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Stock Market Gains and Aggregate Consumption: A Permanent Income Approach

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I. Introduction

Stock market gains have interested and intrigued economists for a
long time. Although a few attempts have been made to explain the behavior
of stock prices, making capital gains has attracted greater attention than
the more scholarly and less lucrative tasks of examining the sources of
capital gains, and their effect on key economic variables like aggregate
consumption and saving. Corporate stock has been the most important single
source of capital gains for individuals in the United States in recent years.
In 1959 and 1962, the only years for which information on gains realized on
various types of assets is available, more gains were realized on corporate
stock than on any other asset - 42 per cent of all long-term gains in 1959,
and 28 per cent even in 1962 when losses on the stock market were widespread.[1]
The value of stock owned by the household sector has gone up from about
$100 billion in 1947 to almost $700 billion in 1968 - the bulk of the in-
crease being due to accrued gains.

The object of this paper is to examine the effect of stock market gains
on aggregate consumption. Arena [2], which deals with the same time period
as the present study (1947-64), concluded that postwar stock market movements
had little or no impact on aggregate consumption. Silverberg [13], however,
found a "small, but frequently significant, negative relationship between
recent stock price changes and the saving rate," thereby implying that con-
sumption would increase when stock market gains accrue. Before any attempt is

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made to reconcile these diametrically opposite conclusions, it should be noted that these studies are based on rather weak theoretical foundations, and their statistical tests are inconclusive. Moreover, they do not use the same equations and data sources. Arena estimates a linear equation, using aggregate consumption as the dependent variable, and income and gains, lagged one period sometimes, as the explanatory variables. Silverberg, however, relies mostly on simple and partial correlation coefficients between saving and an index of stock prices, without lagging any of the variables. Given the erratic movements of stock prices, it is to be expected that consumption would respond to stock market gains with a lag, and as suggested by more recent work in this area [6], the lag-structure might be more complicated than what Arena's study indicates. The question of the effect of stock market gains on aggregate consumption, therefore, needs to be re-examined.

The plan of the paper is as follows: Section II deals with the specification of the consumption function, the estimates of stock market gains and other data are described in Section III, the empirical results are presented in Section IV and the conclusions are discussed in Section V.

II. The Specification of the Consumption Function

The conclusion that stock market gains do not affect consumption is usually justified by arguing that the distribution of stock ownership is highly skewed towards upper income groups whose spending patterns are hardly affected by short-term stock movements.[2] In the terminology of the permanent income hypothesis, such gains and losses are likely to be viewed as "transitory income". But, regardless of the merits of the income distribution argument, the question whether stock market gains are treated as transitory income, or like income from other sources, cannot be answered on a priori grounds. It is best determined by

specifying and estimating the consumption function according to the permanent income approach.

Let consumption, C_t, be a constant function, k, of permanent income, Y_t^p.

(1) $C_t = kY_t^p + u_t$

$C_t - u_t$ can be called planned consumption. There is a controversy about whether capital gains should be treated as income or as a part of wealth. In some studies, e.g. Spiro [14], retained earnings, which can be interpreted as a proxy for stock market gains, were added to personal disposable income. The income tax law treats portions of realized gains as income for tax purposes, and some theorists would include all gains in personal income; others, however, attribute capital gains to changes in asset prices and incorporate them in wealth.[3] In the permanent income framework, if gains are treated as transitory income, they would be added to wealth in the first instance. We shall use both the income and the wealth approaches in our specification. If gains are included in income directly, permanent income is the sum of expected disposable income (Y_t^e) and expected capital gains (G_t^e). Equation (1) can then be rewritten as follows:

(2) $C_t = k_1 Y_t^e + k_2 G_t^e + u_t$.

A test of the equality of k_1 and k_2 would determine whether stock market gains and other types of income have equal effect on aggregate consumption.

In the wealth approach, we can assume that permanent income depends on expected non-property income, Y_t^n, defined here to include all disposable income except that derived from investment in corporate stock.

(3) $Y_t^p = Y_t^n + \beta S_t$

where β is the "normal" return on stock holdings, and S_t is the value of stock held by individuals. β would depend on current and expected corporate earnings

besides other factors, but to focus more sharply on accrued gains, we assume that β is a function of dividends and stock market gains. We further assume that individuals change their estimate of the value of stock they own, not with every movement in stock prices, but rather on the basis of an average of past accrued gains.

$$(4) \quad S_t = S_{t-1} + S(L)G_t$$

where $S(L)$ is a lag-generating function.[4]

By repeated substitutions, equation (4) can be restated in terms of distributed lag functions of past capital gains:

$$(5) \quad S_t = L(Z)X_t$$

where $L(Z)$ is a lag-generating function, and $X_t = \sum_{i=0}^{\infty} G_{t-i}$.[5]

Substituting equation (5) into (3) and (3) into (1) we get:

$$(6) \quad C_t = kY_t^n + k\beta L(Z)X_t.$$

The coefficients of the lagged independent variables in equations (2) and (6) would show the time shape of response of consumption to changes in income and capital gains.

