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Giovanna Tagliabue, Ambrogio Ghiringhelli**

MORE CONSUMER EXPENDITURE CONSIDERATIONS

The scope of this paper is to test empirically whether wealth had a significant effect on aggregate consumption in Italy in the period 1951–1990. The structure of this paper is as follows.

In section 1 some theoretical considerations on consumption behaviour are summarized. A simple model is presented and a consumption function is derived from the model in section 2. The empirical result of the long run relationship is presented in section 3. Section 4 contains a discussion on the short run relationship specifying the role of wealth and the interest rate. Finally, section 5 concludes by commenting on those results in the light of consumption behaviour.

1. INTRODUCTION

The purpose of this work is to conduct an empirical investigation on the role of wealth in consumption testing a few postulates of the "wealth theories" of consumption.

Firstly H. Metzler had the idea to include a wealth variable in a consumption function in addition to the income variable. Friedman's "permanent income" theory of consumption is evidently a wealth approach to consumption, treating explicitly consumption as a function of the sum of human and non-human wealth. In the same direction goes F. Modigliani with his "life cycle" consumption theory in which consumption is a function of "tangible and intangible" components of wealth. Tangible non-human wealth is essentially a measure of wealth consisting of structures, land and natural resources, machinery and other durable equipment and inventory stocks. Intangible human wealth is derived from education and training, health and mobility.

A somewhat similar and more general approach underlies the enormous literature on the "permanent income" and the "life cycle" consumption hypotheses. Many serious attempts have been made in this direction and in the following years two types of tests appeared in the literature to examine the validity of the permanent income hypothesis (Laumas 1992).

The first test was designed to prove the validity of the "strict version", that, in short, permanent consumption is proportional to permanent income and the marginal propensity to consume out of transitory income is close to zero. The

* The authors are based in the University of Milan, Italy; e-mail: ec@iumiso.s.poc.unimi.it

second test looked at the length of the consumer horizon, to see if it was longer than one year. The majority of the studies have been confined to the first type of test. The second type of test has an important contribution: M. Friedman (Friedman 1963) in his calculations of the consumption function for the USA estimated the consumer units horizon as approximately three years.

It seems, therefore, that not merely is wealth a relevant variable in consumption decisions, but also the degree of liquidity has an important influence on consumption.

Firstly W. L. Springer (Springer 1977, p. 299–306) found that the effects of nominal interest rates and inflation are different for different components of aggregate consumption and for different measures of the expected rate of inflation. After that period, even though many empirical contributions (Gyflason 1980, p. 223–225) have supported the view that consumption and interest rates, and consequently liquidity, are inversely related, there still remains a great deal of conflicting evidence regarding how to model and forecast the "wealth" variable. Part of this conflict is due to the difficult problem of combining the economic theories proposed and the statistical methods to handle time series data. In fact often the different results obtained in the literature come from the diversity of data models employed in the various studies.

2. THE MODEL

The theoretical life-cycle hypothesis and the permanent income hypothesis of consumption are the basis of a more general approach to estimate an aggregate consumption function for Italy. To estimate our equations we employ data (reported in appendix) for the period 1951 until 1990, from the data base of N. Rossi. The analysis behind the computation is the cointegration analysis given in R. F. Engle and C. W. Granger (Engle and Granger 1987, p. 251–276) contribution.

So, before the method of Engle and Granger can be performed, it is essential to identify the order of integration of each variable (the variables are consumption, income, and permanent wealth in logarithmic form, denoted by the lower case letters *c*, *y*, *wf*.), and a convenient way is by using the method proposed by D. Dickey and W. Fuller (Dickey and Fuller 1981, p. 1057–1072), later transformed in the augmented Dickey-Fuller test, hereafter called the ADF test. (The software used – Eviews 2.0 – performs automatically the ADF test.)

The results of the testing procedure, with constant term and trend, are given in Table 1.

