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INDEXATION AND HOUSEHOLD SAVING BEHAVIOR: SOME EMPIRICAL EVIDENCE

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ABSTRACT

This paper attempts to shed some light on the empirically unsolved issues concerning the impact on the saving behavior of households of the introduction of indexed financial assets. Quite suitable data from Finland are utilized, and empirical findings support the view that the hedging ability of indexed assets can affect the portfolio decision. The hypothesis that indexation of financial assets leave the savings ratio unaltered could, however, not be rejected.

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CONTENTS

1 INTRODUCTION

Various arguments in favor of the introduction of indexed financial assets have been advocated. In these the saver's right to a positive real rate of return and the opportunity to reduce risks associated with inflation uncertainty is stressed. The possibility to stimulate household saving has also been discussed. Theoretically it has been shown that the introduction of indexed financial assets indeed may affect the saving behavior of households in many ways. The hedging ability, the distinct feature of indexed assets, may thus affect the portfolio decision (Fischer (1975)), while the effect on the savings ratio in general is ambiguous (Bhattacharya (1979)). Because of the lack of suitable data no empirical analyses of these issues have been conducted, thus limiting the discussion to the theoretical level only. The aim of this paper is to produce empirical evidence of how indexation affects household saving behavior by utilizing rather unique Finnish data.

2 THEORETICAL CONSIDERATIONS AND ESTIMATED MODELS

The hedging ability

The key feature of an indexed asset is the ability to act as a hedge against inflation. When assessing the impact of such an asset on the saving decision empirical it is of cruical importance to know just how good a hedge the asset under consideration actually was, and even more important, how good the hedging ability was relative to other assets.

The indexed assets analysed in this paper are the indexed deposit accounts used in Finland 1955-1968. Interest is focused on the 100 %-indexed A-accounts, on which in addition to a base rate an monthly index provision was paid. On the B-account the provision was half of that of the A-account. These accounts where at times rather popular; in March 1968 indexed deposits accounted for 37,7 % of all deposits. The total interest paid on the indexed deposits will be denoted r_A and r_B, respectively. Other "assets" concidered are the nearest deposit substitute, a high-interest saving account, r_h, indexed and non-indexed government bonds, r_{io} and r_o respectively, and common shares, r_s (computed as a log.diff. of an index of common shares).[1]

The hedging ability of these assets was evaluated econometrically. The results indicate that only the A-account was a hedge against inflation (the analysis is presented in Appendix 1). This situation is favourable as there are no other assets which could blur the assessment of the consequences of indexation.

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[1] All data used in this study was provided by the Bank of Finland and the Central Statistical Office of Finland, except the index data, which was kindly provided by the Savings Banks' Research Foundation, and the series for r_{io} and r_o, which were constructed by Paunio & Suvanto (1975).

The demand for an indexed asset

Taking into account the purchasing-power risk associated with the uncertain future inflation rate when modelling household portfolio behavior brings a hedging motive into the demand for an asset. This is formally demonstrated in e.g. Boonekamp (1978) where a portfolio model is defined in terms of the real value of the household's wealth. The author demonstrates the consequences of price uncertainty for the allocation of wealth between two monetary assets, one of which is money. Money is considered a safe asset in nominal, but not in real, terms, while the other asset may be risky in both nominal and real terms. Boonekamp derives the following asset demand equation

$$(1) \qquad Q = (r/\mathrm{var}(r))\mathrm{RRA}^{-1} + (\mathrm{cov}(r, \pi)/\mathrm{var}(r))(1 - \mathrm{RRA}^{-1})$$

where the demand Q is expressed as a fraction of present real wealth (W), r = expected nominal rate of return of the asset, var(r) = variance of the rate of return (nominal rate of return risk), cov(r, π) = covariance between the rate of return and inflation (hedging ability) and RRA = the Arrow & Pratt measure of relative risk aversion. We note that the demand can be separated into a speculative demand and a hedging demand. The latter component vanishes if the price level is known with certainty, if the asset cannot act as a hedge agains inflation, or if RRA = 1. In this study, however, none of these conditions are likely to be met.

Throughout the analysis it is assumed that RRA is a constant (Friend & Blume (1975) present empirical evidence in favour of this assumption). The demand equation (1) provides a framework for analysing the demand for an indexed asset in general, and the inflation hedging motive in particular. By proxying W with an income variable Y, and by linearizing the multiplicative terms, one obtains the following specification of the demand for an indexed asset

(2) $$\ln i_t = a_o + a_1 \ln y_t + a_2 r_t + a_3 var_t + a_4 cov_t + u_t$$

where lni = natural logrithm of real per capita index deposits, lny = natural logarithm of real per capita household disposable income, r = expected total nominal yield on index deposits, var = lagged 4-quarter moving variance of r, cov = lagged 4-quarter moving covariance between r and the inflation rate. u is an error term, t denotes the time subscript, and the cost-of-living index is used for deflating and in the inflation rate (log.diff. of the cost-of-living index).

We note that the hedging demand (the latter component in the theoretical model (1)) in the empirical model (2) is represented by the two separate variables var_t and cov_t. Testing for the relevance of the hedging motive thus basically amounts to testing the hypothesis that $a_3 = a_4 = 0$. Furthermore only the expected signs of a_2 and a_3 are unambiguously given by the model (1); a_2 should have a positive and a_3 a negative sign.

