STRUCTURAL CHANGE AND POSTWAR ECONOMIC STABILITY:

AN ECONOMETRIC TEST

E. Philip Howrey

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ABSTRACT

It is sometimes suggested that the United States economy is currently more stable than it was before World War II. The reaction to a given change in autonomous expenditure, for example, is thought to be less violent now than it was in the 1920's and 30's. The relative stability of the postwar period as contrasted to the instability of the interwar period is often attributed, at least in part, to structural changes that have taken place since the 1930's. The purpose of this paper is to explore within the context of several simple macroeconomic models the magnitude and significance of the structural changes that have taken place since the 1930's.

The method that is used to examine the structural-change hypothesis is first to estimate separately for 1921-41 and 1946-66 the parameters of a macroeconomic model of income determination. The parameter estimates are then compared to see if there are any significant differences between the two periods. Finally, the dynamic properties of the systems for each of the subperiods are derived and compared. The presumption is that the parameter estimates and the implied system behavior will reflect the structural changes that have been effected since the great depression.

A set of muliplier models was analyzed in which consumption expenditure is the only endogenous expenditure variable. The results

indicate that significant parameter shifts have taken place between the two subperiods. However, whether or not these shifts have contributed to economic stability is somewhat problematical. Although the expenditure multipliers are in most instances smaller for the postwar model than for the interwar model, the differences are not statistically significant.

A multiplier-accelerator model was also estimated for the two separate periods. A comparative dynamic analysis of the two structures indicates that the postwar structure is more stable than the interwar model in the sense that the characteristic roots of the postwar model are smaller in absolute value than the characteristic roots of the interwar model. It was also found, however, that the postwar expenditure multipliers for this model were larger than the interwar multipliers. Again the differences were not statistically significant. Although these results are of some interest in their own right, they suggest that a more delicate approach may be necessary in order to resolve the structural-change hypothesis.

STRUCTURAL CHANGE AND POSTWAR ECONOMIC STABILITY: AN ECONOMETRIC TEST

E. Philip Howrey*

I. Introduction

It is sometimes suggested that the United States economy is currently more stable than it was before World War II. The reaction to a given change in autonomous expenditure, for example, is thought to be less violent now than it was in the 1920's and 30's. The relative stability of the postwar period as contrasted with the instability of the interwar period is often attributed, at least in part, to structural changes which have taken place since the 1930's. The increased reliance on automatic stabilizers such as the corporate profits tax, progressive income tax, unemployment compensation and other transfer payments is said to provide the economy with an increased measure of stability. However, the increased stability of the postwar period has also been explained by favorable trends in population and other variables which are usually assumed to be exogenous and by more active discretionary monetary and fiscal policy.[1] The purpose of this paper is to explore within the context of several simple macroeconomic models the magnitude and implications of the structural changes which have taken place since the 1930's.

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[1]For a discussion of the various factors that are sometimes suggested as being responsible for the relative stability of the postwar period, see Gordon [8, pp. 215-217] and Burns [3].

Two types of indirect evidence have been advanced to support the structural-change hypothesis. First, the remarkable ability of the economy to withstand the periodic deflationary pressures which have appeared in the postwar period is sometimes used to support the hypothesis. The second type of empirical support is based on an analysis of the effectiveness of the automatic stabilizers which have been instituted since the chaotic period of the 1930's.[2]

A more direct test of the structural-change hypothesis is attempted in this paper. This test involves a comparison of the properties of two identically specified models, the parameters of which have been estimated separately from annual data for the sub-periods 1921-41 and 1946-66. A comparison of the parameter estimates for these two periods obviates the necessity to formulate the stabilizers explicitly for the effects of structural change should be reflected in the reduced-form parameter estimates. It seems reasonable to suppose, for example, that the post-war autonomous expenditure multiplier is smaller than the corresponding multiplier for the interwar period. In addition, the dynamic properties of the sub-period models should reflect the presumed increased stability resulting from structural changes which have taken place between these two periods.

In the next section, the properties of a simple multiplier model estimated from interwar and postwar data are explored. Then in Section III a multiplier-accelerator model is examined. Although these models are quite simple, they do lead to some interesting conjectures about the impact and statistical significance of structural change experienced by the United States economy during the last half century.

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[2]For a discussion of the effectiveness of various automatic stabilizers, the reader is referred to Eilbott [6] and the referenced cited there.

