RECENT EVOLUTION OF ITALIAN HOUSEHOLDS' EQUITY PORTFOLIO CHOICES: AN EMPIRICAL INVESTIGATION

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1. INTRODUCTION

The mean-variance paradigm of Markowitz (1952) is probably the most widespread model for describing the investors' financial behaviour and for analysing the effects of the risk-return trade-off on portfolio diversification. However, its empirical foundations are still weak, in spite of the great deal of statistical testing. Empirical econometric analysis has raised a number of discrepancies between the implications of the Markowitz paradigm and the statistical evidence.

The limiting assumptions of the theoretical construction in which the model is defined (representative agent, expected utility maximisation, static equilibrium, quadratic utility function[1] and homogeneous preferences) could be a partial explanation of this lack of coherence between the model and the empirical evidence. The framework defines a static equilibrium and does not face neither the intertemporal dimension of the trade-off between risky and safe assets, nor the problems deriving from agent heterogeneity. Moreover, the solution is based on some further assumptions concerning transaction costs and market completeness which could compromise the reliability of the model.

In spite of its limiting assumptions, the Markowitz paradigm has been highly influential for the empirical literature on portfolio choice, but it seems unable to explain either the heterogeneity in individual decisions (due to the representative agent hypothesis), or the changes in household portfolio choices, which are pointed out by the statistical evidence on the temporal evolution of actual portfolios (due to the static nature of the model). Models that consider third and fourth moments (skewness and kurtosis) for capturing price dynamics have had no particular success and also the further extensions of the mean-variance model that have been proposed in order to account for empirical anomalies have not provided solutions able to match the empirical evidence.

The differences between theory and data have generated a huge literature on the so-called financial puzzles: stock market non-participation puzzle, home bias

[1] With other utility functions the solution of the model corresponds to a second order approximation of the maximisation problem, maintaining the representative agents assumption (homogeneity of preferences).

puzzle, equity premium puzzle[2]. The econometric analysis of these puzzles has followed two main approaches:

a) trying to improve the standard model by relaxing some of its assumptions in order to reconcile it with empirical evidence;

b) refining the empirical analysis.

The first approach has attempted to reconcile theory and data by introducing "ad hoc" solutions or relaxing one or more restrictive assumptions. By focusing on the consumption of stockholders, Attanasio and Vissing-Jorgensen (2003) have found plausible values of the relative risk-aversion coefficient which partially explain the equity premium puzzle. Some authors introduced habit formation preferences, heterogeneity, etc. (Curcuru, Heaton et al., 2007); other authors argued that transaction costs could be a possible explanation of the puzzles (Vissing-Jorgensen, 2002; Attanasio and Paiella, 2007; Paiella, 2007). These works have provided interesting results but the differences between what theory predicts and what empirical evidence shows are generally too large to be fully explained by the proposed adjustments to the standard model.[3]

The second approach, focusing on actual portfolio choice data, has became increasingly relevant in recent years, producing interesting results both for the Italian case (Guiso, Haliassos and Jappelli, 2002; Guiso and Jappelli, 2002; Guiso, Haliassos and Jappelli, 2003) and for other countries (Shum and Faig, 2006; Hochguertel, 2001; Chapman, Dow and Hariharan, 2005; Bergstresser and Poterba, 2004).

It is interesting to notice that despite those innovations, econometric portfolio choice models are still strongly related to the assumption of equilibrium, while practitioners normally act assuming the existence of disequilibria in financial markets and arbitrage opportunity due to overreaction or underreaction to news. Moreover, the empirical analysis of portfolio performance has shown that the well known momentum and contrarian trading strategies, which exploit the arbitrage opportunities deriving from market disequilibria, generate significant arbitrage profits (Fama and French, 1992; Mengoli, 2004; Balvers and Wu, 2006).

The static nature and the limiting assumptions of the theoretical model (representative agent, no transaction costs, complete markets and homogeneous preferences) seem the main reasons of the lack of coherence between the predictions of the Markowitz model and the actual choices of investors, therefore we ground our analysis on a simple dynamic model of portfolio choice and analyse the temporal evolution of the actual composition of Italian households' portfolios in order to explain financial and housing investment choices and to detect possible determinants of the observed disequilibria phenomena.

In the next section we outline the general framework, laying the foundations of the empirical analysis. In the third section we describe the data used in our analy-

[2] See the seminal papers by Mankiw and Zeldes (1991), French and Poterba (1991), Mehra and Prescott (1985).

[3] For example, transaction costs should be implausibly high to justify actual portfolios. Recently, Paiella (2007) finds that the lower bound to the forgone gains for not investing in risky assets ranges from 0.7 to 3.3 percent of consumption (non-durable goods and services); for the wealthiest third of riskless asset holders, the forgone gains could be as high as 6.7 percent.

ses and show some stylized facts emerging from the aggregate temporal evolution of Italian households' portfolio choices, giving specific attention to equities and housing. In the fourth section we model the stock market participation decision process and display some microeconometric explanations of the temporal evolution of portfolio choices of Italian households.

2. THEORETICAL GROUNDS

The empirical analysis of the temporal evolution of portfolio choices requires an intertemporal formulation of the choice problem. Let us consider an investor who wants to maximize the expected utility of his future wealth W_{t+s} by means of a series of portfolio choices to be made in periods $t+1$, $t+2$, $t+s$, given the information x_t about the state of the economic system at the period in which the investor chooses (with $s = 1$ the specification collapses to the static uniperiodal model). In discrete time the optimal problem is defined by

$$U(r, W_t, x_t) = \max_{t+r} E_t[(u(W_{t+r})]$$

$$\text{s.t.} \quad W_{h+1} = W_h(x_h' r_{h+1} + R_h^f) \ .$$

This problem can be solved by assuming a sequence of uniperiodal optimization problems with state-dependent utility function (Brandt, 2007). The first order condition is

$$E_t\{U_i'[r-1, W_t(z_t r_{t-1} + R_t^f)x_{t+1}]r_{t+1}\} = 0 \,,$$

where U_i' is the partial derivative with respect to the i-th argument, z_t is the optimal portfolio at time t, r_{t+1} is the expected risky asset return at time t+1 and R_t^f is the return of the risk-free asset.

In fact, an investor that has wealth W_t at time t and wants to maximize his/her expected utility function at time $t+r$, modifies the portfolio composition (risky assets/risk-free asset) at the end of each period by evaluating and processing the information x_t about the state of the system. Hence, the optimal financial choice at time t (defined by the above system of non-linear equations) is time dependent and, in the case of CRRA utility function, is strictly related to the state of the economy.

The solution of the intertemporal optimal portfolio problem stresses the time dependence of financial investment. Within this theoretical framework, we do not try to estimate separate functional forms for each state of the world (regime), because even with large data set we would not have adequate degrees of freedom. We will present a statistical analysis of the time evolution of portfolio choices at the macro level, analysing the aggregate quarterly financial time series and we will

model stock market participation choices of Italian households estimating reduced-form probit equations for direct and indirect stockholding in a sequence of cross-sectional surveys, in order to analyse the stability of the microeconometric parameters of the stock market participation process.

