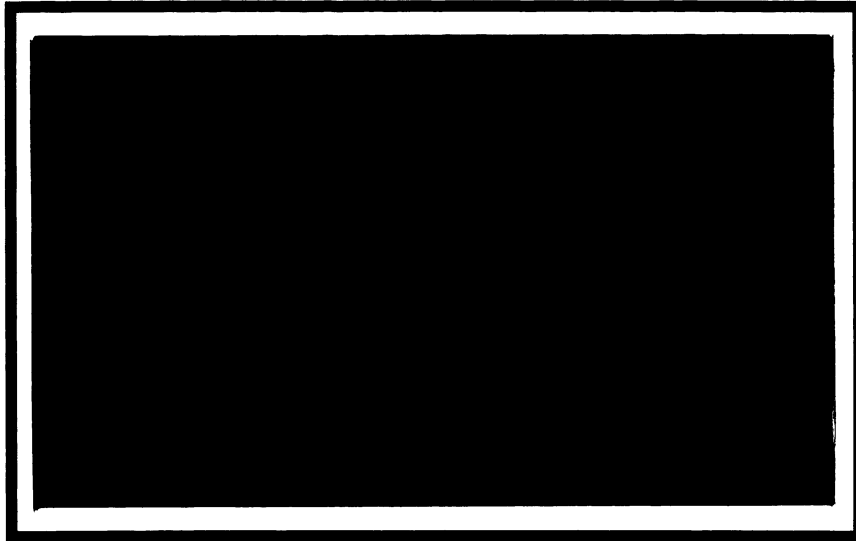


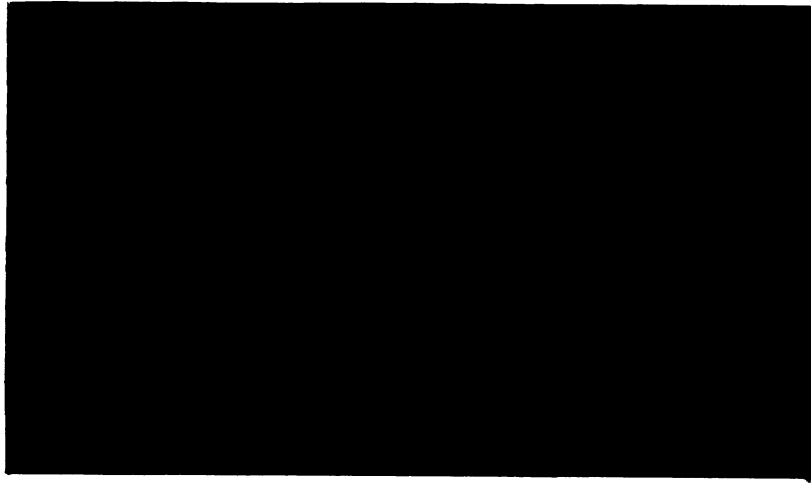
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**Center for Research on Economic and Social Theory
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Discussion Paper



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THE DYNAMICS OF THE MICHIGAN QUARTERLY
ECONOMETRIC MODEL OF THE U.S. ECONOMY

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I. INTRODUCTION

The Michigan Quarterly Econometric Model (MQEM) of the U.S. economy is the principal model of the Research Seminar in Quantitative Economics (RSQE) of the University of Michigan. MQEM is a medium size non-linear model designed primarily for short-term forecasting and policy analysis. There are 62 stochastic equations and 50 equations representing identities and constructions. The short-term nature of the model results from the basic structural characteristic that output is primarily expenditure-determined. The supply constraints in the model operate on productivity and prices, and through the effects of inflation, relative prices, the real money stock and interest rates back on real expenditures. The model focuses on the determination of the principal variables in the National Income and Product Accounts, major monetary aggregates and interest rates, prices, and employment and productivity. The most important exogenous variables are nominal government expenditures (other than unemployment benefits and interest payments which are endogenous), exports and foreign prices, crude materials and agricultural prices, and the monetary base.

Most equations in the current version of MQEM have been estimated by (Generalized) Least Squares over the period 1954.1-1979.4 and the equations, along with variable mnemonics are reproduced in the Appendix.

Section II of this paper explains the block structure of the model and discusses the dynamic properties of individual equations. Policy multipliers are discussed in Section III, and a brief conclusion is contained in Section IV.

II. BLOCK STRUCTURE AND EQUATION DYNAMICS

The Michigan model can be considered to be composed of six main blocks of equations: Wages and Prices, Productivity and Employment, Expenditures, Income Flows, Monetary Sector, and Output Composition. Though the model is an integrated and interdependent system, this classification is convenient for understanding and analyzing the system of equations. Table 1 outlines the model in this six block form, noting the important characteristics of the major endogenous variables. The following discussion of MQEM then describes each of these blocks in more detail.

A. WAGES AND PRICES

This block of 15 equations contains the two behavioral relationships which explain the basic wage rate and price level in the model, specifically, compensation per hour and the implicit output deflator, both for the private nonfarm sector. These two variables then serve as the principal variables in explaining the 12 implicit deflators which relate to various components of GNP as reflected in the National Income and Product Accounts.

Compensation per Hour The wage equation in the model, which explains the rate of change of the money wage, is an expanded version of the Phillips-Lipsey mechanism. Wage changes respond to the employment of capital, both human and physical, through the inclusion of a weighted average of the employment rate (human capital) and capacity utilization (physical capital) with weights $2/3$ and $1/3$, respectively. Wage changes also respond to the recent (short-term) rate of price inflation in the consumption sector, a long term inflation rate, and the change in the minimum wage rate. The elasticity of wage changes with respect to price changes is about .4 in the short run, and increases to about .85 in the

Table 1

The MQEM Model; Main Blocks and Principal Endogenous Variables

<u>Block & Endogenous Variables</u>	<u>Units of Measurement^{1/}</u>	<u>Behavioral (B), Definitional (D), or Hybrid (B-D)^{2/}</u>	<u>Simultaneous (S) or Recursive (R) in Model</u>	<u>Dependent Variable in Level (L), Natural log (ln) &/or Change (Δ) Form</u>	<u>Contains Lagged Dependent Variable</u>	<u>Estimated with Correction for First Order Autocorre- lation^{3/}</u>
A. Wages and Prices						
Compensation per hour	1977=100	B	R	$\Delta \ln$	Yes	No
Private nonfarm GNP deflator	1972=100	B	R	$\Delta \ln$	Yes	No
12 GNP component deflators	1972=100	B	R	$\Delta \ln$	8 of 12	No
B. Productivity & Employment						
Output per hour	1977=100	B	S	$\Delta \ln$	No	No
Employment rate, males 20 and over	%	B~D	S	$\Delta \ln$	No	No
Aggregate Unemployment Rate	%	B	S	L	No	Yes
C. Expenditures						
Consumption						
Auto Sales	mill. of units	B	R	L	Yes	No
Autos, New	'72 \$'s	B~D	R	ΔL	No	Yes
Autos, Net Used & Parts	'72 \$'s	B	R	L	Yes	No
Furn. & Household Equip.	'72 \$'s	B	S	L	Yes	No
Other Durables	'72 \$'s	B	S	L	Yes	No
Nondurables	'72 \$'s	B	S	L	Yes	No
Services	'72 \$'s	B	S	ΔL	No	No
Investment						
Business Fixed						
Structures	'72 \$'s	B	R	L	Yes	No
Equipment						
Agriculture	'72 \$'s	B	R	L	Yes	No
Production	'72 \$'s	B	R	L	Yes	No
Other	'72 \$'s	B	R	L	Yes	No
Residential Construction	'72 \$'s	B	R	L	Yes	No
Housing Starts	thous. of units	B~D	R	ΔL	Yes	No
Inventory	'72 \$'s	B	S	L	Yes	No
Imports	'72 \$'s	B	S	\ln	Yes	No

Table 1, Cont..

<u>Block & Endogenous Variables</u>	<u>Units of Measurement^{1/}</u>	<u>Behavioral (B), Definitional (D), or Hybrid (B-D)^{2/}</u>	<u>Simultaneous (S) or Recursive (R) in Model</u>	<u>Dependent Variable in Level (L), Natural log Change (Δ) Form</u>	<u>Contains Lagged Dependent Variable</u>	<u>Estimated with Correction for First Order Autocorre- lation^{3/}</u>
D. Income Flows						
Private Wages & Salaries	\$'s	D	S	$\Delta \ln$	No	No
Profits	\$'s	B-D	S	ΔL	No	No
Dividends	\$'s	B	S	L	Yes	No
Other labor income	\$'s	B	S	$\Delta \ln$	Yes	No
Nonfarm Proprietor Income	\$'s	B	S	$\Delta \ln$	No	No
Farm Proprietor Income	\$'s	B	S	$\Delta \ln$	No	No
Gov't Unemployment Benefits	\$'s	B	S	$\Delta \ln$	No	No
E. Monetary Sector^{4/}						
M1BPLUS	\$'s	B	S	L	Yes	No
M2PLUS	\$'s	B	S	$\Delta \ln$	Yes	No
90 Day Treasury Bill Rate	%	B	S	\ln	Yes	Yes
Budget Identity	\$'s	D	S	Δ	No	No
4 Term Structure Equations	%	B	S	L	Yes	No
F. Output Composition						
Services Component of Real GNP	'72 \$'s	B	S	ΔL	Yes	No
Manufacturing Index of Industrial Production	1967=100	B	R	L	Yes	No
Index of Available Capacity in Manufacturing	1967=100	B-D	R	ΔL	Yes	No

^{1/}Where the dependent variable is an index, the base year is given (e.g., 1977=100).

^{2/}An estimated equation is considered "Definitional" if its form is motivated by a definition but at least one of the variables required by the definition is not contained in the model and must be represented by available proxy variables. A "Hybrid" equation is a "Definitional" equation in which an assumed behavioral relation has been substituted for one or more of the variables required by the definition.

^{3/}Refers to whether or not the equation, with dependent variable in the form specified, has been corrected for first-order autocorrelation.

^{4/}M2PLUS is defined as M2 plus short term treasury securities. M1BPLUS equals M1B plus total savings at all depository institutions.

long run (see equation A1 in the Appendix).

Output Deflator, Private Nonfarm GNP The rate of inflation in the private nonfarm sector of the economy is determined primarily by the rate of increase of standard unit labor cost. The latter is measured by the rate of increase of hourly compensation (averaged over four quarters) less the trend rate of growth of productivity (which adjusts actual average productivity for short-term variations in GNP growth and capacity utilization). In addition, the rate of inflation depends on the level of capacity utilization and price "shocks" deriving from the behavior of farm prices and crude materials prices, including oil (see equation A2 in the Appendix).

B. PRODUCTIVITY AND EMPLOYMENT

Output Per hour, Private Nonfarm Sector In the Michigan Model productivity growth derives from capital accumulation in the long run and is responsive to capacity utilization and changes in output in the short run. The equation is of the form

$$(1) \quad \Delta \ln OMH77 = \alpha_0 \Delta \ln GNP72 + \alpha_1 \ln \left(\frac{JIPM}{JCAP} \right) + \sum_{i=1}^6 \beta_i \ln (IBF72 - IPDAG72)_{-i}$$

where

OMH77 = output per hour, private nonfarm sector.

GNP72^{1/} = real gross national product.

IBF72 = real business fixed investment.

IPDAG72 = real fixed investment, producers' durable equipment in agriculture.

JIPM = manufacturing index of industrial production.

JCAP = index of available capacity in manufacturing.

The lag structure on investment represents the time-delayed effect of capital

^{1/}A suffix "72" always indicates an expenditure variable measured in 1972 dollars. Expenditure variables, without the suffix are understood to be measured in current dollars.

accumulation on productivity. With $\sum \beta_j$ estimated to be + .01447 (see equation B1 in the Appendix), a permanent ten percent increase in the level of real non-farm investment eventually raises the annual rate of growth of private nonfarm productivity by about one-half of one percentage point (assuming no change in capacity utilization or GNP growth).

Employment Rates The principal employment variable in the model is the employment rate for males 20 years of age and over. The reasons for using this rate are, i) there is relatively little cyclical variability in the corresponding labor force group, thus permitting us to by-pass any labor force forecast in explaining this employment rate; and ii) the male 20 and over employment rate has performed better than the aggregate employment rate as an indicator of labor market tightness in the wage equation. The model explains the employment rate by approximating the identity relating employment changes to changes in output, productivity and hours worked. Output and productivity are explained within MQEM. Cyclical changes in hours worked are represented to be a function of changes in output interacted with the unemployment rate so that a given rate of growth of output results in a smaller increase in employment at the peak of the cycle (low unemployment rates) when overtime hours are more easily available than additional workers (see equation B2 in the Appendix).

The aggregate unemployment rate is approximated as a function of the male unemployment rate. It plays no role in the dynamics of the model other than in determining aggregate unemployment benefits.

C. EXPENDITURES

There are sixteen expenditure flows (all in billions of 1972 dollars) explained in this block of the model. Seven are consumption equations, eight are investment equations and there is one import equation (see Table 1). New

car sales are explained in units which are then "priced up" to determine real expenditures on new cars.

Consumption Equations All of the consumer demand equations are derived either from a stock adjustment model with a Houthakker-Taylor transformation or from a Koyck distributed lag model. The auto purchases equation, for example, is a stock adjustment equation in which the desired stock of autos, K^* , is defined by:

$$(2) \quad K^* = \alpha_0 + (\alpha_1 + \alpha_2 \Delta JICS) YPERM72_{-1} \\ + \alpha_3 YT72_{-1} + \alpha_4 RUM_{-1} + \alpha_5 R_{-1} + \alpha_6 PA$$

where

YPERM72 = real permanent income, a distributed lag on real disposable income net of transfer payments.

R = a three quarter average of the spread (in percentage points) between long and short term interest rates.

YT72 = real transitory income, the difference between disposable income and permanent income.

JICS = Survey Research Center Index of Consumer Sentiment.

RUM = percentage unemployment rate for males 20 years and over.

PA = the relative price of purchasing and operating an automobile.

Applying the Houthakker-Taylor transformation to the stochastic partial adjustment equation

$$(3) \quad AUTOS = \beta(K^* - K_{-1}) + \delta K_{-1} + \epsilon$$

results in the automobile demand equation:

$$(4) \quad AUTOS = \beta[K^* - (1 - \delta)K^*_{-1}] + (1 - \beta)AUTOS_{-1} + u \quad 0 < \beta \leq 1$$

where

AUTOS = units of retail new car sales.

δ = the quarterly depreciation rate on the actual stock of cars (K_{-1}).

u = the disturbance term [= $\epsilon - (1 - \delta) \epsilon_{-1}$].

Equation C1 in the Appendix is the estimated version of equation (4).

Personal consumption expenditures on nondurable goods is an example of an equation based on a first-term-free Koyck distributed lag:

$$(5) \quad CN72 = \alpha_0 + \beta \alpha_1 YD72 + \beta \sum_{i=1}^{\infty} \lambda^i YD72_{-i} + \gamma \alpha_2 PN + \gamma \sum_{i=1}^{\infty} \lambda^i PN_{-i} + u$$

where

CN72 = real personal consumption expenditures on nondurable goods.

