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AN ANALYSIS OF THE EFFECTS OF TRANSITORY INCOME ON EXPENDITURE OF NORWEGIAN HOUSEHOLDS

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Introduction

This paper reports the results of an empirical analysis of consumer reaction to short-run deviations of income from relatively long-run or average income levels. The basic theoretical framework chosen for the analysis could be called a "generalized Friedman" model. The data are Norwegian: a cross-section budget study using the household as observation unit and one month as the observation period. The monthly information is augmented by the annual incomes of each of the sample households for a two-year period. Although the results are strictly applicable to Norwegian households headed by salaried personnel, their qualitative implications are probably valid in a much broader context. If so, the results indicate a need for changes in models used for short-term forecasting and a program for collecting monthly budget data.

As a guide for economic policy the simple textbook relation between disposable income and consumption expenditure leaves much to be desired. The reasoning which led Keynes to suppose that a change in income would lead to a like-signed change in both consumption and saving still seems sensible, but quarterly changes in per-capita price-adjusted series show many violations of that simple rule.[1/] This gross inconsistency is not limited to the very

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1/ See Gardner Ackley, Macroeconomic Theory, The Macmillan Company, New York, 1961, pp. 258-261.

short-run; year-to-year changes and even longer periods fail to satisfy Keynes' "fundamental psychological low."

It is evident that a more complex theory is needed to account for the highly varied aggregate responses to changes in disposable income. The value of improvements in this area is high indeed, the range of responses to income change has been large enough to make or break otherwise sound stabilization policies. This study is no more than a small contribution to development of such a theory. The general approach emphasizes the dynamic behavior of the household in its efforts to finance a program of consumption activities of variable and uncertain urgency, out of currently available and expected future flows of disposable resources. The specific aspect studied here is the reaction to very short-run changes in income.

Description of the Data

In 1958 the Norwegian Central Bureau of Statistics carried out a household budget study. Their survey, like our B.L.S. surveys, provides a basis for weighting cost-of-living index numbers as well as a source of data for a variety of investigations. The bulk of the Norwegian interview schedule is devoted to obtaining a complete flow statement of receipts, expenditures, and changes in wealth for a single month. In order to provide useful information about both yearly averages and seasonal patterns, the sample was divided into 12 parts and one part interviewed shortly after each of the 12 months of 1958. Each of the twelve monthly subsamples was independently chosen; they were not, for example, further particularized as to region.

Households headed by wage earners, salaried employees, self-employed persons and retired persons were surveyed in 1958. The present study is limited to the salaried employee category primarily because they provide a large (765 households), but not unwieldy sample of fairly homogeneous households. Moreover, as a group, the salaried employees can be expected to have straight-forward, easily categorized receipts and expenditures, and to be able and willing to provide responsible, reasonably accurate information about them. It is planned to extend the analysis to the other categories of households in the '58 Survey. The remaining groups can provide a "fresh sample" for testing hypotheses suggested by the salaried employee data.

The feature which makes this survey more useful than dozens of others is the possibility of collating annual incomes from tax returns for the 1957 and 1958 calendar years with the individual monthly accounts. Through the good offices of Mr. Arne Amundsen of The Statistisk Sentralbyrå the annual incomes were matched with the household observations and my requests for statistical calculations were carried out by the staff.[2/]

[2/] I cannot commend too highly the work of the staff at the Statistisk Sentralbyrå. They were efficient, cooperative, patient, and thoroughly competent. I owe particular thanks to Mr. Finn Anderson who carried out the large scale calculations on the electronic computer.

The annual income data make it possible to recognize monthly incomes which are high or low relative to the annual average and thus provide a means of separating the effects of short-and long-run income variation. This unique

configuration of income information permits a direct and objective decomposition of the cross-section differentials into short-and long-run components. It may be, of course, that the behavior of households cannot be adequately explained by any refinement of objective income measures. But the advantages of dealing with readily measured variables suffice to motivate continued effort and innovation along these lines.

Theory and Hypotheses

The Friedman Hypothesis provides a convenient point of departure for analyzing short- and long-run income elasticities.[3/] According to that theory

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3/ The theory is fully presented in Milton Friedman, A Theory of the Consumption Function, Princeton University Press, 1957. A useful summary and synthesis with other theoretical and empirical work is provided by M.J. Farrell, "The New Theories of the Consumption Function," The Economic Journal, Vol. LXIX (December 1959), pp. 678-696.

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current income receipts are decomposed into two unobservable components. One, the permanent component, is a household's subjective estimate of the constant income stream which is equivalent to the expected, possibly variable, income stream it anticipates over some relevant horizon. The other, so-called transitory component is measured by the deviation of current income receipts from permanent income. Friedman makes an analogous decomposition of consumption expenditures and then completes the model by making permanent consumption proportional to permanent income and specifying zero correlations between the two transitory components and between each of the transitory

components and its permanent complement.

In the present context the annual incomes (actually an average drawn from them) will be interpreted as measuring permanent income and the deviation of the household's net receipts in the interview month from the average will be viewed as transitory income. Two remarks are appropriate here. In the first place, Friedman's permanent income is a subjective estimate formed by the household and oriented toward expectations about the future. The empirical counterpart suggested above is an objective magnitude referring mostly to the past. It will be a poor substitute if the household expects the future to be much different from the past, whether or not its expectation is eventually justified. To the extent that 1958 annual income reflects income not yet received by households interviewed early in 1958, it nominally measures future income. But it is an ex post magnitude and may be quite different from the household's ex ante expectations.

Secondly, the short- and long-run periods provided by the data of this inquiry are respectively one month and two years in length. In Friedman's theory, and in theoretical and empirical analysis which have followed it, the long period over which permanent income is discounted is longer than two years. Furthermore, the period over which the transitory deviation is measured is commonly a year. It follows that income over a two year period may reflect properly designated transitory influences and that the monthly transitory component (even if it were correctly derived through a perfect permanent income measure) will contain seasonal and accidental or random components that would be averaged out in an annual transitory income.

While borrowing the distinction between permanent and transitory income, one may choose to remain skeptical about the added specification of a zero propensity to consume from transitory income. In the models subsequently fitted to the sample data, transitory income is explicitly introduced. This provides a particularly stringent test of the "zero propensity" hypothesis; one would scarcely expect the elasticity of monthly consumption with respect to monthly transitory income to be larger than the elasticity involving the same annual components. The greater importance of very short-term random elements in the monthly components argues against this. Certainly if the time period is made short enough -- week, day, hour or micro-second -- arguments for a zero elasticity on transitory income finally become compelling.

