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MINNESOTA STATE REVENUE TRENDS AND FORECASTS:

Implications for State Fiscal and Economic Growth Planning
in the 1980's

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Abstract

This report addresses problems of statistical measurement in state revenue forecasting and impact assessment. Both personal income and state tax and other general revenue data are analyzed and reviewed in the context of state fiscal and economic growth planning and related decision information needs. A shift-and-share method of analysis is used to partition sources of change in personal income and state revenue variables and to identify rates of change in these variables for the 1970-80 period. This report is the second in a series on Minnesota's shift to services and its impact on jobs, income, and taxes.

Summary and Conclusions

The Minnesota state revenue system is predicated on economic growth. Rapid, and, indeed, above-average, economic growth sustained a sharply expanding state and local government sector in the 10-year period from 1970 to 1980.

While the 1970's started with legislation to expand the state revenue system, the decade ended with legislation to curtail its future expansion with tax indexing. However, general economic conditions rather than any new legislation became the principal factor accounting for its current crises.

Examination of Minnesota economic growth trends and prospects in the 1970's reveals an expanding economy increasingly dependent on national and world markets. Its agriculture experienced impressive gains in the early 1970's which momentarily pushed per capita income above the U.S. average in 1973. This notable performance was not repeated, however, until 1977 when a surge of new investment and construction, coupled with a rapidly expanding manufacturing sector, again pushed Minnesota per capita income above the national average. An above-average income level was sustained for the rest of the decade.

Growth in Minnesota state revenues outpaced growth in the Minnesota economy, especially in the first half of the 1970's, because of the tax law changes initiated in the 1971 special legislative session. Dramatic increases in sales and income tax revenues supported equally dramatic increases in state expenditures. By 1975, however, signs of a slowdown in the remarkably rapid growth of state tax revenues were evident in the lagging growth in Minnesota individual income tax collections. Deduction of Federal income tax payments and additional medical expenses accounted

for much of the reduced tax yield, relative to its performance in the U.S. as a whole.

Further signs of slowdown were evident by the end of the 1970's in both sales tax and corporation net income tax collections. The two taxes were particularly sensitive to the effects of general economic conditions on business investment outlays and gross profits. Tax indexing also occurred in this period to further reduce tax revenues, but its effect was small compared with the impact of the general business cycle on business sales, purchases, and profits, especially in the construction and the durable goods manufacturing industries.

State tax revenue and economic forecast methods are examined, finally, in the context of Minnesota state economic and tax revenue trends and prospects outlined earlier. Two tasks of state revenue forecasting are identified, namely, the forecasting of state tax revenue collections and the forecasting of the effects of these collections on specific economic activity in the state. While the first task is one of fiscal management for which responsibility is centered currently in the Department of Finance, the second task is one of general economic management. This task is shared by several state departments and agencies as well as the private sector. Because of the shared nature of this task, the preparation, maintenance, and utilization of an information system for state revenue impact assessment also must be shared. System integrity inevitably emerges as an important question to be addressed. This report concludes with a review of econometric models for state tax revenue and economic impact forecasting which addresses this final question.

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Wilbur R. Maki

The Minnesota revenue system, like the general economy itself, has been predicated on growth in product, income and expenditures. Without economic growth, state revenues would drop precipitously, thus endangering the delivery of many public services.

In Minnesota, state revenues rose sharply in the first half of the 1970's. This period was marked, also, by a sharp shift from dependence on the local property tax to increasing dependence on federal transfer payments, individual and corporate net income taxes, and sales and general receipts taxes. In contrast to the early 1970's, the second half of the decade was marked by a gradual slowing down in state revenue receipts. Individual and corporate net income tax, as well as sales tax, revenues, while increasing in absolute levels in Minnesota, declined relative to U.S. trends in the 1975-78 period and, again, in fiscal year 1980.

Study Objectives

The purpose of this report is to account for the contrasting patterns of growth and decline in Minnesota state and local revenue receipts in the context of Minnesota and U.S. economic and demographic conditions. This assessment is intended as an introduction to a detailed examination of the Minnesota economy today and its prospects for the 1980's, especially in its public revenues. Alternative approaches in the study of state and local revenues are identified and examined with particular reference to

information needs of state and local fiscal management in the 1980's. State and local revenue implications of alternative state economic forecasts also are reviewed and discussed in this report.

While an assessment of state economic forecasts and forecast methods is an important purpose of this report, the data presented here are intended primarily to illustrate the type and quality of information which may prove useful in dealing with generally unanticipated interruptions in the flow of public revenues from a variety of revenue sources. Closely related to the identification of useful economic information is the design and implementation of procedures for obtaining this information and, also, monitoring its reliability, cost and accessibility.

The nature and severity of the current state revenue shortfall is illustrated by the differential rates of change in state tax revenue receipts in the 1970's. As shown in Table 1.1, general revenues from own sources, that is, taxes and service charges, were 84.4 percent, 80.3 percent, and 80.5 percent of total state and local revenues in 1970, 1975 and 1979, respectively. Large increases in federal transfer payments to state and local governments accounted for the declining importance of own revenues in the 1970-75 period, but this trend changed, especially for Minnesota, in the post-1975 period. Increases in the relative importance of state tax revenues occurred each year in the 1970's. Reductions in total federal transfer payments were larger at the state level than the local level. When the annual increases in state tax revenues declined relative to U.S. trends, earlier trends in local property tax revenues reversed direction, also.

Annual changes in selected state tax revenues -- general sales, individual income and corporate net income -- illustrated in Figure 1.1

Table 1.1. Estimated State and Local General Revenues from Specified Revenue Source, Minnesota, Fiscal Years 1970, 1975 and 1979. 1/

Revenue Source	Total Receipts (mil. \$)		Proportion of Total (pct.)		Minn. Spec. Rev. as Prop. of U.S. Spec. Rev. (pct.)		
	1970	1975	1970	1975	1970	1975	1979
State fed. transfer	382	752	14.8	15.4	2.0	2.1	1.9
General sales	196	384	7.6	7.9	1.4	1.6	1.5
Motor fuels	123	144	4.8	3.0	2.0	1.7	2.2
Alch. bev. & tob.	84	127	3.2	2.6	2.3	2.4	2.3
Other sales taxes	60	141	2.3	2.9	2.0	2.8	2.6
Indiv. income	346	807	13.4	16.6	3.8	4.3	3.8
Corp. net income	80	196	3.1	4.0	2.1	3.0	2.9
Motor veh. & oper.	67	94	2.6	1.9	2.5	2.4	2.5
Other state taxes	65	128	2.5	2.6	1.3	1.7	1.9
State chg. & misc.	222	387	8.6	7.9	2.3	2.3	2.0
Local fed. tran.	22	210	0.8	4.3	0.8	1.9	1.6
Property taxes	644	905	24.9	18.6	2.0	1.8	1.9
Other local taxes	16	34	0.6	0.7	0.1	0.1	0.3
Local chg. & misc.	281	560	10.8	11.5	2.2	2.4	2.1
Total	2,588	4,870	100.0	100.0	2.0	2.1	2.1

1/ U.S. Bureau of the Census, Government Finances in 1978-79, U.S. Government Printing Office, Washington, D.C., 1980; and earlier years.

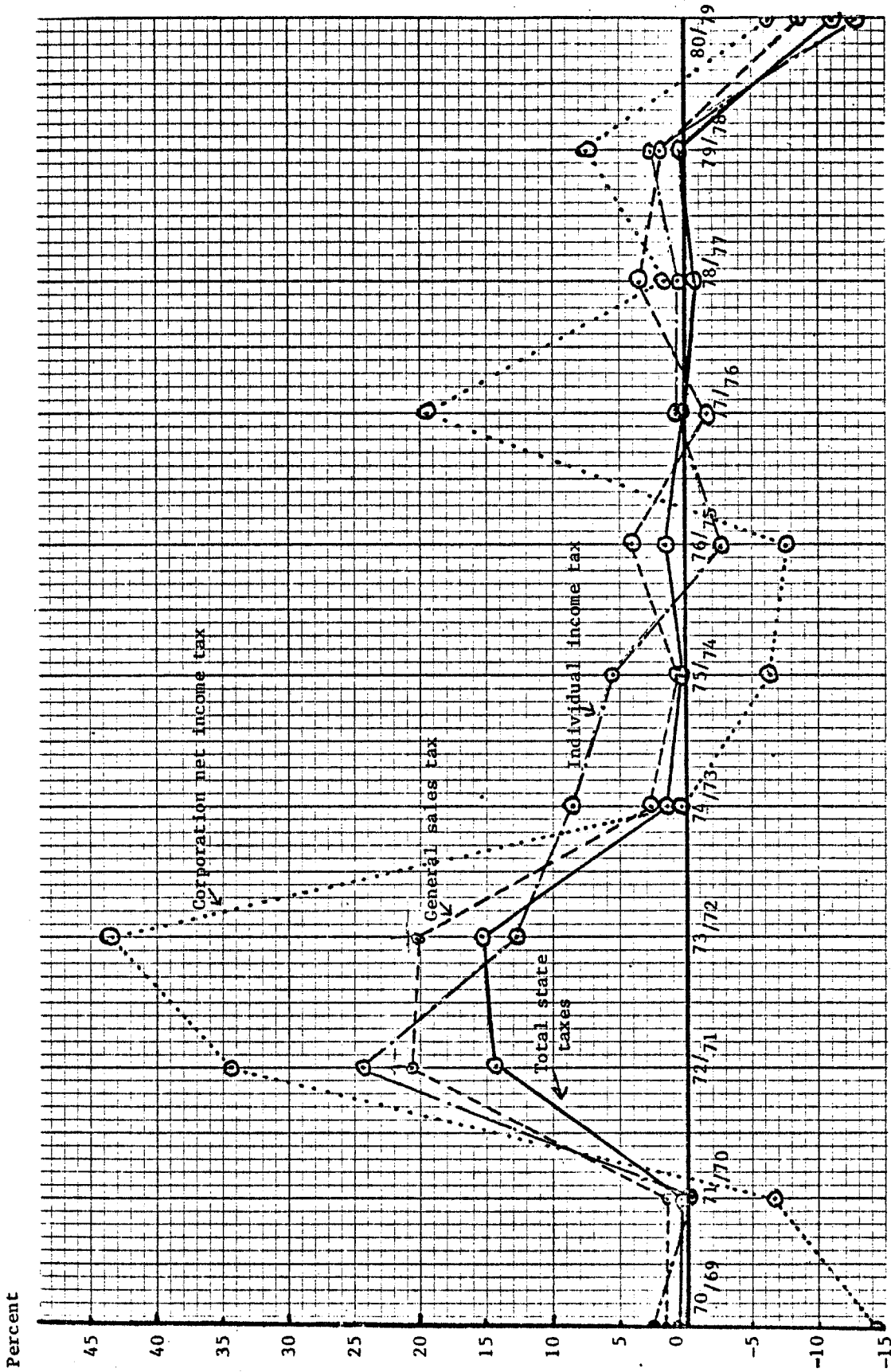


Figure 1.1. Annual Rates of Change in Total and Specified Tax Receipts Relative to Annual Rates of Change in Nonfarm Personal Earnings (lagged by six months), Minnesota, 1969-70 to 1979-80.

with reference to annual changes in nonfarm personal earnings, lagged six months. Annual growth rates are shown as differences between the annual rates of change for the particular state tax and total earnings (i.e., wages and salaries and proprietorial income) of the nonfarm work force. Thus, a positive value denotes an above-average annual rate while a negative value denotes a below-average annual rate, relative to the change in nonfarm earnings.

