A Simulation Model for Oklahoma with Economic Projections from 1963 To 1980

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There is a great deal of planning for area development. Planning is being done by the Federal Government, Regional Planning Commissions, State Governments, many kinds of multi-county planning agencies, and many many communities. Realistic economic planning requires good consistent projections. Sidney Sonenblum and Louis Stein [8] emphasize the need as follows:

> "One of the critical problems in planning at any level, including state or regional planning, is to obtain internally consistent projections of relevant variables."

It is the goal of this paper to develop a planning model which will make internally consistent projections. The paper is presented in three sections. First, the Oklahoma social accounting system is presented. Second, the state simulation model is outlined. Third, empirical results (income and employment projections) of the simulation model are presented and analyzed.

The Oklahoma Social Accounting System

The Oklahoma social accounting system is outlined in Figure 1. The system is divided into three main accounts: (1) a capital account; (2) an interindustry account; and (3) a human resource account. The interindustry account forms the core of the complete system. Connected to it are the capital and human resource accounts.

For this study, the Oklahoma economy was divided into 12 endogenous sectors and 5 exogenous sectors. The endogenous sectors include agriculture, manufacturing, service, and mining activities. Agricultural

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activities were divided into two sectors: crops, and livestock and livestock products. This division allowed the two main agricultural enterprises in the state, wheat and cattle to be studied separately.

Manufacturing activities were divided in four sectors based on the economic activity in the state. Because of the large amount of agricultural and mining products being processed in Oklahoma, separate sectors were included for agricultural processing and petroleum processing. The remaining manufacturing activities were classified into a machinery sector and an "all-other" manufacturing sector. The service-type activities of the economy were aggregated into five sectors: transportation, communication, and public utilities; finance, insurance and real estate; services; wholesale and retail trade; and construction. Also, since the mining of crude oil plays an important role in the economy of Oklahoma, a separate sector for mining activity was included.

Five exogenous sectors were included in the model. Government activities were split into two sectors: federal, and state and local. The remaining exogenous sectors were households, private capital formation and exports. A complete listing of the endogenous and exogenous sectors is given below:

Endogenous Sectors

(1) Livestock and Livestock Products
(2) Crops
(3) Agricultural Processing
(4) Petroleum
(5) Machinery
(6) Other Manufacturing
(7) Mining
(8) Transportation, Communication and Public Utilities
(9) Real Estate, Finance and Insurance
(10) Services
(11) Wholesale and Retail Trade
(12) Construction

Exogenous Sectors

(1) Federal Government
(2) State and Local Government
(3) Private Capital Formation
(4) Households
(5) Exports

The Interindustry Account[1]

As noted in Figure 1, the interindustry section of the Oklahoma social accounting system consists of three basic parts: a transaction table or flow table, a direct coefficient table, and a direct and indirect coefficient table. The transaction table is the base of the interindustry account and the other tables are derived directly from it.

[1] For a complete discussion and presentation of interindustry analysis or input-output analysis, see William H. Miernyh, *The Elements of Input-Output Analysis*, Random House, New York, 1957.

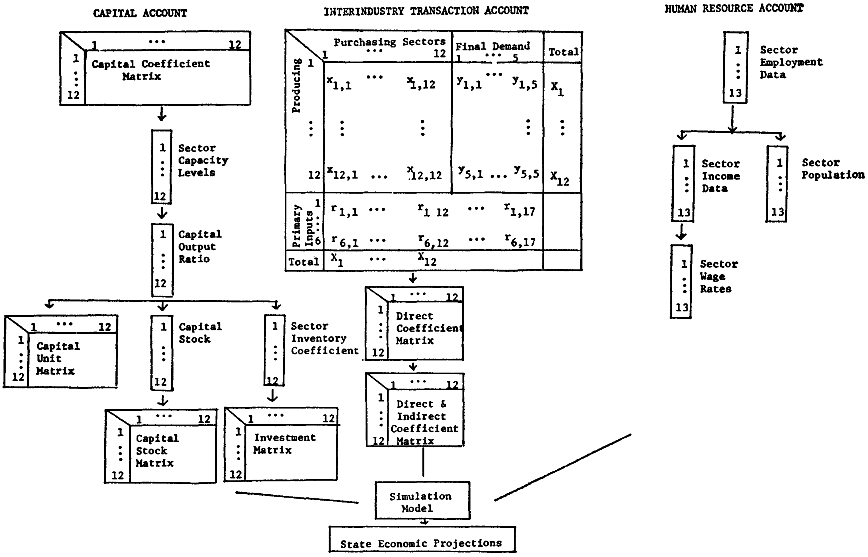

Figure 1: The Oklahoma Social Accounting System.

The transaction table is a double accounting system where reading down the endogenous sectors, the purchase of each sector are determined; whereas reading across each sector, the sales of each sector are determined. The final demand section includes the exogenous sectors and consists of the activities of those who purchase goods and services from the producing sectors. The primary input section consists mainly of imports, households, government and depreciation. The figures in these rows indicate the amount of primary inputs purchased by the sectors in the processing and final demand sections.

The direct coefficients indicate the input requirements per dollar of output for a given sector. The direct coefficients are relevant only for the processing sectors; therefore, technical coefficients are computed only for the columns of the purchasing sectors. Calculation of the coefficients consists of dividing all the entries in each industry's column by the total input for that sector. The direct and indirect coefficients indicate the total change in input requirements as a result of a one dollar change the final demand. The total change includes the direct effect as well as all indirect effects resulting from the initial one dollar change.