YD72 = real disposable income.

PN = the relative price for nondurable goods.

u = stochastic disturbance.

If $\alpha_1 = 1$ and $\alpha_2 = 1$, equation (5) reduces to a standard geometric, or Koyck, distributed lag equation. Lagging equation (5), multiplying by the decay rate λ , and subtracting the result from equation (5) yields an estimable form of the nondurable goods consumption function. Equation C6 in the Appendix is the estimated version of the equation and implies neither $\alpha_1 = 1$ nor $\alpha_2 = 1$.

Tables 2-4 display the dynamic properties of the entire set of consumption equations. Table 2 shows the quarterly response of each consumption category and total consumption (C72) to a permanent one billion dollar increase in the path of real disposable (non-transfer) income. For total consumer spending,

Table 2

Quarterly Changes in Real Consumer Spending in Response to a Permanent One Billion Dollar Increase in Real Disposable Income (Billions of 1972 \$'s)

<u>Quarter</u>	<u>Nondurables</u>	<u>Services</u>	<u>Autos</u>	<u>Furniture & HH equipment</u>	<u>Other Durables</u>	<u>Total C72</u>	<u>Addendum: New Car Purchase (millions of units)</u>
1 (impact MPC)	.124	.051	0	.025	.014	.213	0
2	.164	.051	.104	.038	.015	.292	.035
3	.195	.051	.103	.048	.016	.332	.034
4	.219	.051	.095	.053	.017	.358	.032
5	.238	.051	.098	.057	.017	.379	.029
6	.251	.051	.095	.058	.018	.394	.026
7	.262	.051	.092	.058	.019	.407	.024
8	.270	.051	.080	.058	.019	.416	.019
9	.276	.051	.072	.057	.020	.422	.015
10	.281	.051	.070	.057	.020	.428	.013
11	.285	.051	.068	.057	.020	.433	.012
12	.287	.051	.068	.057	.021	.437	.011
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∞ (steady state MPC)	.297	.051	.063	.043	.023	.470	.009

the impact MPC is .213 and it accumulates to a long run MPC of .470. Though this is lower than might be expected, it can be explained by the form of the consumer services equation. Consumer expenditures on services is specified as a first-difference equation and is estimated to contain a strong upward trend in service consumption (\$3.4 billion 1972 dollars per quarter) and is only minimally affected (impact MPC = .051) by an increase in real disposable income. This small effect, taken together with the other components of consumer spending, results in the small long run MPC.

The results of a 50 basis point increase in the spread between long and short-term interest rates are shown in Table 3. The increase in the spread, implying greater credit availability, causes an initial increase of .287 billion 1972 dollars in spending on automobiles and a long run increase of 1.669 billion 1972 dollars. This, along with a long run increase in furniture and household equipment of .702 billion 1972 dollars results in a long run increase in total consumption of 2.37 billion 1972 dollars.

Table 4 summarizes two multiplier experiments to determine the percentage change in consumption due to a 10 percent increase in the price of gasoline and due to a 10 percent increase in the price of an automobile. In the first case, an increase in the price of gas causes consumers to purchase fewer new cars and to spend more 1972 dollars on maintaining their existing cars. The total amount of 1972 dollars spent on nondurable consumption, of which gasoline is a component actually declines. Thus, in the aggregate, total consumption falls by .42 percent in the first quarter and in the long run by .09 percent. The second experiment yields the expected result that an increase in the price of an automobile causes the amount spent on new cars to decline, with total consumption declining slightly also (.46 percent in the first quarter and .04 percent in the long run).

Table 3

Quarterly changes in Real Consumer Spending
in Response to a Permanent 50 Basis Point Increase
in the Spread between Long-Term and Short-Term
Interest Rates (billions of 1972 \$'s)

Quarter	Autos	Furniture & HH Equipment	Total C72	Addendum:
				New Car Purchases (millions of units, SAAR)
1	0	0	0	0
2	.287	.051	.338	.071
3	.562	.088	.650	.120
4	.843	.126	.969	.155
5	.850	.161	1.011	.110
6	.886	.195	1.081	.081
7	.935	.226	1.162	.063
8	.990	.256	1.247	.051
9	1.042	.285	1.327	.043
10	1.092	.312	1.404	.039
11	1.140	.337	1.477	.035
12	1.184	.362	1.546	.033
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∞	1.669	.702	2.370	.030

Table 4

Percent Change in Real Consumption Expenditures Due to a 10 Percent Increase in the Price of Owning and Operating an Automobile.

Quarter	10% increase in the price of gasoline				10% increase in the price of an automobile			
	Autos, New	Autos, Other ^{1/}	Total Autos	Total C72	Autos, New	Autos, Other ^{1/}	Total Autos	Total C72
1	-6.54%	2.70%	-2.97%	-.42%	-13.18%	.65%	-7.82%	-.46%
2	-4.42	3.71	-1.23	-.36	-8.74	.17	-5.25	-.32
3	-3.03	4.94	0.10	-.28	-6.25	.04	-3.75	-.22
4	-3.11	6.22	1.17	-.22	-6.74	.00	-3.63	-.18
5	-1.52	6.82	1.59	-.17	-3.56	.00	-2.23	-.14
6	-1.05	6.87	2.06	-.14	-2.69	.00	-1.66	-.11
7	-0.94	7.18	2.23	-.12	-1.81	.00	-1.12	-.07
8	-0.83	7.21	2.30	-.10	-1.25	.00	0.79	-.05
9	-0.66	7.35	2.53	-.08	-1.38	.00	0.85	-.06
10	-0.54	7.43	2.62	-.07	-1.24	.00	0.76	-.05
11	-0.61	7.49	2.62	-.06	-1.21	.00	0.74	-.05
12	-0.64	7.25	2.47	-.06	-0.85	.00	0.54	-.04
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∞	-1.45	5.52	1.85	-0.09	-0.90	.00	.00	-.04

^{1/}Parts and Net Purchases of Used Cars

Business Fixed Investment Business or Non-residential Fixed Investment Expenditure is disaggregated into two broad categories, producers' durable equipment (IBFPD) and structures (IBFNC). Equipment is further disaggregated into three sub-categories: production equipment (IPDQ), agricultural equipment (IPDAG) and other equipment (IPDO). Table 5 shows the composition of gross private domestic investment in 1980 and the magnitudes and composition of the fixed investment categories explained in the model. As the Table indicates, the category which we refer to as production equipment is relatively homogeneous in composition and we have been able to model IPDQ by drawing heavily on standard capital and investment theory.

Investment in production equipment is modeled as the sum of two components. One is machinery investment in existing plants, say M. This is represented by a stochastic partial adjustment mechanism:

$$(6) \quad M = \beta(K_m^* - K_{m,-1}) + \delta K_{m,-1} + u_m$$

where K_m is the actual stock of production equipment, K_m^* is the desired stock, β is the quarterly speed of adjustment, δ is the quarterly rate of economic depreciation, and u_m is a stochastic disturbance. The second component of investment in production equipment is the machinery investment complementary to new plants, say C:

$$(7) \quad C = \alpha \sum_{i=0}^{\infty} \beta(1 - \beta)^i \text{IBFNC72}_{-1} + u_c$$

and

$$\sum_{i=0}^{\infty} \beta(1 - \beta)^i = 1,$$

Table 5

Gross Private Domestic Investment, 1980

	<u>Mnemonic</u>	<u>Billions of '72\$'s</u>
<u>Gross Private Domestic Investment</u>		<u>\$203.6</u>
<u>Business Fixed Investment</u>	IBF72	<u>158.4</u>
Structures	IBFNC72	48.4
Producers' Durable Equip.	IBFPD72	110.0
Residential	IRC72	48.1
Change in Bus. Inventories	IINV72	-2.9
<u>Producers' Durable Equipment</u>	IBFPD72	<u>\$100.0</u>
Agric. Equip.	IPDAG72	4.3
Production Equip.	IPDQ72	24.3
Other Equip.	IPD072	81.4
<u>Production Equipment</u>	IPDQ72	<u>\$24.3</u>
Metalworking Mach'y		<u>6.2</u>
General Indust. Mach'y		5.9
Instruments		4.0
Special Indust. Mach'y		3.3
Fabricated Metals		3.2
Misc. Electrical		1.7
<u>Other Equipment</u>	IPD072	<u>\$81.4</u>
Office and Store Equip.		<u>15.8</u>
Communication Equip.		15.1
Trucks		9.0
Passenger Cars		8.5
Photographic Equip.		5.8
Transport & Dist. Equip.		5.1
Furniture		4.6
Construction Mach'y		3.2
Service Industry Mach'y		3.1
Aircraft		2.7
Other		8.5

where IBFNC72 is nonresidential construction in 1972 dollars and u_c is a stochastic disturbance. Notice that the same adjustment parameter, β , is used in both equations. Although this is a relatively restrictive assumption, it is the only way to aggregate M and C, which are never observed separately. Adding (6) and (7) and rearranging terms yields:

$$(8) \quad C + M \equiv IPDQ72 = \beta(K_m^* - (1 - \delta)K_{m,-1}^*) + \alpha\beta IBFNC72_{-1} + (1 - \beta)IPDQ72_{-1} + \varepsilon$$

where

$$\varepsilon = u_m + u_c$$

The specification of K^* is as follows:

$$(9) \quad K^* = \alpha_0 + \alpha_1 \sum_{i=2}^7 GNP72_{-i}/6 + \alpha_2 \left(\sum_{i=4}^9 UCKPDQ_{-i} / \sum_{i=4}^9 JCMH_{-i} \right)$$

where UCKPDQ is the user cost of capital for production equipment, which depends on the real interest rate, the depreciation rate allowable for tax purposes, the investment tax credit rate, and the price of equipment (see equation G28 in the Appendix).

Equations for other types of fixed investment are essentially geometric distributed-lag models driven by real GNP, interest rates, and elements of the tax structure relevant to capital investment.

Four multiplier experiments were run over a forty quarter period on the fixed investment equations in MQEM: (1) an increase in the path of real GNP by one billion 1972 dollars, (2) an increase in both short and long term interest rates by one percentage point, which raises the level of rates while holding the term structure fixed, (3) an increase in the investment tax credit rate by one percentage point, and (4) an increase in the tax depreciation rates by six,

ten, five, and ten percentage points for structures, production equipment, agriculture equipment, and other equipment, respectively. The results are presented in Tables 6-8.

The marginal propensity to invest with respect to real GNP is shown in Table 6. Producers' Durable equipment exhibits a long run MPI of nearly 1/10, and displays a dynamic path which initially overshoots the long run effect. Investment in nonresidential construction shows a smooth convergence to a long run MPI of about .051, and the long run MPI for total business fixed investment is just under .15.

The results in Table 7 indicate the sensitivity of investment to a one percentage point increase in long term interest rates (holding the term structure of interest rates fixed). It takes half a year before any investment response occurs, then five more quarters before the investment decline reaches one billion 1972 dollars. Within three years of the initial percentage point increase in interest rates, investment has declined by about 2 billion 1972 dollars, and after 10 years, the effect has risen to \$3 1/2 billion.

Table 8 summarizes the effects on investment of changes in relevant tax parameters. The effect of a one percentage point increase in the investment tax credit (say, from 10 to 11 percent) is shown in the first column of Table 8. Within three years, an additional percentage point in the rate of investment tax credit increases business fixed investment by about 200 million 1972 dollars, and the effect rises to only about 250 million over a ten year period.

The effects of higher tax depreciation rates are shown in the second column of Table 8. The extent of the perturbations in depreciation rates for which the experiment is calculated is quite close to the actual changes in depreciation rates resulting from the Economic Recovery Tax Act of 1981. Investment responds to these changes with a one year lag and the increase in investment reaches

Table 6

Effects of a Permanent One Billion
Dollar Increase in Real GNP

Quarters	Effect on		
	Producers' Durables	Nonresidential Construction	Total Business Fixed Investment
	------(billions of 1972 dollars) -----		
1	0	0	0
2	.0397	.0244	.0641
3	.0792	.0483	.1276
4	.1160	.0470	.1629
5	.1094	.0468	.1563
6	.1119	.0473	.1592
7	.1144	.0477	.1621
8	.1168	.0481	.1649
12	.0995	.0493	.1488
16	.0961	.0500	.1462
20	.0954	.0505	.1459
24	.0954	.0508	.1461
28	.0957	.0510	.1467
32	.0958	.0511	.1470
36	.0959	.0512	.1471
40	.0959	.0513	.1471

Table 7

Effect of a Permanent One Percentage Point Increase
in Interest Rates

Quarters	Business Fixed Investment. Investment (billions of 1972 dollars)
1	0.0
2	0.0
3	-0.10574
4	-0.28711
5	-0.53102
6	-0.78468
7	-1.01971
8	-1.23400
12	-1.9031
16	-2.3564
20	-2.7010
24	-3.0248
28	-3.2420
32	-3.3576
36	-3.4492
40	-3.5559

Table 8

Effects on Real Business Fixed Investment of
Changes in the Investment Tax Credit and Tax Depreciation Rates

(Billions of 1972 \$'s)

<u>Quarters</u>	<u>Effect due to an increase of one percentage point in the Investment Tax Credit</u>	<u>Effect due to increases in Depreciation Rate Allowable for Tax Purposes*</u>
1	0	0
2	0	0
3	0	0
4	0	0
5	.0614	.7884
6	.1059	1.3795
7	.1376	1.8255
8	.1609	2.1715
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12	.1966	2.7185
16	.2101	2.9590
20	.2208	3.1825
24	.2208	3.2881
28	.2229	3.4005
32	.2331	3.5217
36	.2431	3.6723
40	.2540	3.8442

*The increases in annual tax depreciation rates are 6, 10, 5, and 10 percentage points for structures, production equipment, agricultural equipment, and other equipment, respectively.

2 billion 1972 dollars within 2 years of the change in depreciation rates. After 10 years the effect is up to 3.8 billion 1972 dollars. Interestingly, the positive effect on investment of these changes in depreciation rates is nearly identical to what would occur as a result of an easing of monetary policy which succeeded in reducing interest rates by about one percentage point (Compare Tables 7 and 8).

D. INCOME FLOWS

Accounted for in this block of the model are a variety of components of national and personal income, including private wages and salaries, corporate profits, proprietor incomes, and various tax flows. The Income Flows sector of the model accounts for GNP as the sum of the various incomes, taxes and capital consumption allowances generated in producing the GNP; while the Expenditures block of the model accounts for GNP by adding the final purchases of consumers, business, government and the foreign sector.

The private wages and salaries equation is based on the identity which relates the wage bill to compensation per hour, output, and productivity (see equation D1 in the Appendix). The profit equation explains the change of corporate gross cash flow as a function of changes in revenue, the wage bill, materials costs, and capital costs. Corporate revenue is taken to depend on current dollar expenditures on private nonfarm output, while capital costs are approximated as a function of interest rates and investment expenditures (see equation D6 in the Appendix).