Clearly evident in the comparison of the three state taxes is the volatility in their annual rates of change. Most volatile of the three is the corporate net income tax, while the general sales tax is least volatile.

When actual state tax yields are adjusted for the various changes in tax laws, year-to-year changes in total state tax revenues correlate closely with year-to-year changes in nonfarm earnings. A 10-percent change in nonfarm personal income is associated with an approximately 10 percent change in total state tax receipts. Indeed, for the 1969-80 period, when total nonfarm personal earnings increased from \$10,298 million to \$29,423 million, total state tax revenues increased from \$915 million to \$3,238 million. Thus, a 10 percent increase in nonfarm personal earnings was associated with a 12.4 percent change in state tax revenues. The larger than proportional rate of change is the result of tax law changes which increased tax revenues by increasing individual tax rates. Had individual tax rates remained fixed during the 1969-80 period, each 10 percent increase in nonfarm personal earnings would have resulted in approximately a 10-percent increase in total state tax revenues. Elimination of the deduction of federal income tax payments, like increasing the maximum tax rate, would increase the tax yield. This would result in an apparent

upward bias in the state tax elasticity coefficient with respect to nonfarm earnings.

The data in Figure 1.1 suggest that nonfarm personal earnings could serve as a surrogate for factors affecting state tax receipts. If this were tried, accurate forecasts of changes in state tax receipts would still require accurate forecasts of nonfarm personal earnings. Additional explanatory variables would further reduce the forecast variance by accounting for year-to-year fluctuations in individual tax receipts, for example, the corporate net income tax, which correlates with measures of economic activity in the construction and the durable goods manufacturing industries. These, and related, issues in the building of a state revenue forecast model are presented later in this report. First, however, a plan of study is presented for organizing the model-building activities and validating the model and its forecasts.

Method of Approach

The method of approach outlined in this report starts with an assessment of state economic growth trends and prospects, with particular reference to jobs and personal income originating in specific industries in Minnesota and the U.S. Alternative state revenue forecast methods are examined in the context of these trends and the forecast methods used in extending them. Revenue forecast series prepared with the forecast methods are examined, also, in the context of existing statewide forecasts of industry employment, earnings and output. Finally, the forecasts and the forecast methods are examined from a fiscal management perspective.

The problem focus of this report is capsuled, in part, in the growth rate differentials between state tax revenues and nonfarm personal earnings presented earlier in Figure 1.1. For example, the rate of growth in total

tax revenues from 1971 to 1972 and, again, from 1972 to 1973 was 14.4 percent and 15.3 percent, respectively, above the rate of growth in nonfarm personal earnings. These differentials were due almost entirely to tax law changes in 1971, i.e., increase of general sales tax from 3 percent to 4 percent, introduction and subsequent increase of motor vehicle excise tax from 3 percent to 4 percent, increase of individual income tax rates from the 1.5 percent-to-12 percent range to a 1.6 percent-to-15 percent range, and increase of corporate net income tax rate to 12 percent and elimination of federal tax deduction. These changes resulted in an increase of roughly \$532 million in state revenue receipts in 1972 and 1973 and an additional \$3,614 million in total state tax revenues in the period from 1974 to 1979 (assuming, of course, that the relationship identified earlier between state tax revenues and nonfarm personal earnings held for the 1974-1979 period). Thus, because of the tax law changes enacted in both the regular and special legislative sessions in 1971, Minnesota state revenue collections were \$4.1 billion, or 27 percent, larger than the \$15.4 billion they would have been (for the 1970-79 period) under the state tax laws in effect in 1970.

The effects of the 1979 tax law changes (i.e., indexing of individual income tax brackets to 85 percent of the CPI), unlike the effects of the 1971 tax law changes, were obscured by the larger effects of the 1980 recession. Growth in state tax revenues, relative to nonfarm personal earnings, declined, not only for individual income taxes, but, also, for general sales and corporation net income taxes. Major tax law changes in the 1979 legislative session were confined to the individual income tax. The analytical problem is to differentiate between the effects of tax law changes and the effects of recession. A dependable forecast method similarly must have sensitivity to the sources of change, whether legislatively

or externally mandated (i.e., by general economic conditions).

Besides accounting for year-to-year changes in state tax revenues that effect the accuracy of state revenue forecasts, this report presents alternative approaches for measuring the effects of state tax revenues on state economic growth and development. An increase in state tax revenues denotes a reduction in the disposable income of households and businesses. The use of this income differs with each sector of the economy, not only in levels of current spending but in capital outlays. Subsequent effects of the different expenditure patterns on state economic growth, while difficult to measure, are nonetheless important to the future economic viability and well-being of Minnesota government and business. Thus, the economic impact of the state tax structure is a topic of increasing concern and, also, controversy in both government and business.

STATE ECONOMIC GROWTH

State economic growth is measured by changes in personal income, among other variables. Total personal income of Minnesota residents was \$14,571 million in 1970, or \$3,819 per person, which was \$74 below the U.S. average. By 1975, the total and per capita personal income of Minnesota residents had increased to \$22,686 million and \$5,758, respectively. By 1977, the Minnesota per capita income of \$7,106 exceeded the U.S. average (by \$74) for the first time since 1973, when agricultural income increased sharply above its historical levels.

More Jobs, More Income

Much of recent income gains in Minnesota is attributed to above-average expansion of the Minnesota work force, as already noted in earlier reports (10,11). While much of this expansion in work force occurred in the services-producing industries, manufacturing employment also expanded, particularly durable goods, which includes machinery (like construction, farm, mining, industrial and service) and also computer and professional, technical and controlling instruments and equipment. The services-producing industries include transportation, communications and public utilities; wholesale and retail trade; finance, insurance and real estate; personal, business, and professional services; and government. The services-producing industries are characterized by lower earnings per hour and higher part-time employment than the goods-producing industries. Thus, job expansion may not translate into higher incomes if the new jobs replace older, higher paying jobs, or if the new jobs are in lieu of jobs in industries with high earnings.

In Minnesota, large increases in services-producing jobs have been accompanied also by large increases in total earnings. This is indicated

by the upward trend in total earnings of the service industry, i.e., personal, business and professional services, shown in Table 2.1. Here, services refers to the one industry group in the services-producing sector of the Minnesota economy. The data also show sharp increases in durable goods manufacturing in both the 1970-75 period and the post-1975 period. Indeed, total earnings increased more rapidly in these two industry groups than in the U.S. as a whole, as indicated by the large, positive state-share effects.

The data in Table 2.1 are based on the results of a simple shift-and-share analysis of a highly aggregated Minnesota economy (see, ref.10 for further discussion of this procedure). Change in total earnings, say in durable goods manufacturing from 1970 to 1975, is attributed to a national-growth effect, an income-mix effect, and a state-share effect. National growth refers to individual industry change equivalent to the change in total earnings of wage and salary and self-employed workers in all industry in the U.S. while income mix refers to the differential change in these earnings in a particular industry, like durable goods manufacturing, in the U.S. State share refers to the differential change in the individual industry earnings in Minnesota as compared with the U.S. In the 1970-75 period, for example, the national growth effect was equivalent to an increase of \$8,361 million in Minnesota total earnings. The national growth in total personal income was 57.4 percent. The corresponding Minnesota growth was \$8,109, or 55.6 percent.

The below-average growth in Minnesota total earnings in the 1970-75 period is attributed to an adverse income-mix effect (of -\$62 million) and an adverse state-share effect (of -\$184 million). The income-mix effect was negative for most industry, but in Minnesota the income-effect was

Table 2.1. Change in Total Personal Earnings in Specified Industry Due to National Growth, Income Mix, and State Change, Minnesota, 1970-75, 1975-79, and 1979-80. 1/

Personal Income Source	Change, 1970-75			Estimated 1975	Change, 1975-79			Estimated 1979	Change, 1979-80			Estimated 1980
	National	In-	State		National	In-	State		National	In-	State	
	Growth	come	Share	Total	Growth	come	Share	Total	Growth	come	Share	Total
Total Earnings, by Place of Work:												
Agriculture	880	505	70	380	1,260	688	-126	734	1,994	-635	14	-425
Ag.Serv., For., Fish.	36	21	1	13	49	27	13	47	96	-3	0	6
Mining	150	86	72	104	254	139	71	192	446	26	-56	36
Construction	832	477	-162	232	1,064	581	100	827	1,891	-163	-78	-55
Mfg., Nondur.	1,240	711	-287	500	1,740	951	-61	950	2,690	-73	138	330
Mfg., Durables	1,723	988	-312	715	2,438	1,332	323	1,949	4,387	-289	103	246
Trans., Comm., Util.	866	497	-48	506	1,372	750	118	896	2,268	-34	-35	154
Trade	2,003	1,149	-139	1,037	3,040	1,661	-121	1,712	4,752	-78	-51	339
Fin., Ins., Real	607	348	-59	270	877	479	167	744	1,621	57	10	227
Services	1,827	1,048	29	1,061	2,888	1,578	245	2,135	5,023	128	725	902
Government	1,693	971	-4	1,071	2,764	1,510	-486	1,105	3,799	-106	-4	265
Total	11,857	6,801	-839	5,890	17,747	9,696	243	11,239	28,986	-1,170	324	2,006
Personal Income Receipts, by Place of Residence:												
Total Earnings	11,829	6,785	-912	5,892	17,721	9,682	335	11,213	28,934	-817	-31	1,999
Less: Pers. Contr.	485	278	113	509	994	543	-137	552	1,546	-25	21	148
Plus: Prop. Inc.	1,841	1,056	58	1,246	3,087	1,687	166	1,541	4,628	357	22	834
Plus: Tran. Pay.	1,387	796	911	1,484	2,871	1,569	-395	1,105	3,976	313	-33	671
Total Pers. Inc.	14,579	8,361	-62	8,109	22,686	12,395	243	13,305	35,991	-122	-63	3,356

1/ Based on unpublished data from: U.S. Department of Commerce, Regional Economic Information System, Washington, D.C., 1981.

negative overall because of its slightly more than proportional share of below-average income growth industries and other income sources. The negative state-share effect was due largely to the below-average growth in farm earnings relative to the U.S. average for this industry and the below-average growth in earnings from the mining and construction industries and in transfer payments.

