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TIGHTNESS OF MONEY AND HOUSEHOLDS´ CONSUMPTION BEHAVIOR: A TEST WITH FINNISH DATA***

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TIGHTNESS OF MONEY AND HOUSEHOLDS´ CONSUMPTION BEHAVIOR: A TEST WITH FINNISH DATA

by:

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Abstract

This note reports the testing of hypotheses concerning whether the tightness of money affects households´ demand for money, nondurables, durables and houses. Empirical analysis with Finnish quarterly data suggests that with houses and money, but not so much with nondurables and durables, the effect is of crucial importance. Experiments with different wealth proxies also display the importance of credit rationing, it is e.g. found that consumers have very short planning horizons.

1. Introduction

This note contains some estimation results of a four commodity model with money, nondurables, durables and houses. This model is used in testing the importance of credit rationing with respect to consumer behavior. Finnish data is used mainly because of two reasons: First, according to "conventional wisdom", which is also supported by some econometric analyses, credit rationing plays a decisive role in the Finnish financial market. Second, there has recently been a growing interest in Finland in developing operational measures for the tightness of money. Our four-commodity model is derived using standard neoclassical analysis of consumer´s intertemporal choice. This model allows us to examine the role of relative prices and different wealth terms together with our proxies for the tightness of money and availability of credit and with some alternative specifications for the formation of expectations.

We start by presenting a short derivation of our model in section 2, empirical results with Finnish quarterly data are reported in section 3, and finally some concluding remarks follow in section 4.

2. Theoretical Considerations

A standard neoclassical model of consumer intertemporal choice is applied here (as a general reference, see Deaton and

Muellbauer (1980)). Besides nondurables goods, denoted by C, the stock of real money balances, M/P, two stocks of durable goods are considered here: consumer durables, D, and houses, H. It is assumed that the stocks of D and H yield consumption service flows proportional to their magnitude. Hence these stocks appear in the intertemporal utility function. The inclusion of real money balances in the utility function is motivated by the transaction cost argument (cf. Brock (1974), p. 769). Thus, given the supply of labor the utility function can be written in the form:[1)]

$$(1) \qquad U = U(C_1, C_2, \ldots, C_T, D_1, D_2, \ldots, D_T, H_1, H_2, \ldots, H_T, M_1/P_1, M_2/P_2, \ldots, M_T/P_T, A_T/P_T)$$

where 1 is the present and T the terminal period. A_T denotes the value of assets (except money), which together with D_T, H_T, and M_T/P_T represent the consumer's bequest. Now the relevant intertemporal budget constraint corresponding to (1) is:

$$(2) \qquad \Sigma R_t p_t C_t + \Sigma R_t v_t^* D_t + \Sigma R_t v_t^* H_t + \Sigma R_t (r_t/(1+r_t)) M_t + R_T A_T = W_1$$

where R_t is the discount factor with $R_1 = 1$, v_t^*, u_t^* and $r_t(1+r_t)^{-1}$ are the user costs of durables, houses and real money balances, respectively, r_t is the nominal rate of interest, and W_1 is intertemporal wealth, which, in turn, can be expressed as:[2)]

$$W_1 = v_t(1-d)D_0 + u_t(1-h)H_0 + M_0 + (1+r_0)A_0 + \sum_{t=1}^{T} R_t y_t \tag{3}$$

where d and h stand for the depreciation parameters of D_t and H_t, v_t and u_t are the purchase prices of consumer durables and houses, the respective volume indeces being D_t^x and H_t^x, y_t is the consumer´s (nonasset) disposable income and P_t is the implicit deflator of households expenditure (i.e., $p_t C_t + v_t D_t^x + u_t H_t^x$).

The user cost terms, v_t^* and u_t^*, mentioned above take the standard definition:

$$v_t^* = v_t(r_t + d - (1-d)\Delta v_{t+1}/v_t)/(1+r_t) \tag{4}$$

and analogous form holds for u_t^*. Now maximization of (1) subject to (2) gives under weak separability of U(.):[3)]

$$Y_t = f(W_t, R_t p_t, R_{t+1}p_{t+1}, \ldots, R_T p_T, R_t v_t^*, R_{t+1}v_{t+1}^*, \ldots, R_T v_T^*, R_t u_t^*, R_{t+1}u_{t+1}^*, \ldots, R_T u_T^*, R_t P_t r_t', R_{t+1}P_{t+1}r_{t+1}', \ldots\ldots\ldots, R_T P_T r_T') \tag{5}$$

where Y_t serves as a general index for C_t, D_t, H_t and M_t/P_t, $r_t' = r_t/(1+r_t)$.

