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Discussion papers

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INFLATION, TIGHT MONEY AND THE SAVING FUNCTION: EVIDENCE FROM FINLAND***

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Abstract

A 'money illusion' saving function in which unanticipated changes in inflation affect saving ratio positively is extended by allowing credit market tightness to affect saving behaviour. The evidence taken together is strongly in favour of this extended 'money illusion' saving function. Tight money - apart from having expected and highly significant signs - improves the performance of the saving function, while still letting the role of other explanatory variables unchanged.

1. INTRODUCTION

Aggregate consumption and saving functions derived both from the life cycle hypothesis (LCH) by Ando-Brumberg-Modigliani and from the permanent income hypothesis (PIH) by Friedman are puzzling among others because of their zero degree homogeneity in nominal variables. This does not allow for inflation to have any independent effect on real consumption and saving.

Consumers may not, however, have sufficient information to distinguish between relative and general price movements when both are changing simultaneously. Now if inflation is unanticipated, then consumers find that the goods they are buying are more expensive than expected and interpret this to mean a rise in the relative prices of those goods thus decreasing their demand and increasing real saving. Deaton (1977) has developed and tested a formal model of disequilibrium involuntary saving along these lines and found some support to it by using the U.S. and U.K. quarterly data. Our experiments with Finnish data (Koskela and Virén (1980)) were also roughly in line with this hypothesis, even though there were signs according to which specification of the saving function might not be totally appropriate.

In the light of frequently published indices of the cost of living, however, consumers' uncertainty about the current price level may be suspected and it can be argued that the most obvious form of uncertainty about prices is that relating to the future. E.g. if present and future consumption are complements and future price level has been underestimated, then consumers save less than they would have, had they correctly foreseen the future price level. Thus they start the next period with smaller assets than they would have liked and increase their saving so that unanticipated future inflation causes saving to rise. This story with uncertainty about relative prices over time also suggests a positive relationship between saving and unanticipated inflation and have been discussed in Deaton (1980) and Deaton and Muellbauer (1980).

The purpose of this paper is to present some further developments and tests of the saving function starting from the intertemporal framework where uncertainty about future inflation plays an important role. More specifically, our major task is to allow for tightness in the capital market to have effects on the saving behaviour and to test this extended 'money illusion' saving function by using the revised Finnish quarterly data over the period 1960(I)-1979(IV).[1)]

We proceed as follows: Theoretical considerations leading to specifications of the saving functions to be estimated are presented in section 2, while section 3 is devoted to empirical analysis.

2. THEORETICAL CONSIDERATIONS

This section presents specifications of the saving function to be estimated. We start from the intertemporal framework with uncertainty about relative prices over time and extend it by allowing for tightness in the capital market to affect saving behaviour.

Assume that consumers take their labour supply as given and determine their intertemporal consumption conditional on expected future income streams. The intertemporal budget constraint can be written as

$$(1) \qquad W_1 = \sum_{i=1}^{T} R_i p_i c_i$$

where $W_1 = (1+r_1)A_0 + \sum_{i=1}^{T} R_i Y_i$ = the current wealth position in period 1 (the sum of non-human ($(1+r_1)A_0$) and human wealth ($\Sigma R_i Y_i$)), c_i = consumption, p_i = the price of consumption, R_i = the discount rate factor, Y_i = the earned income, all in period i. T is the length of the planning horizon, A_0= the value of assets at the beginning of period 1, and r_1 = the nominal interest rate in period 1. Maximizing the intertemporal utility function $U(c_1,L_1,\ldots,c_T,L_T)$, where L describes the labour supply, subject to (1) yields the consumption function of the form $c_t = c_t(W_1,R_1p_1,\ldots,R_Tp_T,\bar{L}_1,\ldots,\bar{L}_T)$, in which $\bar{L}_1,\ldots,\bar{L}_T$ are the number of hours the consumer expects to work in each period. This consumption function describes behaviour in a certain period and one might expect that as new information becomes available, new plans will be calculated.

Because previous consumption levels are not optimal in the presence of new information, the current consumption will be modified by past consumption. With weakly intertemporally separable preferences, however, all past effects go solely via assets. Moreover, if preferences are homothetic, then we obtain $p_t c_t = k_t W_t$, where $W_t = A_{t-1}(1+r_t)+R_t^{-1}E(\sum_1^T R_i Y_i)$, and E = the (mathematical) expectations operator. It should be emphasized that generally k_t is not a constant, but depends on relative prices over time as we show in a moment. Utilizing the asset accumulation equation $A_{t-1} = (1+r_{t-1})A_{t-2} + Y_{t-1} - p_{t-1}c_{t-1}$ makes it possible to transform W_t into the form:

(2) $$W_t = (1+r_t)(W_{t-1}-p_{t-1}c_{t-1}) + n_t$$

where n_t denotes the change in expected income prospects from t on between t-1 and t and can be expressed as:

(3) $$n_t = R_t^{-1}[E_t(\sum_{i=t}^{T} R_i Y_i) - E_{t-1}(\sum_{i=t}^{T} R_i Y_i)]$$

It is to be seen that consumption is associated with its own lagged value and with income "innovations" n_t (Bilson (1980), Hall (1978)).