The Capital Account

The capital coefficient matrix forms the base of the Oklahoma capital analysis. Each capital coefficient indicates the amount of capital goods required by the i^{th} sector per dollar's worth of capital expenditures in the j^{th} sector. Capital-output ratios were adopted for the 12 endogenous sectors. Capital-output ratios were defined as the ratio of total cost of plant and equipment to output at capacity. Estimates of capacity-operating levels for each sector were obtained from employment data. Peak employment was assumed equal to 100 percent capacity operation.

The capital unit matrix is derived from the capital-output ratios and the capital coefficient matrix. Each coefficient in this matrix indicates the capital goods required from sector i to produce one unit of output capacity for sector j. The coefficients are computed by multiplying the capital coefficients of a sector times the capital-output ratio of that sector. The capital stock matrix can be derived with the capital-output ratios, an output estimate, and the capital coefficient matrix. The capital-output ratio times the estimated output at capacity yields the amount of capital in each sector. The amount of capital in a sector times that sector's capital coefficients column yields the composition of each sector's capital. Each element in the matrix represents the total value of capital goods produced by sector i and invested in sector j.

Inventory coefficients were derived that indicate the amount of inventory needed per unit of output. Some researchers desire to know the total amount of capital needed to expand output as well as the composition of capital. By adding the capital unit coefficients and the inventory coefficients for a sector, the total amount of capital required per unit of output expansion is estimated. This addition yields a combined capital and inventory unit matrix from which the investment matrix is calculated. Each coefficient is obtained by dividing the column entry of the combined capital and inventory unit matrix by the total of all entries for that column. Investment coefficients are defined as the value of output of the producing sector i needed by the purchasing sector j per unit of investment in j. To complete the capital structure analysis, depreciation coefficients were estimated. Depreciation rates were estimated as the ratio of depreciation to depreciable assets.

The Human Resources Account

Of vital importance in a state accounting system is the human resource account. From this account, data are available on employment, income, and population for the state. Included in the employment portion are estimates of wage and salary employment and proprietor employment by sector. With employment data and the output data from the transaction table, labor-output ratios are developed. The income portion includes wage and salary and proprietor income data by sector. With the employment and income data, income rates for wage and salary workers as well as proprietors are calculated. To complete this section, population estimates are presented.

The Simulation Model

The simulation model is formulated around the basic Leontief input-output system. The complete multiple-sector recursive model consists of 51 major equations. Many of the 51 major equations are disaggregated into sub-equations; one sub-equation for each endogenous sector in the Oklahoma economy. Thus, the entire system includes over 300 equations. The model was formulated in Fortran and can be run on the computer at relatively low cost enabling the researcher to experiment with the model by changing variables and measuring their impact. The model is presented first by a set of equations predicting final demand, then sector output is determined and finally the method of deriving state economic variables (employment and income) is shown. The latter part is not presented in equation form because of limited space but is broadly discussed.

Final Demand

The final demand or exogenous sectors consist of the activities of those who purchase goods and services from the producing sectors. Final demand in the Oklahoma study is composed of five sectors: a capital formation; household; federal government; state and local government; and exports.

The Capital Sector

The accelerator principle reflects the fact that a change in output over time, or from one period to another, influences net investment as the addition to capital stock in a period of time. The investment due to changes in output is shown as "induced investment" as opposed to "autonomous investment" which in practice is not influenced directly by recent changes in output. Thus, total investment in a period is made up of two components: (1) replacement investment or autonomous investment and (2) new plant and equipment investment or induced investment. The technique adopted in this analysis is similar to recent theory proposed by Jorgenson and contains the two components of investment (36).

The replacement component is merely a function of capital stock times depreciation rate. Capital stock (K_t^j) at the beginning of each period is equal to capital stock available the preceding period plus new plant and equipment investment made during the preceding year.

$$(1) \quad K_t^j = K_{t-1}^j + (In)_{t-1}^j$$

where

K_{t-1}^j = capital stock for sector j in year t-1, and

$(In)_{t-1}^j$ = new plant and equipment investment in sector j in year t-1.

Replacement investment $(Ir)_t^j$ is then calculated as follows:

$$(2) \quad Ir = A_{17} K_t^j$$

where

A_{17} = depreciation rates.

The second component of investment, new plant and equipment $(In)_t^j$, is estimated using the accelerator principle as follows:

$$(3) \quad (In)_t^j = A_1^{t-1} \; A_2 \; (X_{t-1}^j - X_{t-2}^j)$$

where

A_1^{t-1} = average capital-output ratios in year t-1

A_2 = one plus change in capital-output ratio of sector, and

X_t^j = output by sector.

The matrix A_2 incorporates a change in technology into future estimates of capital as trends in the capital-output ratios are included in the estimate of new plant and equipment. Total investment (I_t^j) is then a sum of the two components.

$$(4) \quad I_t^j = (Iy)_t^j + (In)_t^j$$

The composition of each sector's new investment is then determined as follows:

$$(5) \quad (CA)_t^j = A_3 \; I_t^j$$

where

A_3 = capital coefficient matrix, and

CA_t^j = capital accumulation by sector in year t.

The Household Sector

Models which estimate consumer expenditures often consider three categories of goods; non-durables, durables, and services.[2] Butler [3] and Burk [2] analyze the trends in consumption of durables, non-durables, and services. Non-durables, and services are usually relatively smooth, while durable purchases fluctuate quite widely.

