DOCUMENT

DE TRAVAIL

N° 266

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December 2009

BANQUE DE FRANCE

EUROSYSTÈME

DIRECTION GÉNÉRALE DES ÉTUDES ET DES RELATIONS INTERNATIONALES

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[‡]We thank Gilbert Cette and Stéphane Grégoir for their comments and suggestions. This paper represents the views of the authors and should not be interpreted as reflecting those of Banque de France.

Abstract

The existence of an equity premium puzzle has been largely emphasized in the empirical literature: one observes low risky assets holding that the standard portfolio choice model (with expected and discounting utility and homothetic preferences) is not able to explain. Besides modifications of rationality assumptions, other changes have been introduced in the standard framework to account for this equity premium puzzle: the existence of transaction costs, liquidity constraints or other risks (e.g. risks associated with employment, income, health,). These background risks (i.e. risks that are unavoidable, exogenous and independent from the financial market risk) may lead households to reduce their stockownership in order to limit their global exposure to risk. Recent developments examine the role of housing on stockholding as another background risk. This paper analyses the empirical link between stockholding and housing wealth within this framework. We use the French wealth survey (Enquête Patrimoine 2004, Insee) that gives us detailed information on households portfolio, socio-demographic variables, and several measures of preference and exposition to various risks (income, unemployment, health, and business). We find that an increase in the housing to net wealth ratio crowds out stock market investment for a given total financial wealth: when facing real estate exposure to risk, households tend to moderate their global exposure to risk by limiting the share of their financial wealth invested in stocks. Among the other significant determinants of the equity premium puzzle, we emphasize the role of transaction and information costs, the attitude toward risk and the exposition to various risks in hampering investments in stocks.

Keywords: Portfolio choice, background risks, housing demand, life-cycle model

JEL classification: D91, G11, R22, E21

Résumé

La littérature empirique sur les choix de portefeuille souligne l'existence d'une énigme de la prime de risque: les ménages détiennent une faible part d'actifs risqués que le cadre standard (espérance d'utilité, préférences homothétiques) ne peut expliquer. Pour rendre compte de ce faible investissement en actifs financiers risqués, les développements récents de la littérature ont considéré l'existence de coûts de transaction, de contraintes de liquidité ou encore d'autres risques (associés au marché du travail, à la santé, au marché immobilier). Ces background risks (i.e., qui sont inévitables, exogènes et indépendants du risque des marchés financiers) peuvent conduire les ménages à restreindre leur détention d'actions pour limiter leur exposition au risque global. Cet article analyse le lien entre l'investissement en actifs financiers risqués et l'exposition au risque immobilier à partir de l'enquête Patrimoine 2004 (Insee). Outre la composition du portefeuille des ménages, cette enquête fournit également des mesures de préférence et d'exposition à divers risques (revenu, emploi, santé, patrimoine professionnel). Nous trouvons qu'un accroissement du ratio de la richesse immobilière sur la richesse nette réduit l'investissement en actions des ménages à richesse financière donnée: en cas d'exposition à un risque immobilier, les ménages limitent leur exposition au risque global en restreignant la part de leur richesse financière investie en actions. Parmi les autres facteurs explicatifs de l'énigme de la prime de risque, notre étude met en avant le rôle significatif des coûts de transaction et d'information, de l'aversion pour le risque et de l'exposition aux autres risques.

Mots-clés: choix de portefeuille, background risks, immobilier, modèle de cycle de vie

JEL classification: D91, G11, R22, E21

1 Introduction

The recent financial crisis sheds light on the interaction between indebtedness, housing wealth and financial portfolio for households. In France, the housing price index and the stock price index decreases respectively by 7% and 40% between March 2008 and March 2009. At the same time, households' overindebtedness increases a lot (+16% between January 2009 and March 2009[1]). All these changes impact dramatically households' wealth in all of its dimensions.

In this paper, we focus on the link between risky portfolio and the households' real estate exposure to risk. As this asset is the main component of households' worth and often acquired by highly leveraging, it creates a risk that is taken into account by households when deciding the composition of their financial portfolio. Moreover, housing wealth is also a specific asset due to its illiquid nature that may constrained households' decision to rebalance their portfolio.

An additional motivation for this paper is to contribute to the empirical literature about the equity premium puzzle. Indeed, the standard portfolio choice framework predicts that households' wealth is fully diversified and does not vary during the life cycle (Merton, 1971). In particular, the share of risky assets in total assets is always positive and depends on assets features (risk and return) and on the relative risk aversion of stockholders but it does not vary according to other stockholders' characteristics such as their age. However, a large strand of the empirical literature emphasizes the existence of an equity premium puzzle: one observes a low risky assets holding that the standard model (with expected and discounting utility and homothety) is not able to explain, except if eccentric values of risk aversion are considered. This equity premium puzzle deals both with the amount of risky assets and with the participation of households to financial markets (Haliassos and Bertaut, 1995; Haliassos, 2003). For example, only 20% of French households own financial risky assets directly or indirectly via mutual funds (the proportion of households participating directly to the stock market is more limited (15%)).

Various modifications of the standard hypothesis of the portfolio choice model have been introduced to account for the equity premium puzzle. It may be due to transaction costs (King and Leape, 1998), liquidity constraints (Gollier, 2001) or to the existence of other risks (Kimball, 1993). In this last case, unavoidable risks such as unemployment risk, or uncertainty about future incomes lead households to moderate their global exposure to risk by reducing the share of financial wealth invested in stocks. This behaviour, called temperance, may thus contributes to the equity premium puzzle.