This approach contributes new interesting results also for the problems deriving from the change of the group of investors (Heaton and Lucas, 1996) and for the risk sharing problem in its linkages with the changes in the participation process (Pijoan-Mas, 2007). The former has been analyzed in the context of heterogeneous preferences of economic agents (Hansen and Jagannathan, 1991; Heaton, 1995; Heaton and Lucas, 1996): portfolio choices may change over time not only because of "state modifications" or intertemporal decisions, but also because, in a context of investor heterogeneity, changing the group of investors results in a modification of household financial portfolio. The latter have recently been examined by Pijoan-Mas (2007), who pointed out that intertemporal saving decisions play a crucial role for the dynamics of preference parameters which drive portfolio choices in the process of consumption smoothing (risk sharing). Estimating the relations between Italian households' financial assets and their socioeconomic characteristics in a sequence of periods, we evaluate the different reactions to shocks of different socioeconomic clusters, giving new insights to the analysis of the changing preferences deriving from modifications in the group of investors. Moreover, testing the stability of the participation parameters in a temporal sequence of cross-sections, we evaluate the structural relevance of these temporal changes. The formulation of the choice problem in an intertemporal setting and integrating aggregate statistical analysis of time series and the stability analysis of the participation parameters, provide a comprehensive framework for the statistical analysis of the temporal evolution of household portfolios and stock market participation.

3. STATISTICAL EVIDENCE

The statistical information on Italian households' wealth comes basically from two sources: the cross-sectional Survey on Household Income and Wealth (SHIW) and the time series data on National and Financial Accounts (NA and FA).

The SHIW[4] is a biannual survey run by the Bank of Italy with the specific aim of providing information on household saving, income and wealth; it collects detailed information on the composition of household wealth (real and financial) and on the socioeconomic characteristics of each family head. We consider the 1998 – 2000 – 2002 and 2004 waves.

The system of FA provides quarterly time series data on the temporal evolution of aggregate household financial investments;[5] this source can be integrated with

[4] Bank of Italy (1998, 2000, 2002, 2004).

[5] The time series of Financial Accounts on assets and liabilities (currency and deposits, equities, mutual funds, bonds, T-Bill, etc.) of households, firms, financial institutions, central government and rest of the world are published by the Bank of Italy since 1990 (Bonci and Coletta, 2006; Bruno, 2006).

household housing investments, provided by the system of National Accounts (NA), in order to construct quarterly time series data on household real and financial wealth for the period 1995.1-2007.1, corresponding to the statistical information provided (at lower frequency) by the Survey on Household Income and Wealth. The higher frequency of financial and national account data enlighten the time path of household savings and investment decisions (on a macroeconomic basis), while SHIW cross-sectional data enlighten the microeconomic factors affecting households' participation choices.

3.1. *Temporal evolution of households' investments: equities, bonds and housing*

The values of the vector z_t for Italian households provided by FA data show a sharp increase in aggregate Italian households' stockholdings, from the first quarter of 1995 to the first quarter of 2000 (see Table 1). The new century starts with a strong decline in 2000.2 which lasts with more or less intensity until the end of 2004. A new phase of stock wealth accumulation begins at the beginning of 2005 (see Table 1 and Figure 1).

TABLE 1

Stockholdings
The table reports the aggregate stockholdings of the Italian household sector, 1995-2007. Data drawn from Italian Financial Accounts (millions of euro)

Time	*Stockholdings*	*Time*	*Stockholdings*
1995.1	247206	2001.1	694253
1995.2	241394	2001.2	691445
1995.3	242174	2001.3	586705
1995.4	251119	2001.4	675398
1996.1	250475	2002.1	733616
1996.2	260381	2002.2	674111
1996.3	253935	2002.3	598666
1996.4	257214	2002.4	643584
1997.1	263847	2003.1	525492
1997.2	290522	2003.2	641926
1997.3	315842	2003.3	546237
1997.4	352949	2003.4	623481
1998.1	453787	2004.1	588996
1998.2	441385	2004.2	605203
1998.3	386431	2004.3	597594
1998.4	459887	2004.4	675420
1999.1	500010	2005.1	746708
1999.2	492933	2005.2	726168
1999.3	499654	2005.3	815281
1999.4	705931	2005.4	786776
2000.1	800596	2006.1	834582
2000.2	748138	2006.2	815114
2000.3	761040	2006.3	841885
2000.4	763059	2006.4	830976
		2007.1	888993

Focusing on the period 2000.2-2005.1, during which households' stockholdings declined, FA time series data show that the disinvestment occurred mainly from 2000 to 2003, but the recovery is significant only from 2005. After 2005.2, equity investments increased steadily and in 2006.1 the amount of equities held by Italian households goes beyond the previous top settled in 2000.1.

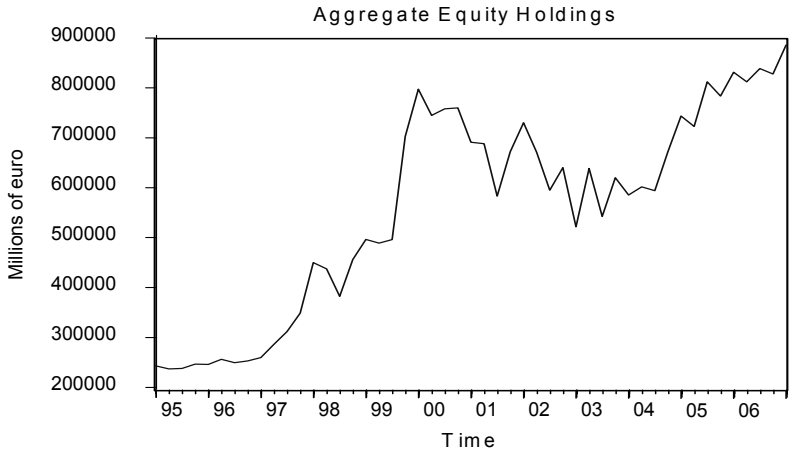

Figure 1 – Aggregate Equity Holdings; our elaboration based on FA data.

Survey cross-sectional data (SHIW) show a small decline in household stock-holdings in the period 2002-2004. The reduction in stock market participation rates between 2002 and 2004 seems in contrasts with the marked increase in equity returns which materialized in that period, but quarterly time series data show the non-linear evolution between the two waves (2002 and 2004) of the SHIW: stock market participation declined only in the first year and was followed by a partial recovery in 2004.

The picture described by time series financial data confirms the decline in stock market participation in the period 2000-2004 pointed out by SHIW data (see section 4.1), and it locates the starting point of the decline in the second quarter of year 2000.

Figure 2 reports the evolution of financial portfolio shares. From 2000 to 2004 the equity portfolio share declines from 31.9% to 26.9%; at the end of 2004 equity portfolio share starts a new rising period which reaches its maximum in 2007.1 (31.6%), without outclassing the previous maximum.