Non-durable outlays tend to move in a positive trend with very few declines, if any. Since 1950, the amount spent for non-durables has increased every year but the proportion of income spent on them has declined. Non-durables include spending for food, clothing, gasoline, drugs, household supplies, and other similar items. In this study, demand for non-durables $(H_n)_t^j$ was estimated with per capita demand and population data as follows:

(6) $(H_n)_t^j = [A_4(PCHn)_{t-1}^j]P_t$ and

(7) $(PCHn)_{t-1}^j = (Hn)_{t-1}^j / P_{t-1}$

where

A_4 = diagonal matrix of one plus growth rate of non-durable goods,

$(H_n)_{t-1}^j$ = column vector of non-durable purchases by sector in year t-1,

$(PCHn)_{t-1}^j$ = column vector of per capita demand for non-durable goods in year t-1, and

P_t = population in year t.

Purchase of durable goods, which include such things as automobiles, appliances, and furniture, may be postponed more readily than non-durables, and thus adding to business cycles. Durable purchases in the study were estimated with disposable income as follows:

(8) $(hd)_t = a_3 a_1 [a_2 (PCY_{t-1})] P_t$ and

(9) $(PCY)_{t-1} = Y_{t-1}^{DI} / P_{t-1}$

where

$(hd)_t$ = total demand for durable goods in year t,

a_1 = ratio of durable expenditures to disposable income,

a_2 = one plus the expected rate of growth of personal disposable income,

a_3 = one plus the change in the ratio of durable goods to disposable income in year t-1, and

$(PCY)_{t-1}$ = per capita disposable income in year t-1.

[2] An illustration of this is found in Klein's model (6). Also Suits (7) and Forum (4) use a somewhat similar breakdown in their models.

The composition of the durable purchases was computed as follows:

$$(10) \quad (H_d)_t^j = A_5(hd)_t$$

where

A_5 = diagonal matrix of proportion of durable purchases from sector j, and

$(H_d)_t^j$ = column vector of sector purchases of durable goods.

Demand for services have increased the most during recent years, reflecting the fact our society is becoming increasingly service-oriented. Service demand was estimated as follows:

$$(11) \quad (H_s)_t^j = [A_6 \ PCH_s)_{t-1}^j]P_t \text{ and}$$

$$(12) \quad (PCH_s)_{t-1}^j = (H_s)_{t-1}^j / P_{t-1}$$

where

$(H_s)_{t-1}^j$ = diagonal matrix of service purchases in year t-1 by sector,

$(PCH_s)_{t-1}^j$ = column vector of sector per capita consumption of services in year t-1,

A_6 = diagonal matrix of one plus the growth rate of services,

and

$(H_s)_t^j$ = column vector of sector consumption of services in year t.

Exports

In national models such as found in [6], exports are related to world demand. In state models, exports are influenced mainly by U. S. demand. A study which uses this procedure was completed by Tiebout [9]. Trends in U. S. production are obtained and applied to the present share of Oklahoma exports. This assumes that Oklahoma exports will grow in the same proportion as U. S. demand for those exports. Services (defined to include the transportation, communications, and public utility sector; real estate, finance, and insurance; wholesale and retail; service sector; and the construction sector) are assumed to be determined by state economic activity and are not related to U. S. demand. Thus, their export demand $(E_s)_t^j$ is assumed zero. Export demand is specified in two equations (durables and non-durables) as follows:

$$(13) \quad (E_n)_t^j = A_7 \ (E_n)_{t-1}^j$$

where

A_7 = diagonal matrix of one plus growth of non-durables, and

$(E_n)_t^j$ = column vector of sector exports of non-durables.

(14) $(E_D)_t^j = A_8 \, (E_D)_{t-1}^j$

where

A_8 = diagonal matrix of one plus growth rate of durables, and

$(E_D)_t^j$ = column vector of sector exports of durables.

Governments

In recent years, state and local government spending has followed a straight line trend as closely as can be expected in economic forecasting. Under these circumstances, simple extrapolation procedures may be the best procedure for the forecaster. Research by Wiedenbaum [10] and Butler [3] support these results. Thus, state and local government final demand $(SL)_t^j$ is estimated as:

(15) $(SL)_t^j = A_9 \, (a_4) \, (SL_T)_{t-1}$

where

A_9 = column vector where elements are proportions of state and local expenditures from sector j,

a_4 = scalar of one plus annual rate of growth in state and local expenditures, and

$(SL_T)_{t-1}^j$ = scalar of total state and local government expenditures in year t-1.

Federal government purchases at the national level fluctuate quite widely (4), (9), (10). The overhead costs remain rather constant and are fairly easy to predict. However, expenditures for national defense and special programs controlled by the legislature are difficult to determine and as a result forecasting of federal expenditures by states is almost an unattainable task. For Oklahoma, the best estimate seems to be a trend established from previous years expenditures. Thus,

(16) $F_t^j = A_{10} \, [a_5(F_T)_{t-1}]$

where

A_{10} = column vector where elements are proportion of federal expenditures from sector j,

a_5 = scalar of one plus annual rate of growth in federal expenditures,

$(F_t)^j$ = column vector where elements are federal expenditures from sector j in year t, and

$(F_T)_{t-1}$ = scalar of total federal expenditures in year t-1.