E. MONETARY SECTOR

Of primary importance in the MQEM monetary sector are a money supply equation and a set of money (or liquidity) demand equations which jointly determine the 90 day Treasury Bill rate. In addition, the sector includes a set of term struc-

ture equations and a government budget identity which links monetary and fiscal policy.

The basic liquidity demand equation relates to the demand for $M2PLUS^{2/}$ and is derived from a partial adjustment model in which desired liquidity balances depend multiplicatively on the inflation rate, an interest rate, income, the rate of change in income and the price level. Our estimated equation implies a speed of adjustment coefficient of about 50 percent per quarter, a long run income elasticity of .54, and a long run interest rate elasticity of $-.05$ (see equation E1 in the Appendix). In contrast to the relatively interest-inelastic liquidity demand equation, the estimated money supply equation displays a long run elasticity that is virtually unity (see equation E2 in the Appendix). The money supply and liquidity demand equations, along with the equation explaining the proportion of liquidity balances held as money (equation E11 in the Appendix) determine the level of interest rates.

Fiscal and monetary policy are explicitly linked together in MQEM through the inclusion of a government budget identity. In theoretical discussions of the budget identity, three methods of financing a deficit are generally acknowledged: 1) borrowing from the public by issuing bonds; 2) increasing the amount of high powered money outstanding; and 3) reducing government holdings of cash. Our budget equation E5 in the Appendix recognizes each of these methods of financing a deficit, as well as accounting for the seasonality of treasury financing patterns.

A set of four term structure equations relate the 5 year government bond rate, the corporate Aaa bond rate, the 4 to 6 month commercial paper rate and the 90 day CD rate to the treasury bill rate. Each equation may be derived from an adaptive expectations specification in which some alternative interest rate

^{2/} $M2PLUS$ is M2 plus short term treasury securities held by the nonbank public and not already included in M2.

depends on current and lagged values of the treasury bill rate. In addition, each equation contains an inflation rate so as to allow a different inflation premium for each interest rate.

Tables 9 and 10 provide some detail on the dynamics of the MQEM monetary sector. In Table 9, the income elasticities resulting from a permanent 1 percent increase in real GNP are presented. This experiment may be viewed either as a 1 percent increase in output with the price level held constant or a 1 percent increase in prices with real output held constant. After six quarters, the basic liquidity demand variable (M2PLUS) shows an income elasticity of nearly .53. Thereafter, as rising interest rates begin to lower the desired stock of money, the money elasticities begin to fall. After 40 quarters, the income elasticity for M2PLUS is .44 with the corresponding figure for M1BPLUS^{3/} equal to .25.

Table 9 also shows the sensitivity of short and long term interest rates to changes in GNP. Both the treasury bill rate and the CD rate show fairly sharp inverted-U responses as their income elasticities peak at about .6 after 5 quarters before dropping off to the .25 range after 40 quarters. In contrast, the long term interest rate elasticities barely exceed .3 at their peak before leveling off at the .23 range in 40 quarters.

The impact of a permanent one percentage point increase in the annual rate of inflation is shown in Table 10. With the resulting higher price level, nominal demand for M2PLUS has increased by \$68.1 billion after 40 quarters and demand for M1BPLUS has increased by \$23.3 billion. While the level of interest rates rises continuously, the response is fairly sluggish so that after 40 quarters, nominal interest rates have increased by only 33-39 basis points. This

^{3/}M1BPLUS is M1B plus total savings at all depository institutions, M1BPLUS is "money" in MQEM.

Table 9

Income Elasticities Resulting from a Permanent 1 percent Increase in Real GNP

Quarters	Elasticities of Monetary Aggregates		Elasticities of Interest Rates			
	M1BPLUS	M2PLUS	Treasury Bill Rate	5 Year Gov't Bond Rate	Corporate Aaa Rate	90 Day CD Rate
	1	.184	.186	.097	.055	.024
2	.375	.383	.247	.116	.054	.246
3	.451	.470	.365	.162	.080	.364
4	.478	.508	.467	.200	.102	.512
5	.486	.522	.549	.203	.117	.622
6	.487	.526	.485	.195	.132	.559
7	.482	.526	.468	.219	.154	.537
8	.478	.525	.533	.238	.168	.600
12	.453	.506	.412	.235	.206	.503
16	.404	.499	.450	.328	.272	.476
20	.375	.503	.411	.300	.266	.430
24	.356	.478	.379	.252	.260	.454
28	.325	.455	.380	.277	.260	.481
32	.303	.444	.315	.250	.254	.376
36	.270	.441	.329	.260	.252	.351
40	.245	.436	.261	.232	.235	.293

Table 10

Effect of a Permanent One Percentage Point Increase in the Annual Rate of Inflation

Quarters	Billions of Dollar Change in		Basis point change in			
	M1BPLUS	M2PLUS	Treasury Bill Rate	5 Year Gov't Bond Rate	Corporate Aaa Rate	90 Day CD Rate
	1	-.17	-.24	-.1	.91	1.57
2	-.34	-.49	-.3	1.89	3.80	-6.29
3	.293	.41	.08	3.32	5.17	-8.77
4	.86	1.24	.63	5.14	6.43	-11.07
5	1.43	2.10	.47	6.19	7.56	-10.54
6	2.04	3.02	1.40	7.22	8.67	-9.96
7	2.64	3.96	2.12	8.31	9.78	-9.06
8	3.23	4.92	2.54	9.13	10.77	-8.46
12	5.97	9.39	4.24	12.10	14.33	-6.20
16	8.24	14.62	10.92	17.01	18.78	2.32
20	10.57	20.33	13.27	19.85	22.47	5.73
24	13.75	26.95	11.74	20.53	24.44	3.80
28	17.25	34.90	11.98	21.62	26.05	4.16
32	20.96	44.45	15.67	24.43	28.24	8.56
36	22.74	55.31	27.33	31.51	33.16	23.00
40	23.27	68.13	35.29	37.09	38.71	33.63

implies that real interest rates are still more than 60 basis points below their preinflation levels.

F. OUTPUT COMPOSITION

This last block of equations explains sector outputs and output indexes used elsewhere in the model. These include the services component of GNP, the manufacturing index of industrial production and the index of available capacity in manufacturing.

III. FULL MODEL POLICY MULTIPLIERS

In the preceding section, we attempted to provide some flavor of the structure of MQEM, including a discussion of the dynamic characteristics of some of the model's individual sectors. The results reveal both that the model has the potential of reacting strongly to policy induced shifts in expenditure levels and interest rates, and that such policy shifts may very well produce a pattern of cyclical response in aggregate output. This section pursues these matters in greater detail by considering the results of two multiplier experiments designed to reveal the dynamic properties of the model as a whole.

Table 11 presents the results of an experiment in which the control path of nondefense government purchases was raised by 10 billion (current) dollars over a 40 quarter horizon. The first column contains the deviations, by quarter, for the real value of government purchases ($\Delta G72$) which results from the 10 billion dollar shift in nominal government spending. The other deviations in the table are normalized by dividing through by the deviations in real government purchases. The normalized deviations can thus be interpreted as dynamic multipliers per billion dollars of real government purchases.

Column 2 shows the cyclical response of real GNP to the increased government spending. Rising from an impact magnitude of .9, the fiscal policy multiplier

Table 11

Fiscal Policy Multipliers from a Permanent \$10 Billion
Increase in Nondefense Government Purchases

Quarter	Deviations from Control	Deviations from Control Normalized by $\Delta G72$					Treasury Bill Rate %
	Government Purchases in billions of 1972 Dollars $\Delta G72$	Real GNP (billions of 72 \$'s)	GNP (billions of current \$'s)	Consumption (billions of '72 \$'s)	Business Fixed Investment (billions of 72 \$'s)	GNP Deflator (1972=100)	
1	11.68	.90	.89	.06	0	0	.004
2	11.47	1.19	1.18	.15	.06	0	.01
3	11.35	1.34	1.34	.23	.14	.00	.01
4	11.14	1.42	1.38	.27	.20	.001	.01
5	10.88	1.44	1.51	.30	.22	.004	.01
6	10.68	1.43	1.57	.34	.23	.01	.01
7	10.59	1.41	1.63	.36	.23	.02	.01
8	10.44	1.39	1.71	.38	.23	.03	.01
9	10.19	1.35	1.80	.40	.22	.04	.01
10	10.07	1.31	1.88	.42	.21	.05	.01
11	9.98	1.29	1.99	.44	.20	.06	.01
12	9.76	1.28	2.14	.47	.19	.08	.01
.							
:							
.							
16	9.11	1.18	2.80	.53	.17	.14	.01
20	8.22	.93	3.62	.53	.12	.24	.01
24	7.62	.78	4.86	.59	.06	.35	.01
28	7.18	.84	6.06	.68	.06	.42	.01
32	6.72	.86	7.42	.79	.07	.50	.01
36	6.21	.77	8.78	.87	.05	.59	.02
40	5.75	.58	9.91	.87	.002	.69	.03

for real GNP reaches a peak of 1.44 after only 5 quarters. Thereafter, as prices and interest rates begin to respond, the multiplier for real GNP begins to decline in a cyclical pattern. As can be seen from columns 4 and 5, this pattern is largely determined by the response of private investment to the increased government spending. In spite of the inflation which is generated by the increased spending, the consumption response remains strong throughout the full 40 quarters. On the other hand, short term increases in private investment are ultimately crowded out by the higher interest rates so that after 10 years, no significant change in business fixed investment can be found. It is this decline which reduces the multiplier for real GNP to .58 after 40 quarters.

Some evidence on the effect of monetary policy is presented in Table 12. The table shows the impact on a number of key aggregates in the model of a permanent 10 percent increase in the path of the monetary base. The easing of monetary policy has no impact on GNP in the initial quarter (all interest rate effects are lagged at least one quarter in MQEM) and only minimal impact in the second quarter. The effect of reduced interest rates on aggregate demand, however, begins to gather steam by the fourth quarter and by the end of the second year, real GNP is \$5.7 billion higher than its level in the control run. After 40 quarters, the treasury bill rate has fallen by 76 basis points (implying a money-interest rate elasticity of .62). While some inflation has been generated by the easing of monetary policy, the effect of the reduced interest rates is strong enough to lead to rather substantial increases in both consumption and investment. At the end of 40 quarters, real GNP is \$6.3 billion higher than in the control run.

IV. CONCLUSION

This paper has focused principally on the equation structure and dynamic

Table 12

Effect of a Permanent 10% Increase in
the Monetary Base

Quarter	Change in							
	Monetary Base (billions of current \$'s)	Real GNP (billions of '72\$'s)	GNP (billions of current \$'s)	Consumption (billions of '72 \$'s)	Business Fixed Investment (billions of '72 \$'s)	M1BPLUS (billions of current \$'s)	GNP Deflator 1972=100	Treasury Bill Rate %
1	7.05	0	0	0	0	1.66	0	1.23
2	7.18	.24	.23	.15	0	3.18	0	1.43
3	7.33	.92	.90	.47	.05	4.41	0	1.50
4	7.45	2.01	1.93	.88	.19	5.33	0	1.48
5	7.62	3.23	3.24	1.26	.44	5.86	.001	1.38
6	7.77	4.29	4.37	1.52	.78	6.30	.003	1.37
7	7.93	5.09	5.28	1.74	1.11	6.97	.007	1.41
8	8.00	5.68	5.94	1.96	1.37	7.59	.016	1.39
9	8.18	6.03	6.58	2.19	1.57	7.98	.030	1.34
10	8.33	6.23	7.05	2.39	1.71	8.29	.050	1.35
11	8.46	6.29	7.46	2.55	1.79	8.68	.076	1.36
12	8.66	6.25	7.81	2.70	1.84	9.10	.110	1.35
16	9.35	6.28	10.29	3.34	1.87	12.43	.304	1.60
20	10.20	7.35	15.01	3.88	2.39	15.18	.602	1.56
24	10.92	6.88	19.26	4.15	2.74	17.07	.954	1.41
28	11.72	5.17	22.11	3.93	2.39	18.98	1.222	1.35
32	12.73	3.70	24.43	3.56	1.96	21.01	1.403	1.41
36	13.91	3.95	27.89	3.65	1.89	25.42	1.469	1.65
40	15.06	6.30	33.17	4.34	2.56	30.91	1.418	1.76

properties of the current version of MQEM. It updates some of the analysis contained in the published report on the version of the model which existed in 1973.^{4/} In the intervening years the model has about doubled in size, a fully articulated monetary sector has been added, the income side of the model has been substantially expanded, and expenditure flows have become more disaggregated. The model continues to be employed in real-time forecasting applications, which is its principal purpose. In addition, however, it is also in frequent use by doctoral students and the RSQE senior staff both to address important policy issues^{5/} and as a test vehicle for various research applications of econometric methods.^{6/} As has been the case throughout the three decades of RSQE's existence, research on the Michigan Model is a continuing task, and the model rarely "sits still" for very long.

^{4/}S.H. Hymans and H.T. Shapiro, "The Structure and Properties of the Michigan Quarterly Econometric Model of the U.S. Economy," International Economic Review, October 1974.

^{5/}See, for example, J.P. Crary, "Some Aspects of the Current Structure of the Michigan Models" in The Economic Outlook for 1981 (RSQE, 1981), for a discussion of MOEM and Supply Side Economics.

^{6/}See, for example, E.P. Howrey, S.H. Hymans, and M.N. Greene, "The Use of Outside Information in Econometric Forecasting," RSQE Working Paper R-106, 1981.