Among the other financial assets (cash "on hand", mutual funds and bonds), quarterly time series data point out the following trend in portfolio shares:

- mutual funds increase their share from 1995 (4,94%) to 1999.1 (22,55%), but in the following years this asset reduces persistently its share in Italian households' portfolios from 22,55% (1999.2) to 10,46% in 2007.1;
- cash "on hand" held by households falls from 55% in 1995 to 33% in 2007;
- the share of BOT held by households falls from 12% in 1995 to 0,3% in 2003.4 and then it remains constant until year 2006; in the latest year Italian households accumulate again BOT, bringing the corresponding share to 1,04% in 2007.1;
- corporate bonds behave like BOT until 1998, but in the following years the share of this asset increases from 17,83% in 2000.1 to 23,71% in 2007.1, pointing out a switching from BOT to bonds in Italian households' portfolios.

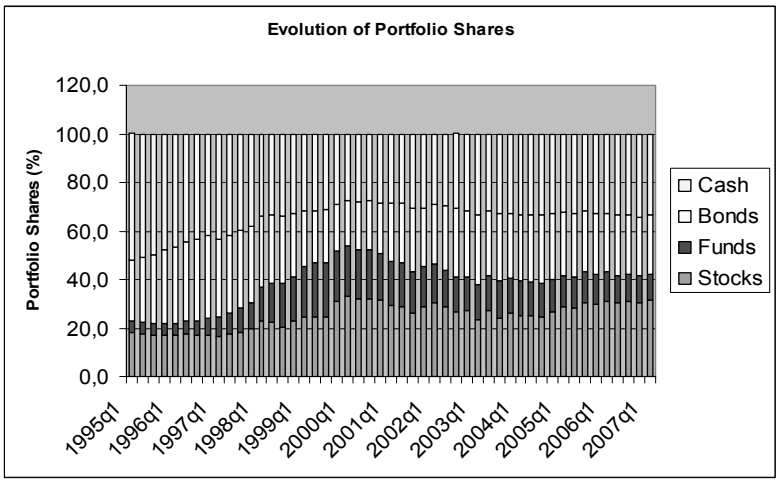

Figure 2 – Evolution of Portfolio Shares; our elaboration based on FA data.

Housing investments are included in cross-sectional SHIW data but are excluded from FA time series data.[6] The system of National Accounts (NA) is the only source available to complete the FA time series information on household portfolios including data on real estate investments.

Housing investments are relevant components of Italian households' wealth, therefore they should be included also in time series data in order to depict the time path of Italian households' portfolio choices in the intervals between SHIW waves.

Aggregate housing investments resulting from NA data at current prices increase continuously from 1995 to 2007 (see Figure 3). In the period 2000-2004 housing investments surged by 25.54%, while equity holdings reduced by 11.5%.[7] In the sub-period 2002-2004 equity holdings increase marginally (+4.95%), in spite of the marked increase in equity returns (34.6%); in this period Italian households increased the share of housing investments in their portfolio (housing investment increased by 11.38%) though the increase in housing returns was smaller than that in equities (+31,3% and +34,6% respectively). The increase in equity returns have not been enough high, in the risk-return space, to overcome the increase in housing returns in the same period. The comparison between the evolution of households' stockholdings and housing investments in the Italian case seems to point out the existence of a trade-off between equity and housing investments which could be an expression of irrational behaviour and which seems not justified by expected asset returns and risks of these assets.

[6] Data concerning real wealth and housing investments are provided by SHIW and by National Accounts (NA), but the former measures the value of the real wealth held by households, while the latter measures investment flows and refers to the whole economy, without classification by institutional sectors.

[7] Our elaborations based on NA and FA data.

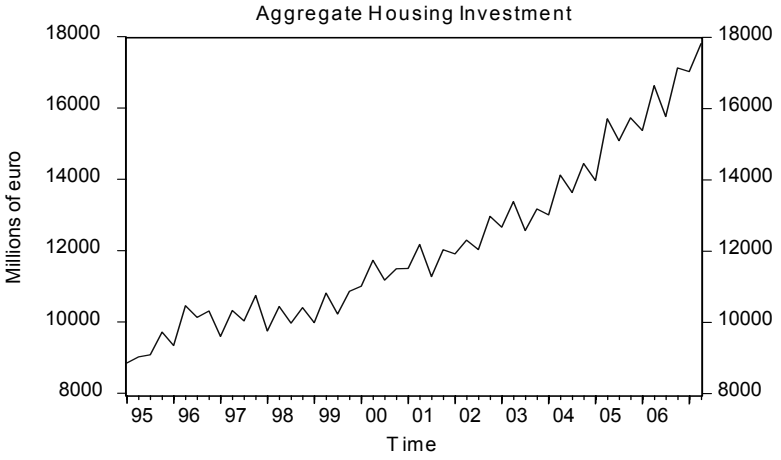

Figure 3 – Aggregate Housing Investment; our elaboration based on NA data.

In summary, quarterly time series data show that corporate bonds and housing are the only assets which increase their shares in Italian household portfolios in the new century.

The portfolio composition of households resulting from SHIW data in 1998, 2000, 2002 and 2004 (see Table 2) gives some more insights into this process notwithstanding the methodological differences between FA and SHIW data. In 1998 and 2000 indirect stockholdings (equity mutual funds) are partially overestimated because they include not only equity mutual funds but also other mutual funds. Since 2002 SHIW wave, we have accurate data on equity mutual funds and the two data sources become comparable with respect to this item. Managed investment accounts are included in the other investment classes (stocks, bonds, etc.) in FA data, while are evaluated as a separate component in SHIW data. The category "bonds" includes government and corporate bonds at different maturities (long term and short term expiration date), both in FA and SHIW data (see Table 2 and Figure 2). Finally, to the so-called "cash on hand" (monetary riskfree assets), in the case of SHIW data includes also monetary mutual funds.

Quarterly time series data define the timing of the investment process and integrate the information on the evolution of household portfolios provided by the biannual SHIW.

TABLE 2

Portfolio Composition – SHIW data
The table reports the portfolio composition of households.
Our elaboration based on data drawn from the 1998, 2000, 2002 and 2004 SHIW

	Stocks	*Mutual Funds*	*Managed Investment Accounts*	*Bonds*	*Cash*	*Total*
1998	8.80	12.83	9.90	18.17	50.30	100
2000	10.97	14.78	7.30	19.43	47.52	100
2002	8.15	8.40	5.38	20.57	57.50	100
2004	8.17	8.76	5.23	23.43	54.41	100

The analysis of the evolution of household investments points out the trade-off between equities and housing and the strong volatility in portfolio shares of Italian households; both elements seem to indicate the existence of irrational behaviour or, at least, a complex dynamics of the elements of the vector z_i which could be the result of structural changes in the participation process or be explained by the dynamics of returns. Therefore, in the next two sub-sections we will analyse prices and volatility for the main asset classes resulting from market time series data, while in the forth section we will analyse the main determinants of stock market participation choice of the Italian households and test the temporal stability of the parametric structure in microeconometric regression equations estimated from SHIW cross-sectional data.

3.2. *Dynamics of asset prices*

Returns on Italian equity investments evaluated through the evolution of the Italian Stock Exchange price index (Mibtel) show a sharp increase from 1995 to 2000 and then a reduction up to the end of 2002, followed by a recovery which lasts until the first quarter of 2007 (see Figure 4).