Besides modifications of rationality assumptions, other extensions of the model, that take into account the interactions between financial and other assets, explicitly consider housing as a specific asset in the households' portfolio. Indeed, a negative correlation between housing and financial returns leads to consider housing as a spe-

[1]Source: Banque de France, Secretariat of the Household Debt Commissions.

cific asset that may hedge financial market risk. In this case where housing and stock returns are negatively correlated, Pelizzon and Weber (2008) show that portfolio efficiency analysis must take into account housing decision. If the housing and financial market returns are not (or positively) correlated, housing wealth may nevertheless affect stockholding through the households' temperance behaviour described above. Indeed, various papers show that housing wealth crowds out stockholding due to liquidity constraints and to the risk associated with owning real estate (Fratantoni (2001), Flavin and Yamashita (2002), Cocco (2004), Yao and Zhang (2005)). They also find that the heterogeneity over the life cycle observed in households' portfolio composition (in particular, the increase in stockholding with age) may be due to changes in housing wealth. Young households invest in housing by getting mortgages. They take into account the risk associated with this debt when determining their stockholding. In other words, the risk associated with indebtedness lead them to limit their participation to (risky) financial markets. Afterwards, the reimbursement of the contracted debt reduces the share of housing wealth in the total net wealth as well as the risk associated with the global portfolio (financial and housing wealth). Households become thus interested in increasing the share of risky financial wealth in order to benefit from higher returns.

In this paper, as we are not able to find a significant correlation between stocks and housing returns in France for the relevant period for the survey we use, we focus on the role of housing as a background risk[2]. Previous empirical investigations show that housing wealth crowds out stockholding (Cocco (2004), Saarimaa (2008), Yao and Zhang (2005), Yamashita (2003)). We estimate a similar model on French wealth data. Compared to the previous papers cited above, our empirical analysis fully takes into account the risk aversion of the households as well as other background risks (income and unemployment risks, business risk) that were previously studied separately from the real estate exposure to risk (for instance, see Guiso et al. (1996)).

The paper is organized as follows. Recent developments of the literature about portfolio choice, especially about the role of housing, are summarized in the second section. Then, our dataset as well as a first descriptive analysis of households portfolio is presented before estimating the relationship between households' risky asset demand and different sources of background risks.

2 Recent developments in portfolio choice models

In this section, we first emphasize recent developments on intertemporal portfolio choice mainly concerning the effect of age, transactions costs, and uncertainty regarding future income on risky asset demand. Then we investigate how housing has

[2]We rely on the last available French wealth Survey (Insee, 2004). Le Blanc and Lagarenne (2004) using the previous wave of this survey (1998) find a weak negative covariance and focus on the diversification effect of housing in the portfolio.

been introduced in this model.

2.1 Complete Markets

Optimal portfolio theory, as developed by Arrow (1965), describes an investor who maximizes utility, $u(.)$, at a given period, by allocating wealth, W, over the different assets available on the market. If shares are divisible and capital markets are perfect, and if the investor's relative risk aversion ($-u''W/u'$) is constant, the proportion of wealth devoted to each share, w is independent of W. In addition, the demand for risky assets is a positive function of W (if absolute risk aversion ($-u''/u'$) is falling in wealth).

This theory has been combined with a life-cycle model, in which the agent chooses both the optimal level of consumption and portfolio allocation each period (Merton, 1969 and 1971, and Samuelson, 1969). Markets are still considered to be complete (no future income risk) and perfect (no transaction costs). If utility is additively separable over time, and if the distribution of share prices is described by geometric Brownian motion, then portfolio structure is independent of age (the hypothesis of rational myopia[3]) and of consumption choices. In addition, investors hold all shares available on the market (risk free as well a risky shares) in some proportion (two funds separation theorem): in other words, portfolios are complete. Formerly, in Merton (1971), the share of wealth invested in the risky financial asset, w, is defined as:

$$w = \frac{\alpha - R}{\sigma^2 \gamma}$$

with α the return of the risky asset, R the return of the safe asset, σ^2 the variance of the return of the risky asset and γ the relative risk aversion.

Gollier and Zeckhauser (2002) try to explain changes in portfolio composition over the life cycle within this framework. They show that if investors' absolute tolerance for risk ($-u'/u''$, the inverse of absolute risk aversion) is convex (and not linear, as in Merton's model) the young will invest more in risky assets than will the old.[4]

Other recent extensions consider agents' behavior in incomplete and imperfect markets in order to explain the limited diversification of households' portfolios, and in particular the limited participation to the risky financial markets (the equity premium puzzle).[5]

[3] Apart from assets' technical characteristics (return and risk), this myopia is linked to agents' tolerance for risk (the inverse of their risk aversion) which has to be linear in wealth (Mossin, 1968).

[4] The demand for risky assets is related in a convex manner to the amount of wealth invested. In this case, the share of risky assets in wealth fall with age, and is linear in global wealth.

[5] Other models have considered the relationship between the labor market and the demand for risky assets. Bodie et al. (1992) show that more flexible labor supply allows agents to cover more easily any losses on capital markets, and thus to invest more in risky assets.

