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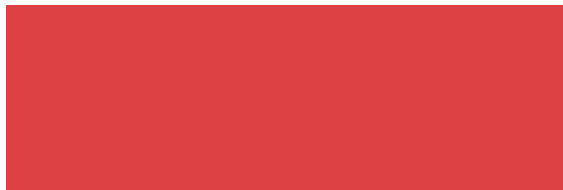
october 2002

# How do Households Invest their Wealth?

**Miquel Faig**



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*Published by: CREI  
Universitat Pompeu Fabra.  
Ramon Trias Fargas, 25-27 08005 Barcelona  
Tel. 93 542 24 98  
© CREI, 2002  
© of this edition: Miquel Faig  
ISSN: 1137 - 7844  
Design: Fons Gràfic  
Printed by: Masanas Gràfiques  
Legal register: B-44533-2002*

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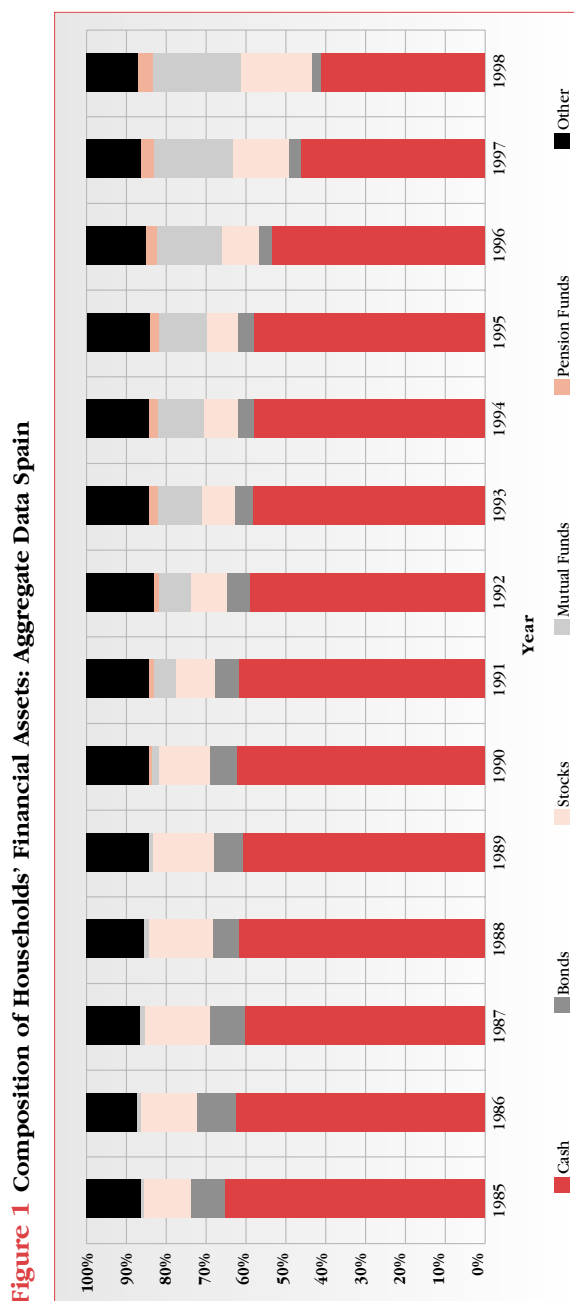
**Miquel Faig\***

An important decision people face is how to invest their wealth to form a portfolio of assets. In recent years, this decision has become increasingly complex as the menu of available financial assets has increased dramatically. In particular, low and medium income individuals today have a much wider range of options than they had as recently as in the early eighties, when most of them saw no other viable choice than to save in bank accounts. These same individuals can today choose from a wide variety of mutual and pension funds that offer the opportunity to invest in bonds and stocks at low minimum requirements and intermediation fees.

Figure 1 shows the composition of financial assets held by households in Spain<sup>1</sup>. In 1985, pension and mutual funds together accounted for a mere 0.35 percent of the total financial assets held by households. Thirteen years later, in 1998, pension funds accounted for 3.5 percent of the total financial assets and mutual funds accounted for 22.4 percent. During the same period, the share of liquid assets with a safe return, denoted as cash<sup>2</sup>, and the share of bonds respectively declined from 64.8 and 8.4 percent in 1985 to 40.9 and 1.6 percent in 1998. This spectacular shift is not unique to Spain. Most developed countries experienced a similar rapid transformation of households' portfolios during this period. (See, for example, Guiso, Haliassos, and Japelli (2001) for an interesting collection of empirical analyses of households' portfolios in several developed countries.)

Now that a large fraction of the population faces non-trivial allocation of wealth decisions, the development and dissemination of portfolio theory has become more interesting and more necessary than ever. Many individuals are bewildered by the large array of investment choices available to them. As a result, a large industry of professional investment advisors has emerged.

Investors will benefit from a better understanding of how their portfolios should be formed. Their future well-being may be greatly affected by the strategies they use in forming their portfolios. Moreover, the lessons of portfolio theory may help inform a wide range of public policy questions. For example, an understanding of how individuals allocate the wealth in their private pension funds is indispensable for the formation of a sound social security policy. Similarly, it is important to understand how



individuals self-insure with their savings in order to evaluate the usefulness of the public unemployment insurance.