Indexation and the savings ratio

Until quite recently it was widely believed that the introduction of indexed financial assets would increase the household savings ratio (see e.g. Levhari & Liviatan (1979)). Theoretically the effect depends i.a. on the precise form of the household's utility function, and Bhattacharya (1979) shows that the effect in general is ambiguous. Thus interest is focused on providing empirical evidence that could bear on this issue.

The analysis is carried out within the "money illusion" savings function proposed by Deaton (1977). In this specification unanticipated real income ($y-y^e$) and unanticipated inflation ($\pi-\pi^e$) affect the savings ratio (s/y) positively together with the one period lagged savings ratio

$$(3) \qquad (s/y)_t = b_0 + b_1(y-y^e) + b_2(\pi-\pi^e)_t + b_3(s/y)_{t-1} + v_t$$

where superscript e denotes an expected variable (from an univariate AR(2) model) and v is an error term. Three different attempts to detect the effect of indexation are made. First, the significance of an auxiliary variable i/I, the share of indexed deposits in total deposits, is evaluated. Second, the significance of a dummy variable D, set at 1 during the indexed period (I) 1955-1968, and at 0 during the non-indexed period (NI) 1969-1981, is observed. Third, a stability test of the Chow-type is performed using 1968/1969 as the breaking point.

3 ESTIMATION RESULTS

The demand for an indexed asset

Estimation results with model (2) and the fully indexed A-accounts (and the cost-of-living index as deflator) are presented in Table 1.[2] In addition to OLS estimates results with Hatanaka's (1976) efficient and consistent two-step estimator are displayed.[3] As the variables var_t and cov_t to a large extent contain the same information, the sensitivity of the specifications to adjustment for multicollinearity was evaluated by means of the Hoerl & Kennard (1970) ridge regression. As the choice of proxy for household wealth W might not be trivial, two proxies in the context of quarterly data, and two other in the context of monthly data will be employed. We now turn to results with quarterly data with household real disposable income and the trend component of this variable as alternative proxies for W.

On the whole specification (2) performs rather well. The nominal rate of return and the nominal risk always display the expected sign, and they are mostly quite precisely estimated. The hedging demand differs significantly from zero, and the variables are

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[2] Because of low degrees of freedom actual, instead of expected, variables had to be used. Separate tests for the constancy of a_3 and a_4 where also performed, but as the results of these did not differ from the joint test only one test is reported. The choice of deflator was made on the basis of over-all model performance. The Davidson & MacKinnon (1981) J-test could not conclusively order the models using a cost-of-living index and a GDP-deflator (t-ratios for A-accounts were .44 vs. 1.58, and for B-accounts .04 vs. 1.40).

[3] Note that $\bar{R}^2$ statistics and t-ratios are not strictly comparable across equations whenever adjustment for serial correlation is made. The dependent variable is a function of the $\tilde{u}$:s, and equations with different $\tilde{u}$:s thus have different dependent variables and different variances.

TABLE 1 Estimation results with model (2)

no	(1a)	(2a)	(3a)	(4a)	(2b)	(4b)	(2c)	(4c)
constant	-1.56	-4.71	-.278	8.34	-5.69	32.4	-3.28	4.16
	(1.38)	(2.75)	(.55)	(1.45)	(5.90)	(5.59)	(2.74)	(1.04)
y_t	-.403	-8.41	1.81	-14.4	-10.4	-45.8	-5.46	-.805
	(.13)	(1.75)	(.27)	(1.80)	(3.20)	(6.29)	(1.45)	(1.50)
r_t	.019	.160	1.85	.182	.185	.150	.086	.108
	(.28)	(2.03)	(.28)	(2.19)	(3.16)	(3.97)	(1.88)	(1.98)
var_t		-.840		-.944	-.535	-.450	-.581	-.642
		(2.50)		(2.56)	(2.32)	(3.09)	(2.20)	(2.31)
cov_t		-.538		-.451	-.215	-.022	-.594	-.518
		(.82)		(.69)	(.74)	(.11)	(.89)	(.77)
$\bar{R}^2$	-.1121	.2447	-.1084	.2022	.5322	.7733	.1420	.1291
LM(4)	19.1	12.5	18.4	17.2				
Engle	2.41	9.03	5.12	9.43				
STAB		1.31		1.30				
F		4.52		2.37				
S	5.07	1.48	4.32	2.72				
$\tilde{u}_{t-1}$	2.79	.861	3.91	.539	.735	.814		
	(5.17)	(1.45)	(5.19)	(.91)	(6.15)	(16.5)		
$\tilde{u}_{t-2}$	-1.73	-.705	-2.46	-.243				
	(1.57)	(.85)	(1.63)	(.41)				
$\tilde{u}_{t-3}$	3.33	-.705	2.85	.369				
	(2.81)	(.85)	(1.69)	(1.04)				
$\tilde{u}_{t-4}$	-2.20	-.039	-2.20	-.023				
	(3.33)	(.08)	(1.68)	(.07)				
W-proxy	y	y	trend y	trend y	y	trend y	y	trend y
method	OLS	OLS	OLS	OLS	H2S	H2S	HK	HK

