Economic Forecasting for Statewide Highway Studies*

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● THIS PAPER is directed specifically toward improving methods and procedures involved in the conduct of highway needs studies. It is limited to those problems which are common to state engineering needs studies, and finance and taxation studies.

The plan of investigation was to isolate one of the important problems, to formulate concepts for solving the problem, and to identify the techniques, methods and sources of data, but to stop short of developing the mechanics for acquiring and applying the data.

THE PROBLEM

Engineers and economists recognize as one of the important areas for improvement of state highway needs and taxation studies the forecasting of motor vehicles and vehicle-miles of travel. Such forecasting is basic both to the engineer's estimate of highway needs and to the economist's estimate of future revenue to meet such needs.

The present forecasting procedure in use is to project for the state under study the following: population, number of motor vehicles per person, and motor fuel consumption per vehicle.

Each projection is then tested against national population forecasts and the economic prospects of the state, and adjusted as required. This procedure results in forecasts of the number of vehicles which will be registered, of the motor fuel which will be consumed, and of the travel which will develop in that state.

After several years of experience with this method of forecasting, engineers and economists have found that the results are consistently too low. The present method could be improved by injecting factors to reflect more of the economic forces at play, or that improved methods of forecasting based on such economic factors could be devised.

PROGRESS IN ECONOMIC FORECASTING

One development that points to the desirability and feasibility of economic forecasting for highway purposes is the emergence of economic analyses and forecasts at high government levels and throughout big business.

The federal government has set as the economic goal of the nation the encouragement of economic growth and stability in terms of maximized employment, production, and purchasing power. Under the Employment Act of 1946 establishing this economic goal as a national policy, specific national objectives and procedures were outlined and the Council of Economic Advisors to the President and the Congressional Joint Committee on the Economic Report were established as implementing agencies. The Joint Committee in 1954 published a bulletin which included a 20-year forecast of gross national product, or GNP as it is frequently called (1). The GNP forecast was $530 billion for 1965 and $634 billion for 1975. The 1955 GNP was $391 billion, or 4½ percent more than the Committee forecast.

The Department of Agriculture has published projections of the demand for agricultural products in which a GNP range of from $705 to $740 billion for 1975 (in 1953 dollars) is used (2). In 1956 dollars, the GNP range would be in the neighborhood of $720 to $760 billion. The New York Port Authority is using an estimated GNP of $700 billion for 1975 for its planning purposes.

Most, if not all, of the larger corporations of the country now prepare short- and long-range forecasts of the economy as a whole and of the place their corporations oc-

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cupy in that economy. Many business firms now find it profitable to gear their capital and sales programs to long-range forecasts.

With the federal government paving the way in the field of economic forecasting, the states and other governmental units may find it advantageous to follow suit. It should prove especially valuable to those who are involved in state highway planning.

ECONOMIC FORECASTING FOR HIGHWAYS

The first step in the development of procedures for economic forecasting in the highway field was to review the considerable work that had been done by federal and other agencies in determining the relation between automotive transport and the accepted economic measures or indices.

The Bureau of Public Roads has explored the relation of motor vehicle travel to GNP and the national income. E. H. Holmes in 1950 observed that "traffic is a part of our economy and grows with it." (3) This statement was based on his finding that from 1932 for nearly 20 years, exclusive of the years of wartime restrictions, the increase in vehicle-miles of travel had paralleled the increase in national income and GNP. The growth was "at a rate of over 4 percent per year, compounded." He concluded, "I venture to express my confidence in the future of the country to the extent of anticipating a traffic increase of 4 percent per year for a reasonable planning period of 15 to 20 years." This forecast has had a beneficial effect on national highway planning.

The President's advisory committee on a National Highway Program in its 1955 report (4), charted the trends in motor vehicle travel and GNP from 1931 to 1953 and showed that the two lines moved along together for all except the years with wartime restrictions. This travel trend was projected to 1965 and its relation to several economic forecasts noted.

An analysis of the relation of inter-city freight movements to GNP was made by Wilfred Owen of the Brookings Institution. He found that over the years from 3 to 3.6 ton-miles of inter-city freight have been transported for each dollar of GNP. In recent years increasing amounts of such freight have moved by highway.

