.Ser	6699.399	3953.597	2745.803
Ser.Agr	536.451	381.303	155.148
Ser.Min	1776.112	1317.129	458.983
Ser.Man	7166.082	5276.715	1889.367
Ser.Ser	13932.169	9744.389	4187.781

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.001, LMIG 18.048, KMIG 9.564
TCAP 19361.900, TLAB 30418.911, LS 37489.772
ADJL 1.000, LY 37509.394, ALY 37527.451
KY 19362.735, TY 708.877, YENT 20369.962
RETENT 9081.974, YH 53918.835, DYH 46937.235
HSAV -3872.109, SAV 7999.384, INV 7994.472
YGOV 27583.381, GOVEXP 32016.022, IBTX 5265.658
GRP 62864.720, AHEXP 50702.218, HTAX 6981.599
FTAXT 25.759, FTAXL 6129.922, FTAXK -1007.227
ENTX 1700.536, ENTYDIS 9587.452, LHHH 126.701
TQGOVR 3576.958, TQGOVM 1415.965, TQINV 2656.546
LYDIS 31397.529, TYDIS 683.118

Year Two

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	0.999	0.022	1.000	1.000	0.394
Min	1.000		0.055	1.000	1.000	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.073	1.003	1.002	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4339.160	1750.686	2588.290	1215.842
Min	1.000	1.000	12073.161	6272.673	5797.527	2167.225
Man	1.000	1.000	34182.237	18329.630	15829.001	21458.248
Ser	1.003	1.000	58970.667	49366.594	9585.261	16916.183

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1711.435	432.347	570.212	708.877	1580.938	1003.633
Min	4328.891	1620.120	2708.771		4436.411	1979.830
Man	11591.797	7570.233	4021.564		9086.257	12462.096
Ser	32756.489	20796.330	12060.168		16679.913	6683.937

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.571	328.953	147.290	181.663	32.960	12.862
Min	6416.240	1730.600	1588.881	141.719	261.162	231.246
Man	21548.356	8378.955	2659.360	5719.594	2677.912	1854.611
Ser	23363.837	40180.912	30670.856	9510.075	2020.888	1477.266

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.098	20.227	9.779	10.448	96.186
Min	29.916	34.856	19.095	15.761	665.891
Man	823.301	7206.261	4753.003	2453.257	186.893
Ser	543.623	735.952	557.405	178.547	4301.812

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.170	674.967	579.203
Agr.Min	13.254	8.102	5.152
Agr.Man	1241.258	863.167	378.091
Agr.Ser	75.890	34.703	41.187
Min.Agr	135.159	123.321	11.838
Min.Min	3450.214	2177.303	1272.911
Min.Man	1567.752	1256.914	310.838
Min.Ser	1263.116	878.873	384.244
Man.Agr	605.778	159.593	446.185
Man.Min	1838.666	1388.773	449.892
Man.Man	12418.885	3594.067	8824.817
Man.Ser	6685.027	3943.824	2741.202
Ser.Agr	536.062	380.884	155.178
Ser.Min	1773.257	1314.574	458.684
Ser.Man	7152.239	5264.734	1887.509
Ser.Ser	13902.280	9719.721	4182.567

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.120, KMIG -1.186
TCAP 19360.714, TLAB 30419.031, LS 37527.451
ADJL 1.000, LY 37527.581, ALY 37527.701
KY 19360.611, TY 707.974, YENT 20367.770
RETENT 9081.369, YH 53914.060, DYH 46933.158
HSAV -3871.723, SAV 7999.165, INV 7997.219
YGOV 27573.081, GOVEXP 31947.252, IBTX 5250.782
GRP 62847.067, AHEXP 50678.179, HTAX 6980.903
FTAXT 25.726, FTAXL 6129.943, FTAXK -1007.160
ENTX 1700.423, ENTYDIS 9585.979, LHHH 126.831
TQGOVR 3575.985, TQGOVM 1416.938, TQINV 2658.012
LYDIS 31397.758, TYDIS 682.248

Year Three

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	0.999	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.073	1.003	1.002	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4339.744	1750.756	2588.804	1215.851
Min	1.000	1.000	12104.566	6281.445	5820.149	2168.173
Man	1.000	1.000	34179.206	18337.496	15818.113	21461.847
Ser	1.003	1.000	58962.552	49359.846	9583.897	16914.113

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1710.763	432.478	570.311	707.974	1581.005	1003.650
Min	4340.151	1624.467	2715.684		4443.970	1980.953
Man	11590.769	7569.905	4020.864		9096.150	12461.568
Ser	32851.977	20792.179	12056.184		16681.556	6684.432

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.655	328.950	147.293	181.656	32.960	12.862
Min	6424.922	1731.649	1590.051	141.599	261.162	231.288
Man	21557.721	8381.046	2658.800	5722.245	2677.912	1854.226
Ser	23365.988	40169.938	30662.430	9507.508	2020.889	1477.264

+	QGOVM	QINV	QINVR	QINVM	ibt

Agr	20.098	20.227	9.779	10.448	96.199
Min	29.874	34.856	19.109	15.747	667.623
Man	823.685	7206.260	4751.912	2454.348	187.063
Ser	543.625	735.952	557.404	178.548	4288.355

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.339	675.076	579.262
Agr.Min	13.288	8.123	5.165
Agr.Man	1241.148	863.106	378.042
Agr.Ser	75.880	34.699	41.180
Min.Agr	135.177	123.355	11.822
Min.Min	3459.189	2184.243	1274.947
Min.Man	1567.613	1257.197	310.416
Min.Ser	1262.943	879.176	383.768
Man.Agr	605.860	159.535	446.324
Man.Min	1839.731	1392.157	447.574
Man.Man	12417.783	3592.027	8825.755
Man.Ser	6694.348	3952.431	2741.916
Ser.Agr	536.134	380.935	155.199
Ser.Min	1777.871	1317.992	459.879
Ser.Man	7151.609	5264.260	1887.348
Ser.Ser	13900.375	9718.369	4182.006

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -6.74280E-4, KMIG 2.328
TCAP 19363.043, TLAB 30419.029, LS 37527.700
ADJL 1.000, LY 37527.699, ALY 37527.699
KY 19363.246, TY 708.189, YENT 20370.538
RETENT 9082.556, YH 53915.508, DYH 46934.840
HSAV -3871.593, SAV 8000.483, INV 7996.879
YGOV 27560.571, GOVEXP 31946.691, IBTX 5239.241
GRP 62838.374, AHEXP 50679.602, HTAX 6980.668
FTAXT 25.734, FTAXL 6129.943, FTAXK -1007.292
ENTX 1700.645, ENTYDIS 9587.336, LHHH 126.830
TQGOVR 3575.641, TQGOVM 1417.282, TQINV 2659.090
LYDIS 31397.756, TYDIS 682.455