In addition, an explicit measure of the transitory components provides an opportunity to test for possible asymmetry in the effects of positive and negative departures from permanent income. Although it lacks full accreditation from utility theory, the notion that a positive deviation encourages either an optimistic advance or an improvident splurge, while a negative one seldom triggers a hasty retreat, does have some intuitive appeal. It is supported by casual observation, introspection, and the sociological and psychological considerations adduced by Duesenberry in support of the relative income hypothesis.[4/] In any case the data permit a relatively direct test of the

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[4/] See James S. Duesenberry, Income, Saving and the Theory of Consumer Behavior, Harvard University Press, Cambridge, 1949, especially Chapter 3.

proposition and for that added reason transitory income was introduced in regressions in a form which allowed for asymmetrical effects.

An attempt was made to provide explicit allowance for change in the significance of the annual income measures for members of successive monthly subsamples. For example, 1958 annual income represents information not yet available to a member of the January subsample, while it is past experience to members of the December subsample. It proved impossible to isolate the effects of that peculiarity because they were thoroughly confounded with other sources of month-to-month variation in the several elasticities. The failure, however, suggested a further test to establish the existence and importance of month-to-month variation in the income elasticities of consumption. It is disconcerting to find variation in parameters we have all expected or devoutly hoped to possess short-run stability. The consumption function is indeed complex if its parameters show the full range of secular, seasonal, and irregular time-patterns and the econometric problem of estimating those patterns is staggering. Nevertheless, if the variation is there it must be squarely faced; neither theory nor policy will be improved by ignoring it.

Consumption as considered in the theory of consumer choice is a pure flow of goods and services. This flow is very imperfectly measured by expenditure. This is particularly troublesome when the period of observation is short because a high proportion of the purchases simply add to stocks that are consumed directly or via their services over a longer period. In

the analysis which follows consumption expenditure is used as the dependent variable without any attempt at refinement. For most policy purposes expenditure is the variable of primary interest and so expenditure need not be considered solely as a poor proxy for consumption. This consideration provides an additional reason for including transitory income in the consumption function -- investment in stocks of consumer goods may be related to transitory income even if "pure" consumption is not. Besides total consumption expenditure, expenditure on specific categories of goods can be treated separately. This enables one to determine whether purchases of "immediate" consumption goods, such as food, are less elastic with respect to transitory deviations than purchases of clothing or household durable goods (none of the households in the sample purchased automobiles during the observation period). Housing expenditure, including payments for utilities and maintenance is also treated separately but since it is such a hodge-podge of rentals, fixed interest charges, etc., it is hard to form hypotheses about the resulting elasticity.

The breakdown of total consumption expenditure into more detailed groups is paralleled on the saving side by distinguishing between contractual and non-contractual forms of saving. Here, it might be supposed, the implication of Friedman's Hypothesis for saving would be most readily apparent in the non-contractual part. It should absorb a very high proportion of the transitory deviations of income. Contractual saving, on the other hand, might behave more like regular or habitual outlays on the consumption side.

To summarize, the main propositions which will be examined in the

subsequent report of empirical findings are:

a) Transitory deviations of income in a single month from more long-run levels are reflected only (mostly) in saving, and not (slightly) in consumption outlays.

b) The distinction between permanent and transitory income serves no useful purpose because the household reacts identically to changes in either one.

c) The household attaches no importance to year-to-year changes in income; given the total income received over a two year period the household is virtually indifferent as to its distribution between the two years.

d) Household reaction, to transitory income, if any, is entirely symmetrical as regards positive and negative deviation from permanent income.

e) Household reaction to year-to-year income change is entirely symmetrical as to increases and decreases.

f) The parameters of the consumption function are stable over time except for the linear changes induced by the roughly linear change in the ex ante/ex post mixture in the meaning of the income variables.

Description of the Variables

Independent Variables:

By accident, the annual income data, and consequently the "permanent incomes" derived from them, are gross of income tax. The error could have been rectified but was not on the grounds that it is not of crucial importance. The "permanent" income which is derived from the annual data would be approximate even if the annual data were net of taxes. It is not self-evident that a better proxy for permanent income could be obtained from net annual income than from gross. The other variable based on the annual income data is the year-to-year change; in this case allowance can be made for the fact that the net change is inflated by some average of marginal tax rates. In preliminary work, monthly tax payments were included in the model explicitly. With taxes introduced separately, monthly income could have been measured in gross terms, symmetrically with the annual incomes. Unfortunately, owing to a peculiarity of the newly introduced tax withholding scheme, tax payments had a strong but largely spurious correlation with permanent income.[5/] To avoid needless distortion, tax payments were omitted

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5/ The nuisance correlation led to estimates implying that consumption expenditure increases with tax payments, holding gross monthly income constant -- a result that would revolutionize fiscal policy if it could be believed.

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and monthly income measured net of taxes. The nominal "permanent income" variable (Y) was formed as the simple average of monthly incomes over

the two year period:

$$Y = \frac{1}{24} \quad [1957 \text{ Annual Income} + 1958 \text{ Annual Income}] \ .$$

The choice of equal weights for the two years was essentially arbitrary. The arbitrariness is partly removed however in models which include the income change variable (ΔY) . This variable is defined as the difference between average monthly income in the two years:

$$\Delta Y = \frac{1}{12} \quad [1958 \text{ Annual Income} - 1957 \text{ Annual Income}] \ .$$

In the logarithmic models ΔY is defined differently to avoid negative values:

$$\Delta Y' = 1958 \text{ Annual Income} \div 1957 \text{ Annual Income} \ .$$

When present, the income change variable can be interpreted in a conventional way or as a correction to be applied to the equal weights assigned to the separate components of Y .

The nominal "Transitory Income" variable (y) can now be defined as the deviation:

$$y = \text{Net Income Receipts in Survey Month} - (Y + K) \ ,$$

where K is chosen to make Σy approximately zero over the whole sample.

As with the income change variable, an alternate form is used in logarithmic models:

$$y' = 1 + \frac{y}{Y+K} = \frac{\text{Net Income Receipts in Survey Month}}{Y+K}$$

To provide for asymmetry in the effects of y, its absolute value is introduced as an additional variable, denoted as $|y|$ (or $|\log \Delta Y'|$), in some of the models. The coefficient of $|y|$ will be zero if there is no asymmetry in the effect of positive and negative values of y. If it is greater than zero then the effect of a positive value of y is algebraically larger than that of a similar negative value. The same device is used for examining asymmetrical effects of ΔY, the corresponding symbols are $|\Delta Y|$ and $|\log \Delta Y'|$.