Other agencies have made studies of the relation of automobiles to personal income. The Federal Reserve Board, as a result of its 1954 survey of consumer finances, concluded that "automobile ownership is clearly related to income." (5) Only 25 percent of the low-income ($1,000) families owned automobiles, whereas over 92 percent of the high-income ($7,500) families owned automobiles. The number of families owning two or more cars is also related to income.

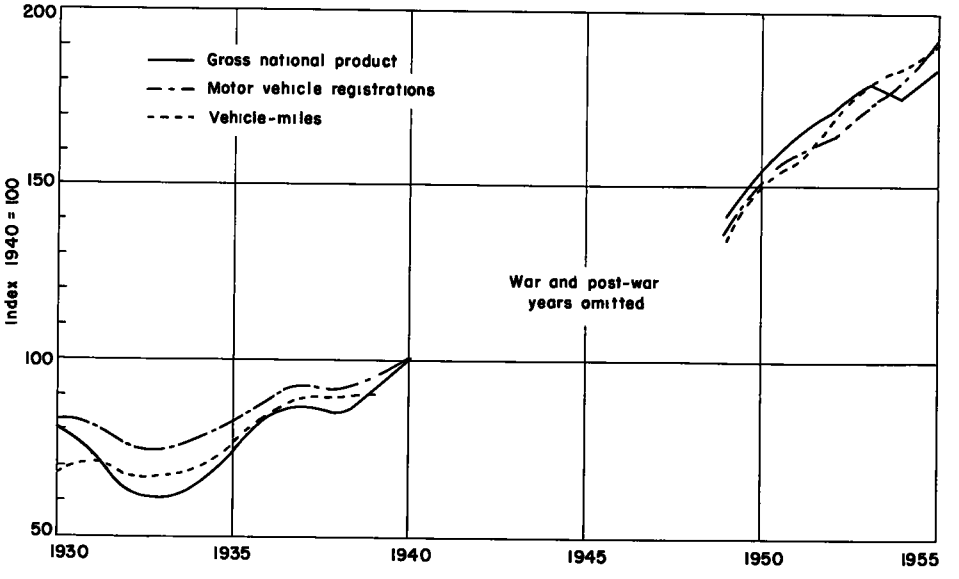

Figure 1. Relationship of motor vehicles and travel to gross national product.

TABLE 1

RELATION OF MOTOR VEHICLES REGISTERED AND TRAVEL TO GROSS NATIONAL PRODUCT, 1930-1955
(For indices, 1940 = 100)

Year	Gross National Product[a] (10)	Index	Motor Vehicles (11)	Index	Vehicle Miles (11)	Index
	(billion)		(million)		(billion)	
1930	$165	80	27	83	206	68
1931	153	74	26	81	216	72
1932	129	63	24	75	201	66
1933	127	61	24	75	201	66
1934	140	62	25	78	216	71
1935	154	74	26	82	229	76
1936	174	84	28	88	252	83
1937	185	87	30	93	270	89
1938	177	85	29	92	271	90
1939	190	92	31	96	285	91
1940	208	100	32	100	302	100
	(War and post-war years omitted)					
1949	295	142	45	140	424	140
1950	322	155	49	154	458	151
1951	345	166	52	162	491	162
1952	357	172	53	167	514	170
1953	374	180	56	176	544	180
1954	365	176	59	183	561	185
1955	391 (12)	188	63	196	583	193

[a] 1955 prices.

TABLE 2

RELATION OF PERSONAL INCOME TO GROSS NATIONAL PRODUCT, 1930-1955

Year	Gross National Product (10)	Personal Income (10)	
		Amount	Percent of GNP
	(billion)	(billion)	
1930	$ 91	$ 77	85
1931	76	66	86
1932	58	50	85
1933	56	47	85
1934	65	54	83
1935	72	60	83
1936	83	69	82
1937	91	74	81
1938	85	68	80
1939	91	73	80
1940	100	79	79
	(War and post-war years omitted)		
1949	257	207	80
1950	284	227	80
1951	328	255	78
1952	345	271	79
1953	364	286	79
1954	360	288	80
1955	391 (12)	306 (12)	78