2.2 Imperfect and Incomplete Markets

Holding and transaction costs are the only viable explanation of incomplete portfolios, notably with respect to shares (Haliassos, 2003; Vissing-Jorgensen, 2002).[6] King and Leape (1987 and 1998), for example, show that incomplete portfolios are generated by introducing fixed transaction costs and costs of information acquisition (in terms of time and money) into Merton's model. In particular, investment in risky assets, which is associated with both more information and higher transaction costs, is positively linked with global wealth (which allows such costs to be borne), and with age and education, both of which measuring the agent's information stock.

Recent work has also considered the management of multiple risks by savers. Portfolio choice is then analyzed in the presence of exogenous risks against which no insurance is available (background risk). The effect of multiple sources of risk on savers' behavior, particularly on their demand for risky assets, depends on both the type of risk and individuals' preferences. Pratt and Zeckhauser (1987), Kimball (1993), and Gollier and Pratt (1996) show under which conditions on preferences there is *substitution* between endogenous portfolio risk and independent exogenous risk, such that individuals reduce their demand for risky assets as other risks appear (for exemple income or health risks).

Pratt and Zeckhauser (1987) show that the presence of *undesirable* background risk[7], substitution of risks, for a risk-averse agent, requires *proper* preferences, i.e. with successive derivatives which alternate in sign. Kimball (1993) shows that individuals with decreasing absolute risk aversion (DARA) and decreasing absolute prudence (DAP)[8], reduce their demand for risky assets[9] when background risk is *loss-*

[6] The other imperfections mentioned above only predict incomplete portfolios if they are accompanied by fixed transaction and information costs. They do, however, intensify the effect of such costs (Haliassos, 2003).

[7] A risk is undesirable if, at every level of wealth, the introduction of the risk reduces utility (expected-utility-decreasing risks). It can be shown that every risk with zero mean and positive risk premium fulfils this condition.

[8] Kimball (1990) measures absolute prudence via $-u'''/u''$. Positive prudence is required for precautionary saving (excess saving engendered by exogenous independent income risk). If prudence is decreasing, it can be shown that the amount of precautionary saving falls with wealth.

[9] This continues to hold in an intertemporal setting under certain hypotheses. In a two-period model, Elmendorf and Kimball (2000) show that, under *standardness*, a rise in exogenous income risk reduces the demand for risky assets. Saving rises under more restrictive preference conditions (CRRA, for example). Viceira (2001) considers an intertemporal model for which he derives an approximate analytical solution. He shows that a rise in the variance of future income growth, at constant mean, reduces the demand for risky assets and raises precautionary saving (if utility is CRRA and the return to investment is independent of the income risk). Agents first adjust their precautionary saving, and then reallocate their portfolio (see also Campbell and Viceira, 2002).

aggravating.[10] Such preferences are described as *standard*.[11] Last, Gollier and Pratt (1996) considered a more restricted class of *unfair risks*[12], and obtain less restrictive conditions on preferences for substitution between risks (convex increasing absolute risk aversion). They categorize such preferences as exhibiting *risk vulnerability*.[13]

The hypothesis of independence between risks (between income and portfolios), which is common to all of the work above, is not above criticism (Campbell and Viceira, 2002, Haliassos, 2003, and Heaton and Lucas, 2000). If the correlation between the risk of the financial portfolio and the other risks is positive, the above conclusions continue to hold, and a temperate individual will invest even less in risky assets. However, if the correlation is negative, the effect of income risk on the demand for risky assets is ambiguous, and can even be positive under certain conditions (Arrondel et al, 2009).

Risk over labour income also affects the relation between liquidity constraints and portfolio choice. Koo (1998) shows that restricting agents' access to credit markets in the future reduces the demand for risky assets[14]. An investor who is liquidity constrained holds less risky assets . Liquidity constraints thus reinforce the negative effect of exogenous risk on the percentage of risky assets in the financial portfolio.

2.3 Housing in Portfolio Choice Models

Introducing housing in a portfolio choice model is difficult because of its characteristics: compared to financial assets, housing is relatively indivisible and illiquid. Transaction costs are very high in time and in money, even when selling. Imperfections in the housing credit market, institutional constraints, uncertainty about quality, and the fact that every unit is unique can explain these transaction costs. Fiscal considerations are important when analyzing the role of housing: most often, tax treatments of owner occupied in housing are often preferential, especially in France.

Last but not least, households' decisions on housing are the result of dual behavior that more generally affects durable goods: as a generator of housing services, housing satisfies consumption needs; as an asset, housing is taken into consideration

[10] A risk is *loss-aggravating iff*, at every level of wealth, the introduction of the risk reduces marginal utility (*expected-marginal-utility-increasing risks*). It can be shown that every risk with zero mean and positive precautionary premium (so that the individual is "prudent" in Kimball's sense) fulfils this condition. For DARA utility functions, all *undesirable* risks are also *loss-aggravating*. The case of *standard* preferences includes the case of *proper* preferences.

[11] Kimball (1993) also introduces the notion of *temperance* $(-u''''/u''')$, which represents the desire to reduce one's global exposure to risk. If individual preferences are standard, then temperance is greater than prudence, which is itself superior to absolute risk aversion under DARA.

[12] A risk is *unfair* if its expected value is negative. Note that *undesirable* risks include *unfair* risks as a special case.

[13] A classification of preference restrictions, from the most to the least restrictive, is proposed by Gollier and Pratt (1996): *Standard*$\Rightarrow$*Proper*$\Rightarrow$*risk vulnerability*$\Rightarrow$*DARA*.

