The Demand for UK Ordinary Life Insurance: 1946-1968*

by S.R. Diacon**

1. Introduction

A study of the demand for life insurance is of interest for three main reasons: first, to investigate the behaviour of households, particularly with respect to the provision of protection and contractual saving; secondly, to determine the total sales and changing structure of the UK business of life offices and thirdly to explain the role of life insurance in the context of the UK economy.

The methodology adopted in this paper is to use various econometric techniques to examine the purchase (in terms of premium income) of UK ordinary life insurance. Annuities, single premium policies, equity-linked contracts and group life insurance are specifically excluded from the analysis. Time series of various economic indicators are used as exogenous explanatory variables in order to ascertain their influence on demand. Allowance is also made here for the effects of the endogenous explanatory variables (mainly the price of life insurance) by building a suitable econometric model.

The available data unfortunately limits the scope of the study in a number of significant respects, the most important being caused by a major discontinuity in the UK Department of Trade returns in the year 1968/9 when the 'Insurance Companies (Accounts and Forms) Regulations 1968' substantially altered the reporting requirements. This meant that pre- and post-1969 data was not comparable and consequently, the study was limited to the years 1946 to 1968. This limitation is particularly unfortunate because, of course, 1946 to 1968 was a period of reasonably mild inflation and the effect of inflation expectations is almost certainly underestimated in comparison with the experience of the 1970's.

Additional data was obtained from a survey of the fifteen largest UK life offices and naturally the use of this information makes the implicit assumption that the sample is representative of the industry.

Any study of the demand for life insurance must cover the two major aspects: new business and (contractual) business in force. Generally, when we speak of demand, it is premium income that concerns us since it represents the most accurate measure of the

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quantity of life insurance purchased by a household. Although an analysis of new business premium income presents no real difficulties, a study of business in force involves more problems because of the strong trend elements involved: not surprisingly, the pattern of continuing contractual savings remains particularly stable over time (for example, see S. Neumann [13]). As an alternative to premium income in force, therefore, an analysis has been conducted of the surrender of existing life insurance contracts which represents those contractual savings which have been prematurely liquidated.

Although life insurance is purchased in the UK for a variety of reasons, these can all be grouped into two broad headings: in order to save for the future and/or to provide protection for dependents against the financial consequences of premature death. In order to qualify for income tax relief on premiums all UK life insurance renewable premium contracts must include an element of protection: the most popular contracts (endowment and whole of life) typically include both long-term contractual savings and protection elements. Consequently, a rigorous analysis of the demand for life insurance is not really possible unless some method is devised to separate out the protection and savings elements of new business premium income. An analysis of total premium income is insufficient because the effects of the explanatory variables on the savings and protection elements cannot be distinguished. For similar reasons, an analysis of the different types of contract is a gross simplification.

2. The derivation of the dependent variables

The objective of this section is to describe the calculation of series for aggregate new business premium income for protection-based and savings-based ordinary life insurance purchased in the UK over the years 1946 to 1968. These calculations use a variety of data and are rather complex to perform; consequently only a brief outline will be given here but further details can be obtained from the author.

First, we consider the protection requirements of an individual policyholder: these requirements hinge upon two main criteria – the amount of protection needed and the duration (or more specifically, the age at which such a requirement ceases). Broadly, we can say that for an individual policyholder, there is a maximum amount for which a bequest can be made for protection purposes (say B^*) and a maximum age, after which no further protection is needed (say age x^*). The reasoning is that any bequest in excess of B^* provides an amount that is more than adequate to cover the financial consequences of premature death (this amount could be measured by the individual's human wealth at each age). Similarly, after some age (x^*) the policyholder's former dependents are dependent no longer and there remains no further liability to be covered by life insurance. If we are therefore prepared to assume that no policyholder (at inception age x) will purchase a temporary life insurance contract for sum insured and policy term in excess of B^* and $(x^* - x)$ respectively then it follows that these policies are purchased for protection motives only. By aggregating over all such policies purchased in one year by UK policyholders, we obtain the first element of aggregate expenditure on protection-based life insurance.

Next, consider the individual policyholder purchasing an endowment policy with sum insured S , inception age x and policy term n . The pure premium is then given by $S.P_{x:\overline{n}|}$ (using the standard actuarial notation – see P. F. Hooker and L. H. Longley-Cook [7]). That part of the pure premium covering the purchase of the temporary insurance portion of the endowment is then given by $S.P_{x:\overline{n}|}$; since this represents the contribution towards the provision of protection, the balance $S(P_{x:\overline{n}|} - P_{x:\overline{n}|})$ must be allocated to savings-based life insurance. It can be argued that the bonus loading in a with-profit endowment office premium must be allocated to saving and the expenses loading (covering administration costs) to consumption (corresponding to the definitions of ‘consumers’s expenditure’ used to compile the UK National Income accounts, e.g. see R. Maurice [12]). We note however that the temporary insurance part of the endowment should only bear a part of the loading for administration costs, so this loading must be divided between the protection-based and savings-based elements (say in proportion to the size of the pure premium). In summary, we can say that for an individual endowment the premium expenditure on the protection-based element is given by:

$$S.P_{x:\overline{n}|} + \frac{P_{x:\overline{n}|}}{OP} \cdot (EL)$$

while the premium expenditure on the savings-based element is given by:

$$S(P_{x:\overline{n}|} - P_{x:\overline{n}|}) + BL \\ + \frac{(OP - P_{x:\overline{n}|})}{OP} \cdot EL$$

where EL – Expenses Loading
 BL – Bonus Loading (for With Profits policies)
 OP – Office (market) Premium

Since the allocation to savings-based and protection-based elements obviously depends on the individual characteristics of the policyholder (viz x and n), aggregation over all such policyholders cannot be easily accomplished.