TABLE 3

PERSONAL INCOME AND MOTOR VEHICLES REGISTERED IN THE UNITED STATES, SELECTED YEARS

Year	Personal Income (10)	Consumer Price Index (10)	Personal Income[a]	Motor Vehicles (11)	Motor Vehicles per $10,000 of Personal Income
	(billion)		(billion—constant dollars)	(million)	
1929	$ 85 8	73.3	$117.0	26 5	2.27
1940	78.7	59.9	131 0	32.0	2.44
1950	227.0	102.8	221.0	49.2	2 22
1951	255.3	111.0	230.0	51 9	2 25
1952	271 1	113.5	239.0	53.3	2.23
1953	286 2	114 4	249.0	56.3	2 26
1954	287 6	114.8	251 0	58 6	2 33
1955	303.4	114.5	265.0	62 8	2 37

[a] In 1947-1949 prices.

TABLE 4

RELATION OF MOTOR VEHICLES REGISTERED AND TRAVEL TO DISPOSABLE PERSONAL INCOME, 1930-1955
(For indices, 1940 = 100)

Year	Disposable Personal Income[a] (10)	Index	Motor Vehicles (11)	Index	Vehicle Miles (11)	Index
	(billion)		(million)		(billion)	
1930	$119	82	26.5	83	206	68
1931	112	77	25.9	81	216	72
1932	95	66	24.1	75	201	67
1933	85	65	23.9	75	201	67
1934	104	72	25.0	78	216	72
1935	114	78	26.2	82	229	76
1936	128	87	28.2	88	252	84
1937	133	91	29 7	93	270	90
1938	125	86	29.4	92	271	90
1939	136	93	30 6	96	285	91
1940	146	100	32.0	100	302	100
	(War and post-war years omitted)					
1949	212	145	44.7	140	424	140
1950	230	158	49 2	154	458	152
1951	233	160	51 9	162	491	163
1952	239	164	53.3	167	514	170
1953	251	172	56.3	176	544	180
1954	254	175	58.6	183	561	185
1955	271 (12)	186	62.8	196	583	193

[a] 1955 prices.

A study by the Bureau of Labor Statistics shows that the percentage of family income expended for highway transport varies greatly for cities of different sizes in different parts of the country—6 percent in New York City, 10 percent in Chicago and 15 percent in Los Angeles (6).

The results of these studies not only encouraged the investigation of economic forecasting for state highway study purposes, but gave direction to certain phases of the investigation. Among other things, the national findings pointed up the need for adjustments to reflect state differences.

REVIEW OF NATIONAL RELATIONSHIPS

The next step was to review, up date and explore the national relationships of motor vehicles and travel to the national economic indices of GNP, personal income, and disposable personal income. The findings were briefly as follows:

1. Over the 25-year period from 1930 to 1955, except for the war-affected years,

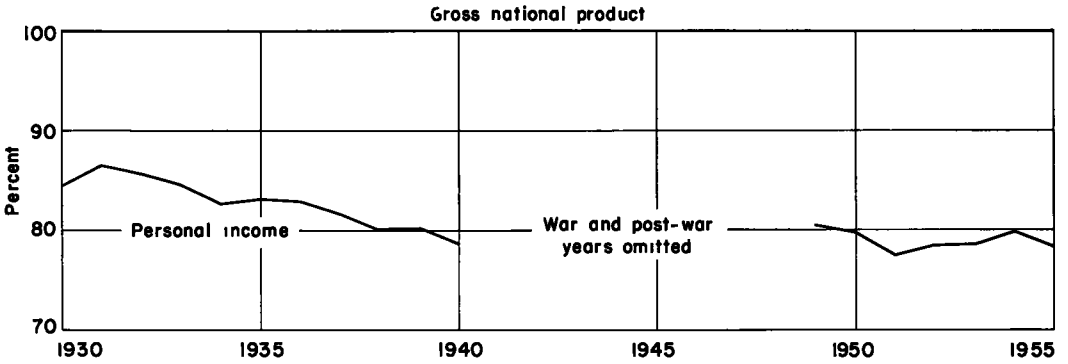

Figure 2. Personal income as a percentage of gross national product.

motor vehicle registrations and vehicle-miles of travel have generally moved along together, increasing 193 percent and 196 percent, respectively, between 1940 and 1955 (Table 1 and Figure 1). The conclusion from this finding was that subsequent explorations could be simplified by concentrating on one of the two and so the index was chosen.