Turn now to consider how k_t depends on relative prices over time. Assume that preferences can be described by the CES utility function:

(4) $$U = A(\sum_{i=1}^{T} a_i c_i^{-v})^{-1/v}, \ \Sigma a_i = 1$$

Maximizing (4) subject to (1) suggests the following consumption function $p_t c_t = \{(a_t^q p_t^{1-q}) / [E_t(\sum_{i=t}^{T} a_i^q p_i^{1-q})]\} W_t$ where $q = (1+v)^{-1}$ = the intertemporal elasticity of substitution. Substituting the right-hand side of (2) for W_t implies after some manipulation:

$$(5) \qquad c_t = (a_t/a_{t-1})^q (1+r_t^*)^q p_t^e c_{t-1} + k_t n_t / p_t$$

where r_t^* = the real rate of interest, and

$$(6) \qquad p_t^e = E_{t-1}(\sum_{i=t}^{T} a_i^q p_i^{1-q}) / E_t(\sum_{i=t}^{T} a_i^q p_i^{1-q})$$

describes the change in price expectations from t on between t-1 and t.

Before going further it is useful to consider a special case of (4). With Cobb-Douglas preferences the intertemporal elasticity of substitution is equal to one so that we have $c_t = (a_t/a_{t-1})(1+r_t^*)c_{t-1} + k_t n_t/p_t$. In this usual specification of LCH a lá Ando-Brumberg-Modigliani changes in future price expectations will have no effect on current consumption in contrast with the case where the intertemporal elasticity of substitution different is from one.

Utilizing the approximation $(s/y) \approx \log y - \log c$, where $y_t = Y_t/p_t$, the expression (5) can be transformed into the form

$$(7) \qquad \Delta(s/y)_t = 1-(a_t/a_{t-1})^q(1+r_t^*)^q p_t^e + \Delta\log y_t - k_t n_t/p_t c_{t-1}$$

where Δ = the backwards first difference operator. The role of future price expectations can be seen from (7). More specifically, if the anticipated rate of inflation rises between t-1 and t, p_t^e will be less than unity so that c_t will be smaller than it would have, had anticipations remained constant.

Next we have to construct proxies for the unobserved variables p_t^e and (n_t/p_t) and to allow for the tightness in the capital market to affect consumption and saving behaviour.

Suppose that changes in anticipated inflation and income from t on between t-1 and t can be proxied as follows $p_t^e = \beta(p_{t-1}/p_t)$ and $(n_t/p_t) = \alpha y_{t-1}$. If we substitute these proxies for p_t^e and (n_t/p_t) in (7) and use Taylor approximations to linearize the (p_{t-1}/p_t)- and (y_{t-1}/c_{t-1})-terms, then we end up with the following saving function

$$(\mathrm{I}) \qquad \Delta(s/y)_t = b_0^1 + b_1^1\Delta\log p_t + b_2^1\Delta\log y_t + b_3^1(s/y)_t + u_t^1$$

where u_t^1 is the error term, and $b_1^1, b_2^1 > 0$, $b_3^1 < 0$. It should be remarked that (I) can be derived from the disequilibrium story where uncertainty about the current price level plays a major role with static inflation rate and real income expectations (Deaton (1977), Koskela and Virén (1980)). If, however, changes in real income expectations can be proxied by $(n_t/p_t) = \alpha(y_{t-1}-y_{t-2})$, then substituting these proxies for p_t^e and (n_t/p_t) in (7) implies after some manipulation

$$\text{(II)} \qquad \Delta(s/y)_t = b_0^2 + b_1^2 \Delta \log p_t + b_2^2 \Delta \log y_t + b_3^2 (s/y)_{t-1} + b_4^2 (s/y)_{t-2} + u_t^2$$

where b_1^2, b_2^2, $b_4^2 > 0$, $b_3^2 < 0$ and $|b_3^2| > b_4^2$.

Thus far consumption and saving behaviour has been related to 'wealth' in the form of non-human assets and discounted future income. If consumers, however, are subject to binding borrowing constraints, then current income is not important in the sense of contributing to discounted future income, but in the sense of providing consumers with liquidity.

There are various ways borrowing constraints can affect consumption and saving behaviour. For consumers who are constrained to borrow less than they would wish, any increase in available resources will be spent so that borrowing constraints tend to increase the marginal propensity to consume and decrease the marginal propensity to save. On the other hand, a rise in the tightness in the capital market might have a discouragement effect on the saving behaviour. In both of these cases, however, the longer run effect of a rise in the tightness is to raise the saving ratio because downpayment ratios get higher and tend to induce higher net asset holdings.