Year Four

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	0.999	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.073	1.003	1.002	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4340.785	1750.770	2589.831	1215.784
Min	0.999	1.000	12102.972	6280.498	5819.502	2167.893
Man	1.000	1.000	34169.284	18335.649	15810.049	21463.770
Ser	1.002	1.000	58971.226	49364.530	9587.892	16911.123

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1711.388	432.655	570.544	708.189	1581.007	1003.596
Min	4339.579	1624.253	2715.326		4443.511	1980.721
Man	11587.404	7567.708	4019.696		9094.401	12460.601
Ser	32853.196	20794.413	12057.478		16682.687	6683.161

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.603	328.948	147.304	181.643	32.960	12.863
Min	6424.232	1731.113	1589.561	141.552	261.162	231.289
Man	21555.002	8383.833	2659.236	5724.596	2677.911	1854.085
Ser	23365.851	40171.765	30665.823	9505.937	2020.889	1477.373

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.097	20.227	9.780	10.447	96.222
Min	29.873	34.856	19.109	15.747	668.203
Man	823.826	7206.260	4751.512	2454.748	187.196
Ser	543.515	735.952	557.441	178.511	4276.157

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.639	675.284	579.355
Agr.Min	13.286	8.122	5.164
Agr.Man	1240.788	862.894	377.894

Agr.Ser	75.890	34.707	41.183
Min.Agr	135.209	123.385	11.825
Min.Min	3458.734	2183.976	1274.759
Min.Man	1567.158	1256.838	310.320
Min.Ser	1263.130	879.312	383.818
Man.Agr	606.004	159.544	446.460
Man.Min	1839.489	1391.890	447.599
Man.Man	12414.177	3590.354	8823.823
Man.Ser	6695.332	3952.612	2742.719
Ser.Agr	536.263	381.057	155.206
Ser.Min	1777.637	1317.912	459.724
Ser.Man	7149.532	5263.114	1886.417
Ser.Ser	13902.420	9720.604	4181.814

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -6.79533E-7, KMIG 0.002
TCAP 19363.045, TLAB 30419.029, LS 37527.698
ADJL 1.000, LY 37527.698, ALY 37527.698
KY 19363.045, TY 708.479, YENT 20370.337
RETENT 9082.557, YH 53915.485, DYH 46935.257
HSAV -3871.349, SAV 8000.727, INV 7995.807
YGOV 27546.989, GOVEXP 31945.653, IBTX 5227.779
GRP 62827.001, AHEXP 50679.776, HTAX 6980.227
FTAXT 25.745, FTAXL 6129.943, FTAXK -1007.292
ENTX 1700.645, ENTYDIS 9587.135, LHHH 126.830
TQGOVR 3575.610, TQGOVM 1417.311, TQINV 2659.452
LYDIS 31397.755, TYDIS 682.734

Year Five

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	0.999	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.072	1.003	1.002	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4340.509	1750.275	2590.050	1215.419
Min	1.000	1.000	12092.172	6276.915	5812.289	2167.137
Man	1.000	1.000	34148.100	18329.493	15795.040	21463.057
Ser	1.002	1.000	58971.506	49362.306	9590.403	16906.958

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1711.569	432.599	570.491	708.479	1580.505	1003.238
Min	4335.706	1622.767	2712.940		4440.213	1979.958
Man	11580.220	7562.921	4017.299		9089.226	12456.428
Ser	32852.047	20802.039	12062.337		16679.520	6680.337

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2583.743	328.948	147.310	181.639	32.960	12.864
Min	6420.172	1730.830	1589.286	141.544	261.162	231.278
Man	21545.656	8386.289	2659.045	5727.244	2677.911	1853.874
Ser	23359.861	40171.360	30666.620	9504.735	2020.888	1477.477

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.781	10.446	96.216
Min	29.884	34.856	19.105	15.751	668.275
Man	824.037	7206.260	4750.912	2455.347	187.267
Ser	543.410	735.952	557.476	178.475	4263.387

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.559	675.284	579.275
Agr.Min	13.274	8.115	5.159
Agr.Man	1240.019	862.395	377.623
Agr.Ser	75.890	34.710	41.181
Min.Agr	135.201	123.373	11.829
Min.Min	3455.649	2181.685	1273.963
Min.Man	1566.186	1255.953	310.233
Min.Ser	1263.136	879.203	383.933
Man.Agr	605.966	159.490	446.475
Man.Min	1837.847	1390.522	447.325
Man.Man	12406.480	3587.183	8819.297
Man.Ser	6695.363	3952.031	2743.332
Ser.Agr	536.229	381.062	155.167
Ser.Min	1776.050	1316.825	459.224
Ser.Man	7145.098	5260.215	1884.882
Ser.Ser	13902.484	9721.418	4181.064

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 1.297, KMIG 0.023
TCAP 19363.067, TLAB 30420.326, LS 37527.698
ADJL 1.000, LY 37529.108, ALY 37530.405
KY 19363.069, TY 708.414, YENT 20370.363
RETENT 9082.569, YH 53917.990, DYH 46937.889
HSAV -3871.279, SAV 8000.809, INV 7996.060
YGOV 27534.916, GOVEXP 31946.479, IBTX 5215.145
GRP 62817.033, AHEXP 50682.333, HTAX 6980.101
FTAXT 25.743, FTAXL 6130.173, FTAXK -1007.293
ENTX 1700.647, ENTYDIS 9587.146, LHHH 128.240
TQGOVR 3575.493, TQGOVM 1417.428, TQINV 2660.020
LYDIS 31400.232, TYDIS 682.672

Year Six

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	0.999	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.072	1.002	1.002	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4341.147	1750.222	2590.741	1215.328
Min	1.000	1.000	12080.134	6273.068	5804.103	2166.572
Man	1.000	1.000	34139.120	18327.446	15788.115	21464.719
Ser	1.002	1.000	58987.323	49372.008	9596.522	16903.943

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1711.756	432.697	570.645	708.414	1580.445	1003.163
Min	4331.391	1621.107	2710.284		4437.293	1979.385
Man	11577.175	7560.817	4016.358		9087.069	12455.377
Ser	32873.230	20805.704	12065.034		16681.287	6678.726

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2583.608	328.940	147.315	181.625	32.960	12.865
Min	6416.679	1729.906	1588.372	141.534	261.162	231.265
Man	21542.448	8389.105	2659.580	5729.525	2677.911	1853.761
Ser	23360.018	40177.888	30674.347	9503.534	2020.887	1477.627

+	QGOVM	QINV	QINVR	QINVM	ibt

Agr	20.095	20.227	9.782	10.445	96.230
Min	29.897	34.856	19.101	15.755	668.278
Man	824.149	7206.259	4750.593	2455.666	187.405
Ser	543.260	735.951	557.527	178.424	4261.748