The remainder of this booklet summarizes the current state of research on portfolio theory, with particular emphasis on recent contributions. It is organized as follows. Section 1 reviews the early mean-variance portfolio model of Markowitz. Section 2 discusses the impact that numerical methods and the availability of disaggregated data on consumer finances have had on the direction of research in portfolio theory. Section 3 describes the valid economic reasons why investment horizon matters for the formation of a portfolio. Section 4 discusses how changes in expected real interest rates and risk premia affect portfolio choice. Section 5 looks at the effect of having a stable job or being an entrepreneur on optimal portfolio choice. Sections 6 and 7 explain the complications introduced by the existence of borrowing constraints on consumers and liquidity constraints on entrepreneurs. Sections 8 and 9 seek explanations for the wealth and age profiles of households' portfolios. Finally, Section 10 concludes.

## **1. The Mean-Variance Model**

The question of how individuals should form their portfolios is a central part of finance theory. In fact, this issue originated the modern theory of finance with the work of Markowitz (1952). This work addresses the question of how to form an optimal portfolio when investors care about the mean and the variance of the total return of their portfolios. Appropriately, his work has been labeled the mean-variance portfolio model. This model is still the standard theory of the portfolio taught in most business schools.

The mean-variance portfolio model assumes that individuals have a given amount of wealth to invest for one period and have an array of assets to choose from. The return of these assets, except perhaps for one, is stochastic. Therefore, the wealth at the end of the investment period is a stochastic variable, whose distribution depends on the composition of the portfolio. Investors prefer portfolios that yield the highest possible mean of this terminal wealth, but they dislike its variance because they are risk averse. As a result, the optimal portfolio entails a compromise between the mean and the variance of the terminal wealth and hence the mean and the variance of the global return of the portfolio.

Despite its simplicity, the mean-variance portfolio model provides valuable insights into the behavior of a rational investor. For example, the model shows that, since the investor cares about his total wealth at the end of an investment period, the risk of holding an asset should not be measured with the variance of its own return, but with the covariance between the return of the asset and that of the whole portfolio. This explains why investors should purchase insurance despite the fact that its return has low mean and high variance.

The model also has some strong implications. For example, if there is an asset with a safe return (cash), the model predicts that all investors should hold the same combination of risky assets. With a given initial wealth, investors that differ in their willingness to trade the mean for the variance of their portfolio should hold different amounts of the safe asset, but they should hold identical proportions of all the risky assets. This result was named the mutual fund theorem by Tobin (1958) because he stated that individuals achieve their best portfolio holding just two

assets: the safe asset and shares of a single mutual fund that includes all the other risky assets.

## 2. Beyond the Mean-Variance Model

For a quarter of a century after the seminal work of Markowitz, portfolio theory received many contributions. Most notably, the original static mean-variance model was generalized to a dynamic framework, and risk aversion was linked to preferences over consumption streams<sup>3</sup>. However, the initial research impetus died down after these accomplishments. Although portfolio models continued to gain standing among economists and financial practitioners, researchers in finance felt that there was little they could add to the available theory with the limited tools they had at hand. However, all this changed with the introduction of numerical methods to economics and finance, and more importantly, with the availability of disaggregate survey data on households' finances. The spread of these two new tools has led to a major revival of research on portfolio theory during the last few years.

Numerical methods have allowed researchers to solve more realistic and interesting models of how households form their portfolios. With these numerical methods, financial economists can predict the optimal portfolio of an investor under a complex set of realistic circumstances. Some of these circumstances are the result of market imperfections such as borrowing constraints, incomplete markets, or imperfect information. Other circumstances involve more realistic distribution of returns or more realistic investment horizons. Numerical methods also allow us to simulate how optimal portfolios evolve over time and in response to shocks<sup>4</sup>.

The availability of disaggregate survey data has provided an even more radical impetus to portfolio theory: it has allowed the study of portfolio theory to move from the normative realm of how households should invest their wealth into the positive realm of how they actually do it. A good example of survey data on households' finances, and one that has been studied extensively, is the United States Survey of Consumer Finances.

The United States Survey of Consumer Finances is a rich source of information on the financial characteristics of households. Since 1983, this survey has collected detailed information on households' assets and liabilities, as well as accompanying household characteristics such as labor force activities, demographics, attitudes, and income from various sources. In recent years, the available sample of this survey consists of about 3,000 households drawn at random from a standard sample representative of the entire USA population. In addition, this sample is supplemented by approximately 1,500 households drawn from individuals with high income in their tax records. This over-sampling of high income individuals is desirable because rich individuals tend to be under-represented in standard samples but they are the ones holding most of the national wealth.

Surveys similar to the United States Survey of Consumer Finances also exist in countries such as Italy, Germany, the Netherlands, and the United Kingdom. (See Guiso, Haliassos, and Japelli (2001) for a collection of analyses of these data surveys). Collectively, these surveys provide invaluable data which allow for the verification or rejection of the predictions of portfolio theory. As a result, these data have acted as a stimulus for more accurate and realistic portfolio theory.

