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Chapter Author: Franco Modigliani

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Part V

Fluctuations in the Saving-Income Ratio: A Problem in Economic Forecasting

Franco Modigliani

Institute of World Affairs

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I The Problem

Considerable attention has been given in recent literature to the problem of forecasting the main components of national income, especially the level of savings at full employment in an early post-transitional year such as 1950. Almost invariably the method consists in projecting the relations between national income or gross national product and its components observed in the decades of the 'twenties and 'thirties (or only in 1929–40) to the much higher level of income expected for the post-transitional period. The aim of this paper is to show that because of the violent cyclical fluctuations that characterized the period of observation the results tend to be systematically biased. Some criticism on this score has already been voiced by other authors,[1] but no systematic attempt has apparently been made to formulate it precisely, to test its validity, and to indicate its quantitative implications for purposes of estimation and of forecasting.

We shall examine several relations among economic variables, show that there is evidence of a pronounced discrepancy between the cyclical, or short-run, and the secular, or long-run, form of these relations, and suggest methods of analysis by which it seems possible to estimate both. Although the results are tentative and leave many questions unanswered, it is hoped that the broad lines of approach suggested will be of some use in improving the reliability of our long-range as well as short-run forecasts.[2]

II Recent Estimates of the Consumption Function

Starting with the crucial question of forecasting savings from disposable income, a procedure for which several methods have

[1] See, for example, Hart, 'Model Building and Fiscal Policy', *American Economic Review*, Vol. 35, No. 4 (Sept. 1945), especially pp. 533–6; Colin Clark 'Postwar Savings in the U. S. A.', Institute of Statistics, Oxford, *Bulletin*, Vol. 7, No. 6 and 7 (May 19, 1945), pp. 97ff. A. H. Hansen gives an illuminating discussion of this problem in his *Fiscal Policy and Business Cycles* (Norton, 1941), Ch. 11.

[2] This study was completed before the publication of the revised estimates of national income and its components by the Department of Commerce in August 1947 ('National Income', *Survey of Current Business*, Supplement, July 1947). No attempt has been made to revise the quantitative results obtained for the United States, because the new estimates do not go sufficiently far back to allow for a satisfactory test of the hypothesis advanced in this paper. The implications of the revised estimates are commented upon in the Postscript, Section XIV. We merely point out here that although the revisions would affect some of the

been employed, we consider briefly those suggested by Mosak, Woytinsky, and especially Smithies.[3]

Mosak's method is most open to criticism. It consists in using the relation between consumption expenditure and disposable income in current prices observed during 1929–40 as a first approximation to the consumption function of the American economy.[4] Applying this relation to his forecast of disposable income in 1950, which, assuming 1940 rates of taxation, would amount to about 154 billion current dollars, Mosak obtains an estimate of individual savings of nearly $22 billion, some 14 percent of disposable income.

This approach has been severely criticized by Woytinsky who points out the logical difficulties involved in extrapolating a relation between undeflated dollar series. More generally, the relation between undeflated dollar series tends to be systematically biased, especially when the time series are for a period characterized by cyclical fluctuations as violent as those of 1929–40. Theoretical considerations as well as statistical evidence indicate that there is a marked tendency for prices to fluctuate together with physical quantities during a cycle. The cyclical covariation of prices in turn tends to cause a marked positive correlation between the dollar series, even if the 'true' relation between the series in real terms is slight or negative.

Hence, the relation between series in current prices, even if more pronounced than that between the corresponding deflated series (as it often is) is an unreliable tool of analysis; extrapolation of such a relation implies, among other things, extrapolating the cyclical relation between movements of real income and prices, a particularly unjustified procedure in *long-range* forecasting.

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specific quantitative estimates given below for the United States, they do not in any way invalidate the substance of the argument.

[3] J. L. Mosak, 'Forecasting Postwar Demands: III', *Econometrica*, Vol. 13, No. 1 (Jan. 1945), pp. 25–53; W. S. Woytinsky, 'Relationship Between Consumers' Expenditures, Savings, and Disposable Income', *Review of Economic Statistics*, Vol. 28, No. 21 (Feb. 1946), pp. 1–12; Arthur Smithies, 'Forecasting Postwar Demand: I', *Econometrica*, Vol. 13, No. 1 (Jan. 1945), pp. 1–14.

[4] Mosak's paper indicates that he was aware of the oversimplification involved in his approach but felt that it would not affect his results unduly.

These remarks explain in part why Mosak's formula leads to untenable results when applied to estimates of disposable income and consumption for the years immediately preceding World War I, when prices were disproportionately lower than income as compared with 1929–40. Thus, for 1913 when, according to the latest estimates of the Department of Commerce, disposable income amounted to about $33 billion and savings to $3 billion, Mosak's formula gives a level of savings of −$2 billion! If this formula fails so completely when extrapolated only fifteen years back to a much lower level of income, we cannot put much confidence in the results of extrapolating it ten years forward to a much higher level.[5]

None of the objections leveled against Mosak's type of approach can be raised against the extrapolation of the equation used by Smithies:

II 1 $$C = 76.58 + .76Y + 1.15(t - 1922).$$

C denotes real consumption, Y real income per capita (both in 1929 dollars), and t time. In the first place, Smithies' equation is based on the relation between deflated series (the deflator being the cost of living index), and in the second, the period of observation includes the seven relatively stable years 1923–29.

Despite these differences in approach, when Smithies' formula is applied to forecasting the level of individual savings at full employment in 1950, the results are strikingly similar to Mosak's. Thus, for a disposable income of $154 billion in 1943 prices (corresponding to Smithies' assumption C with respect to the tax structure) he, too, estimates savings to be $21–22 billion, some 14 percent of disposable income.

These results deserve closer examination. Smithies' equation not only gives a very close fit for the period of observation, but also, contrary to Mosak's, appears to explain satisfactorily the

[5] Note that the relations between 1913 and the period of observation, on the one hand, and that between 1950 and the period of observation, on the other, are similar in many respects. Both years are separated from the period of observation by a major war with a marked price rise. Also, the level of income that may be expected to prevail in 1950 at full employment is likely to be nearly as much above the average income for the period of observation as the income prevailing in 1913 is below it.

relation between income and consumption prevailing in earlier decades. In Smithies' own words, "applying the above formula to changes in Kuznets' national income figures we obtain a close approximation to changes in his consumption figures".[6] This, in turn, raises an interesting question. As is well known, Kuznets' estimates indicate that the ratio of consumption to net national product has remained remarkably stable in the five decades 1879–88 to 1919–28, fluctuating between a minimum of 88 and a maximum of 89.2 percent, and showed no tendency to fall with the secular increase in income. Similarly, according to the Department of Commerce estimates, the average ratio of consumers' expenditures to disposable income in 1923–40 amounted to about 91 percent and remained consistently above 88 percent (except in 1923 when it was 87.4 percent). If Smithies' formula satisfactorily explains the relation between income and consumption prevailing in this period, why does application of the same formula, when extrapolated to 1950, yield a consumption-income ratio of only 86 percent?

To answer this question we must note that, according to Smithies' equation, the consumption-income ratio depends upon the rate at which income grows. From this equation we can, in fact, derive the following:

$$\text{II } 2 \qquad \frac{C_t}{Y_t} = \frac{(76.6 + 1.15t')}{Y_t} + .76; \; (t' \text{ denotes } t - 1922)$$

Equation II 2 shows that the ratio $\frac{C_t}{Y_t}$ will tend to rise, fall, or remain constant depending upon whether the fraction on the right side tends to rise, fall, or remain constant; and this, in turn, obviously depends upon the relation between the coefficient of t

[6] Smithies, *op. cit.*, p. 6. Kuznets' figures are those given in his 'Uses of National Income in Peace and War', National Bureau of Economic Research, *Occasional Paper 6*, March 1942, p. 31, Table 2, and p. 35, Table 6. These estimates were somewhat revised in Kuznets' later study, *National Income: A Summary of Findings* (National Bureau of Economic Research, 1946). Since this book was not published until after our study had been completed, the discussion in the rest of this section is based on the earlier estimates referred to by Smithies. Certain implications of the new estimates are, however, discussed in note 10.

and the actual rate of growth of income in time. In particular, the income-consumption ratio will tend to fluctuate around a constant level α, if

$$\frac{76.6 + 1.15t'}{Y_t} + .76 = \alpha$$

that is, if Y grows at the specific rate given by the formula:

$$\text{II 2a} \qquad Y_t = \frac{76.6}{\alpha - .76} + \frac{1.15t'}{\alpha - .76}$$

In the five decades covered by Kuznets, the consumption-income ratio fluctuated around .89. If we substitute this figure for α in formula II 2a, the coefficient of t is approximately 8.8. In other words, it appears that if income per capita is growing in the long run at the average rate of about \$8.8 per year, *then, and only then,* will the consumption-income ratio computed from Smithies' equation tend to fluctuate around a constant long-run level of .89. The average growth of income per head in Kuznets' estimates happens to be precisely \$8.5 per year. This, then, explains why Smithies' formula seems consistent with the constancy of the saving-income ratio exhibited by Kuznets' estimates. On the other hand, according to Smithies' forecast, disposable income at full employment in 1950 would amount to \$1,060–1,070 per capita in 1929 prices, while the corresponding figure in 1940 was only \$675. His forecast therefore implies an increase in real income per capita of nearly \$40 per year from 1940 to 1950. With such an unprecedented rate of growth, Smithies' formula naturally leads to a saving-income ratio 20 to 30 percent higher than that implicit in Kuznets' historical estimates, and 40 and 60 percent higher than the ratio of saving to disposable income in the 'twenties and 'thirties, as estimated by the Department of Commerce.

We do not intend to discuss here whether the optimism of Smithies and of many other investigators in forecasting such a stupendous growth in the years to come is at all justified.[7] The

[7] It is true that by 1941 income per capita had already risen to about \$775. Still, Smithies' forecast would imply an annual increase from 1941 to 1950 of some \$30 per head. Inasmuch as in 1941 we were very close to full employment, this rise in income would have to be brought about almost exclusively by increases in

question that interests us here is whether, assuming the correctness of this forecast, we can put much confidence in the projection of Smithies' formula to a period when income is assumed to be rising at a rate about eight times as high as during the period of observation, and five times as high as during the period covered by Kuznets' data, to which this formula was applied. In other words, is the rise in the saving-income ratio (the fall in the consumption-income ratio) that follows from Smithies' formula for periods of rapid rise in income acceptable in the light of statistical experience?

Table 1 contains a partial answer. Although Smithies' formula gives a surprisingly good approximation to the actual total change in savings over the period as a whole, it fails rather badly in each subperiod in which the growth of income was markedly different from the critical rate of $8.8 per year (col. 4). The reason is not hard to find. As we have just seen, according to Smithies' formula the consumption-income ratio depends upon the rate at which income grows. Kuznets' estimates, on the other hand, show that the fluctuations in this ratio were not only very small but were essentially unrelated to the rate of growth of income. It must be noted in particular that in the last decade covered by Table 1, when per capita income rose at an annual rate of $16, or twice as high as the critical rate, Smithies' formula is biased distinctly upward, indicating an increase in savings 26 percent larger than the actual increase. How then can we apply this formula with confidence to a period in which income is supposed to grow at an even faster rate?

Since the publication of Smithies' paper, the Department of Commerce has made available revised estimates of disposable income and consumption for 1919–28[8]. If Smithies' method is applied to these revised data, the results are:

II 3 $$C = 71.7 + 78Y + .83(t - 1922)$$

productivity. (Also Smithies' forecast of disposable income includes a small amount of nonproduced income or net transfer payments; these, however, represent less than 2 percent of disposable income.)

[8] These estimates are reproduced in the Appendix Table, columns (1) and (2).

TABLE 1

Changes in Kuznets' Estimates of Savings compared with Changes computed by Smithies' Formula

Period	Changes in Av. Annual Savings (billions of current $)		% of Error (3) − (2) / (2)	Av. Annual Rate of Change in Real Income per Capita ($, 1929 prices)
	As given by Kuznets[a]	As est. by Smithies' formula[b]		
(1)	(2)	(3)	(4)	(5)
1879–1888 to 1889–1898	.42	−.08	−120	+3
1884–1893 to 1894–1903	.40	+.19	−52	+5.6
1889–1898 to 1899–1908	.84	+.83	−1	+8.8
1894–1903 to 1904–1913	1.17	1.08	−8	+8.1
1899–1908 to 1909–1918	1.83	1.29	−30	+6.1
1904–1913 to 1914–1923	3.57	2.83	−21	+8.7
1909–1918 to 1919–1928	3.63	4.58	+26	+16.1
1879–1888 to 1919–1928	6.72	6.62	−1	+8.5

[a] 'Uses of National Income in Peace and War', National Bureau of Economic Research, *Occasional Paper 6*, 1942, p. 31, Table 2, col. 2. Kuznets uses the term 'net capital formation' rather than 'savings'.

[b] The figures in this column were computed as follows: Kuznets' net national product (*ibid.*, col. 1) was deflated by using the price index implicit in his conversion of consumer outlay to 1929 prices (p. 35, Table 6), and divided by the average population for each decade (*Statistical Abstract of the United States, 1944–45*, p. 8). Substituting the resulting real income per capita series in Smithies' equation and giving to t the value corresponding to the middle of each decade, we obtain a series of computed changes in real consumption per capita.

At this point there were two possible lines of procedure. We could subtract Kuznets' changes in real consumption and Smithies' changes in real consumption from Kuznets' changes in real income, thereby obtaining a true and 'computed' series of changes in real savings per capita. This comparison, not given in the table since we are more interested in comparing changes in aggregate savings in current dollars than changes in real savings per capita, shows percentages of error considerably greater than those in the table, ranging from a maximum of 150 percent for the first period to a minimum of 21 and 18 percent for the third and fourth periods, respectively, and amounting to 73 percent for the last period.

The other possible procedure—the one followed—was to transform the series of 'computed' *changes* in 'real consumption per capita' into a series of 'computed' real consumption per capita, adjusting the constant term in Smithies' equation so that actual and computed series would agree in the last decade. This series was then converted into aggregate consumption at current prices by multiplying it by the price index and average decade population. Subtracting this series from Kuznets' series of net national product in current prices we obtain 'computed' average yearly savings in current prices for each decade. From this series we computed changes in savings (col. 3).

The multiple correlation coefficient, though somewhat lower than that originally obtained by Smithies, remains very high, .991.[9] What is significant, however, is the sizable fall in the coef-

[9] Smithies has informed us that the correct figure should be .996, rather than .97 as given in *op. cit.*, p. 6, note 2.

ficient of time—from 1.15 to .83. The new time trend of consumption is no longer in line with the rate of growth of Kuznets' national income; the new equation therefore gives a distinctly worse approximation even for the aggregate change in savings from the first to the last decade.[10]

To conclude: although Smithies' hypothesis is theoretically consistent, his contention that it explains past developments satisfactorily is not fully warranted. In fact, if we accept Smithies' hypothesis that consumption depends essentially on current income, plus a trend factor entirely independent of income, we must accept also the hypothesis that the apparent long-run stability of the saving-income ratio is essentially due to chance, that is, to the coincidence of the time trend of income with the 'independent' time trend of consumption. The latter hypothesis, however, is obviously not very satisfactory and, furthermore, does not stand up well under closer examination of the data.

This criticism leads us to formulate a counter-hypothesis: (a) the apparent long-run stability of the saving-income ratio in the course of the gradual secular expansion of income is not due to chance, but rather to a structural property of the system, a consistent phenomenon that can be extrapolated; (b) the tendency for saving to fluctuate together with and proportionately more than income, which according to the available evidence has been very pronounced in the interwar decades, is a cyclical phenomenon.

The hypothesis that the relation between savings, consumption, and income might be influenced by cyclical conditions has already been advanced by other authors and has recently been tested by Woytinsky. His approach, however, is not very convincing inasmuch as he segregated 1931–34 from 1923–40, and fitted separate equations to 1931–34 and to the remaining years (1923–30 and

[10] Kuznets' revised estimates in *National Income: A Summary of Findings* imply an upward revision of the ratio of net capital formation to income up to the decade 1914–23 (p. 53, Table 16). While we did not recompute our Table 1 on the basis of the revised estimates (given in full in Kuznets' *National Income since 1869*, National Bureau of Economic Research, 1946), there is reason to believe that Smithies' equation, especially after the revision of the time trend indicated in the text, would significantly underestimate savings in the early decades.

1935–40). This procedure seems to us too arbitrary and we see no reason therefore to place much confidence in the extrapolation of the various regression equations Woytinsky obtained for the 'more or less prosperous years' which indicate that the saving-income ratio tends to fall as income rises. The distinction between prosperity and depression is obviously quantitative, not qualitative, and can therefore be measured. This idea will be developed in the next section as we proceed to formulate our hypothesis more precisely, to demonstrate that it can be tested statistically, and to show that there is support for it.

III An Alternative Hypothesis Tested for the United States

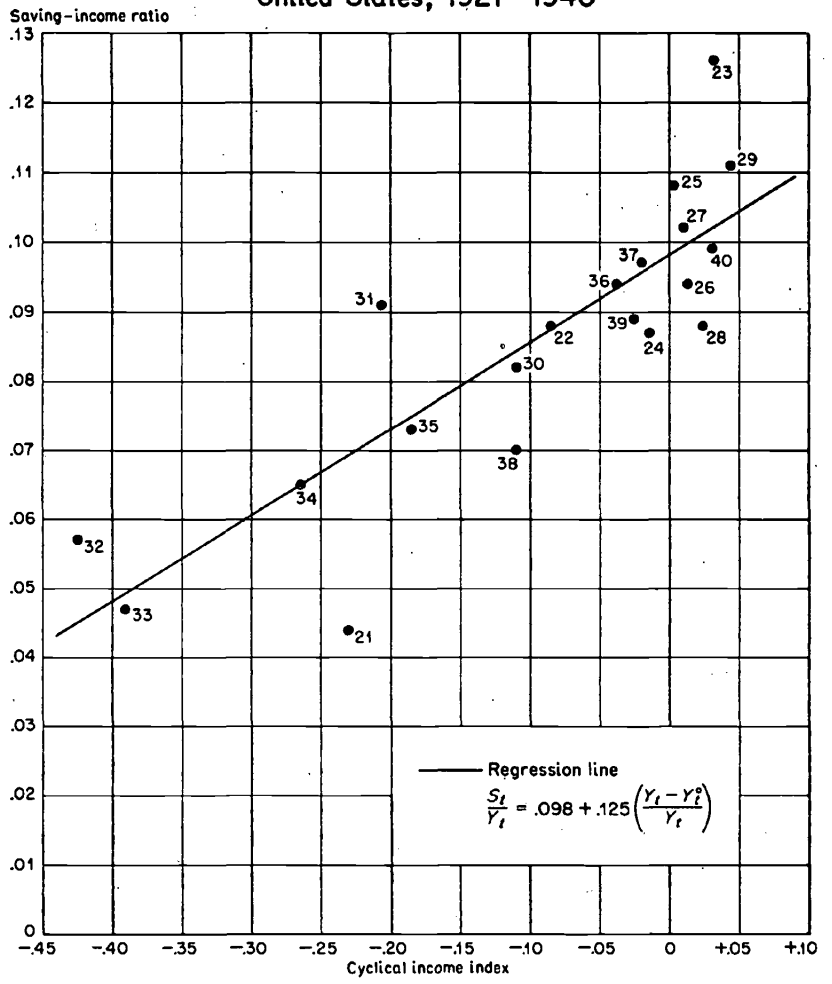
First we formulate operational definitions of what we mean by 'cyclical' and 'secular' changes in income. By the secular movement of income we mean a movement that carries real income per capita above the highest level reached in any preceding year; by cyclical movement we mean any movement, whether upward or downward, that leaves real income per capita below the highest previous peak.[11] These definitions may be conveniently given in symbolic terms. Let Y_t denote real income per capita in the year t and Y_t° denote the highest real income per capita realized in any year preceding t; the change in income between the year t and the year $(t + 1)$ will be called cyclical, if both Y_t and $Y_{t+1} < Y_t^\circ = Y_{t+1}^\circ$; otherwise, it will be called secular. The quantity $\frac{Y_t - Y_t^\circ}{Y_t}$ will be referred to as the 'cyclical income index'. In terms of the above definitions and symbols, the hypothesis we offer states that the proportion of income saved will be positively related to, and largely explained by, the cyclical income index.