2. Over the last five years of the 25-year period from 1930 to 1955, motor vehicles have been increasing at a higher rate than GNP, motor vehicles at 28.6 percent and GNP at 21.4 percent. This finding indicates that factors other than economic growth may be involved and need to be sought out. Among the possible factors are the following: the movement of substantial numbers of persons from low-income to medium-income groups with the result that many more can afford automobiles; the more rapid growth of suburban areas and their greater dependence on motor vehicle transportation as compared with central city areas; the more rapid growth of states with high dependence on motor vehicle transportation as compared with states with low dependence on such transportation; and the increase in trucking as the result of the diversion of freight from the railroads to trucks.

3. A comparison of the national economic indices of GNP and personal income from 1930 to 1955 shows that, except during the deep depression and war-affected years, they moved along together, personal income amounting to from 78 to 80 percent of GNP (Table 2 and Figure 2). This finding means that during normal years these two indices are interchangeable. Since GNP figures are not available for individual states, it was necessary to use personal income figures.

4. The relation of motor vehicles to personal income has remained remarkably constant over the years. The number of motor vehicles per $10,000 of personal income (1947-1949 prices) was 2.3 in 1929, 2.4 in 1940, 2.2 in 1950 and 2.4 in 1955 (Table 3).

5. Disposable personal income, that is, income available after taxes, logically should be superior to other economic indices for motor vehicle comparisons since it is the income a family can spend as it wishes. Actually over the 25-year period from 1930 to 1955, exclusive of the war years, it did not differ materially from GNP in rate of increase, but in the period from 1950 to 1955 it increased at a slower rate than GNP, 17.8 percent as compared with 21.4 percent (Table 4 and Figure 3).

6. The relation of motor vehicles to disposable personal income has been a consistent upward trend over the years.

TABLE 5

DISPOSABLE PERSONAL INCOME AND MOTOR VEHICLES REGISTERED IN THE UNITED STATES, SELECTED YEARS

Year	Disposable Personal Income (10)	Consumer Price Index (10)	Disposable Personal Income[a]	Motor Vehicles (11)	Motor Vehicles per $10,000 of Disposable Personal Income
	(billion)		(billion—constant dollars)	(million)	
1929	$ 83.1	73.3	$113	26.5	2.34
1940	76.1	59.9	127	32.0	2.52
1950	206.1	102.8	200	49.2	2.46
1951	226.1	111.0	203	51.9	2.55
1952	236.7	113.5	209	53.3	2.55
1953	250.4	114.4	218	56.3	2.58
1954	254.8	114.8	223	58.6	2.63
1955	269.2	114.5	235	62.8	2.67

