The Effects of Life Assurance and Pension Funds
on Other Savings : The Postwar U.K.Experience*

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INTRODUCTION

The main purpose of this paper is to test the substitution hypothesis of saving for the case of Life Assurance and Pension Funds (LAPF) on the one hand, and other (personal and corporate) savings, on the other. The focus is the postwar U.K. period.

Earlier U.K. findings on this issue rejected the substitution hypothesis. Most, in particular time series, studies though, are subject to various limitations: that is, they focused on a very short period of time: made an uncritical use of the official data, that may cast doubt on their results: estimated consumption functions, which do not explicitly allow the testing of the effects of LAPF on other than personal savings too, such as corporate retentions: finally, confined their attention to - in most cases - one specification of the consumption function.

In this paper we attempt to provide new, free from the above problems, evidence, by covering all postwar U.K. period (1951-1981): estimating private (i.e. personal plus corporate) saving functions: adjusting the official data to become compatible with our theoretical requirements: and, adopting three different specifications which together are consistent with most saving behaviour models available. We further test the sensitivity of the marginal propensity to save to alternative definitions of disposable income, and derive a general estimated saving function which is tested down to give us the equation that most parsimoniously describes our data. Against that, alternative hypotheses-specifications are tested.

Section I has 'theoretical considerations'. Section II examines the substitutability debate and surveys previous empirical studies. Section III has new empirical results. Conclusions follow. Finally the Appendix has a sepcification search.

I. Theoretical Considerations

In recent years research on the economic role of corporate pension funds has proliferated. In a prophetic article Garvy (1950) anticipated things to come, but it was the meteoric growth of the funds in the last fifteen years that triggered economists' interest. In the U.K. participation in corporate pension funds schemes was rising steadily after the second world war, reaching its peak in 1967 with around half of the workforce belonging to such schemes.[1] (See Green, 1982).

The halt in the rise of the participation rate did not stop contributions to the funds from growing. The net inflow[2] in Life Assurance and Pension Funds (LAPF) rose from 4.87% of personal sector disposable income (P.S.D.I.) in 1967 to 7.47% in 1981, with its peak in 1979 when it reached just over 7.50% of PSDI.[3] In the late 70's corporate pension funds owned 1/5 of equity of all ordinary shares in the U.K. (See Minns, 1982).[4] In the U.S. the relevant figure was higher (See Drucker, 1976).

Two closely related aspects of the pension funds growth received the lion's share of economists' interest: first the issue of whether pension funds can generate a higher level of private saving than could be possible in their absence; second, the implications of the ownership and control of the funds on capital markets, real investment and the institutions of the macroeconomy.

Drucker (1976) in the U.S. paid particular emphasis to the last question. He observed that in the late 70's workers in the U.S. owned more than 25% of business equity through their pension funds.

Adding the ownership of self employed, public employees and school and

college teachers' funds, the figure went up to more than 1/3 of equity

capital. Considering this more than enough for control of the means of

production, Drucker concluded that an 'unseen revolution' transformed

the U.S. to the first truly socialist country. This was the pension

funds revolution whose agent was ... General Motors! (p.5).

Not everybody would go as far as Drucker. In the U.K. for

example Minns (1981) concentrated on the control rather than the owner-

ship of the funds: his substansive finding being that over 2/3 of the

funds are in fact controlled by banks and other financial institutions.

Such control might have had a distorting impact on capital markets [5]

(see Rose, 1983) and adverse effects on real investment. [6] (See Minns,

1982). Still, Drucker's views help emphasise the far reaching

implications of the pensions funds question.

What reasons underly the growth of the funds? One suggestion

is tax advantages (see e.g. Feldstein, 1978). Indeed both in the U.K.

and the U.S. pension funds income is treated favourably by the tax

authorities (see Threadgold, 1978, and Rose, 1983, for the U.K. and

Feldstein, 1978, for the U.S.) Still one could question the direction

of causality in the above reasoning. [7]

A second argument refers to a 'labour turnover' or a

'loyalty-control of the workforce' effect. For the former effect-

employers are taken to incur information, training and other costs as

a result of early leaving, which they can reduce simply by discouraging

early leavers. This can be effected if vesting [8] and leaving

conditions are such that leaving before retirement implies a loss of

pension rights. Less than full transferability [9] and incomplete

preservation of pension rights may result in a 'loyalty-control of the workforce' effect (see Green, 1982), which can be further accen-
tuated as 'final salary schemes' spread [10/].

It is necessary for the above argument to hold that partic-
ipation in the schemes is compulsory (i.e. condition of employment) and strong disincentives to early leavers exist. Further, that employers have played a very significant role in the introduction of the schemes. Green (1982) has arguments for both. [11/] Still it is not clear whether the above conditions are sufficient too. Rose (1983) questioned the relative advantages of incomplete vesting and final salary schemes in reducing labour mobility and inducing work-
force loyalty, in comparison to potential alternatives. For Drucker (1976) and Minns (1981) it was both the employers and employees that initiated the introduction of the schemes. Further, the compulsory membership to the schemes is not inconsistent with the third reason advanced for the growth of the funds: the 'saving instrument' effect.

In this argument pension funds, being deferred wages, result in a part of the workforce's 'life cycle' income being saved before it actually goes to the wage earners' hands. This reduces the obvious 'risk' of this income being consumed rather than saved. Further, it may have the beneficial - for the company sector - effect of putting part of the company finance outside the banking system. (See Rose, 1983). To the extent that such policies result in a higher level of saving on the part of the wage earners than they would have otherwise chosen to have, we are faced with a 'forced saving' effect (see Feldstein, 1978).

The 'forced saving' argument and its underlying implications
of constrained households choice (see e.g. Rose 1983, and Pitelis,
1983) are closely related to the other important aspects of the pension
funds' growth: its impact on other savings.   On this relationship we
will basically focus in the rest of this paper.   Before that, we will
briefly refer to some other economic aspects of the pension funds
growth of some interest, from which our analysis will be aided or for
which it will have some observations and/or implications.   First,
their effects on the 'propensity to save' and the 'paradox of saving'
(see e.g. Pearte and Thomas, 1981, and Cuthberston, 1983).   Second,
their impact on inducing early retirement (see Zabalza et al, and
Munnell, 1976).

The first two issues basically refer to measurement and
definitional problems of the official statistics, but their implications
are far reaching since they cast doubts on long existing or strongly
believed economic dogmas. [12/]   The induced retirement issue is very
closely related to the substitutability issue, and it is not obvious
that they can be examined separately at all. [13/]   (See Rose, 1983).
Perhaps this interconnection is one of the reasons why the substitution
issue has been so extensively analysed. Another reason may be the
multiplicity of factors affecting the analysis of pension funds.   This
makes it virtually impossible to obtain a conclusive answer for our
queries without resorting to econometric estimation. Before that,
however, we survey the substitution versus non-substitution debate as
well as the previous empirical findings.