In Chart 1 the saving-income ratio is plotted against the cyclical income index for the twenty years 1921–40, both quantities com-

[11] This is in accordance with Marshall's use of 'secular', since an expansion in income above the highest previous peak must, in general, be due to the gradual secular improvement in technology and/or an increase in capital per worker.

CHART 1

Relation between the Saving-Income Ratio and the Cyclical Income Index $\left(\frac{Y_t - Y_t^o}{Y_t}\right)$ United States, 1921–1940



puted from the latest Department of Commerce estimates.[12] Evidently, between the two variables there is a marked direct

[12] For sources and methods of computation for these series, see Appendix references A and B.

relation which appears to be essentially linear. The coefficient of correlation is .84, definitely significant in view of the relatively large number of observations. The regression equation is:

III 1 $$S_t/Y_t = .098 + .125(Y_t - Y_t^\circ)/Y_t$$

or

$$C_t/Y_t = .902 - .125(Y_t - Y_t^\circ)/Y_t$$[13]

According to this equation, if income were secularly constant savings would be about 10 percent of income, but if income rose r percent above or fell r percent below the previous peak, the ratio would change .125 (.01) r. (For instance, with a secular growth of 5 percent, the ratio would amount to approximately $10\frac{1}{2}$ percent, while with a cyclical fall of 30 percent, it would amount to only about 6 percent.)

Our correlation coefficient cannot be compared directly with that obtained on Smithies' hypothesis, since the latter relates consumption to income, while in our equation it is the consumption-income ratio that is explained. To make a comparison, we must restate our hypothesis in terms similar to those of Smithies; this can be done by multiplying both sides of the equation III 1 by Y_t:

III 2 $$C_t = k\ Y_t - b(Y_t - Y_t^\circ) = (k-b)Y_t + b\ Y_t^\circ$$

This hypothesis can be tested by correlating consumption with Y_t and Y_t°. In making this test we shall also be answering one

[13] The analysis in the text refers exclusively to 1921–40, though the Department of Commerce has prepared estimates of disposable income and consumption as far back as 1909. It is, however, generally conceded that the margin of error in the estimates of savings for the period before 1919 is sufficiently wide to make the inclusion of these years inadvisable. Their inclusion would, we believe, reduce rather than increase the reliability of the regression equation for purposes of extrapolation. For the sake of comparison, we might add that with the inclusion of 1910–14 the correlation coefficient falls somewhat—from .84 to .77—and the regression equation changes only slightly:

$$S_t/Y_t = .094 + .114(Y_t - Y_t^\circ)/Y_t$$

Finally, if we extrapolate our equation III 1 back to 1910-14 we get, in all cases, a distinctly better approximation to the Department of Commerce estimates of consumption than by extrapolating Smithies' equation II 3. Both equations underestimate the consumption-income ratio; in equation III 1, the underestimate ranges from zero to 3 percent.

important objection that can be raised against our initial approach: namely, that by using the saving–income ratio instead of saving itself as a dependent variable we are assuming *a priori* and without test that consumption is an homogeneous function of the independent variables. This assumption, however, should be tested by carrying out the correlation indicated by equation III 2, then examining whether the constant term in the resulting equation is sufficiently small to be consistent with the hypothesis that its true value is approximately zero. If we make the correlation the regression equation is:

III 3 $$C_t = 2(\pm 32) + .773 Y_t + .125 Y_t^\circ$$

The corresponding multiple correlation coefficient is .992,[14] practically the same as the coefficient, .993, obtained by applying Smithies' hypothesis to the revised Department of Commerce estimates for 1921–40.[15] Furthermore, the constant term in equation III 3 is evidently quite small and is statistically insignificant, being only a small fraction of its standard error, 32.

This last result is of particular interest from our point of view. The equations obtained by Mosak and Smithies (and by most other investigators as well) contain relatively large positive constants, implying that the marginal propensity to consume is less than the average and that changes in income tend to produce

[14] The simple and partial correlation coefficients are $r_{cy} = .988$; $r_{cy^\circ} = .15$; $r_{yy^\circ} = .07$; $r_{cy.y^\circ} = .992$; and $r_{cy^\circ.y} = .54$. The partial correlation $r_{cy^\circ.y}$ is not very high; nevertheless, in view of the large number of observations, it is statistically significant; in fact, by the usual test, its level of significance lies between 1 and 2 percent. Furthermore, the partial correlations are distinctly larger than the corresponding simple ones. Also, for the revised Smithies' equation, II 3, the partial correlation $r_{ct.y}$ is also only .59. If we use the ratio of the mean square successive difference to the variance of the residuals (hereinafter referred to as K) to test the randomness of the residuals in time, we get a value of 2.51. On a 5 percent level of significance, this value of K is not inconsistent with the hypothesis that the residuals are random. It is in this sense that we refer to K as insignificant in the discussion that follows. (See B. I. Hart and John von Neuman, 'Tabulation of the Probabilities for the Ratio of the Mean Square Successive Difference to the Variance', *Annals of Mathematical Statistics*, Vol. 13, pp. 207–14.) The appropriateness and efficiency of this test for our purpose is open to considerable doubt. Nonetheless, it appears to be as good a test as is available.

[15] The addition of the years 1921 and 1922 to the period originally used by Smithies (1923–40) raises Smithies' multiple correlation from .991 to .993.

less than proportional changes in consumption. On this basis both authors are led to conclude that the saving–income ratio is bound to increase whenever income rises (Mosak) or at least, whenever real income tends to rise at a sufficiently high average annual rate (Smithies).

Our results indicate instead that we must distinguish between (a) the short-run or cyclical marginal propensity to save, and (b) the long-run average and marginal propensity.

a) As long as income rises secularly, Y_t and Y_t° will rise together. Therefore, the saving–income ratio will depend not on income, but essentially on the rate of change in income. This can best be seen if we rewrite equation III 3 using the identity $S_t = Y_t - C_t$:

$$S_t = -2 + .102Y_t + .125(Y_t - Y_t^\circ)$$

Since the constant term is entirely negligible in comparison with the relevant values of Y, saving tends to represent approximately 10 percent of income plus some 12 percent of the increment of income. Because of the last term, the proportion of income saved will tend to vary somewhat in years of secular expansion, increasing as the rate of change in income accelerates.[16] But since the normal secular growth is in the order of 2 to 3 percent, we may conclude that the saving–income ratio will tend to fluctuate around a level of about $10\frac{1}{2}$ percent. This figure clearly measures also the proportion of any secular increment in income that will tend to be saved in the long run (that is, the long-run marginal propensity to save).

b) In the case of cyclical fluctuations in income, on the other

[16] Such a lag seems to explain, for instance, the high saving-income ratio for 1923 and 1929. It undoubtedly explains also, at least in part, the exceptionally high saving-income ratio for 1941, when, according to the Department of Commerce estimates, real income per capita increased 15 percent—three to four times more than the largest annual growth in the entire period of observation. If we extrapolate our equation to this year, we obtain a saving-income ratio that is higher than in any other year but still falls considerably short of the Department of Commerce figure, 15.9 percent. It is not unlikely that for exceptionally high secular rates of increase above the highest previous peak, the lag of consumption may be more pronounced (and possibly last longer) than indicated by our equation; this point will be briefly considered later. Extrapolation of Smithies' equation also fails to explain the behavior of consumption in 1941, since it gives the very same figure as our equations III 1 and 3.

hand, Y_t° is fixed by definition. Hence, the relation between saving and income takes the form: $S_t = -(2 + .125Y_t^\circ) + .23Y_t$. The cyclical marginal propensity to save is given by the coefficient of Y_t or .23, as compared with the secular marginal propensity of .10 to .11. Also, on account of the constant term, the saving–income ratio tends to fluctuate with income during each cycle, falling below the secular level as income declines and rising toward it again as income increases.[17]

IV. The Common Sense of the Hypothesis

Is our hypothesis based on, or at least consistent with, realistic assumptions concerning economic behavior? Clearly, the confidence we can place in our results depends largely on the answer.

Our long-run hypothesis may at first appear entirely unrealistic. Casual observation, fully confirmed by all budget studies, reveals that the rich save more than the poor. However, both everyday experience and budget data relate to the behavior of different people at the same point of time, whereas our hypothesis concerns the behavior of aggregates in time. There is strong reason to suppose that as aggregate income increases, persons moving into progressively higher income brackets do not tend to acquire the saving habits characteristic of persons formerly in the income bracket; on the contrary, they may tend to save less. Indeed, it can easily be demonstrated that the hypothesis that they save as much would lead to rather absurd results.[18] Our tentative con-

[17] Our conclusions must, of course, be qualified to the degree that our estimates of the regression coefficients, especially that of Y_t°, are subject to error. What has been said, however, will help to make clear the full implications of our hypothesis and statistical results.

[18] All budget studies consistently show that the lowest group of income receivers as a whole tends to dissave a more or less substantial proportion of its income. Now, let us consider the 'break-even' income in the latest available budget study; then as we move back in time to lower and lower levels of aggregate income, we must expect to find a gradual increase in the proportion of income receivers who got less than this 'break-even' income. We should therefore be led to conclude that the proportion of income receivers who dissaved would also grow larger and larger as we move further back in time, a conclusion that can certainly not be considered very realistic. (The alternative would be to make even less realistic assumptions concerning changes in income distribution.)

clusion is, in fact, supported by a careful analysis of American budget material carried out by Dorothy S. Brady and Rose D. Friedman.[19] The reason persons in each income bracket tend to save less as aggregate income rises secularly, and the plausibility of our long-run hypothesis become apparent when one considers the nature of economic progress. Economic expansion is not characterized by the availability of increasing quantities of the same commodities, but rather by the continuous improvement of many old commodities and by the continuous appearance of entirely new ones. If consumers had no choice except to spend their increasing income on more and more of the very same commodities, then indeed it would not be surprising to find at least some relative increase in saving as income rises. Actually the increment in income accruing to each group of income receivers tends to be absorbed by the new commodities that gradually become available. If we compare the consumption of a family with a certain income in 1940 with that of a family with the same (real) income in 1870, we would expect to find that the additional spending of the 1940 family was absorbed by the purchase of commodities that did not exist in the earlier period. Thus, the hypothesis that the saving–income ratio tends to be relatively independent of the secular expansion of income (that is, in comparison with its cyclical behavior) is not unrealistic and also is not inconsistent with, but is supported by, budget data.

With respect to our cyclical hypothesis, there are numerous supporting factors. We confine ourselves here to considering briefly the three that seem to be quantitatively most important: (a) cyclical changes in the income distribution, (b) rigidity of acquired consumption habits, and (c) fluctuations in the level of unemployment.

a) There is some evidence that, at least for higher income brackets, the distribution of income tends to become less unequal as income contracts, and tends to resume its initial shape as income recovers. Though the quantitative importance of this phenomenon has not been firmly established, it is well known that agricultural income

[19] See 'Savings and Income Distribution', *Studies in Income and Wealth, Volume Ten.*

and profits in general tend to fluctuate proportionately more than other incomes during a cycle;[20] and there is good reason to suppose that profit earners or entrepreneurs, especially farm families, have, on the whole, a greater than average propensity to save.[21] We have, therefore, grounds for expecting that a cyclical fall in income will tend to be accompanied by a redistribution of income from groups having a greater propensity to save to groups with a smaller propensity to save, while a cyclical rise in income will have the opposite effect.[22]

b) A marked fall in income below an accustomed level, such as occurs during a cycle, creates strong pressure on acquired consumption habits. This pressure tends to be met by partly maintaining consumption at the expense of saving. That is, savings tend to bear the brunt of a cyclical change in income, falling proportionately more than consumption and income as income declines. Similarly, as income moves back toward the initial level, there is pressure to restore the initial relation between income and saving. In other words, the saving-income relation tends to retrace the same cyclical path in the opposite direction, saving rising relatively faster than consumption as income increases.[23]

It may be objected that if income remains below the highest previous level for a considerable time, there must be a tendency for consumers to become fully adjusted to the lower level by rearranging their expenditure pattern without waiting for income to recover. However, in the available estimates, there is no evidence of such an adjustment. In any case, such an adjustment is likely to be much less important than may appear at first glance, es-

[20] The proposition concerning the cyclical behavior of aggregate profits is tested in Section VIII.

[21] With regard to farm families, see Brady and Friedman, *loc. cit.*

[22] For a further theoretical discussion of this point, see, for instance, Michael Kalecki, *Essays in the Theory of Economic Fluctuations* (Farrar & Rinehart, 1939), pp. 42–74, especially p. 65, and pp. 116–49. Note that in his 'trendless economy' fluctuations in income coincide with what we have defined as cyclical fluctuations in income.

[23] This factor was especially stressed by James Duesenberry in a paper presented at a meeting of the Econometric Society in Atlantic City, N. J., in January 1947. Mr. Duesenberry independently developed and tested a hypothesis very similar to our equation III 1.

pecially in an expanding economy. First, income receivers are inclined to look upon a fall in income as temporary and therefore be less willing to make any further painful adjustments. Second, the individual does not consciously pattern his consumption habits on the period when his income was highest. Again, the point is that the secular expansion of income brings with it a continuous change in the types of commodities available and in the structure of expenditures. These commodities, as well as the habits of using them, obviously cannot disappear even when income falls to, or below, some previous level at which they did not exist. Finally, the quantitative importance of a gradual adjustment is further minimized by a third feature that characterizes the cycle.

c) As is well known, cyclical fluctuations in income are much more the result of changes in unemployment than of changes in the income of the employed.[24] The cyclical income index may therefore be expected to move in close harmony with the ratio of the unemployed to the total labor force. Now, if there is a long-run tendency for employed persons to consume a constant proportion of their income, any substantial fluctuation in the level of employment will cause consumption to fluctuate proportionately less than income, since though the unemployed produce no income, they necessarily maintain at least part of their consumption.[25] In other words, the level of savings corresponding to any given level of income tends to be lower (that is, the level of consumption tends to be higher), the greater the unemployment, since the savings of the employed are partly offset by the dissavings of the unemployed.

The above arguments explain why savings tend to fluctuate proportionately more than income as long as income fluctuates below its previous peak. But the same sort of consideration also explains why a similar relation holds when the cyclical income

[24] After the contraction of 1929, for instance, per capita income did not recover until 1940, but per capita income of employed persons had virtually recovered by 1935.

[25] This is not strictly true for disposable income, which includes transfer payments to the unemployed. See, further, Section V in which a statistical attempt to measure the influence of the specific factor of unemployment is discussed.

index is positive. As explained above, when this index is positive, it measures essentially the rate of growth in income, and if this rate is much higher than the normal secular rate determined by the rate of technological progress, the saving-income ratio too must tend to rise above its normal secular level. First, if the growth is larger than can be accounted for by technological progress, it must tend to be accompanied by a further fall in unemployment. Second, such a development is likely to be accompanied by features characteristic of boom years, such as abnormally high profits and raw material prices. Finally, our hypothesis states that eventually consumption will rise in proportion to income, but this adjustment may easily occur with some lag. It is theoretically conceivable that the relation between the saving-income ratio and the cyclical income index may not be the same quantitatively when the latter is positive and when it is negative. From the few observations at our disposal we cannot estimate separate relations, although there is some indication that the line of relation may be somewhat steeper for positive than for negative values of the cyclical income index.[26]

V Attempts at Refinements

Since the characteristic cyclical-secular pattern of saving is due to the joint action of several factors, should we not introduce these factors directly into the analysis instead of measuring them indirectly through the cyclical income index? There is no denying that the approach presented so far is greatly oversimplified. On the basis of theoretical considerations, one should introduce not only the specific factors mentioned in the preceding section but also other factors, some of general significance (for example, fluctuations in instalment credit, capital gains and losses, permanency of the highest previous income level), and some of special

[26] On this point see also note 16. The relation may not be linear. The difficulty of estimation is increased by the fact that the variance of the positive values of the cyclical income index must, because of its nature, be relatively small. Whereas there are no *a priori* limits to the negative values of the cyclical income index (since current income may theoretically fall to zero) the possibility of increases above the previous peak is generally limited by technological conditions.

significance for the United States in the period under consideration (for example, changes in income taxation and in the volume of transfer payments).

Any attempt to refine our approach, however, meets serious difficulties. For one thing, no estimates are available for some of the theoretically relevant variables; and those that are available are so crude as to make their value dubious for the purpose of refining the approach. Moreover, it is doubtful that the present estimates of consumption and saving are sufficiently accurate to justify a more refined approach involving a large number of independent variables, especially when we consider that the simple correlation between consumption and income is already in the order of .99. The most important consideration, however, is more technical. As we have argued, all the factors of greatest quantitative importance have a strong cyclical character and are highly intercorrelated among themselves and with the cyclical income index. Hence, even if we had the necessary statistical information, any attempt to measure the separate influence of each factor would lead at best to highly uncertain estimates. These *a priori* considerations are fully confirmed by certain attempts in this direction made during the course of this study.

One such attempt, which aimed at measuring the separate influence of unemployment, may be briefly described here both as an illustration of this point and for its intrinsic interest.

