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Abstract:

This note contains empirical results for the 'disequilibrium' saving function specification, in which uncertainty about relative prices in a cross-section sense plays a major role. Quarterly time series evidence from several OECD countries over the period 1967(II)-1980(III) lies in striking conformity with the view - suggested particularly by Deaton - that there is a positive relationship between unanticipated inflation and the saving ratio.

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1. INTRODUCTION

In most western European countries personal saving has recently attained unprecedented levels in relation to personal disposable income and this has been accompanied by equally high inflation rates. Because of their zero degree homogeneity assumption the standard versions of the life cycle and permanent income hypotheses are not, however, well equipped to analyze changes in the inflation rate. While there have been no lack of explanations linking the two (see e.g. Deaton (1977), Gylfason (1981), Howard (1978) and Juster and Wachtel (1972)), perhaps the most interesting hypothesis is the one proposed by Deaton (1977).

Deaton starts from the notion that economic agents have insufficient information to distinguish between relative and general price movements when both are changing simultaneously. Under these circumstances unanticipated inflation is misinterpreted as the rise in the relative prices of the goods economic agents are currently buying, so that real saving increases. Deaton (1977) has developed and tested a formal model of 'disequilibrium' saving along these lines and found some support to it by using the U.K. and U.S. quarterly time series data over the period 1954-1974.

This note contains some further tests of this 'disequilibrium' saving hypothesis in the following respects: First, the hypothesis is tested by using quarterly time series data from Canada, Finland, France, UK and USA over the period 1967(II)-1980(III). Taking account of generally high inflation rates in the late seventies and differences between these countries e.g. in the rate of inflation and working of capital markets it is interesting to look at the performance of the hypothesis under various circumstances. Second, since incorrect expectations play a major role in the hypothesis we experiment with some alternative hypotheses on expectations formation. A final check of robustness is to use the real rate of interest as an additional explanatory variable. This is of interest because it may affect the 'equilibrium' saving ratio, which was assumed constant in Deaton (1977).

2. EMPIRICAL RESULTS

Assuming that there is uncertainty about the current price level, so that economic agents know only the prices of goods they are currently buying, makes it possible to derive the following saving function under certain, rather plausible, assumptions

$$(1)\qquad (s/y)_t = b_o + b_1(y_{ht}-y^{*}_{ht}) + b_2(p_{ht}-p^{*}_{ht}) + b_3(s/y)_{t-h}$$

where h denotes the length of differencing, y and p rates of change in real income and price level respectively and variables with (*) refer to anticipated values. The coefficients b_1, b_2 and b_3 should be positive (see Deaton (1977) for details).

Since anticipated rates of changes in real income and price level are unobservables and there is no survey data covering the whole sample, links of expectations to observed variables have to be spesified. A very simple way of doing this is to assume - analogously to Deaton (1977) - constant expectations so that $y^{*}_{ht} = y^o$ and $p^{*}_{ht} = p^o$. This leads up to the following specification for the saving ratio (s/y)

(2) $(s/y)_t = b_o + b_1 y_{ht} + b_2 p_{ht} + b_3 (s/y)_{t-h} + u_t$

where u_t is an error term.[1] In the case of static expectations we end up with

(3) $(s/y)_t = b_o + b_1(y_{ht} - y_{ht-z}) + b_2(p_{ht} - p_{ht-z}) + b_3(s/y)_{t-h} + u_t$

where z = the length of the period. It may be worthwhile to point out that from the point of view of adaptive expectations hypothesis the above mentioned hypotheses represent two opposite extreme alternatives.

Equations (2) and (3) were estimated by using seasonally unadjusted cross-country data from Canada, Finland, France, UK and USA over the period 1967(II)-1980(III).[2] In what follows we have used the four-quarter differences (h=4/4) so that e.g. $(s/y)_{t-1}$ describes the saving ratio lagged by four quarters.