APPENDIX:

Equations of MQEM

A. Wages and Prices

$$\begin{aligned}
 \text{A1} \quad \Delta \ln \text{JCMH} = & .01068 + .95113 * \left(\frac{\Delta \text{WUSMIN}}{\text{JCMH}_{-1}} \right) \\
 & (.00158) \quad (.37764) \\
 & + .19034 * \ln \left(\frac{\text{PC}_{-1}}{\text{PC}_{-3}} \right) + .04995 * \left(\frac{2 * \text{REM}_{-1} + \text{JCU}_{-1}}{3} \right) \\
 & (.05963) \quad (.01769) \\
 & + .06602 * \frac{\text{DTSI}}{\text{JCMH}_{-1}} + .00959 * \text{DFRZ1} + .46464 * \frac{\text{RPPER}_{-2}}{100} \\
 & (.01288) \quad (.00330) \quad (.14300)
 \end{aligned}$$

$$R^2 = .740 \quad \text{S.E.} = .0033 \quad \text{D.W.} = 2.18 \quad \text{F.P.} = 1956.4-1979.4$$

$$\begin{aligned}
 \text{A2} \quad \Delta \ln \text{PPNF} = & -.00453 + .02476 * \Delta \ln \text{PFP}_{-1} \\
 & (.00146) \quad (.00615) \\
 & + .04890 * \ln \left(\frac{\text{PCRUDE}_{-1}}{\text{PCRUDE}_{-3}} \right) \\
 & (.00874) \\
 & + .00089 * \sum_{i=5}^6 \beta_i * \left(\frac{1}{1-\text{JCU}} \right)_{-i} \\
 & (.00019) \\
 & - .00270 * (\text{DFRZ2} + \text{DFRZ3}) \\
 & (.00154) \\
 & + .03614 * \text{DFROFF} \\
 & (.00800) \\
 & + .16655 * \ln \left[\left(\frac{\text{JCMH}_{-1}}{\text{JCMH}_{-5}} \right) - \sum_{i=1}^4 \frac{\text{QMHT}_{-i}}{4} \right] \\
 & (.01581)
 \end{aligned}$$

$$\beta_i = (.6, .4)$$

$$R^2 = .855 \quad \text{S.E.} = .0030 \quad \text{D.W.} = 2.27 \quad \text{F.P.} = 1958.3-1979.4$$

A3

$$\Delta \ln \text{PCDO} = .00060 + .37649 * \Delta \ln \text{PPNF}$$

(.00089) (.08924)

$$+ .22593 * \frac{\text{DTEX}}{\text{PCDO}_{-1}} + .43429 * \Delta \ln \text{PCDO}_{-1}$$

(.15233) (.08650)

$$R^2 = .530 \quad \text{S.E.} = .0054 \quad \text{D.W.} = 2.22 \quad \text{F.P.} = 1954.3-1979.4$$

A4

$$\Delta \ln \text{PCDA} = .00122 + .23032 * \Delta \ln \text{PPNF}$$

(.00160) (.14983)

$$+ .74503 * \Delta \ln \text{PAUTO}$$

(.08740)

$$R^2 = .551 \quad \text{S.E.} = .0095 \quad \text{D.W.} = 2.00 \quad \text{F.P.} = 1955.4-1979.4$$

A5

$$\Delta \ln \text{PCDFE} = -.00235 + .38189 * \Delta \ln \text{PPNF}$$

(.00066) (.07190)

$$+ .23913 * \Delta \ln \text{PPNF}_{-1} + .13273 * \frac{\text{DTEX}}{\text{PCDFE}_{-1}}$$

(.08463) (.10489)

$$+ .26485 * \Delta \ln \text{PCDFE}_{-1}$$

(.08867)

$$R^2 = .739 \quad \text{S.E.} = .0035 \quad \text{D.W.} = 1.93 \quad \text{F.P.} = 1954.3-1979.4$$

A6

$$\begin{aligned} \Delta \ln PCN = & .00101 + .48494 * \Delta \ln PPNF \\ & (.00064) \quad (.07653) \\ & + .06057 * \Delta \ln PFP + .09147 * \Delta \ln PM \\ & (.00680) \quad (.02283) \\ & + .07878 * (1 - DPGAS) * \Delta \ln PGAS \\ & (.01432) \\ & - .00205 * DPGAS + .16405 \Delta \ln PCN_{-1} \\ & (.00114) \quad (.07592) \end{aligned}$$

$$R^2 = .867 \quad S.E. = .0034 \quad D.W. = 2.24 \quad F.P. = 1954.2-1979.4$$

A7

$$\begin{aligned} \Delta \ln PCS = & -.00047 + .24890 * \Delta \ln PPNF \\ & (.00084) \quad (.05085) \\ & + .07138 * \ln \left(\frac{JCMH_{-1}}{JCMH_{-5}} \right) \\ & (.02464) \\ & + .43925 * \Delta \ln PCS_{-1} \\ & (.08355) \end{aligned}$$

$$R^2 = .850 \quad S.E. = .0022 \quad D.W. = 1.95 \quad F.P. = 1955.2-1979.4$$

A8

$$\begin{aligned} \Delta \ln PCPI = & -.00018 + 1.1372 * \Delta \ln PC \\ & (.00057) \quad (.04463) \\ & - .00042 * (RAAA - RCPCD)_{-2} \\ & (.00025) \\ & - .02886 * \Delta \ln \left(\frac{CDA72 + CDFE72 + CD072}{C72} \right) \\ & (.01146) \end{aligned}$$

$$R^2 = .881 \quad S.E. = .0030 \quad D.W. = 1.92 \quad F.P. = 1954.3-1979.4$$

A9

$$\begin{aligned} \Delta \ln \text{PINC} = & -.00042 + .75392 * \Delta \ln \text{PPNF} \\ & (.00126) \quad (.17358) \\ & + .08930 * \ln \left(\frac{\text{PCRUE}}{\text{PCRUE}_{-2}} \right) \\ & (.01923) \\ & + .26983 * \Delta \ln \text{PINC}_{-1} \\ & (.07889) \end{aligned}$$

$R^2 = .724$ $S.E. = .0077$ $D.W. = 2.39$ $F.P. = 1954.3-1979.4$

A10

$$\begin{aligned} \Delta \ln \text{PIRC} = & -.01428 + .74604 * \ln \left(\frac{\text{JCMH}}{\text{JCMH}_{-2}} \right) \\ & (.00287) \quad (.09394) \\ & + .00229 * \sum_{i=1}^3 \beta_i (\text{RAAA} - \text{RCPCD})_{-i} \\ & (.00074) \\ & + .10684 * \Delta \ln \text{PCRUE} \\ & (.03534) \end{aligned}$$

$\beta_j = (.41, .49, .10)$

$R^2 = .552$ $S.E. = .0089$ $D.W. = 2.30$ $F.P. = 1954.4-1979.4$

A11

$$\begin{aligned} \Delta \ln \text{PG} = & .00480 + .76785 * \Delta \ln \text{PPNF} \\ & (.00092) \quad (.06963) \\ & + .19429 * \text{DGPAY} * \Delta \ln \left(\frac{\text{YGWS}}{\text{EGOV}} \right) \\ & (.04832) \\ & + .12703 * \Delta \ln \left(\frac{\text{GFD} + \text{GFO}}{\text{GFD} + \text{GFO} + \text{GSL}} \right) \\ & (.03870) \end{aligned}$$

$R^2 = .646$ $S.E. = .0051$ $D.W. = 1.72$ $F.P. = 1954.2-1979.4$

A12

$$\begin{aligned} \text{PIPD} = & (\text{IPDQ72} * \text{PIPDQ} + \text{IPD072} * \text{PIPDO} \\ & + \text{IPDAG72} * \text{PIPDAG}) / \text{IBFPD72} \end{aligned}$$

A13

$$\Delta \ln \text{ PIPDQ} = -.00123 - .01996 * \Delta \ln \text{ PCRUDE}$$

$(.00075) \quad (.01968)$

$$+ .54193 * \Delta \ln \text{ PPNF} + .68939 * \Delta \ln \text{ PIPDQ}_{-1}$$

$(.09494) \quad (.05581)$

$R^2 = .874 \quad \text{S.E.} = .0041 \quad \text{D.W.} = 1.40 \quad \text{F.P.} = 1958.3-1979.4$

A14

$$\Delta \ln \text{ PIPDAG} = -.00091 + .71634 * \Delta \ln \text{ PPNF}$$

$(.00181) \quad (.16327)$

$$+ .51827 * \Delta \ln \text{ PIPDAG}_{-1}$$

$(.08317)$

$R^2 = .573 \quad \text{S.E.} = .0100 \quad \text{D.W.} = 1.64 \quad \text{F.P.} = 1958.3-1979.4$

A15

$$\Delta \ln \text{ PIPDO} = -.00150 + .63225 * \Delta \ln \text{ PPNF}$$

$(.00086) \quad (.10467)$

$$- .06716 * \Delta \ln \text{ PCRUDE} + .47978 * \Delta \ln \text{ PIPDO}_{-1}$$

$(.02217) \quad (.07670)$

$R^2 = .733 \quad \text{S.E.} = .0047 \quad \text{D.W.} = 2.23 \quad \text{F.P.} = 1958.3-1979.4$

B. Productivity and Employment

$$\begin{aligned}
 \text{B1} \quad \Delta \ln \text{ QMH77} = & \underset{(.02802)}{-.08798} + \underset{(.00357)}{.01302} * \text{D5467} \\
 & + \underset{(.00195)}{.00601} * \text{D6873} - \underset{(.00302)}{.00090} * \text{D79} \\
 & - \underset{(.01334)}{.07218} * \ln \left(\frac{\text{JIPM}}{\text{JCAP}} \right) + \underset{(.06532)}{.64693} * \Delta \ln \text{ GNP72} \\
 & + \underset{(.00543)}{.01447} * \sum_{i=1}^6 \beta_i * \ln (\text{IBF72} - \text{IPDAG72})_{-i}
 \end{aligned}$$

$$\beta_i (.1, .15, .25, .25, .15, .1)$$

$$R^2 = .624 \quad \text{S.E.} = .0053 \quad \text{D.W.} = 2.04 \quad \text{F.P.} = 1959.3-1979.4$$

$$\begin{aligned}
 \text{B2} \quad \Delta \ln \text{ REM} = & \underset{(.00033)}{-.00394} + \underset{(.03204)}{.27252} * \Delta \ln \text{ GNP72} \\
 & + \underset{(.03493)}{.11239} * \Delta \ln \text{ GNP72}_{-1} \\
 & + \underset{(.00828)}{.02990} * \frac{\text{RUM}_{-1} + \text{RUM}_{-2}}{2} * \sum_{i=1}^2 \frac{\Delta \ln \text{ GNP72}_{-i}}{2} \\
 & - \underset{(.03679)}{.05975} * \Delta \ln \text{ QMH77} - \underset{(.00089)}{.00071} * \text{DVNUP} \\
 & - \underset{(.00070)}{.00107} * \text{DVNDOWN}
 \end{aligned}$$

$$R^2 = .789 \quad \text{S.E.} = .0021 \quad \text{D.W.} = 1.79 \quad \text{F.P.} = 1954.4-1979.4$$

B3

$$\text{RUG} = .70447 + (.01710 - .00021 * \text{DFPR}) * \text{TIME}$$

$(.09533) \quad (.00156) \quad (.00005)$

$$+ (.94317 + .00232 * \text{DFPR}) * \text{RUM} + .4771 * \mu_{-1}$$

$(.01624) \quad (.00106)$

GLS

$$R^2 = .987 \quad \text{S.E.} = .084 \quad \text{D.W.} = 2.05 \quad \text{F.P.} = 1954.3-1979.4$$

C. Expenditure

$$\begin{aligned}
 \text{C1} \quad \text{AUTOS} = & 1.6153 + .06733 * (\text{YPERM72}_{-1} - .95 * \text{YPERM72}_{-2}) \\
 & (.33694) \quad (.01723) \\
 & + .02354 * (\text{YT72}_{-1} - .95 * \text{YT72}_{-2}) \\
 & (.01082) \\
 & - 13.458 * \left[\frac{2 * \text{PAUTO} * \text{DAUTO} + \text{PGAS} * \text{DJGPM} * \text{JGPM}}{3 * \text{PC}_{-1}} \right. \\
 & + \left. \frac{(1 - \text{DJGPM}) * \text{PGAS}}{3 * \text{PC}_{-1}} - .95 * \left(\frac{2 * \text{PAUTO}_{-1} * \text{DAUTO}_{-1}}{3 * \text{PC}_{-2}} \right. \right. \\
 & \left. \left. + \frac{\text{PGAS}_{-1} * \text{DJGPM}_{-1} * \text{JGPM}_{-1} + (1 - \text{DJGPM}_{-1}) * \text{PGAS}_{-1}}{3 * \text{PC}_{-2}} \right) \right] \\
 & + .00001 * (\Delta \text{JICS}_{-1} * \text{YPERM72}_{-1} - .95 * \Delta \text{JICS}_{-2} * \text{YPERM72}_{-2}) \\
 & (.00001) \\
 & - .45861 * (\text{RUM}_{-1} - .95 * \text{RUM}_{-2}) \\
 & (.13789) \\
 & + .42406 * \left(\sum_{i=1}^3 \frac{(\text{RAAA-RCPCD})_{-i}}{3} - .95 * \sum_{i=2}^4 \frac{(\text{RAAA-RCPCD})_{-i}}{3} \right) \\
 & (.13351) \\
 & + .53677 * \text{DASTRIKE} - .39243 * \text{DASTRIKE}_{-1} \\
 & (.08844) \quad (.09843) \\
 & + .64293 * \text{AUTOS}_{-1} \\
 & (.07629)
 \end{aligned}$$

$R^2 = .950$ $S.E. = .4548$ $D.W. = 2.40$ $F.P. = 1957.2-1979.4$

C2
$$\Delta \text{CDAN72} = \begin{matrix} .09981 & + & (1.5228 & + & .00256 & * & \text{YPERM72}_{-1}) & * & \Delta \text{AUTOS} \\ (.03275) & & (.31703) & & (.00050) & & & & \end{matrix}$$
$$- \begin{matrix} .68216 & * & \Delta (\text{AUTOSIZE} * \text{AUTOS}) & - & .4965 & \mu_{-1} \\ (.18882) & & & & & \end{matrix}$$

GLS

$R^2 = .957$ $S.E. = .4715$ $D.W. = 1.87$ $F.P. = 1955.4-1979.4$

C3
$$\text{CDA072} = \begin{matrix} -4.4820 & - & .09304 & * & \Delta \text{AUTOS} \\ (.93515) & & (.10914) & & \end{matrix}$$
$$+ \left[\begin{matrix} .00646 & + & .00075 & * & \sum_{i=1}^3 \frac{(\text{RAAA} - \text{RCPCD})_{-i}}{3} \end{matrix} \right] * \text{YPERM72}_{-1}$$
$$+ \begin{matrix} 2.6433 & * & \text{PGAS} * \text{JGPM} \\ (.88054) & & \text{PC}_{-1} \end{matrix}$$
$$+ \begin{matrix} 1.7848 & * & \text{DJGPM} * & \frac{2 * \text{JGPM}}{\text{JGPM}_{-12} + \text{JGPM}_{-16}} \end{matrix}$$
$$+ \begin{matrix} .24840 & * & \text{DASTRIKE} & + & .80692 & * & \text{CDA072}_{-1} \\ (.13064) & & & & (.04032) & & \end{matrix}$$
$$- \begin{matrix} .22386 & * & \Delta \text{CDA072}_{-1} \\ (.09582) & & \end{matrix}$$

$R^2 = .994$ $S.E. = .5849$ $D.W. = 2.20$ $F.P. = 1958.1-1979.4$

C4

$$\begin{aligned}
 \text{CDFE72} = & -3.3466 + (.00734 - .00005 * \text{TIME}) * \text{YPERM72}_{-1} \\
 & (1.4966) \quad (.00352) \quad (.00003) \\
 & + .02494 * (\text{YD72} - \text{YPERM72}_{-1}) \\
 & (.00767) \\
 & + .02775 * (.3 * \text{IRC72} + .7 * \text{IRC72}_{-1}) \\
 & (.01112) \\
 & + .10177 * (\text{RAAA} - \text{RCPCD})_{-1} - .20194 * \Delta \text{CDFE72}_{-1} \\
 & (.06419) \quad (.10350) \\
 & + .93620 * \text{CDFE72}_{-1} \\
 & (.04779)
 \end{aligned}$$

$$R^2 = .998 \quad \text{S.E.} = .5446 \quad \text{D.W.} = 1.92 \quad \text{F.P.} = 1955.3-1979.4$$