Total consumption may be considered to be made up of the consumption of the employed and of the unemployed. The first quantity (denoted below by C_E) may again be assumed to depend on the current and on the highest previous income: using E for the number employed, I for the aggregate income they earn (net of personal taxes), and $\frac{I_t^\circ}{E_t^\circ}$ for the highest previous income per employed person, we have:

$$\text{V 1} \qquad C_E = \left[\mathrm{a} \frac{I_t}{E_t} - \mathrm{b} \left(\frac{I_t}{E_t} - \frac{I_t^\circ}{E_t^\circ} \right) \right] E_t$$

$$= \mathrm{a} I_t - \mathrm{b} \left(\frac{I_t}{E_t} - \frac{I_t^\circ}{E_t^\circ} \right) E_t \, ; \, (1 > \mathrm{a} > \mathrm{b} > 0)$$

Next, denoting by U the number unemployed, by C_U their consumption, and by TY the amount of transfer payments going to the unemployed, we may assume the following approximate relation:

$$\text{V 1a} \qquad C_U = \left(\mathrm{c} + \mathrm{d}\frac{TY}{U}\right)U = \mathrm{c}U + \mathrm{d}TY; (\mathrm{c} > 0, 0 < \mathrm{d} < 1)$$

Adding V 1 and 1a, we have for total consumption, C:

$$\text{V 1b} \qquad C = C_E + C_U = \mathrm{a}I_t - \mathrm{b}\left(\frac{I_t}{E_t} - \frac{I_t^\circ}{E_t^\circ}\right)E_t + \mathrm{c}U + \mathrm{d}TY$$

$$= \mathrm{a}(I + TY) - \mathrm{b}\left(\frac{I_t}{E_t} - \frac{I_t^\circ}{E_t^\circ}\right)E_t + \mathrm{c}U + (\mathrm{d} - \mathrm{a})TY$$

Equation V 1b may conveniently be further transformed to express per capita consumption in terms of disposable income per capita and the proportion of unemployed workers. Denoting population by P, the labor force by L, and aggregate disposable income by $Y = I + TY$, and recalling that in the period of observation the labor force was practically a constant proportion of population (let us say, $L = \propto P$), we obtain:

$$\text{V 1c} \qquad \frac{C}{P} = \mathrm{a}\frac{Y}{P} - \propto \mathrm{b}\left(\frac{I_t}{E_t} - \frac{I_t^\circ}{E_t^\circ}\right)\frac{E}{L} + \propto \mathrm{c}\frac{U}{L} + (\mathrm{d} - \mathrm{a})\frac{TY}{P}$$

An attempt was made to test equation V 1c statistically for 1923–40, although information on employment and unemployment is far from satisfactory. The subscripts 1 through 5 refer to the variables of equation V 1c in the order in which they appear. If we first correlate per capita consumption with income per capita and the coefficient of unemployment, we obtain results very similar to those obtained for the hypothesis of equation III 2, namely, a multiple correlation of .992, a partial correlation $r_{14.2}$ of .62 (note, however, that we have lost two observations), and the following regression equation:

$$\text{V 2} \qquad \frac{C}{P} = 8.6(\pm 26) + .88\frac{Y}{P} + 105\frac{U}{L}$$

It appears that the secular relation between consumption and income (that is, the relation that prevails when U/L is small and constant) is essentially the same as that obtained from equation III 3. The constant term is again quite small, and is insignificant when compared with its standard error (26); the secular propensity to consume (.88) is only slightly lower. Furthermore, this equation indicates that for a given level of income, consumption tended to increase 105 (real) dollars per unit change in the unemployment coefficient. (Since the labor force is about 40 percent of the population, this implies that aggregate consumption tended to increase $260 per unit increase in the number unemployed, a result not entirely unrealistic.)

Finally, if we assume a 'full employment' value for U/L of some 2 percent and extrapolate the equation for values of real income of between 900 and 1,000 real dollars (the only range we need consider for 1950), we again obtain a saving–income ratio of not quite 11 percent. The similarity of these results with those of equation III 3 are, of course, not surprising since, as we have argued, the quantity U/L and the quantity $(Y - Y^\circ)$ are bound to be very closely related.

But if we now proceed to introduce the quantity $\left(\frac{I}{E} - \frac{I^\circ}{E^\circ}\right)\frac{E}{L}$ as a fourth variable, we get entirely unsatisfactory results. The net correlation between consumption and the coefficient of unemployment, $r_{14.23}$, falls to .2, and similarly, the net correlation $r_{13.24}$ is only $-.49$, whereas $r_{13.2}$ was $-.72$. Both partial correlations are now so low that the corresponding regression coefficients, which should measure the separate influence of the two variables, are entirely unreliable.[27]

It is to be hoped that as new and more reliable statistical information becomes available for a greater number of years, it

[27] In view of these results, it seems useless to add to the correlation the last variable of equation V 1c, namely, TY/P. In any event, the importance of this variable could not be large, since transfer payments represented at best a small fraction of income; furthermore, the weight of this variable in equation V 1c should be theoretically equal to the difference between the (long-run) marginal propensity to consume earned income and the marginal propensity to consume transfer payments.

will become possible to refine the analysis.[28] All we can say with relative confidence at present is that the *joint* effect of the various factors was to produce a cyclical marginal propensity to consume in the order of 75 percent as compared with a long-run average and marginal propensity of 89 to 90 percent.

The failure to reach reliable quantitative conclusions for the individual factors is probably not as serious as might appear. As we have argued, the intercorrelation between the theoretically relevant independent variables is a systematic phenomenon that may be expected to hold in the future. If so, the determination of the separate influence of each variable, though undoubtedly of theoretical interest, is not of crucial importance for forecasting. Pending further refinements, it appears that our simplified approach, despite its theoretical crudeness, may be extrapolated with relative confidence. These conclusions are fully supported by an analysis of Canadian and Swedish material.

VI The Hypothesis Tested for Sweden and Canada

The consumption-income relation in Canada for 1923–39 is shown in Chart 2.[29] Owing to the nature of the original estimates, the two series differ considerably from those used for the United States, not only in reliability but also in concept. The series graphed on the horizontal axis is deflated gross national product; the consumption estimate graphed on the vertical axis includes government expenditure but excludes expenditure on consumer durables except motor cars, for which a crude adjustment was

[28] One factor of special importance is instalment credit because it tends to offset, to some extent, the action of the three factors discussed in Section IV. As a result of the decline in the expenditure on durable goods as income falls cyclically, new instalment borrowing tends to decline, falling short of repayments on outstanding loans, which depend on purchases contracted for earlier. This tends to maintain saving as income declines. The opposite movement occurs when income is recovering, the increase in saving being partly offset by an increase in net instalment borrowing. Unfortunately, no adjustment could be made for this factor because good estimates of instalment credit are unavailable for the period before 1929. For 1929–40, if one subtracts from aggregate savings the net yearly change in instalment credit, the scatter of Chart 1 improves considerably.

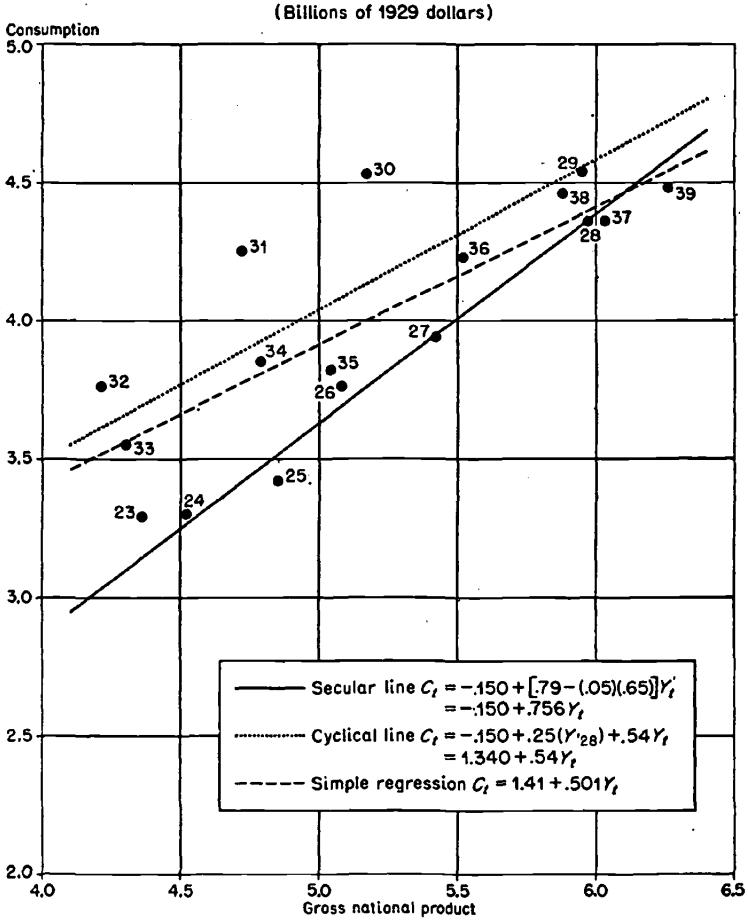
[29] For the sources and derivation of the series on which Chart 2 is based, see Appendix reference C.

made. (Estimates of net national product seem somewhat less reliable than those of gross national product.) For lack of a better

CHART 2

Relation between Consumption and Gross National Product Canada, 1923 – 1939

(Billions of 1929 dollars)



See Appendix reference C for sources and derivation of series.

deflator, the cost of living index was used to deflate both series. Obviously the two series thus obtained are theoretically not entirely satisfactory; nevertheless, they should be adequate to

indicate whether generalizations can be made from the results for the United States.

The scatter of points follows closely the pattern indicated by our hypothesis: during the cyclical fluctuations in income from 1928–29 to 1937, consumption did not retrace the path it had followed during the expansion from 1923 to 1929, but remained consistently higher, fluctuating around a cyclical line distinctly flatter than the secular line. Furthermore, the configurations of the scatter suggest also a marked short lag of consumption behind income, a lag that did not appear in the case of the United States (see, however, Sec. XII).

All this is clearly brought out by correlation analysis. The simple correlation between consumption and income is only .77. The regression equation of consumption, C, on income, Y, (both expressed in billions of deflated dollars) is:

VI 1 $$C_t = 1.41 + .50Y_t$$

This would indicate a marginal propensity to consume of only about 50 percent. But when we introduce lagged income, Y_{t-1}, and the highest previous income, Y_t°, as additional variables, the correlation rises to .97 and the regression equation takes the form:

VI 1a $$C_t = .15 + .135Y_t + .405Y_{t-1} + .25Y_t^\circ$$[30]

From equation VI 1a we may easily compute both the cyclical and secular relation of income and consumption. To obtain the first we recall that, for cyclical changes in income, Y_t° is a constant, and we rewrite equation VI 1a:

VI 1a1 $$C_t = (-.15 + .25Y_t^\circ) + .54Y_t - .405(Y_t - Y_{t-1})$$

[30] Denoting the variables C_t, Y_t, Y_{t-1}, Y_t°, by the subscripts 1, 2, 3, and 4, the relevant simple and partial correlation coefficients are: $r_{12} = .77$; $r_{13} = .91$; $r_{14} = .65$; $r_{12.34} = .44$; $r_{13.24} = .79$; $r_{14.23} = .78$.

What is striking is the apparently negligible net influence of current income as measured by the net correlation $r_{12.34}$. Apparently, lagged income has a much greater influence in terms of both simple and net correlation. From a purely statistical point of view, current income could be neglected, since it does not raise the multiple correlation significantly. From the economic point of view, however, it is hardly conceivable that current consumption should not be influenced, at least in some degree, by current income. The variable Y_t is therefore included, although this diminishes the reliability of the individual regression coefficients. The value of the statistic K is 2.11, which is not significant (see note 14).

This shows that the cyclical marginal propensity to consume is indeed, on the average, only about .54; it is somewhat higher if income is falling, in which case $(Y_t - Y_{t-1})$ is negative, and somewhat lower if income is rising. To estimate the secular relation, on the other hand, we replace Y_t° by Y_{t-1}:

VI 1a2 $\quad C_t = -.15 + .79Y_t - .65(Y_t - Y_{t-1})$

This indicates that even when the normal secular growth of income is allowed for, the secular marginal propensity is in the order of .75, which is 50 percent higher than the estimate based on the simple regression. Furthermore, the constant term in equation VI 1a, contrary to that of equation VI 1, is definitely small (the mean value of Y is 5.23) and does not differ significantly from zero, indicating again that the long-run average and marginal propensity to consume are almost the same. The secular relation between consumption and income, given by equation VI 1a2, is graphed as a solid line in Chart 2, assuming that income grows 5 percent a year (the average percentage growth for 1923–29). By comparing this line with the simple regression equation VI 1, graphed as a broken line in Chart 2, we can see how significant the difference between our approach and the usual one becomes when the relations are extrapolated to levels of income sizably higher than were realized in the period of observation.

According to these results, both cyclical and secular propensities to save are impressively higher than those obtained for the United States. The difference, however, appears to be largely explained by differences in definitions. When adjustment is made as closely as possible to United States Department of Commerce definitions, the secular marginal propensity to save in terms of national income may be estimated to be 11–12 percent.[31]

[31] Based on the estimates given, depreciation constitutes some 13 percent of net national income in years of secular expansion. If we accept this figure, and assume a normal secular growth of income of 3 to 5 percent, the marginal (and average) propensity to save would be 14 to 15 percent. From this figure we must still subtract expenditure on the relevant part of consumer durables. Expenditure on these goods in the United States may be roughly estimated to be 3–4 percent of net income (based on the estimates in 'Consumption Expenditure, 1929–1943', *Survey of Current Business*, June 1944, Table 2). The percentage need not be strictly applicable to Canada; it is nevertheless clear that with this final adjustment the net marginal propensity to save cannot be far from 11 to 12 percent.

It must, of course, be recognized that this brief analysis of Canadian experience is necessarily rather crude and that the quantitative results are tentative. In particular, the exceptionally marked lag of consumption behind income deserves further investigation. However, even our crude analysis shows rather convincingly that the discrepancy between the cyclical and secular relation of income and consumption is at least as pronounced in Canada as in the United States.

The data for the United States and Canada analyzed so far cover a period that is relatively short and entirely dominated by the cycle of the 'thirties. It is important to test our hypothesis over a longer interval. Probably the only country for which this can be done at present is Sweden, for which continuous estimates of national income and consumption are available from 1896 to 1934, though, again, they are conceptually somewhat different from those used for the United States.[32] These estimates, adjusted for changes in prices and population, are plotted in scatter diagram form in Chart 3 (omitting the war years 1914–18). The relation between the two variables appears to follow the pattern indicated by our hypothesis: when income falls below the previous peak there is a distinct tendency for consumption not to retrace the secular path, but to remain at a higher level, fluctuating about a line markedly less steep than the secular line. Indeed, the hypothesis of equation III 2 appears to fit the data remarkably well, as indicated by a multiple correlation coefficient of .997 and significant partial correlations for all variables.[33] The regression equation is:

VI 2 $$C_t = 61 + .85Y_t - .35(Y_t - Y_t^\circ) = 61 + .50Y_t + .35Y_t^\circ$$

[32] The major conceptual difference is that the Swedish estimates include taxes and corporate savings in income, and government expenditures on goods and services in consumption. For sources and methods used in computing these series, see Appendix reference D. Estimates are available for 1935–39 also, but are not truly comparable with earlier years.

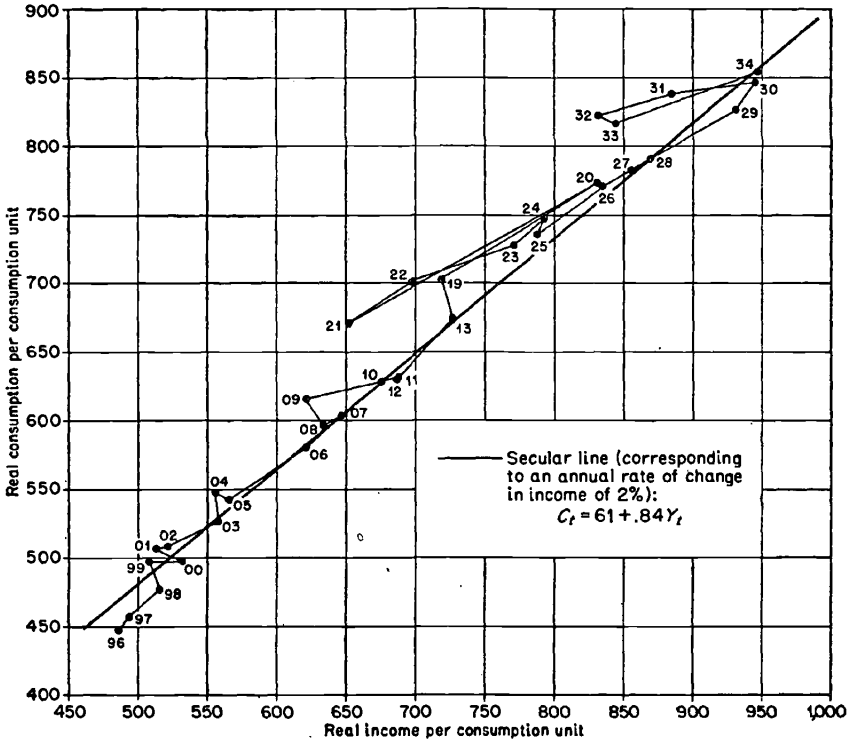
[33] The simple and partial correlation coefficients are:

SIMPLE CORRELATIONS	PARTIAL CORRELATIONS
$r_{cy} = .985$	$r_{cy.(y-y^\circ)} = .996$
$r_{c(y-y^\circ)} = -.26$	$r_{c(y-y^\circ).y} = -.88$
$r_{c(y-y^\circ)} = -.1$	

The value of K is 1.54, which is not significant (see note 14).

CHART 3

Relation between Income and Consumption
Sweden, 1896–1934 (1914–18 omitted)
(Kronor of 1910–13 purchasing power)



From this equation it appears that the long-run marginal propensity to consume is in the order of .85 or slightly less, depending on the secular growth of income, while the short-run marginal propensity is only .5.[34] The fact that the cyclical marginal propensity appears to be so much lower for Sweden than for the United States probably reflects the influence, in the course of the cycle, of cor-

[34] If we assume the normal secular growth of income to be some 2 percent per year (approximately the average growth in the past) we can replace Y_t° by $.98Y$, obtaining: $C_t = 61 + .50 + .98(.35)\ Y_t = 61 + .84Y_t$. This equation may be considered the long-run consumption function and is graphed as a solid line in Chart 3. It indicates a long-run marginal propensity to consume of about .84.

porate savings and dissavings, which are included in the Swedish income estimates (see Sec. XII). Similarly, the somewhat lower long-run marginal propensity obtained for Sweden (.84 to .85 as compared with .89 to .90 from the Department of Commerce series) cannot be taken as a certain indication of structural differences, since it too may reflect, in some degree, purely conceptual differences.