By assuming that expectations about income and gains are approximated by the same geometric lag function, we can apply the Koyck transformation to derive

$$(2') \quad C_t = \alpha C_{t-1} + k_1(1-\alpha)\, Y_t^d + k_2(1-\alpha)\, G_t + u_t - \alpha u_{t-1}, \text{ and}$$

$$(6') \quad C_t = \alpha C_{t-1} + k(1-\alpha)\, Y_t^w + k\beta(1-\alpha)\, X_t + u_t - \alpha u_{t-1}$$

where Y_t^d is personal disposable income, and Y_t^w is non-property income in year t.

Given our specification of the consumption function, if stock market gains affect consumption significantly, the coefficients of capital gains

in equations (2') and (6') should be positive and significantly different

from zero. The primary hypotheses to be tested, therefore, are:

(H1) $k_2 > 0$ and significant, and

(H2) $k\beta > 0$ and significant.

If these coefficients cannot be distinguished from zero, we shall conclude

that stock market gains have no effect on consumption.

Empirical estimates of the model - equations (2'), (6'), and others

based on more general distributed lag functions are presented in Section III.[6]

III. The Data

For estimating the equations derived above, we define consumption to

include personal expenditures on non-durable goods and services, and deprecia-

tion on consumer durable goods. Data on non-property income are from official

sources. These definitions and data series have been used in a number of

econometric studies of the aggregate consumption function. Equations (2) and

(6) contain some expected variables which cannot be directly observed. Many

techniques have been suggested in the literature to estimate expected income.

The method most commonly used is to construct a weighted average of past in-

comes which we shall use here also.[7] What is new and unique in this study,

however, are the quarterly estimates of accrued stock market gains which are

being used for the first time.

At first glance, the problem of estimating accrued gains appears to be

rather simple. There are published data on the value of stock outstanding,

new acquisitions, and stock prices from which capital gains can be estimated.

But the value of stock outstanding estimated by various government agencies

differs by $50 billion in some years. No reliable information is available

about the assets and liabilities of brokers and dealers, and non-profit

institutions like foundations, universities, hospitals etc. The stock held by them, therefore, cannot be separated from the holdings of the household sector. Intercorporate holdings and unlisted stocks create further difficulties. There is no fully satisfactory solution to these problems. They have been either ignored, or adjusted for arbitrarily in earlier studies. The result is that although all of them show large amounts of accrued gains, the estimates differ considerably.[8] A detailed discussion of these problems lies outside the scope of this paper, but it is important to point out that we have excluded the holdings of the eleemosynary institutions from the value of stock held by the household sector, leaving, by definition, the stock owned by individuals only, and have checked the final estimates of accrued stock market gains for consistency.[9]

The period of observation is 1948 through 1964 (1953-64 for quarterly data),[10] and all the variables are measured in billions of current dollars.[11]

IV. Empirical Estimation

Annual Data

Equations (2') and (6') estimated from annual data for the years 1948-64 are as follows:

$$(2') \quad C_t = \underset{(7.76)}{0.495} Y_t^d - \underset{(-0.17)}{0.002} G_t + \underset{(6.25)}{0.471} C_{t-1} \qquad R^2 = 0.999$$

$$(6') \quad C_t = \underset{(9.43)}{0.563} Y_t^w + \underset{(2.34)}{0.012} X_t + \underset{(5.90)}{0.406} C_{t-1} \qquad R^2 = 0.999$$

The t-values listed in parentheses indicate that current income and lagged consumption are the most important variables in both equations. From the coefficients of income and lagged consumption, we can estimate the marginal propensity to consume (mpc). It turns out to be 0.95 in equation (2') and 0.94 in (6'), which compare favorably with estimates of mpc derived in other

time-series studies of the aggregate consumption function. The coefficient

of accrued gains is negative but insignificant in the income approach. A

significantly negative coefficient would be very difficult to justify on

theoretical grounds.[12] Gains, however, are significant at the 95 per cent

level in the wealth approach. We, therefore, reject (H1) and accept (H2):

stock market gains are not treated as income directly, they affect consumption

via wealth. The coefficient of X_t in (6'), however, is much smaller than the

coefficients of the other variables, which suggests that consumption would

respond less to capital gains than to changes in income.

The above result depends crucially on the assumption on which equations

(2') and (6') are based, i.e. both expected income and gains follow the same

geometric lag function. To obtain a more general test we relax this restriction

partly: we retain the geometric lag assumption but allow different adjustment

coefficients for expected income and gains.[13] The results, reported in Table 1,

do not alter much. The income variable is still the most important variable.