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.743	675.418	579.325
Agr.Min	13.261	8.107	5.154
Agr.Man	1239.692	862.198	377.494
Agr.Ser	75.911	34.721	41.190
Min.Agr	135.222	123.386	11.836
Min.Min	3452.208	2179.107	1273.101
Min.Man	1565.774	1255.497	310.277
Min.Ser	1263.475	879.304	384.171
Man.Agr	606.054	159.490	446.564
Man.Min	1836.017	1389.071	446.946
Man.Man	12403.217	3585.737	8817.480
Man.Ser	6697.159	3952.771	2744.387
Ser.Agr	536.308	381.160	155.148
Ser.Min	1774.281	1315.643	458.638
Ser.Man	7143.218	5259.355	1883.861
Ser.Ser	13906.211	9725.129	4181.078

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -0.001, KMIG -0.786
TCAP 19362.321, TLAB 30420.325, LS 37530.405
ADJL 1.000, LY 37530.403, ALY 37530.402
KY 19362.253, TY 708.574, YENT 20369.502
RETENT 9082.168, YH 53917.463, DYH 46937.870
HSAV -3870.997, SAV 8000.690, INV 7995.626
YGOV 27532.108, GOVEXP 31945.415, IBTX 5213.661
GRP 62814.890, AHEXP 50680.627, HTAX 6979.593
FTAXT 25.749, FTAXL 6130.173, FTAXK -1007.249
ENTX 1700.572, ENTYDIS 9586.761, LHHH 128.238
TQGOVR 3575.518, TQGOVM 1417.402, TQINV 2660.291
LYDIS 31400.229, TYDIS 682.825

Year Seven

PK PT IBTAX PR P PN

Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	1.000	0.359
Man	1.000		0.005	0.999	1.000	0.339
Ser	1.000		0.072	1.002	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4341.740	1750.389	2591.168	1215.425
Min	1.000	1.000	12067.037	6269.373	5794.706	2166.274
Man	0.999	1.000	34141.008	18328.812	15788.636	21468.794
Ser	1.002	1.000	59011.758	49392.211	9600.747	16910.212

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.150	432.786	570.790	708.574	1580.605	1003.259
Min	4326.695	1619.300	2707.394		4434.511	1979.052
Man	11577.815	7561.108	4016.707		9087.304	12456.694
Ser	32884.354	20809.088	12067.579		16684.359	6679.952

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2583.864	328.947	147.320	181.627	32.960	12.865
Min	6413.565	1729.022	1587.475	141.547	261.162	231.248
Man	21543.998	8392.999	2660.769	5732.230	2677.910	1853.747
Ser	23364.311	40200.074	30691.484	9508.590	2020.887	1477.638

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.243
Min	29.914	34.856	19.095	15.761	668.222
Man	824.163	7206.259	4750.552	2455.707	187.603
Ser	543.249	735.951	557.531	178.420	4255.003

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.915	675.519	579.396
Agr.Min	13.247	8.098	5.148
Agr.Man	1239.761	862.253	377.508
Agr.Ser	75.942	34.736	41.207
Min.Agr	135.240	123.396	11.845
Min.Min	3448.465	2176.219	1272.246
Min.Man	1565.861	1255.404	310.457

Min.Ser	1263.998	879.493	384.505
Man.Agr	606.137	159.509	446.628
Man.Min	1834.026	1387.556	446.470
Man.Man	12403.903	3585.871	8818.032
Man.Ser	6699.932	3954.368	2745.564
Ser.Agr	536.381	381.215	155.166
Ser.Min	1772.351	1314.226	458.126
Ser.Man	7143.611	5259.683	1883.928
Ser.Ser	13911.967	9729.235	4182.732

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 1.958, KMIG 0.150
TCAP 19362.471, TLAB 30422.283, LS 37530.402
ADJL 1.000, LY 37532.530, ALY 37534.488
KY 19362.484, TY 708.760, YENT 20369.741
RETENT 9082.244, YH 53921.699, DYH 46942.036
HSAV -3871.036, SAV 8000.727, INV 7995.077
YGOV 27524.919, GOVEXP 31945.685, IBTX 5207.071
GRP 62812.803, AHEXP 50684.827, HTAX 6979.663
FTAXT 25.756, FTAXL 6130.521, FTAXK -1007.257
ENTX 1700.586, ENTYDIS 9586.911, LHHH 130.366
TQGOVR 3575.497, TQGOVM 1417.422, TQINV 2660.333
LYDIS 31403.968, TYDIS 683.004

Year Eight

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	0.999	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.072	1.002	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.872	1750.935	2591.754	1215.758
Min	1.000	1.000	12056.313	6266.366	5786.994	2166.014
Man	0.999	1.000	34157.340	18333.154	15800.610	21472.614
Ser	1.001	1.000	59009.901	49388.374	9602.732	16905.061

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.782	432.968	571.055	708.760	1581.167	1003.604
Min	4322.849	1617.816	2705.033		4432.464	1978.780

Man	11583.353	7564.608	4018.745		9089.159	12459.091
Ser	32875.632	20806.895	12066.845		16686.660	6679.194

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.771	328.918	147.304	181.614	32.960	12.865
Min	6411.245	1728.070	1586.530	141.539	261.162	231.234
Man	21548.249	8396.927	2662.586	5734.341	2677.910	1853.927
Ser	23365.855	40189.537	30685.206	9504.328	2020.887	1477.735

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.268
Min	29.928	34.856	19.090	15.766	668.296
Man	823.984	7206.259	4751.062	2455.198	187.881
Ser	543.152	735.951	557.564	178.387	4246.376

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.242	675.685	579.557
Agr.Min	13.234	8.091	5.144
Agr.Man	1240.354	862.657	377.697
Agr.Ser	75.941	34.734	41.206
Min.Agr	135.276	123.422	11.854
Min.Min	3445.400	2173.851	1271.549
Min.Man	1566.610	1255.870	310.740
Min.Ser	1263.958	879.321	384.637
Man.Agr	606.295	159.588	446.707
Man.Min	1832.396	1386.429	445.967
Man.Man	12409.837	3588.389	8821.449
Man.Ser	6699.721	3954.754	2744.968
Ser.Agr	536.521	381.341	155.180
Ser.Min	1770.777	1313.141	457.636
Ser.Man	7147.028	5262.537	1884.491
Ser.Ser	13911.529	9729.641	4181.887

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.004, KMIG -0.792
TCAP 19361.678, TLAB 30422.286, LS 37534.487
ADJL 1.000, LY 37534.492, ALY 37534.496
KY 19361.610, TY 709.057, YENT 20368.822