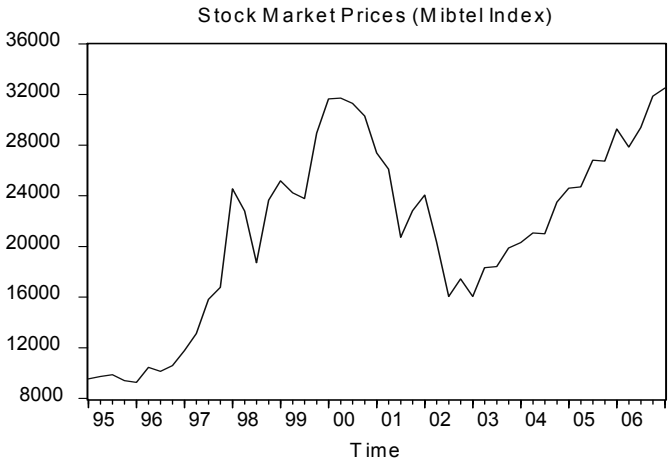

Figure 4 – Stock Market Prices (Mibtel Index); data drawn from www.borsaitaliana.it.

The evaluation of housing returns is less direct. Data on house prices are drawn from "Il Consulente Immobiliare", a publication edited by "Il Sole 24ore" which collects data at the province level and reports the price per square meter of new or recently renovated dwellings located in three different areas (central city, semi-central area and the outskirts). For our analysis we have computed an average price index based on the six most representative cities: Milan, Rome, Turin, Florence, Bologna and Naples. Figure 5a and 5b show the evolution of house prices from 1995 to 2006. Return on housing investment is remarkable: prices are

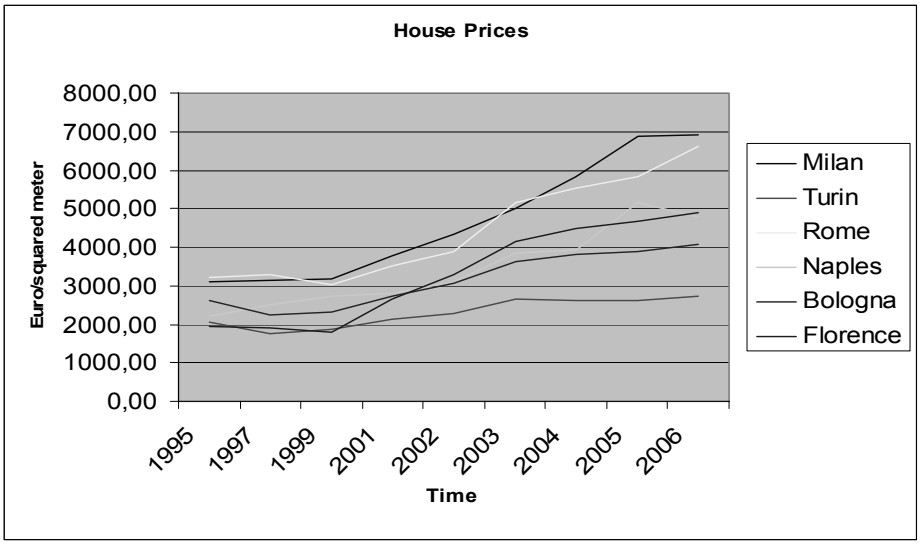

Figure 5a – House Prices; our elaboration based on data drawn from "Il Consulente Immobiliare".

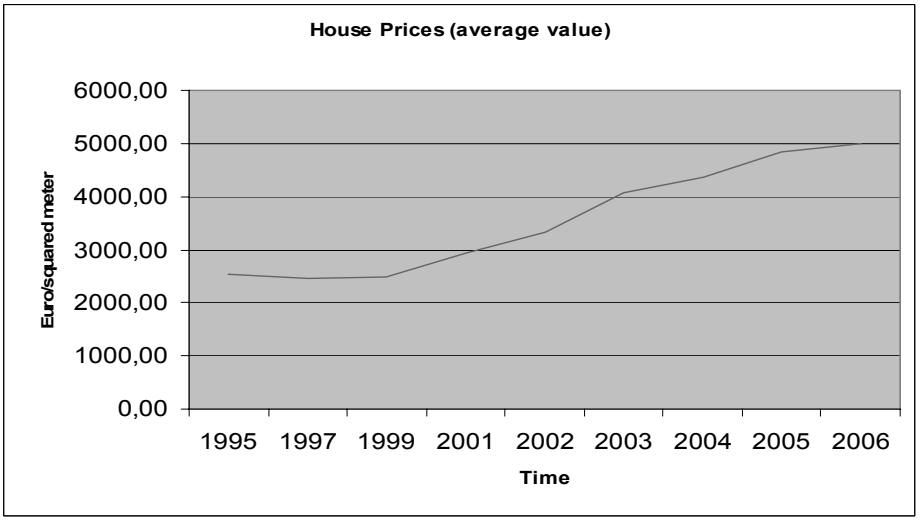

Figure 5b – House Prices (Average Value); our elaboration based on data drawn from "Il Consulente Immobiliare".

quite stable until 1998, then increase by 102,62% from 1999 to 2006. In particular, in the period 2002-2004, as seen in the previous section, return on housing investment rose by 31.3%, real estate investment (resulting from National Accounts data) increased by 11.38%, real wealth resulting from SHIW data increased by 12.82%, but stock market participation declined. Looking at this particular period, the shift from equity to housing seems evident and not justified by returns:

TABLE 3

Volatility and Stock Returns

The table reports the quarterly volatility of stock returns, the average quarterly stock return and the relative Sharpe ratio. Our elaboration based on data drawn from www.borsaitaliana.it.

Periods	*Quarterly Volatility of Stock Returns (%)*	*Average Quarterly Stock Return (%)*	*Sharpe Ratio (%)*
1995-07	11.75	3.21	0.27
1995-00	13.42	5.90	0.44
2000-07	9.60	0.75	0.08
2000-04	11.24	-0.94	-0.08
2000-02	12.80	-5.90	-0.46
2002-04	7.16	4.00	0.56

from 2002 to 2004 equity prices increase by 34.6% while housing prices increased by 31.3%. Nevertheless, extending the temporal horizon to the period 2000-2004 we find out that house prices rose by 61.41%, while equity prices rose only by 25,71%: the decline in stock market participation after 2002 could be interpreted as a lagged response (two years lag) to the price dynamics in the previous two years.