Total final demand (Z_t^j) is a combination of demands from households, federal government, state and local government, exports, and capital. It is computed as follows:

$$(17) \quad Z_t^j = (CA)_t^j + F_t^j + (SL)_t^j + (H_t)_t^j + (E_t)_t^j$$

where

Z_t^j = column vector of total final demand by sector for year t,

$(H_t)_t^j$ = column vector of household demand by sector for year t[3], and

$(E_t)_t^j$ = column vector of export demand by sector for year t.[4]

Determining Sector Output

Sector output X_t^{jd} required to produce final demand is

$$(18) \quad X_t^{jd} = A_{11} Z_t^j$$

where

A_{11} = matrix of direct and indirect coefficients.

However, this output cannot be produced if labor and plant capacity are not available. Available labor (L_t^j) by sector is:

$$(19) \quad L_t^j = A_{12} (A_{13}) L_{t-1}^{je}$$

where

L_{t-1}^{je} = column vector of sector employment for year t-1,

A_{12} = diagonal matrix of sector labor force-employment ratio,[5] and

A_{13} = diagonal matrix of one plus growth rate of sector employment.

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[3] $$(H_t)_t^j = \begin{bmatrix} (H_n)_t^j \\ (H_d)_t^j \\ (H_s)_t^j \end{bmatrix}$$

[4] $$(E_t)_t^j = \begin{bmatrix} (E_n)_t^j \\ (E_D)_t^j \\ (E_s)_t^j \end{bmatrix}$$

[5] Labor force-employment ratio is the available labor force for each sector divided by the employment in that sector. It was determined by calculating capacity employment and adjusting this downward by sector to the 1963 labor force. This was divided by 1963 sector employment to yield the ratio. Sector employment was not allowed to increase in an unrestricted manner due to institutional restraints.

Thus maximum output (X_t^{jL}) due to labor is computed as follows:

$$(20) \quad X_t^{jL} = A_{14}^{t-1} A_{15} L_t^{j}$$

where

A_{14}^{t-1} = diagonal matrix of sector output-labor ratios, and

A_{15} = diagonal matrix of one plus annual rate of growth in output-labor ratio.

The maximum output (X_t^{jc}) due to capital is:

$$(21) \quad X_t^{jc} = X_{t-1}^{jc} + (I_n)_t^{j} / [A_{16}^{t} \cdot A_2]$$

where

X_{t-1}^{jc} = column vector of maximum production by sector for year t-1,

$(I_n)_t^{j}$ = column vector of new plant and equipment investment by sector in year t,

A_{16}^{t} = diagonal matrix of capital-output defined at capacity levels in year t, and

A_2 = diagonal matrix of one plus change in capital-output ratio.

Realized output (X_t^{jR}) in each sector is the minimum due to demand, plant capacity, or labor force constraints. It is expressed as follows:

$$(22) \quad X_t^{jR} = \min (X_t^{jd}, X_t^{jL}, X_t^{jc}).$$

State Economic Projections

Once output is determined, the simulation model projects the labor force (wage and salary workers and proprietors) and income (wage and salary, proprietor, property, and transfer payments). Employment-output ratios and changes in employment-output ratios combine to project employment by sector. Wage rates and changes in wage rates combine to project income payments by sector. Also, the model projects such economic variables as value added, federal tax collections, and state and local tax collections. Space does not permit the presentation of the equations for these relationships.[6]

General Simulation Results

The model was run using the data presented in the social accounts from 1963 to 1980. The projected results obtained from the model are compared with published income and employment data. A discussion of the comparisons is presented as well as a discussion on the projected 1980 results.

[6] For a complete discussion and prosentation of the simulation model, see Gerald A. Doeksen, *AS Social Accounting System and Simulation Model Projecting Economic Valuables and Analyzing the Structure of the Oklahoma Economy.* (Unpublished Ph.D. thesis, Oklahoma State University, 1971).

Employment Projections

Employment projections are presented on Figures 2 through 8. Figure 2 contains estimates on aggregate employment, proprietor employment, and wage and salary employment. The solid line indicates values derived from the simulation model. The broken line shows the actual estimates as published by the Oklahoma Employment Security Commission. Total employment is forecast to increase from 374,700 in 1963 to 1,347,645 in 1980. The forecasted data from 1964 to 1969 is slightly higher than the actual estimates. Wage and salary employment is projected to increase from 638,400 employed in 1963 to 1,094,841 by 1980. The projections are above the actual estimates for 1964 through 1967, and slightly below the estimates for 1968 and 1969.

Proprietor employment according to the simulation model is projected to increase only slightly from 236,300 in 1963 to 252,804 in 1980. The simulation model results are above the actual estimates. The reason proprietor employment changes very little is that the decreasing number of farmers is offset by a slight increase in proprietor employment for the service-type sectors.[7]

Figure 3 contains projections for the number of wage and salary workers and proprietors derived from the simulation model for agri-

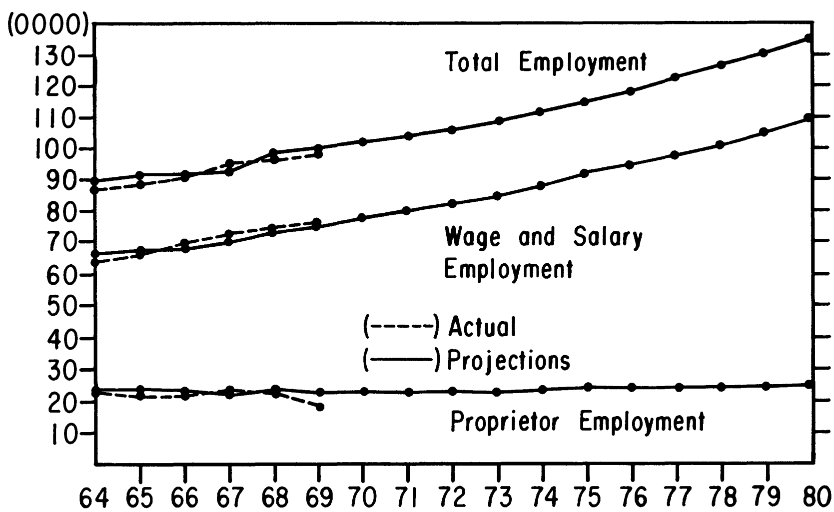

Figure 2: Total Employment, Proprietor Employment, and Wage and Salary Employment, Oklahoma.