On the basis of these considerations we assume that k_t is positively related to a variable describing tightness in the capital market, We denote this variable by RAT, and use specifications $k_t = k_1 RAT_t$ and $k_t = k_0 + k_1 RAT_t$, where $k_1 > 0$. Proxying changes in real income expectations by $(n_t/p_t) = \alpha(y_{t-1} - y_{t-2})$ the saving function can be expressed in the former case as

$$\text{(III)} \qquad \Delta(s/y)_t = b_0^3 + b_1^3 \Delta\log p_t + b_2^3 \Delta\log y_t + b_3^3 SR_{t-1} + b_4^3 SR_{t-2} + u_t^3,$$

and in the latter case as

$$\text{(IV)} \qquad \Delta(s/y)_t = b_0^4 + b_1^4 \Delta\log p_t + b_2^4 \Delta\log y_t + b_3^4 SR_{t-1} + b_4^4 SR_{t-2} + b_5^4 (s/y)_{t-1} + b_6^4 (s/y)_{t-2} + b_7^4 RAT_t + u_t^4,$$

where $b_1^3, b_1^4, b_2^3, b_2^4, b_4^3, b_4^4, b_6^4 > 0$, $b_3^3, b_3^4, b_5^4 < 0$, $|b_3^3| > |b_4^3|$ and $SR_{t-1} = (s/y)_{t-1} RAT_t$, $SR_{t-2} = (s/y)_{t-2} RAT_t$.

The equations (III) and IV) represent generalized versions of the 'money illusion' saving functions, in which tight money has been introduced as a factor affecting saving behaviour. Notice also that, in contrast with conventional specifications of LCH, real assets do not occur as explanatory variables. This is because with weakly intertemporally separable preferences the lagged dependent variable contains all relevant information about past asset levels.

3. EMPIRICAL EVIDENCE

3.1. Descriptive statistics

In this section saving function specifications (I)-(IV) are tested by using Finnish seasonally adjusted quarterly data over the period 1960(I)-1979(IV).[1)]

As a background some descriptive statistics on $\Delta(s/y)_t$, $\Delta\log p_t$, $\Delta\log y_t$, $(s/y)_{t-1}$ and RAT_t are presented in Table 1, in which r_s = the coefficient of correlation between $\Delta(s/y)_t$ and the corresponding explanatory variables, m = the sample mean and $R^2_{(12)}$ = the squared coefficient of correlation for the AR(12) regression equation for each variable.

Table 1. Some descriptive statistics

	m	r_s	$R^2_{(12)}$
$\Delta(s/y)_t$	.0003	1.000	.4430
$\Delta\log p_t$	.0195	.0669	.1958
$\Delta\log y_t$	.0100	.6402	.2082
$(s/y)_{t-1}$	.0240	-.5185	.2876
RAT_t	.3266	.0034	.9130

Table 1 suggests against getting spurious regressions because of trending data (cf. Granger and Newbold (1974)).

We used the difference between the banks' marginal cost of central bank borrowing (MC) and their weighted average lending rate (r_L) as the proxy for tight money (for details of constructing this series, see Tarkka (1981).[2] This series is reported in Figure 1 and it seems to be highly erratic. Presumably, however, its quarter-to-quarter variation includes temporary changes in the banks' liquidity situation, which do not after some delay give rise to changes in their lending behaviour, non-price loan terms and credit rationing. Therefore, in order to eliminate these temporary changes in the banks' liquidity situation a smoothed series was constructed as follows

$$(8) \qquad RAT_t = \sum_{i=4}^{9} (MC_{t-i} - r_{L,t-i})$$

and it seems to display the same overall pattern as $MC_t - r_{L,t}$ (see Figure 2). The determination of i is discussed in the next section.

3.2. Estimation results

We started by running regressions for saving function specifications (I)-(IV). OLS estimation results are summarized in Table 2.[3] Coefficient estimates, values of t-statistics, the goodness-of-fit statistics R^2, DW-statistics, Box-Pierce statistics with 12 d.f., Q(12), and Lagrange Multiplier autocorrelation statistics with 6 d.f., LM(6), (see Godfrey