II. The Substitution Hypothesis and the Previous Evidence

A standard prediction of the neoclassical theory is that similar products will act as substitutes for each other. In the case of savings this 'substitution' hypothesis is associated in particular with the Life Cycle Hypothesis (LCH) of Ando and Modigliani (1963). The complexity of factors affecting pension funds makes it difficult to accept the simplistic view that substitution will be perfect. In particular, the conditions that should be satisfied in order that this hypothesis is true, are rather extreme. [14] (See e.g. Feldstein, 1978).

In general the degree of substitution would seem to depend on two basic factors: the extent to which individuals are aware of, and want to substitute for increases in pension funds by decreasing personal voluntary savings and/or by borrowing; and the extent to which they can. In practice, it seems doubtful that any of these conditions will be satisfied. If pension funds provide annuities on more favourable terms than individuals could buy themselves, pension funds might tend to reduce voluntary savings. [15] The awareness of their pension funds rights by individuals, however, may be incomplete or tend to be under-estimated due to uncertainty and illiquidity of pension funds equity. In such a case a low valuation will be put on pensions funds rights and individuals will end up with a higher level of total assets than desired. [16]

Even with full knowledge on the part of the individuals, it is not obvious that they will be willing to substitute for different types of savings. An alternative could be to choose earlier retirement. This could explain non-substitution in an extended Life Cycle framework (but see note 13/). Assuming that individuals have perfect knowledge

and want to substitute, it does not follow that they can. This,

Feldstein (1978) observes, is particularly true for employees with

low earnings whose public social security programs provide them with

what they might consider as sufficient retirement income. "Since

these individuals would generally find it impossible to borrow against

future pension benefits, they are forced to accumulate more for their

retirmenet than they would otherwise prefer" (Feldstein, 1978, p.282).

Further the 'forced saving' is the only 'unambiguous effect' (ibid

p.284) on total asset accumulation.

The previous discussion accounts for two deficiencies of the

simple Life Cycle framework over which recent concern has been raised.

(See particularly, King, 1984). That is, imperfect capital markets

and the possibility of some individuals' behaviour being closer to

the requirements of the Life Cycle model than of others. See also,

Pitelis (1983). As regards the latter it may be fruitful to further

extend the (implied from the previous discussion but never explicitly

spelled out) distinction between employees and employers' behaviour,

and analyze its implications for the substitution issue.

In general, employers will be expected to better conform to

the requirements of the simple Life Cycle model: i.e. be better

informed and face not binding constraints in the capital markets,

at least as far as substitution for pension funds increases is concerned.

Thus, mon-substitution on their part will, as a rule, only be expected

if it is so desired on their part. Two reasons suggest that

employers would not desire subsitution. First, pension funds are

in principle 'deferred wages' and not employers' savings: i.e. by

definition they cannot act as 'forced savings' in their case.

Second, even if employers tend to regard pension funds as their saving

and consider their level excessive, microeconomic theory would suggest
that substitution should be expected between pension funds on the one
hand and corporate retained earnings on the other, [19] / rather than
between pension funds and employers' voluntary savings. The above
reasoning may be fruitful in face of some apparently perverse empirical
findings of no substitution on the part of employers.(see below).

With employers not being willing, and low level employees
not being able to substitute, the use of aggregate date would be
expected to provide support for the add-on or independence hypothesis,
(that is, that pension funds will add-on, on a one to one basis, to other
personal saving): or some imperfect sbustitutability reflecting
basically the behaviour of highly paid white collar workers whose
voluntary personal savings and/or access to borrowing may be such as
to allow them to substitute, if they want to. The possibility of
some substitution between corporate pension funds and corporate
retained earnings could not be excludedeither (see also Garvy, 1950,
but Murray, 1968).

Early empirical work on this issue did not appear to support
the above suggestions. In the U.S. Cagan (1965) found cross-section
evidence for no substitution and possible complementarity: that is
increased pension funds were resulting in increasing other personal
savings too. He attributed this seemingly perverse finding to a
'recognition effect', that is the view that a (subjectively perceived)
'adequate' retirement income previously out of reach, is now attainable.
Garvy (1950) anticipated this idea fifteen years earlier Cagan's sample
was not representative (see Murray, 1968). Katona (1965) however,
used a representative sample of households in the continental U.S,

and supported the complementarity hypothesis. His explanation was the 'goal gradient' effect, which assumes that effort is intensified the closer is one to one's goal. Munnell (1976) attributed the Cagan Katona findings to the 'induced retirement' effect. She had U.S. cross-section evidence for the imperfect substitution hypothesis. Canadian cross section evidence by King and Dicks-Mireaux (1983) resulted in similar findings. Schoeplein (1970) examined the effects of pension funds on other retirement saving. He found evidence of substitution in lower and middle classes but supported the Cagan-Katona findings for higher income classes. Daly (1983) supported the add-on and limited complementarity.

U.K. cross section evidence for the add-on hypothesis was found by Zabalza et al (1978). Green (1981) had support for the complementarity hypothesis. Hemming and Harvey (1983) used a more elaborate approximation of the pension funds variable to Green's, and a similar data series. They found support for Green's earlier findings but concluded that the add-on was equally sustainable to the complementarity

In the time series front, Feldstein (1978) estimated private (personal plus corporate) saving functions for the 1929-74 U.S. period. He found perfect substitution. Threadgold (1977) estimated consumption functions with 1963-77 U.K. quarterly data. He found add-on for employers and imperfect substitution for employees. Browning (1982) used a similar series (1962-1979). He found limited substitution berween gross pension wealth (i.e. state plus corporate pension wealth) and aving, but use of an extended Error Correction type of the consumption function.
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The observed differences in the empirical findings necessitate further research but also an attempt to avoid the problems of the previous studies. In the U.K. the relevant variation is not as high as in the U.S. where Feldstein's findings are in stark contrast to all other studies, which range from small substitution to independence and complementarity. Concern in the U.K. has been raised with regard to the unreliability of the cross-section data.[20] On the other hand the existing time series evidence is confined to a fairly short period of time,[21] and is also subject to the criticisms advanced in the introduction. To account for that we adopt the procedure described there. It is perhaps worth stressing that the impact of LAPF on corporate retentions too, which in the U.S. has been examined by Feldstein (1978), has never been examined before with U.K. data: as a result of the (otherwise perfectly legitimate) focus on the consumption function.