C5

$$\begin{aligned}
 \text{CD072} = & 2.7557 + .01380 * \text{YD72} - .01116 * \text{YD72}_{-1} \\
 & (1.7342) \quad (.00377) \quad (.00372) \\
 & - 15.065 * \left[\frac{\text{PCDO}}{\text{PC}} - \left(\frac{.01116}{.01380} \right) * \left(\frac{\text{PCDO}}{\text{PC}} \right)_{-1} \right] \\
 & (5.4208) \\
 & + .88652 * \text{CD072}_{-1} \\
 & (.04613)
 \end{aligned}$$

$$R^2 = .998 \quad \text{S.E.} = .2867 \quad \text{D.W.} = 2.17 \quad \text{F.P.} = 1954.3-1979.4$$

C6

$$\begin{aligned}
 \text{CN72} = & 62.484 + .12360 * \Delta \text{YD72} + .06970 * \text{YD72}_{-1} \\
 & (21.917) \quad (.02620) \quad (.02258) \\
 & - 46.716 * \left(\frac{\text{PCN}}{\text{PC}} \right)_{-1} - 219.95 * \Delta \left(\frac{\text{PCN}}{\text{PC}} \right) + .76502 * \text{CN72}_{-1} \\
 & (17.431) \quad (47.859) \quad (.07875)
 \end{aligned}$$

$$R^2 = .999 \quad \text{S.E.} = 1.688 \quad \text{D.W.} = 1.80 \quad \text{F.P.} = 1954.3-1979.4$$

$$C7 \quad \Delta CS72 = 3.3566 + .05087 * \Delta \left(\frac{YD + TSIP}{PC/100} \right)$$

(.22345) (.01542)

$$+ 23.446 * \left(\frac{PCS}{PC} - 1 \right)$$

(3.8028)

$$R^2 = .394 \quad S.E. = 1.086 \quad D.W. = 2.11 \quad F.P. = 1954.2-1979.4$$

$$C8 \quad IBFNC72 = 1.6697 + .02439 * (GNP72_{-1} - GNP72_{-3})$$

(.66817) (.00573)

$$+ .00561 * \left(1 + \frac{TDEPRNC_{-4} - 1}{4} \right) * \sum_{i=2}^5 \beta_i * GNP72_{-i}$$

(.00252)

$$- 28.132 * \sum_{i=2}^5 \beta_i * \left(\frac{UCKNC}{PPNF} \right)_{-i} + .88927 * IBFNC72_{-1}$$

(13.360) (.04232)

$$\beta_i = (.4, .3, .2, .1)$$

$$R^2 = .985 \quad S.E. = .8931 \quad D.W. = 1.70 \quad F.P. = 1955.2-1979.4$$

$$C9 \quad IBFPD72 = IPDQ72 + IPD072 + IPDAG72$$

$$C10 \quad IPDQ72 = -2.2345 + .05834 * \sum_{i=2}^7 \frac{GNP72_{-i}}{6}$$

(.53164) (.00925)

$$- .05396 * \sum_{i=3}^8 \frac{GNP72_{-i}}{6}$$

(.00902)

$$- 6.2153 * \left[\frac{\sum_{i=4}^9 UCKPDQ_{-i}}{\sum_{i=4}^9 JCMH_{-i}} \right]$$

(2.6943)

$$- \frac{.05396}{.05834} * \left[\frac{\sum_{i=5}^{10} UCKPDQ_{-i}}{\sum_{i=5}^{10} JCMH_{-i}} \right]$$

$$+ .07045 * IBFNC72_{-1} + .68843 * IPDQ72_{-1}$$

(.01821) (.05826)

$$R^2 = .991 \quad S.E. = .4207 \quad D.W. = 1.37 \quad F.P. = 1960.3-1979.4$$

C11

$$\begin{aligned}
 \text{IPD072} &= -6.9647 + .54490 * \text{DASTRIKE} \\
 &\quad (1.6619) \quad (.23378) \\
 &+ .49501 * \sum_{i=2}^5 \frac{(\text{RAAA} - \text{RCPCD})_{-i}}{4} \\
 &\quad (.18409) \\
 &+ .00636 * \left[1 + \frac{\text{TDEPRO}_{-4} - \frac{1}{6} + \text{TITCR}_{-4} - .07}{4} \right] * \sum_{i=3}^5 \text{GNP72}_{-i} \\
 &\quad (.00146) \\
 &+ .03968 * (\text{GNP72}_{-1} - \text{GNP72}_{-4}) \\
 &\quad (.01098) \\
 &+ .02410 * \text{DUM74} * (\text{GNP72}_{-4} - \text{GNP72}_{-8}) \\
 &\quad (.00864) \\
 &+ .70811 * \text{IPD072}_{-1} \\
 &\quad (.06669)
 \end{aligned}$$

$$R^2 = .996 \quad \text{S.E.} = 1.267 \quad \text{D.W.} = 2.23 \quad \text{F.P.} = 1958.2-1979.4$$

C12

$$\begin{aligned}
 \text{IPDAG72} &= .10183 \\
 &\quad (.14190) \\
 &+ .00032 * \left[1 + \frac{\text{TDEPRAG}_{-4} - \frac{1}{6} + \text{TITCR}_{-4} - .07}{4} \right] * \sum_{i=3}^5 \text{GNP72}_{-i} \\
 &\quad (.00010) \\
 &+ .15128 * \Delta \text{IPDAG72}_{-1} + .73372 * \text{IPDAG72}_{-1} \\
 &\quad (.11491) \quad (.07564)
 \end{aligned}$$

$$R^2 = .917 \quad \text{S.E.} = .3136 \quad \text{D.W.} = 1.89 \quad \text{F.P.} = 1958.3-1979.4$$

C13

$$\begin{aligned} \text{IRC72} = & 3.3458 + 1.0290 * \sum_{i=1}^3 \beta_i * (\text{RAAA-RCPCD})_{-i} \\ & (1.6424) \quad (.17314) \\ & + .00850 * \sum_{i=1}^3 \beta_i * \text{YD72}_{-i} \\ & (.00186) \\ & - \frac{2.2012 * Q_{-1} * \text{PIRC} + Q_{-2} * \text{PIRC}_{-1}}{(1.7164) \quad \text{PC}_{-1} + \text{PC}_{-2}} \\ & - 4.1318 * \text{D763} + 1.0918 * \text{IRC72}_{-1} \\ & (1.4631) \quad (.09614) \\ & - .24449 * \text{IRC72}_{-2} \\ & (.09221) \end{aligned}$$

β_i (.41, .49, .10)

$R^2 = .984$ S.E. = 1.385 D.W. = 1.85 F.P. = 1954.4-1979.4

C14

$$\begin{aligned} \Delta \text{ HOUSES} = & -14.139 + 59.027 * \Delta \text{ IRC72} + 12.418 * \Delta \text{ IRC72}_{-1} \\ & (9.7932) \quad (6.1720) \quad (7.8562) \\ & - .58331 * \Delta \text{ HOUSES}_{-1} - .25941 * \Delta \text{ HOUSES}_{-2} \\ & (.13272) \quad (.11984) \end{aligned}$$

$R^2 = .524$ S.E. = 97.78 D.W. = 2.14 F.P. = 1954.4-1980.4

C15

$$\begin{aligned} \text{IINV72} = & -15.322 + .20032 * (\text{FS72} - \text{SERVE72})_{-1} \\ & (2.9477) \quad (.02935) \\ & - .09823 * \text{SINV72}_{-1} + .28021 * \Delta \text{ M72} \\ & (.01470) \quad (.17238) \\ & + .22240 * \text{IINV72}_{-1} \\ & (.08431) \end{aligned}$$

$R^2 = .608$ S.E. = 4.134 D.W. = 1.92 F.P. = 1954.3-1979.4

C16

$$\begin{aligned} \ln M72 = & -1.9960 + (.44480 + .13338 * \Delta \ln \text{SINV72}) * \ln \text{GNP72} \\ & (.50045) \quad (.10980) \quad (.06544) \\ & + .01040 * \text{DAPACTM} + .04581 * \text{DM72SS} \\ & (.00525) \quad (.02786) \\ & - .01666 * \text{DM72SS}_{-1} + .02835 * \text{DM72DOCK} \\ & (.02845) \quad (.00449) \\ & - .00786 * \text{DM72DOCK}_{-1} + .72356 * \ln M72_{-1} \\ & (.00466) \quad (.06964) \end{aligned}$$

$R^2 = .997$ $S.E. = .0278$ $D.W. = 1.67$ $F.P. = 1955.4-1979.4$

D. Income Flows

$$\begin{aligned} D1 \quad \Delta \ln YPWS = & -.00237 + .98731 * \Delta \ln JCMH \\ & (.00130) \quad (.07824) \\ & + 1.2014 * \Delta \ln GNP72 - .79930 * \Delta \ln QMH77 \\ & (.06082) \quad (.07328) \\ & - .05887 * \frac{DTSI}{JCMH_{-1}} \\ & (.01888) \end{aligned}$$

R² = .844 S.E. = .0045 D.W. = 2.09 F.P. = 1954.2-1979.4

$$\begin{aligned} D2 \quad \Delta \ln YOL = & .00814 + .42522 * \Delta \ln YPWS \\ & (.00218) \quad (.07836) \\ & + .47304 * \Delta \ln YOL_{-1} \\ & (.07166) \end{aligned}$$

R² = .548 S.E. = .0080 D.W. = 1.77 F.P. = 1954.3-1979.4

$$\begin{aligned} D3 \quad \Delta \ln YNFP = & .00274 + .49252 * \Delta \ln YPWS \\ & (.00230) \quad (.11660) \\ & + .07746 * \Delta \ln YCP \\ & (.02179) \end{aligned}$$

R² = .346 S.E. = .0119 D.W. = 1.37 F.P. = 1954.2-1979.4

D4 $\Delta \ln YFP = -.00160 + .93498 * \Delta \ln GNP72$
 (.01004) (.70582)

+ .94477 * $\Delta \ln PFP$ + .19836 * $\Delta \ln PFP_{-1}$
 (.13365) (.13127)

- .62458 * $\Delta \ln PCRUDE_{-1}$
 (.25219)

$R^2 = .427$ S.E. = .0690 D.W. = 2.21 F.P. = 1954.3-1979.4

D5 $\Delta \ln YUNB = .25506 + .21097 * \Delta RUG$
 (.31133) (.01899)

+ 1.0042 * $\Delta \ln \left(\frac{RUM}{RUG} \right)$
 (.24861)

+ .26063 * $\left[\ln \left(\frac{JCMH}{JCMH_{-4}} \right) - 1 \right]$ + .56204 * DUBEXT
 (.33068) (.14537)

$R^2 = .779$ S.E. = .0619 D.W. = 2.04 F.P. = 1955.1-1979.4

D6 $\Delta (YCP+KCAC) = -.78174 + .69306 * \Delta \left[PPNF * \left(\frac{GNP}{PGNP} - \frac{YGWS}{PG} - \frac{YFP}{PFP} \right) \right]$
 (.30963) (.02909)

- .50191 * $\Delta \left[ULC77 * \left(\frac{GNP}{PGNP} - \frac{YGWS}{PG} - \frac{YFP}{PFP} \right) \right]$
 (.05224)

- .01438 * $\Delta \left[PCRUDE * \left(\frac{GNP}{PGNP} - \frac{YGWS}{PG} - \frac{YFP}{PFP} \right) \right]$
 (.00559)

- .09904 * $\sum_{i=1}^2 \left(\frac{RAAA}{100} * IBF \right)_{-i}$
 (.03641)

$R^2 = .899$ S.E. = 1.905 D.W. = 1.71 F.P. = 1954.3-1978.4

D7
$$\text{YPDIV} = .18268 + .02745 * (\text{YCBT} - \text{TCF} - \text{TCSL})$$

(.17107) (.00628)

$$+ .01298 * \text{IVA} + .94171 * \text{YPDIV}_{-1}$$

(.00766) (.02158)

$R^2 = .998$ $\text{S.E.} = .4947$ $\text{D.W.} = 1.38$ $\text{F.P.} = 1954.2-1979.4$

D8
$$\Delta \text{TIBF} = -.00738 + (.01096 + .01947 * \text{DEX65}) * \Delta \text{GNP}$$

(.04935) (.00151) (.00602)

$$+ 1.0642 * \text{DTIB}$$

(.06781)

$R^2 = .743$ $\text{S.E.} = .2890$ $\text{D.W.} = 1.92$ $\text{F.P.} = 1954.2-1979.4$

D9
$$\Delta \text{TIBSL} = .81166 - (.09511 - .03006 * \ln \text{TIME}) * \Delta \text{GNP}$$

(.09382) (.03131) (.00669)

$$- 6.5319 * \text{DPRCP13}$$

(.49882)

$R^2 = .817$ $\text{S.E.} = .4851$ $\text{D.W.} = 1.09$ $\text{F.P.} = 1954.2-1979.4$

D10
$$\Delta \ln \text{TSIF} = .00572 + .84110 * \Delta \ln \text{YPWS}$$

(.00337) (.16845)

$$- .29170 * \Delta \ln \left(\frac{\text{YPWS}}{\text{WCETL}} \right) - .00692 * \Delta \text{RUG}$$

(.02463) (.00473)

$$+ .76098 * \Delta \ln \text{TSIFR}$$

(.03926)

$R^2 = .904$ $\text{S.E.} = .0127$ $\text{D.W.} = 2.58$ $\text{F.P.} = 1954.2-1979.4$

D11
$$\Delta \ln \text{TSIP} = -.00176 + 1.0374 * \Delta \ln \text{TSI}$$

(.00120) (.02706)

$R^2 = .936$ $\text{S.E.} = .0093$ $\text{D.W.} = 2.16$ $\text{F.P.} = 1954.2-1979.4$

D12

$$\begin{aligned}
TCF = & 3.2450 - [.01730 - .75813 * TCFR \\
& (.79294) (.05311) (.11064) \\
& - .00034 * \Delta (YCBT-TCSL)] * (YCBT-TCSL) \\
& (.00007) \\
& - (.29628 * TITCR_{-1} + .17327 * \Delta TITCR) * IBFPD \\
& (.09531) (.07373) \\
& + .8593 * \mu_{-1}
\end{aligned}$$