Family size (f) is introduced in all models so that the estimates of the income effects can be measured net of size influences. The variable is measured in adult-equivalent units through application of weights developed by the Norwegian Central Bureau of Statistics for various age-sex categories. The adult equivalent scale was the most convenient variable to use because it had been coded and punched, moreover it seemed as suitable for the limited objective stated above as a simple nose-count.

Seasonal influences are also partialed out in a gross fashion by introduction of a set of binary variables M_i ($i = 1, 2, \ldots, 12$).[6/] They

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[6/] Binary variables (sometimes called dummy variables) take on values of zero or one. In this case $M_i = 1$ for observations gathered in month i and equals zero for other observations.

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are typically appended to arithmetic or logarithmic models as a matter of course to provide respectively additive or proportional adjustment for seasonal factors. In one portion of the analysis they are allowed to interact with the other variables in the model.

Finally, time (t) is introduced at one point in its interactions with the several income variables. This variable takes the values 1, 2, ..., 12, depending on the month in which the household was interviewed. It can be further defined as:

$$t = \sum_{i=1}^{12} iM_i$$

For convenience the variables are listed below:

1. Y = "permanent" income = average monthly income in 1957 and 1958
2. ΔY , $\Delta Y'$ = income change
3. y , y' = transitory income = deviation of monthly income from average

4. $|y|$, $|\ell ny'|$, $|\Delta Y|$, $|\ell n\Delta Y'|$ = "asymmetry variables" for transitory income and income change respectively

5. f = family size

6. M_i = monthly binary variables (i = 1, 2, ..., 12)

7. t = chronological time

Dependent Variables:

Consumption (C) is basically a measure of expenditure on consumer goods. It is corrected for changes in stocks of fuel and food supplies but otherwise it is based on purchases. Four specific classes of consumption outlay are also analyzed. They are:

C_1 = Food consumption (corrected for change in supplies)

C_2 = Expenditure on housing, fuel, utilities and repair. (Does not include payments which increase equity.)

C_3 = Expenditure on household durables

C_4 = Expenditure on clothing and footwear

Saving (S) can be defined as a residual: gross income minus taxes and consumption expenditure. It is separately measured, however, and can be further divided into Contractual Saving (S_c) and Other Saving (S_o) . The saving variables may take on negative values and consequently are not treated in the logarithmic models.

Tables 1 and 2 give a simple statistical description of the variables. The upper portions of these tables show a matrix with variances on the diagonal, covariances below the diagonal and simple correlation coefficients above the diagonal. The lower parts of the tables show means and standard deviations. Table 1 contains statistics on the primary variables used in additive or arithmetic models; Table 2 refers to those from the multiplicative or logarithmic models.

Report of Findings

The dependent variables listed above have been expressed as linear functions of various subsets of the listed independent variables and a random residual. The statistical model underlying the analysis is the general linear regression model. Ordinary least squares estimation techniques have been used throughout.

Model I:

The most restrictive set of additive models (Model I) to be examined here can be written in the form:

$$C = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 f + \beta_2 Y + \beta_3 y + \beta_4 \Delta Y + u$$

for consumption. Equations of the same form were fitted with S, S_c and S_o as dependent variables. The multiplicative models of corresponding

TABLE 1

Simple Statistics for the Primary Variables in Additive Models

	f	Y	y	ΔY	C	S	S_c	S_o
f	1.125	.286	.088	.015	.396	- .065	.052	- .142
Y	181.66	357,932.	- .369	.033	.555	- .123	- .022	- .149
y	72.76	-171,245.	602,259.	- .060	.110	.648	.706	.187
ΔY	6.75	8,377.	- 19,797.	182,901.	- .076	.039	.014	.039
C	304.42	240,793.	61,641.	- 23,535.	525,807.	- .420	.037	- .618
S	-50.33	- 54,217.	369,308.	12,136.	-223,488.	538,522.	.692	.689
S_c	29.63	- 7,098.	291,676.	3,195.	14,252.	270,354.	283,320.	- .046
S_o	-79.96	- 47,118.	77,632.	8,941.	-237,739.	268,169.	-12,966.	281,134.
Mean	2.48	1,430.	0.28	85.26	1284.07	4.61	75.58	- 70.97
Standard Deviation	1.06	598.	776.	427.	725	734	532	530

Note: f is measured in adult-equivalent units, all other variables in Norwegian Kroner (7 Kr ≈ $ 1.) per month.

TABLE 2

Simple Statistics for the Primary Logarithmic Variables

	ℓn f	ℓn Y	ℓn y'	ℓn Δy'	ℓn C	ℓn C_1	ℓn C_2	ℓn C_3	ℓn C_4
ℓn f	.2411	.361	.166	- .034	.503	.700	.135	.249	.318
ℓn Y	.0790	.1981	- .091	.018	.583	.474	.294	.260	.213
ℓn y'	.0573	- .0284	.4946	- .068	.205	.197	.164	.133	.112
ℓn ΔY'	-.0068	.0032	- .0196	.1657	- .106	- .058	- .064	- .064	- .043
ℓn C	.1302	.1366	.0758	- .0227	.2778	.699	.474	.525	.494
ℓn C_1	.1654	.1016	.0668	- .0113	.1775	.2318	.249	.303	.313
ℓn C_2	.0988	.1955	.1728	- .0388	.3730	.1791	2.2305	.189	.116
ℓn C_3	.2038	.1931	.1560	- .0433	.4618	.2435	.4724	2.7877	.286
ℓn C_4	.2386	.1450	.1203	- .0268	.3982	.2301	.2634	7288	2.3310
Mean of logs	.8049	7.1780	- .2862	.0605	7.0215	5.9578	4.5878	3.1096	4.3552
Geometric Mean	2.24	1310.	.751	1.063	1120.	387.	98.	22.	78.
Standard Deviation of logs	.491	.445	.703	.407	.527	.481	1.493	1.669	1.526

restrictiveness (Model I') take the form:

$$\ell nC = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 \ell nf + \beta_2 \ell nY + \beta_3 \ell ny' + \beta_4 \ell n\Delta Y' + u$$

for total consumption with equivalent equations applied to the four detailed consumption categories, C_1, C_2, C_3, and C_4. The estimated coefficients together with their estimated errors, standard deviation of residuals and R^2, are shown in Table 3.