In Table 3 we report volatilities, returns and Sharpe-ratios for different sub-periods and along the entire period considered (1995-2007). We observe that in the period 1995-07, when the stock market performance was globally very high, the volatility was high as well (13.42%); in the period 2000-02, when stock returns drop dramatically, the volatility remains high, while in the period 2002-04 the volatility is relatively low (7.16%) and the Sharpe-ratio reaches its highest value (see Table 3). The volatility of equity return is very high in absolute value until 2004, then it declines and remains low until the end of 2006. These empirical facts appear to be particularly puzzling combined with the reduction in participation rates and suggest again the presence of irrational behavior in household portfolio choices.[8]

3.3. *Portfolio holdings and asset prices: further evidence*

In this sub-section we try to separate the variations in households' portfolio holdings due to price changes from variations due to actual changes in portfolio composition, to point out some "macro" aspects of the relationships between households' investment decisions and asset prices. In order to pursue this aim, we define deflated variables by dividing the values of each asset class (equities, bonds, mutual funds, etc.) for the corresponding price index with the possibility of decomposing the variation in each asset into two components:

– change in prices (without changing the physical amount of assets);

– change in the quantities held of each asset class.

The decomposition results are partially unexpected: Italian household portfolios have kept nearly the same quantities of equities during the entire period

[8] The volatilities of equity and housing returns are not comparable because of the different time frequency of the corresponding time series data.

(1995-2007), modifying significantly both the quantity of BOT and of mutual funds; the quantity of BOT shows the higher negative variation and a strong negative trend.

The coefficient of variation for the period 1995-2007 is low for equity holdings and high for short-term T-Bills (BOT); moreover, in the indirect stockholding case (mutual funds), the coefficient is higher than in the direct stockholding case (0.17 and 0.29). Italian investors behave in an unusual way. The holdings of BOT have the maximum value of the coefficient (0.91), suggesting that they might have been used as a buffer for liquidity; the investment in mutual funds is provisional and changes more frequently than the direct investment in the stock market (the "buy and hold" investment strategy seems to be the dominant behaviour only for this asset class).

The buy and hold equity strategy comes out also from the plot of prices, quantities and values of equity portfolio (see Figure 6): the value line and the price line nearly overlap each other, while the line of the deflated amount of equities is nearly constant along the entire period. Moreover, the infrequent quantity changes (in 1997-1998 and in 2002-2003) turn out to be opposed to price variation. The correlation coefficient between returns (changes in prices) and changes in quantity of equity holdings is significantly negative (-0,37).[9]

Analysing some sub-periods, we find other unexpected results. In particular, an irrational behaviour emerges not only in the period 2002-04 (see sections 3.1 and 3.2), but also in the period 2000-02, when the large drop in stock prices (-42.34%) is contextual with an increase (+46,27%) in the quantity of stocks held by Italian households in their portfolios.

The analysis of the composition of the vector z_t and of the temporal evolution of its components (housing, equities, mutual funds, bonds and BOT) underlines some unusual behaviour of Italian households. Bonds and Bot are very unstable, while equities are the most stable elements of the vector. Moreover, the managed components of z_t (mutual funds) are less stable than those households buy or sell directly in the stock market; the quantity of stocks held by Italian households changes seldom, mainly after some exuberance and with wrong "time to market". More generally, the incoherence between the temporal evolution of equity investments and equity prices is underlined by the corresponding correlation coefficient which is significantly negative (-0,37). The most relevant change takes place after the "internet bubble", when households shifted their portfolio composition from equities to housing; the shift happens with a relevant lag (about two years) and generates a new (real estate) bubble.

Financial education of Italian households seems quite rough and professional agents of the monetary and capital markets are not able to induce rational behaviour. Therefore, in the following section, we will seek for some explanations of this unusual behaviour, investigating the individual determinants (education, age, wealth, etc.) of Italian households' behaviours emerging from micro SHIW data.

[9] When Italian households deviate the buy and hold strategy for equity, they bring about losses.

TABLE 4

Coefficients of Variation of Italian households' asset holdings
The Table reports the coefficients of variation (σ/μ) of some financial assets (1995-2007).
Our elaboration based on FA data

	Equities	*Mutual Funds*	*Bonds*	*BOT*
Standard Deviation	95854	4089	136607	53345
Mean	563847	14303	506407	58319
Coefficient of Variation	0.17	0.29	0.27	0.91

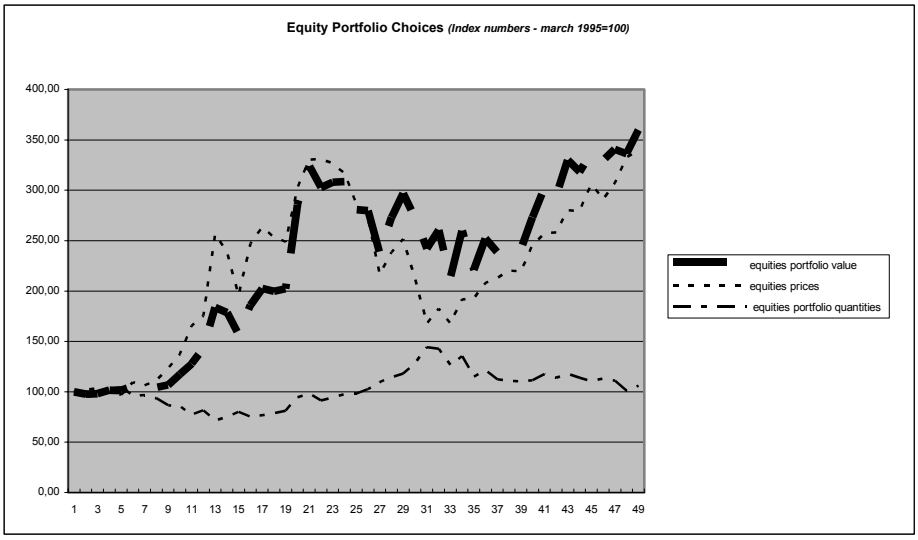

Figure 6 – Equity portfolio value, equity prices and equity portfolio quantities; our elaboration based on FA data.

4. STOCK MARKET PARTICIPATION AND HOUSEHOLD CHARACTERISTICS: ECONOMETRIC ANALYSIS

4.1. *Stock market participation rates*

The Survey on Household Income and Wealth (SHIW) can be used to analyse the temporal evolution in stock market participation at a biennial frequency; in this paper we consider the four surveys 1998, 2000, 2002 and 2004.

In 1998 the participation rate for direct stockholding was 8.4%, mutual funds were owned by 10,8% of Italian households and the total stock market participation rate (direct and indirect stockholding) was 15.5% (Tables 5, 6 and 7).

In 2000 Italian households increased the rates of financial participation both for equities and mutual funds which reached the values of 10.2% and 12.1% respectively. The increase in financial participation was widespread and total financial participation reached its maximum.