Table 1

ADF test of series: consumption (*c*), income (*y*), health (*wf*) in logarithmic form

Series	No. of lags	Test ADF(ι)	Critical values
c	1	-0.021	1% -4.2165 5% -3.5312 10% -3.3937
y	2	-0.0239	1% -4.2242 5% -3.5348 10% -3.5348
wf	1	-2.190	1% -4.2165 5% -3.5312 10% -3.3937

Source: elaboration on data in appendix.

The lower, in absolute value, is the ADF statistics computed for a tested variable, the more it is likely that the variable is non-stationary, so we cannot accept, for our sample, the hypothesis of stationarity.

Consequently the next step is to establish the order of integration, in other words, to test whether the variables are stationary after taking first differences denoted as Δc, Δy and Δwf.

In Table 2 all these statistics are significant at a significance level of 5%.

Table 2

ADF test of the first differences of series: consumption, income, health in logarithmic form

Series	No. of lags	Test ADF(ι)	Critical values
Δc	1	-3.87	1% -4.2242 5% -3.5348 10% -3.4010
Δy	2	-3.73	1% -4.2340 5% -3.5386 10% -3.4086
Δwf	1	-3.58	1% -4.2242 5% -3.5348 10% -3.4010

Source: elaboration on data in appendix.

Therefore our search of the appropriate order of integration of the variables is over. Our conclusion is that the consumption (*C*), income (*Y*), and wealth (*WF*), are integrated of order 1 or I (1).

After having tested the order of integration of the variables involved, it is possible to use the same test of Engle and Granger for testing if the variables are cointegrated. In the definition of cointegration if there is a long run relationship between two or more variables, the idea is that deviations from this long run are stationary and the variables in questions are said to be cointegrated. Besides it is possible to formulate and estimate a model with an error correction mechanism to explain the short run relations.

The life cycle hypothesis and the permanent income hypothesis are consistent with an aggregate consumption function, suggested by A. Brodin and R. Nymoen (Brodin and Nymoen 1992, p. 431–453), of the form:

$$C_t = K\, Y_t^{\,b1}\, WF_t^{\,b2} \tag{1}$$

where: C_t is consumption, K a constant term, Y_t income, and WF_t wealth, all at time t.

In (2) lower case letters denote logarithms of the original variables and "*e*" is white noise:

$$c_t = k + b_1 y_t + b_2 wf_t + e_t \tag{2}$$

where: $c_t = \ln(C_t)$, $k = \ln(K)$, $y_t = \ln(Y_t)$ and $wf_t = \ln(WF_t)$.

Equation (1) and (2) can be estimated by linear least squares, paying attention to the fact that the series are not stationary.

The basic equation (1) can be formulated as:

$$c_t = \mathbf{x}_t'\boldsymbol{\beta} + e_t\,, \tag{3}$$

where: "c_t" is the logarithm of the consumption at time "*t*", $\mathbf{x}_t$ is the vector of variables, as $\mathbf{x}_t' = [1, y_t, wf_t]$ and $\boldsymbol{\beta}' = [k, b_1, b_2]$ is the vector of coefficients.

The method of Engle and Granger consists of a two-step procedure. Firstly we estimate "**b**" for β. Secondly, the error correction mechanism, representing deviation from the long run path is computed as :

$$\tilde{e}_t = c_t - \tilde{c}_t = c_t - \mathbf{x}_t'\mathbf{b}\,, \tag{4}$$

computing the ADF test to the residuals, to examine whether they appear to be stationary. If the residuals are found to be stationary, then (3) is a long run relationship.

3. THE LONG RUN RELATIONSHIP

We turn now to an effort at explaining the long run relationship given by (1). The same data spans the period from 1951 to 1990. The variables (data is reported in appendix) used are the following: "c": total personal non durable consumption; "wf": total family wealth; "y": disposable income in logarithmic form. All variables are measured in real terms.

Estimation of equation (1) by the ordinary least squares method produced this regression:

$$\tilde{c}_t = \underset{(0.07)}{0.61} + \underset{(0.017)}{0.82 y_t} + \underset{(0.016)}{0.096 wf_t} \tag{5}$$

where: $T = 40$, $R^2 = 0.998$, $DW = 0.64$.