### 3. Investment Horizon

Long-term investors may perceive risk very differently from short-term investors and accordingly form different portfolios. This has been recognized for many years by both financial advisers and financial economists. However, some of the reasons proposed to explain why investment horizons matter are fallacious. Furthermore, the quantitative importance of the relevant horizon had not been fully appreciated until the application of sophisticated numerical methods to the calculation of optimal portfolios.

One fallacious distinction that is drawn between short and long-term investment horizons is the following: the rates of return of financial assets are stationary random variables. The rate of return for a short horizon such as a year is random and hence risky, but the annual rate of return for a long period such as fifty years is practically known because of the law of large numbers. Therefore, as the fallacy goes, the risk of an asset with random returns declines over time, and as a consequence, long-term investors should hold a larger proportion of risky assets than short-term investors. This final conclusion is simply wrong. The fact that the annual rate of return when one invests for a long period is practically known does not imply that the terminal wealth is also practically known. The terminal wealth depends not only on the average annual rate of return of an investment, but also on the timing of the returns during the investment period. Moreover, when funds are invested for a long time, small changes in the annual rate of return produce large changes in the terminal wealth<sup>5</sup>.

In fact, as Merton (1969) and Samuelson (1969) have shown, short and long-term investors

should hold identical portfolios if the following conditions hold: individuals have constant relative risk aversion, all of their assets are tradable at no cost, and their investment opportunities are constant over time<sup>6</sup>. Rigorous reasons for investing differently depending on the time horizon require a violation of these conditions.

Constant relative risk aversion means that the willingness of investors to take a bet on a certain proportion of their wealth does not depend on how wealthy they are. Economists think that this specification of preferences is a good benchmark because they appear to be consistent with the long-term evolution of our economies. That is, they are consistent with the fact that despite the tremendous economic growth experienced in developed countries during the last century, the expected rates of return of risky and safe assets today are similar to what they were a hundred years ago.

If we maintain the assumption that individuals have constant relative risk aversion, we are left with two possible reasons why investment horizon matters for portfolio formation: the existence of constraints on trading some assets and the variability of investment opportunities. As an example of the first condition, investors may hold some assets that cannot be traded, such as their human wealth. Alternatively, some assets may be traded but at a transaction cost such as brokerage fees for stocks and realtor commissions for houses. As an example of the second condition, the expected return on some assets may vary over time. The implications of these three possibilities are analyzed in the following sections.

#### 4. Varying Investment Opportunities

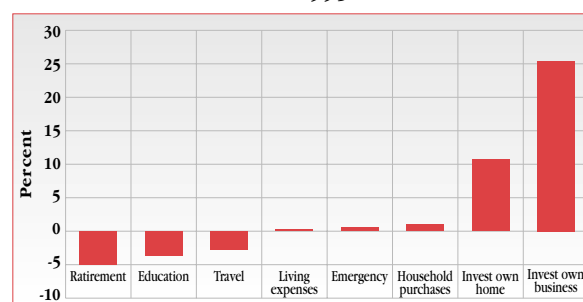
For simplicity, consider an investor forming a portfolio from three possible assets: cash, bonds, and stocks. For a short horizon, cash is a safe asset, while bonds are risky. If indexed for inflation, the yields of both cash and bonds are known with certainty. However, the price of a long-term bond is sensitive to changes in expected future real interest rates. So the return of holding a long-term bond for a short period is risky because one does not know the price of the bond at the end of the holding period. In contrast, cash is a risky asset for long horizons because cash holdings must be reinvested at unknown future real interest rates, whereas inflation-indexed bonds provide a known stream of long-term real payments. Consequently, a conservative investor highly interested in safety should hold relatively large amounts of cash when investing for short horizons but relative large amounts of bonds when investing for long horizons. In a recent, highly celebrated article, Campbell and Viceira (2001) demonstrate that the role of bonds in the portfolio of long-term investors is numerically important and quite distinct from the role of cash<sup>7</sup>.

The difference between the expected return on stocks and cash, referred to as the risk premium, also changes over time. Considerable evidence (see for example Poterba and Summer (1988)) shows that when stock prices have been growing fast for a while, they are more likely to fall and so the risk premium is relatively low. In contrast, losses in the stock market tend to be followed by abnormal gains. This pattern is known as the mean-reversion of stock prices. An important implication of mean-reversion is that stocks are better suited to support a stable

consumption profile in the long-term than the short-term stock price variability would indicate. This implies that investors that are saving for a long-term objective such as their standard of living when they retire should hold more stocks and fewer safe assets in their portfolio than investors saving for a short-term objective.

This implication is tested in Faig and Shum (2001) using data from the 1995 Survey of Consumer Finances of the United States. In this survey, individuals are asked to rank the reasons why they save. Faig and Shum investigate how mentioning a particular reason as one of the top three reasons for saving is related to the share of cash in the financial portfolio after taking into account factors such as age, wealth, labor income and attitudes toward risk. They find that individuals that mention retirement as one of their top three reasons for saving tend to have significantly less cash in their portfolio relative to the individuals that do not mention retirement (see Figure 2)<sup>8</sup>.