II. The Multiplier Model

The regression results described in this section are based on an elementary model of income determination which is quite similar in its construction to a model formulated by Klein [13, pp. 80-84]. The basic equation of the system is the consumption function in which consumption expenditure C is assumed to depend on current and lagged disposable income Y^d, current and lagged cash balances M, and lagged consumption expenditure:

$$(1) \qquad C_t = \alpha_o + \alpha_1 Y_t^d + \alpha_2 Y_{t-1}^d + \alpha_3 M_t + \alpha_4 M_{t-1} + \alpha_5 C_{t-1} \ .$$

Disposable income is defined by

$$(2) \qquad Y_t^d = Y_t - T_t$$

where Y is total income and T is equal to tax receipts less transfers to the private sector which in turn is assumed to be a linear function of income:

$$(3) \qquad T_t = \beta_o + \beta_1 T_t \ .$$

The system is completed by setting income equal to consumption expenditure plus autonomous expenditure:

$$(4) \qquad Y_t = C_t + A_t \ .$$

Attention will be focussed in what follows on the reduced form of the income equation implied by this system. This reduced form equation is given by

$$(5) \qquad Y_t = \gamma_o + \gamma_1 Y_{t-1} + \gamma_2 A_t + \gamma_3 A_{t-1} + \gamma_4 M_t + \gamma_5 M_{t-1} .$$

During the course of this investigation several different specifications of this equation were estimated. These alternative models, obtained by setting various combinations of the parameters equal to zero, are as follows.

Model	Characteristics
I	$\gamma_3 = \gamma_4 = \gamma_5 = 0$
II	$\gamma_3 = \gamma_5 = 0$
III	$\gamma_3 = 0$
IV	no constraints

Model I corresponds to the simplest autonomous expenditure model in which income responds to exogenous expenditure with a Koyck-type distributed lag. In Model II both autonomous expenditure and the money supply are included as explanatory variables to which income responds with a distributed lag. The last two models allow for a more complex adjustment process by including lagged values of autonomous expenditure and the money supply.

Since macroeconomic multipliers are of interest here, the concept of income that is used in the regression analysis is gross national product. Autonomous expenditure is taken to be gross private domestic investment plus government expenditure, and the money supply

is "Friedman-Schwartz" money which includes time deposits in addition to demand deposits adjusted plus currency in circulation.[3] As the controversy over the relative stability of the expenditure multiplier versus the velocity of circulation has shown, the choice of these definitions is somewhat arbitrary. For example, other variables such as net national product, personal income, disposable income, or consumption expenditure could have been used as the dependent variable.[4] Regardless of the choice, however, the presumption is that the parameter estimates for the two separate periods should reflect the structural changes that have taken place within the system so defined, provided the same sets of variables are used for the two periods.

The four models described above were estimated using nominal quantities, real quantities, and per capita real qualtities. The results using nominal quantities are shown in Table 1, real-quantity results are given in Table 2, and the per capita results are described in Table 3. The entries in these tables include the regression coefficients and their estimated standard errors, coefficients of determination adjusted for degrees of freedom ($\bar{R}^2$), and the standard error of the estimate (s). The coefficients of determination all exceed .95 and the null hypothesis that the vector of regression coefficients is not significantly different from zero can be rejected at the one percent level.[5] While the coefficients of autonomous expenditure and lagged income are significantly different from zero for all the different forms of the model, the significance of the coefficients of the money supply is more variable.

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[3]For the 1921-1941 period the data were taken from Klein [13,p.142]. Comparable series spanning the period 1946-1966 were derived from data published in [14], [15], and [16].

[4]For a detailed discussion of the variables that might be and have been used to test similar multiplier models of the process of income determination, see [1], [5], and [7].

[5]The standard significance tests are impaired somewhat by the fact that

TABLE 1. The Nominal Multiplier Model, 1921-41 and 1946-66

Model	Regression Coefficients Standard Errors						Summary Statistics	
	Constant	Y_{-1}	A	A_{-1}	M	M_{-1}	$\bar{R}^2$	s
1921-1941								
I	18.80	.308	1.688				.962	3.19
	4.60	.075	.135					
II	25.54	.346	1.937		-.300*		.970	2.95
	5.45	.072	.177		.152			
III	23.20	.472	1.481		.579*	-.855	.985	2.30
	4.31	.067	.194		.287	.255		
IV	14.27	.808	1.602	-1.058*	.627	-.858	.986	2.12
	6.11	.185	.189	.550	.266	.234		
1946-1966								
I	19.83	.604	1.114				.996	9.91
	8.53	.113	.272					
II	-6.68	.388	1.034		.556		.999	6.06
	7.14	.079	.167		.102			
III	-21.39*	.324	1.107		.006*	.712*	.999	5.82
	11.87	.087	.167		.375	.469		
IV	-16.20*	.717	1.224	-.814	.018*	.382*	.999	4.48
	9.25	.135	.133	.214	.288	.373		

*Not significantly different from zero at the 5 percent level.

TABLE 2. The Real Multiplier Model, 1921-41 and 1946-66

Period	Regression Coefficients Standard Errors						Summary Statistics	
	Constant	Y_{-1}	A	A_{-1}	M	M_{-1}	$\bar{R}^2$	s
1921-1941								
I	21.49	.276	1.560				.977	2.20
	3.79	.078	.128					
II	21.12	.204	1.525		.150*		.981	2.08
	3.60	.085	.129		.088			
III	20.29	.244	1.430		.521*	-.387*	.983	2.03
	3.57	.088	.145		.290	.289		
IV	11.03*	.727	1.608	-1.196*	.469*	-.461*	.987	1.84
	5.56	.245	.158	.584	.264	.265		
1946-1966								
I	8.12*	.667	.929				.994	4.34
	5.50	.090	.201					
II	-4.65*	.409	1.090		.475		.997	2.96
	4.69	.084	.142		.105			
III	-4.56*	.410	1.088		.481*	-.007*	.997	3.06
	5.67	.090	.171		.251	.244		
IV	-2.53	.787	1.168	-.766	.443	-.253*	.998	2.43
	4.54	.140	.138	.244	.200	.209		

* Not significantly different from zero at the 5 percent level.