KEY

Absolute t-ratios are reported in parentheses under the estimated coefficients. OLS denotes ordinary least-squares estimates, H2S estimates from the two-step procedure of Hatanaka (1976) and HK estimates from the Hoerl & Kennard (1970) ridge regression. $\bar{R}^2$ is the squared multiple correlation coefficient adjusted for degrees of freedom. LM(4) is the Breusch (1978) test computed from four autocorrelations. The $\tilde{u}_{t-i}$:s, where i (= 1, 2, 3, 4) refers to the order, on the other hand denote autocorrelations of order i computed in the context of Breusch's test (when in an OLS-column), and on the other hand filters used in the final iteration in the Hatanaka procedure (when in an H2S-column). Engle is the Engle (1982) test, and STAB the Ashley (1984) test for the coefficients of var_t and cov_t. F is a F-test for the hypothesis that the coefficients of var_t and cov_t both are zero. S is the Davidson & MacKinnon (1984) version of the test of Plosser et.al. (1982). The estimates are based on quarterly data covering 1964/II-1969/I, thus containing 20 observations. The coefficients of var_t and cov_t have been divided by 1000. $\chi^2_{.05,\,4} = 9.49$, $\chi^2_{.01,\,4} = 13.3$, $F_{.05,\,7,\,8} = 3.50$, $F_{.01,\,7,\,8} = 6.18$, $F_{.05,\,2,\,16} = 3.63$, $F_{.01,\,2,\,16} = 6.23$, $F_{.05,\,2,\,13} = 3.81$, $F_{.01,\,2,\,13} = 6.70$, $F_{.05,\,4,\,9} = 3.63$ and $F_{.01,\,4,\,9} = 6.42$.

constant over time. Neither autocorrelation nor heteroskedasticity[4] pose any crucial problem, and the performance in terms of $\bar{R}^2$ is tolerable. Multicollinearity does not seem to be any problem. Furthermore, the specification is rather robust with respect to different proxies for W.

The hedging component turned out to be a most crucial element in the demand for the indexed asset. If this component (i.e. the variables var_t and cov_t) is omitted, the resulting (speculative) model makes no sense what so ever. More precisely, it turned out that the omission of the nominal risk variable var_t accounted for most of the significance. The model was largely unaffected by the omission of the hedging variable cov_t and by various leads and lags of the variable. On an average a_3 was twice as large as a_4, and it was not possible to reject the hypothesis that c_4 was equal to zero.

The rather convincing insignificance of the hedging variable cov_t might be somewhat unexpected, and seems to warrant a closer examination. We note that the model (1) itself does not seem to imply the insignificance. The price level was not known with certainty (there certainly existed a stochastic element in the inflation), the A-account did provide a good hedge against inflation, and there seems to be a concensus that the relative risk aversion exceeds one. If, on the other hand, the covariance term actually is of relatively minor importance, then the low degrees of freedom (15) might make the documentation of this theoretically well motivated variable difficult.

In order to increase the degrees of freedom - and to contrast the model with more detailed data - model (2) was reestimated using monthly data. This, however, necessiated the construction of new proxies for W. In this context the (seasonally adjusted) total industrial production and a linear time trend were used. The connection between household wealth and these proxies is,

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[4] Following the spelling advocated by McCulloch (1985).

admittedly, far from immediate and clear, thus casting doubt over the resulting specifications.

Estimation results with monthly data are presented in Table 2. Several features merit attention, but above all one is left with the same impression as in the previous sections; one cannot comfortably reject the hypothesis that the covariance is of negligible importance for the demand.[5] The t-ratio of a_4 does on several occations exceed two (and a_4 is typically larger than a_3), but on all occations the estimated models suffer from serious drawbacks. Above all, autocorrelation among residuals proved to be irremovable (thus leaving the tests for significance rejecting the null too often).[6] Fragility with respect to the estimated period, "wrong" signs and heteroskedasticity cast further doubt on the reliability of the proxies for W. Thus it seems preferable to work with quarterly data in subsequent analyses.

While model (1) only is concerned with two assets (one of which is money), the possible impact of other assets may be evaluated empirically. This is done simply by adding terms corresponding to r_h, r_{io}, r_o and r_s to model (2).[7] Estimation results are presented

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[5] The only caveat to this statement seems to stem from the fact that the precise form of the relevant hedging variable is inherently difficult to define on a priori grounds. In the monthly context a lagged 12-month covariance (and variance) was used. The alternative to the direct use of the theoretical formulation (from (1)) would be some sort of "data mining", but such an approach seems highly questionable.

[6] No type of adjustment (Hatanaka two-step, Hildreth & Lu or Cochrane & Orcutt) produced residuals indistinguishable from white noise at the 1 %-level (e.g. in (6b) Q(12) = 401!).

[7] In this context theoretically more sound expected values were employed. These were obtained from various expectation models selected on the basis of explanatory power.