From the tabulated results in Table 3, two conclusions may be drawn. Monthly expenditure, in total or for specific items, is less sensitive to differences in transitory income, y, than to differences in Y, the permanent income proxy. At the same time, it is by no means insensitive to transitory differences. While the coefficients of y are only about 1/3 the value of the Y coefficients, y is more variable and thus it accounts for a substantial amount of the variation in expenditure. This is one way of interpreting the generally high "t" ratios for y in the several expenditure regressions. This result establishes a presumption that income deviations for a period as short as a month do have substantial immediate effects on expenditure, contrary to Hypothesis a) listed earlier.

On the other hand Hypothesis b) is also rejected. The coefficients of y are different from zero but emphatically smaller than corresponding Y coefficients. The error of the differences between the Y and y coefficients is 3-1/2% smaller than the error of the corresponding

TABLE 3

Results of Regression Analysis
for Model I and I'

Model I Coefficient of:	f	Y	y	ΔY	S_u	R^2
Dependent Variables:						
C Consumption Exp.	140.48 (19.07)	.7217 (.0363)	.2730 (.0272)	-.1307 (.0443)	520	.4959
S Saving	-140.73 (19.07)	.2780 (.0363)	.7269 (.0272)	.1308 (.0443)	520	.4948
S_c Contractual Saving	-59.15 (12.41)	.2962 (.0236)	.5917 (.0177)	.0660 (.0288)	338	.6050
S_o Other Saving	-81.58 (18.66)	-.0182 (.0356)	.1352 (.0267)	.0648 (.0434)	508	.0996
Model I' **Coefficient of:**	**ℓnf**	**ℓnY**	**ℓny'**	**ℓnΔY'**	**S_u**	**R^2**
Dependent Variables:						
ℓnC Consumption Exp.	.3247 (.0300)	.5705 (.0328)	.1359 (.0200)	-.1118 (.0331)	.3684 (1.45)[1/]	.5216
ℓnC_1 Food Consumption	.5741 (.0254)	.2901 (.0277)	.0798 (.0169)	-.0314 (.0280)	.3119 (1.37)[1/]	.5866
ℓnC_2 Housing, Utilities and Repairs	-.0664 (.1138)	1.0805 (.1244)	.4189 (.0758)	-.2037 (.1257)	1.399 (4.05)[1/]	.1413
ℓnC_3 Household Durables	.5358 (.1257)	.7790 (.1375)	.2523 (.0837)	-.1687 (.1390)	1.545 (4.68)[1/]	.1610
ℓnC_4 Clothing and Footwear	.8373 (.1150)	.4094 (.1257)	.1557 (.0766)	-.1245 (.1271)	1.413 (4.11)[1/]	.1610

Note: a) estimated sampling error shown in parentheses below estimates
b) natural logarithms used throughout

1/ Antilog of S_u: multiplicative error equivalent to t standard errors = factor shown raised to the power t .

Y coefficients for Model I estimates and 8% larger for Model I'.

If the income elasticities shown for the four classes of expenditure are ranked, housing has the highest elasticity of the four, both short-and long-run. Apparently repair and maintenance outlays are sufficiently flexible and important to outweigh the stability of basic housing expenditure. Food expenditure shows the smallest elasticity, as one might expect, and clothing is somewhat more elastic than food. Household durables appear more elastic than total expenditures both short-and long-run but they are not highly elastic considering that such expenditures account for only 6 - 7% of the average Norwegian budget. Since food expenditure is around five times larger than durable goods purchases, the elasticity estimates imply that more of a transitory income receipt goes for food than for durable goods. This is not entirely consistent with permanent income notions.

The saving propensities for the two components of saving present a puzzle. While a large part (but not all) of transitory income is saved, most of it is reflected in contractual saving. This is contrary to most a priori notions about the role of contractual saving. Perhaps the ordinary presumption is conditioned by a habit of considering only positive transitory deviations -- negative ones may compel application for a loan to be paid off in installments. In an attempt to detect the reason for this unexpected result, separate estimates of the Model I equations were formed for Urban and Rural subgroups. It was apparent that the results in Table 3 were dominated by the urban pattern of saving. The rural group showed the expected high propensity to save transitory incomes in non-contractual forms. The analysis of the separate

groups did not produce an explanation for the anomaly but it did trace it to a part of the sample. Further detective work might be needed here or perhaps the result is an extreme sampling error.

The coefficients of the family size variable amply justify their inclusion in the model. With the exception of the housing equation they are all highly significant and the elasticities for the separate categories in Model 2 have sensible relative magnitudes. The low housing elasticity is probably due in part to a real tendency to substitute against housing when size increases and in part to the structure of subsidies for housing.

The ΔY coefficients indicate a weak tendency for expenditure to lag income change. For given total income in the two year period less is consumed in the months of '58 if income has increased than if it has remained constant or fallen. Interpreting the ΔY coefficient as a correction to the equal weights used in forming Y, one finds that a heavier weight would be warranted for the earlier income. (For the C equation in Model I weights of .68 and .32 for '57 and '58 income would eliminate the ΔY coefficient.) These results tend to cast doubt on Hypothesis c) above but the evidence is far from overwhelming, particularly for the detailed categories.

The introduction of long-run income improves the model substantially. In addition to permitting a more direct and partial measure of transitory influences it increases the level of explanation dramatically.

The model:

$$C = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 f + \beta_2 y_d + u \text{ , } (y_d = \text{monthly net income})$$

was estimated and it achieved an R^2 of only .380. Thus the long-run income variables in Model I have explained 18.5% the residual variance after regression on the short-run variables. Incidentally, the coefficient of y_d was .386 in the model above -- it is evident that it is an amalgam of the short-and long-run propensities. In terms of Friedman's theory the .38 regression slope can be interpreted as a weighted average of short - and long-run propensities, i.e.,

$$.38 = P_y \alpha + (1 - P_y) \beta \quad ,$$

where α = propensity to consume permanent income,

β = propensity to consume transitory income,

and P_y = proportion of income variation in sample which is accounted for by variation of permanent income.

A multiple regression of y_d (monthly disposable income) on Y , Δ , f , age, and the seasonal binaries achieved an R^2 of .232. That can be taken as a lower limit estimate of P_y . If, for argument, we take $P_y = .3$ and $\beta = .2$ (c.f., the transitory coefficient in Model I) the relation above implies that $\alpha = .8$ -- a more reasonable magnitude for a propensity to consume. Given $P_y = .3$, $\beta = 0$ would imply $\alpha = 1.26$.

One notable difference resulting from the shortness of the observation period is the magnitude of R^2 for the saving equation. In cross-sections

with annual information the R^2 for saving is usually much smaller than for consumption. This difference is of no particular significance however, it is simply another implication of the relatively small short-run response of expenditure to short-run income change.