TABLE 3. The Per Capita Real Multiplier Model, 1921-41 and 1946-66

Period	Regression Coefficients Standard Errors						Summary Statistics	
	Constant	Y_{-1}	A	A_{-1}	M	M_{-1}	$\bar{R}^2$	s
1921-1951								
I	219.92	.197	1.600				.973	15.58
	32.78	.076	.114					
II	227.46	.204	1.633		-.045*		.974	15.93
	36.64	.079	.133		.088			
III	221.01	.247	1.524		.403*	-.464*	.978	15.02
	34.75	.078	.141		.271	.268		
IV	146.69	.592	1.616	-.857*	.405*	-.487*	.981	14.49
	61.16	.250	.150	.590	.262	.259		
1946-1966								
I	198.45	.397	1.325				.974	31.47
	78.33	.127	.037					
II	-61.06*	.213	1.381		.683		.986	23.13
	62.84	.079	.141		.115			
III	-2.15*	.370	1.022		.970	-.430	.990	20.15
	59.73	.094	.190		.153	.174		
IV	10.93*	.750	1.074	-.747	.919	-.664	.994	16.63
	49.52	.155	.158	.264	.128	.166		

* Not significantly different from zero at the 5 percent level.

In particular, the significance of the money supply as a partial determinant of income seems to be more evident in the postwar period than it was in the interwar period.

A first test of the structural-change hypothesis can now be formulated. If $\underline{\alpha}_1$ ($\underline{\alpha}_2$) denotes the vector of regression coefficients for the interwar (postwar) period, the null hypothesis that no structural change has taken place between the two periods is expressed by $\underline{\alpha}_1 = \underline{\alpha}_2 = \underline{\alpha}$. Using the test described by Chow [4], the F-ratio's appropriate for a test of the structural-change hypothesis are shown in Table 4. From this table it is clear that the null hypothesis is rejected at the five percent level for all but one of the models; for five of the models the null hypothesis is rejected at the one percent level. This indicates that within the framework of these simple models, the data support the structural-change hypothesis at the aggregate level.

TABLE 4. F-Ratios for a Test of the Structural-Change Hypothesis

Model	Nominal	Real	Real Per Capita
I	F(3,34) = 3.24*	F(3,34) = 2.93*	F(3,34) = 2.02
II	F(4,32) = 3.32*	F(4,32) = 5.20#	F(4,32) = 7.73#
III	F(5,30) = 4.25#	F(5,30) = 4.04#	F(5,30) = 6.72#
IV	F(6,28) = 3.18*	F(6,28) = 2.38*	F(6,28) = 3.52*

* Indicates significant structural change at the 5 percent level

\# Indicates significant structural change at the 1 percent level

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[5](continued) the Durbin-Watson statistic, even though it is biased toward two by the inclusion of the lagged value of the dependent variable in the equation, suggests that the residuals are not serially uncorrelated. This tends to inflate the coefficient of determination and reduce the standard errors of the estimates of the coefficients. For this reason the significance tests need to be interpreted with some caution.

In order to determine whether or not the parameter changes between the two periods have resulted in a more stable structural system, several comparisons can be made. The first and simplest comparison involves the impact multiplier associated with a unit change in autonomous expenditure. Estimates of the impact multiplier are provided by the regression coefficients of the autonomous expenditure term in Tables 1-3. A model-by-model comparison of these estimates of the impact multiplier indicates that the postwar multipliers are smaller than the corresponding prewar estimates. The range for the prewar autonomous expenditure multipliers is 1.4 to 1.7 while the postwar multiplier range from 0.9 to 1.4. According to these models a unit change in investment has a smaller impact now than it did in the interwar period and hence the economy is somewhat less vulnerable to erratic changes in autonomous expenditure than it was in the earlier period. This evidence is thus consistent with the hypothesis that structural change has exerted a stabilizing influence on aggregate income.

A second comparison between the two periods involves the long-run equilibrium multipliers shown in Table 5. A quick glance at this table indicates that for eight of the twelve models, the long-run multiplier is smaller during the postwar period than it was during the interwar period. In four cases, however, just the reverse is true. In some cases the differences in the multipliers seems to be rather large. For Nominal Model II for example, the interwar long-run multiplier is 2.96 and the postwar multiplier is 1.69. Even so the two multipliers are not significantly different at the five percent level.[6] From a purely

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[6]This conclusion is based on the fact that the 95% confidence interval for the interwar multiplier includes the postwar multiplier. For a discussion of the construction of confidence intervals on the ratio of linear functions of regression coefficients, see Griliches [9].

descriptive point of view these estimates lend some credibility to the hypothesis that stabilizing structural change has taken place although the evidence is not completely convincing from the point of view of statistical inference.