RETENT 9081.840, YH 53921.160, DYH 46942.023
HSAV -3870.744, SAV 8000.615, INV 7994.234
YGOV 27514.576, GOVEXP 31943.896, IBTX 5198.822
GRP 62803.985, AHEXP 50682.401, HTAX 6979.137
FTAXT 25.767, FTAXL 6130.522, FTAXK -1007.212
ENTX 1700.510, ENTYDIS 9586.471, LHHH 130.371
TQGOVR 3575.760, TQGOVM 1417.159, TQINV 2659.796
LYDIS 31403.974, TYDIS 683.291

Year Nine

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.055	0.999	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.072	1.002	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.845	1750.956	2591.706	1215.759
Min	1.000	1.000	12036.301	6260.240	5773.116	2165.110
Man	0.999	1.000	34159.948	18331.094	15805.272	21466.737
Ser	1.001	1.000	59000.197	49378.223	9603.186	16898.096

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.069	432.943	571.069	709.057	1581.203	1003.621
Min	4315.673	1615.047	2700.626		4427.606	1977.829
Man	11584.237	7564.970	4019.268		9087.619	12457.434
Ser	32868.334	20809.327	12069.249		16684.310	6676.858

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.824	328.887	147.289	181.598	32.960	12.865
Min	6405.436	1726.841	1585.285	141.556	261.162	231.210
Man	21545.051	8392.190	2661.531	5730.660	2677.911	1854.067
Ser	23361.169	40177.101	30677.282	9499.815	2020.887	1477.821

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.267
Min	29.952	34.856	19.082	15.774	667.855
Man	823.844	7206.260	4751.460	2454.800	188.083
Ser	543.066	735.951	557.593	178.358	4237.203

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.234	675.677	579.557
Agr.Min	13.213	8.078	5.135
Agr.Man	1240.449	862.720	377.729
Agr.Ser	75.928	34.728	41.199
Min.Agr	135.275	123.411	11.864
Min.Min	3439.681	2169.519	1270.161
Min.Man	1566.730	1255.741	310.989
Min.Ser	1263.750	878.935	384.815
Man.Agr	606.291	159.616	446.675
Man.Min	1829.354	1384.211	445.144
Man.Man	12410.785	3589.290	8821.496
Man.Ser	6698.620	3954.502	2744.118
Ser.Agr	536.518	381.363	155.155
Ser.Min	1767.838	1311.035	456.803
Ser.Man	7147.574	5263.239	1884.334
Ser.Ser	13909.240	9728.674	4180.565

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 1.096207E-4, KMIG -1.466
TCAP 19360.212, TLAB 30422.287, LS 37534.497
ADJL 1.000, LY 37534.497, ALY 37534.497
KY 19360.085, TY 709.016, YENT 20367.214
RETENT 9081.093, YH 53920.282, DYH 46941.766
HSAV -3870.400, SAV 8000.212, INV 7994.394
YGOV 27504.821, GOVEXP 31944.049, IBTX 5189.409
GRP 62793.007, AHEXP 50681.795, HTAX 6978.517
FTAXT 25.766, FTAXL 6130.522, FTAXK -1007.129
ENTX 1700.370, ENTYDIS 9585.751, LHHH 130.371
TQGOVR 3575.963, TQGOVM 1416.957, TQINV 2659.377
LYDIS 31403.975, TYDIS 683.251

Year Ten

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.072	1.002	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4343.138	1751.126	2591.829	1215.853
Min	1.000	1.000	12019.183	6256.880	5759.366	2165.120
Man	0.999	1.000	34166.557	18330.590	15812.376	21461.965
Ser	1.001	1.000	58997.153	49373.028	9605.343	16891.760

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.144	432.975	571.152	709.016	1581.391	1003.734
Min	4309.535	1612.678	2696.857		4424.169	1977.620
Man	11586.479	7566.247	4020.233		9087.483	12457.065
Ser	32876.879	20810.043	12070.524		16684.332	6675.020

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.125	328.850	147.271	181.579	32.960	12.865
Min	6401.790	1727.128	1585.396	141.732	261.162	231.179
Man	21544.547	8387.429	2660.544	5726.886	2677.911	1854.231
Ser	23359.355	40167.377	30671.907	9495.466	2020.887	1477.933

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.273
Min	29.983	34.856	19.072	15.784	667.573
Man	823.680	7206.260	4751.926	2454.334	188.308
Ser	542.954	735.951	557.631	178.320	4228.527

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.319	675.717	579.602
Agr.Min	13.194	8.066	5.128
Agr.Man	1240.689	862.882	377.807
Agr.Ser	75.923	34.726	41.197
Min.Agr	135.284	123.407	11.877
Min.Min	3434.788	2165.495	1269.292
Min.Man	1567.033	1255.691	311.341
Min.Ser	1264.685	879.576	385.109
Man.Agr	606.332	159.661	446.671
Man.Min	1826.753	1382.339	444.414
Man.Man	12413.187	3590.719	8822.469
Man.Ser	6698.274	3954.764	2743.511

Ser.Agr	536.554	381.420	155.134
Ser.Min	1765.324	1309.266	456.058
Ser.Man	7148.956	5264.649	1884.306
Ser.Ser	13908.521	9728.997	4179.522

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -0.344, KMIG -1.446
TCAP 19358.766, TLAB 30421.943, LS 37534.497
ADJL 1.000, LY 37534.123, ALY 37533.779
KY 19358.640, TY 709.062, YENT 20365.688
RETENT 9080.356, YH 53918.746, DYH 46940.950
HSAV -3870.000, SAV 7999.875, INV 7994.258
YGOV 27494.969, GOVEXP 31943.708, IBTX 5180.681
GRP 62782.163, AHEXP 50680.580, HTAX 6977.796
FTAXT 25.768, FTAXL 6130.461, FTAXK -1007.047
ENTX 1700.232, ENTYDIS 9585.100, LHHH 129.997
TQGOVR 3576.208, TQGOVM 1416.712, TQINV 2658.883
LYDIS 31403.318, TYDIS 683.294

Year Eleven

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.072	1.001	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4343.365	1751.250	2591.931	1215.919
Min	1.000	1.000	11993.455	6250.361	5740.167	2164.628
Man	0.999	1.000	34171.692	18329.196	15818.897	21456.602
Ser	1.001	1.000	58996.615	49369.520	9608.318	16885.235

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.278	432.988	571.229	709.062	1581.531	1003.817
Min	4300.310	1609.120	2691.190		4417.786	1976.879
Man	11588.221	7567.107	4021.114		9086.400	12456.076
Ser	32880.267	20812.728	12073.355		16683.803	6672.743

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.348	328.817	147.255	181.562	32.960	12.865

Min	6394.667	1727.230	1585.300	141.930	261.162	231.140
Man	21542.474	8382.752	2659.596	5723.157	2677.911	1854.399
Ser	23356.549	40160.145	30668.750	9491.391	2020.887	1478.062