[a] In 1947-1949 prices

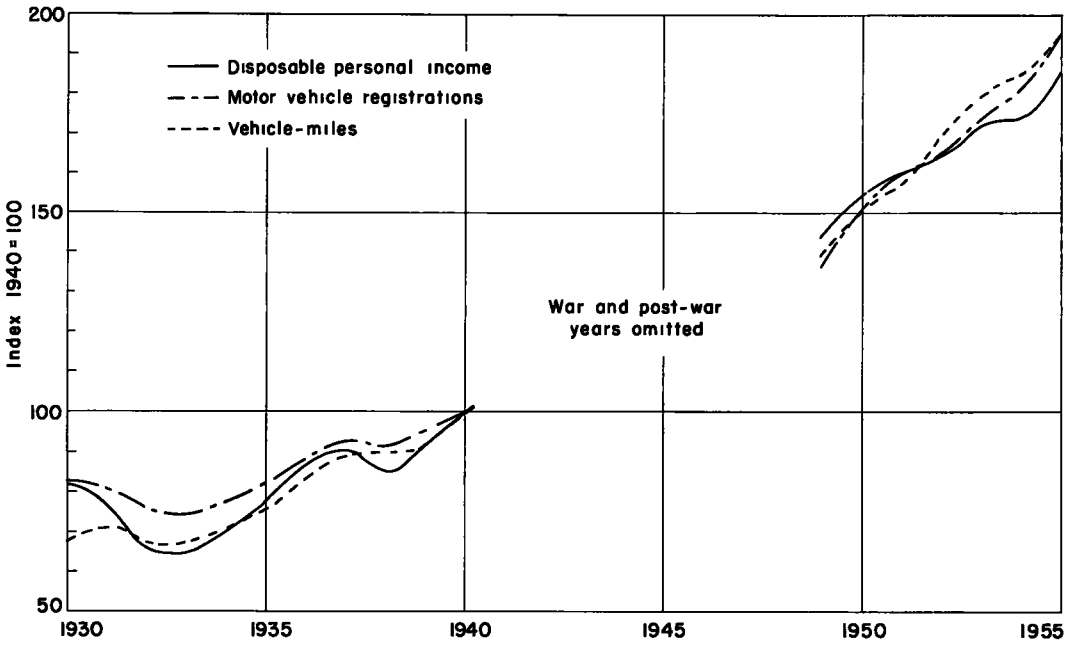

Figure 3. Relationship of motor vehicles and travel to disposable personal income.

The number of motor vehicles per $10,000 of disposable personal income (1947-1949 prices) increased from 2.3 in 1929 to 2.5 in 1940 and 1950 and to 2.7 in 1955 (Table 5). It was not possible to make further use of disposable personal income in this study since figures are not available for individual states.

PROPOSED PROCEDURES

Three procedures have been developed for injecting economic factors into forecasting for state highway study purposes, two of them projections and one a forecast. In each procedure the number of motor vehicles and the vehicle-miles of travel can be related to an economic measure and projected or forecast.

The first procedure is to take a state economic index such as personal income, determine the historical relationship between motor vehicle registrations and vehicle-miles and the index, project the index and then project motor vehicle registrations and vehicle-miles on the basis of that relationship.

A second procedure is to take a national economic forecast such as personal income or GNP, relate a state index such as personal income to it, and project the state index on the basis of its historical relation to the national index. Then the state motor vehicle registrations and vehicle-miles can be projected by relating them to the projected state index. This procedure is better than the first, but its basic weakness of continuing past relationships in a given state can cause major errors.

The third and most comprehensive procedure is to take the national economic forecasts of GNP and national personal income, study the prospects of the major sectors of a state's economy in relation to these forecasts, and prepare a state forecast.

ANALYSIS OF PROCEDURES

As a demonstration of the workability of the proposed procedures a determination and analysis was made of the historical relationships basic to each. Personal income was chosen as the economic index for each procedure for two reasons; (1) as previously stated, national personal income showed a consistent relationship to GNP and was therefore equally as good for out purposes, and (2) no GNP figures were available for individual states.

TABLE 6

RELATION OF MOTOR VEHICLES REGISTERED TO PERSONAL INCOME, BY STATE, 1955

State	Personal Income (12)	Motor Vehicles (11)	Motor Vehicles per $10,000 of Personal Income
	(million)	(thousand)	
Alabama	$ 3,674	1,041	2.8
Arizona	1,588	415	2.6
Arkansas	1,913	584	3.1
California	29,438	6,190	2.1
Colorado	2,729	737	2 7
Connecticut	5,497	926	1.7
Delaware	980	154	1.6
Florida	5,923	1,616	2 7
Georgia	4,882	1,239	2.5
Idaho	895	338	3.8
Illinois	20,988	3,269	1 6
Indiana	8,201	1,763	2 2
Iowa	4,213	1,195	2.8
Kansas	3,393	1,048	3 1
Kentucky	3,728	1,032	2.8
Louisiana	3,910	952	2.4
Maine	1,443	323	2.2
Maryland	5,463	938	1.7
Massachusetts	10,010	1,546	1.5
Michigan	15,632	3,114	2.0
Minnesota	5,394	1,365	2.5
Mississippi	2,018	637	3.1
Missouri	7,560	1,490	2.0
Montana	1,160	336	2.9
Nebraska	2,147	662	3.1
Nevada	572	124	2.2
New Hampshire	958	217	2.3
New Jersey	12,304	2,071	1.7
New Mexico	1,134	340	3.0
New York	36,255	4,655	1.3
North Carolina	5,371	1,437	2.7
North Dakota	882	309	3.5
Ohio	18,442	3,526	1 9
Oklahoma	3,328	1,026	3.1
Oregon	3,090	802	2 6
Pennsylvania	20,724	3,737	1.8
Rhode Island	1,599	310	1.9
South Carolina	2,557	782	3.1
South Dakota	850	325	3.8
Tennessee	4,288	1,168	2.7
Texas	14,116	3,869	2.7
Utah	1,238	336	2.7
Vermont	568	136	2.4
Virginia	5,494	1,243	2.3
Washington	5,179	1,164	2.3
West Virginia	2,555	552	2.2
Wisconsin	6,569	1,386	2.1
Wyoming	547	174	3.2
District of Columbia	1,992	197	1 0
Total	$303,391	62,794	2.1