Another interesting comparison of the interwar and postwar systems involves the speed of adjustment to changes in autonomous expenditure.

TABLE 5. Long-Run Autonomous Expenditure Multipliers, 1921-41 and 1946-66

Model	Nominal	Real	Real Per Capita
1921-1941			
I	2.44	2.21	1.19
II	2.96	1.92	2.34
III	2.80	1.89	2.02
IV	2.83	1.51	1.86
1946-1966			
I	2.81	2.79	2.20
II	1.69	1.84	1.75
III	1.64	1.84	1.62
IV	1.45	1.89	1.31

These differences are particularly pronounced for Model I in which the prewar impact multipliers are all smaller than the corresponding postwar impact multipliers but the long-run multipliers are larger for the postwar period than for the interwar period. The average lag implied by the distributed lag relationship between income and autonomous expenditure is longer for the postwar period than it is for the interwar period. Using Nominal Model I to illustrate this point, the average interwar lag is less than six months (.45 of a year) while the postwar lag is almost

exactly one year. Stated alternatively, 91% of the total response to a change in autonomous expenditure is completed within one year in the interwar period; in the postwar period only 64% of the total response is achieved within a year.[7] The slower transition rate from one equilibrium state to another implied by the postwar models imparts a certain amount of smoothness to the disequilibrium adjustment path and therefore is consistent with stabilizing structural change.

This last point is illustrated quite strikingly by the power spectra implied by the two models. The power spectra implied by the interwar and postwar versions of Model I are shown in Figure 1. These graphs indicate in terms of the distribution of variance among different frequency components the response of income to a sequence of independent random variables.[8] Since the area under the curve is the variance of income, it is clear that the implied variance of income during the postwar period is greater than the variance of income during the interwar period. This is due in part to the fact that the estimated variance of the residuals from the linear regression model is larger for the postwar model. But even if the residual variance had been the same for the two periods, the postwar variance of income would have been larger because the speed of adjustment is slower postwar than it was prewar.[9] It is also apparent that while the spectra implied by both models slope downward which indicates that low-frequency variations contribute more to the variance of the implied income series than do high-frequency variations, the postwar spectrum has a more pronounced downward slope. This means that low-frequency variation is relatively more pronounced in the postwar period than it was in the interwar period.

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[7] For a model of the form $Y_t = \alpha Y_{t-1} + \beta X_t$, the average lag is equal to $\alpha/(1-\alpha)$ and the fraction of the total response to a unit change in the independent variable X that is completed in one year is $\beta(1+\alpha)/[\beta/(1-\alpha)]=1-\alpha^2$.