GLS

$$R^2 = .974 \quad S.E. = .5788 \quad D.W. = 2.36 \quad F.P. = 1954.2-1978.4$$

S-
D13

$$\begin{aligned}
\Delta TCSL = & .02065 + (.00961 + .00047 * TIME) * \Delta YCBT \\
& (.02014) (.01118) (.00013)
\end{aligned}$$

$$R^2 = .727 \quad S.E. = .1929 \quad D.W. = 2.24 \quad F.P. = 1954.2-1979.4$$

D14

$$\begin{aligned}
\Delta TPSL = & .02766 + .02997 * \Delta (YP-GTROF-GTRSL-YUNB+TSIP) \\
& (.07072) (.00506)
\end{aligned}$$

$$\begin{aligned}
& + .31651 * D674 + .15778 * D711 \\
& (.15180) (.17755)
\end{aligned}$$

$$R^2 = .645 \quad S.E. = .4637 \quad D.W. = 1.70 \quad F.P. = 1954.3-1979.4$$

D15

$$\Delta TP = (.20 + DTPR) * \Delta (YP-GTROF-GTRSL-YUNB+TSIP) + DTP$$

D16

$$\begin{aligned}
\Delta GINTF = & .10899 + .22186 * \frac{RG5}{100} * \Delta GDEBTP \\
& (.05096) (.08331)
\end{aligned}$$

$$\begin{aligned}
& + .48158 * \Delta GINTF_{-1} + .19691 * \left(\frac{RG5}{100}\right)_{-1} * \Delta GDEBTP_{-1} \\
& (.08280) (.09053)
\end{aligned}$$

$$R^2 = .501 \quad S.E. = .4200 \quad D.W. = 2.44 \quad F.P. = 1954.4-1979.4$$

E. Monetary Sector

$$\begin{aligned}
 \text{E1} \quad \Delta \ln \text{M2PLUS} = & .00488 - .02825 * \Delta \ln \text{RG5} \\
 & (.00194) \quad (.01021) \\
 & + .29520 * \Delta \ln \text{GNP72}_{-1} + .18657 * \Delta (\Delta \ln \text{GNP72}) \\
 & (.11307) \quad (.08325) \\
 & + .29529 * \Delta \ln \text{PPNF} - .36593 * \Delta \ln \left(\frac{\text{PPNF}}{\text{PPNF}_{-2}} \right) \\
 & (.11174) \quad (.13045) \\
 & + .23582 * \frac{\Delta \text{GDEBTP}}{\text{GNP}} + .45279 * \Delta \ln \text{M2PLUS}_{-1} \\
 & (.11308) \quad (.10128)
 \end{aligned}$$

$R^2 = .558$ $\text{S.E.} = .0057$ $\text{D.W.} = 2.25$ $\text{F.P.} = 1959.3-1979.4$

$$\begin{aligned}
 \text{E2} \quad \ln \text{RTB} = & -1.2579 - .01017 * \text{DSEAS1} - .00059 * \text{DSEAS2} \\
 & (.48872) \quad (.01136) \quad (.01698) \\
 & + .01753 * \text{DSEAS3} + 1.5182 * \ln \text{RDIS} \\
 & (.01206) \quad (.14516) \\
 & - .84155 * \ln \text{RDIS}_{-1} - .59703 * \ln \text{MBASE} \\
 & (.13170) \quad (.21133) \\
 & + .58406 * \ln \text{M1BPLUS} + .60078 * \Delta \ln \text{GDEBTP} \\
 & (.20616) \quad (.46965) \\
 & + .43558 * \ln \text{RTB}_{-1} + .3123 * \mu_{-1} \\
 & (.10008)
 \end{aligned}$$

GLS

$R^2 = .952$ $\text{S.E.} = .0646$ $\text{D.W.} = 1.78$ $\text{F.P.} = 1959.1-1979.4$

E3

$$\begin{aligned} \Delta \text{ MBASE} = & .12816 + .13235 * \text{ DSEAS1} \\ & (.08124) \quad (.08397) \\ & + .26574 * \text{ DSEAS2} - .23836 * \text{ DSEAS3} \\ & (.08267) \quad (.08530) \\ & + .93287 * \text{ FDCUR} + .69548 * \Delta \text{ MRAM} \\ & (.05477) \quad (.09190) \\ & + .42698 * (\text{ RTB} - \text{ RDIS}) - .34652 * (\text{ RTB} - \text{ RDIS})_{-1} \\ & (.13846) \quad (.13408) \end{aligned}$$

$$R^2 = .801 \quad \text{ S.E.} = .423 \quad \text{ D.W.} = 1.81 \quad \text{ F.P.} = 1959.2-1979.4$$

E4

$$\begin{aligned} \Delta \text{ MRAM} = & .00745 - 1.2567 * \Delta \text{ RRDEM} + .19502 * \text{ DSEAS1} \\ & (.03680) \quad (.18556) \quad (.06381) \\ & - .05266 * \text{ DSEAS2} - .10923 * \text{ DSEAS3} + \text{ DRAM} \\ & (.06303) \quad (.06294) \end{aligned}$$

$$R^2 = .634 \quad \text{ S.E.} = .3700 \quad \text{ D.W.} = 1.77 \quad \text{ F.P.} = 1954.2-1979.4$$

E5

$$\begin{aligned} \Delta \text{ GDEBTP} = & .55257 + 3.5034 * \text{ DUM75} - (1 + .34800 * \text{ DSEAS1} \\ & (.38232) \quad (.77726) \quad (.14331) \\ & - .24087 * \text{ DSEAS2} - .09652 * \text{ DSEAS3}) * \frac{\text{ NIASF}}{4} \\ & (.11420) \quad (.12373) \\ & - (1 - 1.9550 * \text{ DSEAS1} + 3.9176 * \text{ DSEAS2} \dots \\ & \quad (.90123) \quad (.91648) \\ & - .15510 * \text{ DSEAS3}) * \text{ FDCUR} - 1.5918 * \text{ DSEAS1} \\ & (.67337) \quad (.92694) \\ & - 3.8519 * \text{ DSEAS2} + 3.0176 * \text{ DSEAS3} \\ & (.98850) \quad (1.0318) \end{aligned}$$

$$+ \Delta \text{ GCBDD} + \Delta \text{ GOLD} + \Delta \text{ TCO} + \Delta \text{ SDR}$$

$$R^2 = .890 \quad \text{ S.E.} = 2.962 \quad \text{ D.W.} = 2.36 \quad \text{ F.P.} = 1959.2-1979.4$$

$$E6 \quad \Delta \text{GCBDD} = 1.4650 + .03061 * \text{DSEAS1} + .48334 * \text{DSEAS2}$$

(.42923) (.21851) (.21508)

$$- .23139 * \text{DSEAS3} - .23982 * \text{GCBDD}_1$$

(.21633) (.07028)

$$R^2 = .168 \quad \text{S.E.} = 1.261 \quad \text{D.W.} = 2.26 \quad \text{F.P.} = 1954.2-1979.4$$

$$E7 \quad \text{RG5} = .05227 + .04158 * \text{DSEAS1} + .03345 * \text{DSEAS2}$$

(.04655) (.02479) (.02452)

$$+ .02702 * \text{DSEAS3} + .03903 * \text{RTB}_1$$

(.02465) (.02670)

$$+ .30635 * \Delta \text{RTB} + .19091 * \text{RAAA}_2$$

(.03377) (.03107)

$$+ 1.0976 * \Delta \text{RAAA} - 1.5924 * \left(\frac{\text{PPNF}}{\text{PPNF}_{-2}} - \frac{\text{PPNF}_{-2}}{\text{PPNF}_{-4}} \right)$$

(.09626) (1.7417)

$$+ .74419 * \text{RG5}_1$$

(.05148)

$$R^2 = .995 \quad \text{S.E.} = .1361 \quad \text{D.W.} = 1.97 \quad \text{F.P.} = 1955.1-1979.4$$

$$E8 \quad \text{RAAA} = -3.1925 + .27273 * \text{RTB} - .26205 * \text{RTB}_1$$

(1.7062) (.02572) (.04345)

$$+ .08210 * \text{RTB}_2 - .01903 * \text{DSEAS1} + .03884 * \text{DSEAS2}$$

(.02980) (.02477) (.02460)

$$- .02433 * \text{DSEAS3} + 3.3057 * \frac{\text{PPNF}}{\text{PPNF}_{-2}} + .90921 * \text{RAAA}_1$$

(.02463) (1.7217) (.01503)

$$R^2 = .996 \quad \text{S.E.} = .1388 \quad \text{D.W.} = 1.73 \quad \text{F.P.} = 1954.3-1979.4$$

E9
$$RCP = .40013 + .93350 * RCD + .6269 * \mu_{-1}$$

 (.06469) (.00894)

GLS

$R^2 = .994$ $S.E. = .0910$ $D.W. = 2.03$ $F.P. = 1963.1-1979.4$

E9'
$$RCP = 5.7865 + 1.0301 * RTB - .48010 * RTB_{-1}$$

 (1.3301) (.03788) (.08607)

$$- .06910 * DSEAS1 + .07194 * DSEAS2 + .04028 * DSEAS3$$

 (.03665) (.03647) (.03690)

$$+ 1.6878 * DSPRD - 5.6875 * \frac{PPNF}{PPNF_{-4}} + .54373 * RCP_{-1}$$

 (.15855) (1.3443) (.05874)

$R^2 = .993$ $S.E. = .2038$ $D.W. = 1.53$ $F.P. = 1955.1-1979.4$

E10
$$RCD = -.27379 + 1.1292 * RTB - .45348 * RTB_{-1}$$

 (.10817) (.04700) (.10842)

$$+ 1.8356 * DSPRD - 5.9351 * \left(\frac{PPNF}{PPNF_{-4}} - 1 \right)$$

 (.18150) (1.7344)

$$- .13828 * DSEAS1 + .07212 * DSEAS2 + .08625 * DSEAS3$$

 (.05060) (.05032) (.05056)

$$+ .49012 * RCD_{-1}$$

 (.06800)

$R^2 = .991$ $S.E. = .2278$ $D.W. = 1.96$ $F.P. = 1963.2-1979.4$

$$\begin{aligned} \text{E11} \quad \frac{\text{M1BPLUS}}{\text{M2PLUS}} &= .01241 - .00363 * \text{RTB} + .00160 * \Delta \text{RTB}_{-1} \\ &\quad (.00634) \quad (.00064) \quad (.00109) \\ &+ .00268 * \text{RTB}_{-2} - .00369 * \text{D66} + 1.2521 * \left(\frac{\text{M1BPLUS}}{\text{M2PLUS}} \right)_{-1} \\ &\quad (.00066) \quad (.00128) \quad (.10622) \\ &- .26304 * \left(\frac{\text{M1BPLUS}}{\text{M2PLUS}} \right)_{-2} \\ &\quad (.01449) \end{aligned}$$

$R^2 = .999$ $\text{S.E.} = .0032$ $\text{D.W.} = 2.04$ $\text{F.P.} = 1959.3-1979.4$

F. Output Composition

$$\begin{aligned}
 \text{F1} \quad \Delta \text{ SERVE72} &= 1.3610 + 1.1472 * \Delta \text{ CS72} \\
 &\quad (.43699) \quad (.12533) \\
 &+ .03322 * \Delta (\text{GNP72} - \text{CS72}) \\
 &\quad (.01778) \\
 &- .11033 * \Delta \text{ SERVE72}_{-1} \\
 &\quad (.07565)
 \end{aligned}$$

$$R^2 = .500 \quad \text{S.E.} = 1.663 \quad \text{D.W.} = 1.96 \quad \text{F.P.} = 1954.3-1979.4$$

$$\begin{aligned}
 \text{F2} \quad \text{JIPM} &= -15.471 + .14984 * \text{FSMF72} \\
 &\quad (2.2098) \quad (.02132) \\
 &+ .09840 * \text{CN72} + .12394 * \text{FSNMF72} \\
 &\quad (.02175) \quad (.02402) \\
 &+ (.06695 - .00141 * \sum_{i=1}^4 \text{IINV72}_{-i}) * \Delta (\text{FS72} - \text{SERVE72}) \\
 &\quad (.04255) \quad (.00077) \\
 &+ .20636 * \text{IINV72} + .43127 * \text{JIPM}_{-1} \\
 &\quad (.02587) \quad (.05944)
 \end{aligned}$$

$$R^2 = .999 \quad \text{S.E.} = 1.177 \quad \text{D.W.} = 1.44 \quad \text{F.P.} = 1955.1 - 1979.4$$

$$\begin{aligned}
 \text{F3} \quad \Delta \ln \text{ JCAP} &= .04959 - .00502 * \text{D5864} - .00226 * \text{D7074} \\
 &\quad (.00845) \quad (.00078) \quad (.00037) \\
 &+ \left(\frac{.00785 + .00544 * \frac{\text{JCU}_{-1} + \text{JCU}_{-2}}{2}}{(.00519) \quad (.00156)} \right) * \\
 &\quad \sum_{i=0}^1 \beta_i * \ln(\text{IBFNC72} + \text{IPDQ72})_{-i} \\
 &- .01817 * \ln \text{ JCAP}_{-1} \\
 &\quad (.00206)
 \end{aligned}$$

$$\beta_i (.7, .3)$$

$$R^2 = .905 \quad \text{S.E.} = .0011 \quad \text{D.W.} = 1.42 \quad \text{F.P.} = 1958.4 - 1979.4$$

G. Miscellaneous Definitions

$$G1 \quad ULC77 = \frac{JCMH}{QM77} * 100$$

$$G2 \quad RUM = 100 - REM$$

$$G3 \quad GTRP = GTROF + GTRSL + YUNB$$

$$G4 \quad YP = YPWS + YGWS + YOL + YFP + YNFP + YPRENT + YPDIV + YPINT \\ + GTRP + BTRP - TSIP$$

$$G5 \quad YD = YP - TP$$

$$G6 \quad YD72 = \frac{YD}{PC} * 100$$

$$G7 \quad YPERM72 = \sum_{i=0}^5 \beta_i * \left[YD72_{-i} + \left(\frac{TPNS - GTRP}{PC/100} \right)_{-i} \right] \\ \beta_i (.271, .217, .173, .139, .111, .089)$$

$$G8 \quad YT72 = YD72 + \left(\frac{TPNS - GTRP}{PC/100} \right) - YPERM72$$

$$G9 \quad RHSAVE = \frac{(YD - C - HINT - HTRF)}{YD} * 100$$

$$G10 \quad YCBT = YCP - IVA - KCCA$$

$$G11 \quad STAT = GNP - KCA - TIBF - TIBSL - WALD + SLCSF + SLCSSL - YCP \\ - TSI + YPDIV + GTRP - NINT + YPINT - YP$$

$$G12 \quad TIB = TIBF + TIBSL$$

$$G13 \quad TSI = TSIF + TSISL$$

G14 $TC = TCF + TCSL$

G15 $NIASF = TP - TPSL + TCF + TIBF + TSIF - (GFD + GFO + GTROF + YUNB$
 $+ GTRF + GAID + GINTF + SLCSF - GWALDF)$

G16 $NIASSL = TPSL + TCSL + TIBSL + TSISL + GAID - (GSL + GTRSL + GINTSL$
 $+ SLCSSL - GWALDSL - GDIVSL)$

G17 $CDA72 = CDAN72 + CDA072$

G18 $C72 = CDA72 + CDFE72 + CD072 + CN72 + CS72$

G19 $C = \frac{PCDA}{100} * CDA72 + \frac{PCDFE}{100} * CDFE72 + \frac{PCDO}{100} * CD072$
 $+ \frac{PCN}{100} * CN72 + \frac{PCS}{100} * CS72$