Minnesota income growth rates reversed their earlier trends in the 1975-79 period because of positive income-mix and state-share effects. Personal income derived from earnings increased faster than personal income derived from property income and transfer payments for the U.S. as a whole, while in Minnesota, these earnings increased faster than in the corresponding industry in the U.S., except mining. The largest relative increases were in agriculture, durable goods manufacturing and services. The positive income-mix and state-share effects accounted for \$1,543 million, or 13.7 percent, of the \$11,239 million increase in total earnings in the 1975-79 period. Below-average or negative effects of growth in personal contributions to social insurance programs, property income, and transfer payments reduced the importance of the income-mix and state-share effects to 6.9 percent of the total change of \$13,305 million in total personal income.

In the last year of the 1970's, income growth trends were reversed again, not only for all industry in the U.S., but also, for most industry in Minnesota. For the 1979-80 period, negative state-share effects are shown for mining, construction, transportation, communications and utilities, wholesale and retail trade, and government. However, for the personal, business and professional services industry group, the state-share effect was a whopping \$725 million -- the largest of any industry in this or the two previous periods. The large increase in service industry jobs was

accompanied by a large increase in service industry income payments to wage and salary workers and proprietors. Also during this period, the state-share effect for property income was positive but it was negative for transfer payments. Indeed, the 1979-80 period culminated a decade of below-average growth in transfer payments from federal and state governments to Minnesota residents.

More Cyclical Sensitivity

Above-average growth in durable goods manufacturing accounts, in part, for the increasing cyclical sensitivity of the Minnesota economy. State tax revenue collections were more severely affected by the general business cycle in 1980 than in previous years. The Minnesota economy had become more like the U.S. economy in its responsiveness to general economic conditions. A high proportion of employment in agriculture and trade and services industries was no longer enough to dampen the adverse effects of national economic recession and thus remove its impact on state tax collections and other income-dependent activities.

The cyclical sensitivity of Minnesota personal income receipts is illustrated in Table 2.2 by their annual rates of change relative to total nonfarm earnings in Minnesota and the U.S. (with the latter conforming closely to changes in Gross National Product). While the year-to-year variability in Minnesota total personal income deviated from the national pattern in part because of the great variability of Minnesota's large farm income component, nonfarm earnings in Minnesota correlated closely with U.S. nonfarm earnings. Year-to-year fluctuations in earnings in the construction and the durable goods manufacturing industries also corresponded closely with year-to-year fluctuations in U.S. nonfarm earnings. On the other hand, changes in total earnings from trade and service industries were

Table 2.2. Annual Change in Personal Income Receipts from Specified Sources, Represented as Difference from Minnesota and U.S. Nonfarm Earnings, Minnesota, 1969-1980.

Calendar Year	Total Personal Income		Earnings		Difference From Minn. Nonfarm Earnings					Diff. From U.S. Nonfarm Earnings			
	Personal Income	Total	Farm	Non-farm	Construction	Manufacturing	Trade	Services	Government	Total Personal Earnings	Nonfarm State Tax Revenues		
					(percent)								
1969-70	9.1	7.6	22.2	6.6	-4.5	-0.6	5.3	0.8	2.5	6.3	3.2	0.7	1.8
1970-71	5.8	5.0	7.8	6.0	2.4	3.4	-9.3	0.4	1.1	6.6	-0.7	-0.5	14.0
1971-72	9.4	9.3	21.9	8.4	-7.8	1.1	3.1	-2.1	-1.2	3.3	-0.4	1.4	13.9
1972-73	17.9	20.1	36.7	10.9	-3.8	-1.2	5.5	-0.8	0.2	-2.8	7.4	0.4	2.0
1973-74	6.5	3.6	-29.1	9.1	-2.5	-0.2	1.2	3.9	1.3	-2.6	-1.2	0.4	1.0
1974-75	7.1	4.8	-24.1	7.9	-5.1	-3.3	-5.7	-0.1	4.4	4.8	-2.5	-1.7	0.1
1975-76	8.4	8.3	-40.2	12.2	5.5	1.4	-0.3	-3.0	1.4	-4.9	0.8	4.6	4.4
1976-77	14.7	16.8	39.9	11.6	-1.8	-1.7	4.2	-2.1	4.1	-4.2	3.4	0.3	-0.3
1977-78	12.4	13.2	1.4	14.3	7.3	3.8	3.4	-1.4	-0.2	-5.5	-0.1	1.8	1.7
1978-79	13.3	13.9	8.7	14.5	-1.4	-2.4	3.5	1.3	1.4	-4.8	0.6	1.8	-10.5
1979-80	9.5	7.1	-21.3	9.0	-11.9	3.3	-3.4	-1.9	9.0	-2.1	1.6	-0.8	-2.4

counter-cyclical but in a relative sense (because of lagging growth in construction and the durables goods manufacturing industries in the recession years).

The contrasting growth trends in selected Minnesota industries is further illustrated in Figure 2.1. While annual changes in Minnesota nonfarm earnings relative to U.S. nonfarm earnings were small for the 1979-1980 period, annual changes in construction and durable goods manufacturing relative in Minnesota nonfarm earnings were large. Individual industry differences in annual rates of growth were due to factors other than year-to-year fluctuations in general economic conditions and the cyclical sensitivity of individual industry earnings.

In seven of the 10 years from 1969-70 to 1979-80, the rate of growth in nonfarm earnings exceeded the U.S. rate. Rapid expansion of industry employment accounted for much of the growth in total earnings (10,11). The service industry was an important source of this growth, as indicated by the generally upward trend in service industry earnings. In seven of the 10 years, the growth rate in Minnesota service industry earnings exceeded the annual growth rate in Minnesota nonfarm earnings.

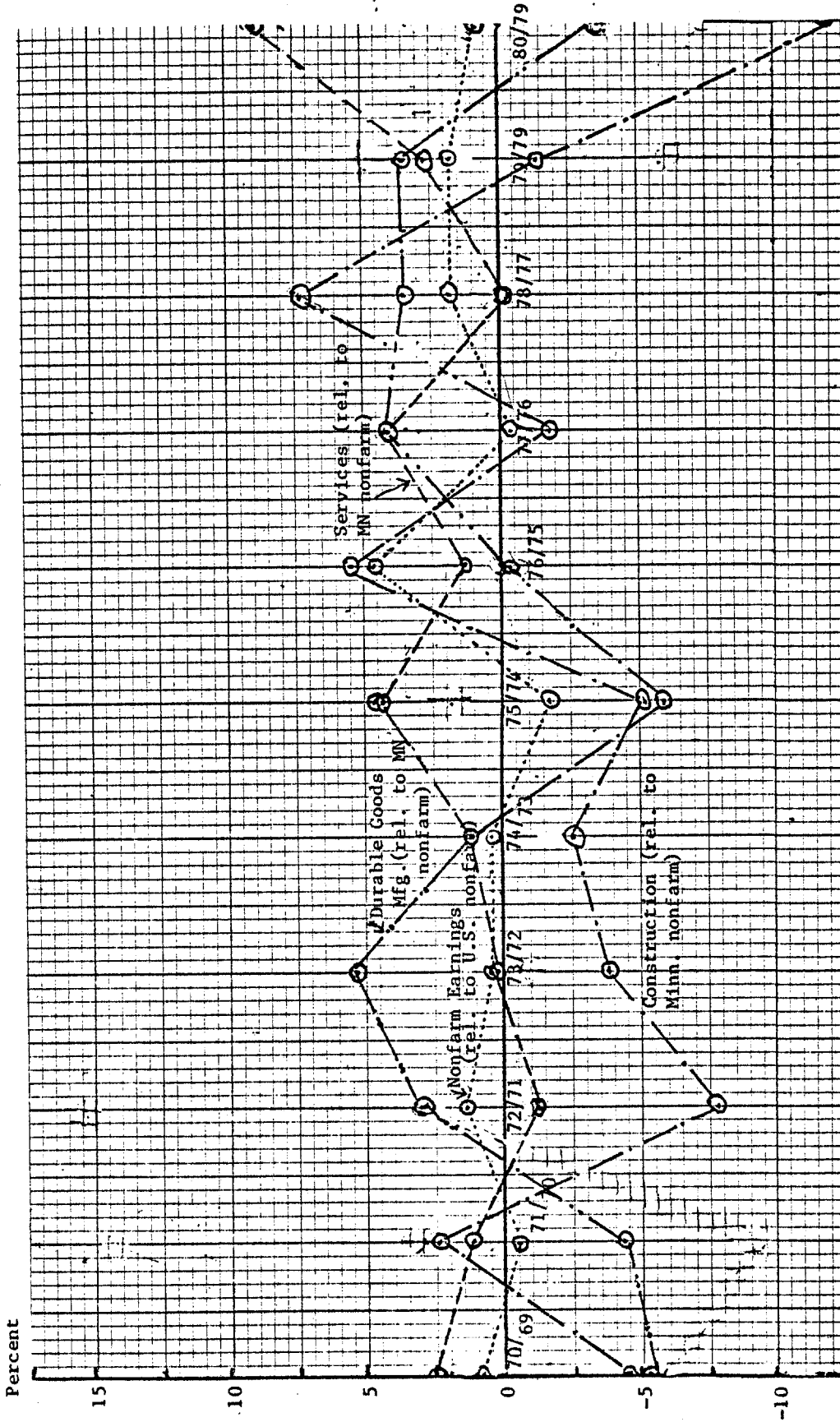


Figure 2.1. Annual Rates of Change in Total and Specified Industry Nonfarm Earnings Relative to U.S. and Minnesota Nonfarm Earnings, Minnesota, 1969-1980.

STATE REVENUE TRENDS

State revenue trends are compared with corresponding revenue trends for the U.S. as a whole to show similarities and differences in state tax yields and performance and to help in identifying factors accounting for these differences. The Minnesota state revenue system, for example, can be characterized by shifts from locally-collected to state-collected taxes and from non-tax to tax revenue sources. To explore the state revenue implications of these shifts, year-to-year changes in specific state and local revenue sources are compared with corresponding changes for the U.S. as a whole.

Rising State and Local Revenues

Rapidly rising state and local revenues characterized the 1970's in both Minnesota and the U.S. For the U.S. as a whole, state and local general revenues per capita increased from \$642 in 1970 to \$1,556 in 1979 -- a 142-percent increase, while total personal income increased from \$3,893 to \$8,773 -- a 125-percent increase. During the same period, Minnesota state and local general revenues per person increased from \$678 to \$1,805 -- a 166-percent increase. As shown in Table 3.1, state taxes were the most rapidly increasing component of state and local general revenues. They nearly doubled from 1970 to 1975 -- a much higher increase than for the U.S. as a whole. The 1970-75 rates were partially reversed, however, in the 1975-79 period when state tax revenues in the U.S. rose more rapidly than in Minnesota. Meanwhile local tax revenues in Minnesota lagged behind the U.S. rates while local non-tax revenues increased more rapidly in Minnesota than in the U.S.