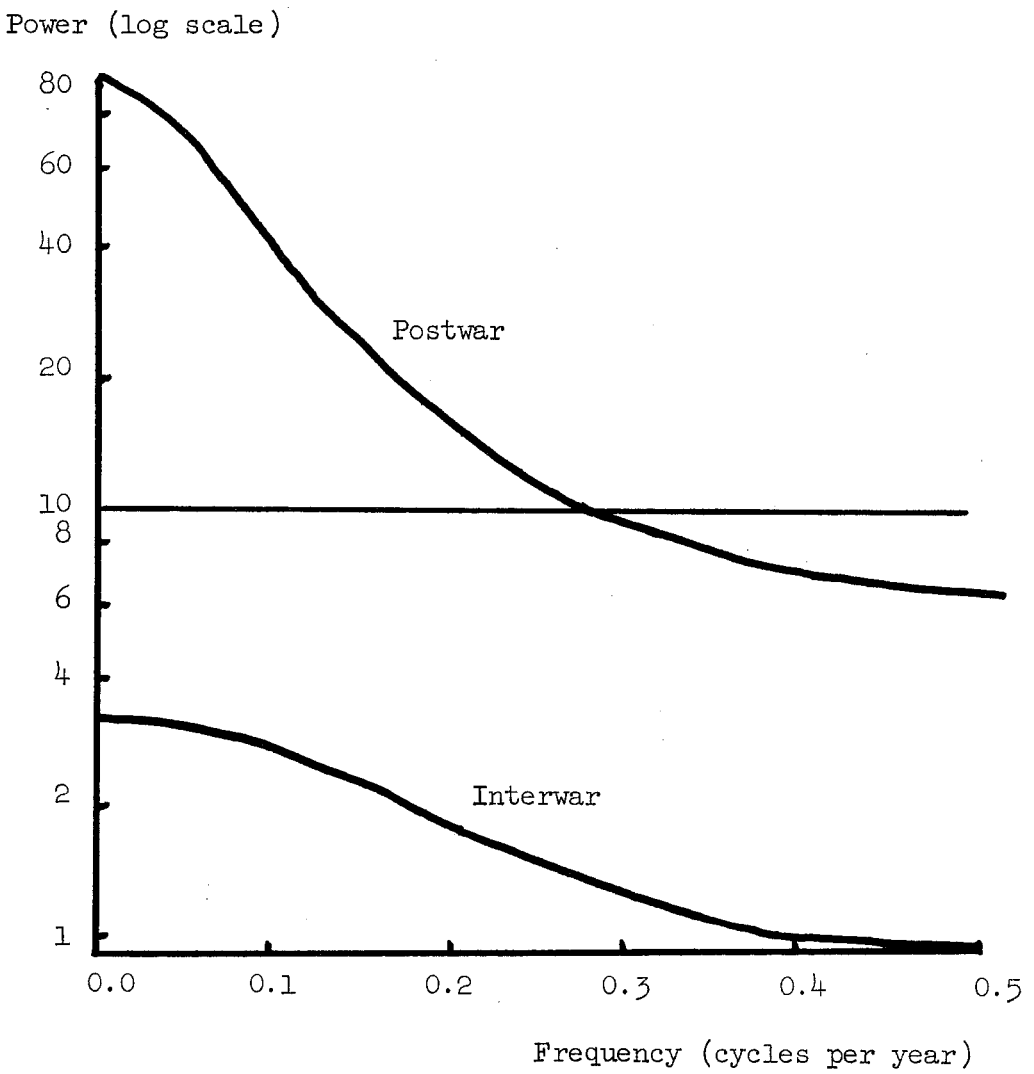

Figure 1. Power Spectra of Income Implied by the Interwar and Postwar Multiplier Models.

The simple multiplier models described here are for the most part consistent with the hypothesis that structural change is responsible, at least in part, for the increased stability that the United States economy has enjoyed during the postwar period. For all but one of the models that were estimated, the null hypothesis of no structural change is rejected at the 95% level. In all cases the autonomous expenditure impact multipliers are smaller for the postwar era than they were in the 1920's and 30's. The corresponding long-run multipliers are also smaller for the postwar period although here there are several exceptions. Finally, the models imply that the economy responds less rapidly to changes in autonomous expenditure now than was the case during the inter-war period. It should be mentioned that these differences are not sharp enough to be verified by tests of statistical significance, but they do emerge as descriptive features of the models.

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[8] The power spectrum of the stochastic process $Y_t = \alpha Y_{t-1} + u_t$ where u_t is a sequence of serially independent random variables with mean zero and variance σ^2 is given by $|1-\alpha e^{-i\omega}|^{-2}\sigma^2/2\pi$ for $-\pi \leq \omega \leq \pi$ ($i = \sqrt{-1}$). For a real-valued process, the spectrum is symmetric so only the values for $0 \leq \omega \leq \pi$ are shown in Figure 1.

[9] This follows from the fact that the variance of income generated by $Y_t = \alpha Y_{t-1} + u_t$ is $\sigma^2/(1-\alpha^2)$ where σ^2 is the variance of the serially uncorrelated random variable u_t.

III. A Multiplier-Accelerator Model

The multiplier models of the preceding section assume that all non-consumption expenditure is autonomously determined. This assumption is relaxed in this section by adding a flexible-accelerator type investment function to the model. The multiplier-accelerator model to be explored in this section consists of three equations:

$$(6) \qquad C_t = \alpha_o + \alpha_1 Y_{t-1} + u_{1t}$$

$$(7) \qquad I_t = \beta_o + \beta_1 (Y_t - Y_{t-1}) + \beta_2 t + \beta_3 I_{t-1} + u_{2t}$$

$$(8) \qquad Y_t = C_t + I_t + G_t$$

In this system C, I, G, Y, and t denote, respectively, personal consumption expenditure, gross private domestic investment, government expenditure, gross national product, and time. The consumption function differs from the relationship specified in the preceding section in that (real) cash balances are not included. In addition a one period expenditure lag is assumed. The investment equation includes an accelerator term, a trend term, and lagged investment expenditure as explanatory variables. Government expenditure is taken to be exogenously determined. This again is a highly simplified aggregate model, but it is reasonable to conjecture that the parameter estimates and implied dynamic properties of the model will reflect the structural changes which have taken place since the 1930's.

The coefficients of this model were estimated by ordinary least squares since the model is fully recursive provided the off-diagonal

elements in the covariance matrix of the disturbance process are zero. Proceeding on the assumption that this condition is satisfied, the least-squares estimates are consistent. In the course of the estimation it was found that the estimated residuals of the consumption function were significantly correlated for both the 1921-41 and the 1946-66 periods. The modified least-squares procedure discussed by Johnston [11, pp. 193-4] was used. The consumption function estimates that were obtained are as follows.[10]

$$(6') \quad C_t - .46C_{t-1} = 24.3 + 0.55(Y_{t-1} - .46Y_{t-2}) \qquad \bar{R}^2 = .65$$
$$(9.1) \quad (.09) \qquad s^2 = 46$$

$$(6'') \quad C_t - .25C_{t-1} = -6.1 + 0.68(Y_{t-1} - .25Y_{t-2}) \qquad \bar{R}^2 = .95$$
$$(12.9) \quad (.04) \qquad s^2 = 91$$

Interestingly enough the propensity to consume is not significantly different in these two subperiods. What is different is the constant terms and the degree of serial correlation of the residuals which is reflected in the quasi-differencing parameters used in the two periods.