G20 $PC = \frac{C}{C72} * 100$

G21 $JCMHD = \frac{JCMH}{PC/100}$

G22 $IBF72 = IBFPD72 + IBFNC72$

G23 $IBFNC = IBFNC72 * \frac{PINC}{100}$

G24 $IBFPD = IBFPD72 * \frac{PIPD}{100}$

G25 $IBF = IBFPD + IBFNC$

G26 $PIBF = \frac{IBF}{IBF72} * 100$

G27 $UCKNC = PINC * \left(\frac{RAAA}{100} + .06 \right)$

$$\begin{aligned}
 \text{G28} \quad \text{UCKPDQ} = & \text{PIPDQ} * \left\{ \text{RAAA}/100 - \left(\frac{\text{PPNF}_{-1}}{\text{PPNF}_{-5}} - 1 \right) + \frac{1}{6} \right. \\
 & - \frac{1}{1 - \text{TCFR}} * \left[\left\{ \text{TDEPRQ} - \frac{1}{6} + \left(\frac{\text{PPNF}_{-1}}{\text{PPNF}_{-5}} - 1 \right) \right\} * \text{TCFR} + \text{TITCR} * \frac{1}{6} \right. \\
 & \left. \left. + \text{TITCR} * \frac{5}{6} * \frac{1}{\sum_{i=0}^{24} \left[\left(\frac{\text{PPNF}_{-1}}{\text{PPNF}_{-5}} \right) / (1 + \text{RAAA}/100) \right]^i} \right] \right\}
 \end{aligned}$$

$$\text{G29} \quad \text{IRC} = \text{IRC72} * \frac{\text{PIRC}}{100}$$

$$\text{G30} \quad \text{IINV} = \text{IINV72} * \frac{\text{PIINV}}{100}$$

$$\text{G31} \quad \text{SINV72} = \text{SINV72}_{-1} + \text{IINV72}$$

$$\text{G32} \quad \text{M} = \text{M72} * \frac{\text{PM}}{100}$$

$$\begin{aligned}
 \text{G33} \quad \text{GNP72} = & \text{C72} + \text{IBF72} + \text{IRC72} + \text{IINV72} + \left(\frac{\text{GFD} + \text{GFO} + \text{GSL}}{\text{PG}/100} \right) \\
 & + \text{X72}_{-} - \text{M72}
 \end{aligned}$$

$$\text{G34} \quad \text{GNP} = \text{C} + \text{IBF} + \text{IRC} + \text{IINV} + \text{GFD} + \text{GFO} + \text{GSL} + \left(\text{X72} * \frac{\text{PX}}{100} \right) - \text{M}$$

$$\text{G35} \quad \text{PGNP} = \frac{\text{GNP}}{\text{GNP72}} * 100$$

$$\text{G36} \quad \text{FS72} = \text{GNP72} - \text{IINV72}$$

$$\text{G37} \quad \text{FS} = \text{GNP} - \text{IINV}$$

G38
$$\begin{aligned} \text{FSMF72} &= \text{CDA72} + \text{CDFE72} + \text{CDO72} + \text{IBFPD72} \\ &+ \text{X72} - \text{M72} + \left(\frac{\text{GFO} + \text{GFD} + \text{GSL}}{\text{PG}/100} \right) \\ &- \text{EGOV} * 8.709 \end{aligned}$$

G39
$$\text{FSNMF72} = \text{FS72} - \text{SERVE72} - \text{CN72} - \text{FSMF72}$$

G40
$$\begin{aligned} \text{GNPERM72} &= \sum_{i=0}^4 \beta_i * \text{GNP72}_{-i} \\ &\beta_i (.297, .238, .190, .153, .122) \end{aligned}$$

G41
$$\text{GDEBTM} = \frac{\text{GINTF}}{4} \left(\sum_{i=0}^{15} \frac{1}{\left(1 + \frac{\text{RG5}}{400}\right)^i} \right) + \frac{\text{GDEBTP}}{\left(1 + \frac{\text{RG5}}{400}\right)^{15}}$$

G42
$$\text{RBASE} = \left[\left(\frac{\text{MBASE}}{\text{MBASE}_{-1}} \right)^4 - 1 \right] * 100$$

G43
$$\text{RM2PLUS} = \left[\left(\frac{\text{M2PLUS}}{\text{M2PLUS}_{-1}} \right)^4 - 1 \right] * 100$$

G44
$$\text{RCPCD} = \begin{cases} \text{RCP from 1954.1-1962.4} \\ \text{RCD from 1963.1-present} \end{cases}$$

G45
$$\begin{aligned} \text{RPPERM} &= \sum_{i=1}^8 \beta_i * 100 * \Delta \ln \text{PC}_{-i} \\ &\beta_i = (.241, .192, .154, .123, .098 \\ &\quad .079, .063, .05) \end{aligned}$$

G46
$$\text{Q} = 1 + .4 * \frac{\text{RCPCD}}{100} * \frac{1 - \left(\frac{1}{1 + \text{RCPCD}/100} \right)^{21}}{1 - \left(\frac{1}{1 + \text{RCPCD}/100} \right)}$$

G47
$$\text{JCU} = \frac{\text{JIPM}}{\text{JCAP}}$$

G48

$$\begin{aligned}
 \text{QMHT} = & .5 * \sum_{i=1}^8 [-.08798 + .013022 * D5467 + .00601 * D6873 \\
 & - .00090 * D79 - .07218 * \ln \left(\frac{\overline{\text{JIPM}}}{\overline{\text{JCAP}}} \right) \\
 & + .64693 * \overline{(\Delta \ln \text{GNP72})} \\
 & + .01447 * \sum_{j=1}^6 \beta_j * \ln(\text{IBF72} - \text{IPDAG72})_{-j}]_{-i}
 \end{aligned}$$

$$\beta_j = (.1, .15, .25, .25, .15, .1)$$

$$\left(\frac{\overline{\text{JIPM}}}{\overline{\text{JCAP}}} \right) = \frac{1979.4}{\sum_{i=1955.3}} \cdot \frac{\left(\frac{\text{JIPM}}{\text{JCAP}} \right)_i}{98}$$

$$\overline{(\Delta \ln \text{GNP72})} = \frac{1979.4}{\sum_{i=1955.3}} \frac{(\Delta \ln \text{GNP72})_i}{98}$$

NOTATION

Most variables are denoted by a suggestive mnemonic. The following rules are followed throughout: i) the same mnemonic is used to represent current and constant dollar expenditure variables, except that the constant dollar version ends with "72", ii) price deflators are represented by a leading "P" followed by the category mnemonic, iii) all mnemonics for consumption expenditure variables begin with a "C", iv) all mnemonics for investment expenditure variables begin with an "I", v) all mnemonics for a dummy variable begin with a "D", vi) all mnemonics for tax variables or tax rates begin with "T", vii) all mnemonics beginning with "R" represent variables scaled in percentage point units.

In the following list, a variable preceded by * is endogenous to the Michigan Model.

*AUTOS	Units of retail new car sales; millions of units, SAAR.
AUTOSIZE	Ratio of the number of small car sales (domestic and foreign) to total new car sales.
BTRP	Business transfer payments, billions of current dollars.
*C	Personal consumption expenditures, total; billions of current dollars.
*CDAN72	Personal consumption expenditures, new automobiles; billions of 1972 dollars.
*CDA072	CDA72 minus CDAN72, billions of 1972 dollars.
*CDA72	Personal consumption expenditures, motor vehicles and parts; billions of 1972 dollars.
*CDFE72	Personal consumption expenditures, furniture and household equipment; billions of 1972 dollars.
*CD072	Personal consumption expenditures, durable goods except motor vehicles and parts, and furniture and household equipment; billions of 1972 dollars.
*CN72	Personal consumption expenditures, nondurable goods; billions of 1972 dollars.
*CS72	Personal consumption expenditures, services; billions of 1972 dollars.
*C72	Personal consumption expenditures, total; billions of 1972 dollars.
DAPACTM	Dummy variable to reflect Canadian auto pact, values defined in the Appendix.

DASTRIKE	Dummy variable for auto strikes, values defined in the Appendix.
DATE	Quarterly calendar date.
DAUTO	Dummy variable to reflect 1975 auto rebates and reaction to higher auto prices in 1974; equals .90 in 1974.2 and 1974.3, .95 in 1975.1 and 1975.2, equals 1.0 otherwise.
DEX65	Dummy variable for the change in federal excise tax law, equal to 1 from 1954.1-1964.1, 0 otherwise.
DFPR	Dummy variable to reflect shift in relation between RUM and RUG values defined in the Appendix.
DFROFF	Dummy variable for removal of price controls; equals .25 in 1974.2-1975.1, 0 otherwise.
DFRZ1 DFRZ2 DFRZ3	Dummy variable to reflect price freeze and Phase II effects on prices and compensation. DFRZ1 equals -1.0 in 1971.4 DFRZ2 equals .5 in 1971.3, 1.0 in 1971.4 equals zero otherwise DFRZ3 equals 1.0 in 1972.2-1972.4
DGPAY	Dummy variable to reflect government pay increases, values defined in the Appendix.
DJGPM	Dummy variable to reflect increased consumer awareness of gas mileage in the cost of running a new car, equal to zero from 1954.1 to 1974.4, 1 otherwise.
DM72DOCK	Dummy variable for dock strikes, values defined in the Appendix.
DM72SS	Dummy variable to reflect steel strike in import equation; equal to .5 in 1959.2, 1.0 in 1959.3, zero otherwise.
DPGAS	Dummy variable for availability of PGAS series, equal to 1 from 1954.1 to 1957.1, zero otherwise.
DPROP13	Dummy variable for the effect of Proposition 13 on-state and local indirect business taxes; equals 1 in 1978.3, 0 otherwise.
DRAM	Dummy variable for the effect on MRAM of changes in the structure of reserve requirements on demand and time deposits, values defined in the Appendix.
DSEAS1	Dummy variable equal to 1 in the first quarter, -1 in the fourth quarter, zero otherwise.
DSEAS2	Dummy variable equal to 1 in the second quarter, -1 in the fourth quarter, zero otherwise.

DSEAS3	Dummy variable equal to 1 in the third quarter, -1 in the fourth quarter, zero otherwise.
DSPRD	Dummy variable for anomaly in spread between RCP and RTB; equals 1.0 in 1974.2 and 1974.3, zero otherwise.
DTCF	Revenue effect of federal tax law changes on federal corporate taxes, billions of current dollars.
DTEX	Dummy variable to reflect direct price effects of changes in excise tax laws in 1965, values defined in the Appendix.
DTIB	Dummy variable to reflect changes in indirect business taxes, values defined in the Appendix.
DTP	Dummy variable to reflect changes in personal taxes, values defined in the Appendix.
DTPR	Dummy variable for personal tax rate.
DTSI	Dummy variable which assumes values equal to the revenue effect of changes in social insurance tax law, values defined in the Appendix.
DUBEXT	Dummy variable for the extension of unemployment benefits beyond 26 weeks, values defined in the Appendix.
DUM74	Dummy variable in IPD072 equation; equals 0 in 1954.1-1973.4, 1 otherwise.
DUM75	Dummy variable in GDEBTP equation; equals 0 in 1954.1-1974.4, 1 otherwise.
DVNDOWN	Dummy variable to reflect effects of wind-down of Vietnam War on employment; equals 1.0 in 1970.1-1972.2, zero otherwise.
DVNUP	Dummy variable to reflect effects of Vietnam War build-up on employment; equals 1.0 in 1965.3-1966.4, zero otherwise.
D5467	Dummy variable for change in trend growth of productivity; equals 1 in 1954.1-1967.4, 0 otherwise.
D5864	Dummy variable in JCAP equation; equals 1 in 1958.1 - 1964.4, 0 otherwise.
D66	Dummy variable in M1BPLUS equation; equals 0 in 1954.1-1965.4, 1 otherwise.
D674	Dummy variable for state income tax law changes; equals 0 in 1954.1-1967.3, 1 otherwise.
D6873	Dummy variable for change in trend growth of productivity; equals 1 in 1968.1-1973.4, 0 otherwise.

D7074	Dummy variable in JCAP equation; equals 1 in 1970.1 - 1974.2, 0 otherwise.
D711	Dummy variable for state personal income tax law changes; equals 0 in 1954.1-1970.4, 1 otherwise.
D763	Dummy variable in IRC72 equation; equals 1 in 1976.3, 0 otherwise.
D79	Dummy variable for change in trend growth of productivity; equals 0 in 1954.1-1978.4, 1 otherwise.
EGOV	Government employment, including armed forces; millions of persons.
*FDCUR	Change from previous quarter in currency held by the public plus unborrowed reserves, billions of current dollars, SA.
*FS	Final sales, billions of current dollars.
*FSMF72	Final sales of manufactured goods, billions of 1972 dollars.
*FSNMF72	Final sales of non-manufactured goods, billions of 1972 dollars.
*FS72	Final sales; billions of 1972 dollars.
GAID	Grants-in-aid to state and local governments, billions of dollars.
*GCBDD	U.S. government deposits except demand deposits at Federal Reserve Banks, N.S.A., average for last month of the quarter.
*GDEBTM	Market value of federal debt held by private investors, billions of current dollars, N.S.A.
*GDEBTP	Gross public debt of the U.S. Treasury held by private investors, billions of current dollars N.S.A., last day of quarter.
GDIVSL	Dividends received by government, billions of current dollars.
GFD	Federal defense purchases of goods and services, billions of current dollars.
GFO	Federal nondefense purchases of goods and services, billions of current dollars.
*GINTF	Net interest paid by federal government, billions of current dollars.

GINTSL Net interest paid by state and local government, billions of current dollars.

*GNP Gross national product, billions of current dollars.

*GNPERM72 "Permanent" GNP, billions of 1972 dollars.

*GNP72 Gross national product, billions of 1972 dollars.

GOLD Gold stock, billions of current dollars N.S.A., last day of quarter.

GSL State and local government purchases of goods and services, billions of current dollars.

GTRF Federal government transfer payments to foreigners, billions of current dollars.

GTROF GTRP minus YUNB minus GTRSL, billions of current dollars.

*GTRP Government transfer payments to persons, total; billions of current dollars.

GTRSL State and local government transfer payments to persons, billions of current dollars.

GWALDF Government wage accruals less disbursements, federal; billions of current dollars.

GWALDSL Government wage accruals less disbursements, state and local; billions of current dollars.

HINT Interest paid by consumers to business, billions of current dollars.

*HOUSES Private housing starts, thousands of units, SAAR.

HTRF Personal transfers to foreigners, billions of current dollars.