**Figure 2** Effect of saving motives on the cash share of the financial portfolio: Survey of Consumer Finances USA 1995



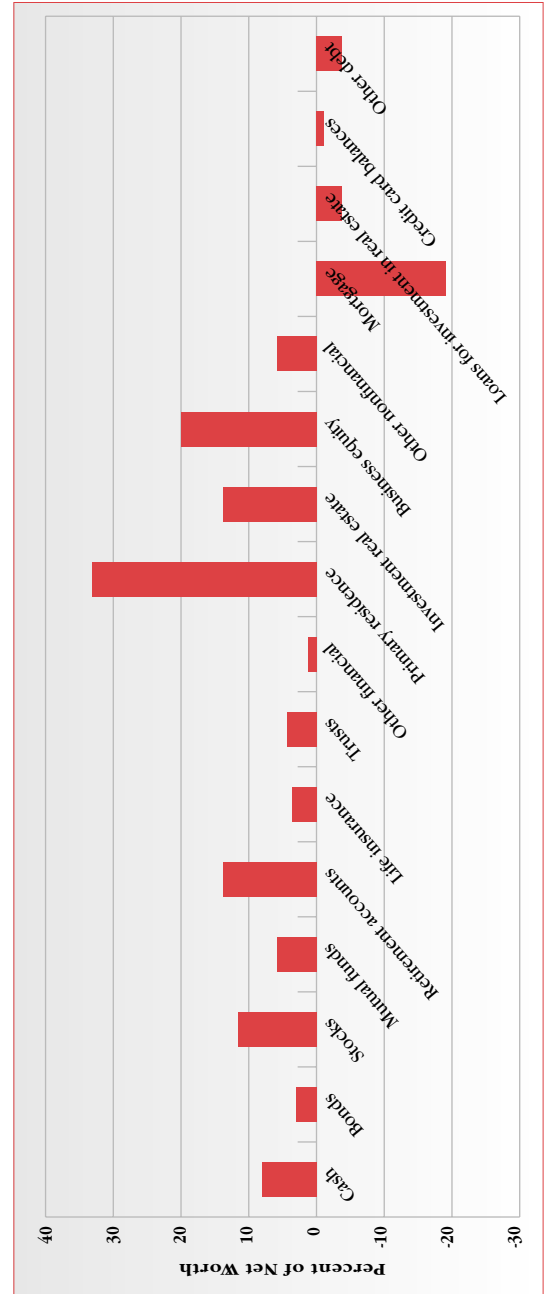
## 5. Labor and Entrepreneurial Income

A large portion of private assets cannot be traded freely, or are at least costly to sell. According to the 1998 Survey of Consumer Finances, the wealth allocated to primary residences represents 33 percent of the households' net worth, while the wealth allocated to business equity and investment real estate represents 20 and 12 percent of the households' net worth respectively<sup>9</sup>. Thus, the total wealth allocated in these three illiquid assets accounts for 65 percent of the households' net worth (see Figure 3)<sup>10</sup>.

Even more importantly, labor income can be thought of as the return of an implicit asset referred to as human wealth. For a large number of households, this is the most important asset they own. Obviously, households cannot sell their human wealth, but they can adjust their tradable assets to take into account the implicit holdings of their illiquid human wealth. For households with a safe job, their human wealth is a fairly safe asset. For them, having a stable job is similar to having a long-term bond yielding a regular return every period. Consequently, households with large holdings of human wealth and a safe job should be less interested in holding financial long-term bonds. Further diversification means holding mainly stocks and other risky tradable assets<sup>11</sup>.

Labor income has still another important interaction with portfolio formation. Workers do not need to work a fixed amount of time. Instead, they can to some degree adjust their labor supply in response to circumstances. The more flexible this response is, the better the workers can cope with a downturn on their financial investments<sup>12</sup>. Young individuals with greater flexibility to vary

Figure 3 Composition of Households' Wealth: Survey of Consumer Finances USA 1998





their lifetime working effort should be better able to hold risky financial assets than older individuals. In the extreme case, a retired person may have no opportunity whatsoever to supply extra labor. Consequently, adjusting for everything else, we would expect the holdings of risky assets to tend to decline with age. Evidence on this effect is discussed in Section 9.

For some individuals, their human wealth is far from a safe asset. Moreover, they may require large risky investments in other assets to obtain the maximum return from their human wealth. This is the case of entrepreneurs. In a frictionless world, the ownership of all firms should be diversified. Stockholders should own the residual claim of firms and managers should be employees selling just their labor. However, our world is far more complex. Some individuals may have a brilliant idea capable of generating a large profit, but the idea by itself cannot be sold. To capture the value of these ideas, the individuals must become entrepreneurs and put them in practice. Moreover, because of informational and incentive problems, entrepreneurs typically assume a large fraction of the risk of their investments.