The major differences between the two subperiods appear in the investment equations. In the interwar period the trend term is not significantly different from zero and it was deleted from the regression equation. The resulting investment function is

$$(7') \quad I_t = 1.1 + 0.38(Y_t - Y_{t-1}) + 0.80I_{t-1} \qquad \bar{R}^2 = .83$$
$$(1.2) \quad (.07) \qquad (.10) \qquad s^2 = 6$$

[10] The data for the interwar period are expressed in constant (1929) dollars and were taken from Kendrick [12, pp. 294-5]. The postwar data are deflated national income and product accounts data from the Survey of Current Business [15].

For the postwar period the trend term is significant and the resulting equation is

$$(7'') \quad I_t = \underset{(614)}{-1634} + \underset{(.08)}{0.49}(Y_t - Y_{t-1}) + \underset{(.32)}{0.86}t + \underset{(.16)}{0.33}I_{t-1} \qquad \bar{R}^2 = 90, \; s^2 = 16$$

The other major difference between these two equations is the estimated coefficient of lagged investment. The larger interwar coefficient implies that the mean lag between investment and changes in income is 4 years while the postwar lag is only about six months (.49 of a year).

The implications of these differences between the two systems of equations can be explored most easily by first determining the final form of the income equation. Introducing the lag operator L defined by $LY_t = Y_{t-1}$, the final forms of the income equations for the two periods are

$$(9') \quad (1-.46L)(1-1.56L + .71L^2)Y_t = 9 + (1.61-2.03L + .60L^2)G_t + (1.61-1.29L)u_{1t} + (1.61-.74L)u_{2t}$$

$$(9'') \quad (1-.25L)(1-1.02L + .44L^2)Y_t = -2411 + 1.26t + (1.96-1.14L + .17L^2)G_t + (1.96-.65L)u_{1t} + (1.96-.49L)u_{2t}$$

The characteristic roots of these two difference equations in Y_t are (.46, $.78 \pm .32i$) for the interwar period and (.25, $.51 \pm .42i$) for the postwar period. The pair of complex roots for the interwar period implies

a period of 16.5 years with a damping factor of .84. For the postwar period, the complex roots have a period of 9.1 years and a damping factor of .66. In business cycle terminology, the interwar period is characterized by a "long-swing model" whereas the postwar period is represented by a "major-cycle model." Thus the structural changes that are reflected in the parameter estimates of this model have resulted in a higher frequency of oscillation with a reduced amplitude (i.e., increased damping factor).

The long-run expenditure multipliers implied by these two systems can easily be obtained from the final-form equations. In the case of the interwar period, the government expenditure multiplier is 2.25 and the postwar multiplier is 3.14. Again it is found that the comparative static multiplier is slightly larger for the postwar period than for the prewar period.

The impulse response functions implied by these two models are shown in Figure 2. These functions indicate the response of income to a unit pulse in government expenditure, i.e., an increase in G followed by a return to its previous level. The postwar impact of a change in autonomous expenditure is larger than the impact implied by the interwar model (1.96 versus 1.61), but the postwar response damps out more quickly than does that of the interwar model. In both cases the response is oscillatory.

The power-spectra of income implied by the two models are shown in Figure 3. It is clear from these spectra that the postwar variance of income is larger than the variance of income implied by the interwar model. The postwar power spectrum is characterized by a relative peak at 10.0 years per cycle while the interwar model exhibits a relative peak at 15.4 years per cycle. The postwar spectrum is somewhat less peaked