Now consider the individual policyholder purchasing a whole of life policy with sum insured S and inception age x . The obvious method of separating the protection and non-lifetime saving elements is to treat the policy as if it were an endowment. First we note that because of underinsurance (reported by the Consumer Association [3] in a survey of 560 members) it seems reasonable to assume that, on average, $S \leq B^*$ so that there is no upper bound above which bequests are made for savings purposes. Secondly, an assumption must be made about the duration of the protection requirement (since it is unlikely to be for the entire lifetime): it seems reasonable to put x^* equal to $(x + e_x)$ where e_x is the expectation of life of a typical policyholder at age x . Consequently, for the whole of life pure premium SP_x , there is an equivalent endowment premium such that:

$$SP_x = S.P_{y:x + e_x - y|}$$

where y – the artificial endowment inception age – is determined uniquely (in practice, $x - 5 \leq y \leq x - 1$ for most rates of interest with mortality rates from the A1949/52 Tables [10]). The analysis can then proceed exactly as in the endowment case to derive premium expenditures on the savings and protection elements.

Finally in this section, we must deal with the problem of aggregation over all endowment and whole of life policyholders in the UK in order to derive figures for aggregate premium expenditure on savings-based and protection-based life insurance. Obviously, if the details of every individual policyholder were known then summation would be no problem; however, only certain national average data values are known in practice so that some approximations must be made.

The modus operandi adopted was to derive annual values for the UK ‘average’ pure premium rate: in the endowment case, this could be denoted by $P_{\bar{x}_t:\bar{n}_t}$. This pure premium rate (for year t) could then be calculated once decisions had been made about:

- a suitable mortality table for year t ;
 - a suitable value of the average inception age ($\bar{x}_t$) for year t ;
 - a suitable value for the average maturity term ($\bar{n}_t$) for year t ;
- and a suitable rate of interest to be used in the premium calculations.

Values for the above factors were calculated with varying degrees of accuracy: rough mortality tables were derived on an annual basis from information published by the Institute of Actuaries [8]; information on $\bar{x}_t$ was available for the different classes of policy up to 1958 from the Institute again [9]; subsidiary calculations indicated that $\bar{n}_t = 20$ for all t was not a bad approximation and ‘calculation’ rates of interest were approximated from the yield derived on invested life office funds.

Once $P_{\bar{x}_t:\bar{n}_t}$ had been calculated for the years 1946 – 1968 (and the corresponding values for the whole of life policies), it is a relatively simple matter to derive the required aggregate premium expenditures (although some use of the survey data was made to cope with problems caused by the with-profits bonus loadings).

3. An analysis of new business premium expenditure

In this section, demand models for protection-based and savings-based life insurance are analysed using time series data for the period 1946-1968. These models differ in a number of respects from those reported by C. Ferry [4] and J. F. Lee & W. M. Whitaker [11], specifically by the inclusion of the supply equations.

The following notation will be used:

- D_t^{Sg} (S_t^{Sg}) – Demand (Supply) for Savings-based life insurance
- D_t^{Pr} (S_t^{Pr}) – Demand (Supply) for Protection-based life insurance
- IP_t^{Sg} – Price Index for Savings-based life insurance

- IP_t^{Pr} — Price Index for Protection-based life insurance
- X_{it} — other exogenous explanatory variables for demand and supply models.

All monetary variables have been adjusted by the Retail Price Index to a base year (1963) and are in per capita terms.

All models tested were of the following basic form :

$$D_t^{Sg} = a_1 + b_1 IP_t^{Sg} + c_1 IP_t^{Pr} + \sum_i d_{i1} X_{it}^D + U_t^1$$

$$D_t^{Pr} = a_2 + b_2 IP_t^{Pr} + c_2 IP_t^{Sg} + \sum_i d_{i2} X_{it}^D + U_t^2$$

$$S_t^{Sg} = a_3 + b_3 IP_t^{Sg} + c_3 IP_t^{Pr} + \sum_i d_{i3} X_{it}^S + U_t^3$$

$$S_t^{Sg} = a_4 + b_4 IP_t^{Pr} + c_4 IP_t^{Sg} + \sum_i d_{i4} X_{it}^S + U_t^4$$

$$D_t^{Pr} = S_t^{Pr}; \quad D_t^{Sg} = S_t^{Sg} \quad (\text{The Equilibrium Condition})$$

X_i^D — Demand exogenous variables

X_i^S — Supply exogenous variables

To avoid simultaneous equation bias and identification problems, the method of Two Stages Least Squares was used to estimate the unknown coefficients. In some cases, an adaptive expectations model was incorporated to allow for inflationary expectations (eg. see P. Cagan [1]).