In the income approach, accrued gains have a negative but insignificant co-

efficient; in the wealth approach, the gains' coefficient is significant at

the 95 per cent level. Once again, however, this coefficient is much smaller

than that of expected income.[14]

Evidence from Quarterly Data

The results reported above were based on annual data for 17 years. For

the same period, there are four times as many quarterly observations; the

equations, therefore, can be estimated more precisely. Quarterly estimates

of equations (2') and (6') are as follows:

(2') $\quad C_t = \underset{(4.47)}{0.168 Y_t^d} + \underset{(1.74)}{0.014 G_t} + \underset{(20.01)}{0.828 C_{t-1}} \qquad R^2 = 0.999$

(6') $\quad C_t = \underset{(5.13)}{0.198 Y_t^s} + \underset{(3.37)}{0.009 X_t} + \underset{(19.22)}{0.798 C_{t-1}} \qquad R^2 = 0.999$

TABLE 1

ESTIMATES OF THE COEFFICIENTS OF THE CONSUMPTION
FUNCTION (ANNUAL DATA). COEFFICIENTS
AND (t-VALUES)[a]

Equation No.	Constant	Y_t^e	G_t^e	Y_t^n	X_t	SEE	D.W.
(2)	-6.793 (-2.89)	0.972 (106.6)	-0.085 (-1.21)	-	-	1.53	0.963
	-	0.966 (144.2)	0.112 (-1.36)	-	-	1.91	0.807
(4)	44.15 (2.61)	-	-	0.725 (8.85)	0.153 (3.24)	1.23	1.35
	-	-	-	0.947 (250.0)	0.029 (4.86)	1.37	0.954

[a] t-values are enclosed in parentheses. Expected income and expected gains follow different geometric lag functions. Where no estimate is shown, the variable is excluded from the equation.

As in the case of annual data, both equations have high R^2s, current income
and lagged consumption have significant positive coefficients, gains are
significant in the wealth approach, and the income coefficient is larger
than that of gains in both eeuations. The big difference, however, is in
the coefficient of G_t in (2'): now it is greater than zero at the 95 per cent
level of significance, which implies that capital gains are significant in
the income approach also. Besides, when standard errors are taken into
account, this coefficient does not differ statistically from the gains'
coefficient in the wealth approach: the value of the appropriate F-test is
too small to reject the hypothesis that the coefficients of capital gains
in equations (2') and (6') are equal. When annual data were used, the
coefficient of G_t in (2') was negative and almost one-sixth in absolute value
of the gains' coefficient in (6').

Results comparable to those in Table 1, i.e., allowing expected income
and gains to follow different geometric lag functions are reported in
Table 2.[15] As expected, the larger number of observations has led to better
estimates of the equations: R^2s are consistently around 0.99, and the
Durbin-Watson statistics, especially in the wealth approach suggests that the
residuals are serially independent. This is not true for equation (2),
however; so we adjust it for first order auto-correlation before inter-
preting the coefficients. The revised equations are listed in the last
two rows of Table 2.

The coefficient of expected income (the marginal propensity to consume)
in all cases is close to unity which is a familiar result from earlier studies
of the permanent income variety. Accrued stock market gains have positive
coefficients, significant at the 95 per cent level, in both the income and

TABLE 2

ESTIMATES OF THE COEFFICIENTS OF THE CONSUMPTION
FUNCTION.(QUARTERLY DATA). COEFFICIENTS
AND (t-VALUES)[a]

Equation No.	Constant	Y^e_t	G^e_t	Y^n_t	X_t	SEE	D.W.
(2)	-2.435 (-1.12)	0.965 (159.9)	0.131 (2.08)			0.837	2.74
	-	0.961 (992.1)	0.039 (1.92)			1.77	0.496
(4)	-8.32 (-2.23)	-	-	1.014 (55.64)	0.022 (2.22)	0.996	1.82
	-	-	-	0.975 (191.0)	0.03 (4.26)	1.04	1.77
(2^b)	-2.92 (-1.64)	0.964 (295.4)	0.138 (3.89)	-	-	0.641	1.94
(2^c)	-	0.962 (705.43)	0.029 (1.71)	-	-	1.20	2.13

[a] t-values are enclosed in parentheses. The data relate to 1953-64.

[b] After correcting for first order serial correlation.

[c] Derived by the Hildreth-Lu scanning procedure.

the wealth approach. The primary hypotheses, (H1) and (H2), set out in Section II are thus confirmed. Aggregate consumption, however, is affected much less by expected gains than by expected income because of the relatively smaller magnitude of the gains' coefficient.

Polynomial Distributed Lags

The results reported so far have been based on the assumption of geometric lag distributions for the expected variables. The consumption function specified in Section II, however, is quite general and can be estimated by using other lag distributions. In what follows, the coefficients of lagged independent variables are estimated by the Almon technique, which computes a separate distribution of lagged coefficients for each variable. Let M and N represent the lag on income and gains respectively. Equation (2) can then be rewritten as:

$$(7) \quad C_t = k_1 \sum_{i=0}^{M} \gamma_i Y_{t-i} + k_2 \sum_{j=0}^{N} \delta_j G_{t-j} + u_t,$$

where γ and δ are the coefficients of lagged income and gains respectively.