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.278
Min	30.022	34.856	19.059	15.797	666.811
Man	823.512	7206.260	4752.403	2453.857	188.525
Ser	542.824	735.951	557.675	178.276	4220.048

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.384	675.749	579.636
Agr.Min	13.166	8.049	5.117
Agr.Man	1240.875	863.009	377.867
Agr.Ser	75.922	34.725	41.197
Min.Agr	135.291	123.398	11.893
Min.Min	3427.435	2159.695	1267.738
Min.Man	1567.268	1255.516	311.751
Min.Ser	1264.673	879.177	385.496
Man.Agr	606.364	159.704	446.660
Man.Min	1822.843	1379.479	443.364
Man.Man	12415.054	3592.011	8823.043
Man.Ser	6698.214	3955.206	2743.009
Ser.Agr	536.582	381.476	155.106
Ser.Min	1761.545	1306.573	454.972
Ser.Man	7150.029	5265.892	1884.136
Ser.Ser	13908.392	9729.861	4178.529

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -9.77614E-5, KMIG -1.878
TCAP 19356.888, TLAB 30421.943, LS 37533.779
ADJL 1.000, LY 37533.779, ALY 37533.779
KY 19356.725, TY 709.083, YENT 20363.666
RETENT 9079.399, YH 53917.906, DYH 46940.776
HSAV -3869.631, SAV 7999.287, INV 7994.208
YGOV 27485.177, GOVEXP 31943.798, IBTX 5171.662
GRP 62771.248, AHEXP 50680.410, HTAX 6977.130
FTAXT 25.769, FTAXL 6130.461, FTAXK -1006.941
ENTX 1700.053, ENTYDIS 9584.214, LHHH 129.997

TQGOVR 3576.467, TQGOVM 1416.453, TQINV 2658.375
LYDIS 31403.318, TYDIS 683.314

Year Twelve

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.071	1.001	1.001	0.557

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4343.316	1751.437	2591.696	1216.057
Min	1.000	1.000	11999.083	6252.069	5744.086	2164.883
Man	0.999	1.000	34182.068	18331.158	15827.301	21453.784
Ser	1.001	1.000	58988.902	49365.077	9605.048	16887.334

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.281	432.985	571.213	709.083	1581.741	1003.967
Min	4302.328	1609.895	2692.433		4419.409	1977.172
Man	11591.740	7569.456	4022.283		9088.804	12457.416
Ser	32881.784	20809.608	12071.308		16683.718	6674.002

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.708	328.782	147.233	181.549	32.960	12.864
Min	6396.581	1727.281	1585.380	141.900	261.162	231.147
Man	21546.219	8378.162	2658.604	5719.559	2677.911	1854.545
Ser	23357.718	40156.632	30664.516	9492.117	2020.886	1477.977

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.277
Min	30.015	34.856	19.061	15.795	667.124
Man	823.366	7206.260	4752.817	2453.443	188.771
Ser	542.909	735.951	557.646	178.305	4215.281

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.371	675.718	579.653

Agr.Min	13.172	8.053	5.120
Agr.Man	1241.253	863.251	378.001
Agr.Ser	75.912	34.719	41.193
Min.Agr	135.289	123.399	11.890
Min.Min	3429.041	2160.916	1268.125
Min.Man	1567.743	1255.962	311.781
Min.Ser	1264.508	879.132	385.376
Man.Agr	606.357	159.732	446.625
Man.Min	1823.698	1380.212	443.486
Man.Man	12418.824	3593.755	8825.069
Man.Ser	6697.339	3955.104	2742.236
Ser.Agr	536.576	381.448	155.128
Ser.Min	1762.372	1307.114	455.258
Ser.Man	7152.199	5267.193	1885.006
Ser.Ser	13906.572	9727.962	4178.610

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.001, KMIG 0.350
TCAP 19357.238, TLAB 30421.944, LS 37533.779
ADJL 1.000, LY 37533.780, ALY 37533.781
KY 19357.269, TY 709.077, YENT 20364.229
RETENT 9079.578, YH 53918.126, DYH 46941.521
HSAV -3869.340, SAV 7999.757, INV 7994.230
YGOV 27480.264, GOVEXP 31943.692, IBTX 5167.453
GRP 62767.580, AHEXP 50680.864, HTAX 6976.605
FTAXT 25.769, FTAXL 6130.461, FTAXK -1006.961
ENTX 1700.086, ENTYDIS 9584.565, LHHH 129.998
TQGOVR 3576.533, TQGOVM 1416.386, TQINV 2657.988
LYDIS 31403.320, TYDIS 683.309

Year Thirteen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.071	1.001	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4343.136	1751.540	2591.413	1216.152
Min	1.000	1.000	12003.717	6253.529	5747.258	2165.103
Man	0.999	1.000	34188.992	18332.295	15833.081	21451.195

Ser	1.001	1.000	58981.918	49361.581	9601.559	16890.300

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.204	432.958	571.169	709.077	1581.849	1004.054
Min	4303.990	1610.533	2693.457		4420.657	1977.410
Man	11594.087	7571.032	4023.055		9090.436	12458.186
Ser	32883.019	20807.422	12075.842		16682.929	6675.252

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.903	328.784	147.229	181.555	32.960	12.864
Min	6398.068	1727.476	1585.586	141.890	261.162	231.152
Man	21548.621	8374.314	2657.715	5716.600	2677.911	1854.649
Ser	23358.180	40155.642	30661.944	9493.700	2020.886	1477.878

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.273
Min	30.010	34.856	19.063	15.793	667.382
Man	823.262	7206.260	4753.113	2453.147	188.998
Ser	543.009	735.951	557.612	178.339	4210.571

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.319	675.670	579.649
Agr.Min	13.178	8.056	5.122
Agr.Man	1241.503	863.409	378.094
Agr.Ser	75.903	34.714	41.189
Min.Agr	135.283	123.396	11.887
Min.Min	3430.365	2161.912	1268.453
Min.Man	1568.061	1256.267	311.794
Min.Ser	1264.358	879.082	385.276
Man.Agr	606.332	159.747	446.585
Man.Min	1824.402	1380.806	443.596
Man.Man	12421.340	3594.950	8826.390
Man.Ser	6696.547	3954.932	2741.615
Ser.Agr	536.554	381.405	155.149
Ser.Min	1763.053	1307.534	455.519
Ser.Man	7153.648	5267.912	1885.736
Ser.Ser	13904.926	9726.078	4178.848