The variables D_t^{Sg} and D_t^{Pr} are, of course, new premium expenditures on renewable savings-based and protection-based life insurance respectively. The price indices, IP_t^{Sg} and IP_t^{Pr} were derived from the survey data showing the office premium charged to a specific policyholder (aged 45, maturity term 10 years (where appropriate)); the corresponding pure premium was then deducted from the office premium to give the Expenses Loading which was transferred into a price index and then adjusted to base year 1963 by RPI. (For a discussion of price, see R. L. Carter and N. Doherty [2], Section 7). The notation of all the Demand and Supply variables used in the analysis are described in Table 1.

Tables 2 to 4 detail the results of a preliminary investigation of the model with different explanatory variables. The models are not without the usual econometric problems of multicollinearity and mild autocorrelation (in Equation C). An attempt has been made to remove the multicollinearity by avoiding the inclusion of variables known to be collinear. No real attempt was made to remove any autocorrelation.

In spite of the econometric problems involved, several illuminating features can be noted from the results:

- i) none of the demand equations show price variables (either IP_t^{Sg} or IP_t^{Pr}) of any significance. Thus it would appear that the Expenditure/Price elasticities of Demand are zero (unless this was a result of inherent multicollinearity). If this result is correct then the Demand equations can be rerun using Ordinary Least Squares (because there are no included endogenous variables). The results of Table 5 confirm the omission of the Price Indices (and also provide better $\bar{R}^2$ and DW results). The insignificance of these price coefficients may be a result of the method of their calculation since purchasers of life insurance do not typically compute the price of the product in the manner described above so that they are, in practice, unaware of the true price. Furthermore the office premium rates on most standard life insurance contracts remained largely unaltered throughout the period under observation.
- ii) the coefficient of INC_t^P (Permanent Income) indicates an average income elasticity coefficient of 3.5 for savings-based and 2.5 for protection-based insurance;
- iii) the coefficient of BSA_t (Building Society Advances) is significantly positive (see Table 5) in the savings-based case but insignificant in the case of protection-based life insurance. The coefficient of BSW_t (Shares and Deposits in Building Societies), on the other hand, is negative in the savings-based case indicating a substitute relationship. Using the results from Table 5, it is interesting to note that a 1% rise simultaneously in BSW_t and BSA_t produces a net 0.2% decrease in the demand for savings-based life insurance;
- iv) it is interesting to note that the Standard Rate of Income Tax (T_t) has a significant effect on both the savings-based and protection-based demand equations (being positive in the former and negative in the latter). Consequently a fall in Disposable Income (as a result of an increase in T_t) is, to some extent, offset by the decrease in net of tax premiums paid: the net effect of a 1% rise in T_t is an approximate 1.5% fall in D_t^{Sg} ;
- v) while not figuring in the savings-based equations, the Unemployment Rate has a significantly positive effect on D_t^{Pr} with an elasticity coefficient of 0.25.
- vi) an examination of the Supply of savings-based life insurance shows that the Price Index IP_t^{Sg} has the expected significantly positive sign. The other important savings-based supply variables are Administration Costs (C_t) and Yield on Invested Funds (YLD_t). Protection-based life insurance is seen as a substitute for supply;
- vii) the supply of protection-based life insurance exhibits more unconventional characteristics since all models indicate a significantly negative coefficient for IP_t^{Pr} . Savings-based contracts are seen as a complement in supply. A possible explanation for this behaviour lies in the fact that in the UK, savings-based contracts form the major part of life office business, so that the response to an increase in IP_t^{Pr} is to increase the supply of savings-based contracts (which com-

monly have a protection element incorporated therein). The other important protection-based supply variables are the Yield on Invested Funds (YLD_t) and the response to the Optimum Gearing Level ($G_{t-1} - G_t^*$) which indicates that life offices vary S_t^{Pr} in order to maintain an optimal gearing ratio of with-profits to total business (see H.F. Fisher and J. Young [5] for a further discussion of gearing).

Tables 6 and 7 re-examine the Demand and Supply equations but include an inflationary expectations variable ($\dot{P}_t^e$). It has been assumed that $\dot{P}_t^e$ conforms to an adaptive expectations formulation:

$$\dot{P}_t^e = (1 - f) \dot{P}_{t-1}^e + f \cdot \dot{P}_{t-1}$$

where $0 \leq f < 1$.

So if we have the (simplified) demand model:

$$D_t = b \dot{P}_t^e + U_t + a \quad \text{where } U_t \text{ is a random error term}$$

we get

$$D_t = b((1 - f) \dot{P}_{t-1}^e + f \dot{P}_{t-1}) + U_t + a$$

so that, by substituting for $\dot{P}_{t-1}^e$, we end up with:

$$D_t = af + (1 - f) D_{t-1} + b.f.\dot{P}_{t-1} + U_t - (1 - f) U_{t-1}$$

Thus Tables 6 and 7 demonstrate models that include the lagged dependent variable as an explanatory variable. The constant term has been suppressed as insignificant on all Equations except A (Demand for Savings-based).