TABLE 2 Estimation results with model (2) and monthly data

no	(1a)	(2a)	(2b)	(2c)	(3a)	(4a)	(4b)	(4c)	(5a)	(6a)	(6b)	(6c)
constant	-6.84	-5.64	-3.73	-1.29	-.067	-.061	-2.93	-.060	1.95	2.09	24.6	2.62
	(3.24)	(2.63)	(1.01)	(1.32)	(1.34)	(1.27)	(1.58)	(1.25)	(4.17)	(5.08)	(3.58)	(7.68)
y_t	21.1	-17.9	-2.92	-7.82	-3.57	-2.68	.797	-1.94	.322	-3.26	-35.4	-.711
	(4.27)	(3.50)	(.89)	(3.81)	(1.08)	(.84)	(.70)	(.92)	(.46)	(3.03)	(3.75)	(1.00)
r_t	-.074	-.016	.099	.019	.049	.083	-.002	.052	.013	.232	.077	.014
	(1.65)	(.27)	(1.73)	(.95)	(1.57)	(2.63)	(.15)	(2.37)	(.27)	(3.45)	(2.33)	(2.94)
var_t		-.148	-.217	-.195		-.222	-.258	-.115		-1.02	-.325	-.272
		(.87)	(.85)	(1.34)		(.89)	(1.21)	(.50)		(3.57)	(1.41)	(1.54)
cov_t		-1.11	-1.24	-1.22		-1.27	-.548	-1.19		-1.65	-1.28	-1.22
		(1.85)	(2.17)	(2.02)		(2.43)	(1.33)	(2.30)		(2.68)	(2.63)	(2.04)
$\bar{R}^2$	.2206	.2604	.2390	.2301	.0303	.1131	.0437	.0984	-.0301	.2246	.2067	.2140
LM(12)	40.1	44.9			47.9	43.0			57.9	55.3		
Engle	52.1	51.9			29.9	24.8			56.8	51.9		
F		2.41				3.45				7.40		
S	.39	.50			1.00	1.65			.52	2.70		
ρ			.986				.986				.972	
			(44.4)				(44.4)				(31.5)	
W-proxy	y	y	y	y	y	y	y	y	trend y	trend y	trend y	trend y
method	OLS	OLS	CO	HK	OLS	OLS	CO	HK	OLS	OLS	CO	HK

KEY

(3a), (4a), (4b) and (4c) are based on the first difference form of model (2) (strictly, the inclusion of a constant term in the differenced model is incorrect, but defendable because of restrictions posed by the regression-package in the case of (4b) and (4c), and because the exclusion of the constant term in (3a) and (4a) caused virtually no changes in coefficients and over-all performance). The first-order autocorrelation coefficient is denoted ρ, and ρ in (2b) was forced to take the value estimated in (4b). Estimation by the Cochrane & Orcutt method is indicated by CO. Other symbols are explained in the KEY of Table 1. Data is monthly and cover the period 1964/5-1969/3, and the number of observations is 59 (one observation is lost in differencing). $\chi^2_{.05,\ 12} = 21.0$, $\chi^2_{.01,\ 12} = 26.2$, $F_{.05,\ 2,\ 54} = 3.17$, $F_{.01,\ 2,\ 54} = 5.04$, $F_{.05,\ 2,\ 53} = 3.18$, $F_{.01,\ 2,\ 53} = 5.05$, $F_{.05,\ 1,\ 53} = 4.03$, $F_{.01,\ 1,\ 53} = 7.16$, $F_{.05,\ 2,\ 52} = 3.18$, $F_{.01,\ 2,\ 52} = 5.06$, $F_{.05,\ 2,\ 51} = 3.19$, $F_{.01,\ 2,\ 51} = 5.07$, $F_{.05,\ 3,\ 49} = 2.57$, $F_{.01,\ 3,\ 49} = 3.75$, $F_{.05,\ 4,\ 48} = 2.58$, $F_{.01,\ 4,\ 48} = 3.76$, $F_{.05,\ 4,\ 47} = 2.58$ and $F_{.01,\ 4,\ 47} = 3.77$.

in Table 3. In all cases the auxiliary variables significantly improve the basic model without notable consequences for the basic variables (the income elasticity being an exception). Yield variables are in general significant, but other variables are in general insignificant. The ridge-regressions are of special interest, since multicollinearity in this context to some extent is a problem. The main results, that model (2) is robust to extensions, and that r_h and r_{io} affects the demand positively and r_s negatively, are, however, not altered by modest manipulation of the OLS variance-covariance matrix.

We shall finally analyse to what extent the hedging component in the demand for an indexed asset is of relevance in the case of a partially indexed asset. Estimation results with B-accounts and with an weighted average of A- and B-accounts are presented in Table 4. In the latter case it was possible to use the theoretically more sound expected variables utilized in Table 3. Though the inflation uncertainty approach does not seem to be inappropriate, empirical evidence does suggest that the hedging component in this context is of neglible importance. This conclusion furthermore appears to be robust to alternative deflators and combinations of auxiliary variables (a full set of results are obtainable from the author upon request).[8]

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[8] Dummies D_i (i = 1, 2,..., 5) take the value 1 (otherwise 0) in the following cases: D_A and D_B; A- and B-accounts in use, D_{AT} and D_{BT}; A- and B-accounts liable to tax, and D_T; a tax concession deposit account in use.