[7] Service-type sectors include: transportation, communication, and public utilities; finance, insurance, and real estate; services; wholesale and retail trade; and construction.

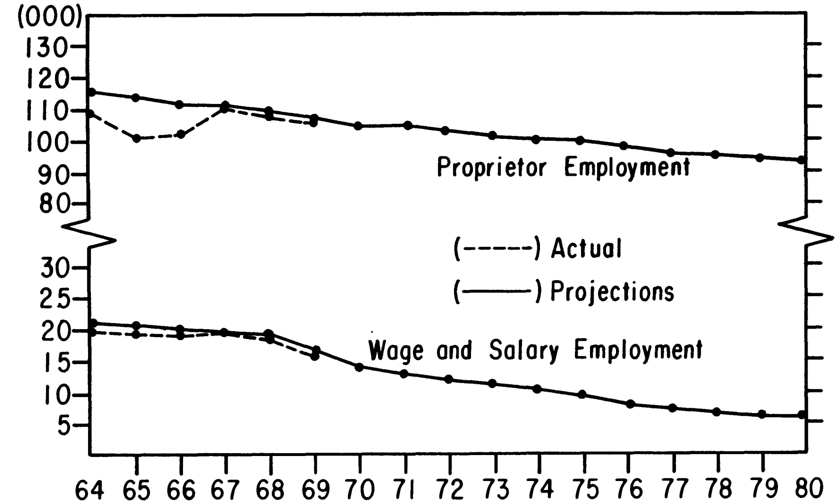

Figure 3: Proprietor Employment and Wage and Salary Employment in Agriculture, Oklahoma.

culture. The actual estimates were obtained from U. S. Department of Agriculture publications. The number of wage and salary workers in agriculture is expected to decrease from 26,000 in 1963 to 6,314 in 1980 according to the simulation model. This indicates the trend in mechanization of the agricultural sectors. The actual data are below the projected values from 1964 through 1966 and about the same as the simulated results from 1967 to 1969. The upper portion of Figure 3 gives the projected number of farmers from 1964 to 1980. The number of non-wage and salary farm workers is expected to decrease from 117,500 in 1963 to 93,283 in 1980. The projected values are above the actual U. S. Department of Agricultural estimates for 1964 through 1966, and quite similar for the years 1967 through 1969.

Data in Figure 4 indicate that very little change is expected in employment in the agricultural processing sector. In fact, wage and salary employment is expected to increase to 17,712 in 1980, an increase of 2,212 from the 15,500 wage and salary workers in 1963. The projections are slightly higher than the actual values. The petroleum sector, also displayed in Figure 4, indicates that wage and salary employment is expected to increase from 7,500 in 1963 to 8,369 in 1980. The actual estimates are slightly below those of the simulation model.

The machinery sector, presented in Figure 5, indicates that wage and salary employment is expected to equal 22,646 in 1980 as compared to

10,500 in 1963. This sector is growing rapidly and the projected values fluctuate around the actual estimates from 1963 through 1968. The "all-other" manufacturing sector represented in Figure 5 indicates an in-

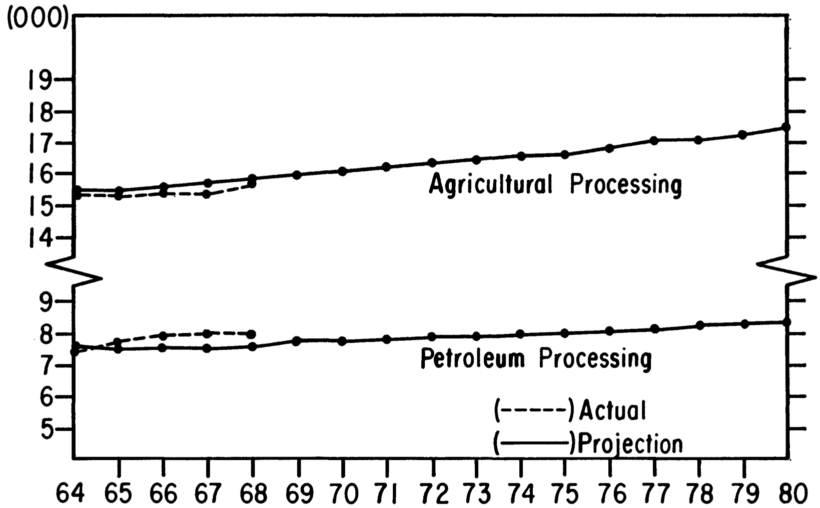

Figure 4: Wage and Salary Employment in Agricultural Processing and Petroleum Processing, Oklahoma.