One additional feature of the results in Table 3 calls for comment. The standard deviation of residuals is large, and R^2 is small for the C_2, C_3 and C_4 regressions. While one might expect that random influences would be more important than systematic ones for detailed categories of expenditure, the indication that 1/3 to 2/5 of the observations are more than 4 times the expected value or less than 1/4 of it is scarcely reassuring. A partial explanation is that for these items an appreciable number of households had zero expenditure. Since the logarithm of zero is somewhat hard to accomodate in a computer, a very small positive number was coded instead of zero. Obviously the variance of the logarithm depends critically on which small positive number is chosen, moreover the residual variance will depend on that choice. If one were primarily interested in investigating variables C_2, C_3, C_4, which have frequent zero values, he might be well advised to find a more suitable model; probit regression for example. In the present analysis primary interest is on the consumption equation. It was felt that parallel treatment of the detailed categories could provide some useful insights at very low cost.

Model II:

The results from Models I and I' confirm the importance and statistical significance of transitory influences on expenditure. The next step is to investigate the effect, if any, of the direction of a transitory change in income. Table 4 displays the estimates, etc., obtained from applying Model II:

$$\ell nC = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 \ell nf + \beta_2 \ell nY + \beta_3 \ell ny' + \beta_4 \ell nY' + \beta_5 |\ell ny'| + \beta_6 |\ell n\Delta Y'| + u$$

to consumption, and equivalent forms to C_1 , C_2 , C_3 and C_4 .

The coefficients for $\ell ny'+$ are obtained as $\beta_3 + \beta_5$; for $\ell ny'-$ they are $\beta_3 - \beta_5$. The hypothesis of complete symmetry in the effects of positive and negative values of $\ell ny'$ implies $\beta_5 = 0$. That hypothesis is rejected at the .05 level in all 5 cases, at the .01 level for all except C_2 . Symmetry for longer-run changes can be tested through β_6 . The hypothesis that $\beta_6 = 0$ cannot be rejected at the .05 level.

The asymmetry in the influence of y is also in the predicted direction. The readiness with which expenditures are expanded in response to short-run increases is not fully balanced by prompt contraction after a reverse in fortunes. For total expenditure as well as specific types, the upward short-run elasticity appears to be about the same size as the coefficient

TABLE 4

Results of Regression Analysis for Model II

dependent variables: \ coefficient of:	ℓnf	ℓnY	$\ell ny'+$	$\ell ny'-$	$\ell n\Delta Y'+$	$\ell n\Delta Y'-$	S_u	R^2
ℓnC Consumption Expenditure	.2952 (.0288)	.6417 (.0324)	.6942 (.0699)	.0698 (.0206)	-.0553 (.0495)	-.1363 (.0476)	.3520 (1.422)[1/]	.5645
ℓnC_1 Food Consumption	.5629 (.0253)	.3136 (.0285)	.2960 (.0614)	.0547 (.0181)	-.0504 (.0435)	-.0031 (.0418)	.3095 (1.363)[1/]	.5964
ℓnC_2 Housing, Utilities and Repairs	-.0947 (.1144)	1.1294 (.1286)	.9784 (.2770)	.3553 (.0817)	-.3748 (.1961)	-.0180 (.1887)	1.3955 (4.037)[1/]	.1474
ℓnC_3 Household Durables	.4934 (.1261)	.8825 (.1419)	1.0563 (.3056)	.1570 (.0901)	-.0774 (.2163)	-.2130 (.2081)	1.5393 (4.661)[1/]	.1700
ℓnC_4 Clothing and Footwear	.7931 (.1150)	.5275 (.1294)	.9804 (.2787)	.0567 (.0822)	.9053 (.1972)	-.2824 (.1898)	1.4038 (4.071)[1/]	.1745

Note: a) estimated sampling error shown in parentheses below estimates
b) natural logarithms used throughout

1/ Antilog of S_u : multiplicative error equivalent to t standard errors = factor shown raised to the power t .

of Y, while the downward elasticity is much smaller. It should be recalled that the Y coefficients are biased as estimates of "permanent income" elasticities. The bias is measured roughly by the elasticity of the relation between net and gross income. Consequently the upward elasticities remain somewhat smaller than the long-run ones.

As for the effects of ΔY, they remain weak. Only 2 of the 10 estimates exceeds twice its estimated error. One of these (for C) indicates a significant lag in adjusting to decreases in income; the other (for C_4) indicates anticipatory or negatively lagged adjustment to increases. The estimates imply a slower adjustment to decreases than to increases for C, C_3 and C_4; they imply the reverse for C_1 and C_2.

In summary, the evidence provided by Model II strongly supports the notion of asymmetry in the effects of short-run income change. The evidence is much weaker for ΔY. For C and C_1 where the zero-observation problem does not weaken the fit, the estimates show significant lags in total consumption for decreases in income but not for increases; no significant lag is shown for food, as one might expect from the relative ease of adjusting food outlays.

Model III:

The next step in the analysis involves the added feature of coefficients which may vary in a linear pattern over the 12 consecutive sample-months. As mentioned earlier, the annual incomes pertain to the calendar years 1957

and 1958; the monthly surveys were carried out during 1958; consequently the 1958 annual income is a different sort of variable, in relation to the information available to respondents, for each of the 12 sub-samples. Similarly the recency, and probably the relevance, of 1957 income changes in a roughly linear way for the successive samples. For this reason the coefficients of all variables which depend on the annual income data might be expected to change, and to change linearly over the year.

Since all the income variables in Model II depend on the calendar year data, Model II $\frac{1}{2}$ was formed as:

$$C = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 f + \beta_2 Y + \beta_3 y + \beta_4 \Delta Y + \beta_5 |y| + \beta_6 |\Delta Y| + \gamma_2 tY + \gamma_3 ty + \gamma_4 t\Delta Y$$

$$+ \gamma_5 t|y| + \gamma_6 t|\Delta Y| + u$$

for consumption. Equivalent equations were used for S, S_c and S_o and also for ℓnC, ℓnC_1, ℓnC_2, ℓnC_3, and ℓnC_4 except that all independent variables except M_i and t appear as logarithms. As a further test of the need to treat ΔY as elaborately as y, the joint hypothesis that $\beta_6 = \gamma_4 = \gamma_6 = 0$ was tested. It was rejected only in the S_c and S_o regressions. But, as with the previous anomaly involving the saving components, the rejection was dominated by the urban sub-sample. Consequently it was decided to suppress the three tested coefficients and to concentrate on Models III and III', which are as follows.