Next we drop the future price terms from (5), impose zero degree homogeneity by deflating the wealth and price terms by P_t and simply linearize (5) to get:

(6) $$Y_t = b_0 + b_1 r'_t + b_2 \bar{p}_t + b_3 \bar{v}_t + b_4 \bar{u}_t + b_5 \bar{W}_{ht} + b_6 \bar{W}_{nt}$$

where $\bar{p}_t = p_t/P_t$, $\bar{v}_t = v^*_t/P_t$, $\bar{u}_t = u^*_t/P_t$, $\bar{W}_{ht}$ is consumer's real human wealth and $\bar{W}_{nt}$ consumer's real nonhuman wealth (in terms of (3) W_{ht} stands for $\Sigma\, R_t Y_t$ while W_{nt} represents the rest of the RHS of (3)).

To complete the model we introduce the tightness of money proxies and use the standard (partial) stock adjustment process

(7) $$Y_t - Y_{t-1} = g(Y^*_t - Y_{t-1})$$

as a general framework for integrating these variables into the analysis and taking into account the fact that demand cannot, due to e.g. these factors, instantaneously adjust to the optimal level. Y^*_t indicates here this 'optimal' value of Y_t given by (6).

In this connection two proxies for the tightness of money and/or availability of credit are experimented: GA_t and RAT_t. The former corresponds to government (subsidized) loans to households for housing construction which are generally considered to be of great importance for the housing industry. Possibly they have also spillovers (e.g. with respect to the demand for furniture and other durables). The latter is here - as well as in some recent Finnish studies, e.g. Koskela and Virén (1981) - used as a general proxy for the tightness of money. When constructing this variable we have used the difference between the banks' marginal cost of central bank borrowing, MC_t, and their weighted average lending rate, r_t[4].

There are two ways these variables may affect Y_t: either they affect directly Y_t^* or they affect the speed of adjustment, g, for instance so that $g = g_0 - g_1 RAT_t$. The first possibility could be called an "expectations effect" (the other being then an "adjustment effect") because it results from the fact that consumers - anticipating binding borrowing constraints - start spending less and accumulating more liquid assets for eventual future use (the study of Foley and Hellwig (1975) concerning trading uncertainty represents a more formal analysis in this respect). The second possibility is related to the costs of adjustment in the sense that when the tightness of money increases, more consumers meet borrowing restrictions which lowers the average speed consumers are able to adjust to the optimal level, Y_t^*.

If we consider these hypothesis in terms of the equations to be estimated, we find that the "expectations effect" implies an additive specification given by (8), while the "adjustment effect" with RAT_t implies a multiplicative specification given by (9).

$$(8) \qquad Y_t = \tilde{b}_0 + \tilde{b}_1 r_t' + \tilde{b}_2 \bar{p}_t + \tilde{b}_3 \bar{v}_t + \tilde{b}_4 \bar{u}_t + \tilde{b}_5 \bar{W}_{ht} + \tilde{b}_6 \bar{W}_{nt} + \tilde{b}_7 GA_t + \tilde{b}_8 RAT_t + \tilde{b}_9 Y_{t-1}; \; Y = M/P, C, D, H.$$

(9) $$Y_t = \hat{b}_0 + \hat{b}_1 r'_t + \hat{b}_2 \bar{p}_t + \hat{b}_3 \bar{v}_t + \hat{b}_4 \bar{u}_t + \hat{b}_5 \bar{W}_{ht} + \hat{b}_6 \bar{W}_{nt}$$

$$+ \hat{b}_7 GA_t + \hat{b}_8 RAT_t + \hat{b}_9 Y_{t-1} + \hat{b}_{10} r'_t RAT_t + \hat{b}_{11} \bar{p}_t RAT_t$$

$$+ \hat{b}_{12} \bar{v}_t RAT_t + \hat{b}_{13} \bar{u}_t RAT_t + \hat{b}_{14} \bar{W}_{ht} RAT_t + \hat{b}_{15} \bar{W}_{nt} RAT$$

$$+ \hat{b}_{16} GA_t RAT_t + \hat{b}_{17} Y_{t-1} RAT_t; \; Y = M/P, C, D, H.$$

These specifications constitute the starting point for our empirical analysis.