Relative to growth in personal income, state and local general revenues in Minnesota declined in the last half of the 1970's. General revenues per

Table 3.1. State and Local Tax and Other General Revenues Per Person and Per \$1,000 Total Personal Income, Minnesota and U.S., 1970-1980. 1/

Fiscal Year	All										
	General Revenues			State			Local			Other U.S.	
	Minne- sota	U.S.		Taxes Minne- sota	U.S.	Other Minne- sota	U.S.	Taxes Minne- sota	U.S.		Minne- sota
Per Person:	(dollars)										
1970	678	642		268	235	158	141	173	190	79	75
1975	1,242	1,071		516	376	290	248	239	288	196	159
1976	1,366	1,193		561	416	325	280	264	315	216	183
1977	1,496	1,321		625	462	337	305	280	346	253	203
1978	1,638	1,449		686	519	372	333	311	369	269	229
1979	1,805	1,556		772	568	400	366	324	366	309	260
1980 2/				787	606						
Per \$1,000 Total Personal Income:											
1970	178	165		70	60	41	36	45	49	21	19
1975	215	183		89	64	50	42	41	49	34	27
1976	220	186		90	65	52	44	42	49	35	29
1977	211	188		88	66	48	43	40	49	36	29
1978	208	185		87	66	47	42	40	47	34	29
1979	204	178		87	65	45	42	37	42	24	30
1980 2/				82	64						

1/ Based on data in: U.S. Bureau of the Census, Government Finance in 1978-79, U.S. Government Printing Office, Washington, D.C., 1980; and earlier years.

2/ Only state tax revenues estimates were available for Minnesota when this report was prepared.

\$1,000 of total personal income in Minnesota peaked in 1976. Much of the decline since 1976 can be attributed to above-average growth in per capita personal income. Thus, the burden of state taxes, while increasing in total, had become a smaller proportion of total personal income by the end of the 1970's.

Expanding Intergovernmental Transfers

Expanding intergovernmental transfers also characterized the 1970's, with state-to-local transfers being increasingly important as a revenue source for local governments. In this report, however, the spending of state revenues (and, also, of local revenues) is not shown and, hence, only federal-to-state and federal-to-local intergovernmental transfers are examined. In 1970, these transfers amounted to \$382 million and \$22 million, respectively, as shown in Table 3.2. They were 15.6 percent of total state and local general revenues in Minnesota as compared with 16.7 percent of the total for the U.S. as a whole. Thus, in 1970, federal income transfers to state and local governments were 10 percent below the national average.

In the nine-year period from 1970 to 1979, federal income transfers to Minnesota state and local governments increased from \$404 million to \$962 million in 1975, \$1,304 million in 1978 and \$1,429 million in 1979. The average annual rate of increase declined from 27.7 percent in the 1970-75 period to 11.9 percent in the 1975-78 period and 9.6 percent in 1978-79. This decline was less rapid for local government than state government in both Minnesota and the U.S. As noted earlier, state-to-local government transfer payments generally increased during this period.

The shift-and-share method of trend analysis is used briefly to partition the sources of change in general revenue sources of state and local

Table 3.2. Effect of National Growth, Revenue Mix and State Share on Total State and Local General Revenues, Minnesota, Fiscal Years 1970-1979. ^{1/}

General Revenue Source	Change 1970-75			Estimated 1975	Change 1975-78			Estimated 1978	Change 1978-79			Estimated 1979				
	National- Growth	Revenue- Mix	State Share		National- Growth	Revenue- Mix	State Share		National- Growth	Revenue- Mix	State Share		Total			
State fed. tran.	382	285	51	34	370	752	289	3	-72	220	972	84	0	-8	76	1,048
General sales ^{2/}	196	146	1	93	240	436	168	17	0	185	621	54	21	1	76	705
Motor fuels	123	92	-53	-18	21	144	55	-34	41	62	206	18	-7	0	11	217
Alch. bev. & tob.	84	63	-28	9	44	128	49	-32	-8	9	137	12	-10	0	2	139
Other sales taxes ^{2/}	60	45	-6	-9	30	90	35	10	-15	31	121	10	-1	-5	-4	117
Indiv. income	346	258	105	98	461	807	311	131	-174	268	1,075	93	37	51	181	1,256
Corp. net income	80	60	3	53	116	196	75	45	-23	97	293	25	13	26	64	357
Motor veh. & oper.	67	50	-20	-3	27	94	36	-15	9	30	124	11	-3	-3	5	129
Other state taxes	65	48	-18	33	63	128	49	1	4	54	182	16	2	14	32	214
State chg. & misc.	222	165	-1	1	165	387	149	-15	3	137	524	45	39	-33	51	575
Local fed. tran.	22	16	54	118	188	210	81	83	-42	122	332	29	-8	26	47	379
Property taxes	644	480	-146	-73	261	905	348	-95	44	297	1,202	104	-134	88	58	1,260
Other local taxes	16	12	3	3	18	34	13	2	2	17	51	4	1	1	6	57
Local chg. & misc.	281	209	24	46	279	560	216	-35	11	192	752	65	87	-30	122	874
Total	2,588	1,929	-31	384	2,282	4,870	1,873	69	-219	1,723	6,593	570	37	128	735	7,328

^{1/} U.S. Bureau of the Census, Government Finances in 1978-79, U.S. Government Printing Office, Washington, D.C., 1980; and earlier years.

^{2/} Motor vehicle excise tax is included with general sales tax revenues for comparisons.

governments in Minnesota. This method can be applied to other states and, also, the frame of reference can include neighboring states or larger regions of which Minnesota is a part (like the North Central Region), rather than the U.S. as a whole. In this report, only Minnesota and U.S. data are used, as summarized earlier in Table 3.2.

Three sources of change in total general revenue, say from 1970 to 1975, are identified -- a national-growth effect, a revenue-mix effect (which, also, pertains to overall U.S. change, but individual general revenue sources), and a state-share effect. The national-growth and revenue-mix effects are derived entirely from U.S. data. The national-growth effect, for example, is the change in total Minnesota general revenues equal to the relative change in the total general revenues of the state and local governments in the U.S. as a whole while the revenue-share effect is the differential change due to above-average or below-average growth in a specific revenue source when compared with the total change, again based on relative change in the U.S.

The state-share effect is the differential change in a specific revenue source due to above-average or below-average growth in this revenue source in Minnesota as compared with the U.S. This difference, say in federal-to-state transfers, was \$34 million for the 1970-75 period, which compares with \$285 million and \$51 million, respectively, for the corresponding national-growth and revenue-share effects. Thus, in the 1970-75 period federal-to-state income transfers for Minnesota increased more rapidly than for the U.S. as a whole by \$34 million. Indeed, total general revenues of Minnesota state and local governments increased by \$51 million more than for U.S. as a whole, but taking into account the revenue-mix, which included a disproportionately high share of below-average growth revenue sources, the total increased by \$384 million, as indicated by the total state-share effect.

The shift-share method thus offers a useful approach to the study of the sources of change in state and local general revenues. In Minnesota, for example, the \$4,740 million increase from 1970 to 1979 in total general revenues of state and local governments can be attributed to the three change effects, as follows:

<u>Change Effect</u>	<u>1970-75</u>	<u>1975-78</u>	<u>1978-79</u>	<u>Total</u>
		(million \$)		
National-growth	1,929	1,873	570	4,312
Revenue-mix	-31	69	37	75
State-share	284	-219	128	293
	<hr/>	<hr/>	<hr/>	<hr/>
Total	2,282	1,723	738	4,740

The Minnesota total increase was larger than for the U.S. as a whole by \$368 million because of the more rapid shift to state income and sales taxes in Minnesota than in the U.S. This shift resulted in a positive regional-share effect while the above-average growth in the more rapidly growing revenue sources resulted in a positive state-share effect.

When individual general revenue sources are compared, trend differences emerge, for example, the above-average dependence in Minnesota on general sales taxes and property taxes. The much-publicized shift from regressive to progressive taxes and from local to state taxes was perceived as increasing the importance of income taxes and decreasing the importance of property taxes. This, indeed, occurred, but only in an absolute sense. Relative to the U.S. as a whole, the Minnesota revenue system was more dependent on property taxes (and, also, general sales taxes) in 1979 than in 1975, as indicated by the generally positive state-share effects, as summarized below:

<u>Revenue Source</u>	<u>1970-75</u>	<u>1975-78</u>	<u>1978-79</u>	<u>Total</u>
		(million \$)		
General sales tax	93	0	1	94
Ind. income tax	98	-174	51	-25
Corp. income tax	53	-23	26	56
Property tax	<u>-73</u>	<u>44</u>	<u>88</u>	<u>59</u>
Total	171	-153	166	184

Thus, the 1971 legislative changes in the Minnesota individual income tax law made possible a positive state-share effect for the 1970-75 period and the above-average growth in Minnesota total personal income in 1978-79 made possible the positive state-share effect for the 1978-79 period. Growth in Minnesota individual income tax revenues lagged behind growth in this revenue source for the U.S. as a whole because of the federal income tax deductions and other provisions which reduced the income elasticity of the Minnesota income taxes relative to the U.S.

Shifts in dependence of state and local governments on federal income transfers are indicated, also, in the negative state-share effects, as shown below:

<u>Revenue Source</u>	<u>1970-75</u>	<u>1975-78</u>	<u>1978-79</u>	<u>Total</u>
		(million \$)		
Federal-to-state transfers	34	-72	-8	-46
Federal-to-local transfers	<u>118</u>	<u>-42</u>	<u>26</u>	<u>102</u>
Total	152	-114	18	56

Only the above-average federal transfers to local governments in the 1978-79 fiscal year made possible an overall positive state-share effect.

In summary, the 10-year growth in state and local general revenues was due largely to growth in state tax revenues. In the U.S. as a whole, 64 percent of this growth was in state general revenues. In Minnesota, 66 percent was due to state general revenues. A positive state-share effect

for both state and local general revenues indicates above-average growth in overall state and local general revenues, with the distribution of this growth being shared by the principal revenue sources, as follows:

<u>Revenue Source</u>	<u>National- Growth</u>	<u>Revenue- Mix</u> (million \$)	<u>State- Share</u>	<u>Total</u>
State revenues, total	2,795	239	99	3,133
Taxes	1,778	162	174	2,114
Fed. inc. tran.	658	54	-46	666
Charges & misc.	359	23	-29	353
Local revenues, total	1,577	-164	194	1,627
Taxes	961	-369	65	657
Fed. inc. tran.	126	129	102	357
Charges & misc.	490	76	27	593

Both the revenue-mix effects and the state-share effects for Minnesota were positive, i.e., the overall growth in general state and local revenues exceeded the equivalent growth based on overall U.S. rates.