TABLE 5

Participation Rates for Stocks
The table reports the number of participants and participation rates for stocks. Our elaboration based on data drawn from the 1998, 2000, 2002 and 2004 SHIW

Year	*Households*	*Participants*	*Part Rate (%)*
1998	7147	599	8.4
2000	8001	820	10.2
2002	8011	672	8.4
2004	8012	433	5.4

TABLE 6

Participation Rates for Equity Mutual Funds
The table reports the number of participants and participation rates for equity mutual funds. Our elaboration based on data drawn from the 1998, 2000, 2002 and 2004 SHIW

Year	*Households*	*Participants*	*Part Rate (%)*
1998	7147	776	10.8
2000	8001	970	12.1
2002	8011	588	7.3
2004	8012	384	4.8

TABLE 7

Participation Rates for Total Stockholding
The table reports the number of participants and participation rates for total stockholding (stocks plus equity mutual funds). Our elaboration based on data drawn from the 1998, 2000, 2002 and 2004 SHIW

Year	*Households*	*Participants*	*Part Rate (%)*
1998	7147	1110	15.5
2000	8001	1451	18.1
2002	8011	1069	13.3
2004	8012	711	8.9

In the following years stock market participation rates declined heavily and in 2004 total participation rates brought down to 5.4% (equities) and 4.8% (mutual funds).[10]

Tables 5-6-7 report summary statistics concerning Italian households' stock market participation rates and show the large decline in participation which starts from year 2000 and seems not to have reached its minimum within the sampling period.

This behaviour is puzzling because it is totally at odds with the recent prevailing trends in other European countries and U.S. (Gardini and Magi, 2007; Ameriks and Zeldes, 2004; Gomes and Michaelides, 2005) and seems also in contrast with rational risk-return decisions: equity returns increased steadily since march 2003 and the Sharpe-ratio reached its maximum value in 2004 (see Table 3).

[10] We note that in 1998 and 2000 indirect stockholdings are partially over-estimated because they include not only equity mutual funds but also other funds. This problem is due to the nature of SHIW data. Instead, as mentioned in the previous section, since 2002 SHIW data about equity mutual funds are accurate.

The trend in Italian household portfolio composition analysed in the previous sections reflects these participation choices. In the next sub-sections we model the participation process trying to find some micro foundations of this surprising evolution of Italian households' aggregate investment decisions.

4.2. *Participation probit regressions*

To analyse the relationship between stock market participation choice and household socioeconomic characteristics, we estimate the following probit regression model for direct and indirect stock market participation, in four different cross-sections of SHIW data, for a total of 31,171 observations:

$$y_i^* = x_i\beta + \varepsilon_i \qquad i = 1,.....,N$$

with $y_i = 1$ if $y_i^* > 0$ (stockholding) and 0 otherwise. Regressors (x_i) are dummy variables, including age, education, gender, familiar status, real and financial wealth quartiles.[11]

The model allows the analysis of the structural relations among stock market participation decisions and the specific features of the Italian households doing those choices; moreover, by comparing the estimated parameters in the sequence of cross-sectional samples (1998, 2000, 2002, 2004), we can detect possible links between structural microeconomic changes and the wealth composition measured by the vector z_t.

The marginal effects in probit models can be measured by the following expression:[12]

$$\text{ME} = \frac{\partial F(x_i\beta)}{\partial x_{ik}} = \beta_k \phi(x_i\beta),$$

where $F(\cdot)$ is the cumulative distribution function of the normal distribution, $\phi(\cdot)$ is the density function of the same distribution and β_k is the coefficient estimate. Tables 8-9-10 report the marginal effects.

The estimates reported in Tables 8-9 measure the marginal effects[13] of each household feature on direct and indirect stockholding and show the temporal evolution of these structural "micro" parameters from 1998 to 2004. The variables high school and college have a positive impact on the probability of invest-

[11] The econometric specification is similar to Guiso, Haliassos and Jappelli (2003), but we use real wealth quartiles and not income quartiles. If we add income quartiles as regressors, we find that their effect is negative and not significant; but without financial wealth quartiles as regressors, the effect of income quartiles becomes positive and significant. Probably, this is due to the high correlation between income and financial wealth.

[12] As is well known, in probit models the estimated coefficients do not measure marginal effects directly.

[13] For a more detailed description of the impact on participation of household characteristics in the four years, see Gardini and Magi (2007).

TABLE 8

Cross-sectional Probit Regressions for Direct Stockholding
The coefficients in the table indicate the marginal effect of the regressor on the probability of stockownership. Each of the regressors is a dummy variable. z-statistics are reported in parenthesis

Variable	*Stocks*			
	1998	*2000*	*2002*	*2004*
Age 30-39	0.0004 (0.06)	0.0073 (0.84)	0.016 (1.77)	0.033 (2.34)
Age 40-49	-0.0043 (-0.62)	0.019 (2.02)	0.021 (2.29)	0.032 (2.43)
Age 50-59	0.0037 (0.49)	0.023 (2.41)	0.028 (2.84)	0.033 (2.55)
Age 60-69	-0.0004 (-0.06)	0.0084 (0.93)	0.024 (2.51)	0.031 (2.35)
Age 70+	-0.007 (-0.97)	-0.012 (-1.59)	0.0085 (1.01)	0.022 (1.91)
High School	0.041 (9.33)	0.036 (8.86)	0.036 (9.94)	0.023 (7.77)
College	0.085 (10.56)	0.058 (8.60)	0.051 (8.42)	0.042 (8.00)
Married	0.010 (2.87)	0.008 (2.32)	0.010 (3.23)	0.003 (1.26)
Male	0.0073 (1.91)	0.006 (1.58)	0.012 (3.86)	0.011 (5.04)
II fin wealth quartile	0.097 (4.05)	0.16 (4.08)	0.12 (3.79)	0.079 (3.38)
III fin wealth quartile	0.21 (6.76)	0.36 (6.69)	0.24 (5.67)	0.16 (5.06)
IV fin wealth quartile	0.38 (9.43)	0.51 (8.25)	0.39 (7.43)	0.25 (6.46)
II real wealth quartile	0.04 (5.10)	0.034 (5.14)	0.010 (1.94)	0.015 (3.20)
III real wealth quartile	0.03 (4.28)	0.024 (4.04)	0.013 (2.64)	0.012 (2.75)
IV real wealth quartile	0.024 (3.78)	0.016 (2.98)	0.023 (4.38)	0.016 (3.62)
Observations	7,147	8,001	8,011	8,012

TABLE 9

Cross-sectional Probit Regressions for Indirect Stockholding
The coefficients in the table indicate the marginal effect of the regressor on the probability to invest in equity mutual funds. Each of the regressors is a dummy variable. z-statistics are reported in parenthesis