In Table 6, inflationary expectations have been included in the Demand equations only: the major result is that inflation has a marginally significant, negative effect on both D_t^{Sg} and D_t^{Pr} . The coefficient of the lagged dependent variable (i.e. $(1 - f)$ in the above simplified equation) is of special interest as it gives an indication of the length of the consumer's 'memory' when it comes to making inflation expectations. For instance, the value of $f=1$ in both cases demonstrates that the consumer has no memory of previous expectations and formulates current ones on the basis of the immediately preceding actual rate of inflation ($\dot{P}_{t-1}$): the smaller the value of f , the greater the part of previous inflation experience in determining future expectations. It may be that, in the savings-based case, the effects of inflation are cushioned to a certain extent by policyholder's confidence in the ability of with-profits policies to maintain the real value of benefits paid. However, unreported tests did little to verify this hypothesis. The other Demand variables in Table 6 behave in the same way as in Table 5.

In Table 7, inflationary expectations have been included in the Supply Equations. Although the results should be treated with caution because of the obvious presence of multicollinearity, it seems that the coefficient of S_{t-1}^{Sg} is certainly less than unity indicating a value of β of approximately 0.1. Inflationary expectations have a significantly negative effect on S_t^{Sg} — due no doubt to the influence of inflation on future administrative costs. It seems therefore that life offices are more concerned about future inflation (with a longer ‘memory’) than their policyholders in the savings-based market.

The protection-based results of Table 7 are unfortunately not robust enough to make any comment.

4. An analysis of surrender rates

It was hypothesised that the surrender of a life insurance contract may take place for four reasons: because no further need exists for the policy; the policy would still fulfill some purposes but is terminated because a ‘better buy’ substitute exists elsewhere (i.e. competitive pressure); a cash lump sum is required; or to avoid the expenditure on premiums. The methodology utilised here is to derive estimates for the probability of surrender (the Surrender Rate $SURR_t$) and then attempt to explain this Rate with variables purporting to represent the four main reasons for surrender.

The basis for the dependent variable ($SURR_t$) was derived from the figures ‘Surrenders’ (from the Ordinary Branch of Companies doing business in the UK) in the Annual Abstract of Statistics [6]. The figures for ‘Surrenders’ relate to surrender values paid on policies and therefore give no indication of either the numbers of terminations of policies that have not yet acquired a surrender value (e.g. normally in the first two years of a savings-based policy) or the number of terminations of policies that are not normally granted a surrender value (e.g. protection-based policies). Surrender Rates were then derived by expressing ‘Surrenders’ as a percentage of the ‘original population’ (of policies) from which they arose. The ‘original population’ used for year T is given by the formula

$$\sum_{K=2}^6 \frac{E_{T-K}}{I_{T-K}} \cdot (1 - W_{K-1})$$

where E_{T-K} was approximated by new renewable office premiums (excluding temporary life business);

I_{T-K} — the Retail Price Index in year T-K

and W_K — the cumulative probability of termination derived from figures provided by F. D. Patrick and A. Scobbie [14].

The resulting rates of Surrender are given in Table 9.

The figures show that, from a high level immediately after the war, the rates dropped to a low in 1951. Since then rates have been on an upward trend, peaking in 1962.

Although a variety of models were attempted, the best results were obtained using the second-order inflationary expectations model proposed by D. E. Rose [15]. This model is similar to the first-order model used in the new business case but includes, in addition, $SURR_{t-2}$, $\dot{P}_{t-2}$ and X_{it-2} as explanatory variables. The abbreviations are described in Table 11.

The results from these models are illustrated in Tables 10 and 11 and there are several interesting features to report :

- i) in seven out of eight models, the coefficient of $SURR_{t-1}$ is positive, varying in the interval (0.15 to 0.6); the coefficient of $SURR_{t-2}$ is also positive however, being largely in the interval (0.1 to 0.5). The positive coefficient of $SURR_{t-2}$ implies that the addition of the Second Order adaptive expectations *reduces* the expected rate of inflation; consequently it would seem that policyholders generally took an optimistic view of the course of future inflation (expecting any increase to 'tail off');
- ii) the coefficient of $\dot{P}_{t-1}$ is largely negative (although not generally significant) while $\dot{P}_{t-2}$ has a positive effect. Both of these results imply a negative effect for inflationary expectations on Surrender Rates. This effect could be the result of a number of different factors: first, any rise in wages and salaries would make premiums relatively cheaper; secondly, inflation may be linked with an expected rise in the reversionary bonus rate (making life insurance more competitive) and thirdly, any associated drop in market values could reduce the surrender values paid;
- iii) the coefficients of RB_t – the Reversionary Bonus Rate declared (positive) – and RB_{t-1} , RB_{t-2} (negative) all indicate that an increase in RB discourages Surrenders. Since a rise in RB_t increases the surrender value paid, we would not expect this result if Surrenders were largely to obtain Cash. On the other hand, the result is quite acceptable if Surrenders are largely as a result of competitive pressure;
- iv) the results confirm (especially those of Table 11 (A)) that Surrenders do not occur in order to obtain Cash;
- v) similarly, Surrenders do not seem to occur because of the expense of premiums (Table 11 (B)) – this result is expected because of the practice of making such a policy 'paid-up';
- vi) Table 10 (B) attempts to examine Surrenders in the 'No Further Need' category. The Death Rate for Dependents (DRD_t) has a significantly positive effect in many models but Table 10 (B) does not provide evidence for other factors in this category;
- vii) Table 10 (C) attempts to include other variables in the 'Competitive Pressure' category of Surrender (in addition to RB_t and P_{t-1} noted above). Building Society Wealth (BSW_t) appears to have a complementary relationship in this case.