III. Three Estimated Saving Functions and the Empirical Results

The first issue to tackle before estimation is undertaken is to decide on the most appropriate definition of saving and disposable income. Although problems with the use of official statistics are too well, and for too long (see e.g. Friend and Schor, 1959) known to need reiterating here, data availability or inertia has resulted in an unritical use of the official statistics by many studies. This, however, as recent discussion has shown (see note 12) may entail serious costs. At least quantitatively the most serious problem arises from the treatment of LAPF. Thus, contributions to LAPF are included in the official definition of PSDI and since savings are estimated as a residual category, the official definition of savings (P.S.S.) too includes such contributions.

For the purposes of the official compilers - i.e. to estimate the net amount available for lending from one sector to the other, this treatment is correct. If one, however, is interested in estimating say, the propensity to save income actually in the disposal of the households or, for our purposes, the net effect of LAPF (see note 36), on private saving[22] what one needs is to define income and saving net of contributions to LAPF but inclusive of benefits paid by LAPF to households,[23] as only the latter are disposable to the consumers.[24] The resulting series we name net personal disposable income (N.P.D.I.) and net personal savings (N.P.S.).

All time series studies surveyed in the previous section explicitly recognise this problem. Browning (1982) makes no attempt to account for it. Feldstein (1978) suggests that his estimates refer to the 'net effect' of pension funds on PRSA. Threadgold (1978) goes further. He justifies the use of the uncorrected series in terms of the fact that - under plausible assumptions - it allows for distinguishing between employers and employees' degree of substitution. In the last paragraph of his paper he also estimates one regression with the corrected series. The result of this 'alternative approach' lend support to the add-on hypothesis.

In principle Feldstein's and Threadgold's claims are not unjustified. Their treatment, however, of PSDI and pension funds as two different and concurrent explanatory variables in the same equation may entail serious problems. For one the use of PSDI - i.e. NPDI plus LAPF - in itself is equivalent to restricting the coefficients of these two variables to be equal: which is the hypothesis under examination! Further, one could question the importance one should attach to the estimated coefficients and the standard errors of thus obtained coefficients, since collinearity problems in such a case will be expected to be high.[25]

The above, we think, raise some concern over the findings of all

previous time series studies, except for Threadgold's 'alternative approach'.
We pursue extensively this approach here but also make use of the uncorrected
series in some regressions so as to assess the empirical validity of the
previous theorizing in our data framework.

The second issue to tackle is the choice of the estimated saving
function to be used, in order to test the hypotheses in hand. In particular
the use of an equation associated with a specific hypothesis such as, say, the
Life Cycle Hypothesis, may be criticised for lack of generality. To account
for that we too estimate the Life Cycle Hypothesis (LCH) but also a Simple
Linear model, and a Distributed Lag Model. The latter is shown to lead to
the same estimated form as the LCH. (See also Pitelis, 1984)

The data we use for the purposes of this paper cover the 1951-1981
U.K. period and are taken from the National Income Accounts, i.e. Economic
Trends, 1982 Annual Supplement and the National Income and Expenditure
(Blue Book). The LAPF series was made available to us by the Central
Statistical Office. The Interest Rate (IR_t) series used is the Treasury Bill
Rate obtained from the International Monetary Fund (IMF) Financial Statistics,
1983. Data availability determined the end period, while the postwar
readjustments and the rationing of durables determined the starting period.
All (but the IR_t) series are after-tax and before providing for depreciation,
stock apreciation and additions to tax reserves. They are measured in constant
prices, obtained by use of the Implied Consumers Expenditure Deflator.
Adjustments to the official data were performed as described above.

In its simplest and more general form the hypothesis under examination
can be written as :

$$PRSA_t = s(NPDI_t, LAPF_t, CORE_t, Z_t) \tag{1}$$

where s is assumed to be a linear functional form, Z is a vector of

other relevant explanatory variables (here the interest rate, IR_t), and t is a time subscript. For estimation purposes and including a constant term, the stochastic version of (1) can be written as :

$$PRSA_t = a_o + a_1 NPDI_t + a_2 LAPF_t + a_3 CORE_t + a_4 IR_t + u_t \qquad (2)$$

$$u_t = NID(0, \sigma^2)$$

Alternative hypotheses can be tested by focusing on a_2.[26/] The respective implications are:

Perfect Substitution	$a_2 = 0$
Imperfect Substitution	$0 < a_2 < 1$
Independence or Add-on	$a_2 = 1$, and
Complementarity	$a_2 > 1$

1: The Simple Linear Model The specification tested is a Simple Linear (S.L). It involves estimating versions of (2) obtained by lagging in turn one or more of the explanatory variables by one period.[27/] Its basic purpose is to avoid problems of dynamic specification inherent in more complicated models, but also to provide with useful information as to the dynamic specification one should adopt. The simplest version that is econometrically acceptable is one that includes the lagged value of CORE in (2), and this equation is our starting point. Results from estimating the SL model are reported in Table 1. A total of 12 equations are reported which were considered to be useful for the hypotheses we examine. Other results are available from the author on request. Suffice is to say here that they support the same findings as the ones reported. All equations were originally estimated with ordinary Least Squares (OLS) but they were found to suffer from first order autocorrelation and we used a Maximum Likelihood (M.L.) technique to remove it.[28/] These M.L. estimates are reported. Below we summarise the underlying logic of the reported regressions and their results.

In Table 1, equation 1.1 is first estimated. This was obtained by imposing the restrictions $a_1 = a_2$ in (2). It results in an equation which involves the official definition of disposable income (PSDI) but not LAPF. It gives a Marginal Propensity to Save (MPS) of 0.16 which is close to usually reported coefficients for this variable. It implies that the coefficient of LAPF is also 0.16. Equation 1.2 tests this restriction by simply splitting PSDI to NPDI and LAPF. This way the MPS net personal disposable income can also be tested. An F test rejects the restriction at the 10% level. The coefficient of NPDI is insignificant implying a MPS equal to zero. The coefficient of LAPF is insignificantly different from one, in a one failed 't' test and supports the add-on hypothesis. The explanatory power of the equation is improved.

Equation 1.3 follows the 'orthodox' approach of including both PSDI and LAPF as concurrent explanatory variables. The result is startling. 1.3 reproduces exactly 1.2. The coefficient of PSDI drops and stands now as a perfect proxy to NPDI in 1.2 : similarly the coefficient of LAPF falls. Since 1.1, 1.2 and 1.3 together can be viewed as a version of Frisch's Confluence Analysis,[29/] these findings can be fairly safely attributed to multicollinearity. In view of the latter's effects on the coefficients estimates and standard errors, 1.3 can be dismissed and along with it perhaps the validity of the 'orthodox' approach can be questioned, at least in our data framework. Equation 1.4 is equation 1.2 but NPDI is now set to zero. This restriction is not rejected.