Variable	*Equity Mutual Funds*			
	1998	*2000*	*2002*	*2004*
Age 30-39	0.008 (0.70)	0.010 (1.02)	0.017 (1.56)	0.025 (2.06)
Age 40-49	0.0043 (0.38)	0.023 (2.14)	0.012 (1.22)	0.031 (2.50)
Age 50-59	0.013 (1.10)	0.035 (3.01)	0.025 (2.18)	0.032 (2.60)
Age 60-69	0.015 (1.26)	0.017 (1.55)	0.007 (0.65)	0.033 (2.60)
Age 70+	-0.015 (-1.43)	-0.003 (-0.32)	-0.0002 (-0.02)	0.008 (0.86)
High School	0.046 (7.70)	0.039 (8.44)	0.030 (6.65)	0.017 (6.51)
College	0.090 (8.95)	0.064 (8.37)	0.043 (6.09)	0.022 (5.23)
Married	0.016 (2.83)	0.0075 (1.72)	0.010 (2.47)	-0.0006 (-0.26)
Male	0.003 (0.52)	0.006 (1.31)	0.0012 (0.28)	0.0077 (3.60)
II fin wealth quartile	0.099 (4.80)	0.19 (4.23)	0.0075 (1.88)	0.047 (2.66)
III fin wealth quartile	0.26 (9.95)	0.42 (7.16)	0.098 (10.84)	0.13 (5.10)
IV fin wealth quartile	0.43 (14.05)	0.62 (9.39)	0.21 (18.49)	0.24 (6.80)
II real wealth quartile	0.043 (4.52)	0.028 (4.14)	0.0095 (1.41)	0.0054 (1.41)
III real wealth quartile	0.026 (3.14)	0.0075 (1.29)	0.012 (1.88)	0.0060 (1.71)
IV real wealth quartile	0.012 (1.52)	-0.0063 (-1.18)	0.013 (2.09)	0.0028 (0.84)
Observations	7,147	8,001	8,011	8,012

ing in stocks and mutual funds, but education's marginal effects are noisily decreasing over time, suggesting the existence of a structural shift in parameter values. Guiso, Haliassos and Jappelli (2003) argue that the role of "new investors" (new entrants in the stock markets) may be important for understanding the volatility of equity markets, because of their low "financial sophistication" and hence their possible underreactions or overreactions to different stock markets signals. Behind this consideration there is the idea that newcomers are less educated than incumbents. In the period 1998-2004 it is possible that an increasing share of less educated investors moved into the stock market, but our estimation results show that there is also a decreasing effect over time of education variables on stock market participation.

TABLE 10

Pooled Regressions for Participation
The table reports pooled Probit regressions for direct, indirect and total stockholding.
The sample uses the pooled data of the 1998-00-02-04 SHIW waves.
We have a total of 31,171 observations. z-statistics are reported in parenthesis

Variable	*Stocks*	*Funds*	*Total*
Age 30-39	0.008 (2.01)	0.010 (2.08)	0.022 (3.26)
Age 40-49	0.011 (2.64)	0.012 (2.49)	0.027 (3.91)
Age 50-59	0.015 (3.53)	0.018 (3.61)	0.038 (5.33)
Age 60-69	0.009 (2.10)	0.009 (1.98)	0.024 (3.45)
Age 70+	-0.002 (-0.69)	-0.008 (-1.80)	-0.008 (-1.34)
High School	0.034 (17.97)	0.031 (14.65)	0.060 (20.15)
College	0.059 (17.91)	0.052 (14.74)	0.104 (20.34)
Married	0.008 (4.80)	0.006 (3.30)	0.015 (5.34)
Male	0.011 (7.18)	0.008 (4.20)	0.018 (6.68)
II fin wealth quartile	0.11 (7.81)	0.10 (8.15)	0.18 (11.51)
III fin wealth quartile	0.24 (12.41)	0.25 (15.08)	0.38 (19.75)
IV fin wealth quartile	0.38 (16.06)	0.42 (20.43)	0.57 (26.28)
II real wealth quartile	0.023 (7.69)	0.018 (5.80)	0.035 (7.93)
III real wealth quartile	0.018 (6.69)	0.010 (3.64)	0.025 (6.11)
IV real wealth quartile	0.02 (7.25)	0.003 (1.29)	0.017 (4.31)
Observations	31,171	31,171	31,171

In 2002 there are important shifts also in the estimated effect of real wealth and age.[14] The results concerning age show some interesting and controversial outcomes. As Tables 8-9 show, the probit regressions indicate that participation is not always concave in age, in contrast with the prevailing literature; moreover, some of age dummies are not significant (direct stockholding case). The small differences between age classes, combined with the lack of coefficient stability, seem to indicate that age does not affect stockholdings in Italy. This result countervails previous studies where concavity seems to hold[15] and is not consistent with "rational" life-cycle asset pricing models, remarking again the presence of myopic investors in Italian financial market (Gardini and Magi, 2007). Financial wealth quartiles have a large and positive impact on the probability of direct and indirect stockholding; such effect, which is increasing in wealth, decreased considerably in the last four years. The effect of financial wealth on direct and indirect stockholding is increasing from 1998 to 2000, but from 2000 to 2004 it is decreasing[16] (changes in investors' behaviour are probably linked to the effects of financial wealth). This dynamic behaviour could be an explanation of the drop in equity investments occurred in the period 2000-2004: financial wealth is an important determinant of the probability to invest in stocks and in this period the richest households reduced their participation in the stock market (financial wealth parameters fall from 2002 to 2004).

[14] In previous sections we have seen that since 2002 investment decisions do not seem to be coherent with the dynamics of stock returns.

[15] For the Italian case see Guiso, Haliassos and Jappelli (2002); Guiso and Jappelli (2002); Guiso, Haliassos and Jappelli (2003).

[16] As a caution to this analysis, we recall that recent works on Italian households' financial wealth stress the fact that risky financial wealth is probably strongly underestimated. For example, in aggregate data, the stockownership seems to be underestimated by 70% (see D'Aurizio, Faiella, Iezzi and Neri, 2006).

Real wealth quartiles have a decreasing impact on the probability of investing directly in stocks and the same thing holds for indirect stockholding. As we have argued in section 3, the trade-off between real and financial assets seems to play an important role in explaining the reduction of stock market participation in recent years. Myopic investors (maybe those less educated) have probably chosen to move their savings from financial to real assets, following the large and steady increase in real estate returns which occurred in the last decade.

4.3. *Test of parameter stability over time*

The differences in the parameter estimates obtained in the four cross-sections could indicate the existence of a structural change in the (stock market) participation process of Italian households.

The potential instability of parameters reflected by the change in coefficient estimates can be statistically investigated by running a Likelihood Ratio (LR) test for binary choice models which compares the likelihood of the unrestricted regression estimation with that of the restricted model.

The unrestricted probit regression model allows the coefficients to differ in the four surveys and can be estimated from the pooled sample by using the following specification:

$$y_i^* = \beta_0 + \beta_{1,98} AGE30\_98_i + \beta_{1,00} AGE30\_00_i + \beta_{1,02} AGE30\_02_i + \beta_{1,04} AGE30\_04_i +$$
$$\beta_{2,98} AGE40\_98_i + \beta_{2,00} AGE40\_00_i + \beta_{2,02} AGE40\_02_i + \beta_{2,04} AGE40\_04_i + ...$$
$$.... + \beta_{15,98} WR4\_98_i + \beta_{15,00} WR4\_00_i + \beta_{15,02} WR4\_02_i + \beta_{15,04} WR4\_04_i + \varepsilon_i$$

with $\varepsilon_i \sim iidN(0,1)$ and where the first subscript in the parameters indicates the regressor and the second subscript indicates the year;[17] for example, in $\beta_{1,98}$, 1 corresponds to the regressor (*AGE30*), while the second subscript indicates the year 1998 (see Table 8-9-10 for the complete list of variables). The unrestricted equation has a total of 60 regressors (61 with the constant term β_0)[18] and parameters have been estimated with data concerning the four cross-sections, for a total of 31,171 observations.