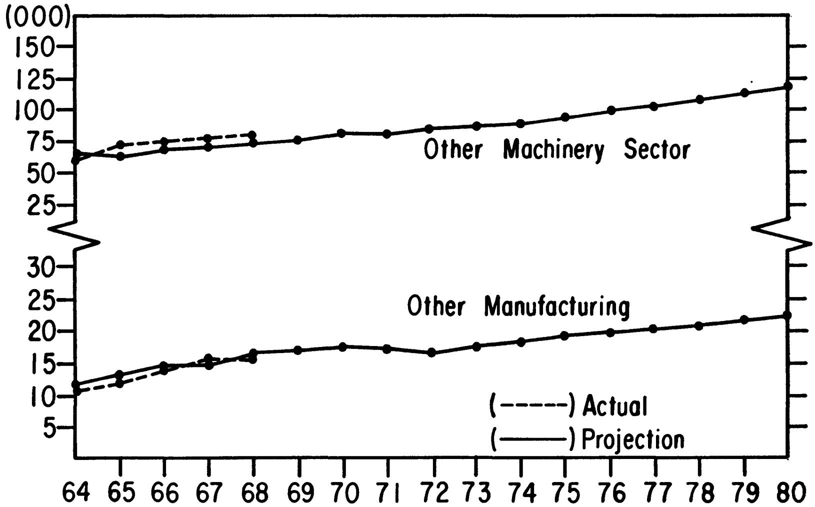

Figure 5: Wage and Salary Employment in Machinery and Other Manufacturing Sectors, Oklahoma.

crease in wage and salary employment from 1963 to 1980. Final employment in 1980 is estimated at 122,233 workers. The actual estimates are slightly lower than the simulation projections. Wage and salary employment (Figure 6) in the mining sector decreases from 1963 to 1980. Wage and salary employment in 1980 is forecast at 39,461 as compared to 42,-400 in 1963. The actual data varies on both sides of the simulation model results.

The activity of the five service type sectors depends heavily on the activity of the durable and non-durable sectors. Wage and salary employment is expected to increase in all of these sectors except in the construction sector where employment first decreases and then increases. In general, the projected values are close to the actual results as published by the U. S. Department of Labor. These comparisons as well as the complete projections are presented on Figures 6, 7, and 8. The government sector represented in Figure 9 indicates a nincrease in wage and salary employment from 1963 to 1980.

Income Projections

Income projections are presented in Figure 10 and Table 1. Data in Figure 10 yields an overview of the aggregate income projections (1963 prices). Simulation results are compared with actual data published by

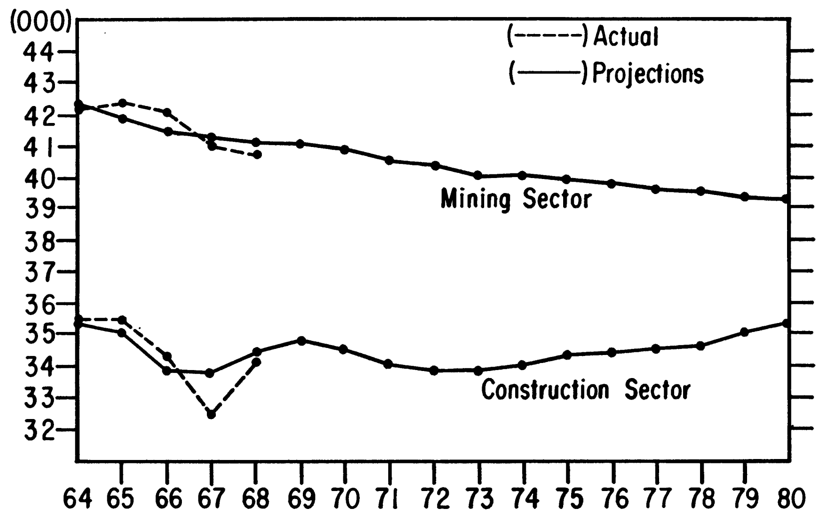

Figure 6: Wage and Salary Employment in the Mining and Construction Sectors, Oklahoma.

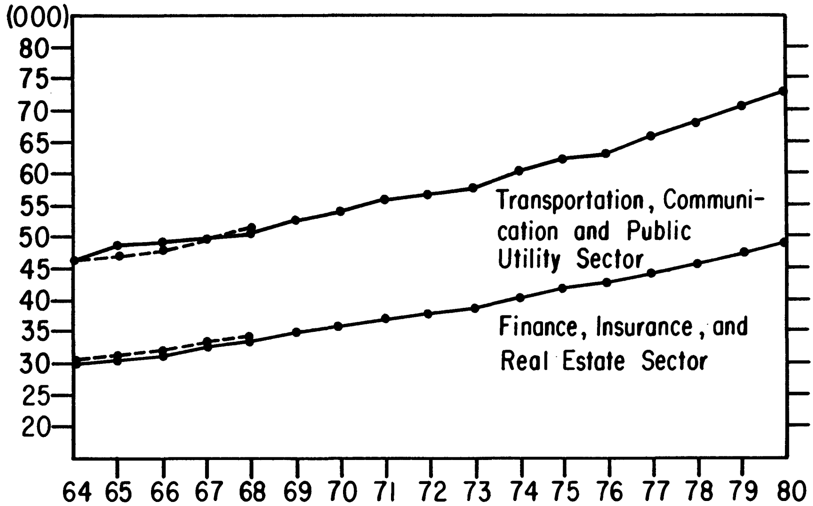

Figure 7: Wage and Salary Employment in the Transportation, Communication, and Public Utilities, and Real Estate, Finance and Insurance Sectors, Oklahoma.