TABLE 3 Estimation results with model (2) and other assets

no	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4c)	(1c)	(2c)	(3c)	(4c)
constant	-46.1	-6.21	-3.26	-1.92	-42.9	-7.06	-4.89	-3.48	-1.55	-5.35	-2.75	-1.32
	(5.14)	(4.03)	(2.21)	(1.79)	(9.41)	(7.85)	(5.34)	(4.05)	(3.52)	(3.67)	(2.06)	(1.74)
y_t	5.71	-1.70	.298	1.28	8.46	-10.5	-9.85	-3.90	-1.34	-3.42	.304	1.43
	(1.31)	(.36)	(.06)	(.43)	(3.86)	(2.74)	(2.97)	(1.50)	(.99)	(.77)	(.07)	(.59)
r_t	.075	.320	.304	.137	.088	.216	.287	.156	.014	.242	.214	.054
	(1.37)	(3.78)	(3.89)	(1.87)	(3.35)	(2.66)	(6.24)	(3.39)	(1.41)	(3.43)	(3.88)	(1.86)
var_t	-.314	-.941	-1.02	-.375	-.252	-.781	-.923	-.696	-.297	-.836	-.817	-.136
	(1.28)	(3.37)	(3.88)	(1.34)	(1.98)	(1.36)	(4.95)	(3.01)	(1.24)	(3.05)	(3.39)	(.80)
cov_t	-.116	-.363	.027	-.360	-.194	.095	-.140	.052	-.598	-.447	-.110	-.540
	(.26)	(.67)	(.04)	(.95)	(.77)	(.27)	(.49)	(.14)	(.84)	(.79)	(.19)	(1.45)
rZ_t	7.76	.412	.032	-.058	7.30	.024	-.083	-.045	.001	.270	.041	-.057
	(4.65)	(3.04)	(.29)	(3.81)	(9.13)	(2.26)	(1.36)	(3.93)	(3.04)	(2.78)	(.69)	(3.91)
$varZ_t$			-1.88	.038			-2.50	.020			-.135	.060
			(1.84)	(.91)			(3.88)	(.64)			(1.64)	(1.73)
$covZ_t$		3.27	-1.43	.370		-.362	.339	.237		2.14	-1.49	.447
		(1.04)	(.99)	(2.08)		(.91)	(.37)	(2.35)		(.68)	(1.05)	(2.54)
$\bar{R}^2$	.6840	.5007	.5672	.7938	.8723	.7179	.7069	.8923	.6077	.5291	.5307	.7798
LM(4)	17.7	12.0	19.5	14.1								
Engle	7.04	7.14	1.34	10.2								
F	21.7	5.35	3.83	11.7								
$\tilde{u}_{t-1}$	.978	-.220	.874	-1.18			.407					
	(3.44)	(.43)	(5.39)	(1.54)			(1.44)					
$\tilde{u}_{t-2}$	-.316	-.180	5.39	1.54				-.359				
	(.94)	(.40)	(1.01)	(1.98)				(1.71)				
$\tilde{u}_{t-3}$	-.261	.255	-.058	-.968		.177						
	(.76)	(.50)	(.52)	(1.35)		(.90)						
$\tilde{u}_{t-4}$	-.560	.464	-.002	-1.09	-.857							
	(2.32)	(.91)	(.01)	(1.65)	(3.95)							
Z	r_h	r_{io}	r_o	r_s	r_h	r_{io}	r_o	r_s	r_h	r_{io}	r_o	r_s
W-proxy	y	y	y	y	y	y	y	y	y	y	y	y
method	OLS	OLS	OLS	OLS	H2S	H2S	H2S	H2S	HK	HK	HK	HK

KEY

F is a F-test for the hypothesis that all the parameters associated with an asset Z are equal to zero. See Table 1 for other symbols. $F_{.05,\ 3,\ 10} = 3.71$ and $F_{.01,\ 3,\ 10} = 6.55$.

TABLE 4 Estimation results with model (2) and partially indexed assets

no	(1a)	(2a)	(3a)	(4a)	(1b)	(2b)	(3b)	(4b)
constant	-8.37	-10.4	-.186	-4.34	-10.3	-13.2	-3.86	-3.69
	(7.07)	(9.01)	(.12)	(4.01)	(11.3)	(9.35)	(1.57)	(1.57)
y_t	-7.25	-12.3	8.63	-10.7	-8.81	-20.4	-9.38	-6.73
	(4.43)	(6.10)	(3.16)	(3.17)	(6.85)	(6.01)	(3.12)	(2.99)
r_t	.278	.194	.115	-.018	.503	.138	.011	.025
	(1.99)	(1.63)	(1.06)	(.29)	(5.20)	(1.26)	(.268)	(.69)
var_t	-1.42	2.58	.433	.407	-2.44	-3.60	.307	.322
	(.33)	(.72)	(.83)	(1.30)	(1.01)	(1.02)	(1.47)	(1.96)
cov_t	-.259	-.103	.518	.037	.298	-.158	-.117	.314
	(.10)	(.05)	(.47)	(.07)	(.21)	(.07)	(.39)	(1.40)
D_A		1.13		.559		1.81		.805
		(3.39)		(1.78)		(5.09)		(4.34)
D_B				-1.44				-1.24
				(3.97)				(5.63)
D_{AT}				-1.64				-1.53
				(4.25)				(6.93)
D_{BT}				-1.33				-.811
				(3.51)				(3.74)
D_T				-1.38				-.314
				(2.03)				(.79)
$\bar{R}^2$	.3883	.5757	34477	.9155	.6419	.5730	.1754	.9591
LM(4)	22.7	12.9	30.5	8.91				
Engle	9.86	.91	15.6	15.5				
F	.32	1.04	.62	.17				
$\tilde{u}_{t-1}$	1.48	.885	1.24	.355	-.714	.122	.963	.551
	(4.69)	(2.67)	(6.00)	(1.71)	(4.22)	(.56)	(31.0)	(3.47)
$\tilde{u}_{t-2}$	-.838	-.484	-.379	-.143				
	(1.70)	(1.06)	(1.38)	(.66)				
$\tilde{u}_{t-3}$	.083	.035	.530	-.441				-.763
	(.17)	(.08)	(1.67)	(2.06)				(4.46)
$\tilde{u}_{t-4}$	-.132	.058	-.552	-.084				
	(.41)	(.01)	(2.57)	(.35)				
W-proxy	y	y	y	y	y	y	y	y
method	OLS	OLS	OLS	OLS	H2S	H2S	H2S	H2S

KEY

In (1a), (2a), (1b) and (2b) B-indexdeposits are used. Data cover the period 1960/I-1967/I, and the number of observations is 29. (3a), (4a), (3b) and (4b) are based on a weighted average of A- and B-indexdeposits. The covered period is 1960/I-1969/I, and the number of observations is 37. See Table 1 for an explanation of symbols. $X^2_{.05,\ 4} = 9.49$, $X^2_{.01,\ 4} = 13.3$, $F_{.05,\ 4,\ 78} = 2.51$, and $F_{.01,\ 4,\ 78} = 3.65$.