3. Empirical analysis

3.1. Data

Finnish quarterly data covering the period 1962(2)-1973(3) is used in the empirical analysis. The data is seasonally adjusted, and expressed in per capita terms. A detailed description of the time series used can be found in Mellin and Virén (1981).

In order to be able to estimate (8) or (9), we require operational proxies for the user cost and wealth terms. The former, defined in (4), include unobservale anticipated price change rates for $\Delta v_{t+1}/v_t$ and $\Delta u_{t+1}/u_t$. In the same way, the human wealth variable, W_{ht}, is defined in terms of (anticipated) future income stream[5]. In the subsequent analysis we use two alternative sets of proxies for these terms. On the one hand, we simply replace v^e_{t+1}/v_t and u^e_{t+1}/u_t by the corresponding actual values[6)], and $\bar{W}_{ht}$ by $\bar{y}_t$ which is households' real disposable income for period t, on the other hand, we utilize the adaptive expectations hypothesis. That is, we compute for instance w.r.t. income

$$(10) \qquad y_{pt} = b_y \bar{y}_t + (1 - b_y) y_{pt-1}.$$

This is nothing but the standard empirical specification for the permanent income variable (cf. e.g. Darby (1974)). The values of b_i are estimated by a search procedure so that search is conducted between zero and one at .10 intervals. In the first phase we compute the value of b_y for the (permanent) income variable $\bar{y}_{pt}$, and then in the second phase, given this value, we estimate the other parameters for the price change rates using a two-dimensional simultaneous search over b_v and b_u[7)].

As far as the non-human wealth term, W_{nt}, is concerned, we proxy it by A_t which consists of households' liquid assets, debts and stocks of consumer durables and houses[8)]. Finally the user cost of money, $r_t/(1+r_t)$ is simply approximated with r_t.

3.2. Estimation results

We estimated first equation (8) with and without the RAT_t and GA_t terms using the simple expectations proxies mentioned above.

After that we estimated (9) using the same proxies. LS estimates of (8) with Cochrane-Orcutt procedure are presented in Table 1. Using this table as a reference, it appears that the equations fit the data rather well. If the cross price effects are ignored, the coefficient estimates are (with two exceptions: $\bar{u}_t$ in the H_t - equation and $\bar{A}_t$ in the M_t/P_t - equation) of the right sign and in most cases significant at e.g. 5 % level. On the other hand, the Box-Pierce statistics, with 12 lags (Q(12)) show that the residuals are almost white noise. Moreover, there was hardly any correlation between the GLS residuals (it was only the residuals of C_t and D_t which had a correlation coefficient .263 exceeding the 5 % critical level with t- statistic). However, the Chow statistics computed for the first 35 and last 34 observations did not behave equally well. As the statistics in Table 1 show, there are troubles with the stability of the durables and money demand equations[9].

Now, the crucial question is, what is the role of the GA_t RAT_t variables. If we compare the estimates of (8) with and without these variables, we find an interesting result. That is, if both GA_t and RAT_t are dropped from (8), all the t- ratios of the income proxy, $\bar{y}_t$, increase - in the housing equation even up to 3.69 - while all the t- ratios of the non-human wealth proxy, $\bar{A}_t$, decrease . Thus, if we estimate these demand equations without any considerations with respect to the tightness of money, as it is usually done, we find a strong dependence on current income, the other wealth variables being more or less insignificant. Our exercise suggests that this

Table 1. GLS estimates of (8)