[14] Formally, Gollier (2001) shows that liquidity constraints reduces the demand for risky assets if tolerance for risk is an increasing convex function of wealth.

in investment decisions.

The first specificities have been introduced in a portfolio choice model with market imperfections and transaction costs by Grossman and Laroque (1990) or Bar Ilan and Blinder (1992). The dual dimension of home owner-occupation - consumption and investment - makes the model more complex and invalidates some of important results of the previous model. First, it refutes the first separation theorem between portfolio choice and consumption decisions. Second, with proportional transaction costs on housing and other specific market imperfections (taxation, down payment, borrowing restrictions, etc.), the market is not traded on continuously, but spaced out over time. So assets demand in the Merton model, which is the same as in the static portfolio model of Tobin-Markovitz, is no longer valid.

Henderson and Ioannides (1983) consider explicitly and simultaneously the two-dimensional aspect of housing. They show that in the absence of institutional considerations, the decisions to purchase dwellings for owner occupation and for renting out is only explained by the difference between the investment demand h_i for housing (owning for portfolio motive) and the consumption demand h_c (explaining housing needs). If the first variable is greater than the second one, households become owner-occupiers of their primary residence. If the difference is large enough, they invest in dwelling for renting out as well.[15]

Brueckner (1997) extends this model to investigate the portfolio choice of homeowners. He finds that if the constraint $(h_i - h_c)$ is binding, the homeowner's optimal portfolio is inefficient (in a mean-variance sense). When this constraint is not binding, the consumption motive can be separated from the investment motive and the portfolio is efficient. This separation is due to the fact that when the constraint is not binding, the consumer can increase his consumption demand without affecting his investment demand by reallocating his housing portfolio between primary residence and dwelling to rent out. Hence, heterogeneity appears between the portfolio choices of owner and tenant of one's primary residence.

2.4 Housing as a Background Risk

When considering the inclusion of housing assets in portfolio, the assumption about the correlation between the housing and stock market returns is crucial. Most of the microeconomic literature assume independence between risks and consider housing as a background risk. More recently, Pelizzon and Weber (2008) extend the analysis by considering the case where returns are correlated and thus where housing may hedge financial market risk.

To be considered as a background risk, housing ownership has to be assumed to be associated with an unavoidable, exogenous and independent risk. In this case, Fratantoni (2001) shows that homeownership (and especially the risk associated with

[15] Ioannides and Rosenthal (1994) test this model on US data and find some facts in favor of the model. Arrondel and Lefebvre (2001) apply the same methodology using French data.

the committed expenditure due to mortgage payments) induces an additional temperance to that caused by labor income uncertainty. This temperance behavior leads household to reduce their exposure to stockmarket risk.

With the same kind of model than Brueckner (1997), Flavin and Yamashita (2002) studied the effect of the dual nature of housing which is both an investment and satisfies consumption needs. They assume that preferential tax treatments of owner occupied housing and transaction costs create frictions large enough to constrain households to include in their portfolio the level of housing consistent with their consumption demand for housing. So, consumption and investment decisions are no longer separable and ownership of housing influences greatly portfolio allocations. With this framework, they show that the heterogeneity over the life cycle observed in households' portfolio composition (in particular, the increase in stockholding with age) may be due to changes in housing wealth. Young households invest in housing by getting mortgages. They take into account the risk associated with this debt when determining their stockholding. In other words, the risk associated with indebtedness lead them to limit their participation to (risky) financial markets. Afterwards, the reimbursement of the contracted debt reduces the share of housing wealth in the total net wealth as well as the risk associated with the global portfolio (financial and housing wealth). Households become thus interested in increasing their risky financial wealth in order to benefit from higher returns.

Yao and Zhang (2005) incorporate the rental market in their model and obtain as a main result that owners reduce the equity proportion in their net worth (substitution effect of home equity for risky stocks) while they hold a higher equity proportion in their liquid financial portfolio (diversification effect).

Cocco (2004) studies the impact of housing decision on investors' portfolio choices by focusing on the role of housing consumption as a liquidity constraint. He shows that housing assets crowd out stockholding in net worth. His model also explains the positive relation between leverage and stockholding.[16] In the Cocco's model, investors characterized by large human capital acquire more expensive houses by borrowing more. At the same time, their human wealth represents a large part of their total wealth. Thus, the positive correlation between stockholding and wealth leads to the observed positive correlation between stockholding and leverage.

The theoretical model of Flavin and Yamashita (2002) is estimated by Yamashita (2003) and Saarimaa (2008) with respectively US and Finnish data. They find a negative correlation between stockholding and housing wealth. Using the Panel Study of Income Dynamics data, Kullmann and Siegel (2005) find that real estate exposure reduces holdings of stocks while Shum and Faig (2006) do not obtain a significant estimate with the Survey of Consumer Finances.

In this paper, we aim at testing the correlation between stockholding and housing wealth by relying on similar models as those cited above. Compared to these

[16]Heaton and Lucas (2000) argue that such a positive correlation reflects an indirect financing of stockholding through leverage.

previous papers, our empirical analysis fully takes into account the risk aversion of the households as well as various background risk faced by households (housing, job market, indebtedness).