With a MPS net personal disposable income equal to zero we can now test whether the change of NPDI affects PRSA. To do that we simply need to add the one period lagged NPDI as an additional explanatory variable to 1.3 : a coefficient ot $NPDI_t$ equal to minus the coefficient of $NPDI_{t-1}$, implying a marginal propensity to save NPDI equal to zero. The obtained equation is 1.5. The restriction is imposed in 1.6. An F test does not

TABLE 1.

'The Effects of LAPF on Other Savings in the Simple Linear Model' Maximum Likelihood Estimates. Dependent Variable: PRSA Annual Data 1951-1981 U.K.

EQN NO	CONSTANT	$NPDI_t$	$NPDI_{t-1}$	$\Delta(NPDI_t)$	$PSDI_t$	LAPF	$LAPF_{t-1}$	$CORE_t$	$CORE_{t-1}$	$COSA_t$	$COSA_{t-1}$	IR_t	IR_{t-1}	$\hat{\rho}$	SSE	$\bar{R}^2$	DW
1.1	-6397.94* (-7.14)				0.16* (6.07)			0.89* (12.43)	0.21* (2.87)			222.44* (3.43)		0.57* (3.51)	$530*10^{10}$	0.9788	1.8864
1.2	-3617.69* (-2.87)	0.07 (1.57)				0.84* (2.61)		0.86* (12.17)	0.27* (3.69)			227.75* (3.43)		0.33x (1.76)	$469*10^{10}$	0.9909	1.8647
1.3	-3617.69* (-2.87)				0.07 (1.57)	0.78* (2.18)		0.86* (12.17)	0.27* (3.69)			227.75* (3.43)		0.33x (1.76)	$469*10^{10}$	0.9909	1.8647
1.4	-1710.04* (-4.98)					1.25* (6.36)		0.87* (11.86)	0.29* (4.06)			258.20* (3.96)		0.33x (1.79)	$517*10^{10}$	0.9903	1.8956
1.5	-4179.80* (-3.16)	0.24* (4.19)	-0.16* (-3.96)			0.60x (1.98)		0.87* (14.94)	0.25* (4.22)			304.82* (5.42)		0.58* (3.53)	$291*10^{10}$	0.9866	1.8363
1.6	-1837.81* (-4.96)			0.16* (3.81)		1.08* (6.28)		0.85* (14.19)	0.30* (5.31)			339.58* (6.10)		0.54* (3.27)	$334*10^{10}$	0.9876	1.8518
1.7	-1779.49* (-5.05)			0.20* (3.89)		0.80* (2.80)	0.45 (1.29)	0.85* (14.31)	0.26* (4.16)			308.06* (5.15)		0.50* (2.94)	$313*10^{10}$	0.9891	1.8531
1.8	-1806.05* (-5.78)			0.27* (5.47)			1.32* (5.78)	0.89* (13.90)	0.23* (3.27)			269.93* (3.89)		0.32 (1.67)	$411*10^{10}$	0.9924	1.9044
1.9	-1883.85* (-5.39)			0.17* (4.13)					0.31* (3.27)	0.90* (20.72)		362.06* (6.99)		0.56* (3.51)	$350*10^{10}$	0.9863	1.8451
1.10	-1823.13* (5.39)			0.19* (4.63)						0.86* (19.30)	0.28* (5.99)	323.49* (6.27)		0.53* (3.23)	$316*10^{10}$	0.9891	1.8655
1.11	-1858.89* (-4.57)			0.25* (4.79)						0.87* (20.07)	0.23* (4.13)	316.88* (6.33)	97.66 (1.63)	0.64* (4.26)	$288*10^{10}$	0.9842	1.6922
1.12	-2715.61* (-3.38)	0.21* (4.72)	-0.17* (-4.24)							0.83* (16.13)	0.25* (4.74)	294.07* (5.22)		0.51* (3.02)	$299*10^{10}$	0.9899	1.8256

Δ denotes the first difference of the relevant variable.   * denotes significance at the 5% level

|t| ratios in parentheses

X denotes significance at the 10% level

reject it at the 5% level. In 1.5 the coefficient of LAPF is significantly different from zero at the 10% level and insignificantly different from one at the 5% level. This supports the add-on. In 1.6 the relevant coefficient is highly significant and still supports the add-on at the 5% level.

In 1.7 the lagged value of LAPF is included. It is insignificantly different from zero. Still it improves the explanatory power of the regression and lowers the sum of squared errors. When it is included to replace LAPF, in equation 1.8, it is strongly significant and also significantly higher than one at the 10% level of a one failed 't' test. This suggests that the finding of 1.7 may simply be due to multicollinearity.

In equations 1.2, 1.3, 1.4, 1.5, 1.6 and 1.7 the coefficients of LAPF and CORE are very close to each other. It might be argued that a better explanation of the dependent variable could be obtained if they were restricted to be equal. Thus, in 1.9 we impose this restriction to 1.6. The restriction is accepted but the explanatory power of the equation is lowered. In face of the findings of 1.8 we impose to 1.7 two restrictions. That LAPF is equal to CORE and that $LAPF_{t-1}$ is equal to $CORE_{t-1}$. This results in 1.10. This equations' explanatory power is an improvement over 1.9 and 1.6 and is as high as in 1.7. The restriction is accepted at the 5% level.[30/]

Equation 1.11 is equation 1.10 but also includes the lagged interest rate variable. This fails to be significantly different from zero, and leads to a reduction of the explanatory power of the equation. If in view of that we restrict it to be zero 1.10 obtains again. An F test supports the restriction at the 5% level. The final equation of the SL model is 1.12. In this equation the restriction that the coefficient $NPDI_t$ is equal to minus the coefficient of $NPDI_{t-1}$ is relaxed, in order to be subjected to a test in the preferred equation, 1.10. As it can be seen the restriction is now accepted at the 5% level of an F test, implying again a marginal propensity

to save NPDI equal to zero: 1.12, has a higher explanatory power, than 1.10

In all equations 1.9, 1.10, 1.11 and 1.12 contractual savings, (COSA) have very high coefficients but fail to be equal to one, thus supporting some imperfect substitution (of the order of 15%) in one period. When, however, the effects of the lagged COSA are also added, to those of $COSA_t$ this ceases to be the case, and the add-on hypothesis is again supported.