Indexation and the savings ratio

Estimation results with the saving specification (3) are presented in Table 5. The basic model fits the data quite well, although some signs of (higher order) autocorrelation can be detected. The lagged dependent variable thus necessiates the use of Hatanaka's (1976) two-step procedure. Results are rather uniform across periods the only notable exception being the coefficient of unexpected inflation. Rather than relating the estimates of b_2 to differences in indexing schemes, one may interpret the findings as fading money illusion due to growing general economic awareness.

Different estimation results regarding the impact on the savings ratio are per se rather clear-clut. No simple relationship between the savings ratio and the share of indexed deposits in total deposits can be detected. No impact due to different regimes can be documented through the use of a dummy variable either.[9] Likewise, it is not possible to reject the hypothesis of a constant relationship between the savings ratio and it's determinants. In brief, no impact what so ever on the savings ratio could be detected. This result stands in contrast to the theoretical result of e.g. Levhari & Liviatan (1979), but lies in accordance with the fuller theoretical analysis of Bhattacharya (1979). Since the methodology employed here by no means is the only conceivable, the interpretion of the - per se conclusive - estimation results still must be labelled tentative. There is, however, some support for the view that the indexed deposits increased one particular form of saving, namely saving in the form of bank deposits (see Appendix 2).

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[9] Indexed bonds existed throughout the whole period, and hence do not matter for the analyses.

TABLE 5 Estimation results with model (3)

no	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
period	I	I	NI	I+NI	I+NI	I	I	NI	I+NI	I+NI
constant	.015	.021	.017	.016	.016	.011	.011	.030	.020	.020
	(4.73)	(4.39)	(3.88)	(6.28)	(4.89)	(2.65)	(1.51)	(3.98)	(3.27)	(3.07)
$(y-y^e)_t$	.534	.496	.655	.620	.618	.477	.480	.649	.598	.597
	(4.45)	(4.15)	(8.06)	(10.1)	(9.66)	(4.95)	(4.79)	(9.84)	(11.5)	(11.2)
$(\pi-\pi^e)_t$	.481	.485	.067	.220	.218	.486	.481	.045	.186	.187
	(2.18)	(2.25)	(.40)	(1.73)	(1.68)	(3.36)	(3.22)	(.37)	(1.76)	(1.77)
$(s/y)_{t-1}$	.343	.261	.411	.391	.388	.241	.245	.175	.211	.209
	(2.75)	(1.99)	(3.83)	(5.34)	(4.96)	(1.57)	(1.60)	(1.63)	(2.35)	(2.25)
D					-.000					-.001
					(.09)					(.10)
$(i/I)_t$		-.042					.003			
		(1.62)					(.11)			
$\bar{R}^2$	.4710	.4979	.5635	.5654	.5601	.5670	.5385	.7041	.6108	.6058
LM(4)	9.07	7.45	13.5	21.2	22.0					
Engle	5.94	5.91	3.09	1.92	1.74					
Chow				1.95						
$\tilde{v}_{t-1}$	-.116	-.132	.125	.049	.084	-.151	-.156	.254	.126	.127
	(.39)	(.39)	(.66)	(.33)	(.56)	(.64)	(.66)	(1.43)	(.90)	(.89)
$\tilde{v}_{t-2}$	.247	.210	.175	.270	.269	.247	.249	.043	.238	.237
	(1.09)	(.114)	(.356)	(.362)	(.359)	(.153)	(.162)	(.349)	(.307)	(.305)
$\tilde{v}_{t-3}$	.207	.114	.356	.362	.359	.153	.162	.349	.307	.305
	(1.04)	(.56)	(2.51)	(3.39)	(3.36)	(.85)	(.84)	(2.39)	(2.75)	(2.73)
$\tilde{v}_{t-4}$	.263	.216	.100	.114	.121	.217	.224	.013	.067	.064
	(.66)	(1.10)	(.66)	(1.00)	(1.06)	(1.27)	(1.25)	(.08)	(.60)	(.57)
method	OLS	OLS	OLS	OLS	OLS	H2S	H2S	H2S	H2S	H2S

KEY

Estimation periods and number of observations are: indexed (I) 1960/III-1969/I, 35; non-indexed (NI) 1969/II-1981/IV, 51; and indexed and non-indexed (I+NI) 1960/III-1981/IV, 86. Chow indicates a stability test with the breaking point 1969/I/II. Other symbols are explained in Table 1. $\chi^2_{.05,\ 4} = 9.49$, $\chi^2_{.01,\ 4} = 13.3$, $F_{.05,\ 4,\ 78} = 2.51$, and $F_{.01,\ 4,\ 78} = 3.65$.

4 SUMMARY AND CONCLUSIONS

The impact of indexed financial assets on the saving behavior of households has been addressed in numerous theoretical papers. The consensus that seems to emerge from the latest studies is that while the portfolio allocation definitely is affected, the effect on the savings ratio is ambiguous. Because of the lack of suitable data, no empirical evidence to bear on these issues has, however, been presented.