Figure 1. $(MC_t - r_{L,t})$-series

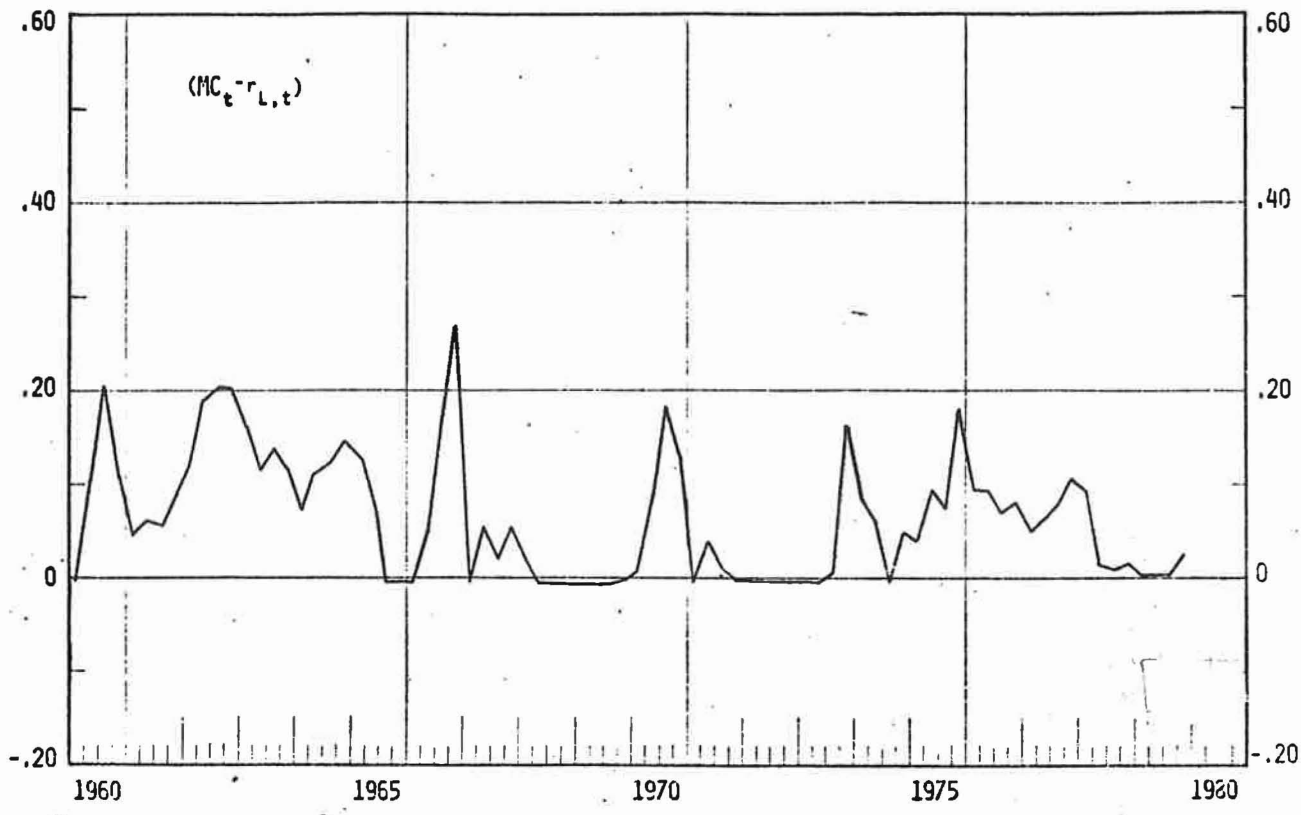
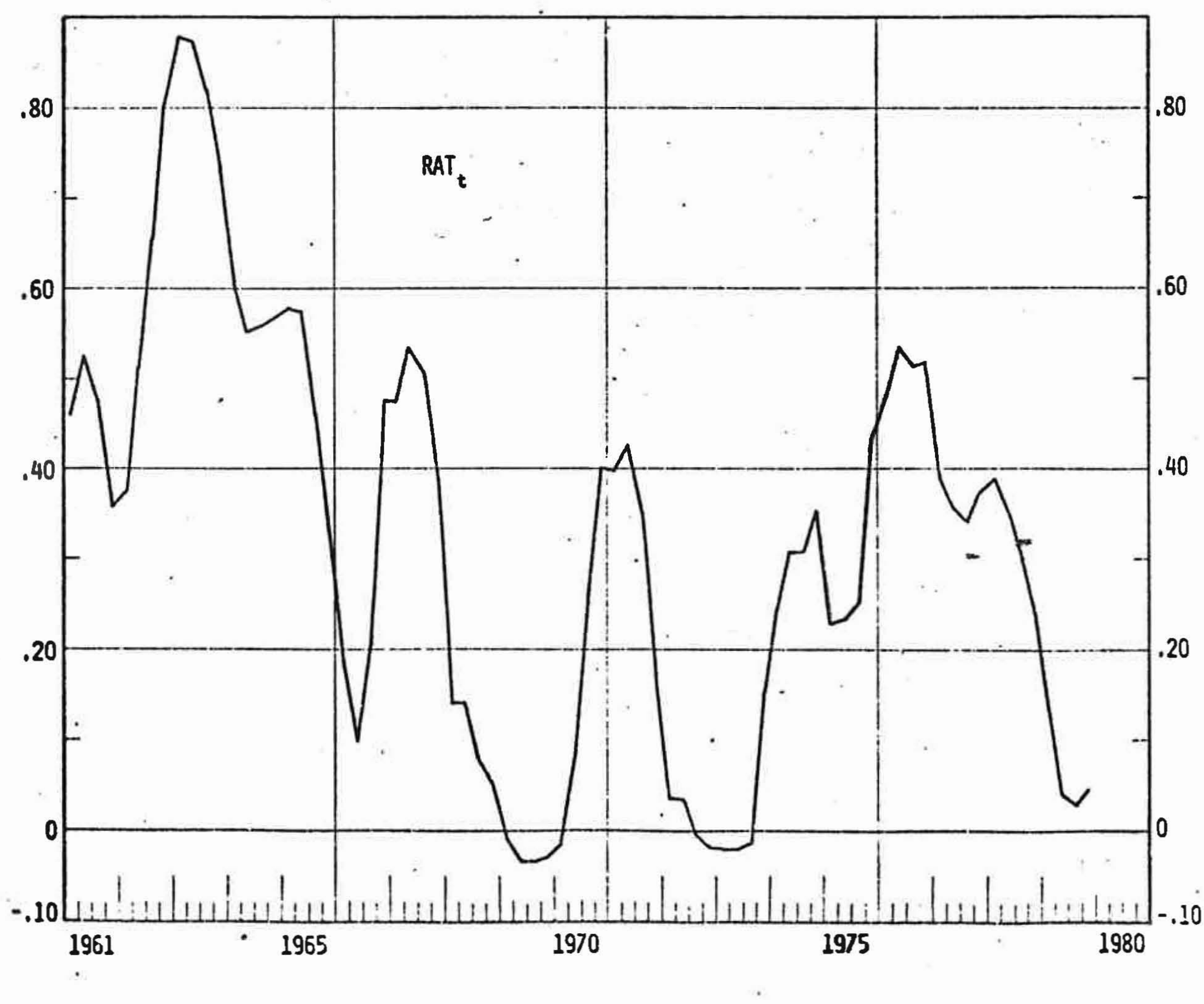