3 Households' Portfolios in France

This descriptive analysis rely on the wealth survey conducted by the French National Statistical Institute (Insee) every 6 years. This survey named "Enquête Patrimoine" is a cross-section and we use the latest available wave (2004) run on a nationally representative sample of 9,692 households, for whom detailed information on earnings, income, wealth and socio-demographic characteristics is available. In particular, it provides:

- detailed information on the socioeconomic and demographic situation of the household (education, occupational group, marital status, information concerning the children...), as well as on the biographical and professional evolutions of each spouse (youth, career, unemployment or other interruptions of professional activity);
- detailed data on household's income, on the amount and the composition of its wealth (including liabilities and professional assets);
- brief information on the inter-generational transfers received and bequeathed (financial helping out, gifts and inheritance) and more generally on the "history" of household's wealth.

The households' portfolio composition in France is reported in Table 1 below. On average, households' wealth amounts to 172,500 euros in 2004. Residential housing is the most widespread type of assets (after saving and current accounts held by the quasi-totality of households in France) and it amounts to 54.9% of the total wealth. About 58% of households own residential housing and 55% are owner of their main residence. This homeownership rate is lower than in other countries : more than 80% in Spain, 69% in Italy, and about 68% in the U.S, according to Bover (2005).

Equities represent about 3.8% of total wealth, only 15.4 % of households hold directly stocks (see Table 2): around 7 percent have listed shares, 1.4 percent hold non-listed shares and 10.2 percent own shares via a PEA (Stocks' saving account). The proportion of households with indirect stockholding -mainly through mutual funds- is around 6.7 percent. It follows that the upper bound of (direct or indirect) stockownership in France is estimated to be around 20 percent of the population. The average amount invested in (direct) stocks is about 4,350 euros (28,000 euros among direct stockholders) and households invest on average 1,146 euros in mutual funds (65,600 euros among owners).

Compared to the U.S., stock market participation remains limited in France. For the same surveyed year (2004), using the Survey of Consumer Finances, Bucks et al. (2009) report that the fraction of households holding directly or indirectly publicly traded stocks is about 50% in the U.S. This lower participation in stock markets is

more generally observed in Europe, except in Sweden and in the U.K. (See Guiso et al., 2003).

Table 1. Portfolio composition in France

Asset classification	Proportion holding the asset (%)	Mean asset holding (€)	Percentage of total wealth
Saving & current accounts	99.4	13,600	7.9
Employer sponsored saving plan	16.7	1,350	0.8
Housing saving schemes	41.3	4,950	2.9
Life insurance	25.8	7,850	4.5
Annuities	11.6	1,593	0.9
Residential housing	57.8	94,650	54.9
Equities (shares, bonds, mutual funds)	25.8	6,650	3.8
Dwelling for renting out, investment in lands & business asset (non exploited by the owner)	18.4	26,674	11.2
Business asset (exploited by the owner)	16.9	21,250	12.3
Other assets	5.8	1,300	0.8
Total	100.0	172,500	100.0

Source: Patrimoine 2004 (Insee survey)

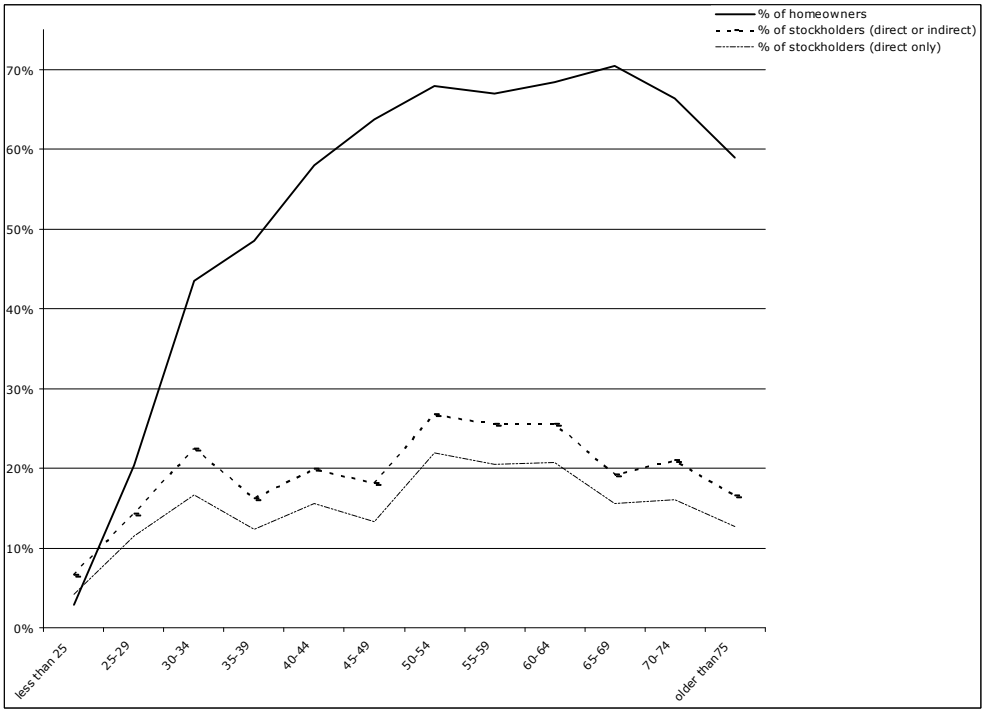
Table 2. Stockholding in France

	Ownership (%)	Average Amount (€)	Average amount by stockowner (€)
Direct holding			
Stocks:	15.4	4,348	28,169
- Listed stocks	7.2	1,594	132,408
- Unlisted stocks	1.4	766	200,388
- Listed or unlisted stocks via PEA	10.2	1,988	39,312
Indirect stockholding			
Mutual funds (excluding money market funds)	6.7	1,146	65,584