Model III (used for C , S , S_c , and S_o):

$$C = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 f + (\beta_2 + \gamma_2 t)Y + (\beta_3 + \gamma_3 t)y + \beta_4 \Delta Y + (\beta_5 + \gamma_5 t)|y| + u$$

Model III' (used for ℓnC , ℓnC_1 , ℓnC_2 , ℓnC_3 , ℓnC_4)

$$\ell nC = \sum_{i=1}^{12} \alpha_i M_i + \beta_1 \ell nf + (\beta_2 + \gamma_2 t)\ell nY + (\beta_3 + \gamma_3 t)\ell ny' + \beta_4 \ell n\Delta Y' + (\beta_5 + \gamma_5 t)|\ell ny'| + u$$

Table 5 contains the main results from the Model III and III' regressions. As before, the positive and negative transitory change parameters are obtained by taking the sum or difference of the y and $|y|$ coefficients. The joint influence of the 4 parameters in Model III (III') not present in Model I (I') was tested for significance and was found significant at the .01 level for each of the dependent variables in Table 5. A test of the "time-varying kink" examined the joint hypothesis that $\beta_5 = \gamma_5 = 0$. That hypothesis was rejected at the .01 level for all equations except C_2 (housing), in that case it was rejected at .05.

Interpretation of the pattern of variation of the several coefficients is quite difficult. As will be made clear presently the linear patterns of change estimated above will not bear close scrutiny. But prior to that argument, a few comments can be made about Table 5. First, the family size coefficients are of the same general magnitudes as in the previous

TABLE 5

Results of Regression Analysis for Models III and III'

MODEL III

dependent variables: \ coefficient of:	f	Y	y+	y-	ΔY	S_u	R^2
C Consumption Expenditure	115.62 (18.70)	.5983 + .0279t (.0813) (.0101)	-.0916 + .0805t (.0546) (.0117)	.5516 - .0227t (.1406) (.0189)	-.1207 (.0426)	499.	.5385
S Saving	-115.83 (18.70)	.4009 - .0279t (.0813) (.0101)	1.0918 - .0806t (.0546) (.0117)	.4476 + .0226t (.1406) (.0189)	.1208 (.0426)	499.	.5497
S_c Contractual Saving	- 11.50 (9.18)	.1185 - .0044t (.0399) (.0050)	1.0934 - .0954t (.0268) (.0058)	-.0744 + .0180t (.0690) (.0092)	.0581 (.0209)	245.	.7934
S_o Other Saving	-104.33 (18.43)	.2824 - .0235t (.0801) (.0100)	-.0016 + .0148t (.0538) (.0115)	.5220 + .0046t (.1385) (.0186)	.0627 (.0420)	492.	.1626

MODEL III'

dependent variables: \ coefficient of:	ℓnf	ℓnY	ℓny'+	ℓny'-	ℓnΔY'	S_u	R^2
ℓnC Consumption Expenditure	.2697 (.0287)	.5110 + .0230t (.0605) (.0079)	.3438 + .0643t (.1233) (.0192)	.3250 - .0307t (.0636) (.0070)	-.0932 (.0311)	.3433 (1.412)[1/]	.5820
ℓnC_1 Food Consumption	.5478 (.0255)	.2518 + .0117t (.0538) (.0070)	.0545 + .0427t (.1097) (.0171)	.2069 - .0223t (.0566) (.0063)	-.0232 (.0277)	.3071 (1.360)[1/]	.6037
ℓnC_2 Housing, Utilities and Repairs	-.1536 (.1153)	.8893 + .0471t (.2433) (.0319)	.1192 + .1469t (.4959) (.0771)	.9848 - .0749t (.2558) (.0283)	-.1805 (.1252)	1.3884 (4.008)[1/]	.1584
ℓnC_3 Household Durables	.4417 (.1273)	.7497 + .0256t (.2687) (.0352)	-.0676 + .2108t (.5475) (.0852)	.6170 - .0560t (.2825) (.0313)	-.1347 (.1382)	1.5331 (4.633)[1/]	.1789
ℓnC_4 Clothing and Footwear	.7446 (.1163)	.4884 + .0103t (.2455) (.0322)	.2892 + .1359t (.5003) (.0778)	.5718 - .0619t (.2581) (.0286)	-.0912 (.1262)	1.4008 (4.058)[1/]	.1802

Note: a) estimated sampling error shown in parentheses below estimate
b) natural logarithms used throughout

1/ Antilog of : multiplicative error equivalent to t standard errors = factor shown raised to the power t .

models and call for no special attention. The coefficients of Y show a significant tendency to increase for the C, ℓnC and ℓnC_1 equations. The elasticity of consumption with respect to Y ranges from .534 in January to .787 in December. If this pattern primarily reflected the changing meaning of Y, one might conclude that past income experience is more important than expectations about the future (provided that these can be assumed to be strongly correlated with the eventual experience). More simply, the admixture of information about the household's future income in Y reduces its influence on C relative to a purely ex post Y.

The patterns for the transitory variables are much more dramatic. The positive and negative elasticities for C (ℓnC equation) are about the same in January and they approach one and zero respectively in December. The size of these changes suggested a need for deeper study of the month-to-month variations in the parameters to see if they were adequately represented by the linear pattern. If there are other reasons for variations of the elasticities over the year besides the changing meaning of Y, then the linear patterns are not very meaningful. The next and final part of the analysis is devoted to that question.

Model IV:

In order to leave the monthly pattern of coefficients unconstrained the following models were estimated:

$$\ell nC = \sum_{i=1}^{12} M_i [\alpha_i + \beta_{1i} \ell nf + \beta_{2i} \ell nY + \beta_{3i} \ell ny' + \beta_{4i} |\ell ny'|] + u$$

with similar forms for ℓnC_1 , ℓnC_2 , ℓnC_3 and ℓnC_4 .

Although these equations contain 60 coefficients they are estimated 5 at a time by fitting the bracketed equations to each of the 12 monthly sub-samples individually; only the residual variance is estimated from all 765 observations. ΔY is omitted from Model IV because it proved to have little or no monthly variation and had previously been shown to have a relatively weak influence.

Figures 1 and 2 show the patterns of variation for the three income elasticities in the C and C_1 equations respectively. Although the monthly coefficients must be expected to show large sampling errors, the graphs strongly suggest that the variation would be poorly described by a straight line.