Entrepreneurs are a small fraction of the population, but they are much richer than the average individual. Therefore, the entrepreneurs' behavior is very important for an understanding of financial markets. Using the 1995 Survey of Consumer Finances from the United States, Heaton and Lucas (2000, p. 1177) calculate that "households with business holdings greater than \$10,000 account for about one-third of stockholdings." Also, they find that factors affecting entrepreneurial risk have an effect on the pricing of securities in the stock market.

The return from entrepreneurial activities is not only risky; it is also highly correlated with the stock market. For the same reason that young individuals' holdings of human wealth with a safe job should crowd out holdings of financial assets that are relatively safe for long horizons such as bonds, the ownership of private enterprises should crowd out holdings of risky assets such as stocks. Empirical evidence supports this prediction. Even though entrepreneurs hold a large fraction of stocks, after controlling for their wealth, age, and other characteristics, they tend to hold less stocks and more cash than non-entrepreneurs with similar circumstances (see Heaton and Lucas (2000) Table VII and Faig and Shum (2001) Table V).

## **6. Borrowing Constraints**

Market imperfections affect not only real assets but also financial assets. Specifically, individuals are not able to borrow against the full value of their human wealth, their businesses, or even their homes. This implies that consumption profiles are not only constrained by the overall wealth of an individual but also by borrowing constraints. When a borrowing constraint is binding, individuals will be forced to cut their consumption temporarily below the long-term sustainable level. Because individuals are risk averse, this is an undesirable outcome, and as a result individuals will try to avoid it. They can do this in two ways. First, individuals can build a cushion of precautionary savings with which they can finance temporary increases in spending needs or compensate for temporary drops in labor income. Second, individuals can invest in relatively safe assets to ensure that funds are available when necessity arises.

The effect of saving motives on the share of cash in the financial portfolio, already reported in Figure 2, is somewhat supportive of the prediction that precautionary savings should be safely invested. Individuals that stress saving for emergencies have a larger share of cash in their portfolios than individuals that stress saving for retirement. However, the most remarkable feature in Figure 2 is the safer portfolios of individuals who are saving to invest in their business or their home. The next section provides a rationale for these stronger effects.

## 7. Investment in Entrepreneurial Projects

Borrowing constraints may force individuals not only to cut consumption temporarily in the presence of an adverse shock, but also to jeopardize the continuation of investment projects. Individuals should be more risk averse in their portfolio choice when financial assets are used to fund projects that carry a substantial penalty if they have to be scaled down or discontinued in their final stages. This penalty may result from lumpiness in the investment process, in the sense that once production has started, it has to be continued at a given size. Also, the penalty may be the result of a strong complementarity between investments made at different stages of the project. In either case, once individuals have committed an initial investment in these type of projects, they face a penalty if the project has to be abandoned or be continued on an inappropriate scale due to a lack of liquidity.

To illustrate this point, consider an entrepreneur who has invested heavily in renovating the first floor of a building to open a

store. For this entrepreneur, it would be unwise to invest the funds he has for buying the merchandise and paying the employees in the first season of business in a risky asset such as stocks. If he did so, a downturn in the stock market would compromise not only the funds invested in stocks, but also the continuation of the business once he had exhausted his debt capacity. Furthermore, due to transaction costs, the entrepreneur risks losing some of the capital invested in the renovations if he has to liquidate the business. Certainly, he would lose the return on this capital during the period it takes to sell the business. Hence, the illiquidity of the business project coupled with a limited capacity to borrow should induce this entrepreneur to hold a fairly safe financial portfolio.

Empirical evidence supports this prediction. As mentioned above, Figure 2 indicates that households that intend to invest in a business or a home hold a larger share of cash in their financial portfolios than the other households. The effect for households that save to invest in their own business is particularly strong. These households have an excess of cash equivalent to 25 percent of their financial assets. These effects are calculated after controlling for relative holdings of business and the real estate equity by these households.

## 8. Understanding Wealth Profiles

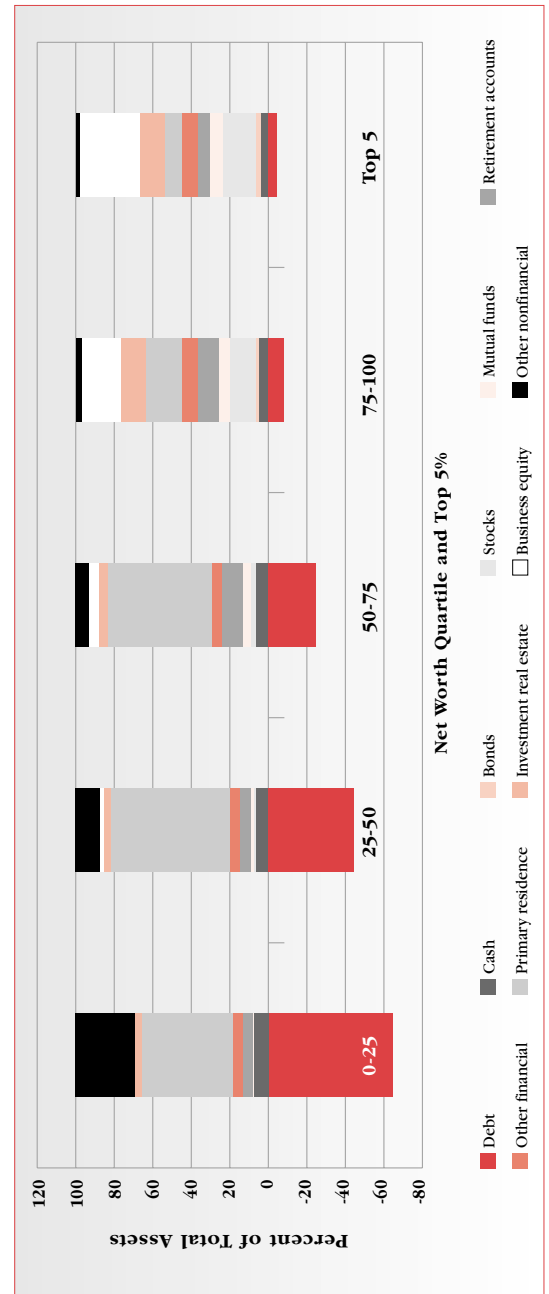
The portfolio composition changes dramatically with wealth. The typical assets held by the rich are very different from those held by others. The richest five percent of individuals hold a large portion of their wealth in business equity, investment real estate, and stocks: 32.4, 13.3, and 15.8 percent respectively (see Figure 4)<sup>13</sup>. In