Source: Patrimoine 2004 (Insee survey)

Concerning the evolution of stockownership along the life-cycle, one can notice the increase in the participation in stockmarkets until age 54 and the decrease after age 64 (see Graph1.). The proportion of owner-occupiers varies a lot according to age: very few young households own their main residence (about 20% of the 25-29 years old), then this rate increases until 70 years old. Our cross-section dataset does not allow us to disentangle between the life-cycle effects and the generation effects behind this pattern. Indeed, the age effect can be due to heterogeneity in the access to credit market, the more pregnant down-payment constraints for young households or to the size of family (and children' age), etc., while at the same time, each generation of households encounters specific economic conditions especially as regards employment, growth, credit conditions and housing policies for a given age.

Graph 1. Percentage of homeowners and stockholders by age



Source: Patrimoine 2004 (Insee survey)

4 The data

As previously mentioned, we rely here on the French Wealth survey (Enquête Patrimoine 2004, Insee). In addition to the composition of households' wealth and to socio-demographic information, a part of the questionnaire gives us a general idea of individuals' degree of exposure and aversion to risk, as subjectively perceived and

assessed by respondents. It consists of a recto-verso questionnaire which was distributed to the interviewees at the end of the first interview. This page submitted to the whole sample must be filled in individually by the interviewee and his/her spouse (if applicable) and returned by post to Insee. Only 4,262 individuals answered to this questionnaire (corresponding to 3,872 households). The content is slightly different for employed persons than for unemployed or non working persons. More specifically, it asks the former to assess their short and long-term risks of unemployment, as well as the likely change in their future income over the next 5 years. In addition, a simple two-stage lottery game enables us to divide the individuals into four groups according to their degree of relative risk aversion following the methodology of Barsky et al. (1997).

4.1 Comparison full sample versus econometric sample

Descriptive statistics are reported in table A1 in the annexes for the whole sample of 9,692 households which is representative of French households and for the sub-sample of the 3,872 respondents to the additional questions about risk attitude. There are some differences between the two samples: in the sub-sample, respondents to the additional questionnaire seem to be more educated; they are more often white-collar workers and less often single and have more children. These differences explain why these respondents are more wealthy (+ 12 percent for gross wealth, +17% for financial wealth) and earn more money at work (+ 12 percent).

These differences in socioeconomic characteristics explain also why the sample of respondents own more often risky assets and are more frequently homeowner. The probability of owning risky assets is higher among the respondents than in the total sample (+4.2 percentage points for direct stockholding and +5.1 percentage points for direct or indirect stockholding). Concerning main residence, the percentage of homeowner is 6.6% higher for respondents and, consequently, housing wealth is 15% more important for this population.

When excluding missing values of the variables that are necessary for our analysis, we are left with 2452 households for whom descriptive statistics are very similar to those reported for the sub-sample of respondents.

4.2 Measures of Background Risks

As previously stated, the Insee wealth survey allows us to take into account various background risks faced by the household: labour market risks (income and unemployment risks), real estate, business.

Labour market risk (σ)

We consider two alternative measures of labour market risk: the income risk and the unemployment risk.

Income risk

We construct a proxy for the subjective variance of household income by following Guiso et al. (1996), i.e. each income recipient was asked to attribute probability weights (100 points) to given intervals of real income increases 5 years ahead of the interview (Arrondel, 2002). The sample average of expected income growth (around 1.1%) is roughly consistent with French time series evidence for the preceding period (around 1.8% for 1998-2003). The mean of the standard error of anticipated income shocks[17] (around 4.3% of current earnings) is closed to the estimates reported by Guiso et al. (1992), but surprisingly low when compared to panel data estimates.[18] Unreported Tobit regressions (Arrondel, 2002) show that households with higher uncertainty have had health problems and/or suffered unemployment in the past, are younger, less risk averse and more often self-employed (excluding farmers).

Unemployment risk

Each respondent has to evaluate the chances to lose his/her job in the five next years. The question is as follows: *"How do you imagine your future employment within the next 5 years:*

1) There is little or no risk that you will lose your job;

2) There is a possibility that you may lose your job (small risk);

3) It is probable that you will lose your job (considerably high risk);

4) It is certain, or almost certain, that you will lose your job".

By making simple assumptions, this information can be used to derive a measure of income variance: with an unemployment insurance replacement rate equal to zero, and assuming no changes in earnings if the respondent does not lose his/her job, it is easy to show that the variance of earnings is equal to $p(1-p)Y^2$ where p is the subjective probability of losing the job and Y is income. If the replacement rate is equal to α, the variance of income becomes $p(1-p)(1-\alpha)^2Y^2$. So we introduce this subjective measure of unemployment risk in our risky asset demand equation.

Exposure to real estate risk

Following Yamashita (2003), Cocco (2004) and Yao and Zhang (2005) we take into account the homeowners' exposure to real estate risk by introducing the ratio of housing wealth to net worth, the ratio of housing debt to net wealth and the ratio of mortgage payments to income (h variables).