There is, however, one interesting difference between equations III 3 and VI 2 that can hardly be explained by differences in definition alone: equation VI 2 contains a constant term that is relatively large and significant in the statistical sense (the standard error of the constant is 9.6). Because of this constant term, equation VI 2 indicates that the long-run average propensity to consume does not coincide as closely with the long-run marginal propensity as it does in the United States; it tends instead to fall gradually as income rises, a fact that can be checked directly from the original data. This, however, in no way invalidates the substance of our argument. What is important is that the long-run marginal propensity to consume is distinctly higher and closer to the average than the short-run marginal propensity, so that the tendency for the saving-income ratio to rise with income is quantitatively rather small in the long run, and much smaller than during a cycle.[35] If we compare years characterized by similar secular growth of income at the beginning and at the end of the period covered by the Swedish series, we find that the consumption-income ratio varied only from about 92–93 to about 89–90 percent, though real income per consumption unit almost doubled.[36] During a single cycle, on the other hand, this ratio fluctuated as widely as +12 to −3 percent. Finally, if equation VI 2 should continue to hold, the long-run saving-income ratio would tend to rise at

[35] As already noted in connection with equation III 3, during the course of the cycle the constant term in equation VI 2 is $61 + .35Y_t^\circ$; in the long run, when Y_t° varies together with Y_t, the constant term is close to 61.

[36] According to our regression equation, the change in the consumption ratio corresponding to the actual change in income would be somewhat smaller, that is, from 94–95 to about 90 percent, because actual consumption in the first few years was somewhat less than our equation indicates. In this connection, see note 39.

an even slower rate (unless per capita income should rise at a much faster rate).[37]

The statistical material available for Canada and Sweden appears to confirm the validity of our hypothesis and the main conclusions that follow from it: the extrapolation of the simple regression equation of consumption on income is entirely misleading and seriously underestimates the future of consumption; and in the long run the saving-income ratio tends to fluctuate very slowly, if at all. It is entirely possible, as the Swedish material suggests, that this ratio might have a tendency to rise as income gradually rises from a very low level, *other things being equal.* Even this tendency, however, is probably weak in comparison with, and may be obscured by, the 'other things' that also change slowly in the long run—for example, the age structure of the population, degree of urbanization, income distribution.[38] Furthermore, our statistical results, as well as theoretical arguments beyond the scope of the present empirical investigation, suggest that once the saving-income ratio has reached a relatively high level, the tendency for a further rise, if present, would be particularly weak under normal peacetime conditions.

VII Implications for Forecasting

We may now briefly examine the implications of our results for purposes of extrapolation. As we have seen, the relation between income and consumption in the United States in the interwar pe-

[37] From the long-run consumption function in note 34, we see that the long-run consumption-income ratio is:

$$\frac{C}{Y} = \frac{61}{Y} + .84$$

For this expression to equal .87 (corresponding to a saving-income ratio of 13 percent) real income per consumption unit should exceed 2,000 kronor; it was about 950 in 1934. Similarly, it would take an income of over 3,000 kronor to bring the consumption-income ratio down to .86.

[38] Evidence of slight shifts in the saving-income ratio from decade to decade are to be found in Kuznets' estimates in *Uses of National Income in Peace and War,* as well as in the Swedish estimates. In view of the margin of error in the estimates, it is, of course, difficult to say how much significance can be attributed to these slight shifts.

riod may be explained approximately as well on Smithies' hypothesis as on our own. For the period of observation, the two hypotheses are equally tenable. But the difference between them becomes quite significant when one tries to make a long-range forecast for 1950. According to Smithies' hypothesis, the gradual upward drift in the short-run consumption-income schedule would depend on the passage of time alone and is therefore entirely unrelated to the growth of income; the relative stability of the saving–income ratio in the past reflects merely a coincidence between the trend of consumption and of income. But, according to our hypothesis, this gradual upward drift is directly related to the growth of income (through the factor Y_t°); it is not a mere coincidence but a systematic phenomenon that can be extrapolated.

The difference between the level of income prevailing in 1940 and the level that may be expected in 1950 at full employment is so large that the relation between Smithies' consumption trend and the secular rate of growth in income no longer holds. On the basis of Smithies' hypothesis we are therefore led to expect a much higher saving-income ratio than was ever realized in the period of observation. On the basis of our hypothesis the saving-income ratio in 1950 would not depend directly on the level of income but only on the cyclical position of that year. Assuming full employment and a normal rate of growth of income (let us say, 2 to 4 percent), equation III 2 or 3 would lead us to expect a saving-income ratio of 10 to $10\frac{1}{2}$ percent.[39] When disposable income is \$154 billion, this implies a savings level of \$16–17 billion; the forecast was \$21–22 billion, or about 14 percent, according to Smithies and Mosak, and \$10–11 billion, or about 7 percent, according to

[39] According to equation III 3, the saving-income ratio will not be entirely independent of the actual level of real income. From this equation we have, in fact:

$$\frac{S}{Y} = 1 - \frac{C}{Y} = 1 - \left[.898 - .125 \left(\frac{Y_t - Y_t^\circ}{Y_t} \right) + \frac{2}{Y_t} \right] = .102 + .125\, r - \frac{2}{Y_t}$$

Here r denotes the assumed rate of growth of income. The value of the last term in the right side of the equation obviously depends on the assumed level of real income, Y_t. However, since real income per capita was nearly \$700 in 1940, the value of this term is, in any event, extremely small. Different assumptions about Y_t (as long as they remain within realistic limits) will not affect the forecast of the saving-income ratio significantly.

Woytinsky.[40] One other approach to the problem of forecasting—that of V. Lewis Bassie, which appeared too late for us to compare his results thoroughly with ours—leads to estimates close to those of Smithies and Mosak.[41] But our examination of Bassie's method gives us no reason to modify our conclusions.

According to the latest estimates of the Department of Commerce, in the first quarter of 1946 disposable income and savings were running at a seasonally adjusted rate of some $140 billion and $19 billion, respectively,[42] indicating that the saving-income ratio had already fallen from the wartime peak of over 28 percent (reached in 1944) to 13½ percent. On the basis of our results a further significant decline may be expected by 1950. This decline will not necessarily proceed without interruption since in the first transitional and post-transitional years the relation between income and consumption is and will be affected by several exceptional circumstances, tending to produce opposite results, any of which may dominate temporarily. For example, shortages of com-

[40] Woytinsky's equations are extrapolated as follows: A disposable income of $154 billion in 1943 prices corresponds to about $130 billion in 1941 prices. Substituting this figure in the two equations considered most reliable by Woytinsky (*op. cit.*, equations 11 and 21a), we obtain $11 billion and $9.5 billion for savings.

[41] 'Consumers' Expenditures in War and Transition', *Review of Economic Statistics*, Vol. 28, No. 3 (Aug. 1946), pp. 117–30. Bassie's hypothesis yields the somewhat odd result that real consumption per capita depends not only on real income per capita but also on the size of the population. It is true that his equation fits the data remarkably well. But the income and consumption series he used are old Department of Commerce estimates, which differ from the current ones, especially for the prewar period. For the period after 1921, the difference between Bassie's and Smithies' hypothesis is not as great as may appear. The short-run marginal propensity to consume is again about .77, while the linear trend is replaced by the gradual increase in population.

The above consideration shows that in Bassie's, just as in Smithies' hypothesis, the upward drift of the consumption schedule is independent of the rate of increase in income. Hence, if we extrapolate Bassie's equation into a period in which income is expected to rise considerably faster than in the past, relative to population, we again get a distinctly higher saving-income ratio than in the period of observation. We are not in a position to compare directly Bassie's forecast of the saving-income ratio with the other forecasts discussed here, since Bassie's results are not given explicitly except in graphic form. If we use our standard test assumption of $154 billion at 1943 prices, Bassie's equation yields a saving-income ratio of about 13.5 percent.

[42] 'Income, Consumption and Savings', *Survey of Current Business*, May 1946, p. 5.

modities and acquired wartime saving habits will tend to keep consumption down, while the backlog of demand for consumer durable goods and the large volume of liquid assets will tend to raise it.[43] If experience after World War I is a criterion, it may be four years before a 'normal' relation is reestablished. In any event, the influence of the transitional phenomena will have largely petered out by 1950. We may therefore expect that the downward trend of the saving-income ratio, already manifest, will eventually prevail, even if a high level of employment is maintained.

Our forecast is, of course, subject to a margin of error that may be negligible relative to consumption but significant relative to saving. As stressed above, this is particularly true of a long-range forecast, such as the present. But even if we try to take into account factors that may in the long run affect the basic level of the saving-income ratio, we have much more reason to expect a downward than an upward shift.[44] It is therefore clear that if our hypothesis is fundamentally correct, as the various tests and arguments previously developed strongly suggest, a saving-income ratio of some 14 percent is entirely out of the question; indeed, even allowing for the margin of error, we should not expect the saving-income ratio to exceed significantly an upper limit of some 11 percent.[45]

[43] For a discussion of the problems of these transitional phenomena see Bassie, *op. cit.*

[44] In addition to the possible effect of accumulated wartime savings, which may lessen the inducement to save, several other long-term factors may be expected to work in the same direction. For an analysis of such factors, see, for instance, George Terborgh, *The Bogey of Economic Maturity* (Machinery and Allied Products Institute, Chicago, 1945), Ch. 4 and 12. A downward shift of the saving-income ratio would also be in line with the marked downward trend exhibited by the revised Kuznets' estimates.

[45] This statement must be qualified to the extent that real income in 1950 may exceed the highest previous income by much more than the 2 to 4 percent assumed in our forecast. In fact, according to equation III 2 or 3, the saving-income ratio will tend to be higher, the higher the rate of increase in income in the given year. Furthermore, the experience of 1941 suggests that in the case of exceptionally sudden increases in income, the saving-income ratio may rise even higher than indicated by our regression equations.

VIII Other Applications: The Profit–Income Ratio

In the preceding pages we have developed a method for separating secular and cyclical factors in the relation between individual savings, income, and consumption. Similar methods applied to the study of the relation between corporate savings and income enable us to supplement our forecast with respect to individual savings. First, we consider the relation between aggregate profits, corporate profits, and national income. The profit–income relation is particularly enlightening because the behavior of profits should be especially sensitive to cyclical fluctuations in income.

Mosak, in forecasting the level of profits, also rejects the possible significance of cyclical factors. His forecasting equation is, in fact, obtained simply by correlating linearly the various components of profits with income in 1929–40 (with certain adjustments).[46] The equations imply a startling discrepancy between average and marginal profit ratios. For instance, for an income (adjusted) of $85 billion (approximately the 1929 value) corporate profits would constitute about 10 percent and total profits about 25 percent of income. But from each increment of income, more than 40 percent would go to profits, and of this amount 24 percent would go to corporate profits. Thus an increase in income, *whatever its nature*, would shift the income distribution in favor of entrepreneurs in general and corporations in particular.

We have every reason to expect that cyclical changes in income would affect profits, especially corporate profits, much more than all other income shares. But it is hard to believe that secular changes in income also would always work in this direction or, at any rate, to the same degree. The income distribution may well change in the long run under the impact of technological, and especially institutional, changes. But such changes are bound to occur gradually at best and, in any event, there is little reason to expect

[46] The 'independent' variable Mosak actually uses is private gross national product minus indirect taxes (*op. cit.*, p. 43). He considers, but quickly dismisses, the possibility that his equations might be misleading for purposes of projection (p. 32). Some of his arguments seem invalid, and others inconclusive. Smithies' procedure appears to be very similar to Mosak's.

that they will be closely related to the size of the money income flow.

These theoretical considerations suggest that Mosak's equations can express only cyclical, not secular, relations; this is entirely confirmed by a statistical check. If his equations are extrapolated only as far back as the years immediately preceding World War I, they fail to given even a remote approximation to the behavior of profits. For example, in 1915, according to the Department of Commerce, corporate profits amounted to about $3 billion and total entrepreneurial income to $11 billion, while, according to Mosak's formulas, corporate profits should have amounted to −$3.2 billion and total profits to $1.9 billion.[47]

The fallacy of Mosak's procedure is obvious in Charts 4 and 5.[48] If we neglect the exceptionally high profits of World War I years (1917–19), which are omitted in the graphs, we have two types of line: a relative flat line going through 1909–13, the decade of the 'twenties (excluding 1921), and 1940; and several steeper cyclical lines, such as those through 1913–16, 1920–22, and 1929–40. Mosak's regression line is essentially the steep cyclical line corresponding to 1929–40. The reason for the large discrepancy between the actual level of profits in 1915 and the level computed from his equation is clear. It is equally clear why he was led to forecast so high a level of profits for 1950. According to his forecast, corporate profits in 1950 at full employment would constitute some 16 percent of income, although the highest ratio in the interwar period was only 10.5 percent. Similarly, total profits would constitute some 31 percent of income, though in the interwar period they appear never to have significantly exceeded 27 percent.

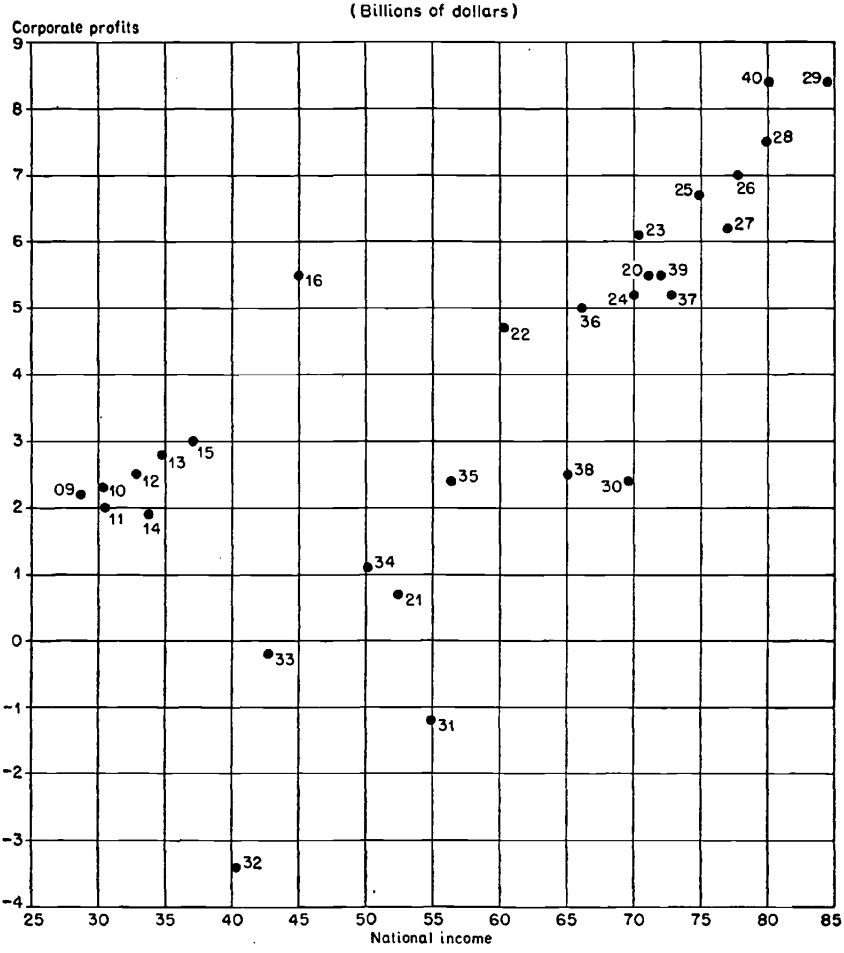
It might seem that a more reliable forecast could be obtained by extrapolating the two relatively flat lines in Charts 4 and 5.

[47] The Department of Commerce figure for gross national product in 1915 is $42.1 billion, for government expenditure $3 billion, leaving a gross private national product of about $39 billion. Indirect taxes are not stated explicitly, but they can be approximated by subtracting personal and corporate income taxes ($.7 billion) from government expenditure. We thus obtain a figure for gross private product, minus indirect taxes, of about $37 billion; substituting this figure in Mosak's equation, we obtain the above results.

[48] See Appendix reference E.

CHART 4.

Relation between Corporate Profits and National Income
United States, 1909–1940 (1917–19 omitted)



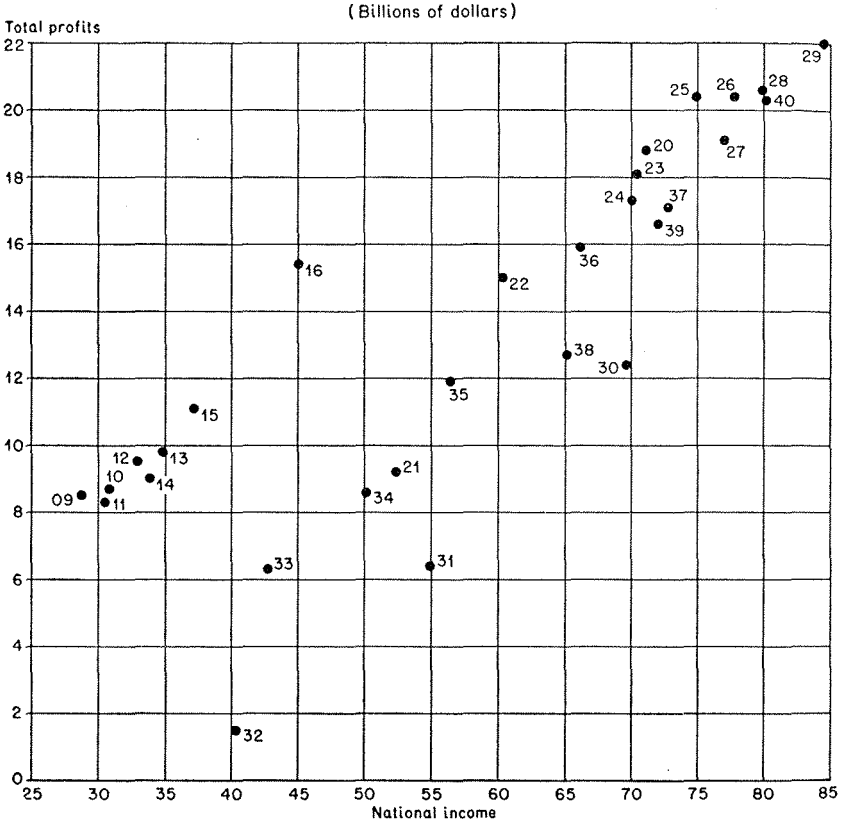
Both series include corporate profits taxes.