The technique is highly flexible; the only restriction it imposes is that the coefficients be derived from a polynomial of a given degree, but the degree of the polynomial and the length of the lag cannot usually be determined by a priori reasoning. If the lag length on one variable is changed, or a restriction imposed on one of the coefficients, all other variables would, generally, be affected. In practice, therefore, the optimal lag structure has to be estimated by trial and error using whatever prior information might be available.

We shall use a third-degree polynomial because at least two critical values might be needed to determine the distribution of lagged income and gains. We also know from the quarterly estimates reported above that long

lags might be involved in forming expectations about income and stock market gains. Therefore, we start with a lag of 8 quarters on income and 12 quarters on gains, and then experiment with different lag-lengths. Furthermore, we expect that as the independent variables recede into the past, their effect on consumption will taper off little by little; so we constrain the lag distributions of both expected income and gains to approach zero gradually.[16]

Various estimates of equation (7), using the Almon technique are presented in Table 3. In equation (3-1), with income lag at 8, and that for gains at 12 quarters, the coefficients of the independent variables have the expected positive signs, and are highly significant. The coefficient of income lagged 7 quarters (γ_7) is highly significant but gains, lagged 9 quarters or more (G_{t-9} onwards) turn out to be insignificant. This suggests that the lag-length should be increased on income and reduced on stock market gains. As the income lag is increased to 10 quarters, holding the lag on capital gains at 12 quarters (equation 3-2 in Table 3), the results do not change appreciably: the constant term and the coefficients of the independent variables increase somewhat and become slightly more significant, R^2 and the Durbin-Watson statistic go up a little, and the standard error declines. The last two coefficients of lagged gains, however, are now insignificant; the lag-length on stock market gains, therefore, has to be shortened.

When gains are lagged 9 quarters (equation 3-3 in Table 3), the sum of gains coefficients is substantially reduced although it is still significant, the standard error of the equation rises sharply, and the Durbin-Watson statistic drops to a low 1.15. Moreover, the coefficients of Y_{t-9} and G_{t-8} are highly significant, which suggests that lags on these two variables should be increased. This is done to obtain equation (3-4) for which both income and gains are lagged 12 quarters. The sum of the coefficients of lagged gains increases, the R^2 is

TABLE 3

ESTIMATION OF THE COEFFICIENTS OF THE CONSUMPTION FUNCTION,
POLYNOMIAL DISTRIBUTED LAGS.   TEXT EQUATION (7)[a]

Equation No.	Independent Variables					R^2	S.E.	D.W.
	Constant	M	$k_1 \Sigma^Y \gamma_i$	N	$k_2 \Sigma^G \delta_j$			
3-1	-15.527 (1.327)	8	1.007 (0.005)	12	0.198 (0.061)	0.9996	0.9817	1.81
3-2	-15.966 (1.309)	10	1.010 (0.005)	12	0.216 (0.060)	0.9997	0.9564	1.88
3-3	-16.590 (1.360)	10	1.012 (0.006)	9	0.143 (0.048)	0.9996	1.130	1.15
3-4	-16.221 (1.269)	12	1.012 (0.005)	12	0.219 (0.058)	0.9997	0.9406	1.89
3-5	-15.320 (1.305)	12	1.010 (0.005)	13	0.195 (0.062)	0.9997	0.9309	2.02

[a]Standard errors are in parentheses.

slightly better, the standard error is reduced and the Durbin-Watson statistic is improved considerably. The last coefficient of lagged gains (δ_{11}) is highly significant; however, if gains are lagged any further - to 13 quarters in equation (3-5), for example - the overall results do not differ much from (3-4), but the coefficient of Y_{t-11} becomes negative and the last 4 coefficients of lagged gains are insignificant, which indicates that we should retrace our steps and shorten the lags.

Although four of the five equations presented in Table 3 are very similar: all variables highly significant, high R^2s, standard errors around 0.95, and Durbin-Watson statistics close to 1.8, we chose (3-4) as our final estimate of equation (7). Its standard error is smaller than those in equations (3-1) - (3-3), and the sum of the coefficients of both lagged income and gains are more significant than in any other equation. The mean lag for income is 3.6 quarters, and that for stock market gains is 5.3 quarters.

The lagged coefficients in equation (3-2) are plotted in Figure 1 and listed in Table 4. The income lag is positive and significant. It has the shape of an inverted U, but as the lag is lengthened, it can be seen in Figure 1 that its shape changes to a significant monotonically declining distribution. As shown in Table 3, the sum of income coefficients, however, increases only slightly, from 1.007 to 1.012.