Figure 2. RAT_t-series



(1978)) are recorded over the period 1962(I)-1979(IV). Moreover, the equations were also estimated over the period 1962(I)-1975(IV) and the remaining 16 observations were then used in post-sample forecasting. Forecast accuracy (parameter stability) was evaluated for these 16 observations by using Chow-test statistics (16, 56-k d.f.), X^2-test statistics with 16 d.f., P(16), (see Davidson and Hendry and Srba and Yeo (1978, p. 674) and root mean square errors RMSE. Finally, the proxy for tight money - transmitting changes in the banks' liquidity situation to changes in their lending, non-price loan terms and credit rationing - was specified as starting from i=4. This was found by estimating the specification (III-1) in Table 2 for i = 2,3,4,5,6, and picking up the value of i at which the residual sum of squares was minimized.

Several features of Table 2 merit note. First, estimation results lie in all cases in conformity with the notion that unanticipated inflation affects saving positively at the very high significance level (see the marginal significance levels). The specification (I-1), which is identical to Deaton's disequilibrium story with uncertainty about current inflation and static expectations (Deaton (1977)), has rather good explanatory power (taking account of erratic behaviour of $\Delta(s/y)_t$) and has expected and significant signs for coefficient estimates. Moreover, the error term is almost white noise, and post-sample forecast performance does not show any signs of serious instability.[4] If the term $(s/y)_{t-2}$ is introduced, then both the goodness-of-fit statistic and the forecast performance are increased while values of autocorrelation statistics decrease slightly.

Table 2. OLS estimates of equations (I)-(IV)

Eq.	constant	log p_t	log y_t	$(s/y)_{t-1}$	$(s/y)_{t-2}$	SR_{t-1}	SR_{t-2}	RAT_t	Regression statistics
(I-1)	-.0035 (0.93) .177830	.4306 (3.39) .000584	.5576 (7.47) .000000	-.4420 (4.99) .000002					R^2=.6165, DW=2.216, Q(12)= 16.919/.152670, LM(6)=10.603/ .101449, P(16)=24.601/.077175, Chow=1.138/.348625, RMSE=.01742
(II-1)	-.0052 (1.40) .083000	.3882 (3.09) .001450	.5541 (7.61) .000000	-.5153 (5.53) .000000	.1893 (2.09) .020180				R^2=.6401, DW=2.190, Q(12)= 16.364/.175127, LM(6)=6.960/ .324562, P(16)=20.725/.189325, Chow=.968/.503601, RMSE=.01592
(III-1)	-.0083 (2.34) .011113	.2934 (2.39) .009813	.6008 (8.36) .000000			-1.0452 (5.33) .000001	.6291 (3.21) .001014		R^2=.6424, DW=2.180, Q(12)= 23.638/.022773, LM(6)=8.517/ .202619, P(16)=15.939/.457274, Chow=.852/.623741, RMSE=.01410
(IV-1)	-.0062 (1.71) .045913	.4177 (3.29) .000795	.5859 (8.28) .000000	-.2600 (1.54) .064101	-.1846 (1.16) .125053	-.5716 (1.62) .054931	-.9584 (2.77) .003610		R^2=.6789, DW=.2.095, Q(12)= 17.537/.130489, LM(6)=7.912/ .244622, P(16) 21.263/.168621, Chow=1.011/.461426, RMSE=.01535
(IV-2)	-.0037 (0.65) .258941	.4262 (3.32) .000725	.5838 (8.20) .000000	-.3137 (1.64) .052812	-.2395 (1.30) .098995	-.4366 (1.04) .151012	1.1044 (2.60) .005713	-.0067 (0.60) .275250	R^2=.6807, DW=2.099, Q(12)= 16.207/.181938, LM(6)=7.287/ .295119, P(16)=21.671/.154136, Chow=1.020/.452825, RMSE=.01559

The absolute values of t-statistics are given in parentheses, and the marginal significance levels are given below the t-statistics. The absolute values of Q(12), LM(6), P(16), and Chow test statistics are also accompanied by the respective marginal significance levels.