In brief, the central findings of the SL model are that: the MPS net personal disposable income is zero: the change of NPDI plays a significant role in explaining PRSA, and similarly the interest rate, IR_t: that LAPF add-on, to PRSA, and finally that the idea that LAPF and CORE have the same lag distribution cannot be rejected: which however is not the case for $\Delta(NPDI)$ and IR_t. From this last observation we can proceed to the Distributed Lag model.

2: The Distributed Lag Model In the face of the findings of the SL model we can rewrite (1) as:

$$PRSA_t = s(LAPF_t, CORE_t, Z_t) \tag{1'}$$

where $\Delta(NPDI)$ is now also included in Z_t. Then, the equation,

$$PRSA_t = \beta_o + \beta_1 LAPF_t + \beta_2 CORE_t + \beta_3 PRSA_{t-1} + \varepsilon_t \tag{2'}$$

$$\varepsilon_t = u_t - \lambda u_{t-1}$$

will be consistent with a geommetrically declining lag/Koyck transformation type of model. (2') is also consistent with a simple lag model, and a partial adjustment model of savings. The difference in the last two cases is that, in contrast to (2') where the error term is first order moving average (M.A.1) of the original (white noise) errors, the error term will

TABLE 2.

"The Effects of LAPF and COSA on Other Savings in the Distributed Lag Model" Maximum Likelihood and Ordinary Least Squared Estimates:

ANNUAL DATA 1951-1981 : U.K.

Dependent Variable : PRSA

Eqn.No.	Constant	$\Delta(NPDI)_t$	$LAPF_t$	$CORE_t$	$COSA_t$	$COSA_{t-1}$	IR_t	IR_{t-1}	$PRSA_{t-1}$	$\hat{\rho}$	SSE	$\bar{R}^2$	DW
2.1	-1450.52* (-6.07)	0.26* (4.08)	0.73* (3.25)	0.82* (13.17)					0.41* (7.37)	0.09 (0.47)	$493*10^{10}$	0.9958	1.8421
2.2	-1420.88* (-6.41)	0.25* (4.37)			0.81* (14.33)				0.40 (9.57)	0.10 (0.51)	$496*10^{10}$	0.9960	1.8292
2.3	-1600.38* (-6.13)	0.28 (6.74)	0.59* (3.14)	0.88* (17.81)			271.75* (5.40)		0.29* (6.94)	0.43* (2.42)	$240*10^{10}$	0.9937	2.0015
2.4	-1507.74* (-5.73)	0.26* (6.55)			0.84* (20.01)		260.29* (5.15)		0.26* (6.94)	0.45* (2.53)	$261*10^{10}$	0.9931	1.8937
2.5	-1662.50* (-5.28)	0.31* (5.58)	0.55* (2.91)	0.90* (15.85)			281.02* (5.58)	49.67 (0.70)	0.26* (3.14)	0.52* (3.03)	$236*10^{10}$	0.9912	1.9727
2.6	-1480.36* (-5.77)	0.25* (4.93)			0.83* (18.76)		255.55* (4.92)	-27.01 (-0.41)	0.28* (5.31)	0.39* (2.12)	$260*10^{10}$	0.9940	1.9209
2.7	-1426.97* (-4.58)	0.25* (4.23)			0.83* (18.29)	-0.03 (-0.23)	248.52* (4.51)	-41.13 (-0.58)	0.31* (2.36)	0.35x (1.83)	260.10^{10}	0.9945	1.9247
2.8	-1516.35* (-4.90)	0.26* (5.18)			0.84* (19.60)	-0.01 (-0.06)	261.18* (4.86)		0.25* (2.34)	0.45* (2.49)	$261*10^{10}$	0.9929	1.8928

Δ denotes the first difference of the relevant variable.

't' ratios in parentheses

*   denotes significance at the 5% level

x   denotes significance at the 10% level

now be uncorrelated. Since significant λ's is (2') will render Ordinary Least Squares (OLS) estimates, biased and inconsistent, we approximate the potential MA1 error in (2') by a first order autoregressive (AR1) error of the form $u_t = u_{t-1} + \varepsilon_{t'}$ [31/] and estimate the $\hat{\rho}$'s with a Maximum Likelihood (ML) technique. When $\hat{\rho}$'s are significant ML estimates are reported, but we report OLS estimates when $\hat{\rho}$'s are insignificant.[32/] This approach is also useful in face of the well known problems of the DW statistic given the LDV.[33/]

On estimation (2') gave:

$$PRSA_t = -1263.59^* + 1.20^* \ LAPF_t + 0.90^* \ CORE_t + 0.27^* \ PRSA_{t-1} +$$

$$(-4.26) \qquad (4.98) \qquad (12.00) \qquad (4.90)$$

$$+ \ 0.06u_{t-1} + \varepsilon_t \qquad \bar{R}^2 = 0.9933 \quad DW = 1.8061 \quad SSE = 860*10^{10}$$

$$(0.31)$$

In terms of explanatory power (2') is an improvement over the SL model. The coefficient of LAPF is statistically equal to one and supports the add-on. Eight more equations of the Distributed Lag (DL) model are reported in Table 2. In 2.1 $\Delta(NPDI)$ is added to (2'). It is significant and results in improving the explanatory power of the equation and reducing the sum of squared errors. The add-on is still supported. In 2.2 the coefficients of LAPF and CORE are restricted to be equal. The restriction is accepted. 2.3 is 2.1 but also includes the interest rate. Similarly 2.4 is 2.2 with the interest rate added. In here too, the restriction that the coefficients of LAPF and CORE are equal is accepted. 2.5 allows a different lag distribution for the IR variable, a treatment consistent with the Koyck transformation model, which results in the lagged IR variable being introduced in the equation. 2.6 results from a same treatment of 2.4. In 2.5 and 2.6 the lagged IR variables are insignificantly

different from zero. When dropped 2.3 and 2.4 result again, and the restriction that they are equal to zero is accepted, at the 5% level of an F test.

In 2.3 and 2.5 the coefficients of LAPF support the imperfect substitution hypothesis. When their coefficients are restricted to be equal to the coefficients of CORE, the restrictions are accepted. The resulting contractual saving (COSA) variable always gives support to limited substitution.

The last two equations in Table 2, are 2.7 and 2.8. They are as 2.6 and 2.4 respectively, but allow a different lag distribution for the COSA variable.[34/] The results support all earlier considerations. What is important, however, in 2.8 is that, it is effectively a restricted version, and constitutes a test of, the Life Cycle Hypothesis, (LCH), subject to the exclusion of the IR variables.