Standard errors are in the brackets, below the estimate. The only sign that something has to be wrong in this regression is the very low Durbin-Watson statistics and it is easy to check that the residuals are not stationary.

It is necessary to modify the equation by introducing other variables in the set of regressors. Adding a linear trend and a dummy variable to catch the "wealth effect", which seems to be different in the period 1951-65 and after 1965, the long run equation becomes:

$$c_t = k + b_1 y_t + b_2 wf_t + b_3 dwf_t + b_4 t \tag{6}$$

where "t" is the trend and "dwf_t" is the dummy variable which is equal wf_t in the period 1951–1964, and zero starting from 1965. In (6), the "wealth effect"in the first period, is equal to ($b_2 \pm b_3$), while in the second period is the value of b_2.

The estimate of (6) is the following:

$$T = 40, \quad R^2 = 0.99, \quad DW = 1.55 \tag{7}$$

The computation of the Durbin-Watson test shows higher value and thanks to the dummy variable "dwf_t", the estimation is getting better and better as graphed in Fig.1.

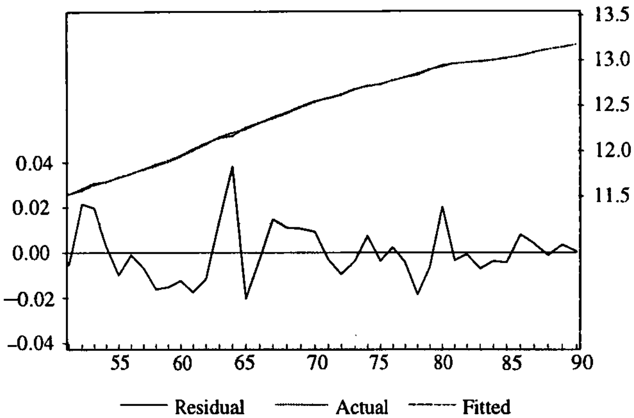

Fig. 1. Long run relationship and residuals
Source: elaboration on data in appendix.

As on the basis of ADF test, the residuals are found to be stationary at 1%, (with the significant value of – 4.296; the critical values are: 1.62 at 5%, 2.62 at 1%), our conclusion is that the equation (7) is a long run relationship.

4. THE SHORT RUN RELATIONSHIP

A long run relationship shows that the variables are in balance but not their casuality. In order to throw some light on the existing casuality it is necessary to study the impact of income and wealth changes and see as they modify the personal consumption expenditure. The relationship between consumption increases that can be explained by income and wealth increases are known as "short run relationship", and the equation has an "error correction model" that can be expressed as :

$$me = (c_t - k - b_1 yt - b_2 wf_t - b_3 dwf_t - b_4 t) \tag{8}$$

The result of the first short run model which includes the first difference of income Δy_t, of wealth Δwf_t, and consumption Δc_t, is given below:

$$\begin{aligned} \Delta\tilde{c}_t &= \underset{(0.0048)}{0.0012} + \underset{(0.082)}{0.51}\Delta y_t + \underset{(0.112)}{0.09}\Delta wf_t - \underset{(0.033)}{0.43} me_{t-1} + \underset{(0.11)}{0.31}\Delta c_{t-1} \end{aligned} \tag{9}$$

$T = 38$, $R^2 = 0.75$, $DW = 2.054$.

Figures in brackets are the values of the standard error.

The results are clearly undesiderable and there are no grounds for accepting the equation as the best one. The value of DW test indicates possible problems of correlated residuals. In spite of the significance of coefficients involved in (9) the wealth's coefficient changes sign from the period 1951–64 to 1965–90 as shown in Fig. 2.