*IBF Business fixed investment, billions of current dollars.

*IBFNC Nonresidential fixed investment, structures; billions of current dollars.

*IBFNC72 Nonresidential fixed investment, structures; billions of 1972 dollars.

*IBFPD Nonresidential fixed investment, producers' durable equipment; billions of current dollars.

*IBFPD72 Nonresidential fixed investment, producers' durable equipment; billions of 1972 dollars.

*IBF72 Business fixed investment, billions of 1972 dollars.

*IINV Change in business inventories, billions of current dollars.

*IINV72 Changes in business, billions of 1972 dollars.

*IPDAG72 Nonresidential fixed investment, producers' durable equipment in agriculture; billions of 1972 dollars.

*IPDO72 Nonresidential fixed investment, producers' durable equipment except in agriculture and production; billions of 1972 dollars.

*IPDQ72 Nonresidential fixed investment, producers' durable equipment in production; billions of 1972 dollars.

*IRC Residential construction expenditures, billions of current dollars.

*IRC72 Residential construction expenditures, billions of 1972 dollars.

IVA Inventory valuation adjustment for corporate profits, billions of current dollars.

*JCAP Index of available capacity in manufacturing.

*JCMH Compensation per manhour, private nonfarm sector; index, 1977 = 100.

*JCMHD Real compensation per manhour; JCMH deflated by personal consumption expenditures implicit deflator.

*JCU Federal Reserve Board index of capacity utilization in Manufacturing, expressed as index between zero and unity (based on 1967 output = 1.0).

JGPM Index of gallons per mile for new cars, 1967 = 1.0.

JICS Index of consumer sentiment, February 1966 = 100.

*JIPM Manufacturing index of industrial production, 1967 = 100.

KCA Total capital consumption allowances with capital consumption adjustments, billions of current dollars.

KCAC Corporate capital consumption allowances with capital consumption adjustments, billions of current dollars.

KCCA Corporate capital consumption adjustment, billions of current dollars.

*M Imports of goods and services, billions of current dollars.

MBASE	Inclusive monetary base, billions of current dollars, S.A., average for last month of quarter.
*MRAM	Reserve adjustment magnitude, as calculated and applied to the monetary base by the Federal Reserve Bank of St. Louis, billions of current dollars N.S.A., average for last month of quarter.
*M1BPLUS	M1B plus total savings at all depository institutions (billions of \$'s; S.A. average for last month of quarter), where M1B equals currency plus demand deposits at commercial banks plus other checkable deposits at all depository institutions including Now accounts, ATS, credit union share drafts and demand deposits at mutual savings banks.
*M2PLUS	M2 plus short term treasury securities (billions of \$'s; S.A. average for last month of quarter), where M2 equals M1B plus savings and small denomination time deposits at all depository institutions, overnight RP's at commercial banks, overnight Eurodollars held by U.S. residents, and money market mutual Fund shares. Short term treasury securities are defined as U.S. Treasury Bills and coupons with remaining maturity of less than 18 months held by the nonbank public less such securities held by money market mutual funds.
*M72	Imports of goods and services, billions of 1972 dollars.
*NIASF	Federal government budget surplus (National Income and Product Accounts Basis), billions of current dollars.
*NIASSL	State and local government budget surplus (National Income and Product Accounts Basis), billions of current dollars.
NINT	Net interest, billions of current dollars.
PAUTO	CPI-W: new cars, 1967 = 100, S.A.
*PC	Personal consumption expenditures implicit deflator, 1972 = 100.
*PCDA	Personal consumption expenditures implicit deflator, motor vehicles and parts; 1972 = 100.
*PCDFE	Personal consumption expenditures implicit deflator, furniture and household equipment; 1972 = 100.
*PCDO	Personal consumption expenditures implicit deflator, durables excluding motor vehicles and parts and furniture and household equipment; 1972 = 100.
*PCN	Personal consumption expenditures implicit deflator, non-durable goods; 1972 = 100.
*PCPI	CPI-U: all items, 1967 = 100, N.S.A.

PCRUDE	Wholesale price index for crude materials less agricultural products; 1967 = 100, S.A.
*PCS	Personal consumption expenditures implicit deflator, services; 1972 = 100.
PFP	Gross farm product implicit deflator, 1972 = 100.
*PG	Government purchases of goods and services implicit deflator, 1972 = 100.
PGAS	CPI-W: Gasoline, motor oil, coolant, and other products; 1967 = 100.
*PGNP	Gross national product implicit deflator, 1972 = 100.
*PIBF	Business fixed investment implicit deflator, 1972 = 100.
PIINV	Inventory investment implicit deflator, calculated as 100 times the ratio of current dollar to constant dollar inventory investment; 1972 = 100.
*PINC	Implicit price deflator business fixed investment: non-residential structures, 1972 = 100.
*PIPD	Implicit price deflator nonresidential fixed investment: producers' durable equipment, 1972 = 100.
*PIPDAG	Implicit price deflator, nonresidential fixed investment, producers' durable equipment in agriculture; 1972 = 100.
*PIPDO	Implicit price deflator, nonresidential fixed investment, producers' durable equipment except in agriculture and production; 1972 = 100.
*PIPDQ	Implicit price deflator, nonresidential fixed investment, producers' durable equipment in production; 1972 = 100.
*PIRC	Residential construction expenditures implicit deflator, 1972 = 100.
PM	Import implicit deflator, 1972 = 100.
*PPNF	Private nonfarm GNP implicit deflator, 1972 = 100.
PX	Export implicit deflator, 1972 = 100.
*Q	Mortgage factor in IRC72 equation.
*QMHT	Trend growth rate of productivity.
*QMH77	Output per manhour, private nonfarm sector; index 1977 = 100.

*RAAA	Corporate Aaa interest rate, percent.
*RBASE	Growth rate of the monetary base, percent annual rate.
*RCD	90 day certificate of deposit rate, percent.
*RCP	Interest rate on 4-6 month prime commercial paper, percent.
*RCPCD	RCP from 1954.1 to 1962.4 and RCD from 1963.1 to present, percent.
RDIS	Discount rate, Federal Reserve Bank of New York; percent.
*REM	Percentage employment rate, males 20 years and over.
*RG5	Yield on U.S. government taxable securities, 5 year issues, percent.
*RHSAVE	Personal savings rate, percent.
*RM2PLUS	Growth rate of M2PLUS, percent annual rate.
*RPPERM	"Permanent" rate of inflation, quarterly rate percent.
RRDEM	Reserve requirement on demand deposits, percent.
*RTB	90 Day Treasury bill rate, daily average of market yield; percent.
*RUG	Global unemployment rate, percent.
*RUM	Unemployment rate, males 20 years and over; percent.
SDR	Allowance for Special Drawing Rights, billions of current dollars, N.S.A., last day of quarter.
*SERVE72	Services component of real GNP, billions of 1972 dollars.
*SINV72	Four times the stock of business inventories, billions of 1972 dollars, end of quarter.
SLCSF	Subsidies less current surplus of government enterprise, federal; billions of current dollars.
SLCSSL	Subsidies less current surplus of government enterprise, state and local, billions of current dollars.
*STAT	Statistical discrepancy in National Income and Product Accounts, billions of current dollars.
*TC	Total corporate profits tax accruals, billions of current dollars

*TCF Corporate profits tax accruals, federal; billions of current dollars.

TCFR Federal statutory corporate tax rate.

TCO Treasury currency outstanding, billions of current dollars, N.S.A., last day of quarter.

*TCSL Corporate profits tax accruals, state and local; billions of current dollars.

TDEPRAG Tax depreciation rate for agricultural equipment.

TDEPRNC Tax depreciation rate for non-residential structures.

TDEPRO Tax depreciation rate for other equipment.

TDEPRQ Tax depreciation rate for production equipment.

*TIB Indirect business tax and nontax accruals, billions of current dollars.

*TIBF Indirect business tax and nontax accruals, federal, billions of current dollars.

*TIBSL Indirect business tax and nontax accruals, state and local, billions of current dollars.

TIME Time trend equal to 1 in 1954.1 and increasing by 1 per quarter.

TITCR Tax rate for investment tax credit.

*TP Total personal tax and nontax payments, billions of current dollars.

TPNS Nonwithheld component of 1968-69 personal income tax surcharge, values defined in the Appendix.

*TPSE Personal tax and nontax payments, state and local; billions of current dollars.

*TSI Total contributions for social insurance, billions of current dollars.

*TSIF Contributions for social insurance, federal; billions of current dollars.

TSIFR Total social security tax rate.

*TSIP Personal contributions for social insurance, billions of current dollars.

TSISL	Contributions for social insurance, state and local; billions of current dollars
μ	A regression residual, used in equations which were fitted with correction for first order autocorrelation of residuals.
*UCKNC	User cost of capital investment in non-residential structures.
*UCKPDQ	User cost of capital investment in nonresidential producers' durable equipment, production.
*ULC77	Unit labor cost, private nonfarm sector; 1977 = 100.
WALD	Wage accruals less disbursements, total; billions of current dollars.
WCEIL	Wage ceiling for social security taxes, thousands of current dollars.
WUSMIN	Minimum hourly wage, current dollars.
X72	Exports of goods and services, billions of 1972 dollars.
*YCBT	Corporate profits before taxes; billion of current dollars.
*YCP	Corporate profits with inventory valuation adjustment and capital consumption adjustment; billions of current dollars.
*YD	Disposable personal income, billions of current dollars.
*YD72	Disposable personal income, billions of 1972 dollars.
*YFP	Farm proprietors income with inventory valuation and capital consumption adjustments, billions of current dollars.
YGWS	Government wage and salary disbursements, including military; billions of current dollars.
*YNFP	Nonfarm proprietors income with inventory valuation and capital consumption adjustments, billions of current dollars.
*YOL	Other labor income, billions of current dollars.
*YP	Personal income, billions of current dollars.
*YPDIV	Corporate dividend payments to persons, billions of current dollars.
*YPERM72	Permanent disposable income, billions of 1972 dollars.
YPINT	Personal interest income, billion of current dollars.

YPRENT	Rental income of persons with capital consumption adjustment, billions of current dollars.
*YPWS	Private wages and salaries, billions of current dollars.
*YT72	Transitory income, billions of 1972 dollars.
:YUNB	Total unemployment benefits paid, billions of current dollars.

APPENDIX

This appendix notes only non-zero values of dummy variables. All unspecified values may be assumed to be zero.

<u>DAPACTM</u>		<u>DASTRIKE</u>	
0.03	1963.1-1963.2	-2.0	1964.4
0.10	1963.3-1964.3	1.2	1965.1
0.26	1964.4-1965.3	0.8	1965.2
0.65	1965.4	-1.0	1967.4
1.00	1966.1-1966.3	0.75	1968.1
1.82	1966.4-1967.3	0.25	1968.2
2.65	1967.4-1968.3	-3.6	1970.4
3.65	1968.4-1969.3	2.4	1971.1
4.00	1969.4-1975.2	1.2	1971.2
3.75	1975.3	-0.5	1973.4
3.50	1975.4 to present	0.375	1974.1
		0.125	1974.2
		-1.0	1976.4
		0.75	1977.1
		0.25	1977.2
<u>DFPR</u>		<u>DGPAY</u>	
1.0	1965.1	1.0	1955.2
2.0	1965.2	1.0	1955.4
3.0	1965.3	1.0	1956.3
.		1.0	1957.3
.		1.0	1960.1-1960.3
23.0	1970.3	1.0	1961.4
24.0	1970.4-1975.4	1.0	1962.4
25.0	1976.1	1.0	1963.4
26.0	1976.2	1.0	1964.3
27.0	1976.3	1.0	1965.4
.		1.0	1967.4
.		1.0	1968.3
39.0	1979.3	1.0	1969.3
40.0	1979.4 to present	1.0	1970.1
		1.0	1971.1
		1.0	1972.1
		1.0	1973.1
		1.0	1973.4
		1.0	1974.4
		1.0	1975.4
		1.0	1976.4
		1.0	1977.4
		1.0	1978.4
		1.0	1979.4
		1.0	1980.4
		1.0	1980.4
<u>DM72DOCK</u>			
-1.0	1965.1		
1.0	1965.2		
-3.0	1969.1		
2.5	1969.2		
0.5	1969.3		
-1.0	1971.3		
-3.0	1971.4		
4.0	1972.1		
-1.0	1977.3		
1.0	1977.4		

DRAM

3.4232 1972.4
-0.6968 1973.1
-2.59 1978.4
3.5 1980.3
3.0 1980.4

DTP

-2.5 1964.1
-5.0 1964.2
-0.3 1964.4
0.6 1965.1
-0.3 1965.2
-1.2 1965.3
-0.3 1965.4
2.0 1966.1-1966.2
-1.5 1967.2
1.0 1968.2
6.1 1968.3
1.0 1968.4
3.6 1969.1
0.2 1969.2
-3.8 1969.3
-2.1 1970.1
-6.8 1970.3
-6.5 1971.1
9.5 1972.1
-8.0 1973.1
-1.0 1973.2
1.8 1973.3
-39.7 1975.2
27.4 1975.3
0.4 1975.4
-1.5 1976.1
0.2 1976.2
1.2 1976.3
0.3 1977.2
-4.0 1977.3
-0.1 1977.4
-4.2 1978.1
-1.0 1978.2
4.0 1978.3
-10.0 1979.1
-10.0 1980.1

DTEX

-0.6 1965.2
-1.8 1965.3
-0.6 1965.4
-1.8 1966.1
0.3 1966.2-1966.3
0.3 1970.3
-0.8 1971.3
-1.3 1971.4
-0.1 1972.1
-0.1 1973.1
-0.1 1974.1
-0.1 1975.1
-0.4 1977.1

DTIB

-0.496 1958.3
-0.339 1959.2
0.339 1959.3
-0.971 1965.2-1965.3
-1.452 1966.1
0.474 1968.1
-0.634 1971.2-1971.3
-1.276 1972.1
0.831 1975.2-1975.3
-3.2 1976.1
-0.1 1976.4
-0.35 1978.1
-0.4 1979.1
2.4 1980.1
6.8 1980.2
3.0 1980.3
4.9 1980.4

DUBEXT

0.133 1958.3
0.220 1961.2
0.230 1972.1
0.212 1975.1
0.162 1975.2
0.117 1975.3
0.022 1975.4
0.011 1976.1
0.027 1977.1

<u>DTSI</u>		<u>TPNS</u>	
1.1	1957.1	0.8	1968.3-1968.4
1.6	1959.1	4.2	1969.1-1969.2
2.2	1960.1	0.2	1969.3-1969.4
1.4	1952.1	1.4	1970.1-1970.2
1.6	1963.1	0.4	1970.3-1970.4
5.0	1966.1		
1.5	1967.1		
2.2	1968.1		
2.0	1969.1		
3.4	1971.1		
3.5	1972.1		
11.5	1973.1		
4.3	1974.1		
1.5	1975.1		
2.7	1977.1		
5.9	1978.1		
9.2	1979.1		
3.6	1980.1		

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