Tax Indexing and Recession

Changes in the state income tax law in 1979 combined with the downturn in the general business cycle to reduce Minnesota state tax revenues below expected levels in the 1980 and 1981 fiscal years. Their combined effects are presented next to illustrate the general nature of the revenue impact measurement problem and the methods for dealing with it.

Growth in specific state tax revenue sources is, first, summarized for the 1969-81 period in Table 3.3. The presentation here simply expands on a portion of the data presented in earlier tables. In 1979 state tax revenues accounted for about 43 percent of the general revenues of state and local government (net of state-to-local and local-to-state transfers) and 66 percent of the total general revenues of state government in Minnesota.

Table 3.3. State Tax Collections From Specified Source, Minnesota, Fiscal Years 1969 to 1981. ^{1/}

Tax Source	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981- ^{5/}
	(thousand \$)												
State tax revenues	914,569	1,020,953	1,099,070	1,324,471	1,638,456	1,842,728	2,022,228	2,218,888	2,485,565	2,759,365	3,166,793	3,237,931	3,404,283
Sales & gross rec., total	404,732	463,014	507,988	580,668	709,157	754,493	797,358	905,485	983,370	1,085,311	1,198,332	1,216,226	1,266,881
General sales	173,961	195,620	212,721	270,128	299,326	348,141	384,391	426,541	466,658	537,478	607,989	650,138	668,747
Motor fuels	115,748	122,880	130,649	136,412	144,573	144,348	143,993	189,603	197,109	205,652	216,554	204,955	205,000
Alcoholic beverages	28,049	34,111	37,415	41,813	46,859	49,033	48,879	49,339	50,502	52,643	53,609	54,201	56,014
Tobacco products	34,073	49,437	58,579	60,012	75,009	77,869	78,789	82,474	83,802	84,696	85,611	86,547	89,199
Insurance	18,714	24,181	29,530	29,939	44,518	31,480	34,443	37,569	46,697	53,607	59,704	63,984	62,942
Public utilities	30,516	33,225	35,382	38,356	43,577	48,730	53,833	58,186	45,486	67,006	78,006	67,697	77,548
Other ^{2/}	3,666	3,556	3,696	4,002	55,286	54,879	53,012	61,753	73,283	84,222	96,855	88,683	87,431
Licenses, total	77,700	84,603	90,226	95,127	112,832	117,513	122,246	137,831	150,063	169,931	182,013	194,485	207,812
Motor vehicles	60,484	64,218	66,452	68,463	83,334	87,807	89,324	96,575	103,798	117,403	122,602	134,506	141,506
Motor veh. operators	2,553	2,629	2,127	4,441	5,885	4,120	4,934	6,256	6,756	6,167	6,224	6,233	6,233
Other ^{3/}	14,633	17,756	21,647	22,223	23,613	25,586	27,988	35,000	39,509	46,301	53,187	53,746	53,746
Individual income, total	304,150	345,733	370,702	483,215	586,235	701,389	807,108	849,520	956,933	1,074,552	1,255,998	1,262,697	2,414,441
Refunds						-157,641	-169,785	-216,849	-254,267	-311,465	-384,606	-486,428	-438,006
Gross collections						859,030	976,593	1,066,369	1,211,200	1,386,017	1,640,604	1,749,125	1,852,447
Corp. net income, total	82,642	79,832	79,969	112,403	170,655	190,336	195,905	196,436	258,095	292,853	356,734	381,217	357,783
Refunds						-13,408	-19,269	-28,100	-27,038	-27,765	-23,609	-31,128	-39,485
General	74,569	70,115	63,563	97,154	154,190	187,215	199,004	203,256	263,737	293,646	347,284	375,510	357,497
Bank excise	8,073	9,717	16,406	15,249	16,465	16,529	16,170	21,280	21,396	26,972	33,059	38,835	39,771
Property	4,602	5,810	6,844	2,868	2,112	2,576	2,355	2,182	3,083	3,760	3,373	4,281	4,300
Death and gift	21,395	20,032	21,733	25,722	32,059	33,859	42,205	44,700	43,214	33,098	40,829	41,922	8,435
Severance	16,217	18,976	18,388	20,080	19,924	29,394	35,897	58,171	59,718	61,945	104,297	118,809	10,931
Other ^{4/}	3,131	2,953	3,220	4,338	5,418	13,394	24,120	24,563	31,084	37,906	25,217	18,294	18,200

^{1/} U.S. Bureau of the Census, State Government Tax Collections in 1980, Series F-80, No. 1, U.S. Government Printing Office, Washington, D.C., 1980; and earlier years.

^{2/} Oleomargarine tax repealed effective July 1975; include 4 percent motor vehicle excise tax starting fiscal year 1973.

^{3/} Corporations in general, alcoholic beverages, amusements (boxing), occupations and business not elsewhere classified, and other licenses (snowmobile, boat and water safety, and aircraft, registration).

^{4/} Mortgage registry, documents, and employers excise tax (with excise tax effective only for period from August 1, 1973 to June 30, 1978).

^{5/} Preliminary estimate based on partial tabulation of fiscal year 1981 state tax receipts.

Growth rates for selected state taxes are compared with growth in total state tax revenues and nonfarm earnings (in preceding calendar year) in Table 3.4. The variability in these rates indicates, in part, the varying degree of sensitivity of each tax to general economic conditions. This variability is due, also, to tax law changes, as indicated in the explanatory footnotes in Table 3.4.

Among the most volatile of state taxes are the corporate net income tax and the severance tax on iron ore and taconite production. Indicated in Table 3.4 are the differential growth rates relative to total state revenues. The latter also varied more widely than the annual changes in total nonfarm earnings in Minnesota (largely because of the tax law changes noted earlier).

Year-to-year variability in the differential rates of changes in the selected state taxes was greatest in the fiscal years immediately following the turning points in the general business cycle, i.e., 1971-72, 1975-76, and 1980-81, except, of course, for the fiscal years following important tax law changes. Even the general sales tax, which most consistently followed the overall pattern of growth in tax revenues, responded sharply to the business cycle. So did severance tax revenues, which, also, were affected by strikes and conditions unique to the mining industry.

The shift-share method is used again to partition the change in total state tax revenues between the three change effects -- national-growth, revenue-mix, and state-share (Table 3.5). In this illustration, total change refers to total state revenues rather than combined state and local general revenues, as in preceding tables. The three change effects in Table 3.5 nonetheless compare closely with the corresponding change effects in Table 3.2, except for the difference in historical periods, i.e.,

Table , Annual Rates of Change in Nonfarm Earnings and Selected State Tax Revenues, Minnesota, Fiscal Years 1969 to 1980.

Fiscal Years	Nonfarm Earnings in Preceding Calendar Year	Total State Tax Revenues	Differential Change Relative to Total State Revenues						
			Sales and Gross Receipts		Licences	Individual Corporation Income		Severance ^{6/} & Tonnage	
			Total	General ^{2/} Other ^{3/}		4/	5/		
1969-70	11.1	11.6	2.8	0.9	4.3	-2.7	2.1	-15.0	5.4
1970-71	6.6	7.7	2.0	1.0	2.7	-1.1	-0.5	-7.2	-10.8
1971-72	6.0	20.5	-6.2	6.5	-15.4	-15.1	9.9	20.1	-11.3
1972-73	8.4	23.7	-1.6	5.1	-8.2	-5.1	-2.4	28.1	-14.5
1973-74	10.9	12.5	-6.1	1.3	-13.4	-8.4	7.1	-1.0	35.0
1974-75	9.1	9.7	-4.0	0.5	-7.9	-5.7	5.4	-6.8	12.4
1975-76	7.9	9.7	3.9	2.4	5.7	3.0	-4.4	-9.3	52.3
1976-77	12.2	12.0	3.4	-1.4	-5.7	-3.1	0.6	19.3	-9.3
1977-78	11.6	11.0	-0.6	4.1	-6.4	2.2	1.3	2.5	-7.3
1978-79	14.3	14.8	-4.4	1.4	-8.4	-7.7	2.1	7.0	53.6
1979-80	14.5	2.2	-0.7	2.6	1.2	4.7	-1.7	4.7	11.7
1980-81	9.0	5.5	-1.3	0.4	-3.4	1.4	6.5	-11.6	-15.5

1/ Motor vehicle excise tax is included with general sales tax revenues for comparisons.

2/ Sales tax rate increased from 3 percent to 4 percent in 1971. Motor vehicle excise tax enacted at rate of 3 percent and increased from 3 percent to 4 percent in special session in 1971.

3/ Motor fuels tax increased from 7 cents to 9 cents a gallon in 1975.

4/ Married taxpayers allowed to file separately on combined individual income tax return in 1971 and rates increased from 1.5 percent - 12 percent to 1.6 percent - 15 percent in 1971. Maximum rate increased to 18 percent in 1977. Rescinded 18 percent top rate in 1978 and 17 percent top rate in 1979. Personal credits increased in 1977, 1978 and 1979. Standard deduction increased to 10 percent up to \$2,000 in 1979. Income tax brackets indexed at 85 percent of increase in CPI in 1979. Low income credit levels and pension income exclusion increased in 1978, 1979 and 1980.

5/ Corporate net income tax rate increased to 12 percent and federal tax deduction eliminated in 1971.

6/ Occupation tax on taconite and iron ore increased in 1971. Taconite production tax increased in 1971, 1975 and 1977 with tax indexed in 1977 to Lower Lakes port taconite pellet price.

Table 3.5. Effect of National Growth, Revenue Mix and State Share on State Tax Revenues, Minnesota, Fiscal Years 1970-1980. 1/

State Tax	Change 1970-75			Esti- mated 1975	Change 1975-79			Esti- mated 1979	Change 1979-80			Esti- mated 1980
	Nation- al Growth	Reve- nue Mix	State Share		Nation- al Growth	Reve- nue Mix	State Share		Nation- al Growth	Reve- nue Mix	State Share	
General sales ^{2/}	131	15	94	436	243	16	10	705	68	0	-32	739
Motor fuels	83	-44	-18	144	80	-50	43	217	21	-26	-7	205
Alch. bev. & tob. 2/	56	-22	10	128	71	-52	-8	139	13	-9	-2	141
Other sales taxes	40	-1	-10	90	50	5	-28	117	11	-5	8	131
Indiv. income	232	131	98	807	451	143	-145	1,256	121	51	-166	1,262
Corp. net income	80	8	54	196	109	52	0	357	34	1	-11	381
Motor veh. & oper.	67	-15	-3	94	53	-24	6	129	12	-8	8	141
Other state taxes	65	-13	32	128	72	-4	18	214	21	20	-53	202
Total	1,021	685	59	2,022	1,129	86	-103	3,134	301	22	-255	3,202

1/ U.S. Bureau of the Census, State Government Tax Collections in 1980, Series GF-80, No. 1, U.S. Government Printing Office, Washington, D.C., 1980; and earlier years.

2/ Motor vehicle excise tax is included with general sales tax revenues for comparisons.