The OLS estimation results with constant expectations are reported in Table 1. $F_{2,50}$ indicates the value of F-statistics for the hypothesis H_o: $b_1 = b_2 = 0$, ρ = the first-order autocorrelation coefficient obtained by the Cochrane-Orcutt procedure (C-O rows), SEE = the standard error of estimate and numbers in parentheses are values of t-statistics. In all cases the standard error of the coefficient estimate of the lagged saving ratio has been computed by using Dhrymes´ Theorem 7.1 (Dhrymes (1971), p.199).[3] The first-order autocorrelation correction is based on observations from correlograms according to which the OLS residuals turned out typically to be of AR(1) type. Also estimating (2) and (3) with AR(2) error process adjustment suggested the same.[4]

Table 1 Estimation results of (2): constant expectations

Country	constant	p_{1t}	y_{1t}	$(s/y)_{t-1}$	R^2	SEE	$F_{2,50}$	D-W	ρ	estimation method
Canada	.0038	.4243	.1746	.5456	.8700	.0091	32.040	1.460	0	OLS
	(0.60)	(6.42)	(3.56)	(6.18)						
Canada	.0013	.4826	.2676	.4752	..	.0083	24.903	2.246	.4492	C-O
	(0.08)	(3.52)	(3.28)	(2.00)					(1.66)	
Finland	-.0095	.1639	.2317	.4774	.3676	.0173	9.150	1.088	0	OLS
	(1.21)	(3.16)	(4.21)	(3.92)						
Finland	-.0249	.2697	.3836	.4362	..	.0141	8.310	2.045	.6114	C-O
	(1.29)	(3.25)	(4.03)	(1.31)					(2.02)	
France	.1106	.1988	.3488	.1238	.3187	.0101	11.430	.868	0	OLS
	(4.68)	(3.29)	(4.49)	(0.85)						
France	.1455	.0642	.3159	.1125	..	.0078	7.734	2.050	.6818	C-O
	(4.98)	(0.69)	(3.92)	(0.01)					(5.00)	
UK	.0184	.2344	.3763	.5160	.7400	.0133	27.506	1.505	0	OLS
	(1.72)	(4.18)	(7.14)	(3.76)						
UK	.0236	.2560	.3626	.4466	..	.0125	23.529	1.934	.2188	C-O
	(2.16)	(4.48)	(6.39)	(3.46)					(1.65)	
USA	-.0011	.1745	.3352	.6640	.3114	.0117	5.581	.438	0	OLS
	(0.07)	(1.82)	(3.22)	(4.38)						
USA	-.0020	.3373	.4358	.4836	..	.0065	4.704	2.010	.8353	C-O
	(0.06)	(2.03)	(3.04)	(1.29)					(4.08)	

Figures in parentheses are absolute values of t- ratios, ρ is the first order autoregressive parameter, the sample size is 54. Critical values of t- statistics: $t_{.05,50} = 1.68$, $t_{.01,50} = 2.40$, critical values of F- statistics: $F_{.05,2,50} = 3.18$, $F_{.01,2,50} = 5.06$.

In all cases the coefficient estimates are of expected signs. In particular, the coefficient estimate of the inflation term (p_{1t}) is significant in all but one cases according to the values of t-statistics at the 5 per cent level. Moreover, if this significance level is used as a benchmark, the hypothesis H_o: $b_1 = b_2 = 0$ can be rejected in all cases. For France, the lagged saving ratio takes a very low value; actually the hypothesis H_o^x: $b_3 = 0$ cannot be rejected. This suggests a rather long adjustment period for the saving ratio to the desired long-run level.[5] Thus, in spite of the rather erratic behaviour of the inflation rate in the seventies, Deaton´s original 'disequilibrium' saving function specification with constant expectations performs strikingly well.

The OLS estimation results with static expectations are reported in Table 2. Substituting static expectations for the constant ones seems to have the effect of making the goodness-of-fit statistics a bit lower, but otherwise there are relatively few changes in the values of coefficient estimates (excluding the constant term). As far as the inflation term ($p_{1t}-p_{1t-(1/4)}$) is concerned, only the coefficient estimate for France is negative. The value of t-statistic does not, however, even in this case justify the rejection of the hypothesis $\overline{H}_o$: $b_1 > 0$ at the 5 per cent level.