A fairly direct test can be made to determine whether there is a significant variation in the monthly coefficients not accounted for by linear patterns. The test examined the following linear restrictions on the parameters of Model IV

1. $\beta_{1i} = \beta_1$, $i = 1, 2, \ldots, 12$

2. $\beta_{2i} = \beta_2 + i\gamma_2$, $i = 1, 2, \ldots, 12$

3. $\beta_{3i} = \beta_3 + i\gamma_3$ $i = 1, 2, 3, \ldots, 12$

4. $\beta_{4i} = \beta_4 + i\gamma_4$ $i = 1, 2, 3, \ldots, 12$

FIGURE 1

Monthly Elasticities for Total Consumption Expenditure

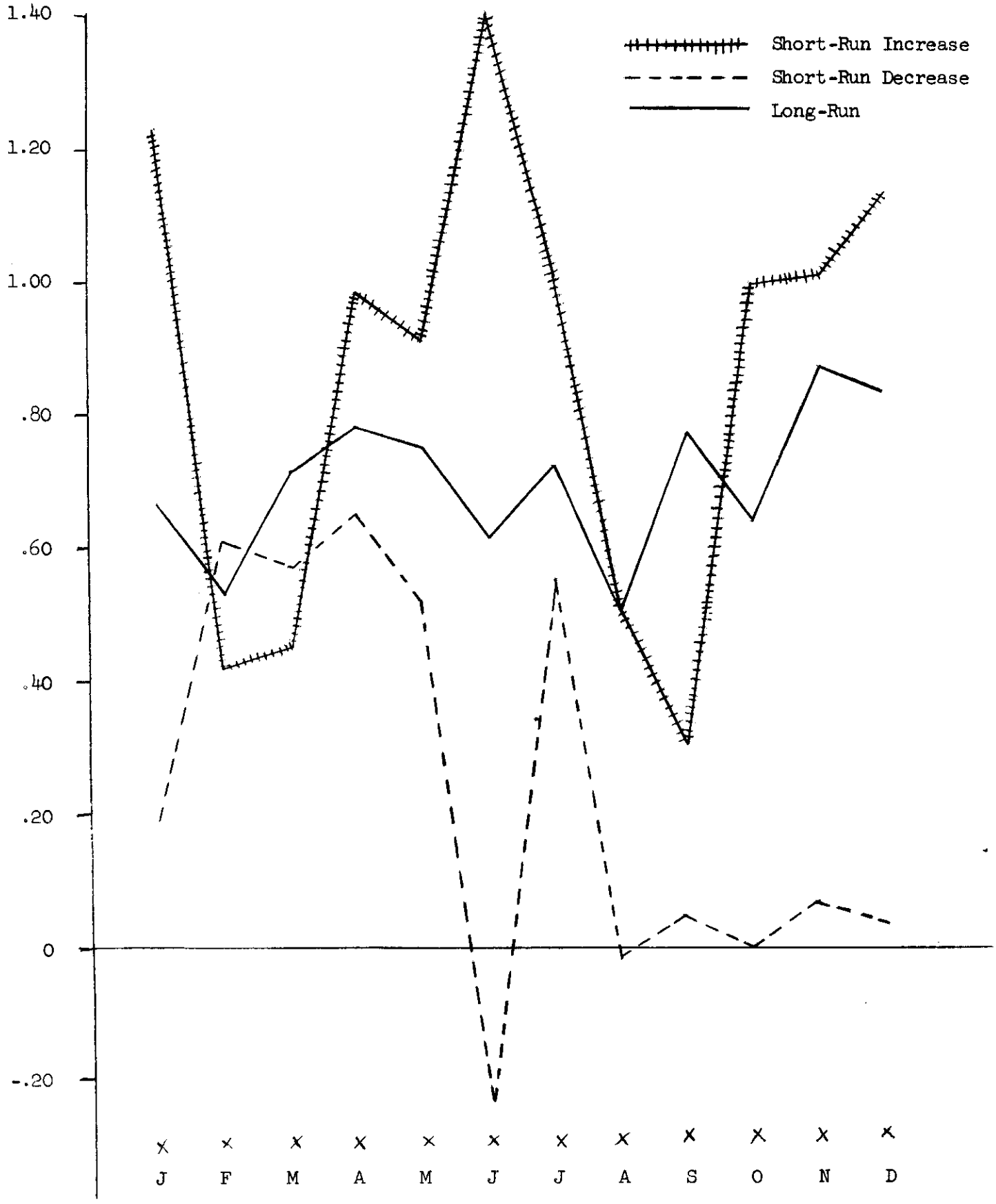
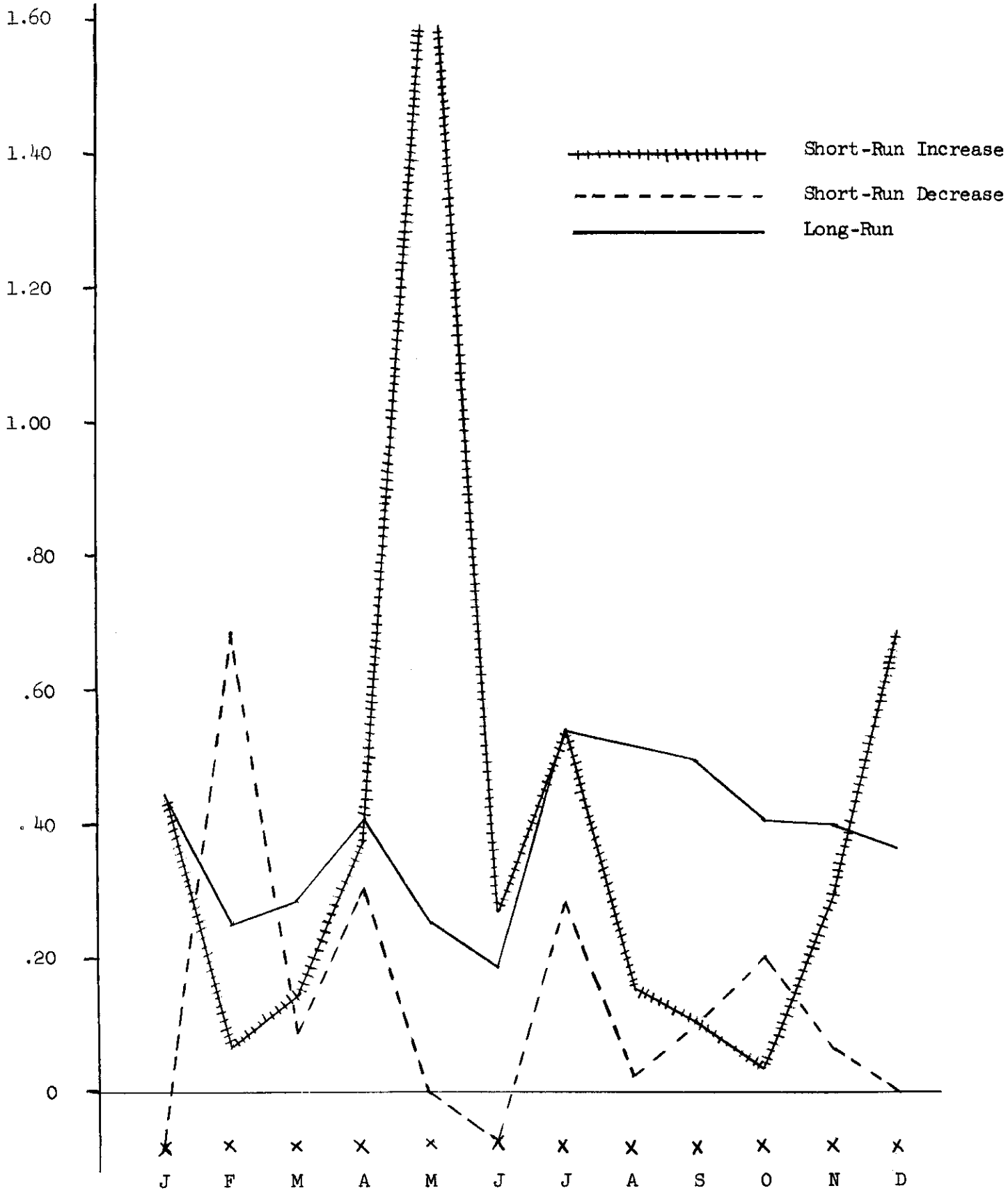