3: The Life Cycle Hypothesis It has been shown (see Pitelis, 1984) that the LCH can be written as:

$$PRSA_t = \gamma_1 \Delta(PRI_t) + \gamma_2 PRSA_{t-1} + \varepsilon_t \tag{3}$$

$$\varepsilon_t = u_t - \lambda u_{t-1}$$

where the effects of the interest rate are taken to operate via the LDV and where PRI represents private income: i.e. NPDI plus COSA. Equation (3) can also be written as:

$$PRSA_t = \delta_1 NPDI_t + \delta_2 NPDI_{t-1} + \delta_3 COSA_t + \delta_4 COSA_{t-1}$$
$$+ \delta_5 PRSA_{t-1} \tag{3'}$$

implying that $\delta_1 = -\delta_2 = \delta_3 = -\delta_4 = \gamma_1$ and $\delta_5 = \gamma_2$. By estimating (3') with a constant term [35/] we obtain equation 3.1 in Table 3. In 3.2 we restrict δ_1

TABLE 3

"The Life Cycle Hypothesis and the Effects of COSA on Other Savings", Maximum Likelihood and Ordinary Least Squares Estimates. Dependent Variable: PRSA. Annual Data 1951-1981: U.K.

Eqn No.	Constant	$NPDI_t$	$NPDI_{t-1}$	$\Delta(NPDI_t)$	$COSA_t$	$COSA_{t-1}$	$\Delta(COSA_t)$	$\Delta(PRI_t)$	$PRSA_{t-1}$	$\hat{\rho}$	SSE	$\bar{R}^2$	DW
3.1	-1384.46^x (-1.92)	0.27* (4.00)	-0.26* (-3.20)		0.81* (12.07)	-0.10 (-0.47)			0.44* (2.59)	0.09 (0.43)	$468*10^{10}$	0.9950	1.8606
3.2	-1245.58* (-4.42)			0.28* (4.29)	0.83 (13.99)	-0.17 (-1.01)			0.52* (4.24)	0.11 (0.55)	$477*10^{10}$	0.9960	1.7781
3.3	-457.60^x (-1.78)			0.45* (7.03)			0.81* (10.94)		1.00 (66.93)	0.15 (0.71)	$787*10^{10}$	0.9936	1.5681
3.4	-535.20^x (-1.82)							0.61* (13.57)	1.00* (58.06)	0.17 (0.87)	$109*10^{11}$	0.9915	1.6048

Δ Denotes the first difference of the relevant variable.

't' Ratios in parentheses.

* Denotes significance at the 5% level.

x Denotes significance at the 10% level.

and δ_2 to be equal and the restriction is accepted. Lagged COSA, however, is always very small quantitatively and insignificantly different from zero. As a result when in 3.3 we restrict δ_3 and δ_4 to be equal the restriction is rejected easily. This is also the case when the most restricted version of the LCH, i.e. (3) is estimated in 3.4.

The conclusion from the above is that the simple LCH is easily rejected by the data. As in the SL and DL models the restriction that the coefficients of $NPDI_t$ and $NPDI_{t-1}$, is accepted, but this is not the case for $COSA_t$ and $COSA_{t-1}$. This implies that COSA have a differential impact on PRSA, not captured via the coefficient of $\Delta(PRI)$. This would suggest that an extention of (3) to include COSA might be an interesting attempt to rescue the simple version of the LCH. This extended LCH, which follows Feldstein (1978), on estimation gave:

$$PRSA_t = -1118.93^* + 0.29^* \Delta(PRI_t) + 0.56^* COSA_t + 0.59^* PRSA_{t-1}$$
$$\quad (4.96) \qquad (4.45) \qquad\qquad (5.65) \qquad\qquad (8.02)$$
$$+ 0.10u_{t-1} + \varepsilon_t \qquad\qquad\qquad\qquad (4)$$
$$\quad (0.53)$$

$$\bar{R}^2 = 0.9961 \qquad DW = 1.7533 \qquad SSE = 488*10^{10}$$

The important thing about (4) is that it performs slightly better in terms of explanatory power than its respective 2.2 of the DL model and 3.2 of the unrestricted LCH model. This would suggest that there is scope in extending the simple LCH. The problem, however, is that in so doing we obtain an equation hardly differnt from the unrestricted simple LCH, and the DL model. To see that one simply has to split $\Delta(PRI)$ in (4) as in (3'), and obtain:

$$PRSA_t = \zeta_1 \Delta(NPDI_t) + \zeta_2 COSA_t + \zeta_3 COSA_{t-1} \qquad\qquad (5)$$
$$+ \zeta_4 COSA_t + \zeta_5 PRSA_{t-1} \qquad\qquad\qquad .$$

where the difference from (3') is that $\delta_1 = -\delta_2 = \zeta_1$ (following the findings of 3.1) and δ_3 in (3') is equal to $\zeta_2 + \zeta_4$ in (5). In view of the findings of 3.2, (5) can also be written as 2.2. That is, for estimation purposes the extended LCH is hardly different to the unrestricted simple LCH or to the DL model. It follows that the findings of the DL model in Table 2 can also be viewed as tests of the simple and extended LCH, and imply that the simple LCH is rejected while the extended is not, but it also needs to be further extended to account for the differential impact of the interest rate on private savings.

On balance, the coefficients of COSA in the LCH support limited (imperfect) substitution. Another interesting finding of the DL model and the LCH is the possibility of deriving Long Run (LR) elasticities of the LAPF, and COSA variables by dividing their coefficients by one minus the coefficient of the LDV. These elasticities are summarised in Table 4.

In general long run elasticities are higher, and in many cases they are significantly higher than one giving support to the complementarity hypothesis. This observation is in line with early U.S. and most U.K. cross section findings. This provides a potential means of reconciling the divergence between time series and cross section results in terms of the well known fact that the former are more appropriate for testing short and medium run substitution, while the latter account for the longer run.

TABLE 4.

'Implied Long Run Elasticities in the DL and LCH Models'

Equation Number	LAPF	COSA
(2')	1.64*	
2.1	1.24	-
2.2	-	1.35*
2.3	0.83	-
2.4	-	1.17*
2.5	0.74	-
2.6	-	1.15*
2.7	-	1.20*
2.8	-	1.12*
3.1	-	1.27*
3.2	-	1.17*
(4)	-	1.37*

*denotes significance at the 5% level of a one tailed 't' test.

In concluding this section it is worth noting the following. In all equations the interest rate was always positive and significant. This is in line with the so called, substitution effect of interest on consumption, and supports earlier findings by Peel (1975). Still no important weight should be attached to this finding as a real interest rate variable which ideally should have been used, was not available or possible to be constructed. Corporate retentions were, in general, shown to add-on (or substitute imperfectly) to other savings. This supports earlier findings by Pitelis (1984).