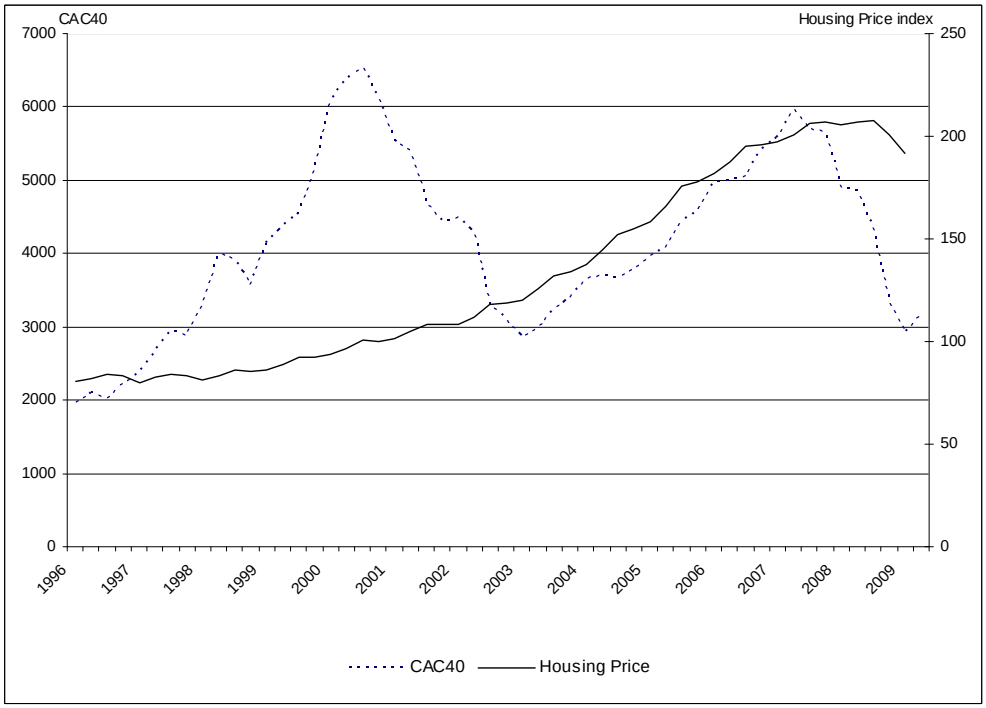
[17] Assuming that five years ahead expected real income is $y_{t+5} = y_t(1+g)$, the formula of the anticipated variance of household income is $var(y_{t+5}) = {\sigma_y}^2 = {\sigma_g}^2 {y_t}^2$, where y_t is current real income, g is the expected growth rate of real income and ${\sigma_g}^2$ its variance. The frequency distribution for the normalized standard deviation σ_y/y_t shows that 45.8% of the households hold point expectations. Only 10% display a ratio above 12.5% of current earnings.

[18] The gap between both is commonly explained by overestimation of true 'uncertainty' in econometric regressions, neglected within interval variation, underreporting of the probability of very low income events and/or measurement error in survey responses. See Guiso et al. (1996, 2001) or Lusardi (1997) for details, and more recently Dominitz (2001) or Manski (2004) for a reassessment.

As housing wealth measure, we use the value of the main residence, the net worth is total wealth less total debt (mortgages for main residence and other properties, consumption loans, professional loans).

The theoretical literature emphasize the two opposite effects that housing wealth may have on stockholding. On the one hand, when reimbursing their loans contracted to buy their main residence, households increase their net wealth and reduce their global exposure to risk, thus they are more prone to rebalance their portfolio to invest in risky financial assets. On the other hand, if housing and stock returns are negatively correlated, owning real estate has a diversification effect on the household's portfolio and thus may encourage stockholding. The graph 2 below draws the evolution of stock and housing prices in France since 1996. For the period 1996Q1-2003Q4 (i.e. before the survey period), the covariance of the returns of both series is equal to -0.160 but insignificant[19].

Graph 2. Evolution of stock prices index (CAC40) and the housing price index in France



Concerning the housing debt variables, we expect a positive effects as found in previous studies. This positive link reflect a "permanent income effect": household with high human income are both prone to get loans to acquire housing assets and to invest in stocks.

[19] This covariance seems to be very sensitive to the reference period: for 1996Q4-2008Q4, we obtain a covariance equal to 0.3.

Table 3 reports some sample statistics calculated by age group for homeowners. As expected, we observe a decrease in both the ratios of house value and housing debt to net wealth with age. Before 40 years old, the ratio of housing to net worth is greater than one reflecting the households' leverage position (housing debt represents about 42% of households net wealth). Then, the housing debt becomes to be reimbursed and the real estate risk exposure decreases. At the end of life, the housing debt is fully reimbursed while house value represents more than 70% of net wealth for homeowners. The other columns report the importance of stockholding across ages. It is difficult to draw a simple relation between the exposure to housing risk and stockholding (ownership and amount) with these simple statistics.