For four selected states for selected years between 1929 and 1955, analysis was made of the historical trend in personal income and motor vehicle registrations and the relation of motor vehicles to personal income. The four states were selected as representative of an average, a high, a low and a special state in terms of motor vehicles per $10,000 of total personal income. The national average of motor vehicles per $10,000 of total personal income (1955 prices) was 2. 1 and the range was from a low of 1. 3 to a high of 3. 8 (Table 6). California, with 2. 1 vehicles, was selected as an average state; Illinois with 1. 6 vehicles, as a low state; Mississippi with 3. 1 vehicles, as a high state; and West Virginia with 2. 2 vehicles, as a special state because it was experiencing a severe economic crisis as a result of technological unemployment in the coal mines.

First Procedure

The historical relationships analyzed for the first procedure included the index and percentage rate of growth of personal income and the ratio of motor vehicles to personal income. In each of the four states these relationships fell into different but consistent patterns.

Personal income for the period from 1929 to 1955 increased at the fastest rate in California, 243 percent, and at the lowest rate in Illinois, 85 percent, (Tables 7 and 8). Between 1950 and 1955 there was a greater disparity in rate of increase —California leading with 35 percent and West Virginia trailing with 4 percent.

The number of motor vehicles per $10,000 of personal income (1947-1949 prices) in these states from 1929 to 1955 remained reasonably constant. In California there were 2. 6 vehicles in 1929, 2. 8 in 1940 and 2. 4 in 1950 and 1955 (Tables 7 and 9). In Illinois in these years there were, respectively, 1. 6, 1. 9, 1. 7 and 1. 8 vehicles, and in Mississippi, 3. 2, 3. 3, 3. 1 and 3. 6 vehicles.

Under the first procedure a state would project its personal income based on the historical trend and then project the number of vehicles based on the historical trend of the ratio of motor vehicles to personal income.

Second Procedure

The historical relationships analyzed for the second procedure included for the selected states their percentage shares of the national personal income for the selected years. Here again the percentage ratio for each state from 1929 to 1955 assumed a consistent pattern. The California percentage increased from 6. 4 to 9. 7 and the Illinois ratio decreased from 8. 5 to 6. 9 (Table 10). Mississippi's percentage fluctuated from 0. 6 to 0. 7 throughout the period. West Virginia's percentage was 0. 9 in 1929,

TABLE 7

TREND OF PERSONAL INCOME, MOTOR VEHICLES REGISTERED AND RELATION OF MOTOR VEHICLES TO INCOME, IN SELECTED STATES, SELECTED YEARS
(Indices, 1940 = 100)