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.001, KMIG 0.288
TCAP 19363.522, TLAB 30421.945, LS 37533.781
ADJL 1.000, LY 37533.783, ALY 37533.784
KY 19363.547, TY 709.033, YENT 20370.525
RETENT 9079.546, YH 53924.253, DYH 46946.901
HSAV -3869.463, SAV 7999.602, INV 7994.402
YGOV 27477.147, GOVEXP 31943.840, IBTX 5163.224
GRP 62769.589, AHEXP 50686.366, HTAX 6977.352
FTAXT 25.767, FTAXL 6130.461, FTAXK -1006.977
ENTX 1700.114, ENTYDIS 9590.865, LHHH 130.000
TQGOVR 3576.543, TQGOVM 1416.376, TQINV 2657.725
LYDIS 31403.323, TYDIS 683.266

Year Fourteen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	0.999	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.945	1751.587	2591.174	1216.182
Min	1.000	1.000	12005.863	6253.978	5748.955	2165.035
Man	0.999	1.000	34194.232	18332.105	15838.504	21445.613
Ser	1.001	1.000	58962.607	49348.409	9595.423	16891.128

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1713.084	432.927	571.124	709.033	1581.915	1004.101
Min	4304.759	1610.827	2693.932		4421.131	1977.370
Man	11595.864	7572.209	4023.655		9090.917	12456.716
Ser	32872.498	20805.984	12074.929		16679.251	6675.767

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2586.015	328.749	147.210	181.540	32.960	12.864
Min	6398.501	1727.424	1585.557	141.867	261.162	231.156
Man	21547.632	8369.538	2656.585	5712.954	2677.911	1854.770
Ser	23355.017	40146.458	30652.619	9493.843	2020.887	1477.751

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.269
Min	30.006	34.856	19.064	15.792	667.501
Man	823.141	7206.260	4753.458	2452.803	189.216
Ser	543.136	735.951	557.569	178.382	4204.987

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.264	675.626	579.637
Agr.Min	13.180	8.057	5.123
Agr.Man	1241.693	863.530	378.164
Agr.Ser	75.878	34.702	41.176
Min.Agr	135.277	123.392	11.885
Min.Min	3430.978	2162.412	1268.566
Min.Man	1568.301	1256.495	311.806
Min.Ser	1263.944	878.832	385.112
Man.Agr	606.305	159.765	446.540
Man.Min	1824.728	1381.124	443.604
Man.Man	12422.244	3596.045	8826.199
Man.Ser	6694.355	3953.982	2740.373
Ser.Agr	536.530	381.353	155.177
Ser.Min	1763.368	1307.660	455.708
Ser.Man	7154.744	5268.276	1886.469
Ser.Ser	13900.374	9721.962	4178.413

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.003, KMIG 0.117
TCAP 19363.640, TLAB 30421.948, LS 37533.784
ADJL 1.000, LY 37533.787, ALY 37533.790
KY 19363.650, TY 708.982, YENT 20370.634
RETENT 9079.606, YH 53924.112, DYH 46947.366
HSAV -3869.127, SAV 7999.998, INV 7994.408
YGOV 27471.835, GOVEXP 31943.999, IBTX 5157.974
GRP 62764.396, AHEXP 50686.493, HTAX 6976.746
FTAXT 25.765, FTAXL 6130.462, FTAXK -1006.984
ENTX 1700.125, ENTYDIS 9590.903, LHHH 130.003
TQGOVR 3576.541, TQGOVM 1416.379, TQINV 2657.422
LYDIS 31403.328, TYDIS 683.217

Year Fifteen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.097	1751.111	2590.802	1215.848
Min	1.000	1.000	11999.872	6251.536	5745.407	2164.303
Man	0.999	1.000	34180.473	18325.846	15831.015	21441.515
Ser	1.002	1.000	58937.697	49326.921	9592.010	16882.716

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.698	432.777	570.939	708.982	1581.446	1003.786
Min	4302.611	1610.000	2692.611		4418.960	1976.637
Man	11591.198	7569.101	4022.097		9086.711	12452.065
Ser	32867.022	20810.069	12077.580		16672.622	6672.659

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.232	328.724	147.202	181.522	32.960	12.864
Min	6395.596	1727.154	1585.290	141.864	261.162	231.152
Man	21538.776	8368.025	2654.692	5713.333	2677.911	1854.725
Ser	23345.282	40126.283	30637.707	9488.575	2020.887	1477.778

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.250
Min	30.010	34.856	19.063	15.793	667.168
Man	823.186	7206.261	4753.330	2452.931	189.329
Ser	543.109	735.951	557.578	178.373	4194.821

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.018	675.509	579.509
Agr.Min	13.173	8.053	5.120
Agr.Man	1241.194	863.195	377.999
Agr.Ser	75.846	34.688	41.158
Min.Agr	135.251	123.366	11.884

Min.Min	3429.266	2161.218	1268.048
Min.Man	1567.670	1255.953	311.716
Min.Ser	1263.410	878.422	384.988
Man.Agr	606.187	159.724	446.462
Man.Min	1823.817	1380.408	443.409
Man.Man	12417.246	3594.395	8822.850
Man.Ser	6691.527	3952.183	2739.344
Ser.Agr	536.425	381.286	155.139
Ser.Min	1762.488	1307.031	455.457
Ser.Man	7151.866	5266.251	1885.615
Ser.Ser	13894.503	9718.054	4176.448

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 8.314591E-5, KMIG -0.413
TCAP 19363.227, TLAB 30421.947, LS 37533.789
ADJL 1.000, LY 37533.789, ALY 37533.789
KY 19363.191, TY 708.736, YENT 20370.152
RETENT 9079.396, YH 53923.500, DYH 46947.438
HSAV -3868.748, SAV 8000.167, INV 7995.160
YGOV 27462.156, GOVEXP 31944.764, IBTX 5147.568
GRP 62753.285, AHEXP 50686.183, HTAX 6976.062
FTAXT 25.756, FTAXL 6130.462, FTAXK -1006.961
ENTX 1700.086, ENTYDIS 9590.671, LHHH 130.003
TQGOVR 3576.519, TQGOVM 1416.400, TQINV 2657.542
LYDIS 31403.327, TYDIS 682.980

Year Sixteen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.701	1751.349	2591.169	1215.976
Min	1.000	1.000	12001.017	6251.855	5746.232	2164.343
Man	0.999	1.000	34186.910	18328.022	15835.271	21444.363
Ser	1.001	1.000	58931.219	49319.515	9592.944	16876.867

+	VA	LAB	CAP	LAND	TVR	TVM

Agr	1712.690	432.881	571.074	708.736	1581.700	1003.932
Min	4303.021	1610.158	2692.864		4419.400	1976.697
Man	11593.381	7570.537	4022.844		9087.526	12453.111
Ser	32884.034	20807.997	12076.327		16673.732	6671.610

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.632	328.689	147.187	181.503	32.960	12.864
Min	6396.097	1727.012	1585.167	141.845	261.162	231.154
Man	21540.637	8371.194	2655.862	5715.332	2677.911	1854.777
Ser	23345.344	40112.960	30629.070	9483.888	2020.887	1477.862