FIGURE 2

Monthly Elasticities for Food Consumption



A composite test of the hypothesis that all the above restrictions are satisfied was carried out. The test involves 41 degrees of freedom. The values of F obtained for ℓnC , ℓnC_1 and ℓnC_4 exceeded the .01 critical value for F with 41 and 705 degrees of freedom. The F value for ℓnC_2 exceeded the .05 level; only the estimates for ℓnC_3 were consistent with the hypothesis.

The rejection of the linearity hypothesis, which includes constant parameters as a special case, establishes the importance of monthly variation in income elasticities -- textbook prototypes of things that remain constant at least over the short-run. Given a presumption that the income elasticities can vary sharply from month-to-month for reasons not yet understood, it is pointless to attempt any interpretation of the linear coefficient patterns in Model III and in particular they should not be expected to add insights about the effect of the changing definition of Y .

The graphs show, and tests confirm, a tendency for consumption expenditure to be more sensitive to increases than to decreases. Thus the basic finding from Model II has not been affected by the discovery of variable elasticities. Similarly the initial result confirming the importance of responses to transitory change has not been weakened.

Aside from a few ad hoc and probably unwarranted observations about holidays and vacation seasons there is not much one can say about the observed pattern of coefficients. Presumably a traditional empiricist decomposition of the variation into seasonal, trend, cyclical and irregular

components would be a useful first step but it is one that cannot be taken with only one year of observations. A more fundamental explanation of the variation would be desirable but is no easier to arrive at.

Whatever the causes and however hard they may be to uncover, it appears that monthly or short-period variation of coefficients is a serious problem. Moreover such variation bears quite directly on short-term forecasting. To the extent such forecasting models are formalized they invariably have constant coefficients; perhaps more attention should be given to the possibility of variable ones.

Summary and Concluding Remarks

Taking the most limited and literal interpretation of the evidence one would conclude that among Norwegian salaried employees, under circumstances prevailing in 1958, those with temporary deviations of income from more long-term levels show substantial deviations of consumption expenditure from "normal" levels. The effect of a given short-term deviation was generally smaller than that of a similar differential in long-term level, and was different depending on the sign of the deviation. Finally the several cross-section elasticities displayed significant variation from month-to-month over the course of the year; the causes of this variation remain unaccounted for.

Given the minimal interpretation the reader may judge how far to generalize about the findings. To give them immediate relevance to current policy issues, such as the impact of permanent or discretionary tax reduction,

generalization over time, space and socio-economic classes would be required. Clearly a similar analysis of comparable U.S. households would be desirable if the data could be assembled, although I doubt that the basic conclusions would be much different.

Generalization over socio-economic groups is more problematic. This investigation was based on salaried employees -- a group which is normally considered to have relatively stable incomes (despite the evidence in Table 1 showing substantial short-run variation). Thus the generally poor showing of Friedman's hypothesis about transitory income is quite consistent with Farrell's conjecture that Friedman's hypothesis holds only for self-employed persons and farmers.[7] Both of these groups may have more widely varying

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[7] See Farrell, Op. Cit., pp. 691-692.

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incomes (plus other peculiarities) and may need to engage in more explicit consumption-smoothing practices than wage or salary earners. Farrell suspects that members of the employee groups tend to follow proportional rules of thumb which would not differentiate among sources or types of income receipts. But, even if one is unwilling to hazard extension of the present findings to other groups, the salaried employee category is large and important enough to warrant interest.

Two other cautionary remarks should be made relative to inference from the present results to effects of tax changes. First, the results pertain to "run-of-the-mill" short-run changes in income; the affected households

may have received much or little concurrent information about the duration of the change. In the case of a tax cut, say, households would be told, or could infer, whether it would last a month or a year and availability of more complete information could affect their response. Second, some of the short-run variation may be recurrent seasonal variation which the household, for convenience, matches with certain postponable expenditures. To the extent that households share a common seasonal pattern, the set of monthly binary variables removes this source of net correlation between transitory income and consumption. But if households have partly individualized seasonal patterns in income, their deliberately coincident extraordinary expenditures will inflate the transitory elasticity. It seems unlikely that this phenomenon is important enough to explain the whole apparent effect of transitory income.

There remains a great deal to be learned about the effect of short-run income changes on expenditure. The nature of the data confined this investigation to study of expenditure changes in response to transitory income of the same month. One would expect expenditure in succeeding months to be affected by short-run deviations, perhaps more than that of the current month. Monthly panel data would permit more complete treatment of the time distribution of the effects of transitory income. The present inquiry provides evidence that the response of expenditure to short-run income change is not inconsequential even in the same month; it has also demonstrated a promising means of extending our understanding in this area. As usual, more data, or perhaps more appropriate data, are needed; but the fact that they were available in Norway inspires the hope that someday they will be forthcoming here.