Except for equation (3-3), which is inferior to other equations in every way, the gains lag is positive in the shape of an inverted U. The effect of increasing the income lag is to flatten the distribution for lagged gains, i.e., the coefficients of the first five lagged terms decrease, and those for others are increased. As is clear from Table 3, the sum of gains coefficients rises from 0.198 to 0.219 and also becomes more significant.[17]

TABLE 4

LAGGED COEFFICIENTS OF INCOME AND STOCK-MARKET GAINS
(Equation 3-4 in Table 3)

Lag	Y_{t-i}	G_{t-j}
0	0.136 (0.034)*	0.010 (0.005)
1	0.138 (0.012)	0.015 (0.005)
2	0.135 (0.011)	0.019 (0.006)
3	0.127 (0.017)	0.022 (0.007)
4	0.115 (0.018)	0.024 (0.007)
5	0.101 (0.016)	0.025 (0.007)
6	0.084 (0.011)	0.025 (0.007)
7	0.067 (0.007)	0.023 (0.007)
8	0.050 (0.008)	0.021 (0.006)
9	0.033 (0.012)	0.017 (0.006)
10	0.019 (0.013)	0.013 (0.005)
11	0.008 (0.009)	0.007 (0.003)
12	0	0

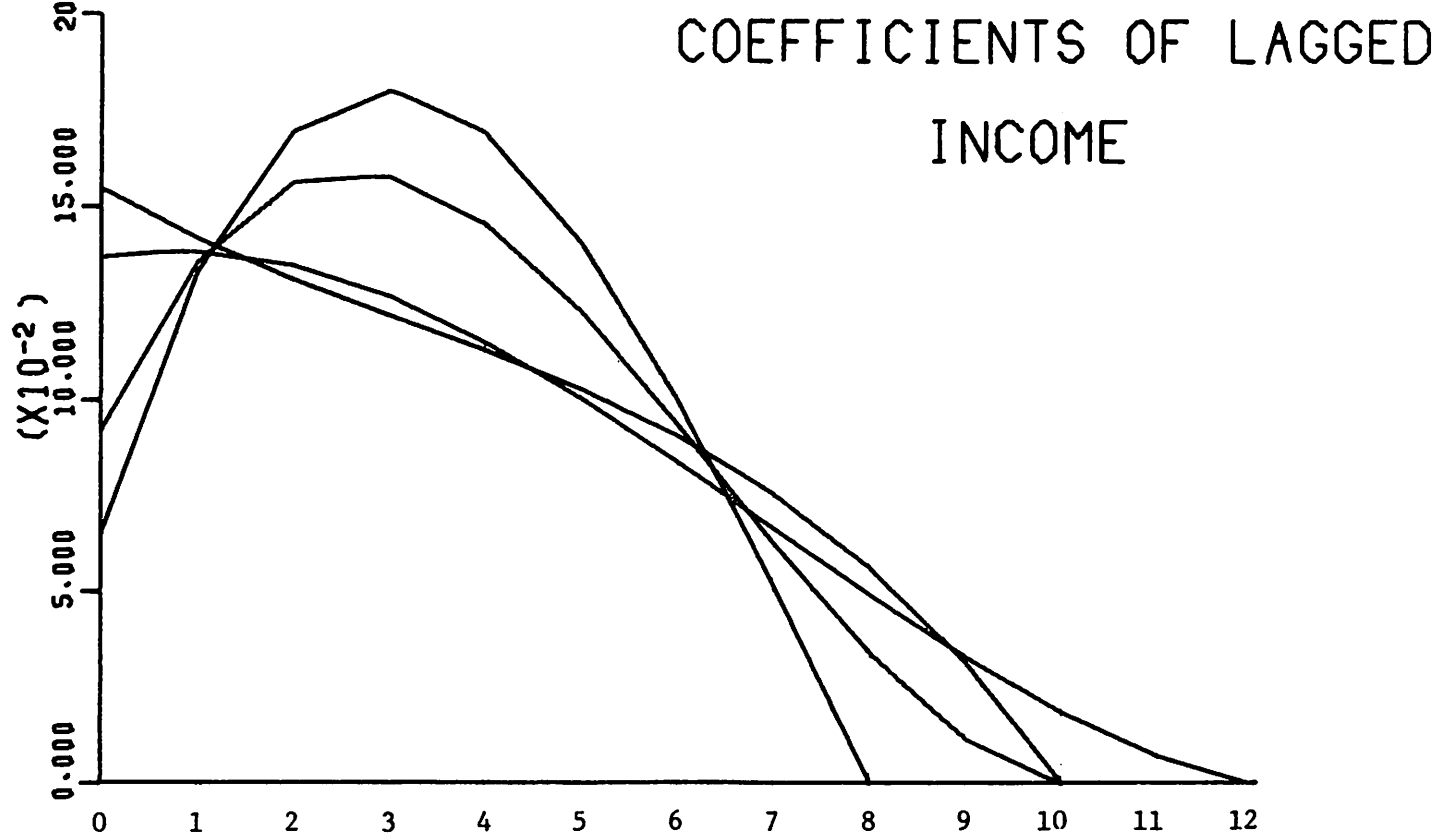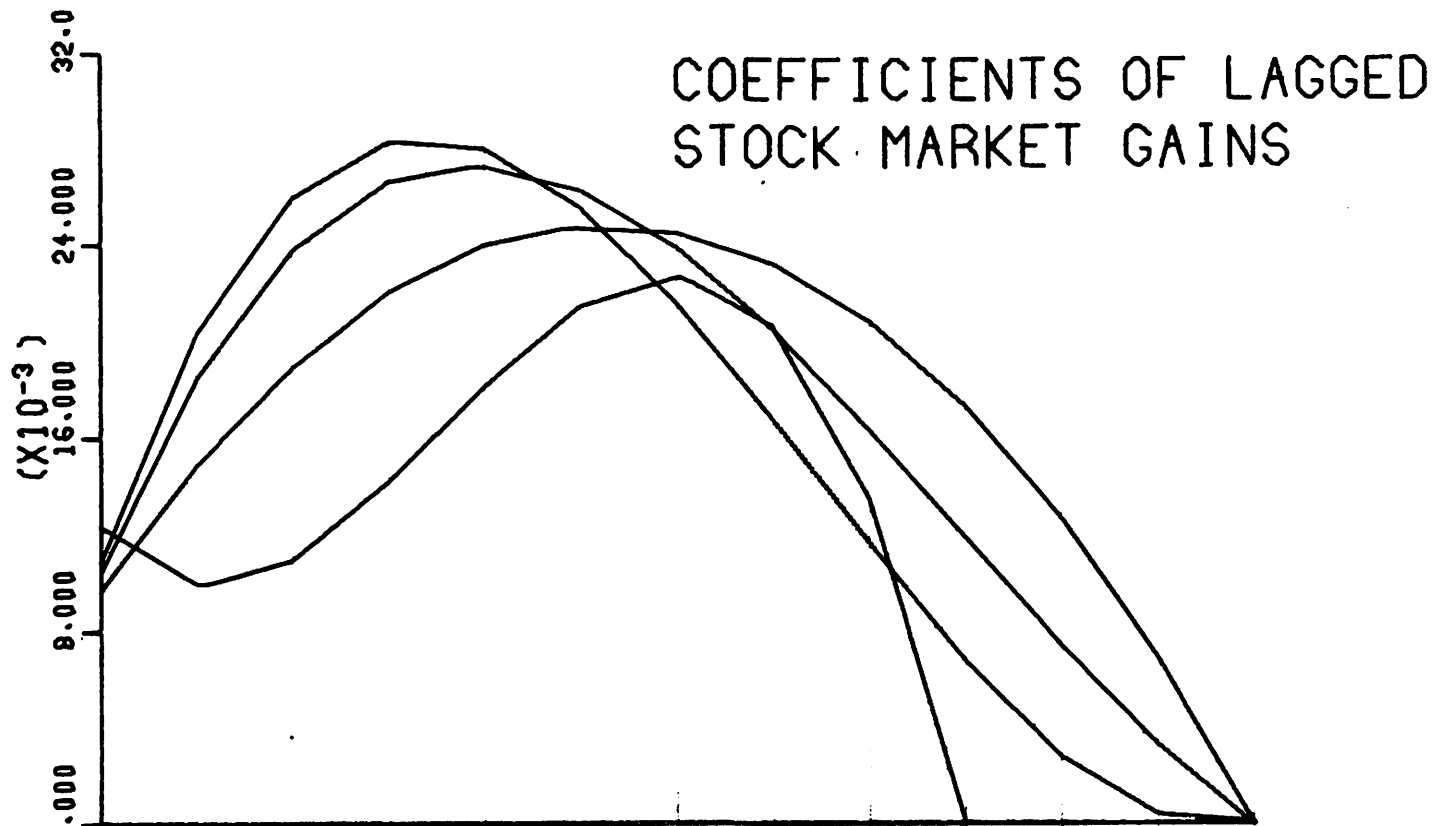*Standard errors are enclosed in parentheses.