This is essentially the procedure recommended by Woytinsky; but even this alternative, though certainly less misleading, must be discarded, not only because it is too arbitrary but also because it is otherwise theoretically unsatisfactory. In fact, any linear relation between income and profits (unless it happens to have an in-

tercept of zero) would imply that a secular rise in income always increases, if there is a negative intercept (as in Chart 4), or always decreases, if there is a positive intercept (as in Chart 5), the share of income accruing to a particular group. As we argued above, such an assumption cannot very well be justified on *a priori* grounds.

CHART 5

Relation between Total Profits and National Income
United States, 1909–1940 (1917–19 omitted)



Both series include corporate profits taxes

These considerations suggest that the whole problem should be attacked by studying the behavior of the *share* of income accruing to profits over as long a period as possible, and by examining whe-

ther its secular pattern can be separated from its cyclical. For this purpose we used the Department of Commerce estimates, available back to 1909. Although for the period preceding 1929, and especially for the earliest years, the estimates are certainly not as reliable as after that date, they should be adequate to give us an approximate general picture of the historical development.

IX Forecasting the Profit–Income Ratio

Following the method used for savings, a cyclical income index was computed according to the formula $\frac{Z_t - Z_t^\circ}{Z_t}$, where Z_t and Z_t° denote respectively the current and highest previous real national income per capita.[49] The resulting series, omitting the war years with which we are not here concerned, is graphed in Chart 6 together with the share of total profits in national income. The year-to-year movements of the two series are remarkably similar, though there appears to be some tendency for the profit share to decline slowly.[50]

If we correlate this profit series (hereinafter denoted by X_1) with the cyclical income index (denoted by X_2) we obtain a correlation coefficient of .88. A large part of the unexplained variance can be explained by adding a linear time trend (t) and the rate of change in wholesale prices (X_3).[51] The addition of the latter variable seems reasonable, especially since the Department of Commerce estimates of total profits include profits and losses on inventories. The multiple correlation coefficient then rises to .95,[52] and the following

[49] For details of computation, see Appendix reference F.

[50] This falling tendency, at least after 1909, is confirmed by Kuznets' estimates in *Uses of National Income*, p. 38, Table 9, and in *National Income: A Summary of Findings*, p. 50, Table 15.

[51] It appears, in fact, that profits were relatively high in years characterized by more or less marked price rises, such as 1916, 1919, 1920, and 1933–36. Similarly, there seems to be some tendency for profits to be relatively low in years of price contraction. For methods used in computing the index X_3, see Appendix reference G.

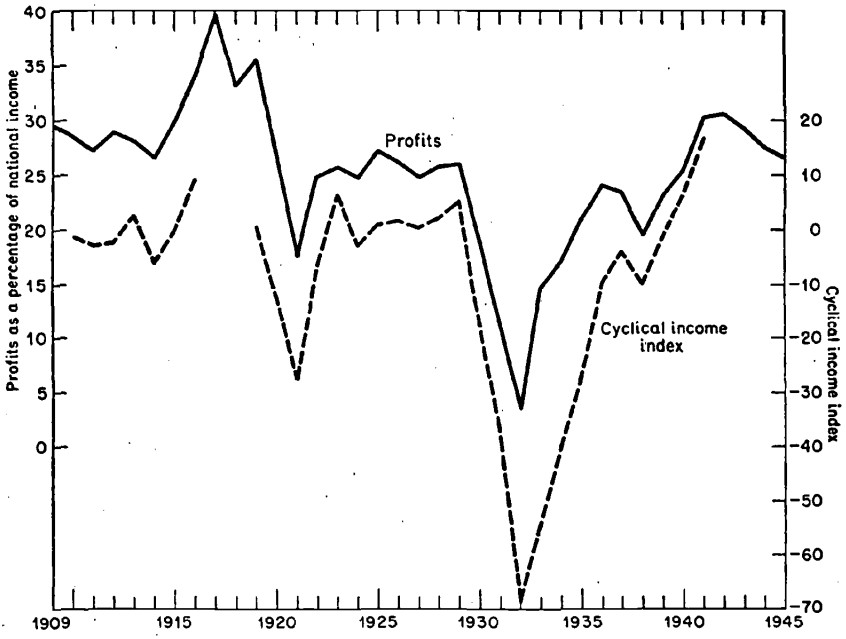
[52] Denoting the variables X_1, X_2, X_3, and t by subscripts 1, 2, 3, and 4, respectively, the relevant simple and partial correlation coefficients corresponding to regression equation IX 1 are $r_{12} = .880$; $r_{14} = -.54$; $r_{13} = .53$; $r_{12.34} = .901$; $r_{14.23} = -.66$; and $r_{13.24} = +.66$. Although the partial correlation between the variable X_1 and t and that between X_1 and X_3 are not very high, they are definitely significant, in view

regression equation is obtained:

IX 1 $X_1 = .256 + .242X_2 + .175X_3 - .002\,(t - 1929)$

CHART 6

Share of National Income Accruing to Profits and the Cyclical Income Index United States, 1909–1945



Equation IX 1 may be interpreted along the lines developed for the savings problem. The share of income accruing to profits, X_1, tends to fluctuate with income during each cycle, falling below and moving back toward the normal secular level—defined as the level that corresponds to the normal secular growth of real income *and* no marked price changes. This normal level may be estimated from equation IX 1 as being about 26 percent at the end of the 'twenties and falling gradually. In years of secular growth, the

of the relatively large number of observations. The value of K is 1.86, which is not significant (see note 14).

profit share tends to fluctuate closely around this level, rising above it if income rises at a faster rate and falling below it in the opposite case.

This result may usefully be formulated also in terms of a marginal profit ratio. By manipulating equation IX 1, it can be shown that instead of the single marginal profit ratio of some 40 percent obtained by Mosak, we should distinguish between a secular one, approximately equal to the normal profit ratio defined above, and a cyclical one, exceeding the secular by an amount nearly as high as the coefficient of X_2.[53] This means that in the interwar period the cyclical marginal profit ratio was as high as 45 to 50 percent.[54]

The difference between the marginal profit ratios corresponding to secular and to cyclical income changes must, of course, be explained along lines quite different from those put foward in the discussion of the savings problem. Without going into a long technical argument, we merely point out that this difference must have to do partly with the difference between short- and long-run marginal costs. As long as output remains below the highest previous peak it presumably fluctuates within the limits of existing capacity; in that event, because of the rigidity of overhead costs, marginal gross and net profits approximately coincide. If, on the other hand, productive capacity itself has to be increased, overhead costs themselves are variables, and marginal net profits tend to fall well below marginal gross profits. Abnormally high profits will, of course, also tend to generate higher real wages through competition and direct workers' pressure. The fact that, in the case of a secular expansion of income, profits tend to be directly related to the rate of change in income is likely to reflect, to some degree, a lag of real wages behind changes in productivity and profits.

[53] The cyclical (secular) marginal profit ratio measures the share of any cyclical (secular) increase in income (in the sense of our definition) accruing to profits.
[54] Verification from the original series is easy: For instance, of a nearly $45 billion fall in income from 1929 to 1932, profits accounted for over $20 billion, and of the subsequent rise of $32 billion in 1932–37, profits accounted for nearly $16 billion. A similar relation is found to hold also for the less pronounced cyclical fluctuations, such as those in 1920–21 (when income fell about $19 billion and profits more than $9 billion), and in 1937 and 1938 (when income fell some $8 billion and profits some $4 billion).

In projecting equation IX 1 to 1950, we must introduce specific assumptions with respect to the value of the 'independent' variables. Since we are interested in forecasting the dependent variable under the hypothesis of full employment we may again assume a value for X_2 between .02 and .04. We may assume also that there are no large price movements and put X_3 at 0. The only serious problem concerns the variable t. It is extremely doubtful that the tendency of the profit-income ratio to fall will continue in the near future. If we do not extrapolate the falling trend beyond 1940 (keeping t in equation IX 1 constant at a value of 11), as seems safer, then, under the assumption stated, we would obtain for 1950 a forecast of 24 to 24.5 percent. Even this forecast is probably somewhat too conservative since there is reason to believe that equation IX 1 exaggerates the strength of the falling trend in the last decade covered by our data.[55] Since the total fall due to the trend in this decade amounts to 2 points, it seems reasonable to allow for this possible source of error by raising and somewhat enlarging the range of our forecast to a level of 25–26 percent.[56]

Despite these upward revisions, our estimate remains impressively below Mosak's 30–31 percent.[57] According to the latest Department of Commerce estimates, in 1945 the profit–income ratio still amounted to some 26.5 to 27 percent, having steadily declined from the record 32 percent in 1942. Our equation indicates that

[55] This is because the cyclical position of the last years covered by our analysis may have been less favorable than indicated by our cyclical index. In fact, if the cycle is long, $\frac{Z_t - Z_t^\circ}{Z_t}$ fails to reflect fully the extent of unemployment due to the secular increase in productivity.

[56] In other words, in projecting equation IX 1, besides taking $t = 11$, we must leave a margin of 1 point for possible underestimation due to the uncertainty of the trend.

[57] Our estimate for 1950 is well below the ratio actually realized in 1941, slightly over 30 percent; all signs, however, indicate that this ratio was abnormally high. Indeed, the experience of 1941 is fully explained by our equation IX 1 as the result of the entirely abnormal rise in income (17 percent) and of the rapid increase in prices. If we extrapolate equation IX 1 to 1941, taking $t = 11$, we obtain a computed value of 29.4 percent; the true value is 30.2 percent. The error is thus quite small and fully within the limit of 1 point referred to in note 56. Chart 6 shows that after a slight further rise in 1942, the share of profits fell consistently until 1945.

this level is probably still somewhat abnormally high and that a further fall of 1 to 2 points may be expected by 1950, unless, of course, the rate of change in income and/or prices should be significantly higher in this year than assumed.

The problem of estimating the future share of income accruing to corporations is more complex, since this share depends not only on the factors determining the income distribution in general, but also on the proportion of national business conducted by corporations.

As might be expected, there is a fairly close relation between the share of total profits accruing to corporations and the cyclical income index (correlation .84); this relation, however, is disturbed in the long run by the gradual relative expansion of the corporate form of organization. On the other hand, all available statistical information on the performance of corporations suggests that this relative growth proceeded at a significantly faster rate before 1929 than after. This raises considerable difficulty with respect to both the method of handling the rising trend within the period of observation and the proper way of extrapolating this trend. Several methods of coping with this problem were devised but will not be discussed in detail. No one method by itself is entirely satisfactory. Nevertheless, the different approaches consistently indicate that although the cyclical marginal corporate profit ratio is as high as 25 to 30 percent, both the long-run marginal and average corporate profit ratios are much lower. Indeed, the various approaches suggest that the ratio of corporate profits to national income in 1950, under our standard cyclical assumption, may be about 10 percent, plus or minus a factor that depends upon our estimate of the relative growth of corporations between 1940 and 1950. This estimate is difficult to make because the marked slackening in the growth of corporations during the 'thirties may be interpreted in two quite different ways: as a sign that the corporate form of organization is mature or as a transitory development associated with the depressed conditions of the period and with other factors that may well be reversed in the future (for example, corporate tax policies). We consider the second view more realistic,

and on this basis, arrive at an estimate of 10 to 11 percent; Mosak's estimate was nearly 16 percent.[58] By 1945 this ratio was estimated to be less than 12 percent, having fallen from a wartime peak of 15 percent; our forecast implies a further slight fall, while Mosak's forecast implies a significant new rise.

X Corporate Savings

The above results have important implications for the probable future level of corporate savings. Clearly, if we expect corporate profits to be fully a third lower than Mosak's estimates, we must expect corporate savings also to be considerably smaller.

The problem of forecasting corporate savings has received much less attention than that of forecasting individual savings, though the strategic role of this variable in the business cycle is obviously of great importance. Unfortunately, the problem is too complex to be accorded a detailed quantitative analysis here. We must point out once more, however, that no reliable conclusion can be obtained by extrapolating (linearly or otherwise) the past relation between corporate savings and profits.[59] Indeed, if we correlate corporate dividends, D, with profits, P, for 1921–40, we get a correlation of only .60 and the following equation:

X 1 $$D_t = 3.3 + .22P_t,$$

which would imply a corporate marginal propensity to save of nearly 80 percent! Nor is this result greatly improved if we introduce, as an additional variable, lagged income to account for the fact that, in general, dividends are paid some time after income

[58] Our forecast is again well below the ratio of 15 percent realized in 1941. The 1941 ratio was, however, exceptionally high, because of the very special conditions prevailing in that year. If we extrapolate any of our equations to 1941 we obtain a computed value for the share of corporate profits of nearly 14 percent.

[59] Mosak does not give explicitly the equation used in his forecast of corporate dividends and savings. From his Table 2 (*op. cit.*, p. 39), it is found that the saving-income ratio rises from zero for a net income of about $3½ billion to a maximum of some 35 percent for net incomes of about $13 billion, then falls again as income rises above this figure. The logic of the assumption underlying these estimates is not explained; Mosak merely says: "the projections of corporate savings out of profits after taxes though estimated conservatively in the light of past data, are necessarily arbitrary since there is no really adequate basis for projecting them" (p. 32).

is earned.[60] Again this absurd result is due to the fact that the relation between corporate savings and income was quite different in the period of steady expansion, 1922–29, from what it was during the violent cyclical fluctuations of the 'thirties. Throughout the 'thirties (and 1921), dividends paid at any level of income were larger than those paid when the same level of income was first reached in the expansion of the 'twenties; and, more generally, they were larger than would be indicated by a line of relation based on 1922–29. Once more one might be tempted to consider this pattern the result of a time trend, but as we shall presently argue, such a procedure would yield quite misleading conclusions.

Jan Tinbergen has advanced an interesting hypothesis to account for the above described behavior of corporate dividends: aggregate dividends may be explained by current and lagged aggregate profits and by the aggregate 'net surplus'. This hypothesis gives an excellent fit for the period he investigated, 1919–32.[61] His approach was applied by us (using, however, a cruder estimate for net surplus)[62] to 1921–40. It must be remembered, however, that in 1936–38 the undistributed profits tax was in force. Since we are interested in estimating corporate dividend policy in the absence of special measures aimed at discouraging saving, these three years must be eliminated (see note 65). When this is done, we obtain a multiple correlation of .98 and very high partial correlations for all the variables.[63] Denoting by N the net surplus, the

[60] The multiple correlation coefficient is only .78 and the estimate of the marginal propensity to save falls only slightly.

[61] *Statistical Testing of Business-Cycle Theories*, Vol. 2, 'Business Cycles in the United States of America, 1919–1932', League of Nations Economic Intelligence Service (Geneva, 1939), p. 115.

[62] For 1921–25 the estimates are taken from Tinbergen, *op. cit.*, App. C, p. 205. For 1926–36 'net surplus' of reporting corporations was used (*Statistical Abstract of the United States*, *1936*, p. 192, and *1946*, p. 298) with no adjustment for nonreporting corporations. The difference between the unadjusted and the adjusted figures given by Tinbergen up to 1932 is rather small. The 'net surplus' figure exhibits a sudden rise in 1937, apparently because 'surplus reserves' were shifted from 'other liabilities' to 'net surplus'. This change in definition was crudely adjusted for by subtracting the change in 'other liabilities', 1936–37 (that is, $9.8 billion) from the 'net surplus' for the years after 1936.

[63] Denoting by the subscripts 1, 2, 3, and 4, dividends, current income, lagged income, and net surplus, respectively, the partial correlations are: $r_{12.34} = .84$; $r_{13.24} = .88$; and $r_{14.23} = .94$.

regression equation is as follows (all variables measured in billions of current dollars):

X 1a $$D_t = .67 + .15P_t + .18P_{t-1} + .062N_{t-1}$$[64]

From these results it would appear that corporate savings are much more predictable than is usually assumed.[65] Indeed, the results may appear suspiciously good. Can we really believe that corporate dividend policy is so strongly and so systematically influenced by the net surplus position? A complete answer would involve a long technical discussion. The matter may be briefly summed up as follows: the relation between aggregate corporate savings and income is undoubtedly influenced by other major and minor factors, but the variable net surplus is, for systematic reasons, a good indirect measure of other major factors.[66] For this reason, though we do not suggest that equation X 1a is sufficient for a complete explanation of corporate dividend policy,[67] we be-

[64] On the basis of theoretical considerations, one should again expect to get a constant term close to zero. The constant obtained is only $\frac{1}{5}$ as large as that of equation X 1 and has a standard error of .27; by the usual tests it is therefore not significant at the 1 percent level, though it is at the 5 percent level.

[65] In 1936 and 1937 dividends exceeded by $900 and $500 million, respectively, the figure computed from this equation, attesting to the effectiveness of the undistributed profits tax. No influence was visible in 1938, when computed dividends are smaller than actual. However, as profits were quite low in this year, the law could not be expected to have much influence.

[66] One important instance may be cited here. Because dividends must depend mainly on aggregate profits of corporations with net income (called, for the sake of brevity, gross profits), which is, in turn, equal to aggregate net profits plus aggregate losses, one would expect the level of aggregate dividends paid at any level of profits to be an increasing function of aggregate losses (treated as a positive quantity) of corporations with no net income. Now if, after an expansion, income falls off cyclically, we may expect that each level of net income will be accompanied by greater losses (or a given level of gross profits by smaller net profits), than when the same income was first reached during the expansion. For example, gross income was approximately the same in 1930 and 1922—a little over $6 billion—but on account of the much larger losses, net income was only $1.7 billion in 1930 as against some $4 billion in 1922. This helps to explain why, as income falls off, a given level of net income tends to be accompanied by bigger dividends. On the other hand, it may be shown that for reasons that are largely systematic the losses corresponding to any level of net income tend to parallel the net surplus corresponding to any level of net income. Thus the variable net surplus indirectly measures this factor too.

[67] For example, there are strong reasons to suppose that corporate savings are

lieve that the approach on which this equation is based is a reliable and promising one under normal conditions.

Unfortunately, present conditions are far from normal. For obvious reasons, dividends were abnormally low, relative to income and reserves, throughout the war. In view of the sluggishness of dividends and of the exceptional investment requirements of corporations, dividends may be expected to rise only gradually, even if income is maintained. Hence Tinbergen's equation does not hold at present and will not hold in the near future. This difficulty is perhaps not too serious, since it is reasonable to assume that an approximately normal relation will have been reestablished by 1950. Even so, it is clear that to make a long-range forecast of corporate savings is especially difficult, since, as can be seen from equation X 1a, dividends and savings are influenced not only by current income but also by the whole path of past income. Even if we assume a full employment level of income in 1950, we cannot extrapolate equation X 1a without making assumptions with respect to the level of profits in the intervening years. Nevertheless, if we adhere to our assumption that the influence of special transitional factors will have largely disappeared by 1950, we have strong reasons to place corporate savings under full employment at 25 to 30 percent of net profits.