contrast, the bottom 50 percent of the wealth distribution holds no appreciable amounts of these three assets, and households from the 50th to the 75th percentile hold minimal amounts of them.

Households in the three lower quartiles of the wealth distribution have most of their wealth invested in their residence and other real assets such as their car and their furnishings. The small financial wealth they hold is mainly composed of retirement accounts and cash. In addition, they are heavily indebted. For example, households in the lowest quartile who have positive net worth owe in average 67.4 percent of the total value of the assets they own. In contrast, for richer individuals the value of their residences, cars, and furnishings are only a small fraction of their total wealth. Furthermore, these individuals owe almost no debt.

The effect of wealth on the composition of the portfolio is at odds with the basic portfolio model. In the absence of transaction costs and informational barriers, the basic portfolio model predicts that rich individuals should invest their nonhuman wealth more cautiously than individuals with stable jobs in the middle and the bottom of the wealth distribution. The reason lies in the benefits of diversification. Proportionately, most of the wealth of rich individuals is nonhuman wealth, while most of the wealth of the rest of the population is human or pension wealth. Therefore, the rich depend proportionately more on the return on their nonhuman wealth for their consumption and should, in relative terms, seek a safer portfolio than the rest of the population. However, the evidence is clearly against this prediction: rich individuals have riskier portfolios than the rest of the population.

**Figure 4 Composition of Net Worth by Wealth Groups: Survey of Consumer Finances USA 1998**



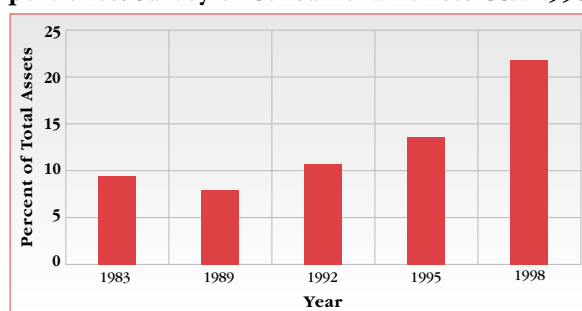
One possible explanation why individuals with a low net worth invest in much safer assets than individuals with a large net worth is the prevalence of precautionary savings, borrowing constraints, or both. As discussed in Section 6, when individuals save as a precaution against a future drop in labor income or an exceptionally large expense requirement such as sickness, they should invest more cautiously. They should specially do so if they expect to face constraints to borrow against their future labor income. However, this explanation is, at best, incomplete. As shown in Figure 4, the richest 5 percent of households have a much riskier allocation of nonhuman wealth than households from the 50th to the 95th percentile of the wealth distribution, even though these latter households, who tend to have stable jobs and sizable savings, are unlikely to face a borrowing constraint.

Another explanation why rich individuals tend to have riskier portfolios of nonhuman wealth than poor individuals is the existence of transaction costs<sup>14</sup>. To invest in a business one must pay setup costs, which is only sensible to do if one is going to invest a relatively large amount. Similarly, transaction costs to invest in stocks are not proportional to the amount invested, instead they are disproportionately large when investing small amounts. Therefore, to acquire a well diversified portfolio of stocks one needs to invest a substantial amount of wealth. Both the setup costs for businesses and the structure of transaction costs for stocks may explain why individuals with a small net worth avoid these assets. Modern mutual funds have diminished barriers to invest in stocks considerably. Therefore, as one would expect, the recent increase in the ease of access to mutual funds has led to wider exposure to the stock

market than ever before. As recently as 1989, only 31.6 percent of USA households held stocks directly or indirectly. In contrast, by 1998 this figure had increased to 48.9 percent<sup>15</sup>. In addition, the share of households' assets held in stocks climbed during this period from 8.3 in 1989 to 21.7 in 1998 (see Figure 5)<sup>16</sup>.