In order to see how far one can get by using 'disequilibrium' effects alone Deaton (1977) assumed the constancy of the 'equilibrium' saving ratio and thus did not account e.g. for the possible role of the real rate of interest as an explanatory variable. Therefore, we introduced the real rate of interest into (1) by using the government long-term bond rate as the nominal interest rate r.[6]

Table 2 Estimation results of (3): static expectations

Country	constant	$\bar{p}_{1t}$	$\bar{y}_{1t}$	$(s/y)_{t-1}$	R^2	SEE	$F_{2,50}$	D-W	ρ	estimation method
Canada	.0060	.7128	.3703	.9546	.7776	.0119	8.331	.881	0	OLS
	(0.97)	(2.89)	(3.83)	(13.20)						
Canada	.0390	.6212	.3099	.5444	..	.0090	6.204	2.153	.7914	C-O
	(1.19)	(2.76)	(3.18)	(1.41)					(2.97)	
Finland	.0119	.1740	.2848	.6068	.3473	.0176	8.085	1.167	0	OLS
	(2.78)	(2.24)	(3.75)	(4.59)						
Finland	.0135	.1768	.2617	.5324	..	.0151	10.651	1.837	.4545	C-O
	(2.60)	(3.15)	(4.47)	(3.90)					(3.75)	
France	.1235	-.3476	.2374	.2591	.1839	.0110	5.415	.649	0	OLS
	(5.39)	(1.88)	(2.29)	(1.87)						
France	.1559	-.2456	.2125	.0564	..	.0077	8.314	1.903	.7049	C-O
	(5.53)	(1.74)	(3.58)	(0.33)					(5.36)	
UK	.0239	.3968	.2828	.8057	.5235	.0181	3.651	1.058	0	OLS
	(2.05)	(2.30)	(2.54)	(7.33)						
UK	.0712	.2917	.2635	.3786	..	.0146	3.863	2.340	.7020	C-O
	(1.96)	(1.67)	(2.74)	(1.13)					(2.79)	
USA	.0277	.3379	.2448	.5461	.2247	.0124	2.163	.495	0	OLS
	(2.69)	(1.14)	(2.08)	(3.58)						
USA	.0458	.2713	.1746	.2591	..	.0076	2.884	1.916	.7826	C-O
	(2.49)	(1.12)	(2.34)	(0.94)					(4.94)	

$\bar{p}_{1t} = p_{1t} - p_{1t-1/4}$, $\bar{y}_{1t} = y_{1t} - y_{1t-1/4}$, figures in parentheses are absolute values of t- ratios, ρ is the first order autoregressive parameter, the sample size is 54. Critical values of t-statistics: $t_{.05,50} = 1.68$, $t_{.01,50} = 2.40$; critical values of F- statistics: $F_{.05,2,50} = 3.18$, $F_{.01,2,50}$.

With constant inflation rate expectations the anticipated real rate of interest had mostly - excluding USA - positive coefficient estimates with reasonably high values of t-statistics. In the case of static inflation rate expectations, however, no clear pattern could be discerned and values of t-statistics were very low. These mixed results for the role of the real rate of interest in the saving (and consumption) function lie in conformity with the existing knowledge about this question (see e.g. Blinder (1981), Boskin (1978) and Gylfason (1981)). Anyway, it it important to emphasize strongly that introducing the real rate of interest had no effect on the positive relationship between the unanticipated real income and inflation rate changes and the saving ratio.[7)]

FOOTNOTES:

1. The saving function specification with constant expectations (2), where uncertainty on relative prices in a cross-section sense plays a major role, is almost identical to the specification derived from an intertemporal utility maximization with uncertainty about relative intertemporal prices and nonunitary elasticity of substitution (Deaton (1980)). More particularly, it can be shown that if changes in price and real income expectations are proxied by the corresponding lagged (actual) values, then one ends up with the following saving function

   (1) $(s/y)_t = b_0+b_1y_t+b_2p_t+b_3(s/y)_{t-1}+b_4(s/y)_{t-2}+u_t$

   where $b_1, b_2, b_3 > 0$, $b_4 < 0$ (see Koskela and Virén (1981)). This equation was also estimated for our sample. The results were rather close to those presented in Table 1 so that they are not reported here.