FIGURE 1. DISTRIBUTION OF COEFFICIENTS OF LAGGED INCOME AND GAINS
IN TABLE 3, EQUATIONS 3-1 TO 3-4

V. Conclusion

This paper has examined the influence of stock market gains on aggregate consumption by incorporating them into the permanent income framework. Expected income and gains are approximated by geometric and polynomial distributed lag functions which are estimated from annual and quarterly data for the years 1947-64. The results suggest that (i) stock price movements have a significant effect on aggregate consumption, but its magnitude is smaller than the effect of income which remains the most important variable in the aggregate consumption function, and (ii) consumption responds to gains with an average lag somewhat longer than to income. When annual data are used, gains are insignificant in the income approach, which suggests that people treat stock market gains as accretions to wealth in the first instance. Quarterly data indicate, however, that such gains are significant in both approaches. Besides, a glance at Table 2 shows that the gains' coefficient has the same magnitude - about 0.03 - in the two cases. Therefore, so far as short run effects on aggregate consumption are concerned, it does not matter whether accrued gains on corporate stock are treated as a part of income or wealth.

These conclusions are at complete variance with the notion widely held that capital gains, by and large, have no significant effect on consumption. The direct comparison is with Arena [2] which examined much the same annual and quarterly data on stock market gains as used in this paper. What explains the difference in results? The biggest factor is that Arena's equations are not derived from any well defined theoretical framework. When it comes to empirical estimation, the difference between Arena's and the present study boils down to the specification of a lag structure. In Arena's work, stock market gains and income are lagged one period at most, whereas

the permanent income framework adopted for deriving our hypotheses leads to a more elaborate lag structure for both income and capital gains. As our analysis shows, consumption responds to accrual of stock market gains with an average lag of about 5 quarters, which is much longer than that used in Arena's study.

We have established that the marginal propensity to consume out of accrued stock market gains is significantly greater than zero, but smaller than mpc out of other types of income. The relatively small magnitude of the gains' coefficient can be readily explained by the belief, widely held, that gains accrue largely to upper income groups who also have a higher propensity to save than people with lower incomes. Consequently, capital gains would have a smaller impact on aggregate consumption than, say, salaries and wages, which would be distributed more evenly. This explanation is re-inforced by the fact that the concept of accrued and not realized gains has been used in the results derived above. There are several restrictions on borrowing on the security of corporate stock: real estate and some other assets make better collaterals; so people might treat accrued gains as contingent or anticipated income and increase consumption substantially only when gains are actually realized. These hypotheses are highly plausible but no suitable data on income distribution of accrued gains, or realized stock market gains are available to test them.[18]

REFERENCES

[1] Almon, S., "The Distributed Lag Between Capital Appropriations and Expenditures," Econometrica, 33 (Jan. 1965), 178-196.

[2] Arena, J. J., "Postwar Stock Market Changes and Consumer Spending," The Review of Economics and Statistics, 47 (Nov. 1965), 379-91.

[3] Bailey, M. J., National Income and the Price Level, (New York: McGraw-Hill Book Company, 1971).

[4] Bhatia, K. B., "Accrued Capital Gains, Personal Income and Saving in the United States, 1948-64," The Review of Income and Wealth, 16 (Dec. 1970), 363-78.

[5] _____, "The Estimation of Accrued Gains on Individuals' Holdings of Corporate Stock," Mimeo.

[6] _____, "Capital Gains and the Aggregate Consumption Function," UWO Research Report No. 7112, (May, 1971).

[7] Board of Governors of the Federal Reserve System, Flow of Funds Accounts 1945-67, (Washington: 1968).

[8] Friedman, M., A Theory of the Consumption Function, (Princeton: National Bureau of Economic Research, 1957).

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

[10] Johnston, J., Econometric Methods, (New York: McGraw-Hill, 1963).

[11] McClung, N., "The Distribution of Capital Gains on Corporate Shares by Holding Time," The Review of Economics and Statistics, 48 (Feb. 1966), 40-50.

[12] McElroy, M. G., "Capital Gains and the Theory and Measurement of Income," Unpublished Ph.D. dissertation, Northwestern University, 1970.

[13] Silverberg, S., "Wealth, Stock Prices, And Consumer Behavior," Western Economic Journal, I(Summer, 1963), 218-25.

[14] Spiro, A., "Wealth and the Consumption Function," Journal of Political Economy, 70 (Aug. 1962), 339-354.

[15] U.S. Treasury Department, Sales of Capital Assets, Statistics of Income 1962, Supplemental Report, (Washington: U.S. Government Printing Office, 1966).

[16] Wright, C., "Estimating Permanent Income: A Note," Journal of Political Economy, 73 (October 1969), 845-50.

FOOTNOTES

[1] Calculated from data reported in [15], pp. 46-47.

[2] This argument is used extensively by Arena [2].

[3] For a fuller treatment of the debate about including capital gains in income or wealth, see Bhatia [4] and McElroy [12].

[4] Alternatively, we could state that S_t depends on S_{t-1} and expected capital gains, and then use a distributed lag specification for expected gains. The wealth concept involved in either case is a subjective value, rather than a market value concept. Subjective value, though extremely difficult to measure, is the more relevant variable for explaining consumer behavior; market value, however, is more objective and is easily ascertained, at least in the aggregate.

[5] This formulation is based on the assumption that $S(L)G_t$ is a geometric lag function. Let

$$S(L)G_t = \alpha_2 \Sigma \alpha_1^i G_{t-i}.$$

Equation (4) can be rewritten as

$$S_t = \alpha_2 \sum_{\tau=0}^{\infty} \alpha_1^\tau X_{t-\tau}$$

where

$$X_t = \sum_{i=0}^{\infty} G_{t-i}.$$

[6] The equations derived above are very similar to those in [6], Section I. However, only annual data are available for all accrued gains which are the subject of [6]. Corporate stock is the only asset-type for which quarterly gains also have been computed. Thus, apart from the importance of stock market gains per se, the lag structure involved can be analyzed more thoroughly.