In this paper data from Finland is utilized to produce empirical evidence on the effects of indexation on the saving behavior of households. Findings support the view that the hedging ability of a fully indexed asset in the presence of inflation uncertainty causes reallocation through a hedging demand towards a larger share of indexed assets. This conclusion seems fairly robust with respect to various proxies for household wealth, modification of the basic model, and estimation methods. Empirical findings regarding the effect on the savings ratio did not reveal any measurable impact. Yet, one has to stress the need for alternative assessments, as well as for analyses of other types of assets in other monetary environments, in order to get a fuller and more accurate picture.

APPENDIX 1

AN EMPIRICAL EVALUATION OF THE HEDGING ABILITY OF CERTAIN FINANCIAL ASSETS

The hedging ability was evaluated as in e.g. Fama & Schwert (1977). For each asset a Fisher equation of the form (A1.1) was estimated

$$\text{(A1.1)} \qquad r_{Z_t} = c_0 + c_1 \, {}_{t-1}\pi^e_t + c_2({\pi_t} - {}_{t-1}\pi^e_t) + e_t$$

where r_Z = total nominal yield of the asset under concideration, ${}_{t-1}\pi^e_t$ = expected inflation rate in period t conditional on the information set at period t-1 (obtained from a time-series model) and π_t = actual inflation rate in period t. If $c_1 = 1$ ($c_2 = 1$) the asset is said to be a complete hedge against expected (unexpected) inflation, and if $c_1 = c_2 = 1$) the asset was a complete hedge against inflation.

Estimation results with seasonally unadjusted data are presented in Table A.1. Estimation results with monthly or annual data could not alter the conclusions drawn from quarterly data, and hence are not reported. Furthermore only results with Hatanaka's (1976) efficient two-step method (H2S) are reported, since OLS-estimates where frequently plagued by severe autocorrelation of orders higher than one in the estimated residuals (a full set of results is available from the author upon request).

Interestingly enough only the 100 %-indexed A-account seems to have been a good hedge against expected inflation. The hedging ability, measured by the coefficient c_1, is rather exactly estimated, and does not differ significantly from one. On the other hand the estimated c_1 is not exactly one. A closer examination of the time

TABLE A.1 Estimation results with model (A1.1)

no	(1)	(2)	(3)	(4)	(5)	(6)
regressand	r_A	r_B	r_h	r_{io}	r_o	r_s
constant	.031	.035	.058	.082	.103	-.042
	(2.63)	(23.1)	(49.4)	(3.57)	(3.22)	(1.01)
${}_{t-1}\pi^e_t$	.931	.531	.025	-.240	.249	.238
	(.40)	(14.7)	(89.6)	(13.3)	(4.74)	(1.01)
	(5.38)	(16.6)	(2.28)	(2.65)	(1.57)	(.34)
$(\pi_t - {}_{t-1}\pi^e_t)$	.294	.187	.007	.056	-.109	-1.52
	(3.01)	(13.4)	(65.6)	(10.6)	(4.80)	(3.64)
	(1.25)	(3.07)	(.45)	(.62)	(.46)	(2.19)
$\bar{R}^2$	.4375	.9172	.2322	.3336	.1378	.2139
Q(12)	9.84	7.79	5.03	8.28	14.1	9.12
$\tilde{e}_{t-1}$	.633	.222	.752	1.04	.707	1.15
	(5.71)	(2.89)	(2.37)	(7.04)	(3.44)	(11.1)
$\tilde{e}_{t-4}$	-.164	-.168	.031	.126	.465	-.100
	(1.60)	(4.01)	(.26)	(.37)	(1.46)	(4.42)
N	40	41	24	24	24	24
period	1955/III- 1968/IV	1957/I- 1967/I	1963/II- 1969/I	1963/II- 1969/I	1963/II- 1969/I	1963/II- 1969/I
method	H2S	H2S	H2S	H2S	H2S	H2S

KEY

Absolute t-ratios are reported in parentheses under the estimated coefficients. The upper ratio refers to the test under $H_0 = 1$, and the lower to the test when $H_0 = 0$ (note that the tests reject the (null-) hypotheses concerning the expected inflation rate too often; see e.g. Pagan (1984)). R^2 is the squared multiple correlation coefficient, and Q(12) denotes the Prothero & Wallis (1976) version of the Box & Pierce (1970) test advocated by Ljung & Box (1978) calculated from 12 autocorrelation coefficients. The filters used in Hatanaka's (1976) two-step method (H2S) are denoted $\tilde{e}_{t-1}$, where i (= 1, 4) refers to the order of the filter. N refers to the number of quarterly observations. $\chi^2_{.05,\,12} = 21.0$, $\chi^2_{.01,\,12} = 26.2$.

series of r_A and ${}_{t-1}\pi_t^e$ suggests that the small deviation from a perfect hedge was caused by the lag by which the index-provisions were paid (about three months), and by the fact that the base rate was changed once during the period. Adjusting for the time lag (or employing the ${}_{t-1}\pi_t^e$-series of Paunio & Suvanto (1975)) furthermore yielded a coefficient of the unexpected inflation that was indistinguishable from one. The partially indexed B-account as conjectured was a partial hedge against unexpected inflation ($c_1 \approx .5$). No other assets were found to have been hedges against inflation.