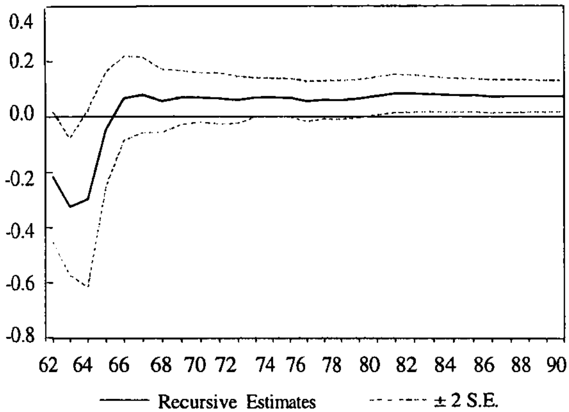

Fig. 2. Recursive residuals of equation estimates
Source: elaboration on data in appendix

So, in order to solve the problem of the nonstationarity of the wealth coefficients, we decided to introduce, in the short run relationship, the dummy variable Δdwf_t. This variable stands for $(wf_t - wf_{t-1})$ for the period 1951–1964 and zero for the period 1965–1990.

The new estimated coefficients are:

$$\Delta\tilde{c}_t = \underset{(0.0037)}{0.00086} + \underset{(0.070)}{0.523}\Delta y_t + \underset{(0.0257)}{0.079}\Delta wf_t - \underset{(0.137)}{0.397}\Delta dwf_t + \qquad (10)$$
$$- \underset{(0.110)}{0.665} me_{t-1} + \underset{(0.085)}{0.325}\Delta c_{t-1}$$

$T = 38, \; R^2 = 0.84, \; DW = 2.19$

The addition of the dummy variable Δdwf_t in (10) improves substantially the general characteristics of the equation (9). The value of wealth coefficient is now 0.079 – 0.397= – 0.318 for the period 1951–1964 and 0.079, and not negative for the period 1965–1990.

The goodness of fit of measure reported here is shown in Fig. 3.

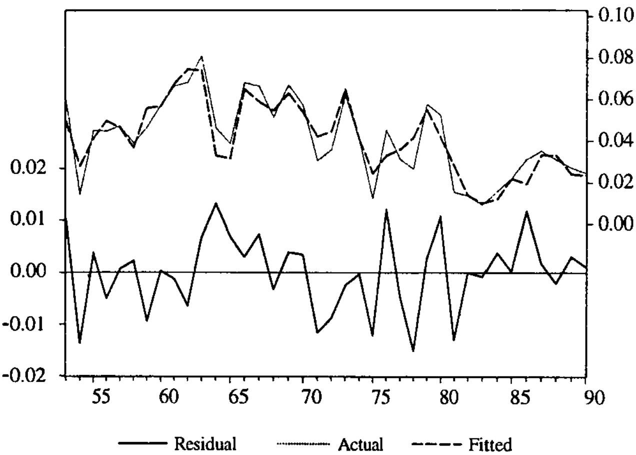

Fig. 3. Graph of short run equation (10) with residuals
Source: elaboration on data in appendix.

An inspection of the time paths of forecasts and realizations shows that the results are fully admissible.

As many models that have been proposed since J. M. Keynes suggest certain needed extensions of existing models of consumption behaviour, we decided to introduce the interest rate into (10). T. Gyflason's empirical evidence supports the view that consumptions and interest rates are inversely related. In addition to income, consumption and wealth we augmented the information set by interest rate (i) in (10).

The estimation result is in (11):

$$\begin{aligned} \Delta\tilde{c}_t &= \underset{(0.0009)}{0.011} + \underset{(0.068)}{0.51}\Delta y_t + \underset{(0.025)}{0.079}\Delta wf_t - \underset{(0.133)}{0.407}\Delta dwf_t + \\ &\quad - \underset{(0.109)}{0.627}me_{t-1} + \underset{(0.08)}{0.34}\Delta c_{t-1} - \underset{(0.00092)}{0.0016}\Delta i_{t-1} \end{aligned} \qquad (11)$$