Second, allowing the proxy for tight money to affect saving behaviour yields even better results. In particular, we would like to stress that in (III-1), where $k_t = k_1 RAT_t$, coefficient estimates of tight money are of expected signs and highly significant. Also the forecast performance (parameter stability) gets much better when tight money variable is introduced. The Box-Pierce statistic, however, indicates that the error term might be serially correlated.

Third, (III-1), (IV-1), and (IV-2) indicate that $k_t = k_1 RAT$ slightly outperforms $k_t = k_0 + k_1 RAT_t$, given $p_t^e = \beta(p_{t-1}/p_t)$ and $(n_t/p_t) = \alpha(y_{t-1} - y_{t-2})$. Even though (IV-1) and (IV-2) have better fit than (III-1) - an appropriate F-test gives namely $F(\text{IV-1 vs. III-1}) = \underset{.030290}{3.6920}$ - the forecast performance gets worse so that we have a conflict between the fit and parameter stability as criteria for model selection (see also Davidson et.al (1978) p. 688). This weaker performance of IV is also confirmed by values of marginal significance levels and by the 'wrong' sign for $(s/y)_{t-2}$. Therefore, we keep to (III-1) as our specification of the saving function with tight money.[5)]

In what follows we make some further checks on specifications I, II, and III. To be more specific, we estimate them over various sub-periods and under various autoregressive specifications of the error term.

Periodic OLS estimates of specifications I, II, and III over sub-periods 1962(I)-1971(IV) and 1962(I)-1975(IV) are recorded in Table 3. Again II and III have the better fit than I, while results are mixed as far as autocorrelation is concerned. None of the autocorrelation statistics, however, is significant for example at the 5 per cent level. Comparing the results over two sub-periods suggests that the instability of the coefficient estimate for unanticipated inflation shows up strikingly in all specifications, but the sharpest change happens with tight money specification, which 'explains' the worsening of autocorrelation test statistics in this case. This may reflect a change in the way inflation rate expectations have been revised in the presence of new information. Nevertheless, we should notice that unanticipated inflation and tight money have the right signs and they are significant. (Notice also the rather poor performance of the $(s/y)_{t-2}$-terms in equations (II-2) and (II-3).)

Finally, properties of error terms for various specifications are scrutinized. OLS residuals for (I-1) are shown in Figure 3 (they look roughly similar for (II-1) and (III-1)).

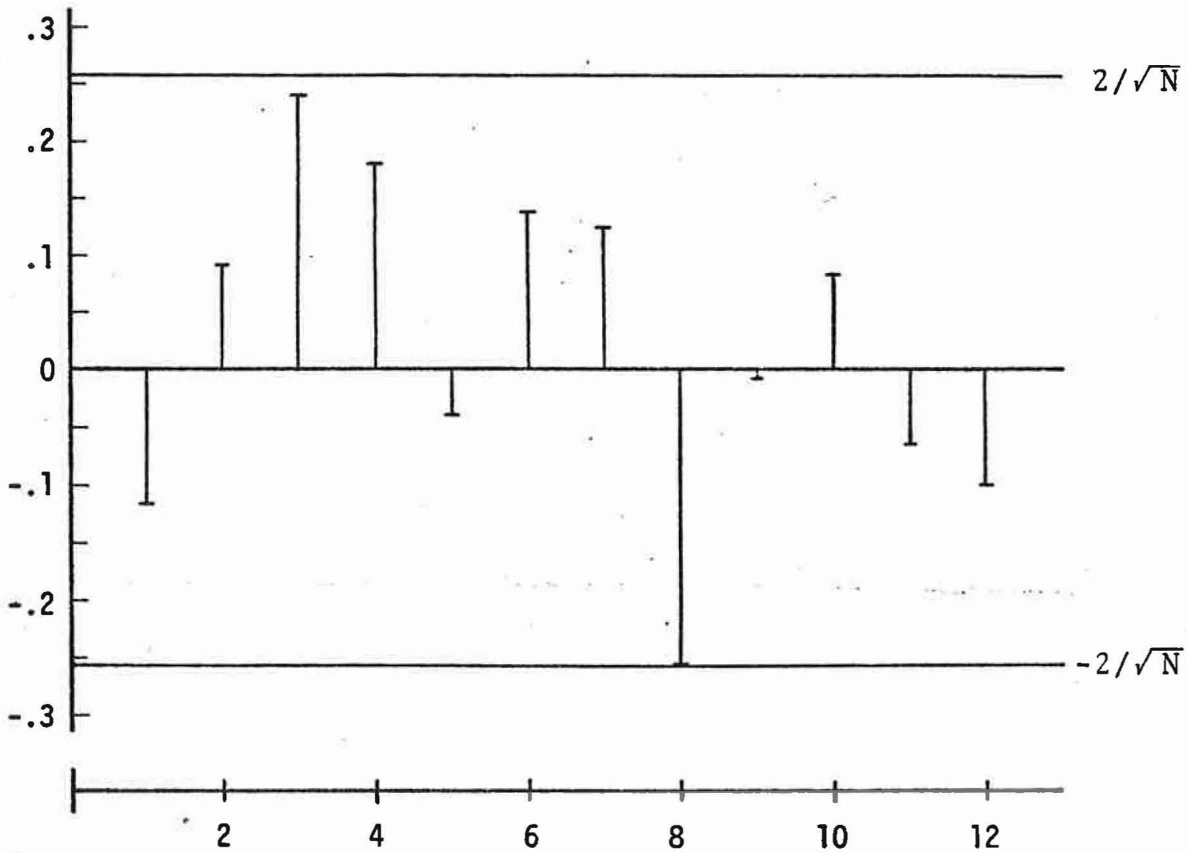
There seems to be signs of autocorrelation of higher than 1^{st} order. Therefore, specifications were re-estimated by assuming that the error terms follow an AR(4) process and results have been summarized in Table 4, in which a's refer to autocorrelation coefficients, S to the standard deviation of residuals and A(4) is X^2-test statistic with $H_0: a_1 = a_2 = a_3 = a_4 = 0$.