5. Conclusions

It is tempting to attempt a large number of conclusions detailing the influence of all explanatory variables in the different models. However the disturbing effects of autocorrelation and multicollinearity (particularly in the Surrenders section) make it more sensible to make only a few basic remarks.

Turning first to the new business Demand models, we have seen that Price is not an important influence on demand: the most competitive influences arise in the (implied) effects of the reversionary bonus (savings-based policies only). Permanent Income figures are the most important explanatory variable indicating average elasticity coefficients of 3.5 and 2.5 in the savings-based and protection-based cases respectively. While appreciably affecting Supply, inflationary expectations have had no effect on the demand for savings-based policies.

An examination of the reasons for the Surrender of contractual savings-based life insurance has revealed that the major reasons are competitive pressure and 'No Further Need'. The importance of the reversionary bonus is once again demonstrated in its negative influence on $SURR_t$.

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Table 1 – Abbreviations for Demand (New Business) Model

<i>Abbreviation</i>	<i>Description</i>
$\dot{P}_t$	Actual Rate of Inflation of RPI over year t (Compounded Continuously)
D_t^{Pr}	Real Demand for Protection – based Life Insurance per 1,000 head of population (1963 £)
D_t^{Sg}	Real Demand for Savings-based Life Insurance per 1,000 head of population (1963 £)
S_t^{Pr}	Real Supply of Protection – based Life Insurance per 1,000 head of population (1963 £)
S_t^{Sg}	Real Supply of Savings-based Life Insurance per 1,000 head of population (1965 £)
IP_t^{Pr}	Real Market price index of protection-based life insurance (1963 = 100)
IP_t^{Sg}	Real Market price index of savings-based Life Insurance (1963 = 100)
YLD_t	Annual Yield on Life and Annuity Funds (Companies established in the UK) based on Book values
SP_t	Real Surplus in year t (1963 £m)
C_t	Real Life Insurance Supply Costs in year t (1963 £m)
$(G_{t-1} - G_t^*)$	Adjustment necessary in Optimal Gearing Level
INC_t^P	Real Permanent Income in year t per capita (1963 £)
LIQ_t	Real Liquid Assets per capita (1963 £)
BSW_t	Real wealth in Building Society shares and deposits per capita (1963 £)
BSA_t	Real Building Society Advances on Mortgages per capita
B_t	Births in year t (000)
M_t	Marriages in year t (000)
T_t	Standard Rate of Income Tax (p in £)
U_t	% Unemployment in UK in year t
ΔU_t	Change in % Unemployment
HPC_t	Total Hire Purchase Credit Outstanding per capita
IF_t^{Pr}	Real Protection-based sums insured in force per capita
IF_t^{Sg}	Real Savings-based sums insured in force per capita

Table 2

Sample Period 1946-1968
Two Stage Least Squares

A. Demand for Savings-based (D_t^{Sg})											
CONST	IP_t^{Sg}	IP_t^{Pr}	INC_t^P	BSA_t	B_t	IF_t^{Pr}	IF_t^{Sg}	R^2	$\bar{R}^2$	F	DW
-1848.626 (951.885)	-0.578 (3.794)	0.864 (2.236)	7.450 (3.222)	12.863 (14.292)	-	-	-1.468 (2.348)	0.97	0.97	129.8	1.521
B. Demand for Protection-based (D_t^{Pr})											
21.212 (391.003)	-0.175 (1.703)	-0.147 (0.880)	0.127 (1.434)	-2.640 (4.878)	0.174 (0.238)	0.686 (0.438)	-	0.92	0.89	30.8	1.604
C. Supply of Savings-based (S_t^{Sg})											
CONST	IP_t^{Sg}	IP_t^{Pr}	SP_{t-1}	C_t	$(G_{t-1} - G_t^*)$	YLD_t	R^2	$\bar{R}^2$	F	DW	
259.963 (465.415)	13.057 (5.949)	-5.989 (2.457)	1.246 (4.482)	-53.304 (48.318)	97.763 (96.635)	32.864 (62.108)	0.82	0.75	12.2	1.388	
D. Supply of Protection-based (S_t^{Pr})											
-2.506 (75.369)	2.486 (0.963)	-1.222 (0.398)	0.474 (0.726)	2.191 (7.824)	36.207 (15.649)	13.533 (10.058)	0.90	0.86	22.7	1.846	

Equilibrium Condition $D_t^{Sg} = S_t^{Sg}$

$D_t^{Pr} = S_t^{Pr}$

Standard Errors in ()

DW – Durbin Watson Statistic

A key to the abbreviations can be found in Table 1.