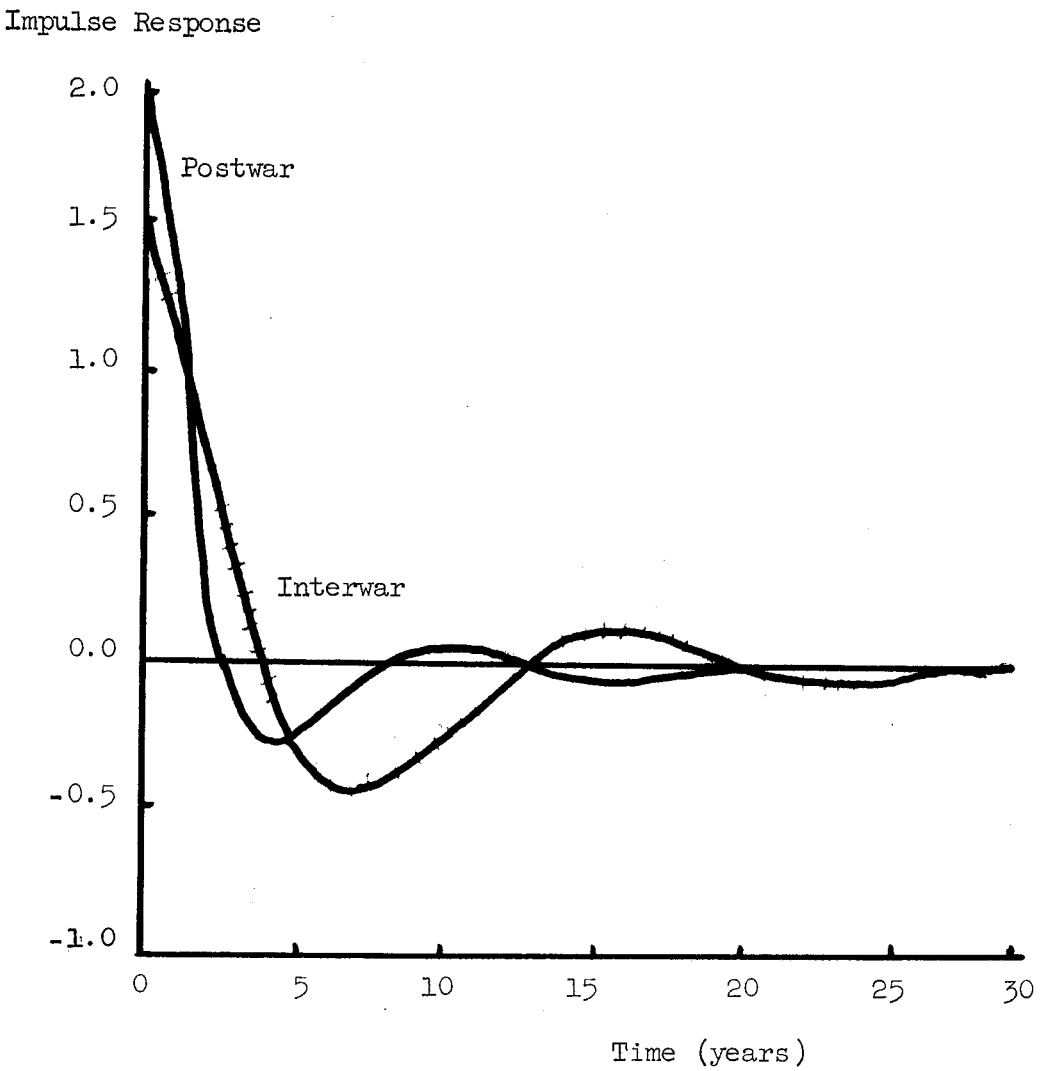

Figure 2. Impulse Response Functions of the Interwar and Postwar Multiplier-Accelerator Models.