This conclusion is based on various pieces of evidence. First, if we look at the relation between saving and income in 1922–40, we find that in years of a 'secular rise' in income the corporate saving–income ratio remained between 20 and 30 percent. Second, our conclusion is supported by a tentative extrapolation of equation X 1a. This extrapolation is necessarily crude, but as long as we make realistic assumptions (based on the results of Section IX and on a price level near the present one) with respect to the full

influenced by investment opportunities, a factor not fully measured directly or indirectly in equation X 1a. Unfortunately, a direct quantitative measure is extremely difficult to obtain.

Another important factor may be the extent to which current income is due to profits on inventories. This factor also is difficult to measure because there are reasons to believe that its importance was growing during the period of observation. (The abnormally high savings of 1941 and 1946 are probably partly related to this phenomenon.)

employment level of profits in 1950, we consistently get an estimate of between $\frac{1}{4}$ and $\frac{1}{3}$.[68] And, finally, essentially the same results were obtained on the basis of two other regression equations, briefly mentioned in note 79.[69] A saving–income ratio significantly above 30 percent could be expected only if 1949 were a relatively depressed year so that 1950 income would be considerably larger. In view of the agreement of the results from the various methods, we consider our forecast fairly reliable.

XI Forecasting the Relation between Aggregate Savings and Income

We now assemble the results in an attempt to form an idea of the aggregate level of savings to be expected at full employment in 1950.

Since individual savings were expressed in terms of disposable income, and corporate savings in terms of national income (before corporate taxes), it is necessary first to establish a relation between these two quantities by means of a specific assumption with respect to the structure of direct taxation. For this purpose and to see more clearly the orders of magnitude involved, our various estimates were converted from percentages to dollars, on the assumption of $200 billion gross national product and 1940 rates of taxation (Table 2). The $200 billion is chosen for convenience in comparing our results with those of Mosak and Smithies, not as an actual forecast, nevertheless, at the current level of prices, it

[68] One way of establishing this result is as follows: net surplus at the end of 1942, adjusted for surplus reserves (see note 62), was some $49 billion. Adding net corporate savings for 1943–46, as estimated by the Department of Commerce, we obtain $71 billion. Substituting in X 1a we have:

$$D'_{50} = .15P'_{50} + .18P'_{49} + 5.1 + .062 \sum_{t='47}^{'49} N_t .$$

To get the upper limit of the estimate, we take P'_{50} = $16 billion, a change at the rate of 10 percent from 1949 to 1950, and accumulated reserves of $5 to $10 billion, and obtain a saving-income ratio of about 34 percent. If, on the other hand, we take P'_{50} = 14 billion and assume there will be no significant change from 1949 to 1950, the ratio is about 26 percent. No essential modification seems necessary if the price level should change somewhat before 1949, because the net surplus may be expected to be adjusted in the proper direction.

[69] These two equations lead to a forecast of 25 to 30 percent, depending on the relation between 1949 and 1950 net profits.

probably represents a fairly realistic assumption, though perhaps somewhat too conservative. Our assumptions concerning taxes are also not entirely arbitrary. To get an idea of the level of capital formation necessary to bring about full employment in the absence of government intervention, we must assume an aggregate tax revenue that will approximately balance federal and local government budgets.[70] As can be seen from Table 2, the aggregate revenue from the assumed tax structure is slightly over $30 billion—a reasonable (though conservative) guess at what government expenditure (federal and local) may amount to at current prices—and a gross national product of $200 billion. Of course, the actual distribution of the aggregate tax burden among different forms of taxation (indirect, personal, and corporate) may well be different from the assumed one. But as long as the total tax burden is fixed, variations in this respect, if within realistic limits, will not materially affect our results.

A gross national product of $200 billion and a tax structure that would approximately balance federal and local budgets would yield an aggregate savings ranging from $19 to $20½ billion.[71] For the same gross national product and the same national income before corporate taxes, Mosak's estimate of total savings, after adjustment to equalize total tax collection, is some $27½ billion.[72]

[70] On this point see the criticism of Mosak's paper by A. G. Hart, *op. cit.*, pp. 541–3. Hart rightly points out that the pessimism of Mosak's results is partly due to his assumption of a tax revenue much in excess of his 'normal' government expenditure.

[71] This result, it should be recalled, is predicated upon certain cyclical assumptions: income in 1950 (in real, as well as in money, terms) will not exceed that of the highest previous year by significantly more than some 4 percent; and economic activity in 1949 itself will not be seriously depressed. From the various regression equations in the text, the reader may easily obtain different forecasts by varying these assumptions as well as the assumptions concerning government revenue and expenditure. Larger expenditures financed from taxes would lead to smaller savings, and vice versa.

[72] Mosak's original estimate is $6 billion for corporate savings and $20.8 billion for individual savings. The latter figure, however, is not fully comparable with our own estimates, since Mosak's aggregate tax revenue exceeds ours by about 10 percent. If we adjust disposable income upward to equalize tax collection, his individual savings figure rises to $21.4 billion, giving $27½ billion for total savings.

Smithies' estimates cannot be directly compared with the two estimates given above, since he starts from a gross national product of $193 billion in 1943 prices and makes different assumptions with respect to the tax structure. An approximate comparison in terms of the saving-income ratio is presented in the text.

TABLE 2
Hypothetical Structure of Gross National Product, 1950
(billions of dollars)

		Total	Tax Revenue	Savings
1	Gross national product	200		
2	Indirect taxes[a]	16	16	
3	Depreciation, depletion & other reserves[b]	11		
4	National income, incl. corp. taxes (line 1 − lines 2 & 3)	173		
5	Corp. profits (10–11% of line 4)	17.3–19.0		
6	Corp. fed. income taxes (25% of line 5)	4.3– 4.8	4.3–4.8	
7	Corp. net profits (line 5 − line 6)	13.0–14.3		
8	Corp. savings[c] (25–30% of line 7)	3.2– 4.3		3.2–4.3
9	Income payments to individuals (line 4 − lines 6 & 8)	166–164		
10	Individual fed. income taxes, 1940 rates[d]	8.6–8.3	8.6–8.3	
11	Individual state & local taxes, & non-tax payments[e]	2	2	
12	Disposable income[f] (line 9 − lines 10 & 11)	155–154		
13	Individual savings (10–10.5% of line 12)[g]	15.5–16.2		15.5–16.2
14	Total		30.9–31.1	18.7–20.5

Amounts of more than $100 billion are rounded off to the nearest billion; amounts below, to the nearest hundred million.

[a] This item is based on the $15.7 billion estimated by Smithies (*op. cit.*, p. 5, Table 1) and the $16.4 billion by Mosak (*op. cit.*, p. 38, Table 1).

[b] Our figure, $11 billion, is taken from Smithies. Mosak's estimate is $8.8 billion, to which he adds $1.7 billion for "capital outlays charged to current expenses". These outlays should logically be included in national income and savings, except possibly for the part that depreciates within the year; we follow here, however, the Department of Commerce procedure. One would expect item 3 (especially depreciation) to be, in the long run, more or less proportional to gross national product (or better, to this quantity minus government expenditure for services). In 1929 depreciation and other reserves were estimated to be nearly 10 percent of (adjusted) gross national product. Applying this ratio, one would get an estimate of some $16 billion. In 1945, however, depreciation was estimated to be only $8 billion and other reserves $1.6 billion. In view of the sluggishness of depreciation, $11 billion does not seem unreasonable, though it may be a bit conservative.

[c] The range of corporate savings is calculated by taking 25 percent of the lowest and 30 percent of the highest figure in line 7.

[d] Obtained by extrapolating Mosak's estimates (*op. cit.*, p. 42, Table 3c, rows 1 and 4).

[e] Smithies, *op. cit.*, p. 5, Table 1, row 11.

[f] It is assumed that transfer payments and contributions to the social insurance fund cancel out.

[g] The higher estimate of the saving-income ratio, 10.5 percent, is applied to the lower figure for disposable income, since this figure corresponds to the upper estimate of corporate savings ($4.3 billion).

Aggregate savings as percentages of national income (including corporate taxes)[73] for 1929 and 1940 are compared with the various forecasts for 1950 in the accompanying figures. The difference be-

		1950		
1929	*1940*	OUR ESTIMATE[a]	MOSAK'S ESTIMATE	SMITHIES' ESTIMATE[b]
11.8	11.2	10.8–11.8	15.8	15.2

[a] If we include 'capital outlays charged to current expenses' in both income and savings, the ratio for 1929 and 1940 become 12.7 and 12.2 percent, respectively, and our own forecast should be raised about one point.
[b] Estimated from Smithies, *op. cit.*, as follows: starting from a gross national product of $193 billion, national income would be $167–168 billion and corporate savings (by interpolating from Smithies' Table 1) about $6 billion. Assuming a total tax revenue of $30 billion, we have a disposable income of 146–147 billion and, applying to these figures Smithies' formula (p. 6), individual savings of $19.4 billion. Hence, aggregate savings would be $25.4 billion, 15.2 percent of national income.

tween the various estimates of savings, though it amounts, at most, to some 5 percent of national income, may very well represent the difference between considerable unemployment, in the absence of appropriate fiscal policy, and dangerous inflation. Indeed, current estimates of the probable demand for private gross capital formation in 1950 are very close to, if not larger than, the flow of gross savings (aggregate net savings plus reserves for depreciation and depletion, and other reserves) indicated by our analysis—$30–32 billion.[74]

XII Another Method of Estimation

Before drawing final conclusions, we consider briefly an important methodological problem. The various regression coefficients used in this paper were computed by the traditional 'single equation estimate' method, that is, by correlating the variable to be 'ex-

[73] The inclusion of corporate income taxes in national income is not only logically more satisfactory but also statistically preferable, since the resulting figure is, for practical purposes, independent of the distribution of the burden of direct taxation between individuals and corporations.

[74] Smithies, for instance, reaches an upper estimate for gross capital formation of $25 billion which, allowing for a rise in prices of some 20 percent since 1943, is equivalent to about $30 billion in current prices. Again, a recent study of the Bureau of Labor Statistics comes to the conclusion that "investment demand" in 1950 would be "twice that prevailing in 1939" (abstract of a paper by W. D. Evans, Jerome Cornfield, and Marvin Hoffenberg, 'Interrelationships of Income, Prices, Demand, and Production at Full Employment', included in 'Report of the Cleve-

plained' with the variables that seem relevant to explain its movements.

The recent contributions in the field of economic statistics by Haavelmo, Koopmans, and others, indicate that this traditional method is not fully warranted and may lead to biased estimates of the parameters. For an exhaustive treatment of the subject the reader is referred to their studies.[75] The bias arises because the given equation, whose parameters are to be estimated, is actually only one of a more general system of equations which simultaneously determine the behavior of the economic variables. The observed values of the variables that enter into the relevant relation are not determined exclusively by the given equation, but by some or all other equations of the system as well. It is therefore necessary, before estimating the parameters, to set up a complete or determined system of equations describing the behavior of the economic system. This system, however, need not contain as many equations as there are variables, because some variables that are relevant in explaining the behavior of economic quantities are determined outside the economic system, or for other reasons may be considered data—for example, the weather, age structure of the population, and also the past values of all variables. We call these variables 'predeterminate', while the others, which are determined by the simultaneous solution of the system, are termed 'endogenous' variables. The system will therefore be complete or determined if it contains as many equations as there are endogenous variables. Once the complete system has been set up, 'unbiased estimates' of the parameters of any equation can be obtained by a procedure that takes into account the restriction imposed by the

land Meeting', *Econometrica*, Vol. 14, No. 2, April 1946, p. 162). As gross capital formation amounted to about $11 billion, if we allow for a rise in price of about 50 percent, this forecast implies a gross capital formation at current prices of $30–33 billion.

[75] See, for example, Trygve Haavelmo, 'The Statistical Implications of a System of Simultaneous Equations', *Econometrica*, Vol. 11, No. 1 (Jan. 1943), pp. 1–12, and 'The Probability Approach in Econometrics', *Econometrica*, Vol. 12, Supplement (July 1944), especially Ch. 5; Tjalling Koopmans, *Statistical Estimation of Simultaneous Economic Relations*, Cowles Commission Papers, New Series, No. 11 (Chicago, 1945).

other equations of the system on the endogenous variables entering the given relation.

We do not intend to make an extensive application of these new methods to our problem, especially since an over-all description of the properties of the new method and of the procedures is not yet available. To one problem, however—the most important, or, at any rate, the most controversial, of those with which we are concerned in this paper—this method may be applied with some justification and not too serious difficulty: estimating the parameters of the consumption function.

If we are willing to make a certain assumption common in the current literature, the consumption function may be embedded in a very simple system of equations. First, according to our hypothesis, the consumption function for individuals has the form:

$$C_t - bY_t - cY_t^\circ - a = e_t,$$

where e_t is the disturbance associated with this equation. Since savings, S, is the difference between consumption and income, we may write:

XII 1 $$S_t - (1 - b)Y_t + cY_t^\circ + a = -e_t$$

Furthermore, because of the statistical definition of the series of consumption and income, we have the following identity:

XII 2 $S = Y - C =$ net government deficit[76]
+ net capital formation − corporate savings

The assumption referred to above consists in considering net government deficit and net capital formation predeterminate variables. This assumption is not entirely unwarranted; it may, in fact, be admitted that both variables are at least partly the result of decisions that do not depend directly on current economic developments. If we could treat corporate savings as a predeterminate variable, equations XII 1 and XII 2 would form a determinate system consisting of two equations and two endogenous variables, S and Y, plus several predeterminate variables. Obviously, however, there is no justification whatever for treating cor-

[76] Net government deficit is defined as the difference between government receipts (including social security contributions) and government expenditure on goods and services plus transfer payments.

porate savings as predeterminate. To meet this difficulty, we may replace the variable Y by a new variable Y', so defined as to include corporate savings (that is, Y is the sum of disposable income and corporate savings). Then Y' minus C will represent the sum of individual and corporate savings, which we denote S'. Equation XII 2 becomes:

XII 2a S' = net government deficit + net capital formation

On the basis of our previous assumption, S' may be treated as a predeterminate variable. With regard to the factors governing aggregate savings of individuals and corporations, we shall again test the hypothesis:

XII 1a $S'_t + AY'_t + BY'_{t-1} + CY'^{\circ}_t + D = e'_t$

The logic of this hypothesis for individual savings has already been explained at length. But from the brief discussion in Section X, it should be clear that the relation between corporate savings and income tends to follow a cyclical-secular pattern fundamentally similar to that which seems to hold for individual savings. As long as profits rise steadily from year to year, dividends tend to keep pace with profits (in terms of equation X 1a, N rises when P rises), and the saving–income ratio depends essentially on the rate of change in income.[77] But if, after a period of expansion, profits undergo a cyclical fall, dividends will tend to fall proportionally much less than income; in other words, savings will fall proportionally much more than income. In Section X, it is true, it was found that if the depression is protracted and is accompanied by gradual deflation, the normal secular relation between savings and profits will tend to be reestablished even though money profits do not go back to the initial level.[78] But this is mainly because we were dealing there with variables measured in money instead of in 'real' terms. While in an expanding economy 'real'

[77] As may be seen from equation X 1a, a certain critical growth of income will keep the saving-income ratio at an approximately unchanged level; in years in which income rises faster, the saving-income ratio will temporarily rise above this level, and vice versa.

[78] In terms of equation X 1a, N will gradually fall as a result of dissavings, bankruptcy, and writing down of assets, so that a normal relation between income and surplus tends to be gradually reestablished.

profits may be expected to return sooner or later to the initial level, money profits evidently need never recover.[79] In equation XII 1a, the effect of deflation on the relation between corporate income and profits is allowed for by using deflated instead of current values.

It must be admitted that the relation postulated in this equation is theoretically less satisfactory than the separate relationships considered in preceding sections. On the other hand, by estimating the parameters of this 'aggregate savings function' by a different and presumably more reliable technique, we shall have a check on our earlier results and forecasts. Furthermore, we shall be able to make more reliable comparisons with the results obtained for Canada and Sweden, where our estimates include corporate as well as individual savings.

Since equations XII 1a and 2a form a determinate system, we may proceed to estimate the parameters of XII 1a by the new 'simultaneous equations' method, which in the present case amounts to fitting the equation by least squares and minimizing in the direction of Y'_t (that is, taking Y'_t as a dependent variable). The traditional single equation method would lead to minimizing in the direction of S'_t (that is, taking S'_t as the dependent variable). Using 1921–40 as the period of observation, the equation is (all variables expressed in deflated dollars on a per capita basis):[80]

$$\text{XII 3} \qquad S'_t = -3 + .512Y'_t - .142Y'_{t-1} - .265Y'^{\circ}_t$$

The multiple correlation, .991, and all relevant and partial correlations are highly significant.[81] Essentially the same results are ob-

[79] In fact, if we replace N in equation X 1a with the highest previous cyclical peak of profits (the cyclical peak being used to allow for the effect of deflation) we again get a fairly good explanation of corporate dividends (the multiple correlation is .91 and the partial correlation between dividends and $P_t{}^{\circ}$ is .67). The corresponding regression equation was used to check our forecast of savings for 1950. The other equation used for this purpose was obtained by replacing the highest previous cyclical peak of profits with the corresponding dividends. The results are very similar.

[80] For the derivation of the series, see Appendix reference H.

[81] Denoting by the subscripts 1, 2, 3, and 4, the variables Y'_t, S'_t, Y'_{t-1}, Y'°_t, respectively, the relevant simple and partial correlation coefficients corresponding to equation XII 3 are: $r_{12} = .91$; $r_{13} = .74$; $r_{14} = .01$; $r_{12.34} = .978$; $r_{13.24} = .84$; $r_{14.23} = .86$; and $R_{1.234} = .991$. The value of K is 1.50, which is not significant (see note 14).

tained if in estimating the parameters of XII 1a, 1936–38 are omitted because of the undistributed profits tax.[82] By analyzing equation XII 3 along the usual lines (a task left to the interested reader) it will be seen that the results are fairly close to those obtained for Canada (when the necessary conceptual adjustments are made) and for Sweden. Comparison with equation III 3, on the other hand, reveals how strongly the rigidity of corporate dividends affects the cyclical relation between consumption and income.

With regard to the secular relation, it will be noted that the constant term in equation XII 3 is entirely negligible; this again supports our hypothesis that in the long run the average propensity to save tends to be constant and independent of the secular expansion of income. Nonetheless, because of the strong lag, the proportion of income saved in years of secular expansion may fluctuate considerably about the normal level, depending on the rate of change in income.