	M_t/P_t	C_t	D_t	H_t
constant	2197.366 (1.17)	881.631 (1.88)	-2344.916 (1.69)	1861.720 (2.86)
r_t	-440.421 (5.21)	-5.569 (0.26)	17.984 (0.53)	-8.873 (0.40)
$\bar{p}_t$	-14.963 (0.91)	-5.366 (1.36)	20.962 (1.63)	20.620 (3.18)
$\bar{v}_t$	-5.208 (1.22)	-.608 (0.50)	-2.917 (2.43)	-.195 (0.42)
$\bar{u}_t$	4.336 (0.76)	-3.358 (1.99)	.645 (0.42)	.106 (0.15)
$\bar{y}_t$	.631 (2.93)	.306 (4.89)	.066 (1.04)	.021 (0.82)
$\bar{A}_t$	-.0206 (1.56)	.0058 (1.35)	.0302 (2.17)	.0305 (3.65)
GA_t	4.055 (2.48)	.531 (1.20)	1.141 (2.12)	1.076 (4.45)
RAT_t	-5.602 (1.31)	-2.807 (2.56)	-.298 (0.19)	-3.483 (3.86)
Y_{t-1}	.858 (17.80)	.442 (4.47)	.805 (13.60)	.959 (20.27)
rho	.011 (0.09)	-.304 (2.63)	.425 (3.87)	.885 (15.81)
R^2	.995757	.993181	.999514	.999973
Q(12)	15.86	8.50	12.24	20.78
Chow ($F_{10,49}$)	3.900	2.352	3.797	1.921
$F_{2,59}$	5.142	3.731	1.307	12.906
$F_{8,51}$	1.463	1.081	1.268	2.125
$F_{10,51}$	1.957	1.723	1.126	4.675

strong income - dependence just reflects the tightness of money, current income serving to some degree as its proxy. What is, however, also important, is the fact that these variables, GA_t and RAT_t, in general improve the fit. This fact becomes apparent when the F- statistics presented in Table 1 are considered. $F_{2,59}$ corresponds to the case where additive GA_t and RAT_t-terms are introduced into "(8)", $F_{8,51}$ corresponds, in turn, to the case where the multiplicative terms of RAT_t are introduced into (8), i.e. it shows whether (9) has better explanatory power than (8). Finally, $F_{10,51}$ shows the improvement of fit when both the additive GA_t and RAT_t and multiplicative RAT_t terms are introduced. If the 5 % level of significance is used as a benchmark, we find that with the demand of houses the tightness of money plays a crucial role. The fact that both $F_{2,59}$ and $F_{8,51}$ exceed the 5 % level of significance suggests that changes in the degree of credit rationing come out through expectations and the adjustment process. With the demand for money only the additive terms seem to improve the explanatory power of the model. It should be pointed out, however, that our testing procedure is not favourable for accepting the hypothesis that the adjustment parameter depends on the tightness of money. That is because (8) includes variables with very low t-ratios which contribute almost nothing to the fit but instead bid down the values of the F- statistics[10). Finally, we can observe that the demand for durables and non-durables is not so much affected by the tightness of money. Again, it should, however, be stressed that our testing procedure is rather "conservative" with respect to the corresponding proxies.

It is clear that there should be a negative relationship between RAT_t and C_t, D_t and H_t. With M_t/P_t there is, however, some ambiguity. Even if the tightening of money might decrease the demand for money via higher interest rates and lower level of economic activity, the expectations (or "precautionary") effect might work to the opposite direction, cf. again Foley and Hellwig (1975)[11)].

The previous estimation results are based on somewhat ad hoc treatment of expectations. We applied therefore also another analysis by utilizing the adaptive expectations hypothesis simultaneously with $\bar{y}_t$, $\Delta v^e_{t+1}/v_t$ and $\Delta u^e_{t+1}/u_t$. By using the procedure described in section 3.1 we found that the value of b_y which minimizes the total sum of the squares of (8) is .7 (the equation-specific minima were obtained with .5, .9, .7 and .9 for M_t/P_t, C_t, D_t and H_t respectively). The value thus obtained is very high - for instance the estimate by Darby with U.S. data is .1 cf. Darby (1974). Our result indicates that consumers assign a large weight to current income in the permanent income. In other words, consumers have a very short planning horizon. All this is, of course, compatible with the idea of continous and effective credit rationing (cf. e.g. Pissarides (1978)).

As far as the user cost terms, $\bar{v}_t$ and $\bar{u}_t$, are concerned, the values of b_v and b_u which minimized the sum of the squares of the whole model were .0 and .1, respectively. In the context of quarterly data these seem rather reasonable values. The corresponding user cost terms are indicated by $\bar{v}_t^a$ and $\bar{w}_t^a$.