[7]Expected income has been defined in some studies as full employment labor income, or current income adjusted for a possible scale factor. Obviously, all these definitions require many arbitrary decisions.

[8]In 1960 for example, the accrued loss indicated by Bailey's study [3] exceeds the amount computed from Flow-of-Fund data in [7] by more than three times while McClung's data [11] show an accrued capital gain.

[9]The problem of estimating accrued gains on individuals' holdings of corporate stock is the subject of another paper, [5], where these issues are discussed in detail.

[10]Although estimates of gains accruing on stock held in the household sector can be made for a few years after 1964, no information is available about the assets and liabilities of the non-profit institutions after 1964. Quarterly estimates are presented for the years 1947-64 in [5], but no quarterly data on consumption, as defined here, are obtainable for the years 1947-52. For these reasons, annual data for the period 1948-64, and quarterly data for 1953-64 are used for the results derived in the next section.

[11]Thanks are due to George Craig, Northern Illinois University for data on C_t, and to William Branson, Princeton University, for data on non-property income. These are essentially the data series used in the FRB-MIT model. I shall be glad to provide a complete data set on request.

Consumption function studies generally use real magnitudes, the current dollar figures used here, therefore, might raise some question. The biggest problem is that while data on consumption and income in constant dollars are available, estimates of real stock market gains are difficult to make. Capital gains are generally estimated by subtracting from the value of stock at the end of a year, the value at the beginning of a year, and net new acquisitions during the year. Prices relating to several points in time are thus involved; the deflation procedure, therefore, gets complicated.

[12]A very implausible justification is alluded to by Silverberg: accrued gains might lead to expectations of further gains; consumers, therefore, would save more to increase their purchases of corporate stock ([13], p. 225).

[13]In calculating expected variables as weighted moving averages of past observed values, weights decline exponentially and add up to unity in all cases. By assuming that expectations about income and gains are based on past experience, the estimation becomes somewhat less complicated as illustrated by equations (2') and (6'). Because of the small number of observations, only five yearly moving averages were computed for annual data, but this restriction is relaxed for quarterly data.

[14]The rather low values of the Durbin-Watson statistic in Table 1 suggest that residuals have positive serial correlation. Consequently, although the coefficients are unbiased, their standard errors are likely to be incorrect; strictly speaking, the usual tests of significance cannot be applied to them. (Cf. Johnston [10]). But there is no easy way of correcting for serial correlation in the present case. We tried to adjust for first order serial correlation, but the Durbin-Watson statistic improves only slightly. For example, equation (4), becomes:

$$C_t = 0.941Y_t^n + 0.037G_t^e \qquad R^2 = 0.999$$
$$\quad (172.5) \quad\quad (4.55) \qquad\qquad D.W. = 0.975$$

The Cochrane-Orcutt technique also did not change the results much. The final judgment on these coefficients, therefore, should be withheld until results from quarterly data are examined.

[15]All computations were done by a computer program SCAN, written by the author. Initial weights were specified for income and stock market gains, and expected variables were determined by the formula:

$$R_t^* = B \sum_{i=0}^{\infty} (1-B)^i R_{t-i}$$

where B is the initial weight. The moving average process was terminated when weights became smaller than 0.0001. For details of this procedure, see Wright [16]. Expected income and gains, computed in this way by varying the weights over a predetermined range, were used to estimate equations (2) and (6). The results reported in Tables 1 and 2 are those for which the residual sums of squares were minimized. Given an adequate search procedure and a correctly specified model, these estimates would be maximum likelihood estimates. Cf. Griliches [9].

[16] Without this restriction, the coefficients of the independent variables outside the stated lag would be assumed to be zero, i.e., the lag distribution would approach zero abruptly. Constrained estimation would be more realistic in the present context.

[17] Equation (3-4) estimated without restricting the last lagged coefficient to zero is as follows:

$$C_t = \underset{(1.219)}{-15.406} + \underset{(0.005)}{1.01} Y_{t-i} + \underset{(0.06)}{0.169} G_{t-j}$$

$$R^2 = 0.9997, \quad S.E. = 0.8730, \quad D.W. = 2.25$$

This does not differ much from the constrained estimates reported in Table 3. The individual lagged coefficients and the shape of the lagged distribution, however, are different now.

[18] Annual data on gains realized on all assets (including corporate stock), however, are available and were used in [6] to examine if accrued and realized gains affected consumption differently. It was found that consumption did respond more to realized gains than accruals, and people treated realized gains like any other income. Cf. ([6], pp. 14-17).

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[17]Equation (3-4) estimated without restricting the last lagged coefficient to zero is as follows:

$$C_t = -15.406 + 1.01 \underset{(0.005)}{Y_{t-i}} + 0.169 \underset{(0.06)}{G_{t-j}}$$
$$\underset{(1.219)}{}$$

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