Introducing the null hypothesis

$$H_0 : \beta_{98} = \beta_{00} = \beta_{02} = \beta_{04} ,$$

where each β_i is a parameter vector (15 x 1),

[17] AGE30 refers to the variable "Age 30-39", AGE40 to the variable "Age 40-49" and WR4 refers to the fourth real wealth quartile.

[18] We have 15 independent variables and four waves of data. For example, for the variable AGE30 we have $AGE30\_98 = AGE30 \cdot D98$, $AGE30\_00 = AGE30 \cdot D00$, where $D98$ and $D00$ are year dummies, respectively for the year 1998 and 2000.

$$\beta_{98} = \begin{bmatrix} \beta_{1,98} \\ \beta_{2,98} \\ . \\ . \\ \beta_{15,98} \end{bmatrix}, \ \beta_{00} = \begin{bmatrix} \beta_{1,00} \\ \beta_{2,00} \\ . \\ . \\ \beta_{15,00} \end{bmatrix}, \ \beta_{02} = \begin{bmatrix} \beta_{1,02} \\ \beta_{2,02} \\ . \\ . \\ \beta_{15,02} \end{bmatrix}, \ \beta_{04} = \begin{bmatrix} \beta_{1,04} \\ \beta_{2,04} \\ . \\ . \\ \beta_{15,04} \end{bmatrix},$$

and each parameter is constrained to be identical in the four surveys (pooled sample), we obtain the pooled restricted regression estimates, which measure average effects and can be seen as a reference point for evaluating the potential structural change in parameters in the four cross-sectional probit regressions. The null hypothesis has been tested computing the following LR-statistic:

$$LR = -2[\ln L_R - \ln L_U] \sim \chi^2_J$$

where $\ln L_R$ is the log-likelihood of the restricted model, $\ln L_U$ is the log-likelihood of the unrestricted model and J is the number of restrictions imposed under the null ($J = 45$).

The maximization of the likelihood in two probit regression models for direct and indirect stockholding provides the following results:

LR = 203.69 (direct stockholding)

LR = 417.72 (indirect stockholding),

hence the null is strongly rejected in both cases.[19]

The results support the hypothesis that in the period 1998-2004 there has been a relevant change in the parametric structure of the financial participation equations of Italian households. The changes concern above all education: the estimated coefficients of the variable "college" fall from 0.085 in 1998 to 0.042 in 2004 (-102%) and also the "high school" coefficients halve themselves (-78%).[20] Other relevant changes, in opposite directions, regard gender (with the "male" variable increasing its coefficients by 50.6%) and age with the class "Age 60-69" that increases its participation coefficients by 77.6%. Household real wealth reduces its effect on financial participation both for rich (-150%) and less rich (-167%).

The potential instability which emerged from these estimates seems to reflect a structural change in the financial participation process of Italian households which is confirmed by the LR-test.

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[19] The critical value of the χ^2 distribution, for the given degrees of freedom, is 69.96 at the 0.01 significance level.

[20] On this topic see again Gardini and Magi (2007), where the role of education variables is emphasized. In particular, they argue that the decreasing participation of the last years could be due to a spin process which has reduced the average education level of Italian investors. On the relationship between Italian households' portfolio choices and the role of education see also Magi (2007).

The temporal evolution of the parametric structure of the participation regressions provides an explanation of the astounding temporal evolution of the components of the vector z_t analysed in the previous sections. Such parameter instability could be due to change in the actual group of investors sharing financial wealth within the market; the panel section of the survey, analysed in a previous work (Gardini and Magi, 2007), has shown that the proportion of well educated investors who leave the stock market in the sampling period is larger than the proportion of poor educated investors who pull out from the stock market. In the period 2000-2004, the stock market loses 8.5% well educated investors and 3.6% poor educated investors in the direct participation case, and 12.8% well educated investors and 8% poor educated investors in the total participation case (see Gardini and Magi, 2007, pp. 103-105).

According to the evidence obtained by the concurrent analysis of time series portfolio compositions and cross-sectional participation choices, the results seem to reflect irrational behaviour of the investors (Shiller, 2000; 2003) which could be linked to the entry in the financial market of less educated investors (Guiso, Haliassos and Jappelli, 2003), but more generally, the results seem to reflect the low mass financial culture (Van Rooij et al. 2007) and the weak interaction between households and financial institutions in the Italian capital market.

5. CONLUDING REMARKS

The state dependence of portfolio choice generates unusual and very unstable behaviour in the Italian stock market. The most important change in the state of the system occurred in 2001, with the end of the internet bubble and the geopolitical instability which followed the twin towers attack; after 2001, the transition to a new equilibrium was marked by a strong switch from equities to housing and generated new disequilibrium. The probit regressions, which model the stock market participation process, show a structural change which could be due to heterogeneity of investor preferences or irrational behaviour of Italian households as well. The lowering role of education and the non-concavity in distribution of financial investments by age is consistent with the irrational behaviour hypothesis.

In particular, we find that: a) Italian households reduced the quantity of equities in their portfolio only after 2002, when the decrease in prices came to an end and a new phase was ongoing; b) Italian stock market participation rates decreased countervailing international trends in equity holdings; c) mutual fund holdings are characterized by a stronger structural change in the participation process and by a marked instability in household holdings.

These results remark three aspects of Italian financial markets:

– the poor financial culture of Italian households with the decreasing role of education and the peculiar structure of the Italian banking system;

– the traditional time-honoured preference for real estate investment combined with the strong influence of financial institutions on household portfolio choices;

– the lags in financial decisions, the reduction of stock market participation and the non-concavity in age of its distribution.

These aspects design a peculiar situation of Italian asset market and irrational portfolio composition. The housing market with its bubbles interacts strongly with the stock market; financial institutions seem to be unable to advise investors suggesting optimal portfolio choices. The deep reason behind all may be the bounded education of investors, in particular the low financial literacy (Van Rooij et al., 2007) of Italian households which is getting worse with the entry of newcomers in the financial market.

Instability of participation parameters and a peculiar evolution of Italian household portfolios pointed out by the concurrent analysis of biannual household financial choices and aggregate portfolio quarterly time series seem to confirm the distance of Italian households' financial decisions from the rational choice predicted by the Markowitz model.

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SUMMARY

Recent evolution of italian households' equity portfolio choices: an empirical investigation

We study Italian households' portfolio choices, with a special focus on equity investments, by analysing jointly time series and cross-sectional portfolio data. We investigate the temporal evolution of the actual composition of Italian households' investments in order to explain their portfolio choices and to detect possible determinants of the observed disequilibria phenomena. Moreover, we model the stock market participation choice by using probit regression techniques and we test for parameter stability over time. Instability of participation parameters and a peculiar evolution of Italian households'

portfolios pointed out by our concurrent analysis of cross-sectional and time series data seem to confirm the distance of Italian households' financial decisions from the rational choice predicted by the Markowitz model. In particular, we find that the housing market bubbles interact strongly with the stock market and financial institutions seem to be unable to advise investors suggesting optimal portfolio choices. The deep reason behind these facts may be the bounded education of investors, in particular the low financial literacy of Italian households.