$T = 38,\quad R^2 = 0.85,\quad DW = 2.35$

The expected negative relation between consumption and interest rate is found but there is reason to believe that there is a considerable sensitivity of aggregate consumption to changes of prices Δp as in the following OLS regression:

$$\Delta\tilde{c}_t = \underset{(0.0032)}{0.0196} + \underset{(0.071)}{0.402}\Delta y_t + \underset{(0.023)}{0.074}\Delta wf_t - \underset{(0.117\ )}{0.364}\Delta dwf_t + \tag{12}$$
$$- \underset{(0.104)}{0.639} me_{t-1} + \underset{(0.08)}{0.453}\Delta c_{t-1} - \underset{(0.0014)}{0.0044}\Delta_2 p_{t-1}$$

$T = 35,\ R^2 = 0.90,\ DW = 2.107$

The modifications affect positively the estimates of parameters that in diagnostic tests look good: R^2 =0.90 is quite high and the adjustment is fairly reasonable as it is possible to see from Fig. 4.

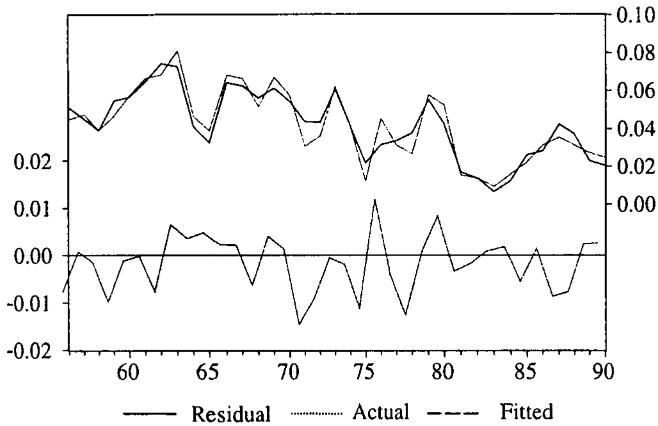

Fig. 4. Estimates of short run equation (12)
Source: elaboration on data in appendix.

Ordinary least squares estimation indicates no problems with autocorrelation on the basis of Lagrange Multiplier of Godfrey Breusch and Pagan. The Cusum and Cusum Q tests show good stability, especially for the period 1970-1990. The estimates have given good results: all the variables are fully consistent and more or less stable with respect to the previously estimated models. More precisely, the estimated income coefficient is slightly smaller than in the previously estimated model while the lagged consumption is slightly greater.

So, the model that appears to provide the most fruitful framework for a consistent understanding of saving behaviour, both in the short period and in the long period in its more general form, according to the kind of consumption depends on expected income, wealth, interest, rate, and prices.

6. CONCLUSION

The purpose of this study is to present a direct investigation of some aspects of the wealth theories of consumption. Such investigations have so far been limited by lack of data, and even now they are disposable only for a few years. The consumption data along with the income and wealth series for 1951 to 1990 are provided by a Bank of Italy survey.

The idea that wealth belongs in the consumption function goes back to H. Metzler, F. Modigliani, M. Friedman and in the '80s to T. Gyflason, N. Davidson and J. C. Usterling. On this basis our paper has the objective of seeing the importance of wealth in the consumption function, both in the short and in the long run period. Our results suggest two conclusions:

Firstly, the parameter estimates have shown the importance of models incorporating error correction mechanism in the economic analyses.

Secondly, there is clear evidence of a wealth effect and a sort of inflation effect, but income and its changes are to have a primary importance.

This is compatible with most long run theories of consumption behaviour, and at the same time seems to capture the short run dynamics adequately.