Apart from transaction costs, information costs also seem to be an important factor in explaining the composition of portfolios. Managing a portfolio requires some knowledge about the menu of available assets, their return characteristics, their tax implications, and their transaction costs. People may avoid some assets because they lack some of this information. Moreover, if their nonhuman wealth is small, it may not be worthwhile to incur the cost of gathering extra information. Guiso and Japelli (2001), using the Survey of Household Income and Wealth from Italy, report that both the ownership of stocks and financial diversification are highly correlated with an index of financial information.

**Figure 5 Average equity share in households' portfolios: Survey of Consumer Finances USA 1998**



## 9. Understanding Age Profiles

As we have seen in the previous sections, age can affect the optimal portfolio of an individual in several ways. First, as individuals grow older they have shorter horizons for working until these horizons reach zero at retirement. In general, these decreasing horizons imply a decline in human wealth as individuals age. Second, individuals tend to increase their nonhuman wealth as they grow older until they start spending this accumulated wealth at retirement<sup>17</sup>. Third, young adults have strong incentives to invest in their own residences, in durable consumption goods, and business equity. Seniors, on the other hand, face opposite incentives to disinvest in these real assets. In particular, seniors often sell their businesses because they require a great deal of supervisory effort.

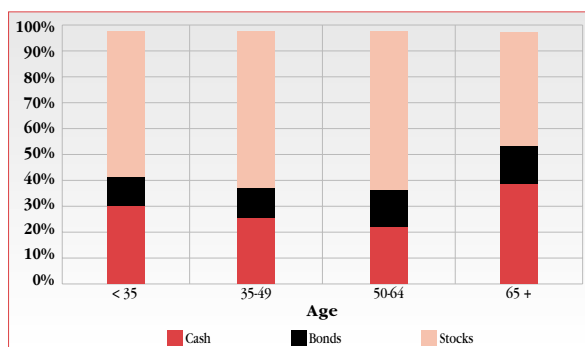
The age profile of the portfolio of financial assets has a characteristic “hump” shape for the share of stocks and “valley” shape for the share of cash (see Figure 6)<sup>18</sup>. The young and the old both have more cash and fewer stocks as a share of their portfolio than the middle-aged. The share

of bonds in the financial portfolio grows slightly with age. The shape of this profile does not disappear when one adjusts for wealth, education, income, and other variables typically used to determine the empirical composition of portfolios.

The relative safety of the financial portfolios chosen by older individuals can be easily explained by three factors. First, old people have a shorter horizon than middle-aged individuals. Second, old people, once retired, have little flexibility with which to adjust their labor effort to compensate for poor returns on their financial assets. Finally, old people depend on their financial savings much more than the middle-aged because they have little human capital and, as we will see below, they have typically liquidated their private businesses.

Far more puzzling is the relative safety of the portfolios chosen by the young (below 35). In view of the arguments from the previous paragraph, we would expect that their financial portfolios would be the riskiest. A possible explanation of why their portfolios are actually safer than those of the middle-aged is that individuals acquire financial information over time, so the young, being poorly informed, avoid assets such as stocks that are harder to manage. Another possible explanation is that most young people do not save primarily for their retirement, as middle-aged individuals do. Instead, the young save primarily for other purposes such as purchasing a home or investing in their own businesses (see Figure 7)<sup>19</sup>. As seen in Section 7, these motives for saving tend to induce safe portfolios of financial assets.

**Figure 6 Average portfolio shares of financial assets: Survey of Consumer Finances USA 1995**



**Figure 7 Mean age for various saving motives: Survey of Consumer Finances USA 1995**

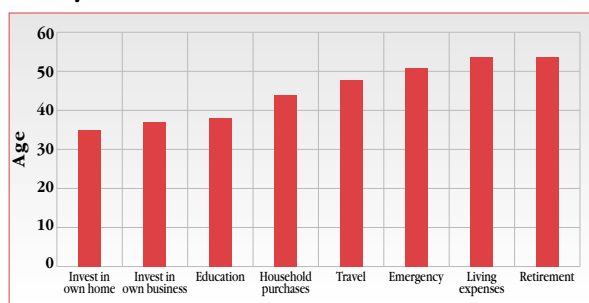
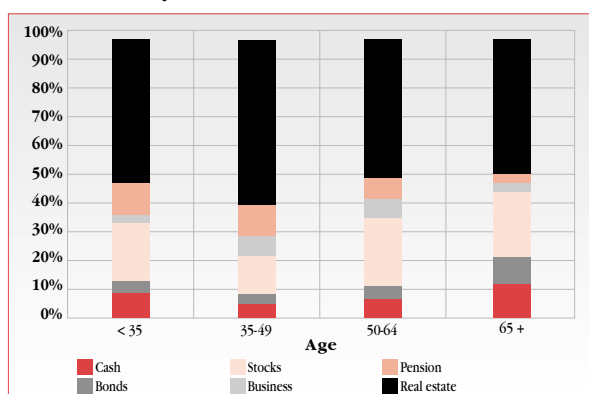


Figure 8 provides the age profile of the portfolio of all the assets held by households. As reflected in this figure, early in their adult life, individuals acquire a home and, in case of entrepreneurs, a business. During middle age, individuals mainly accumulate financial assets. At retirement, many individuals sell their private businesses and invest the proceeds in financial assets. Finally, after retirement, individuals downsize their residence. This last point is not found in the figure, but it is documented in other studies such as Hurd (2001, Table 2).