Year	Personal Income (12)	Consumer Price Index (10)	Adjusted Personal Income [a]		Motor Vehicles		Motor Vehicles per $10,000 of Personal Income
			Amount	Index	Number (11)	Index	
	(million)		(million)		(thousand)		
				California			
1929	$ 5,502	73.3	$ 7,500	76	1,974	71	2.64
1940	5,839	59.9	9,840	100	2,774	100	2.82
1950	19,627	102.8	19,100	194	4,620	166	2.42
1951	22,726	111.0	20,500	209	4,927	177	2.40
1952	25,089	113.5	22,100	225	5,154	186	2.33
1953	26,642	114.4	23,300	237	5,504	198	2.36
1954	27,148	114.8	23,700	241	5,699	206	2.40
1955	29,438	114.5	25,700	262	6,189	223	2.41
				Illinois			
1929	7,280	73.3	9,920	100	1,615	84	1.63
1940	5,964	59.9	9,930	100	1,926	100	1.94
1950	15,984	102.8	15,600	157	2,651	138	1.70
1951	17,777	111.0	16,000	161	2,790	144	1.74
1952	18,579	113.5	16,400	165	2,848	148	1.74
1953	19,669	114.4	17,200	173	2,959	153	1.72
1954	19,786	114.8	17,300	175	3,088	160	1.77
1955	20,988	114.5	18,350	185	3,268	170	1.78
				Mississippi			
1929	570	73.3	780	99	250	97	3.21
1940	474	59.9	790	100	259	100	3.28
1950	1,590	102.8	1,550	196	484	187	3.12
1951	1,740	111.0	1,570	199	510	197	3.25
1952	1,862	113.5	1,640	207	524	202	3.20
1953	1,889	114.4	1,650	209	556	214	3.37
1954	1,811	114.8	1,580	200	585	226	3.70
1955	2,018	114.5	1,760	223	637	246	3.62
				West Virginia			
1929	794	73.3	1,080	83	269	89	2.49
1940	777	59.9	1,295	100	303	100	2.34
1950	2,203	102.8	2,140	165	482	159	2.25
1951	2,439	111.0	2,200	170	490	162	2.22
1952	2,540	113.5	2,240	173	497	164	2.22
1953	2,547	114.4	2,230	172	517	170	2.31
1954	2,419	114.8	2,110	163	513	169	2.43
1955	2,555	114.5	2,230	172	552	182	2.48

[a] In 1947-1949 prices.

TABLE 8

RATES OF GROWTH, SELECTED STATES

Period of Years	Personal Income. Percentage Increase	Motor Vehicles Percentage Increase
	California	
1929-1955	243	216
1940-1955	162	123
1950-1955	35	34
	Illinois	
1929-1955	85	102
1940-1955	85	70
1950-1955	18	23
	Mississippi	
1929-1955	125	155
1940-1955	123	146
1950-1955	14	32
	West Virginia	
1929-1955	107	105
1940-1955	72	82
1950-1955	4	15

TABLE 9

NUMBER OF MOTOR VEHICLES REGISTERED PER $10,000 OF PERSONAL INCOME IN U S & SELECTED STATES[a]

Year	United States	California	Illinois	Mississippi	West Virginia
1929	2 3	2 6	1 6	3 2	2 5
1940	2.4	2 8	1 9	3 3	2 3
1950	2 2	2 4	1 7	3 1	2 3
1955	2 4	2 4	1 8	3 6	2 5

[a] 1947-1949 dollars

TABLE 10

TREND IN STATE PERCENTAGES OF NATIONAL PERSONAL INCOME AND MOTOR VEHICLES REGISTERED, SELECTED STATES, SELECTED YEARS

Year	Percentage of National Personal Income (12)	Percentage of Total Motor Vehicles (11)	Ratio of Motor Vehicles to Personal Income
		California	
1929	6.4	7.5	1.17
1940	7.4	8.7	1.17
1950	8.7	9.4	1.08
1951	9.0	9.5	1.06
1952	9.3	9.7	1.04
1953	9.4	9.8	1.04
1954	9.5	9.7	1.02
1955	9.7	9.9	1 02
		Illinois	
1929	8.5	6.1	0 72
1940	7.6	6.0	0.79
1950	7.1	5.3	0 75
1951	7 0	5.3	0.76
1952	6.9	5.3	0.77
1953	7.0	5.3	0.76
1954	7.0	5.3	0.76
1955	6.9	5.2	0 75
		Mississippi	
1929	0.67	0.94	1.40
1940	0.60	0.81	1 35
1950	0.71	0.98	1.38
1951	0.69	0.98	1.42
1952	0.69	0.98	1.42
1953	0.67	0 99	1 47
1954	0.64	1.00	1.56
1955	0.67	1.01	1.51
		West Virginia	
1929	0.93	1.01	1.09
1940	0.99	0.94	0.95
1950	0.98	0 98	1.00
1951	0.97	0.95	0.98
1952	0.94	0.93	0 99
1053	0 90	0.92	1 02
1954	0.86	0.88	1.02
1955	0 84	0.88	1 05

1.0 in 1940 and 1950, and 0.8 in 1955.