Table 3

Sample Period 1946-1968
Two Stage Least Squares

A. Demand for Savings-based (D_t^{Sg})												
CONST	IP_t^{Sg}	IP_t^{Pr}	INC_t^P	BSA_t	BSW_t	B_t	IF_t^{Pr}	IF_t^{Sg}	R^2	$\bar{R}^2$	F	DW
-2458.751 (874.471)	-4.229 (4.451)	2.624 (2.237)	8.513 (3.391)	15.339 (17.083)	-7.501 (6.743)	0.202 (0.705)	-	3.010 (3.899)	0.97	0.96	77.3	1.946
B. Demand for Protection-based (D_t^{Pr})												
579.856 (972.905)	1.685 (3.703)	-1.436 (2.251)	-0.850 (2.544)	7.015 (14.478)	-6.731 (7.813)	0.121 (0.354)	2.438 (2.135)	-	0.84	0.77	11.5	1.712
C. Supply of Savings-based (S_t^{Sg})												
CONST	IP_t^{Sg}	IP_t^{Pr}	SP_{t-1}	C_t	$(G_{t-1}-G_t^*)$		YLD_t	R^2	$\bar{R}^2$	F	DW	
357.304 (46.817)	9.921 (5.078)	-4.684 (2.096)	-0.165 (3.970)	-58.261 (43.553)	60.973 (84.815)		57.392 (54.389)	0.85	0.80	15.5	1.214	
D. Supply of Protection-based (S_t^{Pr})												
14.806 (66.687)	1.928 (0.812)	-0.990 (0.335)	0.223 (0.635)	1.310 (6.968)	29.664 (13.570)		17.895 (8.702)	0.91	0.89	29.2	1.609	
Equilibrium Condition $D_t^{Sg1} = S_t^{Sg}$ $D_t^{Pr} = S_t^{Pr}$												

Equilibrium Condition $D_t^{Sg1} = S_t^{Sg}$

$D_t^{Pr} = S_t^{Pr}$

Standard Errors in ()

DW -- Durbin Watson Statistic

A key to the abbreviations can be found in Table 1.

Table 4

Sample Period 1946-1968
Two Stage Least Squares

A. Demand for Savings-based (D_t^{Sg})												
CONST	IP_t^{Sg}	IP_t^{Pr}	INC_t^P	BSA_t	LIQ_t	B_t	IF_t^{Pr}	IF_t^{Sg}	R^2	$\bar{R}^2$	F	DW
-2339.710 (673.719)	-3.343 (2.968)	-0.661 (1.394)	5.413 (2.087)	10.960 (9.591)	7.099 (4.858)	0.548 (0.498)	-	-2.319 (2.119)	0.98	0.98	129.9	1.750
B. Demand for Protection-based (D_t^{Pr})												
-394.163 (436.639)	-1.881 (2.145)	-0.999 (0.910)	-0.760 (1.480)	-8.954 (7.423)	4.704 (3.201)	0.379 (0.389)	0.809 (0.667)	-	0.83	0.74	10.1	1.311
C. Supply of Savings-based (S_t^{Sg})												
CONST	IP_t^{Sg}	IP_t^{Pr}	SP_{t-1}	C_t	$G_{t-1} - G_t^*$	YLD	R^2	$\bar{R}^2$	F	DW		
291.946 (417.428)	9.854 (4.913)	-4.510 (1.982)	0.253 (3.972)	-60.611 (43.125)	65.244 (84.124)	65.826 (51.433)	0.86	0.80	15.7	1.251		
D. Supply of Protection-based (S_t^{Pr})												
1.202 (69.179)	2.114 (0.814)	-1.050 (0.329)	0.359 (0.658)	1.344 (7.147)	32.437 (13.942)	17.355 (8.522)	0.91	0.88	27.4	1.691		
Equilibrium Condition $D_t^{Sg} = S_t^{Sg}$												
$D_t^{Pr} = S_t^{Pr}$												

Equilibrium Condition $D_t^{Sg} = S_t^{Sg}$

$D_t^{Pr} = S_t^{Pr}$

Standard Errors in ()

DW – Durbin Watson Statistic

A key to the abbreviations can be found in Table 1.

Table 5

THE DEMAND EQUATIONS

Sample Period 1946-1968
Ordinary Least Squares

Demand for Savings-based (D_t^{Sg})

CONST	INC ^P	BSA _t	BSW _t	B _t	M _t	T _t	U _t	ΔU_t	R ²	$\bar{R}^2$	F	DW
-2803.026 (555.773)	8.094 (1.511)	28.342 (7.145)	-8.146 (2.830)	0.294 (0.252)	-0.379 (0.787)	18.918 (6.139)	-	-	0.99	0.98	216.6	1.818

Demand for Protection-based (D_t^{Pr})

82.569 (141.950)	1.213 (0.154)	-	-	-0.208 (0.095)	0.091 (0.287)	-5.183 (2.988)	25.080 (12.480)	-8.619 (8.737)	0.94	0.92	42.9	2.180
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Standard Errors in ()
DW Durbin Watson statistic
A key to the abbreviations can be found
in Table 1.