The GLS estimates of (8) with Cochrane-Orcutt procedure, given the new "adaptive expectations" proxies are reported in Table 2. It is interesting to compare the results of this Table with those of Table 1. Perhaps, the main difference concerns the price terms; in Table 2 all the own price terms are of the right sign, and except the case of non-durables, significant at 5 % level. The cross-price terms are not symmetric at all. This is not very surprising, given the highly aggregated data. On the other hand, we should point out that in most cases these terms have rather low t- ratios suggesting that the assumption of symmetry cannot after all be rejected in a formal test. Furthermore, the values of the Chow-statistics, which in general are higher than those in Table 1, indicate that the expectations parameters b_y, b_v and b_u might not have been invariant over time.

What is somewhat puzzling with the cross-price terms, is the rate of interest term, r_t, in the durables equation. Even if the corresponding coefficient estimate is positive, it does not impy that the full influence of interest rates on the demand were positive. That is because r_t appears also in the user cost terms. Taking the partial derivative of D_t with respect to r_t results a slight negative "total" effect.

Table 2. GLS estimates of (8) with adaptive expectations

	M_t/P_t	C_t	D_t	H_t
constant	9852.528 (1.89)	1010.746 (0.60)	3183.800 (1.89)	-1920.518 (2.79)
r_t	-248.990 (1.91)	4.888 (0.12)	88.947 (2.63)	-6.293 (0.27)
$\bar{p}_t$	-88.902 (1.91)	-6.542 (0.44)	-27.570 (1.79)	20.821 (3.15)
$\bar{v}_t^a$	-104.367 (1.20)	5.536 (0.19)	-112.741 (5.17)	.981 (0.08)
$\bar{u}_t^a$	120.187 (1.62)	-5.539 (0.24)	26.054 (1.40)	-34.390 (2.45)
$\bar{y}_{pt}$	.850 (2.89)	.377 (4.04)	.102 (1.45)	.060 (1.55)
$\bar{A}_t 10$	-.221 (1.32)	.070 (1.27)	.110 (0.99)	.142 (1.44)
GA_t	2.926 (1.56)	.501 (0.81)	1.038 (2.17)	1.112 (4.72)
RAT_t	-7.949 (1.59)	-3.746 (2.64)	.161 (0.13)	-3.270 (3.74)
Y_{t-1}	.791 (14.91)	.325 (2.98)	.865 (19.73)	.975 (86.25)
rho	.161 (1.35)	-.052 (0.43)	.278 (2.39)	.866 (14.26)
R^2	.995892	.992857	.999692	.999977
Q(12)	16.84	8.02	7.87	16.02
Chow($F_{10,49}$)	5.450	2.792	2.910	4.158

As far as other variables are concerned, GA_t and RAT_t display similar performance as earlier, while with the human and non-human wealth proxies there are some new features. The explanatory power of the assetss variable, $\bar{A}_t$, has clearly decreased - obviously due to the change in the income proxy[12]. In order to evaluate the role of the permanent income concept in our model, we introduced also (in separate regressions) the transitory income variable, $y_{T,t} = y_t - y_{pt}$, into the model as an additional explanatory variable. According to the permanent income hypothesis one might expect that transitory income would increase the demand for real balances and durable- type goods while having no effect on the consumption of nondurables. Estimation results did not follow this pattern. The t- ratios of $\bar{y}_{T,t}$ with nondurables, money and houses were clearly below the 5 % significance level, the one with durables barely exceeding it but the coefficient estimate being negative (cf. again opposite-type estimation results of Darby (1972) and Mishkin (1976))[13].

4. Concluding remarks

This article investigated the effects of the tightness of money on households´ consumption behavior. Empirical evidence with Finnish data suggested that the effects are particularly strong with the demand of houses and money. In the same context it appeared that consumers have clearly shorter planning horizons and greater correlation between consumption and income than what is suggested by the permanent income and lifecycle hypotheses. It was also found that relative prices constitute an important factor when the allocation of funds for different commodities are considered by households.

As for further analysis, we intend to utilize some explicit utility function which makes it possible to parametrize our expenditure system. That in turn is required when testing different cross-equation restrictions concerning e.g. expectations formation.

Footnotes

1) Thus we treat D and H as continous variables and, what is more crucial, we assume that in efficiency-corrected units durables of different ages are perfect substitutes.