CONCLUSIONS

The main substantive findings of this paper are as follows: the observation that LAPF add-on, to other personal and corporate savings, in the short run, and complement them in the longer run: that the marginal propensity to save NPDI is zero:[36/] that the implications of the simple LCH are rejected, which however, is not the case in the extended LCH: and finally, that the DL and LCH models can lead to a general form, in which they can be nested. Starting from this general form it is possible to test down in order to obtain the equation which represents the most parsimonious description of our data. This, we do, in the Appendix. Regarding the aim of this paper, it will be seen that all previous findings are supported.

On balance our results were robust and appeared to subject neither to significant first order autocorrelation or serious collinearity problems. The possibility of simultaneous equation bias cannot be excluded in frameworks such as ours, in which case OLS estimates will be (asymptotically) biased and inconsistent. Still the ML estimates never differed significantly from the OLS ones, which would suggest that perhaps we should not worry unduly.

On the other hand, we can make no claim for conclusive findings. Different specifications, data periods, countries under examination and additional explanatory variables may give rise to different results. We hope that additional research will shed more light to these important relationships. For our purposes it is satisfying that our findings are in broad agreement and hopefully complementary to previous U.K. time series findings.

TABLE 5.

"Specification Search and the Effects of LAPF and COSA on Other Savings : Maximum Likelihood and Ordinary Least Squares Estimates : Dependent Variable : PRSA.

ANNUAL DATA 1950-81 U.K.

EQN No	CONSTANT	$\Delta^2(NDPI_t)$	$\Delta(LAPF_t)$	$\Delta(LAPF_{t-1})$	$\Delta(CORE_t)$	$\Delta(CORE_{t-1})$	$\Delta(COSA_t)$	$\Delta(COSA_{t-1})$	$\Delta^2(COSA_t)$	$\Delta^2(PRI_t)$	$\Delta(IR_t)$	$\Delta(IR_{t-1})$	$\Delta(PRSA_{t-1})$	$\hat\rho$	SSE	$\bar R^2$	DW
5.1	-150.43 (-1.50)	0.37* (2.84)	0.84* (2.41)	-0.04 (-0.01)	0.96* (15.30)	-0.05 (-0.31)					281.98* (5.43)	203.28* (2.25)	0.28ˣ (1.95)	-0.28 (-1.36)	255*10^10	0.9594	2.1504
5.2	-147.82 (-1.55)	0.36* (7.33)	0.88* (3.06)		0.96* (17.44)						216.38* (3.89)	189.00* (2.38)	0.17* (2.98)	-0.27 (-1.31)	256*10^10	0.9628	2.0775
5.3	-162.90* (-2.10)	0.36* (7.63)					0.96* (17.30)				285.69* (6.70)	213.72* (2.67)	0.24* (4.95)	-0.05 (-0.23)	257.10^10	0.9642	2.0688
5.4	-167.34* (-2.04)	0.36* (6.57)					0.96* (16.87)	-0.03 (-0.21)			282.42* (6.11)	212.76* (2.60)	0.26* (2.02)	-0.08 (-0.41)	256*10^10	0.9627	2.1002
5.5	-52.99 (-0.46)	0.27* (4.95)					0.94* (13.10)						0.41* (6.16)	-0.19 (-1.03)	780.10^10	0.8972	2.2389
5.6	-108.87 (-0.93)	0.34* (4.87)					0.95* (13.53)	-0.29 (-1.54)					0.68* (3.70)	-0.19 (-0.98)	730*10^10	0.9024	2.3021
5.7	-189.14 (-1.41)	0.49* (8.17)							0.88* (11.15)				1.21* (11.51)	-0.20 (-1.07)	105*10^11	0.8647	2.3742
5.8	-99.95 (-0.79)									0.63* (11.54)			1.08* (10.47)	-0.31ˣ (-1.75)	156*10^11	0.8402	2.2554

Δ denotes the first differences of the relevant variable. *denotes significance at the 5% level.

Δ^2 denotes the second difference of the relevant variable. ✗ denotes significance at the 10% level.

Appendix

'Specification Search'

The purpose of this appendix is twofold. First to start from a general specification encompassing both the DL and LCH and test down to find the preferred equation. Second to test for the possibility that the often uncomfortably high $\bar{R}^{2}$'s in our previous results are due to trend rather than the explaining power of the models – regressors used.

We can write the general equation as:

$$PRSA_t = \theta_0 + \theta_1 \Delta (NPDI_t) + \theta_2 LAPF_t + \theta_3 LAPF_{t-1} + \theta_4 CORE_t + \theta_5 CORE_{t-1}$$
$$+ \theta_6 IR_t + \theta_7 IR_{t-1} + \theta_8 PRSA_{t-1} \qquad (A.1)$$

(A.1) is consistent with the DL model in its general form and encompasses the LCH as a special case. To account for trend and ensure stationarity of the series (A.1) was subject to first differencing. To the obtained equation a constant term was added to mean correct the series. Given the resulting second differences in few cases these equations were estimated for the 1950–1981 period to ensure thirty effective observations. For the last two reasons the obtained results are not strictly comparable to the previous ones, but we think of no serious reason to suspect that such small differences would lead to any significant changes in our findings.

The estimated version of the general equation is 5.1 in table 5. Both lagged LAPF and CORE in 5.1 are insignificantly different from zero. In 5.2 they are restricted to zero, which restrictions are easily accepted at the 5% level of an F test. The explanatory power of the equation improves. In both 5.1 and 5.2 the coefficients of LAPF and CORE are very close to each other. In 5.3 we restrict them to be equal. The restriction is accepted and there is further improvement in the explanatory power of the equation. Equation 5.4 is the unrestricted version of the simple LCH, (3') or

alternatively version (5) of the extended LCH. It arises by imposing equality restrictions to 5.1 for both current and lagged LAPF and CORE. It can be seen that although the restrictions are accepted and the explanatory power of the equation is higher as compared to 5.1, the lagged COSA variable is insignificant. When set equal to zero we obtain 5.3 again. The restriction is accepted and the explanatory power is higher.

It can be seen that 5.3 is the best equation. It is consistent with the DL model, but rejects the simple LCH implications. The contractual saving coefficient is equal to one supporting the add-on hypothesis. Similarly in 5.1 and 5.2 the coefficient of LAPF are equal to one. As compared to our previous findings the only important difference is the significant lagged IR variable. This would suggest some collinearity problems in the levels specifications. It is also important to note that none of the equations up to this point suffered from first order autocorrelation while the explanatory power of the equations is surprisingly high, despite the de-trending via differencing.