1975-79 and 1979-80 rather than 1975-78 and 1978-79. The 1979-80 period is presented here to show the contrasting patterns of change in state tax revenues during the first half and the second half of the 1970-80 period, as shown below:

<u>Change Effect</u>	<u>1970-75</u>	<u>1975-79</u>	<u>1979-80</u>	<u>Total</u>
		(million \$)		
National-growth	685	1,129	301	2,115
Revenue-mix	59	86	22	167
State-share	<u>257</u>	<u>-113</u>	<u>-255</u>	<u>-101</u>
Total	1,001	1,111	68	2,180

The increase in total Minnesota tax revenues was larger proportionately than for the U.S. because of a favorable revenue-mix, i.e., a larger proportion of tax revenue sources of above-average, rather than below-average, growth.

The impact of the 1979-80 recession on all tax revenue sources is indicated by the generally negative state share effect in 1979-80, as shown below:

<u>Revenue Source</u>	<u>1970-75</u>	<u>1975-79</u>	<u>1979-80</u>	<u>Total</u>
		(million \$)		
General sales tax	94	10	-32	72
Other sales tax	-18	7	-1	-12
Indiv. inc. tax	98	-145	-166	-213
Corp. net inc. tax	54	0	-11	43
Other taxes	<u>29</u>	<u>23</u>	<u>-45</u>	<u>8</u>
Total	257	-103	-255	-101

Indeed, the state-share effect for the individual income tax was negative for two of the three periods largely because of the yield-reducing effect of the federal income tax deduction.

STATE REVENUE FORECASTS AND FORECAST METHODS

State revenue forecasts and forecast methods are viewed next in the context of the state economic growth trends identified earlier. While one purpose of state revenue forecasts is to facilitate fiscal management, another purpose is to determine the economic growth effects of legislative changes in state tax laws. Still another purpose is to determine the state revenue effects of new legislative programs in other areas, like energy, employment, and economic development.

State Revenue Forecasts

While monthly and quarterly revenue forecasts for state fiscal management are available already, forecasts of economic growth effects of changes in tax systems generally are not available. Nor are adequate explanations of the forecasts, and their variance and accuracy, readily available.

Currently available state revenue forecasts are short-term, mostly monthly and quarterly. They are strictly part of the fiscal management process in state government. They are based on models built primarily for predictive (rather than prescriptive, descriptive, or exploratory and educational) purposes. These models, and related data, are now developed in the Minnesota Department of Finance.

Two simple revenue forecasting models are examined with particular attention to the insights they may offer in the design and implementation of a Minnesota revenue forecasting model. The first of the two models was constructed at the University of Iowa to forecast Iowa state tax revenues (1).

The Iowa approach to tax revenue forecasting is described as a hybrid model in which an extrapolative procedure is used to forecast nonfarm

personal income and its various components (i.e., wages and salaries, and proprietors and property income), which are then used in an associative model to forecast sales, use and personal income taxes. The Iowa economy, unlike Minnesota's, is not sensitive to the general business cycle. It is dominated by agriculture and agricultural-dependent activities. Despite the volatility of Iowa farm income, personal consumption expenditures, which support much of the nonfarm economy, lack this volatility. Hence, nonfarm income fluctuations, except for a rather steady growth trend, are quite small in the Iowa economy. Consequently, use of a moving average procedure (specifically the ARIMA method) has yielded adequately accurate quarterly forecasts of nonfarm wages and salaries and nonfarm proprietorial and property income. An ad hoc procedure, which also yields satisfactory results, is used for the quarterly farm forecasts.

A five-equation model has been used to prepare the quarterly forecasts of sales, use and individual income tax receipts. In this model, dummy variables account for seasonality in tax receipts and also for tax law changes. The three principal taxes are then related to the Iowa quarterly income variables as follows:

1. The sales tax (which covers most retail goods) is a function of one-quarter lagged nonfarm income and one-quarter lagged farm income.

These two explanatory variables plus 16 dummy variables, explained 99.6 percent of the variance in the dependent variable for the 1962-76 period.

2. The use tax (which includes a tax on motor vehicles and a tax on intermediate manufacturing inputs) is a function of current quarterly wages and salaries and current quarter U.S. corporate profits before taxes.

These two explanatory variables, plus three dummy variables and its own

value lagged one quarter, explains 96 percent of the variance in the dependent variables.

3. The withholding tax on current wages and salaries (which constitutes about 67 percent of total personal income taxes) is a function of one-quarter lagged wages and salaries. This variable, plus two dummy variables, explains 99.9 percent of the variance in the dependent variable.
4. The declared estimate tax (which constitutes 10 percent of personal income tax collections) is a function of current quarter nonfarm proprietors and property income and two-quarter lagged realized net farm income. These two variables, plus two dummy variables, explain 97.7 percent of the variance in the dependent variable.
5. The return income tax (or balance due, which constitutes the remaining 23 percent of personal income tax collections) is a function of two-quarter lagged nonfarm proprietors and property income and two-quarter lagged realized net farm income. These two variables, plus one dummy variable, explain 88.4 percent of the variance in the dependent variable.

For simple tax revenue forecast purposes, the Iowa model has consistently forecast within a five-percent error margin since its construction in 1979.

The second model -- the Alaska State Personal Income Tax Model -- was built to forecast yearly tax revenues and, also, to simulate the economic impact of tax policy proposals on the Alaskan economy (3). The Alaska personal income tax "piggybacks" the federal tax by using the same allowable deductions and exemptions, except for the inclusion of federal employee cost-of-living allowance and the exclusion of military wages and salaries. The federal tax is not deducted from the state tax.

A 12-equation model represents the Alaska personal income tax structure, as shown in Table 4.1. The explanatory variables for each of the 12 equations are identified individually as being either endogeneous (i.e., predicted within the model) or exogeneous (i.e., pre-specified, or given). Five policy variables -- change in tax rate progressivity, change in floor of tax rate schedule, change in value of personal exemption, tax credit, and tax credit as percent of liability -- are specified, also. This model forecasts with more variance than the Iowa model. The Alaska economy is rapidly growing, with tax revenues tripling in three years. The Alaska model has more equations than the Iowa model, which, also, are interactive.

While the Alaska tax model was used to simulate the personal income effects of tax law changes, the small number of variables precludes the possibility of forecasting trade-offs between income tax payments, personal consumption expenditures and business investment outlays. State government expenditures of income tax revenues, for example, are not included in the model. Hence the effects of redistributing a given level of personal income between private spending and public spending cannot be explored. The simulation of policy options thus remains in a virtual vacuum without the additional variables.

State Economic Forecasts

The Tennessee Econometric Model, which was built in the mid-1970's to forecast Tennessee tax revenues, illustrates the advantages of having a large number of interacting variables, including non-tax variables, to represent the full range of economic activity and the diversity of tax system linkages within a state's economy. The Tennessee model has 77 simultaneous equations and 120 variables, of which 31 are related to the national economy (via the Wharton Annual Industry Forecasting Model) and 89 are state

Table 4.1. Endogeneous and Exogeneous Variables in Alaska Income Tax Model. 1/

Revenue-Related Economic Variable	Endogeneous Variables												Personal Income	Fed. Wage & Salary Civilian Military	Employment	Civilian Population	Other Exogeneous Variables				
	1	2	3	4	5	6	7	8	9	10	11	12									
1. Fed. adj. gross income	1													X							
2. Fed. cost-of-living adj.	X	1																			
3. Adj. gross income		X	1																		
4. Tax returns				1																	
5. Exemptions			X	X																	
6. Value of deductions per return			X				1														
7. Taxable income			X		X	X															
8. Taxable inc. per return			X		X	X	1														
9. Prel. tax rev. per return					X	X															
10. Tax rev. per return								1													
11. Calendar year tax rev.								X													
12. Fiscal year tax rev.				X																	

1/ Oliver Scott Goldsmith, "A State Personal Income Tax Simulation Model", Annals of Regional Science, 13(1): 44-54. 1974.

variables (2). The state revenue-related variables are listed in Table 4.2 with their respective equations and explanatory variables, both endogenous and exogeneous.

The Tennessee Econometric Model depicts Tennessee industry output (i.e., value added, or gross state product originating) as a function of corresponding U.S. industry output, wage rates, interest rates, and/or tax rates. Many of the relationships were significant of the 99 percent level, including the relationship between industry output and related tax rate. The results show, for example, a significant inverse relationship between manufacturing industry output, both durable goods and nondurable goods, and the Tennessee corporation excise tax rate. Unless Tennessee rates change sharply each year, this is indeed a remarkable result. However, most relationships depicted in the model are quite plausible and the overall results can serve as a guide in evaluating other state econometric models.

The Tennessee Econometric Model has been used to demonstrate the effects of alternative tax policies on the state's economy. One simulation shows the effect of a 10-percent increase in the corporation excise tax rate on gross state product (down 1.04 percent), employment (down 0.46 percent), total personal income (down 0.41 percent), per capita disposable income (down 0.46 percent), and retail sales (down 0.34 percent). Corporation excise tax revenues would rise by 6.74 percent and total tax revenues by 0.54 percent. The simulated results depend, of course, on the significant inverse relationship between industry output and the corporation excise tax rate noted earlier.

The Ohio Gross State Product (GSP) Model and its decedents also provide valuable insights into the construction and utilization of state econometric models (5,6,7,8). The original Ohio GSP Model was built in

Table 4.2. Endogeneous and Exogeneous Variables in Revenue-Related Sectors of Tennessee Econometric Model. ^{1/}

Revenue-Related Economic Variables	Endogeneous Variables																					Lagged Endog. Var.	Other Exogeneous Variables
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
1. GSP, mfg., durable	1														X							X	GNP, mfg., dur.; Tenn. mfg. wage rate; U.S. corp. exc. tax rate
2. GSP, mfg., nondurable		1												X									GNP, mfg., nondur.; Tenn. mfg. wage rate; U.S. mfg. wage rate; U.S. corp. exc. tax rate
3. GSP, trade			1											X									U.S. disp. pers. inc.
4. GSP, services				1										X									U.S. disp. pers. inc.
5. GSP, fin. ins., real est.					1									X									U.S. disp. pers. inc.; Tenn. pop.
6. GSP, trans., comm., util.						1																	U.S. disp. pers. inc.
7. GSP, state and local gov.							1																Tenn. pop.
8. Auto. retail sales								1															---
9. Sales and use tax									1														Tenn. sales & use tax rate; U.S. corp. exc. tax rate
10. Gross receipts tax										1													---
11. Cigarette tax											1												Tenn. cig. tax rate
12. Gasoline consumption												1											---
13. Gasoline tax													1										---
14. Alch. beverage tax														1									Alch. beverage tax rate
15. Corp. excise tax															1								Tenn. corp. exc. tax rate
16. Motor vehicle tax																1							---
17. Other taxes																	1						---
18. Total state taxes ^{2/}									X	X				X	X								---
19. Total state gen. rev. ^{2/}														X	X			1					Charges and misc. taxes; intergov. rev.; other rev.
20. GSP, total ^{2/}	X	X	X	X	X	X	X																---
21. Disp. pers. inc.																				1			---
																				X			---

^{1/} Hui S. Chang, "Regional Econometric Model and the Fiscal Policy of a State: The Case of Tennessee", Annals of Regional Science, 11(2): 11-24, 1977.