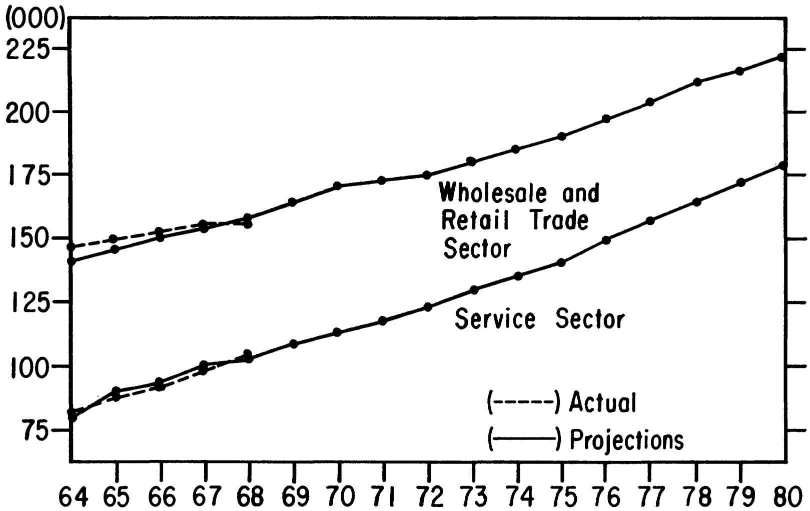

Figure 8: Wage and Salary Employment in the Wholesale and Retail Trade and Service Sectors, Oklahoma.

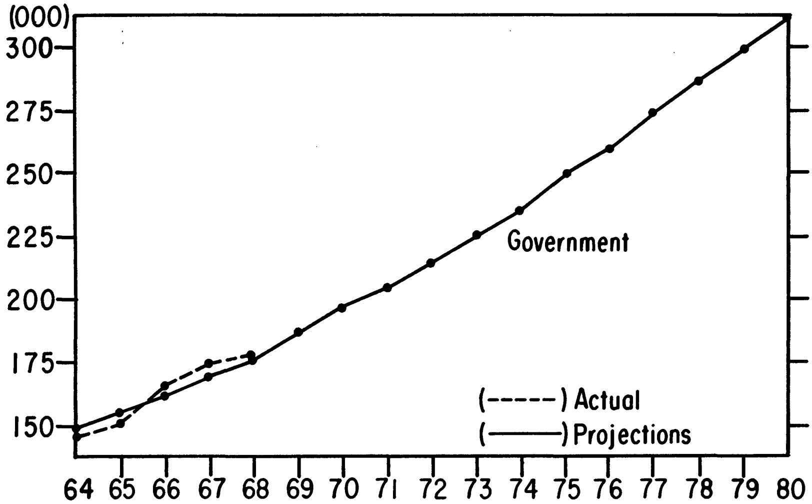

Figure 9: Wage and Salary Employment in the Government Sectors, Oklahoma.

the *Survey of Current Business.* The solid lines in Figure 10 show results from the simulation model, whereas the dotted lines are published estimates.

The top portion of Figure 10 reveals the direction that total personal income is projected to move. Personal income is expected to increase to 12,388 million dollars in 1980 as compared to 4,880 million dollars in 1963. The projections are almost identical to actual estimates published for 1964-68. The middle portion of Figure 9 indicates how wage and salary income is projected to move. It is expected to increase from 2,986 million dollars in 1963 to 7,232 million dollars in 1980. Again the actual and simulated values are quite similar for the years 1964 through 1968. The bottom portion of Figure 10 shows the movement that proprietor's income is projected to take from 1963 to 1980. The actual estimates were slightly higher from 1964 through 1967 and slightly lower during 1968.

Data in Table 1 provides a complete presentation of the income projections of all sectors derived from the simulation model. The data on total personal income, wage and salary income, and proprietor income confirm the conclusions derived from Figure 10. Wage and salary payments by sector are presented in Table 1. A sector comparison illustrates the ability of the model to simulate sector estimates relative to actual estimates. The service-type sectors through their dependence on durable and non-durable sectors have simulated results similar to the

Table 1. Personal Income, Wage and Salary Income and other Income Predictions in Constant 1963 Dollars from 1964 to 1980, Oklahoma. (000,000)

	1964	1965	1966	1967	1968	1969	1970	1971
Personal Income (Projections)	5166	5405	5651	5964	6329	6708	7071	7431
Personal Income (Actual)	5143	5471	5786	6105	6368			
Wage and Salary (Projections)	3157	3284	3415	3591	3812	4036	4239	4433
Wage and Salary (Actual)	3146	3279	3502	3700	3900			
Agricultural (Projections)	32	31	29	28	27	26	25	24
Agricultural (Actual)	27	26	25	28	26			
Manufacturing (Projections)	538	561	580	612	663	713	750	779
Manufacturing (Actual)	536	578	645	668	724			
Agricultural Processing (Projections)	75	77	79	82	85	87	90	92
Petroleum (Projections)	56	58	59	61	63	65	66	68
Machinery (Projections)	64	72	82	86	96	105	109	110
Other Manufacturing (Projections)	343	354	360	383	419	456	485	509
Mining (Projections)	278	282	286	292	298	305	311	317
Mining (Actual)	277	285	287	284	293			
Transportation, Communication, and Public Utilities (Projections)	278	287	297	311	329	346	362	377
Transportation, Communication, and Public Utilities (Actual)	276	282	297	310	328			
Finance, Insurance, and Real Estate (Projections)	140	145	149	156	165	174	182	188
Finance, Insurance, and Real Estate (Actual)	139	142	151	158	165			
Services (Projections)	329	345	362	385	412	440	466	492
Services (Actual)	327	328	347	376	411			
Wholesale and Retail Trade (Projections)	544	554	569	596	627	658	684	707
Wholesale and Retail Trade (Actual)	544	572	592	609	632			
Construction (Projections)	176	180	180	186	196	205	211	216
Construction (Actual)	175	182	182	180	197			
Government (Projections)	842	899	960	1025	1095	1169	1248	1333
Government (Actual)	840	875	970	1080	1117			
Other Labor Income (Projections)	141	152	163	174	187	201	215	231
Other Labor Income (Actual)	146	157	171	177	187			

Table 1. (Cont'd.)