Table 3. Periodic OLS estimates of equations I, II, and III

Eq.	constant	$\Delta\log p_t$	$\Delta\log y_t$	$(s/y)_{t-1}$	$(s/y)_{t-2}$	SR_{t-1}	SR_{t-2}	R^2	DW	Q(12)	LM(6)	N
(I-2)	-.0055	.6816	.4241	-.5717				.5997	2.261	13.865	4.347	62-71
	(1.27)	(3.34)	(4.36)	(4.48)						.309412	.629828	
	.106116	.000980	.000052	.000036								
(II-2)	-.0088	.6868	.4818	-.6292	.2485			.6341	2.183	10.949	2.510	62-71
	(1.91)	(3.48)	(4.84)	(4.93)	(1.82)					.533294	.867347	
	.032063	.000666	.000012	.000009	.038541							
(III-2)	-.0113	.7412	.5097			-1.2020	.4285	.6953	2.213	4.983	1.477	62-71
	(3.07)	(4.14)	(5.75)			(5.93)	(1.96)			.958544	.961008	
	.002028	.000100	.000001			.000000	.028886					
(I-3)	-.0021	.4182	.4372	-.5606				.5355	2.171	17.316	5.443	62-75
	(.055)	(3.11)	(4.73)	(5.24)						.138092	.488373	
	.292435	.001572	.000010	.000002								
(II-3)	-.0036	.3993	.4541	-.6096	.1392			.5485	2.132	16.927	4.264	62-75
	(0.89)	(2.97)	(4.88)	(5.35)	(1.21)					.152364	.640998	
	.188953	.002320	.000006	.000001	.116102							
(III-3)	-.0070	.2509	.5271			-1.1790	.5828	.5386	2.194	19.535	8.529	62-75
	(1.76)	(1.89)	(5.61)			(5.11)	(2.43)			.076410	.201850	
	.042310	.032402	.000000			.000003	.009444					

N denotes the period of estimation.

Figure 3. Autocorrelation function for (I-1)



AR(4) process seems to be justified only in the case of the basic model (I-1), for which H_0 is rejected. In fact, error term behaviour in (I-1) can be regarded as a sign of functional misspecification (III-1) being the 'right' one. Notice namely that coefficient estimate of $(s/y)_{t-2}$ in (II-4) is highly insignificant, while tight money has expected and significant sign.[6] Moreover, (III-4) does not pass the stability test P(16) at the 5 per cent level presumably because of 'unnecessary' AR(4) specification. If the RMSE's for various equations estimated thus far are compared, it is (III-1) that shows the best forecast performance.

The evidence taken together gives strong support for the role of tight money as a factor affecting saving behaviour; tight money variable has expected and significant signs and it improves the performance of the saving function estimated from Finnish quarterly data over the period 1960(I)-1979(IV).

4. CONCLUDING REMARKS

We have analyzed the relationship between aggregate private saving, inflation and tight money by starting from the intertemporal framework where uncertainty about future inflation plays a major role. Our main purpose was to allow for tight money to affect saving behaviour and test this extended 'money illusion' saving function with Finnish data.