From the last four equations reported 5.5 and 5.6 are as 5.3 and 5.4 respectively, but both interest rate variables are now set equal to zero. Obviously these restrictions are rejected but the task was undertaken in order to test the various more restricted versions of the pure simple LCH or DL models against the more general version of the LCH, (3'). It can be seen that lagged COSA is still not significantly different from zero, and setting it to zero results in 5.5: the restriction is still not rejected at the 5% level although the explanatory power of the equation is now lower. Setting, however, $\delta_2 = - \delta_3$ in (3') results in 5.7 and this restriction is clearly rejected. When the most restricted versions of the simple LCH (3) is estimated, it results in 5.6. The implied restrictions are profoundly rejected, and the equation exhibits significant (at the 10% level) first order autocorrelation. The explanatory power of the equation falls too.

Footnotes

1/ As compared to ½ in the mid thirties.

2/ Defined as Employers plus Employees contributions to the funds plus
    rent, interest and dividends earned by the funds minus their
    administrative costs and the benefits paid to the households.

3/ The relevant figures as a proportion of Net Personal Disposable Income
    (NPDI) i.e. PSDI minus contributions plus benefits to LAPF, were 5.13%,
    8.07% and 8.14% for 1967, 1981 and 1979 respectively. (see section III).

4/ This rises to 38% if insurance companies holdings are added.

5/ In particular the growth of the funds is held responsible for the
    increase of the institutional shareholding of U.K. listed securities,
    from 21% in 1959 to 50% in 1978: during which period personal sector
    holdings fell from 66% to 32%.

6/ An argument based on the international character of the London City
    and its 'relative autonomy' from production at home, for its share
    in profits: which results in a short term view of investment.

7/ If e.g. the 'saving instrument' (see below) is the underlying reason
    for the growth of the funds in a parliamentary western democracy one
    might observe tax concessions arising, as corporate leaders advance
    such demands to state officials so that their aims are not thwarted
    by adverse taxation.

8/ The term refers to the idea that a participating employee acquires a
    'vested interest' in a pension only after a number of years. S/he
    cannot until then, draw out the money, borrow against it or assign
    or sell her/his interest. Full vesting exists only if there is
    entitlement to full preservation rights on change of employer.

9/ Full transferability exists if an early leaver receives her/his own
    plus her/his employer's contributions and indexation (i.e. inflation
    proofing).

10/ That is, when pension benefits are measured as a fraction of the last
    (number of) year's salary.

11/ In the late 70's the membership in compulsory schemes was 80% for the
    private sector and nearly 100% for the public sector. For disincentives
    to early leavers see also Rose (1983).

12/ I.e. that the propensity to save net personal disposable income may
    not differ from zero. (See also Marglin, 1975): that the 'paradoxical'
    increase in the saving ratio in the 70's becomes even more paradoxical
    if the discretionary saving ratio (i.e. NPDI minus consumers expenditure
    divided by NPDI) is considered, in that the rate of increase in the
    latter case is even higher. (See Pearce and Thomas, 1981): and that
    inflation effects on saving are sensitive to the definition of saving
    adopted; the impact of inflation on discretionary saving being much
    smaller than on personal sector saving (PSS) - (see Cuthbertson, 1983).

13/ Munnell (1976) argued that induced retirement may result in non
    substitution. Zabalza et al (1978) that non-substitution is a
    prerequisite for induced earlier retirement.

14/ That is, correct employee perception, constant employee total asset accumulation and full funding. (i.e. the maintenance on the part of the company of a pension fund which assets equal the present actuarial value of its employees anticipated pension benefits.

15/ Even so, this will only hold true unless the higher rate of return encourages more saving. (see Threadgold, 1978).

16/ Feldstein (1978) e.g. notes that U.S. household surveys have shown that individuals do not know the money value of their future pensions - albeit he considers emphasis on money values misplaced.

17/ For many employees in this category Feldstein observes, 85% or even more of lost income is replaced by such benefits. (see also, Murray, 1968.) For the U.K. the situation is similar. (see Zabalza et al, 1978.)

18/ Since they both serve the same purpose: i.e. business financing.

19/ See Davidson et al (1978).

20/ See Threadgold (1977), but also Green (1981) and Hemming and Harvey (1983).

21/ One might be interested to test whether the found degree of substitution characterizes all the post war period rather than the very years only of the rapid growth of the funds. One could also think of attributing to such a difference Feldstein's findings.

22/ For other purposes too, like the 'personal saving paradox' (see note 12) or our expectations on the effects of saving on recovery. (see Rose, 1983).

23/ Which is also the official treatment in the case of Social Security. (see Pearce and Thomas, 1981).

24/ This would have no effect on our series if contributions were equal to benefits, i.e. if net inflow to LAPF was zero. This, however, was never the case in the postwar U.K., the net inflow being always positive and close to around 50% of the total contributions to the funds: which makes the correction indispensable.

25/ This is also recognized by Threadgold (1978).

26/ Or, on u_3 if one wants to test the effects of CORE on PRSA.

27/ More lags were tested but they were found not to differ significantly from zero at the 5% significance level.

28/ Equation 1.8 marginally failed to exhibit significant autocorrelation at the 10% level. Still we report ML estimates to ensure consistency with the other equations. The OLS estimates were essentially the same.

29/ A method proposed by Koutsoyiannis (1977).

30/ The same findings were obtained when PRSA were simply regressed to $LAPF_t$, $LAPF_{t-1}$, $CORE_t$ and $CORE_{t-1}$, and then the relevant restrictions were imposed. These equations, moreover, did not exhibit autocorrelated residuals. These results are also available on request.

31/ See e.g. Townend (1977) and Sargent (1968).

32/ To facilitate detection of significant $\hat{\rho}$'s the 10% significance level
is used.

33/ DW's are reported, since if significant, they are valuable indicators
of misspecification. (see Harvey, 1981.)

34/ Different lag distribution was also allowed for Δ (NPDI). Its lagged
value, however, did not differ from zero, and these equations are not
reported to economize space. The results supported earlier findings.

35/ The LCH requires estimation without the constant, which we include for
statistical purposes: i.e. to mean correct our series. Estimation of
the equations in table 3 without the constant resulted in inferior
equations in terms of autocorrelation and misspecification as judged
by the DW. An F test accepted the exclusion only once,(in 3.4).

36/ Together these observations imply that an increase of LAPF by say £1
will increase private savings by exactly £1. While a Marginal
Propensity to Save net personal disposable income of, say, 0.16 would
imply a net addition to the savings pool of 84 pence.

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