**Figure 8 Average portfolio shares of private wealth: Survey of Consumer Finances USA 1995**



## 10. Conclusion

Surveys of consumer finances from several countries including the USA, Italy, Germany, the Netherlands and the United Kingdom provide rich data sets on how individuals invest their wealth. When interpreted with the help of portfolio theory these data sets provide invaluable insights into the determinants of portfolio choice. This essay has summarized some of these key insights. In short, the basic idea that individuals should diversify their investments to minimize risk and maximize expected return is still a useful starting point. However, to explain the complex behavior of investors, we require models with a richer description of the opportunities and necessities facing investors. For example, to explain some of the features observed in the data, we require models that include a realistic treatment of labor and entrepreneurial activities of investors, of how investment opportunities vary over time, of transaction costs, and of possible borrowing constraints. The availability of new sources of individual level data presents an exciting and challenging opportunity for research on portfolio theory. The new contributions that have resulted incorporate a more realistic treatment of the opportunities and objectives facing investors. Moreover, the potential benefits of this research are twofold. Firstly, investors may be able to improve their investment strategies. Secondly, policy makers may be able to use these models to inform policies, such as public pensions, which interact with private savings.

## Notes

(\*) I am grateful to Mara Bergman, Rong Li and an anonymous referee for their comments, although they bear no responsibility on the final outcome of this work.

(1) Figure 1 has been elaborated with data from Cuentas Financieras de la Economía Española, Banco de España, Madrid, 1995 and 1999, (Cuadro III.7.3).

(2) Cash in financial economics is meant to include short term deposits, money market accounts, and money market funds

(3) Important contributions on this issue are Merton (1971) and Breeden (1979)

(4) For monographs on how to apply numerical methods to economics and finance see Judd (1998) and Rogers and Talay (1997) respectively

(5) See Samuelson (1963) for further details on this fallacy.

(6) Moreover, with a unit relative risk aversion (logarithmic utility), short and long-term investors should hold the same portfolio even if investment opportunities change over time.

(7) See also Campbell and Viceira (1999) for a more general discussion on portfolio formation when returns are time varying.

(8) Figure 2 reports the coefficients of dummy variables indicating that a reason for saving is one of the top three for an individual in a regression where the dependent variable is the share of cash in the portfolio of financial assets and the other independent variables are age, age squared, financial net worth, financial net worth squared, investment in housing as a share of net worth, investment in other real estate as a share of net worth, investment in business equity as a share of net worth, risk attitude, and log of labor income. The sample excludes individuals with less than \$1000 of total net worth and zero labor income

(9) Wealth in the Survey of Consumer Finance includes financial assets, business equity and real estate. However, it excludes most consumer durables and human capital.

(10) Figure 3 has been elaborated from Table 2 of Bertaut and Starr-McCluer (2001).

(11) Viceira (2001) elaborates on this point.

(12) See Bodie, Merton, and Samuelson (1992) for this argument.

(13) Figure 4 was elaborated using Table 2 in Bertaut and Starr-McCluer (2001), which was constructed using the Survey of Consumer Finances from the United States.

(14) See Heaton and Lucas (1997).

(15) These figures are from Table 3 in Bertaut and Starr-McCluer (2001).

(16) Figure 5 has been elaborated using data from Table 2 in Bertaut and Starr-McCluer (2001).

(17) The decline in wealth is found after age 70 in Asset and Health Dynamics among the Oldest-Old (United States survey specialized in the finances of old people). See Hurd (2001) for an analysis of this survey.

(18) Figure 6 has been elaborated from Table 8 in Bertaut and Starr-McCluer (2001).

(19) Figure 7 displays the average age of individuals that mention a particular motive as a top three reason for saving. This figure is elaborated using Table IV in Faig and Shum (2001) who use data from the Survey of Consumer Finances from the United States.

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### **Miquel Faig**

Miquel Faig graduated in Economics at the Universitat de Barcelona (1979) and earned his Ph.D. in Economics at Stanford University (1986).

He is currently Full Professor of Economics at the University of Toronto (Canada). He has also been Visiting Professor at the University Pompeu Fabra, Universitat de Girona, and Universitat Autònoma de Barcelona.

His main areas of research have been monetary theory, macroeconomics, and financial economics. Presently, he is working on monetary search models and portfolio theory.

He has published articles in a variety of professional journals such as *The Journal of Finance*, *The Journal of Economic Theory*, *The Journal of Monetary Economics*, *The Journal of Money, Credit, and Banking*, and *the Quarterly Journal of Economics*.

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*Ramon Trias Fargas, 25-27 - 08005 Barcelona*

*Tel: 93 542 24 98 - Fax: 93 542 18 60*

*E-mail: [crei@grup.upf.es](mailto:crei@grup.upf.es)*

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