Table 6

INFLATIONARY EXPECTATIONS (DEMAND EQUATIONS ONLY)

Dependent Model Sample Period 1946-1968 Ordinary Least Squares													
A. Demand for Savings-based (D_t^{Sg})													
CONST	D_{t-1}^{Sg}	$\dot{P}_{t-1}$	INC_t^P	INC_{t-1}^P	BSA_t	BSA_{t-1}	T_t	T_{t-1}	BSW_t	BSW_{t-1}	R^2	$\bar{R}^2$	F DW
-3106.947 (1736.217)	0.086 (0.349)	-7.548 (7.948)	10.861 (4.152)	-1.932 (2.904)	28.485 (7.686)	0.953 (13.515)	20.652 (8.938)	2.174 (15.597)	-13.481 (7.025)	3.635 (5.224)	0.99	0.98	132.6 1.948
B. Demand for Protection-based (D_t^{Pr})													
D_{t-1}^{Pr}	$\dot{P}_{t-1}$	INC_t^P	INC_{t-1}^P	B_t	B_{t-1}	U_t	U_{t-1}	T_t	T_{t-1}	R^2	$\bar{R}^2$	F DW	
-0.175 (0.317)	-2.401 (2.801)	0.416 (2.106)	1.131 (2.046)	0.038 (0.206)	-0.298 (0.185)	10.753 (12.694)	23.981 (11.637)	-1.226 (3.983)	-2.107 (3.943)	0.96	0.93	32.4 2.312	
A. Demand for Savings-based (D_t^{Sg})													
CONST	$\dot{P}_{t-1}$	INC_t^P	BSA_t	BSW_t	T_t								
-3180.512 (474.079)	-8.733 (4.517)	9.469 (1.023)	30.234 (5.204)	-10.560 (1.904)	22.535 (5.792)								
B. Demand for Protection-based (D_t^{Pr})													
$\dot{P}_{t-1}$	INC_t^P	U_t	B_t	T_t									
-3.375 (2.133)	1.252 (0.109)	21.412 (9.234)	-0.181 (0.070)	-2.776 (0.799)									
											R^2	$\bar{R}^2$	F DW
											0.99	0.99	306.7 1.659
											R^2	$\bar{R}^2$	F DW
											0.94	0.93	74.0 2.357
A key to the abbreviations can be found in Table 1.													
DW Durbin Watson Statistic Standard Errors in ()													

A key to the abbreviations can be found in Table 1.

DW Durbin Watson Statistic
Standard Errors in ()

Table 7

INFLATIONARY EXPECTATIONS (SUPPLY EQUATIONS)

Sample Period 1946-1968
Ordinary Least Squares

Supply of Savings-based (S_t^{Sg})

S_{t-1}^{Sg}	$\dot{P}_{t-1}$	IP_t^{Sg}	IP_{t-1}^{Sg}	IP_t^{Pr}	IP_{t-1}^{Pr}	C_t	C_{t-1}	YLD_t	YLD_{t-1}	R^2	$\bar{R}^2$	F	DW
0.894 (0.195)	-22.617 (8.117)	-0.383 (2.275)	-0.840 (2.114)	0.139 (2.059)	0.505 (1.087)	-0.535 (19.096)	-4.903 (16.486)	-23.279 (37.114)	79.885 (62.231)	0.97	0.96	54.6	2.056

Supply of Protection-based (S_t^{Pr})

S_{t-1}^{Pr}	$\dot{P}_{t-1}$	IP_t^{Sg}	IP_{t-1}^{Sg}	IP_t^{Pr}	IP_{t-1}^{Pr}	$(G_{t-1}-G_t^*)$	$(G_{t-2}-G_{t-1}^*)$	YLD_t	YLD_{t-1}	R^2	$\bar{R}^2$	F	DW
0.332 (0.210)	-2.663 (1.808)	-0.712 (0.621)	0.006 (0.494)	0.063 (0.434)	0.153 (0.319)	8.528 (9.103)	-18.858 (8.920)	8.836 (7.805)	31.034 (14.898)	0.97	0.95	43.9	1.990

DW Durbin Watson Statistic
Standard Errors in ()

A key to the abbreviations can be found in Table 1.

Table 8 – Abbreviations for Surrenders Model

<i>Abbreviation</i>	<i>Description</i>
$SURR_t$	Surrender Rates (as a percentage of ‘original population’).
RB_t	The rate of compound Reversionary Bonus declared.
DRD_t	Death Rate of Dependents (deaths as a % of UK population under 15).
DIV_t	The number of Divorces in England and Wales (Decrees Absolute Granted) 000’s.
BSA_t	Real Building Society Advances on Mortgages per capita (1963 £).
$CONS_t$	Real Consumers Expenditure per capita (1963 £).
PDI_t	Real Personal Disposable Income per capita (1963 £).
$\dot{P}_t$	Actual Rate of Inflation of RPI (compounded continuously).
HPC_t	Total Real Hire Purchase Credit Outstanding per capita (1963 £).
BSW_t	Real Building Society Shares and Deposits per capita (1963 £).
U_t	% UK Unemployment.
$BUST_t$	The Number of Bankruptcies Declared in England and Wales per million UK population.