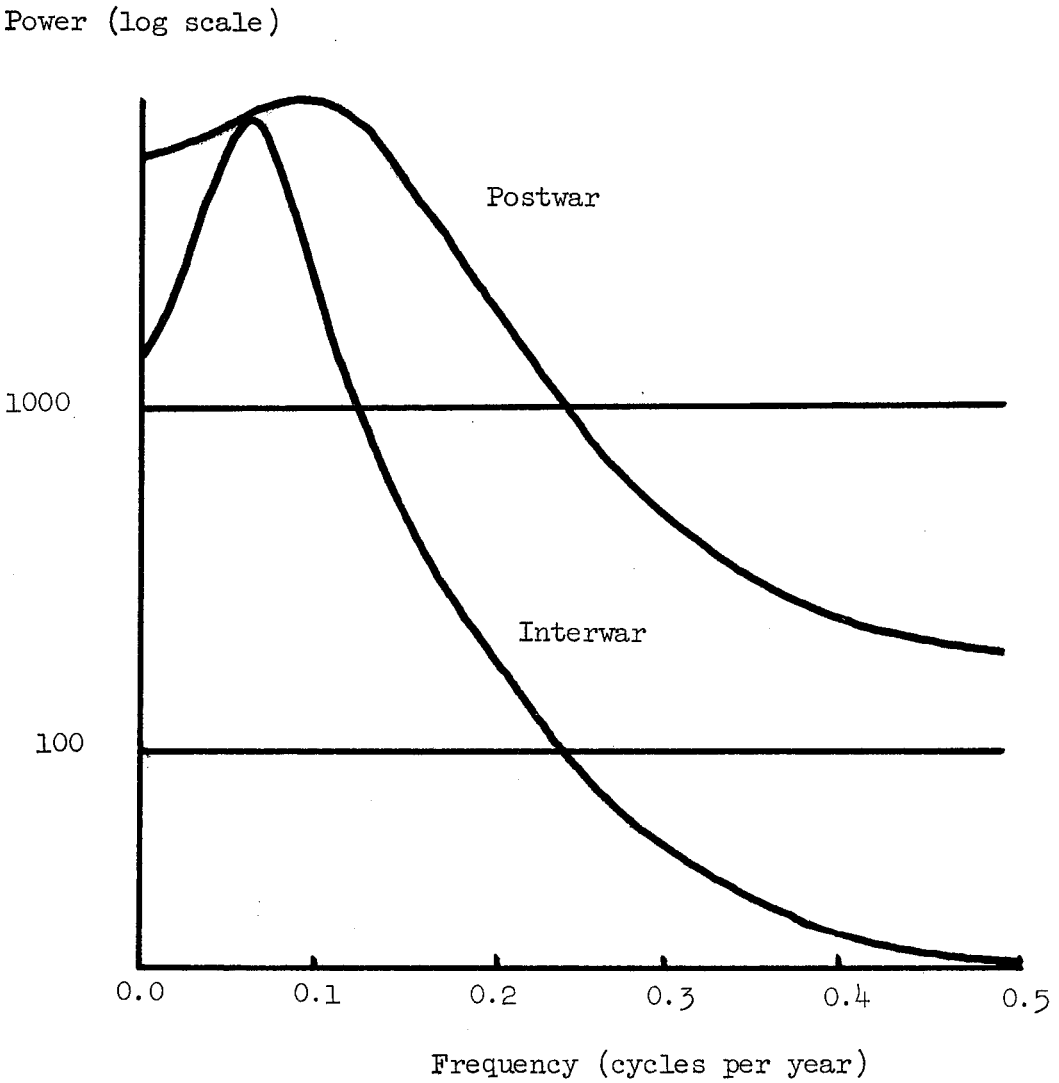

Figure 3. Power Spectra of Income Implied by the Interwar and Postwar Multiplier-Accelerator Models.

and indicates that the response of income to serially independent random disturbances in the consumption and investment equations is less highly concentrated in a narrow band of frequencies than is the interwar response to random disturbances. This means that postwar deviations from equilibrium are less dominated by a regular oscillation than were the prewar deviations from equilibrium.

IV. Concluding Remarks

This paper has been concerned with tests of the hypothesis that structural change has been an important determinant of the relative stability that has been enjoyed by the United States economy during the postwar period. The approach that was pursued here was to estimate the parameters of sets of identically specified models for the two subperiods 1921-41 and 1946-66. The presumption was that the parameter estimates would reflect the structural changes that have taken place over the years since the chaotic period of the 1920's and 30's.

A set of multiplier models was analyzed in which consumption expenditure is the only endogenous expenditure variable. The results indicate that significant parameter shifts have taken place between the two subperiods. However, whether or not these shifts have contributed to economic stability is not entirely clear. The autonomous expenditure impact multipliers are all smaller for the postwar period than for the interwar period, but the differences are not statistically significant. The postwar long-run multipliers are also smaller with only a few exceptions. Once again, however, the differences are not statistically significant.

The parameters of a multiplier-accelerator model were also estimated for the two separate periods. A comparative dynamic analysis of the two structures indicates that the postwar model is more stable than the prewar model in the sense that the characteristic roots of the postwar model are smaller in absolute value than those of the prewar model. It was also found, however, that the comparative static multiplier implied by the postwar model is larger than that of the prewar model and the speed of adjustment is more rapid in the postwar model.

The different results obtained from a comparison of the two periods seem to indicate that a complete resolution of the structural-change hypothesis cannot be accomplished within the context of these two models. The multiplier-accelerator model, in particular, permits several alternative explanations of the relative stability of the postwar period. The trend in investment over the postwar period is undoubtedly partially responsible for the observed stability. It may also be true that government expenditure has exerted a stabilizing influence during the postwar period. This, however, needs to be explored in some detail.

References

[1] A. Ando and F. Modigliani, "The Relative Stability of Monetary Velocity and the Investment Multiplier," American Economic Review, September 1965, 60, 693-728.

[2] W. J. Baumol, "Pitfalls in Centracyclical Policies: Some Tools and Results," Rev. Econ. Stat., February 1961, 43, 21-26.

[3] A. F. Burns, "Progress Towards Economic Stability," American Economic Review, March 1960, 50, 1-19.

[4] G. C. Chow, "Tests of Equality Between Sets of Coefficients in Two Linear Regressions," Econometrica, July 1960, 28, 591-605.

[5] M. DePrano and T. Mayer, "Tests of the Relative Importance of Autonomous Expenditures and Money," American Economic Review, September 1965, 60, 729-752.

[6] P. Eilbott, "The Effectiveness of Automatic Stabilizers," American Economic Review, June 1966, 61, 450-465.

[7] M. Friedman and D. Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897-1958," in Commission on Money and Credit, Stabilization-Policies, Englewood Cliffs 1963, 165-268.

[8] R. A. Gordon, Business Fluctuations, 2nd ed., New York 1961.

[9] Z. Griliches, "Distributed Lags: A Survey," Econometrica, January 1967, 35, 16-49.

[10] E. P. Howrey, "Dynamic Properties of Stochastic Linear Econometric Models," Research Memorandum No. 87, Econometric Research Program, Princeton University, June 1967.

[11] J. Johnston, Econometric Methods, New York 1963.

[12] J. W. Kendrick, Productivity Trends in the United States, Princeton 1961.

[13] L. R. Klein, Economic Fluctuations in the United States, 1921-1941, New York 1950.

[14] Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, selected issues.

[15] U. S. Department of Commerce, Survey of Current Business, May 1967 and selected issues.

[16] U. S. Department of Labor, Monthly Labor Review, selected issues.