It will be recalled that the forecasts developed in Section XI were based on the assumption for 1950 of a secular rate of increase in income centering on 3 percent. If the rate is 3 percent, the ratio S'/Y' from equation XII 3 approximates 11.7 percent. Also, on the basis of the assumption underlying Table 2, $Y' = .92Y$, whence $S'/Y = (S'/Y')\ (Y'/Y) = 10.8$ percent. The equation obtained when 1936–38 are omitted yields (as one would expect) a slightly higher ratio S'/Y'—some 12.5 percent—which implies

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A multiple correlation of .991 is rather impressive when one considers that we are here relating income to saving, not to consumption. Since consumption constitutes a very substantial part of income, the correlation between those two variables is bound to be high, but this is not necessarily so in the case of savings, which constitutes a much smaller proportion of income.

[82] This omission appears especially advisable since in each of the three years (and especially in 1936) actual savings were less than the value computed from equation XII 3. Inclusion of these three years may therefore cause estimates of S' based on equation XII 3 to be biased downward. The equation obtained when we omit the three years is:

XII 3a $\qquad S'_t = -17 + .527Y'_t - .156Y'_{t-1} - .242Y'_t$°

The multiple and partial correlations all rise somewhat ($R_{1.234} = .993$).

$S'/Y = 11.5$ percent. As both results are within the range of our earlier forecast, we have no reason to modify our conclusions.

Note that since the normal secular growth of income also may be taken to be in the order of 2 to 3 percent, the above values of S'/Y (or S'/Y') represent also an approximate measure of the normal secular saving–income ratio and of the long-run marginal propensity to save. If, on the other hand, we fail to take into account the influence of cyclical factors and of the lag, and simply correlate income and savings, we obtain the regression equation:

$$S'_t = -236 + .488Y'_t; (r = .91)$$

We would be led to conclude that the marginal propensity to save amounts to nearly 50 percent, regardless how income changes. The difference between the two estimates is so striking and its implications for purposes of forecasting so obvious that no further comments are required.

If the parameters of equation XII 1a are estimated by the traditional form of fitting, the result is:

XII 4 $\quad S'_t = +2.7 + .49Y'_t - .125Y'_{t-1} - .269Y'_t{}^{\circ}$

Detailed comparison of equations XII 3 and XII 4 reveals that, in the present case, the differences between the estimates obtained by the two approaches are definitely minor, especially when compared with the many other errors that may affect the estimates.[83]

One last point in connection with equation XII 3 is worth brief consideration. Since this equation relates total savings to income, it may be used to gather some information on the probable size of the so-called 'investment multiplier' and to clarify one apparently puzzling problem that arises in this connection.

As we have seen, the consumption functions obtained by other investigators are usually characterized by a relatively low marginal propensity to consume; consequently, they tend to yield relatively low forecasts for aggregate consumption when extrapolated

[83] In the case of Canada the following consumption function is obtained by applying the new method:

$$C_t = -.02 + .05Y_t + .48Y_{t-1} + .24Y_t{}^{\circ}; (R_{Y.SY_{t-1}Y}{}^{\circ} = .984)$$

The reader may compare this equation directly with equation VI 1a.

to values of income above those prevailing in the period of observation. To those who have questioned the realism of these high estimates of the marginal propensity to save, the answer has been that if this parameter actually were considerably lower, our economic system would be highly unstable. If, for instance, the propensity were only 10 percent, the multiplier would be as large as 10 and every small shock would cause violent fluctuations in the system. Since the available statistical information shows that the violent changes in investments during the 'thirties produced proportionally much smaller changes in income, we would have no choice but to accept the conclusion that the marginal propensity to save is relatively high and that the saving–income ratio will therefore keep rising as income rises.[84]

As should be clear by now, this argument is fundamentally wrong, arising as it does from a confusion between the short-run and the secular relation between savings and income. The multiplier can be derived *only* from the cyclical, not from the secular, marginal propensity to save, for two reasons: (1) the multiplier is, and can only be, a short-run tool of analysis; (2) if we have approximately full employment to start with, the multiplier analysis breaks down or, at least, serves no useful purpose. Indeed, in the latter event, the real income multiplier is simply zero. Nor is the money income multiplier (assuming that such a stable multiplier exists) of much use in determining the rise to be expected in the price level, for under inflationary conditions the relation between savings and income may be expected to change.[85] Since the coefficient of Y_t in equation XII 3 is only .51, if investments (plus the net government deficit) increase by an amount ΔI above the preceding year, income will rise by an amount $\Delta Y' = (.1/.51)\,\Delta I$

[84] In this connection, see, for instance, Mosak's reply to Hart's criticism in 'National Budgets and National Policy', *American Economic Review*, Vol. 26, No. 1 (March 1946), pp. 20–43. This point is implicit in most of Section B and is brought out more explicitly in note 30.

[85] It has been shown, for example, that, at least under certain assumptions, once inflation develops, the marginal propensity to save tends to coincide with the 'full employment' ratio of savings to income. See, for instance, Franco Modigliani, 'Liquidity Preference and the Theory of Interest and Money', *Econometrica*, Vol. 12, No. 1 (Jan. 1944), pp. 45–90.

$= 2\,\Delta\,I$. If the new higher level of investment is maintained for a sufficient length of time, income will continue to rise, and the total increment in income will approach the value $\Delta\,Y' = \frac{\Delta\,I}{.51 - .14}$ $= 2.7\,\Delta\,I$. Thus, what we may call the impact multiplier is only 2, while its limiting upper value is still below 3.[86] In considering these results, it is well to keep in mind that our estimates of the parameters of equation XII 3 are necessarily subject to error and, in addition, that we cannot count on perfect stability of saving habits, especially cyclical saving habits. We are inclined to believe, nonetheless, that the above estimates give a reliable idea of the order of magnitude of the multiplier and a realistic starting point for problems of economic policy.

But these results, we repeat, in no way imply that we cannot have full employment in 1950 without a stupendous level of investments (and/or government deficit). The level of income corresponding to a given level of investments depends not on the marginal but on the average propensity to save, which, in turn, depends not only on the slope but also on the position of the short-run consumption function. And our analysis indicates that if income continues to rise secularly, as we may expect it will, the position of the short-run consumption function too may be expected to rise gradually.

XIII Wider Implications

To sum up: this paper suggests that in studying past relations between national income and its components, attention should be given to the possible influence of the cyclical position of the economy. We found for each series analyzed a marked and significant difference between the cyclical or short-run and the secular rela-

[86] The multiplier derived here is merely one of many possible multipliers that may be defined; it gives essentially the increase in aggregate 'factors' income', net of taxes, to be expected from a unit increase in net investments plus government deficit. Other multipliers may be derived from the one given above and estimates of other parameters (such as tax structure and the relation of business reserves to income). The conclusion in the text is substantially unchanged if equation XII 3a (see note 82) instead of XII 3 is used.

tion. Extrapolating the secular relation under specific cyclical assumptions, we obtained estimates for the near future significantly different from other current forecasts. In particular, we found that the share of aggregate income accruing to profits (especially to corporate profits) and the saving–income ratio may be expected to be substantially lower than when estimated by the usual method. This conclusion is of special importance since it suggests that though the task of maintaining full employment may well be difficult in the near future, the dark pessimism of many current investigations is not fully justified. Our results encourage optimism also in that they show that income is probably less sensitive to fluctuations in the level of investments than is usually supposed. We have seen, in fact, that the behavior of savers, especially corporations, has tended to act, and may therefore be expected to act in the future, as a powerful stabilizer. While the maintenance of the secular expansion of income may be expected to require net investments of some 11 to 12 percent of income, a fall in investments may be expected to reduce real income not by 9 times, but only by 2 to 3 times.

The results of our investigation have certain broader implications of a methodological nature. The starting point of our whole approach is the recognition that the relation between economic variables need not be, and frequently is not, symmetric or reversible. The change in X_1 associated with a given change in X_2 may depend on the nature of the change in X_2. The reasons for this irreversibility are, of course, different for different relations. In the case of the consumption function, for example, it is partly due to the irreversibility of consumption habits. In the case of profits, it is probably due partly to the asymmetric behavior of overhead costs which are largely fixed as long as output fluctuates below capacity but become variable when capacity has to be increased. In the case of corporate dividends, it probably reflects the direct and indirect influence of the net surplus position, as Tinbergen suggested.

But these are obviously not the only cases of irreversibility. Many other instances can readily be found. A typical case, for

example, is that associated with short- and long-run supply schedules in the Marshallian sense. The quantity supplied at any given price at point of time t will depend upon the existing capacity, say q_t°. As long as the price remains below a certain critical level (given by the long-run supply schedule) at which it pays to expand capacity, both price and output will move along a short-run supply schedule, say $q_t = f_t(p_t, q_t^\circ)$. But if the price remains for some time sufficiently high to induce an expansion of capacity to a new level, $q^\circ(t + \theta)$, the short-run supply schedule will itself shift upward (if quantity is measured on the vertical axis), and the quantity supplied at any given price will tend to be larger than before capacity was expanded.

To give one more example of irreversibility, the distribution of total employment by main branches of economic activity may be expected to be closely related, in a given country, to the level of real income. At the same time, theoretical considerations, which are confirmed by preliminary investigations carried out for the United States and for Sweden, suggest that the effect of a given change in income on the distribution of employment may be expected to differ substantially depending on whether the change in income is of a secular or of a cyclical nature. The irreversibility in this case is due not only to the rigidity of consumption habits, but also, and even more especially, to differences in the employment structure of different economic sectors. Sectors in which the self-employed play a larger role or, more generally, in which the ratio of employers to employees is relatively high (for example, trade, services, agriculture) will tend to be less affected by a cyclical fall in income (and therefore also by a cyclical rise in income) than sectors in which this ratio is relatively low (for example, manufacturing, mining, transportation). The effect of a secular rise in income, on the other hand, obviously bears no necessary relation to the ratio of employers to employees.[87] In general, therefore, cyclical and secular changes in income will have an asymmetric effect on the distribution of employment. In

[87] For instance, in trade and services a secular rise in income has been accompanied in the past by a relative increase in employment, but in agriculture the opposite has been true.

particular, it is entirely possible (and this seems to be true, for example, for the service industries) that a *cyclical rise* in income will be accompanied by a *fall* in the proportion of people employed in a given sector, whereas a *secular rise* in income will be accompanied by a *rise* in this proportion; or, what amounts to the same thing, that the proportion employed in a given sector will tend to rise both when income *falls* cyclically and when income *rises* secularly.

Many more examples of irreversible relations could be cited. Indeed, irreversibility may be expected to occur whenever economic expansion creates certain *new* obstacles; consequently, if a contraction takes place, the variables will follow a different path from the one they followed before obstacles had been created by the expansion. Rigidities of this type are likely to be quite widespread in our economic system.

Such irreversible relations have not always been sufficiently recognized in the past, or, if recognized, have not infrequently been explained by time trends. Indeed, in an expanding economy, the gradual shift of the short-run schedule along the long-run schedule may easily give the appearance of a time trend, especially if the expansion is fairly steady. But in many cases these apparent trends can and should be resolved into what they really are—systematic relations among economic variables. The establishment and estimation of these relations, whenever possible, amounts to replacing a trend factor, whose value depends only on the passage of time and that can be extrapolated only mechanically, with one whose value depends on the actual performance of the economic system. Our results indicate that this method of analysis, quite apart from its greater theoretical elegance, may be of great practical importance in problems of forecasting since it may enable us to improve our estimates of the short-run relation as well as our long-range forecasts. In fact, whenever the relation is irreversible, the observed values of the variable will lie on different short-run schedules. Hence the equation of relation obtained by simple correlation, or by any other method of estimation that does not properly take into account the irreversible nature of the relation, will describe neither the long- nor the short-run relation.

These considerations are especially important for those engaged in analyzing the American economy, since many statistical series are available only from 1929 or, at best, from the early 'twenties. The period from 1929 to 1941 consists essentially of a single cycle and even the longer period is entirely dominated by the violent cyclical fluctuations of the 'thirties; therefore, whenever the given relation is cyclically sensitive, estimates of the parameters based on this period of observation are in danger of being cyclically biased to a marked degree. The danger implicit in this situation is further increased by the fact that the war economy tended in many cases (for example, in the profit-income relation, the saving-income relation, the distribution of employment) to continue the cyclical relation of the 'thirties; in some cases this relation held until the very end of the war. This situation only heightens the illusion that the relation of 1929–41 can be safely extrapolated into the post-transitional period.

XIV Postscript: The Revised Department of Commerce Estimates

After this paper had been completed and circulated, the Department of Commerce series, on which the statistical analysis for the United States had been based, were thoroughly revised, and the new estimates published in 'National Income', *Survey of Current Business*, Supplement, July 1947. For most series, the revisions are relatively slight, but for individual savings and, to some extent, for corporate savings, they are drastic. For example, for 1929 the estimate of individual savings was cut some 60 percent (from $8.8 to $3.7 billion) and that of corporate savings more than doubled (from $1.2 to $2.6 billion). These revisions are partly explained by changes in the definitions of the various series. Nevertheless, the revisions of a purely statistical nature are also substantial, as can be seen by comparing the earlier Department of Commerce estimate of savings with the series in Table 3. We computed these series on the basis of the revised Department of Commerce estimates, using as far as possible the definitions on which the earlier estimates were based. (This task was greatly facilitated by some very useful tables of reconciliation in the publication cited above.) In 1929, for instance, the revision of a purely

statistical nature amounts to some 50 percent for individual savings and to some 70 percent for corporate savings.

TABLE 3
Revised Estimates of Disposable Income and Personal Savings, 1929–41 and 1946
(billions of dollars)

	Disposable Income[a]	Personal Savings[b]	Corporate Savings[c]
1929	78.0	4.3	2.0
1930	68.7	2.8	−3.5
1931	58.6	1.8	−5.6
1932	44.1	−1.4	−6.2
1933	42.9	−.3	−2.7
1934	49.1	.2	−1.9
1935	55.5	2.2	−1.0
1936	63.6	4.3	−.7
1937	68.4	4.7	−.5
1938	62.4	1.5	−1.3
1939	67.4	3.6	.8
1940	72.8	4.6	1.9
1941	89.1	11.1	4.4
1946	153.3	16.8	

The estimates are based as far as possible on the definitions underlying the old series given in the Appendix Table and may therefore be directly compared with them.

[a] This series was obtained as follows (all references in this and subsequent notes are to 'National Income', *Survey of Current Business*, Supplement, July 1947):
Personal income, old concepts statistically revised (p. 14, Table VII)
minus personal tax and nontax payments (p. 19, Table 3);
minus indirect taxes on owner-occupied dwellings (p. 14, Table VII);
plus change in farm inventories not held for sale.

[b] This series was obtained as follows:
Disposable income
minus personal consumption expenditure, old concept statistically revised. The latter quantity was obtained as follows:
Personal consumption expenditure (p. 19, Table 3)
minus net imputed rent on owner-occupied dwellings;
minus indirect taxes on owner-occupied dwellings;
minus depreciation on owner-occupied dwellings;
minus institutional depreciation;
minus income in kind to armed forces (all from p. 14, Table VII).

[c] This series was obtained as follows:
Corporate undistributed profits (p. 19, Table 1)
minus corporate depletion allowances (p. 47, Table 38). Figures for the latter series are not given after 1943; accordingly, no figure for 1946 is shown in this column.

Obviously it would be desirable to retest our hypothesis for the United States, and to re-estimate the parameters of our equations on the basis of the revised estimates. To make a reliable test, however, we would have to have data at least as far back as 1921.

Unfortunately, revised estimates are available only as far back as 1929. We understand that the Department of Commerce is carrying the estimates back to 1919, but it will be some time before this task is completed.

We attempted to extrapolate the revised estimates from 1929 back to 1921 by means of the old estimates and other statistical information. Several methods were tried, all based largely on the consumption series prepared by Harold Barger,[88] which appears to be conceptually quite close to the Department of Commerce series and agrees remarkably well with the revised estimates for 1929–37.[89]

All the estimates obtained by the various methods displayed a similar pattern, close to that of the old estimates of savings. Savings are found to be negligible and possibly negative in 1921; they rise sharply from 1921 to 1923, the 1923 figures reaching approximately the 1929 level. Between 1924 and 1928 our estimates are, in all cases, lower than for 1923 and 1929, and exhibit rather pronounced and apparently unsystematic fluctuations; furthermore, the results differ with each method of estimation. The doubt thus cast on the reliability of the estimates was strongly re-enforced by the following test. We applied the very same methods used for extrapolation to 1929–37 and compared the results with the Department of Commerce estimates. The discrepancy, though relatively small for consumption, was quite sizable for savings, which are a residual; the average *absolute* discrepancy for each method tried was in the order of 20 percent but the average *percentage* discrepancy was considerably higher—more than 30 percent. Since the margin of error must be expected to be larger for the years before 1929 (when the components of our estimates are obtained by extrapolation rather than by interpolation), we

[88] *Outlay and Income in the United States, 1921–38* (National Bureau of Economic Research, 1942).

[89] For 1929–37 the average absolute discrepancy is some $700 million. Part, however, is to be attributed to a significant difference in the estimates of net imputed rent on owner-occupied nonfarm dwellings, which is not surprising in view of the somewhat arbitrary character of these estimates. Eliminating imputed rent, the average absolute discrepancy is $500 million with a maximum of about $1 billion in 1936. The average discrepancy is some $300 million, Barger's estimates being larger. In 1938 there is an exceptionally large discrepancy, $1.6 billion, but this is not very significant since Barger's data for this year were probably less reliable.

concluded that our series for 1921–28 were far too unreliable to be used for purposes of quantitative statistical analysis, and for this reason we do not reproduce them here.

Despite these unsatisfactory results, some very tentative conclusions may be drawn from the revised estimates available from 1929 on and from our own crude estimates for 1921–28. In what follows, we mean by revised estimates the series in Table 3, which are conceptually comparable, as far as possible, with the old estimates.

In at least one respect the revised estimates give further indirect support to our hypothesis that the relation between consumption and income 1929–40 has a cyclical character and cannot safely be extrapolated to secular changes in income. Several factors point in this direction. If we compute the line of regression of savings on income for 1929–40, which, on the basis of our definitions, are all within the same cycle, the following results are obtained:

XIV 1 $\qquad S_t = -114 + .24Y_t; (r = .95)$

The corresponding results on the basis of the old data are:

XIV 2 $\qquad S_t = -75 + .21Y_t; (r = .95)$

Comparison of these two equations reveals that on the basis of the revised estimates the regression line is even steeper and the constant term even larger than on the basis of the old estimates. We have therefore even more ground to suspect that equation XIV 1 can represent only a cyclical relation.