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.263
Min	30.008	34.856	19.064	15.792	667.232
Man	823.134	7206.261	4753.477	2452.785	189.554
Ser	543.025	735.951	557.607	178.344	4185.988

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.193	675.604	579.589
Agr.Min	13.174	8.054	5.120
Agr.Man	1241.428	863.358	378.070
Agr.Ser	75.838	34.684	41.153
Min.Agr	135.269	123.384	11.885
Min.Min	3429.593	2161.471	1268.122
Min.Man	1567.964	1256.204	311.760
Min.Ser	1263.271	878.341	384.930
Man.Agr	606.270	159.757	446.513
Man.Min	1823.991	1380.570	443.421
Man.Man	12419.584	3595.303	8824.280
Man.Ser	6690.792	3951.895	2738.896
Ser.Agr	536.500	381.362	155.137
Ser.Min	1762.656	1307.227	455.429
Ser.Man	7153.213	5267.537	1885.675
Ser.Ser	13892.975	9717.605	4175.369

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG -0.374, KMIG -0.119
TCAP 19363.108, TLAB 30421.573, LS 37533.789

ADJL 1.000, LY 37533.383, ALY 37533.009
KY 19363.098, TY 708.898, YENT 20370.052
RETENT 9079.335, YH 53922.607, DYH 46947.283
HSAV -3868.338, SAV 8000.516, INV 7994.704
YGOV 27452.001, GOVEXP 31944.072, IBTX 5139.037
GRP 62744.042, AHEXP 50685.620, HTAX 6975.323
FTAXT 25.762, FTAXL 6130.396, FTAXK -1006.954
ENTX 1700.075, ENTYDIS 9590.642, LHHH 129.597
TQGOVR 3576.656, TQGOVM 1416.264, TQINV 2657.366
LYDIS 31402.613, TYDIS 683.136

Year Seventeen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.365	1751.261	2590.920	1215.926
Min	1.000	1.000	11998.785	6251.112	5744.744	2164.190
Man	0.999	1.000	34186.331	18328.188	15834.527	21446.571
Ser	1.001	1.000	58926.151	49313.271	9594.125	16871.304

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.720	432.822	571.000	708.898	1581.618	1003.887
Min	4302.222	1609.851	2692.370		4418.774	1976.540
Man	11593.185	7570.390	4022.795		9086.699	12452.764
Ser	32881.496	20810.096	12077.633		16673.550	6670.104

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.505	328.678	147.180	181.498	32.960	12.864
Min	6395.313	1726.900	1585.053	141.847	261.162	231.152
Man	21539.463	8374.739	2656.925	5717.813	2677.911	1854.758
Ser	23343.656	40102.836	30622.889	9479.945	2020.887	1477.947

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.256
Min	30.010	34.856	19.063	15.793	667.108

Man	823.153	7206.262	4753.422	2452.840	189.741
Ser	542.940	735.951	557.636	178.315	4177.273

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.096	675.546	579.550
Agr.Min	13.172	8.052	5.119
Agr.Man	1241.407	863.339	378.068
Agr.Ser	75.830	34.681	41.150
Min.Agr	135.259	123.373	11.885
Min.Min	3428.955	2160.998	1267.957
Min.Man	1567.937	1256.160	311.777
Min.Ser	1263.162	878.242	384.921
Man.Agr	606.223	159.741	446.482
Man.Min	1823.652	1380.302	443.350
Man.Man	12419.373	3595.156	8824.217
Man.Ser	6690.216	3951.500	2738.715
Ser.Agr	536.457	381.356	155.101
Ser.Min	1762.328	1307.056	455.272
Ser.Man	7153.091	5267.745	1885.346
Ser.Ser	13891.779	9717.393	4174.385

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 1.586, KMIG 0.689
TCAP 19363.798, TLAB 30423.159, LS 37533.009
ADJL 1.000, LY 37534.733, ALY 37536.319
KY 19363.858, TY 708.834, YENT 20370.851
RETENT 9079.686, YH 53926.195, DYH 46951.071
HSAV -3868.228, SAV 8000.977, INV 7994.942
YGOV 27443.932, GOVEXP 31945.167, IBTX 5130.377
GRP 62739.389, AHEXP 50689.696, HTAX 6975.124
FTAXT 25.760, FTAXL 6130.678, FTAXK -1006.993
ENTX 1700.141, ENTYDIS 9591.024, LHHH 131.321
TQGOVR 3576.720, TQGOVM 1416.200, TQINV 2657.393
LYDIS 31405.642, TYDIS 683.074

Year Eighteen

PK	PT	IBTAX	PR	P	PN

Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4342.122	1751.150	2590.788	1215.854
Min	1.000	1.000	11995.819	6250.130	5742.761	2163.992
Man	0.999	1.000	34183.591	18327.760	15832.218	21448.611
Ser	1.001	1.000	58921.772	49307.542	9595.480	16865.788

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.560	432.779	570.948	708.834	1581.509	1003.817
Min	4301.157	1609.445	2691.713		4417.907	1976.331
Man	11592.256	7569.761	4022.495		9085.425	12452.060
Ser	32885.285	20813.205	12079.540		16673.109	6668.472

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.326	328.674	147.179	181.496	32.960	12.864
Min	6394.238	1726.794	1584.940	141.854	261.162	231.149
Man	21537.485	8378.325	2657.929	5720.396	2677.911	1854.716
Ser	23341.582	40093.660	30617.478	9476.179	2020.887	1478.034

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.251
Min	30.013	34.856	19.062	15.794	666.943
Man	823.195	7206.262	4753.302	2452.960	189.916
Ser	542.852	735.951	557.666	178.285	4168.625

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1255.026	675.510	579.516
Agr.Min	13.168	8.050	5.118
Agr.Man	1241.307	863.271	378.036
Agr.Ser	75.825	34.679	41.147
Min.Agr	135.250	123.365	11.886
Min.Min	3428.107	2160.368	1267.739
Min.Man	1567.811	1256.029	311.782
Min.Ser	1263.069	878.145	384.924

Man.Agr	606.189	159.723	446.466
Man.Min	1823.201	1379.936	443.265
Man.Man	12418.377	3594.679	8823.698
Man.Ser	6689.718	3951.087	2738.631
Ser.Agr	536.427	381.359	155.068
Ser.Min	1761.892	1306.807	455.085
Ser.Man	7152.518	5267.629	1884.888
Ser.Ser	13890.746	9717.314	4173.430