Under the second procedure a state would project its percentage of the national personal income based on the historical trend of that percentage, and then project the number of motor vehicles based on the historical trend of the ratio of motor vehicles to personal income.

A variation of the second procedure would be to substitute for the motor vehicle registrations in a state, the state's percentage share of the national total of motor vehicles computed in the same manner as the percentage share of national personal income. The next step would be to compute the historical ratio of the state's percentage share of total motor vehicles to the state's percentage share of the national personal income.

For California this ratio dropped from 1.17 to 1.02 between 1929 and 1955, indicating that its percentage of motor vehicles is not growing as rapidly as its percentage of income (Table 10). The Illinois ratio fluctuated around a constant of 0.75, indicating its percentage of motor vehicles is paralleling its percentage of personal income. The Mississippi ratio increased from 1.4 in 1929 to 1.5 in 1955. In West Virginia in recent years the percentage of personal income has been decreasing rapidly and the percentage of motor vehicles only a little less rapidly, indicating the expected deviations from the national averages. In 1950 West Virginia had 0.98 percent of both personal income and motor vehicles, but by 1955 only 0.84 percent of personal income and 0.88 percent of motor vehicles.

To make a projection in accordance with this variation of the second procedure, a state would first project its percentage of the national personal income and then project its percentage of the motor vehicles based on the historical trend of the ratio of its share of motor vehicles to its share of personal income.

Third Procedure

The third procedure differs from the first two in that it calls for a forecasting ·

rather than a projecting of a state economic index. To prepare a forecast of personal income, a state would analyze and forecast each of the important segments of the state's economy, taking into account the technological developments and other economic forces which are enhancing or depressing the economic outlook of each segment and of the state as a whole.

For example, growth of petro-chemicals has changed the economic prospects for Texas as well as the Northwest very sharply. The relative exhaustion of new, cheap hydro-electric power sources, in combination with new developments in high-temperature, high-pressure fuel generation of power, is reviving the economic prospects of the coal-bearing areas of the East. Developments in synthetic textiles and chemicals are altering the economic prospects for much of the South and New Jersey.

Forecasting techniques incorporating such economic factors have been developed over the past 20 years, according to Robinson Newcomb, consulting economist. While by no means perfect, such techniques do produce a much more useful estimate of the future than do the simpler projecting devices.

The need for a forecast rather than a projection shows up in the personal income trend in West Virginia. In 1950 that state had 0.98 percent of the national personal income but by 1955 it had only 0.84 percent. A projection of this 5 year downward trend would imply a continuation of the conditions which caused it. This decline in personal income was brought about in large part by the introduction of mechanical loading in the mines and the displacement of about half the miners. Now virtually all the mines are mechanized so personal income should be on the rise again.

CONCLUSIONS

The conclusions drawn as a result of the exploratory application of the proposed procedures are that economic forecasting has great possibilities and that personal income, the economic index tested, promises to be fully as useful as anticipated. The fact that in the U.S. and in each of the four states analyzed there has been a consistent relation between motor vehicles and personal income over the past 26 years indicates that future trends in motor vehicles can be expected to move with the projected or forecasted trends in personal income.

The use of personal income as a basis for highway forecasting in the states will be facilitated by the publication probably about March 1, 1957, of "Personal Income by States Since 1929, a Supplement to the Survey of Current Business," prepared by the Office of Business Economics of the U.S. Department of Commerce. This is a publication resulting from a re-working of state personal income data to bring them into agreement with national personal income data.

By using the proposed procedures for analyzing and forecasting highway economics can be brought into step with macroeconomics, the newly developed approach to the economics of national growth which is from the aggregate rather than from the component parts.

The results of economic forecasting for highway purposes will prove far more beneficial to highway planning and development than anyone can foresee at this time. It will provide highway planners with a better understanding of the broader economic implications of their highway problems and plans and, at the same time, give important national economic agencies a better understanding of highways by bringing them within their own frame of reference.

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