This point is further strengthened when we consider that, according to the revised estimates, in each of the years 1932–34 savings were negative or practically zero—to be explained only as a cyclical phenomenon. When the same level of income was first reached in the course of the secular expansion (probably during the first decade of the century), savings must have been substantial. Indeed, unless they were, per capita income could scarcely have expanded further. The irreversible character of the saving-income relation is indicated also by our crude estimates for 1921–28, though these estimates are not sufficiently reliable for a rigorous test.

Finally, according to the Department of Commerce estimates, individual savings, even in 1946, were about 11 percent, somewhat smaller than the figure obtained by extrapolating equation XIV 1, 12 percent, although in 1946 savings were bolstered by the inclusion of profits on inventories of unincorporated business, which were unprecedentedly high.[90] A very crude estimate, based on the data presented in the *Midyear Economic Report of the President*, dated July 21, 1947, suggests that in the first half of 1947 the saving-income ratio was even more significantly short of the figure indicated by the regression line, namely, somewhat less than $8\frac{1}{2}$ percent.[91] Of course, in the light of the special conditions prevailing in these years, the weight that can be attached to the above facts is limited.

In any event, there seems little doubt that the new data strengthen the view that if a stable functional relation between savings and income exists at all, it must be irreversible and must have a steeper slope in the case of cyclical changes in income (or, at any rate, in the short run) than in the case of secular changes (in the long run). Smithies' hypothesis could explain, to some extent, the short-run steepness of the saving-income relation as due to a pure trend. On this point, however, the revised data shed some light. The hypothesis of a pure time trend, whether or not logically satisfactory, was at least statistically tenable on the basis of the old data. On the basis of the new data it appears hardly tenable. In fact, if we introduce time as a third variable into equation XIV 2 we get a partial correlation of $-.70$—not a very high coefficient but still definitely significant. However, if time is introduced into equation XIV 1, the partial correlation coefficient for this variable is only $-.15$—entirely insignificant. It thus appears that a time trend can no longer be adduced to explain the irreversibility of the saving-income relation.

Unfortunately, lacking reliable data for the years before 1929, we are not in a position to test whether the apparent irreversibility

[90] These profits are included in savings in accordance with the earlier concept. If we take into account the inventory valuation adjustment, the proportion saved can be estimated to be about 10 percent.

[91] If we make the inventory valuation adjustment, the proportion is estimated to be about 7.5 percent.

of the saving-income relation can be adequately explained by the fundamental hypothesis of our equation III 2, namely, that in years of secular expansion, the proportion of income saved tends to fluctuate closely around a constant value with deviations that are directly related to the rate of change in income. On the basis of the available data, however, we can make conjectures about the form the savings function would take if our hypothesis is supported by the data to be made available in the future. Using the result of equation XIV 1 as an estimate of the cyclical relation between individual savings and income, the savings function would take the form:

XIV 3
$$S_t = a + .24Y - .18Y_t^\circ$$
$$= a + .06Y_t + .18(Y_t - Y_t^\circ)$$

In this equation, a denotes a constant not very significantly different from zero; the estimate of .06 (more probably between .06 and .07) for the coefficient of Y_t in the right side of the equation is based on the saving-income ratio in 1929, 1937, and 1940. A test of this equation will have to wait until the Department of Commerce supplies us with more reliable estimates for 1919–28.[92]

The above remarks refer mainly to saving by individuals. An attempt was made to retest equation XII 3 too. The revised estimates of corporate savings, adjusted to conform with the old definitions,[93] were extrapolated back to 1921. The results seem considerably more reliable than those obtained for individual savings. Combining these estimates with our previous estimates of individual savings and carrying out the same correlation analysis as for equation XII 3, we again obtained very favorable statistical results (the multiple correlation coefficient is .987 and the partial coefficients range from .77 for Y_t° to .98 for S_t). But, in view of the unreliability of the data on individual savings, the estimates of the parameters are not considered worth reproducing here. Once more we have reason for confidence in the tenability of our hypothesis, but we must await more reliable data before rigorous tests can be applied.

[92] The saving-income ratio for the first half of 1947 appears to be still somewhat above the level indicated by equation XIV 3.

[93] The only significant change in definition appears to be the inclusion of the depletion allowances in corporate profits and savings.

One further point deserves brief consideration. We have stressed elsewhere in this paper the desirability of devoting as much attention and ingenuity to the study of business savings as has been devoted to individual savings. The revised estimates reenforce our plea. One of the most significant effects of the revision (aside from its effect on the morale of the econometricians who put confidence in the old estimates) has been to alter radically the relative contribution of the various components to aggregate savings (Table 4).

TABLE 4
Composition of Savings, 1929 and 1940
Original, Statistically Revised, and New Estimates

	Net Savings			Gross Savings		
	Old (1)	Old Statis. Rev. (2)	New (3)	Old (4)	Old Statis. Rev. (5)	New (6)
1929						
Total, billions of dollars	10.0	6.3	6.3	18.6	14.4	14.9
PERCENTAGE DISTRIBUTION						
Individual	88	68	59	47	29	25
Corporate	12	32	41	6	14	17
Deprec. & other res.				47	57	58
1940						
Total, billions of dollars	8.2	7.6	8.2	17.3	14.1	14.3
PERCENTAGE DISTRIBUTION						
Individual	80	71	61	42	33	26
Corporate	20	29	39	11	13	17
Deprec. & other res.				47	54	47

'National Income', *Survey of Current Business*, Supplement, July 1947.

Saving by individuals, which, according to the old estimates, represented more than $\frac{4}{5}$ of net and nearly $\frac{1}{2}$ of gross savings, now represent less than $\frac{2}{3}$ and about $\frac{1}{4}$, respectively. As columns 2 and 5 of Table 4 indicate, the change in the structure of savings is by no means merely a matter of definition. Consequently, while the study of the consumption functions remains of great importance, it becomes imperative to give close attention to the laws of the

formation of business savings, including capital consumption allowances,[94] which now appear to constitute by far the largest component of the nation's aggregate savings.

APPENDIX

In the following references the symbols (1), (2)···refer to the series reproduced in the corresponding columns of the Appendix Table.

A Saving-income ratio: $\frac{(1) - (2)}{(1)}$

B Cyclical income index $\frac{Y_t - Y_t^*}{Y_t}$

Y_t: (3)

Y_t^*: highest figure of (3) preceding the given year (for instance, $Y_{'24}^* = 594$, $Y_{'25}^* = 594$, $Y_{'26}^* = 596$, etc.). Until 1921 the highest peacetime income seems to have occurred in 1919. Deflated by the BLS cost-of-living index, as was income for the remaining years, it would amount to $598. There are, however, reasons to believe that this index underestimates the level of prices in 1919 and 1920. If we use the index Kuznets computed to deflate consumer outlay (*National Income and Its Composition, 1919–1938*, National Bureau of Economic Research, 1941, p. 145, Table 4, col. 3), which otherwise agrees well with the BLS index, we obtain a real income figure for 1919 of only $551. In view of this wide discrepancy, Y_t^* for 1921–22 and 1923 was taken as $575, the simple average of the two figures cited above.

C Canadian income and consumption estimates

Income: (1) gross national product *minus* (2) international balance on interest and dividends *deflated by* (6) cost-of-living index on a 1929 basis. Consumption: (1) gross national product *minus* (2) international balance on interest and dividends *minus* (3) gross capital formation (including expenditure on consumer dur-

[94] The available data do not at all support the assumption, made more or less tacitly in much of the theoretical literature, that capital consumption allowances are approximately proportional to the value of production.

Appendix Table
Major Series Used in Text

	Disposable Income[a]	Consumer Expenditures[a]	Real Income per Capita[b] (dollars)	National Income[a]	Aggregate Profits[a]	Corporate Profits[a]	Dividends[a]	Price Index[c] (1929:100)
	(billions of dollars)			(billions of dollars)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1909				28.7	8.5	2.2		59
1910				30.4	8.7	2.3		62
1911				30.5	8.3	2.0		62
1912				32.9	9.5	2.5		66
1913				34.8	9.8	2.8		65
1914				33.9	9.0	1.9		66
1915				37.0	11.0	2.9		67
1916				44.8	15.2	5.3		73
1917				53.7	20.1	6.1		
1918				58.3	17.2	3.9		
1919	63.5			68.2	22.8	5.7		115.2
1920	66.8			69.5	17.2	3.9		129.4
1921	52.8	50.5	467	51.7	8.5		2.8	105.2
1922	57.0	52.0	530	59.5	14.2	3.9	2.9	99.6
1923	66.1	57.8	594	69.5	17.2	5.2	3.6	100.8
1924	66.7	60.9	586	69.1	16.4	4.3	3.6	101.3
1925	70.6	63.0	596	73.7	19.2	5.5	4.2	102.4
1926	73.2	66.3	604	76.6	19.2	5.8	4.5	103.3
1927	73.5	66.0	610	75.9	18.0	5.1	4.8	100.5
1928	75.4	68.8	625	78.7	19.4	6.3	5.2	100.9
1929	79.6	70.8	654	83.3	20.8	7.2	6.0	100.0
1930	70.7	64.9	589	68.9	11.7	1.7	5.6	97.1
1931	59.6	54.2	542	54.5	5.7	−1.6	4.2	87.4
1932	45.6	43.0	459	40.0	1.2	−3.6	2.8	78.5
1933	44.5	42.4	470	42.3	5.9	−.6	2.2	75.6
1934	51.0	47.7	517	49.5	8.0	.5	2.6	80.0
1935	56.3	52.2	552	55.7	11.2	1.7	3.0	81.2
1936	65.2	59.1	630	64.9	14.7	3.8	4.7	81.2
1937	69.2	62.5	641	71.5	15.8	3.9	4.7	84.6
1938	62.9	58.5	589	64.2	11.8	1.7	3.2	81.8
1939	67.7	61.7	638	70.8	15.4	4.2	3.8	80.5
1940	72.9	65.7	675	77.6	17.8	5.8	4.0	81.6
1941	88.7	74.6	776	96.9	24.3	8.5	4.5	87.6

[a] Unpublished estimates kindly supplied by the Department of Commerce.
[b] Series of column 1 divided by United States population and deflated by the Bureau of Labor Statistics cost-of-living index.
[c] Index used to deflate national income. 1921–41: price index implicit in the Department of Commerce estimates of national income in average 1935–39 dollars (*Review of Economic Statistics*, Vol. 25, No. 2, May 1943, p. 108, Table 1, col. 5a) converted to a 1929 basis. 1914–20: Simon Kuznets, *National Product in Wartime* (National Bureau of Economic Research, 1945), p. 132, App. Table III 4, line 5; spliced to the previous series in 1919 and 1920. 1909–13: weighted average of National Industrial Conference Board cost-of-living index (weighted in proportion to the ratio of consumer expenditure to national income) and price index of producer durable commodities from William H. Shaw, 'Finished Commodities since 1879', National Bureau of Economic Research, *Occasional Paper 3* (1941), p. 7, Table 1b.

ables) *plus* (4) domestic production of motor cars *plus* (5) imports of motor cars *deflated by* (6) cost-of-living index. (Since the original source includes under gross capital formation consumer as well as producer durables, and does not give details of the two categories, items (4) and (5) were added as a crude adjustment to include in consumption at least the expenditure on passenger cars.)
Sources: (1) and (2), Dominion Bureau of Statistics, Business Statistics Branch, *Monthly Review of Business Statistics*, March 1944, p. 15; (3), *ibid.*, April 1944, p. 38; (4), 'Auto-statistics—1944', in Dominion Bureau of Statistics, *Census of Industry, Mining, Metallurgical and Chemical Branch*, 1946; (5), Dominion Bureau of Statistics, External Trade Branch, *Trade of Canada—Calendar Year*, 1927–1939; (6), *Statistical Year-Book of the League of Nations, 1932–33*, p. 270, *ibid., 1935–36*, p. 242, *ibid., 1941–42*, p. 196.

D Swedish income and consumption estimates
For 1896–1930 the estimates of national income and consumption are from Erik Lindahl, Einar Dahlgren, Karin Kock, *National Income of Sweden, 1861–1930* (Stockholm Economic Studies, No. 5A and B, 2 vol., Stockholm, 1937), Vol. 1, Table 49, col. 10, and Table 57, col. 9. The estimates of national income for the years before 1896 are not complete and therefore cannot be used for our purposes. For 1930–34 the above source quotes (Vol. 1, Table 61) the estimates of Dahlgren in *Produktionsstatistik uppskattming av Sveriges Nationalinkomst aren 1930–1934*, Statens offentliga utredningar 1936: 18 (Stockholm, 1936). These estimates were chained to the earlier estimates in 1930. Both the income and the consumption series were deflated by the cost-of-living index (Lindahl and others, *op. cit.*, Vol. 1, Table 51) and divided by the estimated number of consumption units, given up to 1930 by Lindahl (Vol. 2, Table 64) and extrapolated by us to 1934 by means of an index of population.

E The estimates of national income, aggregate profits, and corporate profits are those reproduced in columns (4), (5), and (6). To these series were added federal corporate income taxes as given in *Statistical Abstract of the United States, 1944–45*, p. 277, Table 291, column 7.

F Z_t: $\dfrac{(4) + \text{corporate income taxes (see reference E)}}{(8) \times \text{United States population}}$

Z_t° : highest value of the index Z preceding the given year

Inasmuch as there is probably no way of computing a satisfactory price index for the war years 1917–18, we took as the highest previous income for 1919 ($Z_{'19}^\circ$) a simple average of $Z_{'15}$ and $Z_{'16}$.

G Rate of change in wholesale prices

Computed by means of the formula $\dfrac{P_t - P_{t-1}}{P_{t-1}}$

P_t: 1914–41, BLS Index of Wholesale Prices: 1909–13, F. C. Mills, *Economic Tendencies in the United States* (National Bureau of Economic Research, 1932), App. III, p. 584 (annual indexes of wholesale prices, all commodities). The 1909–13 series was chained to the 1914–41 series in 1914.

H S': $\dfrac{(1) - (2) + (6) - (7)}{(\text{BLS cost-of-living index}) \times (\text{U. S. population})}$

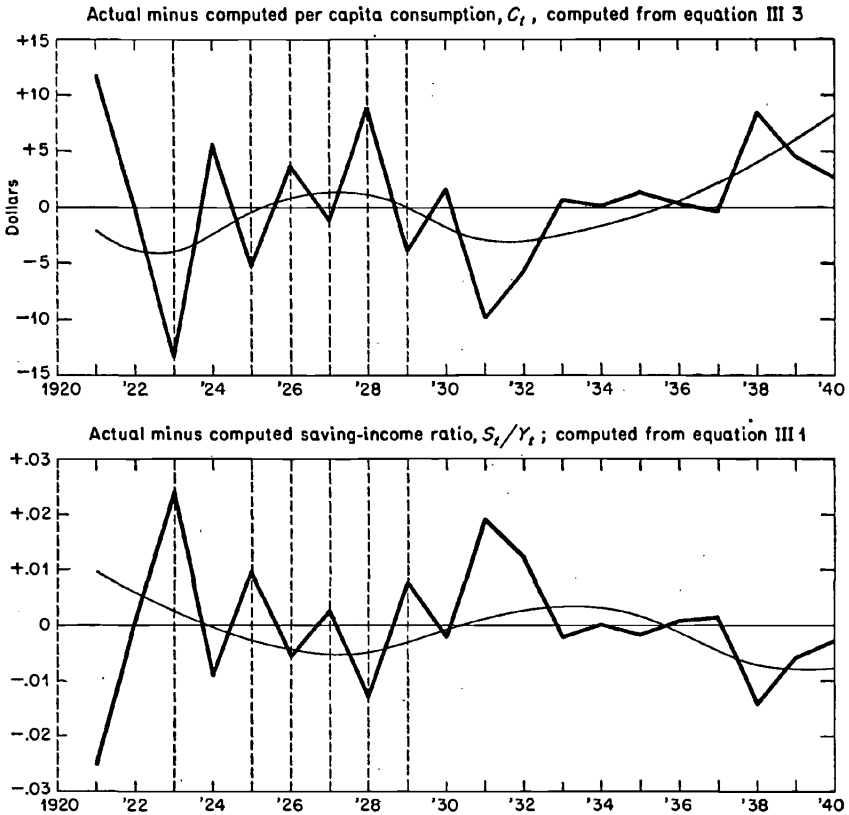
Y': $\dfrac{(1) + (6) - (7)}{(\text{BLS cost-of-living index}) \times (\text{U. S. population})}$

COMMENT

WASSILY LEONTIEF

I have read Modigliani's 'Fluctuations in the Saving-Income Ratio' with great interest. It is an excellent piece of work. There is only one observation I would like to make on Modigliani's consumption function.

Deviations of Actual from Computed Per Capita Consumption and of Actual from Computed Saving-Income Ratio



The dash lines indicate the years in which the highest real income per capita was realized in any year preceding t.

The differences between actual annual consumption figures and theoretical consumption figures computed according to formula III 3—if plotted as a time series—do not seem to represent random deviations; on the contrary, they contain (as can be seen from the graph) a pronounced systematic wave. This wave is present also in the deviations of actual saving ratios S_t/Y_t from those computed on the basis of Modigliani's formula III 1.

If the timing of these waves is compared with the position of Modigliani's "highest years" (Y_t°), on the one hand, and the fluctuation of actual income (Y_t), on the other, one begins to suspect that consumption (C_t) and the saving-income ratio S_t/Y_t of a given year depend not only on current income (Y_t) and the highest previous income (Y_t°) but also on the incomes of the immediately preceding years, Y_{t-1}, $Y_{t-2}, \cdots$. Such an additional term could be introduced in the theoretical formula in the form of a weighted or unweighted moving average of income for a certain number of preceding years.

I would even suggest testing a theoretical relation in which a relatively long, say 5-year moving average, is used and the highest previous income (Y_t°) is entirely eliminated. Being in sympathy with Modigliani's general approach, I hope that this hypothesis will prove to be not less efficient a predictor than his formula containing the asymmetric variable Y_t°.

In conclusion, I would like again to state that Mr. Modigliani's paper is a valuable contribution to the current discussion of statistical consumption functions.

Reply

I am greatly indebted to Professor Leontief for his highly suggestive comment. There are certainly very good *a priori* reasons to expect that consumption habits were influenced by the prevailing income during several recent years; some experiments in the direction of Professor Leontief's suggestions were carried out in the course of the preparation of this manuscript—with not too satisfactory results.

In view of the revisions of the Department of Commerce data, no great significance can be attached to the characteristic shape of the residuals to which Professor Leontief so acutely calls attention. For this reason, it is unfortunately not possible at present to test his suggestion; with data available only since 1929 a five-year moving average would leave us with only some seven years, a period insufficient for testing a hypothesis involving three independent variables. We hope that material will soon be available for a more satisfactory test.