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 2.030, KMIG 0.897
TCAP 19364.695, TLAB 30425.189, LS 37536.319
ADJL 1.000, LY 37538.526, ALY 37540.557
KY 19364.773, TY 708.805, YENT 20371.817
RETENT 9080.143, YH 53930.376, DYH 46955.343
HSAV -3868.178, SAV 8001.485, INV 7995.012
YGOV 27435.775, GOVEXP 31945.408, IBTX 5121.735
GRP 62735.869, AHEXP 50692.192, HTAX 6975.033
FTAXT 25.759, FTAXL 6131.038, FTAXK -1007.044
ENTX 1700.227, ENTYDIS 9591.447, LHHH 133.528
TQGOVR 3576.763, TQGOVM 1416.157, TQINV 2657.484
LYDIS 31409.518, TYDIS 683.046

Year Nineteen

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.071	1.002	1.001	0.558

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4341.934	1751.023	2590.727	1215.764
Min	1.000	1.000	11992.607	6249.036	5740.645	2163.757
Man	0.999	1.000	34179.431	18326.903	15828.919	21450.416
Ser	1.001	1.000	58917.027	49301.492	9596.790	16860.130

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.458	432.745	570.908	708.805	1581.382	1003.730
Min	4300.006	1609.005	2691.001		4416.937	1976.085

Man	11590.845	7568.817	4022.029	9083.842	12451.079
Ser	32890.096	20816.650	12081.646	16672.374	6666.720

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2585.112	328.672	147.179	181.493	32.960	12.864
Min	6393.022	1726.680	1584.819	141.861	261.162	231.146
Man	21534.921	8381.834	2658.865	5722.969	2677.911	1854.660
Ser	23339.096	40084.434	30612.040	9472.391	2020.886	1478.122

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.096	20.227	9.782	10.445	96.247
Min	30.016	34.856	19.061	15.795	666.764
Man	823.251	7206.262	4753.144	2453.118	190.083
Ser	542.764	735.951	557.696	178.255	4159.969

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.972	675.487	579.485
Agr.Min	13.164	8.048	5.117
Agr.Man	1241.156	863.171	377.985
Agr.Ser	75.820	34.677	41.143
Min.Agr	135.245	123.358	11.887
Min.Min	3427.189	2159.692	1267.498
Min.Man	1567.620	1255.845	311.775
Min.Ser	1262.967	878.041	384.926
Man.Agr	606.163	159.705	446.458
Man.Min	1822.713	1379.534	443.179
Man.Man	12416.866	3593.992	8822.873
Man.Ser	6689.179	3950.611	2738.568
Ser.Agr	536.404	381.367	155.037
Ser.Min	1761.420	1306.532	454.888
Ser.Man	7151.647	5267.296	1884.350
Ser.Ser	13889.625	9717.179	4172.445

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 2.027, KMIG 0.888
TCAP 19365.584, TLAB 30427.217, LS 37540.557
ADJL 1.000, LY 37542.760, ALY 37544.787
KY 19365.661, TY 708.791, YENT 20372.756

RETENT 9080.596, YH 53934.477, DYH 46959.557
HSAV -3868.115, SAV 8001.999, INV 7995.056
YGOV 27427.522, GOVEXP 31945.418, IBTX 5113.064
GRP 62732.303, AHEXP 50694.137, HTAX 6974.920
FTAXT 25.758, FTAXL 6131.398, FTAXK -1007.094
ENTX 1700.312, ENTYDIS 9591.848, LHHH 135.731
TQGOVR 3576.792, TQGOVM 1416.126, TQINV 2657.613
LYDIS 31413.389, TYDIS 683.032

Year Twenty

	PK	PT	IBTAX	PR	P	PN
Agr	1.000	1.000	0.022	1.000	1.000	0.394
Min	1.000		0.056	1.000	1.000	0.359
Man	1.000		0.006	0.999	1.000	0.339
Ser	1.000		0.070	1.002	1.001	0.559

+	PX	PE	X	R	EXP	M
Agr	1.000	1.000	4341.889	1750.827	2590.878	1215.605
Min	1.000	1.000	11990.133	6247.983	5739.225	2163.440
Man	1.000	1.000	34170.496	18324.673	15822.223	21451.369
Ser	1.001	1.000	58911.011	49294.242	9598.030	16853.807

+	VA	LAB	CAP	LAND	TVR	TVM
Agr	1712.426	432.736	570.899	708.791	1581.183	1003.582
Min	4299.119	1608.667	2690.452		4416.005	1975.770
Man	11588.816	7567.822	4020.993		9081.372	12449.236
Ser	32894.937	20819.821	12083.559		16670.856	6664.580

+	TV	Q	QR	QM	QGOV	QGOVR
Agr	2584.765	328.663	147.180	181.483	32.960	12.865
Min	6391.775	1726.556	1584.698	141.857	261.162	231.145
Man	21530.609	8384.861	2659.495	5725.366	2677.911	1854.556
Ser	23335.437	40074.514	30606.176	9468.334	2020.886	1478.216

+	QGOVM	QINV	QINVR	QINVM	ibt
Agr	20.095	20.227	9.782	10.445	96.246
Min	30.017	34.856	19.061	15.795	666.626
Man	823.355	7206.262	4752.849	2453.412	190.224
Ser	542.670	735.951	557.728	178.223	4151.242

---- 1058 PARAMETER VALID2 -INTERMEDIATE USE MATRIX-

	V	VR	VM
Agr.Agr	1254.959	675.500	579.459
Agr.Min	13.162	8.047	5.116
Agr.Man	1240.832	862.962	377.869
Agr.Ser	75.812	34.675	41.138
Min.Agr	135.244	123.356	11.887
Min.Min	3426.483	2159.207	1267.277
Min.Man	1567.210	1255.504	311.706
Min.Ser	1262.838	877.938	384.900
Man.Agr	606.157	159.682	446.475
Man.Min	1822.337	1379.188	443.149
Man.Man	12413.619	3592.588	8821.031
Man.Ser	6688.496	3949.913	2738.582
Ser.Agr	536.398	381.389	155.009
Ser.Min	1761.057	1306.342	454.714
Ser.Man	7149.776	5266.247	1883.529
Ser.Ser	13888.206	9716.877	4171.327

---- 1058 PARAMETER VALID3 -VALIDATION OF THE MODEL-

PL 1.000, LMIG 0.829, KMIG 0.320
TCAP 19365.904, TLAB 30429.046, LS 37545.787
ADJL 1.000, LY 37546.688, ALY 37547.516
KY 19365.932, TY 708.793, YENT 20373.044
RETENT 9080.759, YH 53936.822, DYH 46962.262
HSAV -3867.955, SAV 8002.323, INV 7995.201
YGOV 27418.456, GOVEXP 31944.823, IBTX 5104.338
GRP 62726.579, AHEXP 50694.483, HTAX 6974.560
FTAXT 25.758, FTAXL 6131.545, FTAXK -1007.112
ENTX 1700.343, ENTYDIS 9591.942, LHHH 136.632
TQGOVR 3576.781, TQGOVM 1416.137, TQINV 2657.875
LYDIS 31415.971, TYDIS 683.035

VITA

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