^{2/} Identities (as differentiated from behavioral equations).

the late 1960's. It anticipated the rash of state econometric models built at the University of Pennsylvania and elsewhere under the guidance of Nobel-prize winning economist Lawrence Klein, and his associates.

The Ohio GSP Model represents the structure and behavior of the Ohio economy as an integral part of the U.S. economy (Table 4.3). Linkage with the U.S. economy is achieved directly through the two manufacturing sectors and selected income and monetary variables.

A causal ordering of the state variables in the Ohio Econometric Model was prepared to show the linkage variables and relationships involved in the diffusion of impact from external and policy variables to internal and endogeneous variables. Some simultaneity exists in the model, as indicated by relationships above the diagonal entries in Table 4.3.

Policy variables in the Ohio GSP Model include the following:

1. Percentage change in the amount of automobile installment credit in the U.S.
2. GSP in federal government
3. GSP in state and local government
4. New housing permits awarded in issuing places in Ohio
5. Interest rate on corporate bonds
6. Interest rate on 90 day Treasury bills
7. Military prime contracts awarded in Ohio

An early use of this model was the simulation of the effects of maintaining military prime contract awards at the peak level achieved in the Korean War. The results show that had Ohio been able to maintain its peak level of contract awards, it would not have experienced the decline in its share of GNP that occurred in the 1950's. In short, the results show that in the mid-1960's, the Ohio economy had yet to recover from the post-Korean War cutbacks in U.S. defense purchases from Ohio suppliers.

Table 4.3. Causal Ordering of Variables in the Ohio Gross State Product Forecasting Model. ^{1/}

Dependent Variable	Endogenous Variable																											Exogenous Variables
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
1. Δ GSP, mfg.	1																											
2. GSP, mfg. ^{2/}	X	1																										
3. Internally-generated funds, mfg.	X	X	1																									
4. Invest. exp., mfg., mach.			X	1																								
5. Invest. exp., mfg. plant			X	X	1																							
6. Total invest. exp., mfg. ^{2/}			X	X	X	1																						
7. GSP, construction							1																					
8. GSP, trade								1																				
9. GSP, services									1												X	X						
10. GSP, fin., ins., real est. (f)										1										X	X							
11. GSP, known							X	X		X	1																	
12. Δ GSP, known ^{2/}										X																		
13. Δ GSP, other										X																		
14. GSP, other ^{2/}										X																		
15. GSP										X																		
16. Δ GSP, total ^{2/}										X	X																	
17. Personal income																												
18. Fed. income taxes																												
19. Disposable pers. inc. ^{2/}																												
20. Δ Disp. pers. inc. ^{2/}																												
21. Retail sales, less autos																												
22. Auto sales																												
23. Retail sales ^{2/}																												
24. Retail sales tax rec.																												
25. Δ Automobile reg.																												
26. Automobile reg. ^{2/}																												
27. Taxable motor fuel sold																												

^{1/} W.L. L'Esperance, G. Nestel, and D. Fromm, "Gross State Product and an Econometric Model of a State", Journal of American Statistical Association, 64: 787-807, 1969.

^{2/} Identities (as differentiated from behavioral equations).

The Ohio GSP Model was expanded in the 1970's to include additional procedures for handling target (state) variables and instrument (control) variables (5,6,7). Besides the policy variables listed earlier, six target variables -- total gross state product, disposable personal income, known gross state product, gross state product originating in manufacturing, automobile registrations, and internally generated funds -- were set equal to or greater than predetermined levels of these variables. The specified control variables served as means of achieving these goals. Deviations from an optimal time path incurred added costs. The purpose of the simulation exercise was to find a minimal cost time path towards the predetermined goals. Simulation results showed that the time paths of selected endogeneous (i.e., target) variables can be changed by increasing the values of selected exogeneous (i.e., policy) variables. In short, the computer experiments supported the contention that sustained increases in such policy variables as military prime contracts and state government expenditures can increase the gross state product and disposable personal income growth rates.

The Minnesota Trade-Off Model (MINTOM) is a final example of a comprehensive approach to state revenue and economic forecasting. This model has evolved over the past 15 years in several stages, starting with a set of product and income accounts and expanded input-output tables of the Iowa economy. It has been continued with further expansion in Minnesota in the number of industries and sectors included in both the two-region input-output computer program and the dynamic regional economic model used in "driving" input-output final demands (4,9,12). It has been used, also, in classroom teaching in its interactive mode. Students inexperienced in computer program practices can use the interactive mode to simulate effects

of external (i.e., policy or market) changes on the Minnesota economy. The batch mode is available for use in research, analysis, and forecasting.

The MINTOM system is built around nine core modules representing the principal economic and demographic entities in a regional economy and three auxiliary modules, namely, population, export market, industry investment, residentiary final demands, labor force, production, income, employment, households (as decision units), government (also as income-receiving and income-spending decision units) and financial markets (for debt financing of industry investment and government spending). The individual modules, which are linked schematically in Figure 4.1, may be used independently in partial economic analysis. They are most effectively used as inter-connected elements in a recursively computed model of industry-specific activities.^{1/} The interfacing of several of the 12 modules (the 11 listed modules in Figure 4.1 and the residentiary demand module) with computable models of industry location and investment complete the MINTOM system. Thus, MINTOM, when completed, will provide an economic data base and related procedures for assessing the employment, income and population effects of given state revenues and expenditures. Industry-specific measures of the benefits and costs of these expenditures will be obtained from the MINTOM program output.

The causal ordering of the modules is represented, also, in Figure 4.1. Included among the first-order variables, for example, are those in the population, market and investment modules, while the demand and labor force modules contain most of the second-order variables. The first-order and

^{1/} A technical discussion of an earlier version of the MINTOM computer program, then known as SIMLAB, is presented in ref. 9. A new updated version of this reference is being prepared on the MINTOM program.

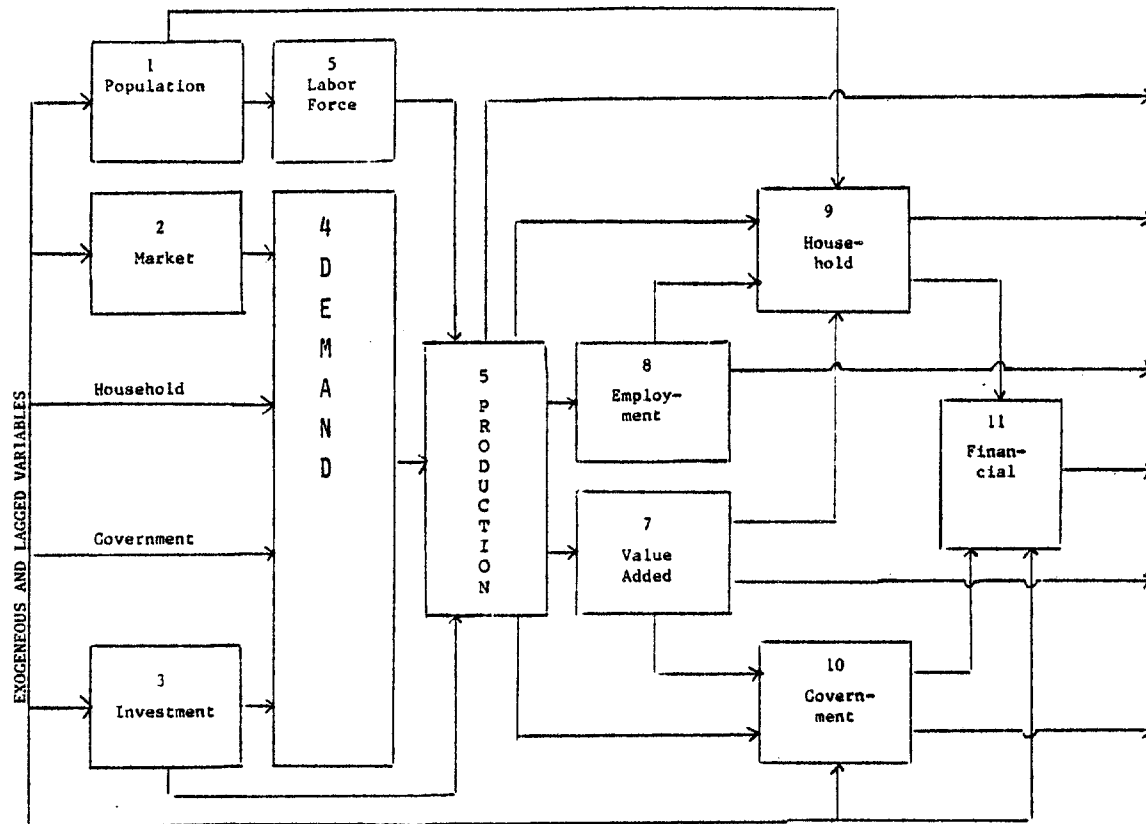


Figure 4.1. Causal Ordering and Linkages of Modules in Minnesota Trade-Off Model Program.

second-order variables are connected to exogenous and lagged variables. The value added and employment modules, which include the principal target, or outcome, variables in this study, relate the production outcomes directly to the household and government modules, or sectors. These linkages transform shifts in value added and employment into corresponding shifts in household and government income and expenditures. Finally, the financial module portrays the financial transactions of the business, household and government sectors of the state's economy. This module contains the principal policy variables available to Minnesota state government in its industrial development efforts.

State policy options and approaches which can be addressed by the MINTOM system would include those which pertain to the key export-producing sectors of the Minnesota economy. They fall into the two categories of employment stabilization and business investment. The important target variables for each policy category are industry output, employment, and value added. Relationships over time among the three variables, along with the balance of trade and balance of payments indicators, are represented, again schematically, in Figure 4.2.

First, the two time periods -- the short-term and the long-term -- are differentiated by their policy outlook. The same target variables are used, however, to monitor the statewide effects of the various policies. The time paths of the target variables may be derived by use of MINTOM. Here, a generalized version of this output is presented simply to emphasize the investment linkages in industry development.