2) (4) is based on the assumption that the consumer receives the income, Y_t, at the beginning of each period, the stock of assets is measured and interest is in turn paid at the end of each period. No interest is paid for money.

3) These results rely on the assumption that households are free to lend and borrow at an identical rate of interest without any quantitative constraints. Moreover, we have written out the maximization problem as if there were perfect knowledge about future price and income (labor demand) terms which are assumed exogeneous. So, what we intend to do here is to specify a general market clearing - perfect foresight model and try then to incorporate more realistic elements to it.

4) In Finland, the banks´ borrowing from the central bank is both the major way of absorbing temporary liquidity changes and a permanent source of finance for lending to the non-bank public. 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. The original quarterly series seems highly erratic, also presumably displaying temporary changes in the banks´ liquidity position which do not give rise to changes in their lending behavior. In order to eliminate these temporary changes in the banks´ liquidity position, we smoothed the series as follows:

$RAT_t = \sum_{i=0}^{3} \alpha^i (MC_{t-4-i} - r_{t-4-i})$, the smoothing factor α being .75. A similar proxy has been used in Koskela & Viren (1981) and Tarkka (1981).

5) If the future income stream is deflated by P_t and written in terms of (anticipated) constant change rate of real income, that would bring the real rate of interest into the model, cf. e.g. Hess (1974).

6) We have indeed used the actual values of v_{t+1} and u_{t+1} in the user cost terms in the first phase of our study. Even if this 'perfect foresight' assumption may be rather strange in this kind of analysis, it may not be totally unjustified. In many cases the future prices of durables and houses are, in fact, known within a range of months or even quarters, e.g. due to the fact that the prices of these kinds of items are fixed only once a year or so. We have, however, also applied the stochastic counterpart of the perfect foresight model, i.e. the rational expectations model, when deriving the values of v_{t+1} and u_{t+1} as least squares predictions from a certain set of variables assumed to be known by the consumers at the beginning of period t. These, not too dissimilar, results are reported in Mellin & Virén (1981).

7) Also a little bit more sophisticated procedure was tried in determining the values of y_{pt}, namely: $y_{pt} = b_y\bar{y}_t = (1+b_y)(1+\delta)\bar{y}_{pt-1}$ where δ stands for the growth rate of permanent income, cf. Darby (1974). The results with this procedure turned out to be identical with those of (10). Notice that the simple human wealth proxy y_t can also be viewed as a permanent income variable, if y_t is generated by a first-order autoregression: $y_t = \rho y_{t-1} + u_t$ with u_t NID$(0,s^2)$. Then, if the consumer's time horizon were infinite and the expectations rational, y_{pt}, could be defined as: $((1+r)/(1+r-\rho))y_t$, cf. e.g. Blinder (1981), p. 32.

8) Given the definition (3), $\bar{A}_t$ includes assets only from period t-1, plus or minus interest or depreciation. We have also in another context experimented with some alternative definitions of households' non-human wealth. It turned out that this rather broad measure, A_t, gives the best fit, with equations similar to (8), cf. Mellin and Virén (1981).

9) The demand for durables equation does not fit the data of of 1960's especially well, possibly due to changes in some institutional factors. For example, the licencing system concerning car imports was abolished in 1962 which presumably had lagged effects. As for the estimates with the data of the 1970's, we can mention that both the GA_t and RAT_t variables were significant (with standard levels of significance) and had expected signs. As for the demand for money equation there seems to be no obvious explanation for the observed instability. It has also come out in some other Finnish studies - clearly more work is needed here.

10) Recall also that both (8) and (9) include the constant term making the corresponding hypotheses in this sense indistinguistable. The hypothesis that $g = g_0 - g_1RAT_t$ implies that the multiplicative terms of (9) should have signs opposite to those of the original terms (given by (8)). When (9) was estimated, 24 of the total number of 32 signs followed, in fact, this expected sign-pattern.

11) There is not very much evidence of the effects of credit rationing on the demand for money. Wong (1977) represents an exception. In a cross-country study of some developing countries he found a strong and systematic negative effect.

12) As a detail of Table 2 we can mention that with the demand for money the long-run permanent income elasticity is 1.4 which is, in fact, compatible with some recent Finnish estimates.

13) For a possible explanation of these results, see Wiseman (1975).

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