The fact that the above analyses mainly reflect conditions in the 1960's calls for a warning note. In the 1970's and in the 1980's quite a few new financial assets have been created, and the hedging ability of the above analysed assets might have changed. Thus it seems questionable wether the results in this study safely could be generalized over time. It would not seem unreasonable to think that elimination of inflation risk in the 1980's - even without the use of explicit indexation clauses - is easier than in the 1960's.

APPENDIX 2

AN EMPIRICAL EVALUATION OF THE EFFECTS OF INDEXED DEPOSITS ON BANK SAVINGS

The main analyses support the view, that while the presence of indexed accounts did alter portfolio allocation, it did not affect the savings ratio as an aggregate. The question then arises, which type of savings - which "assets" - were superseded by the indexed accounts. We know that the indexed accounts at times were rather popular, and that they might have increased deposits on the whole (Ranki (1981), p. 148, fn. 58). Thus it is natural to analyse whether saving through banks increased or not.

The evaluation was carried out within model (3) along the same lines as in the main analysis. In stead of the savings ratio a deposit ratio (I/y) was used. Thus, it must be emphasised that the resulting specification cannot be directly related to the theory underlining Deaton's (1977) specification.

Estimation results are collected in Table A.2. The model fits the data very well (in fact even better than when applied to the saving rate). We note a significant, positive relationship between bank savings and the share of indexed deposits in all deposits. The stability test also hints at differences in saving behavior across indexed and non-indexed periods. The significant dummy variable can be interpreted in the same way.

Though the dummy variable is significant, its sign is - contrary to what would be expected - negative. There is, however, reason to believe that the negative sign is due to other factors than the impact of indexing on bank savings. One might e.g. expect, that the dummy has picked up the effects of periods of high inflation. We

TABLE A.2 Estimation results with model (3) and bank savings

no	(1a)	(2a)	(3a)	(4a)	(5a)	(1b)	(2b)	(3b)	(4b)	(5b)
period	I	I	NI	I+NI	I+NI	I	I	NI	I+NI	I+NI
constant	.003	.005	.004	.001	.004	.006	.006	.007	.007	.011
	(2.34)	(3.17)	(2.02)	(.59)	(3.12)	(2.89)	(3.14)	(2.77)	(3.87)	(5.55)
$(y-y^e)_t$	-.018	-.017	-.019	-.019	-.019	-.017	-.017	-.016	-.016	-.017
	(8.37)	(7.74)	(8.27)	(10.7)	(11.4)	(7.69)	(7.85)	(6.54)	(9.26)	(10.7)
$(\pi-\pi^e)_t$	-.020	-.021	-.011	-.013	-.013	-.019	-.021	-.009	-.010	-.010
	(5.09)	(5.37)	(2.23)	(3.47)	(3.68)	(5.74)	(6.61)	(1.85)	(3.17)	(2.99)
$(s/y)_{t-1}$	.879	.797	.857	.979	.845	.745	.719	.714	.721	.562
	(17.6)	(12.7)	(11.7)	(25.6)	(16.5)	(8.65)	(8.29)	(6.93)	(9.95)	(7.06)
D					-.001					-.001
					(3.66)					(4.41)
$(i/I)_t$		.001						.001		
		(2.00)						(2.02)		
$\bar{R}^2$	.9198	.9269	.7696	.8898	.9043	.8048	.8339	.7332	.6936	.7020
LM(4)	5.97	7.18	16.0	10.1	22.4					
Engle	2.85	2.18	3.53	4.24	5.91					
Chow				3.54						
$\tilde{v}_{t-1}$	.092	.062	.215	-.035	.143	.122	.082	.106	.079	.147
	(.43)	(.28)	(1.22)	(.28)	(1.17)	(.72)	(.42)	(.62)	(.72)	(1.24)
$\tilde{v}_{t-2}$	.184	.241	.481	.175	.388	.215	.246	.353	.300	.376
	(.88)	(1.16)	(2.77)	(1.41)	(3.17)	(1.32)	(1.35)	(2.14)	(2.69)	(3.24)
$\tilde{v}_{t-3}$	.324	.379	.435	.277	.382	.426	.397	.321	.384	.336
	(1.53)	(1.74)	(2.66)	(2.29)	(3.28)	(2.43)	(2.25)	(2.10)	(3.52)	(3.08)
$\tilde{v}_{t-4}$	-.107	-.123	.390	.230	.283	.029	-.106	.298	.328	.224
	(.44)	(.51)	(2.57)	(1.87)	(2.43)	(.14)	(.55)	(2.05)	(3.07)	(2.10)
method	OLS	OLS	OLS	OLS	OLS	H2S	H2S	H2S	H2S	H2S

KEY

Estimation periods and number of observations are: indexed (I) 1960/III-1969/I, 35; non-indexed (NI) 1969/II-1981/IV, 51; and indexed and non-indexed (I+NI) 1960/III-1981/IV, 86. Chow indicates a stability test with the breaking point 1969/I/II. Other symbols are explained in Table 1. $\chi^2_{.05,\,4} = 9.49$, $\chi^2_{.01,\,4} = 13.3$, $F_{.05,\,4,\,78} = 2.51$, and $F_{.01,\,4,\,78} = 3.65$.

note that unexpected (and in fact also expected inflation; the estimates are not reported for space reasons) inflation affects bank saving negatively. A negative sign is also produced if the model overpredicts bank savings under the indexed period. In fact this was the case; the endogenous variable was 0.103 % overpredicted under period I, and 0.065 % underpredicted under period NI.

On the whole the analyses indicate that saving through banks was affected by the presence of indexed accounts. Furthermore, this effect most likely was positive.

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