	1972	1973	1974	1975	1976	1977	1978	1979	1980
Proprietors' Income (Projections)		694	711	728	756	789	823	852	879
Proprietors' Income (Actual)		600	682	765	793	765			
Property Income (Projections)		780	834	891	953	1019	1089	1164	1244
Property Income (Actual)		777	854	943	988	1018			
Transfer Payments (Projections)		518	558	600	645	695	747	804	865
Transfer Payments (Actual)		495	525	564	634	694			
Personal Income (Projections)	7824	8267	8755	9270	9815	10,396	11,017	11,681	12,388
Wage and Salary (Projections)	4645	4897	5178	5469	5778	6103	6457	6832	7232
Agricultural (Projections)	22	22	21	20	19	18	18	17	16
Manufacturing (Projections)	813	862	923	983	1045	1107	1179	1256	1339
Agricultural Processing (Projections)	95	98	101	104	107	110	114	118	122
Petroleum (Projections)	70	72	74	76	79	81	84	87	89
Machinery (Projections)	112	118	129	136	143	149	157	166	176
Other Manufacturing (Projections)	536	574	619	667	716	767	824	885	952
Mining (Projections)	322	329	336	343	351	358	366	374	383
Transportation, Communication, and Public Utilities (Projections)	394	413	434	456	479	504	531	558	588
Finance, Insurance, and Real Estate (Projections)	196	206	216	227	238	250	263	276	291
Services (Projections)	520	552	587	624	664	708	754	804	857
Wholesale and Retail Trade (Projections)	733	764	798	833	871	911	954	999	1045
Construction (Projections)	221	229	239	249	259	269	280	292	304
Government (Projections)	1424	1520	1624	1734	1852	1978	2112	2256	2409
Other Labor Income (Projections)	247	265	285	305	327	351	377	404	433
Proprietors' Income (Projections)	908	943	981	1020	1063	1108	1156	1206	1259
Property Income (Projections)	1329	1421	1520	1624	1736	1855	1983	2119	2266
Transfer Payments (Projections)	930	1000	1077	1158	1246	1341	1442	1551	1669

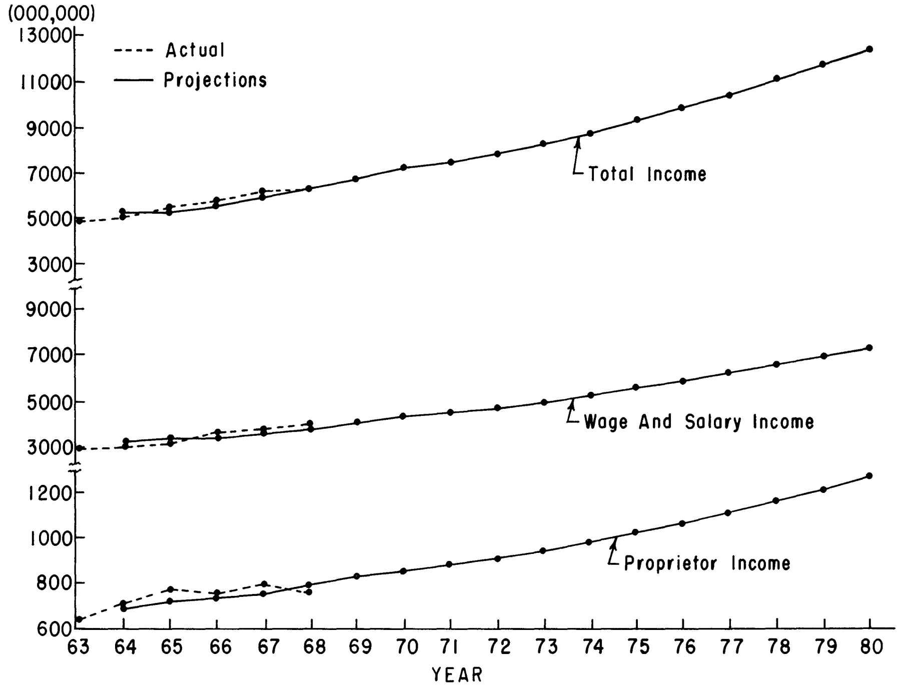

Figure 10. Total Income, Proprietor Income and Wage Salary Income Projections, Oklahoma.

actual estimates. Service and wholesale and retail trade sectors are two sectors which show a rapid increase in wage and salary payments. This exemplifies the growing need for these types of services.

Summary

The goal of the paper was to present a model producing consistent projections for planning purposes. Internally consistent projections were obtained with a social accounting system for Oklahoma and a simulation model. The social accounting system was composed of three main accounts which included: a capital account, an interindustry account, and a human resource account.

The simulation model, composed of 51 major equations and over 300 individual equations, projected state economic variables of employment and income. The actual estimates (from government data sources for years 1963 through 1968) were compared with the projected estimates of the simulation model. The projected estimates proved similar to the actual estimates.

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