2. Main data sources: Quarterly National Accounts Bulletin (OECD) and International Financial Statistics (IMF). Data goes back to 1966, but the first observations were lost in differencing and lagging the variables. Selection of countries was motivated by the desire of getting uniform, and sufficiently long quarterly time series data. A detailed description of data sources and definitions of variables is presented in an unpublished mimeo and is available from the authors upon request.

3. Due to the large standard errors of the coefficient estimate of $(s/y)_{t-1}$ we were unable to compute Durbin's h-statistic for France, UK and USA. For Canada and Finland respectively their values were 2.5942 and 7.4501 thus also indicating the presence of first-order autocorrelation at conventional levels of significance.

4. Only in the case of Canada the value of t-statistic for the coefficient estimate of the second-order term in the AR(2) process was just significant at the 5 per cent level.

5. In Deaton's terminology $(1-b_3)$ describes the reciprocal time horizon (the rate at which wealth is absorbed into permanent income). Therefore, the differences in the coefficient estimates of the lagged saving ratio might reflect the differences in the working of capital markets in the sense that borrowing constraints may induce economic agents to behave as if their planning horizons were 'short' (compare Lawson (1980) with Tobin and Dolde (1971)). (2) was estimated by

substituting a distributed lag form for $(s/y)_{t-1}$ and using the Almon interpolation technique with the maximum length of 6 and the polynomial of third-degree. The following mean lags of $\sum a_i(s/y)_{t-i}$ were obtained for Canada, Finland, France, UK and USA respectively: 1.8918, 2.3935, 3.0560, -.7626, -.4204. It is an interesting task for further research to explore whether differences in the working of capital markets across countries can account for these results.

6. By allowing the 'equilibrium' saving ratio to depend on the anticipated real rate of interest leads up to the specification, in which the anticipated real rate of interest and its change are introduced as additional explanatory variables. The latter variable, however, were insignificant in all cases. With Finnish data we have carried out an extensive amount of further experiments. So e.g. (2) was estimated by using various unrestricted distributed lags involving p,y and (s/y). In no cases better fit was obtained. Of various additional explanatory variables like the real rate of interest and the unemployment rate, only the unemployment rate was significant at conventional levels, but it failed in stability tests. Finally, (2) was estimated with instrumental variable technique with various sets of instruments, but the results were practically unchanged (see Koskela and Virén (1981))

7. A complete set of results is available from the authors upon request. In order to conserve space, only the following, somewhat condensed OLS estimates with constant expectations are presented here as an illustration of the flavour of results (r_t is the nominal interest rate, which is not adjusted for taxes).

	p_{1t}	y_{1t}	$(s/y)_{t-1}$	r_t	R^2	D-W
Canada	.3383	.2321	.4995	.3154	.881	1.518
	(4.56)	(4.32)	(5.12)	(2.24)		
Finland	.1604	.2282	.4209	.0138	.389	1.088
	(3.12)	(4.18)	(3.28)	(1.32)		
France	.1055	.3871	.1620	.2313	.338	.856
	(1.07)	(4.62)	(1.12)	(1.19)		
UK	.0963	.3067	.3978	.3881	.771	1.763
	(1.23)	(5.41)	(2.89)	(2.59)		
USA	.4995	.3276	.2809	-.9127	.507	.601
	(4.54)	(3.68)	(1.80)	(4.41)		

Comparing results with those in Table 1 suggests only slight differences. With static expectations the values of t-statistics of the real rate of interest term $(r_t - p_{1t-(1/4)})$ were -4.62, 0.56, -1.27, 0.80 and -0.77 respectively for Canada, Finland, France, UK and USA.

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