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APPENDIX

This appendix reports a table of data used and graphs of series

Table 1a

Year	C	Y	WF	i
1951	101212.0	119877.2	833831.9	5.655000
1952	107760.0	125052.0	812277.4	5.652000
1953	114407.0	135381.0	809090.3	5.650000
1954	116054.0	140186.9	802701.1	5.648000
1955	121417.0	150799.3	804349.9	6.116000
1956	126997.0	157333.6	790395.2	6.112000
1957	133143.0	167951.1	800187.1	6.110000
1958	138449.0	177818.0	835856.9	6.728000
1959	145059.0	188032.1	829433.8	5.508000
1960	153602.0	201171.1	841508.4	4.917000
1961	164160.0	220542.3	863498.0	5.086000
1962	175741.0	238830.8	866803.6	5.681000
1963	190564.0	256340.4	849741.6	5.994000
1964	199598.0	261947.1	839550.1	7.298000
1965	207479.0	278369.4	943632.4	6.824000
1966	222103.0	294425.7	1052661.	6.422000
1967	237350.0	311375.4	1115735.	6.489000
1968	249884.0	331236.8	1260041.	6.577000
1969	267194.0	358148.9	1462781.	6.724000
1970	282928.0	386244.2	1437539.	8.878000
1971	291741.0	405430.1	1504400.	8.201000
1972	302373.0	423269.4	1688916.	7.322000
1973	321798.0	449591.2	2024543.	7.251000
1974	335111.0	463558.2	2052918.	9.665000
1975	339253.0	471841.2	2213190.	11.30200
1976	354928.0	492820.4	2299524.	12.80000
1977	366184.0	515561.6	2253399.	14.29000
1978	376050.0	539284.2	2381064.	13.32600
1979	398415.0	566676.2	2609526.	13.62100
1980	419882.0	578637.6	2849742.	15.59400
1981	426363.0	605730.8	2846275.	19.97100
1982	432277.0	605814.6	3052469.	20.18700
1983	436272.0	613783.3	2952006.	17.20100
1984	443297.0	618093.9	2952345.	14.03300
1985	453173.0	629954.0	3080555.	12.00000
1986	467560.0	639849.0	3095974.	9.457000
1987	484341.0	666778.2	3344712.	8.561000
1988	499649.0	693469.2	3472286.	8.977000
1989	513406.0	707440.5	3556236.	9.463000
1990	526240.0	726888.4	3646364.	10.17400

C: total non durable consumption in real terms;
Y: total disposable income in real terms
WF: total family wealth in real terms
i: interest rate
Source: from a survey of bank of Italy: Nicola Rossi 1990.

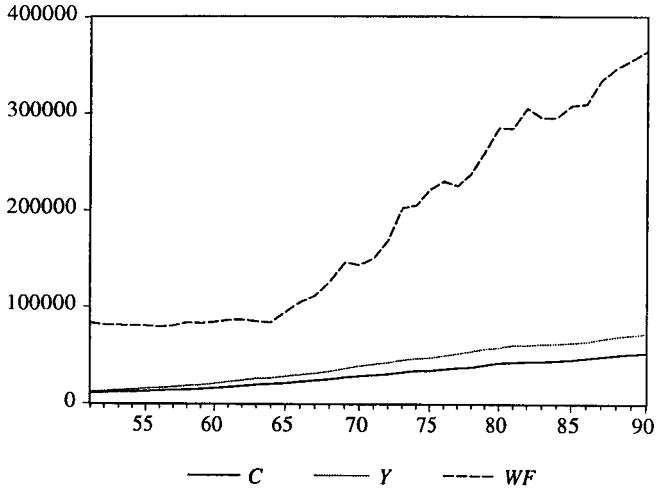

Fig. 1a (Series in original terms)
Source: elaboration on data in appendix

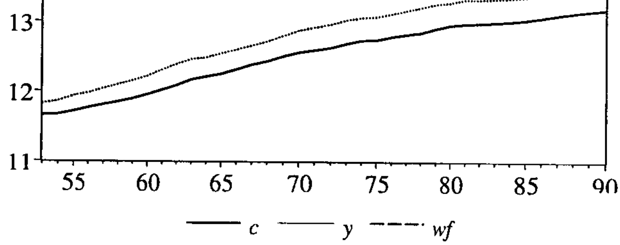

Fig. 2a (Series in logarithmic terms)
Source: elaboration on data in appendix.