Table 9

$SURR_t$ (%)

1945	24.8220	1950	26.4393	1955	30.4203	1960	40.3890
6	41.1060	1	25.8361	6	33.8196	1	46.0081
7	36.1261	2	25.9527	7	36.7746	2	46.8713
8	32.3579	3	27.6890	8	36.6655	3	42.1100
9	28.5692	4	29.0254	9	36.8648	4	43.0160
				1965	41.4119		
				6	41.3658		
				7	42.6244		
				8	43.5737		

Table 10 – Second Order Inflationary Expectations Model

Dependent Variable SURR _t Sample Period 1946-68 Ordinary Least Squares							
CONST	SURR _{t-1}	SURR _{t-2}	$\dot{P}_{t-1}$	$\dot{P}_{t-2}$	RB _t	RB _{t-2}	RB _{t-2}
A.							
12.636 (6.731)	0.455 (0.227)	0.122 (0.262)	-0.345 (0.306)	-0.305 (0.308)	-528.779 (657.207)	247.242 (799.207)	584.918 (814.142)
B.							
17.684 (23.803)	1.336 (0.447)	-1.044 (0.606)	0.841 (0.614)	0.060 (0.533)	-436.232 (1018.840)	476.942 (750.264)	65.252 (875.440)
C.							
1.424 (1.391)	0.203 (0.308)	0.447 (0.479)	-0.746 (0.511)	0.539 (0.853)	-760.068 (1133.463)	-14.366 (985.298)	1385.390 (984.664)

Table 10 – Continued

DRD _t	DRD _{t-1}	DRD _{t-2}	BSA _t	BSA _{t-1}	BSA _{t-2}	DIV _t	DIV _{t-1}	DIV _{t-2}
32.340 (35.563)	16.588 (32.705)	-46.033 (14.903)						
-61.140 (104.810)	83.304 (70.537)	67.977 (75.406)	1.554 (1.151)	1.290 (0.890)	0.355 (0.718)	-1.248 (0.509)	-0.262 (0.417)	-0.440 (0.350)
56.174 (47.721)	16.042 (35.982)	-57.360 (36.231)						

Table 10 – Continued

Δ BSW _t	Δ BSW _{t-1}	Δ BSW _{t-2}	R ²	$\bar{R}^2$	F	DW
			0.93	0.87	15.4	2.027
			0.97	0.90	14.4	2.808
-0.528 (0.412)	-0.561 (0.667)	0.801 (1.168)	0.94	0.86	11.5	1.870

Standard Errors in ()

DW. Durbin Watson Statistic

A key to the abbreviations can be found in Table 8.

Table 11: Second Order Inflationary Expectations Model

Dependent Variable $SURR_t$
Sample Period 1946-68
Ordinary Least Squares

	CONST	$SURR_{t-1}$	$SURR_{t-2}$	$\dot{P}_{t-1}$	$\dot{P}_{t-2}$	RB_t	RB_{t-1}	RB_{t-2}
A.								
	18.715 (16.274)	0.447 (0.306)	0.510 (0.456)	-0.049 (0.486)	0.468 (0.664)	-243.017 (932.604)	412.286 (1093.156)	-507.204 (1262.755)
B.								
	5.987 (8.277)	0.619 (0.331)	0.110 (0.321)	0.358 (0.496)	-0.031 (0.413)	353.835 (807.934)	-184.682 (922.302)	615.159 (959.251)
	DRD_t	DRD_{t-1}	DRD_{t-2}	$\Delta(\frac{CONS}{PDI})_t$	$\Delta(\frac{CONS}{PDI})_{t-1}$	$\Delta(\frac{CONS}{PDI})_{t-2}$	ΔHPC_t	ΔHPC_{t-1}
	29.078 (43.982)	-12.325 (54.371)	-54.862 (23.749)	122.694 (94.204)	80.498 (101.539)	4.672 (67.196)	-0.800 (0.803)	0.588 (0.680)
								ΔHPC_{t-2}
								1.181 (0.858)
				ΔU_t	ΔU_{t-1}	ΔU_{t-2}	$BUST_t$	$BUST_{t-1}$
								$BUST_{t-2}$
	79.824 (46.644)	-8.610 (41.704)	-79.050 (23.135)	-2.724 (2.103)	-3.259 (2.045)	0.280 (1.443)	-0.129 (0.244)	0.265 (0.314)
								-0.372 (0.227)

Table 11 continued

	R^2	$\bar{R}^2$	F	DW
	0.96	0.84	8.3	2.348
	0.96	0.86	9.6	2.623

Standard Errors in ()
DW Durbin Watson Statistic
A key to the abbreviations can be
found in Table 11.