Second, export-producing, or basic, industry is differentiated from residentiary industry, which includes much or all of the following: transportation, communication and public utilities; trade; finance, insurance and

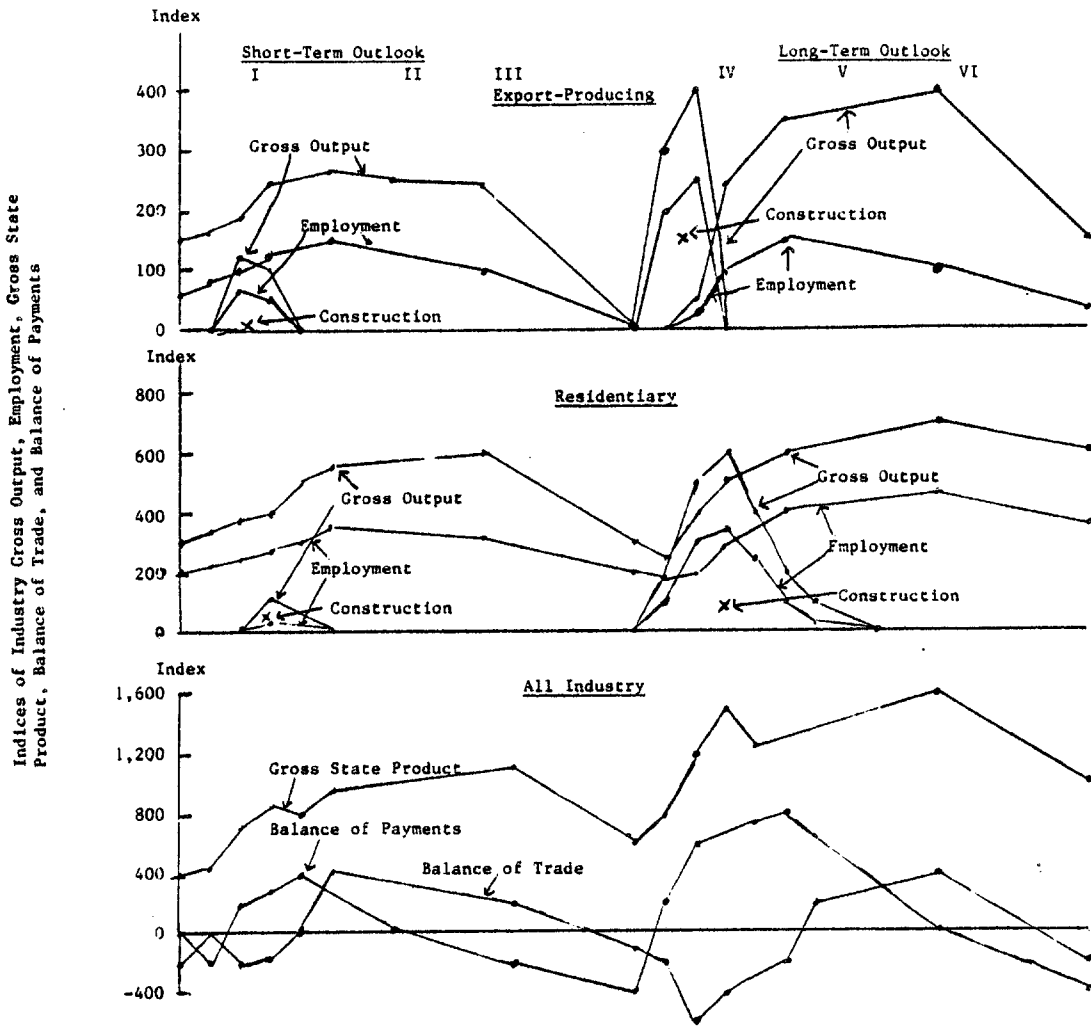


Figure 4.2. Relation of Short-Term Economic Fluctuations and Long-Term Development Trends to Gross Private Capital Formation in Export-Producing and Residential Activities.

real estate; services; and government. A distinguishing characteristic of export-producing industry is its high capital investment, output per worker and growth in output per worker (which account, in part, for the typically high ratios of residential to basic employment).

Third, the relationships between industry gross output and industry employment are differentiated by stage of business cycle and industry development. Output per worker increases rapidly during the initial upswing of the business cycle and it increases, also, from one peak level to the next.

Fourth, the growth in gross state product in the various stages of the business cycle and long-term industry development is accompanied by shifts in money flows into and out of the state. For example, during a period of expanded construction and growth in gross state product, a negative balance of trade (exports minus imports) is accompanied by a positive balance of payments (exports, plus investments and profits, minus imports). During the declining stage of industry development, negative balances of trade and of payments accompany a declining gross state product.

Each of the MINTOM modules is now presented with emphasis on the specific industry policy target and control variables cited in the preceding section. Each module is described briefly, starting with the first-order modules.

The population module is based on an age-cohort survival model. It represents the regional demographic characteristics. It also provides for in-migration and out-migration by age and sex classes and for in-migration employee dependent ratios. While population levels are derived as a final step each year, they are shown as first-order, rather than lagged, variables. Thus, the population module yields forecasts for use in the labor force module as well as summary statistics for evaluating the computational results

of the preceding year program. State investment strategies may be motivated, in part, by a desire to affect the rates of population out-migration. Such efforts may be directed towards particular age groups in the total population, which would be monitored in an assessment of the success of these efforts. Also, the population module lends itself to the development of an allocation-type input-output model in which the output, rather than input, coefficients are fixed. Such a model would be used in the study of period-to-period demographic flows from one population group to another.

The market module capsules the market intelligence of each industry into two variables and two parameters, namely, the U.S. gross output, the annual rate of growth in U.S. gross output, the state's industry market share, and the annual rate of change in the market share. Thus, each industry is linked to the rest of the world through its exports, if any. Changes in output-increasing investment result in corresponding changes in exports and usually in the export-market share for the state's industry. Similarly, changes in the costs of doing business in the state are translated into corresponding changes in export-market shares.

The investment module differentiates between output-increasing and pollution-abatement investment in plant and equipment. It also differentiates between replacement and expansion investment. Capital consumption allowances are derived from depreciation rates and capital stock levels, which are maintained through replacement investment. The latter is limited by the capital consumption allowance, which is a component of industry value added. Expansion investment is limited by business profits before taxes (i.e., value added, less earnings, indirect taxes and depreciation).

The demand module yields forecasts of the export and investment demands, which were derived by the two first-order modules, and the final purchases

of the household and government sectors. The demand module thus "drives" the regional model. Personal consumption expenditures are derived from expenditure elasticity coefficients and forecast levels of total disposable income and total population while federal, state and local government expenditures are linked to population.

The production module makes use of the annual input-output multipliers (derived by the Minnesota two-region input-output model program) in the forecasting of annual industry-specific gross output levels. Industry gross outputs meet the forecast demand levels, subject to the constraints imposed by industry capacity levels, including both capital stock and occupation-specific labor supply.

The labor force module yields forecasts of the supply of labor based on forecast age- and sex-specific labor force participation rates and forecast population levels. The labor supply pool is then distributed among nine occupation classes. This supply is affected by occupation-specific, in-commuting and out-commuting members of the labor force.

The value added module provides for the remuneration of the primary inputs of the production system, namely, labor and capital, in the form of earnings, depreciation, indirect taxes, and business profits before taxes. This module includes also the import rate which is derived from the Minnesota two-region input-output model program.

The employment module represents the occupation-specific industry work force. It contains the parameters for changing the output per worker, the earnings per worker, and the occupational composition of the industry work force. This module capsules, for example, the employment and earnings effects of investment in education.

The household module contains the household-related parameters of total, and, also, employed and unemployed, persons per household. It also provides

for the distribution of total earnings and property income among income classes and the distribution of households among housing units.

The government module represents the public sector activities and the flows of public income and expenditures. It relates each federal, state and local tax to its appropriate source and it provides for the disbursement of all government expenditures. It includes the data base for deriving the annual tax receipts of state and local governments from each industry and sector.

The financial module represents, finally, the financial transactions of the private and public sectors in the state's economy. These transactions determine the distribution of business profits to household, government and business sectors and the availability of financing for private and public investment.

The MINTOM program operates recursively, largely on its own endogeneously-determined data once the computer run begins or the program is perturbed with a policy control variable. During the run, the principal exogenous inputs are the rate of growth of U.S. gross output in each of the basic industries, the rate of change in male and female labor force participation rates, the rate of change in earnings per worker, the output per worker in each industry, and the rate of change in the fertility rates for females of childbearing age.

Once variables and parameters are estimated, the model is fitted to most recent regional population, employment, and earnings series. Fitting is accomplished by adjustment of model variables and parameters from their previously estimated values.

Two tests of validity are applied to candidate models. Both depend on judgement exercised by the model builder. One test involves comparing fitted

model variables and parameters with their previously estimated values. If the candidate model is accepted, the model builder must be prepared to conclude that his original estimates are in error or at least that the fitted model values are within certain acceptable confidence limits. A second test involves examination of model forecasts. Because of the recursive nature of the model, the regional population forecasts are calculated last as a function of forecast employment and other demographic variables. A series of plausible population forecasts suggests that forecasts of other socio-economic indicators are also plausible. Experience has shown that the population forecasts are extremely sensitive to changes in labor force participation rates, output per worker, and length of work week.

Evaluating Forecast Methods

The five econometric models reviewed here barely cover the wide range of such econometric models now in use or under development. The five models were selected simply to illustrate the range of options in forecast methods for state fiscal and economic growth planning.

Of the five models, the Iowa revenue forecasting model is the least complex and, yet, the most reliable performer with reference to forecast accuracy. Its purpose is prediction, which it achieves extremely well. The remaining four models vary in purpose from prediction to prescription, description, and exploration, and combinations of these purposes. An essential first step in model evaluation is to square model performance with its purpose.^{2/}

^{2/} Prediction, as used here, refers to the preparation of point estimates, oftentimes with statistical measures of variance and reliability. Prescription is concerned with the use of the model in exploring alternative conditions, some of which may be sought by the model user or the public. Description involves use of the model in impact analysis, scenario preparation and computer simulation of alternative futures. Use of economic models in exploration and education is probably achieved best in gaming simulation exercises in which the model user interacts directly with the computerized program while playing a particular role as a decision maker and a user of economic information.

Model evaluation becomes difficult as model purpose shifts from prediction to prescription and even more difficult with multiple purposes, like prediction and, also, exploration of alternative future scenarios and their regional implications. Thus, the evaluation of model properties -- scope, time horizon, level of detail, and problem perspective -- is affected by the model purpose, which in state fiscal and economic growth planning, is more often exploratory and educational rather than simply predictive or even prescriptive.

The MINTOM system evolved initially in a research environment in the mid-1960's. It was adapted for teaching purposes at the University of Minnesota. It provided a computer simulation laboratory in regional economic and regional development planning. It was expanded, subsequently, into a multi-purpose research program with extended applications in energy and natural resources planning and, more recently, in manpower and investment planning. With each phase of model expansion, expressed need for easier access was heeded. Currently, a new user interactive program is being prepared which, again, will allow students and others to access the MINTOM data base and related computer simulation capabilities. Of the five models, therefore, the MINTOM system has the capacity to address each of the four purposes, but, particularly, combinations of the four purposes, such as prediction and education.

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