Table 4. Estimation results with AR(4) process

(I-4) $\Delta(s/y)_t = -.0039 + .3941\Delta\log p_t + .5695\Delta\log y_t - .3907(s/y)_{t-1}$

(0.74)	(2.92)	(7.39)	(3.48)
.231003	.002414	.000000	.000454

$a_1 = -.2452$ (1.52) .066718
$a_2 = .0854$ (0.60) .275312
$a_3 = .3104$ (2.52) .007121
$a_4 = .2663$ (2.13) .018511

S = .01359, Q(12) = 11.151, A(4) = 12.053, P(16) = 23.030
.516024 .026901 .112935

(II-4) $\Delta(s/y)_t = -.0044 + .4136\Delta\log p_t + .5689\Delta\log y_t - .4094(s/y)_{t-1}$

(.083)	(3.04)	(7.29)	(3.04)
.204812	.001713	.000000	.001713

$.0222(s/y)_{t-2}$
(0.17)
.432773

$a_1 = -.2238$ (1.27) .104341
$a_2 = .0850$ (0.52) .302429
$a_3 = .2818$ (1.93) .029021
$a_4 = .2376$ (1.86) .033741

S = .01372, Q(12) = 10.796, A(4) = 7.749, P(16) = 19.627
.546478 .101218 .237492

(III-4) $\Delta(s/y)_t = -.0084 + .3299\Delta\log p_t + .5829\Delta\log y_t - .10415SR_{t-1}$

(2.25)	(2.47)	(7.53)	(4.02)
.013947	.008094	.000000	.000090

$.5693SR_{t-2}$
(2.19)
.016088

$a_1 = -.0944$ (0.57) .285337
$a_2 = -.1374$ (0.88) .191076
$a_3 = .1923$ (1.30) .099132
$a_4 = .1287$ (0.90) .185747

S = .01375, Q(12) = 7.645, A(4) = 6.751, P(16) = 30.706
.812221 .149647 .014667

Estimation periods: 1962-1979 (coefficient estimates and regression statistics), and 1962-1975 (post-sample forecasting: P(16) statistics). 4 observations were lost in estimation.

On the whole, the evidence gives strong support for the role of tight money. Apart from having expected and significant sign it improves considerably the performance of the 'money illusion' saving function, while still letting the role of other explanatory variables - unanticipated changes in real income and inflation - unchanged.

Evidently, further work is needed. Various proxies for unobserved variables p_t^e, (n_t/p_t), and tight money should be tested. Particularly, the way inflation rate expectations are revised would seem to have changed abruptly during the period 1972-1975. Further problems occur in inflationary conditions because movements in measured variables may not reflect behavioural changes. This 'mismeasurement' hypothesis - which can be regarded as complementary to those presented above - suggests that spurious elements can account for most of the changes in the saving behaviour in seventies (see e.g. Jump (1980)). This should also be a subject for research.

FOOTNOTES:

1. This data is seasonally adjusted and has been kindly provided by the Bank of Finland. It has been constructed in the context of the quarterly model of the Bank of Finland, which is in preparation.

2. In Finland, the banks' borrowing from the central bank is both the major way of absorbing temporary liquidity changes and a permanent source to finance lending to the non-bank public. As a precondition for access to this borrowing facility the banks' weighted average lending rate, however, must not exceed a certain limit, which is slightly above the basic borrowing rate from the central banks and changes with the latter one. Under these circumstances the difference between the cost and return on lending at the margin can be regarded as an indicator of the banks' liquidity situation (see also Tarkka (1981)).

3. Most of the calculations were carried out with RALS and GIVE programs by Hendry and Srba (1978).

4. Results are very much in line with those obtained by using 'old' Finnish quarterly and annual data over the period 1959-1977 (Koskela and Virén) (1980)).

5. (I-1) was also estimated by using various lag structures for explanatory variables and only the term $(s/y)_{t-2}$ turned out to be significant. Of various additional explanatory variables, like the real interest rate and the rate of unemployment, only the rate of unemployment was significant, but failed in stability tests (P(16) = 50.434/.000020). Finally, (I-1) was estimated with instrumental variable technique with various sets of instruments. When both $\Delta\log p_t$ and $\Delta\log y_t$ were considered endogenous, the following 'representative' saving function was obtained

$$
\begin{array}{llllll}
(1) & \Delta(s/y)_t = & -.0021 & + .3829\Delta\log p_t & + .5276\Delta\log y_t & - .4530(s/y)_{t-} \\
 & & (0.42) & (1.86) & (3.22) & (4.13) \\
 & & .33787 & .033514 & .000967 & .000049
\end{array}
$$

$$DW = 2.177,\ Q(12) = 17.580/.129051,\ S = .01442$$

(S denotes the standard deviation of residuals; the set of instruments included here: $\Delta(s/y)_{t-1}$, p_{t-1}, y_{t-1}, $(s/y)_{t-2}$, $\Delta\log GDP_{t-1}$, $\Delta\log M_1$, $\Delta\log X_t$ (i.e. value of exports), $\Delta\log G_t$ (i.e. value of public consumption), U_{t-1} (rate of unemployment), r_t).

6. Specifications I-III was also estimated by using 1^{st}, 2^{nd}, 3^{rd} and 4^{th} order Cochrane-Orcutt procedure and the results were roughly similar to those which have been reported. We even allowed the error term to follow an AR(8) process with no marked change in results; when testing the H_0: $a_1 = a_2 \ldots a_8 = 0$, the A(8)-statistic was 20.679/.008049 for equation I and 14.900/.061115 for equation III, thus suggesting that the error term of the latter equation (but not that of the former one is white noise.

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