Table 3. Wealth and portfolio composition by age groups (econometric sample: homeowners)

Age	Nber of households (%)	house value/net worth	housing debt/net wealth	Direct stock. /finan. ass.	Direct or indirect stock /finan. ass.	% of stockholders (direct)	% of stockholders (indirect & direct)
<30	0.81	1.437	0.595	0.104	0.104	33.3	33.3
30-40	8.57	1.217	0.425	0.053	0.067	30.2	36.5
40-50	17.14	0.875	0.225	0.047	0.057	26.7	32.7
50-60	23.99	0.742	0.104	0.060	0.076	33.0	39.6
60-70	22.43	0.747	0.044	0.079	0.098	30.0	37.3
70-80	20.49	0.715	0.022	0.061	0.083	26.3	33.4
> 80	6.58	0.728	0.004	0.049	0.067	24.6	27.0

Source: Patrimoine 2004 (Insee survey)

Exposure to Business risk

Finally, we take into account a possible impact of business risk on households financial investments with a dummy variable identifying self-employed heads of households and the ratio of business wealth to net wealth. For people owning a business, the business wealth represents about 31% of their net wealth. As for housing wealth, there is a trade-off between the diversification benefit of owning a business and the benefit of holding liquid financial assets. The diversification benefit encourages to hold business wealth and to invest in financial stock markets while owning such an illiquid and risky asset may discourage temperant households to invest in stocks.

4.3 Measure of risk aversion (γ)

As in Barsky et al. (1997), a measure of risk aversion is obtained by asking respondents about their willingness to gamble on lifetime income, say R (see also Kapteyn and Teppa (2002) for a more recent application). The subject is offered various job contracts in the form of a lottery, with one chance out of two to earn twice more and one chance out of two to earn only λR (with λ a parameter inferior to one). In

the standard framework assuming expected utility, the subject with indirect utility V will prefer the contract to the sure gain R only and only if :

$$\frac{1}{2}V(2R) + \frac{1}{2}V(\lambda R) \geq V(R) \tag{1}$$

with V assumed to be isoelastic of parameter γ. A range of variation for relative risk aversion γ can be determined by varying the value of λ: for instance, if the subject refuse the job contract for $\lambda = 2/3$, but accepts it for $\lambda = 4/5$, the value of its parameter γ is in the interval $[2; 3.76[$.

The outcome is a range measure (in four brackets) for the relative risk aversion coefficient (γ) under the assumption that preferences are strictly risk averse and of the CRRA type. Out of the 3,488 respondents, 58.3% are very risk averse ($\gamma \geq 3.76$) and 26.6% are highly so ($2 \leq \gamma \leq 3.76$). 10.2% display moderate aversion ($1 \leq \gamma \leq 2$) while only 4.8% qualified as low risk averse ($\gamma < 1$). Controlling for demographic and economic factors, unreported evidence (Arrondel, 2009) shows that those who are more risk tolerant are also more willing to take risk in financial decisions and more likely to become self-employed (excluding farmers).

5 Estimation and results

5.1 The model

The empirical test consists in estimating the traditional determinants of the share of stocks in the financial portfolio (income, risk aversion, time preference, information costs, etc.) as well as the impact of other risks (housing exposure to risk, income risk, business risk). In particular, we want to know whether households adopt a temperance behaviour in presence of background risks that lead them to limit the share of risky financial assets in their financial portfolio.

More precisely, we consider the following relation for the share of stocks directly held in the financial wealth[20]:

$$\frac{A_i}{F_i} = g\left(\sigma_i, \gamma_i, h_i, B_i, F_i, X_i\right) + \varepsilon_i \tag{2}$$

where $A_i (\geq 0)$ is the demand for risky assets and F_i is total financial wealth of the household i, σ^2 is the subjective earnings variance, γ_i is the coefficient of relative risk aversion, h represents the housing variables, B_i the vector of other background risks (business and health risks) and X_i is a vector of other variables which influence the demand for risky investments. ε_i is an error term.

The set of explanatory variables X is determined by the classical portfolio choice model and by taking into account its extensions. In portfolio choice models where capital markets are imperfect (transaction costs, holding costs, imperfect information)

[20] As robustness checks we also examine total stocks (direct and indirect, see below).

portfolios are incomplete (King and Leape, 1998). Thus, portfolio choices depend on household's income and wealth (to finance transaction and information costs) and on the stock of financial information (proxied by age, education, parents' wealth composition).

We also introduce the measure of risk aversion described above as well as an indicator of time preference. It is obtained by asking households to give their subjective position on a scale of time preference. More precisely we ask: *"On a scale of zero to ten, where would you place yourself between the following two "extreme" descriptions?*

0 : persons who live day by day and take life as it comes, who don't think too much about tomorrow nor worry about the future;

10: persons who are preoccupied by their future (even their distant future) and whose mind is well set on what they want to be or do later in on life."

As presented before, we also introduce the following variables to account for the impact of housing on stockholding: the ratio of housing value to net wealth, the ratio of housing debt to net wealth and the ratio of mortgage annuities on income.

We also take into account other sources of future exogenous risk, especially on family (we control by marital status and number of children at home or away from home). Finally, we introduce the nature of (present or past) professional activity (employee vs. self-employed for active and retired people) as well as the ratio of business wealth to net wealth).

The effect of age included in X is polysemous (Arrondel and Masson, 2003). Bodie et al. (1992) show that the young enjoy greater labor flexibility than the old and may therefore be more likely to hold risky assets; Gollier and Zeckhauser (1997) show that young households take on relatively more portfolio risk than older households if (and only if) absolute risk tolerance is convex; King and Leape (1987) stress that financial information is acquired slowly along individual's life, a fact that can explain why the young hold a less diversified portfolio than the old: the young are more likely to be liquidity constrained and so less willing to take risk when choosing their portfolio.

From the econometric point of view, the selection bias arising from the fact that a significant proportion of households does not own stocks, is handled by estimating a Tobit model on the share of risky assets where the lower limit is zero (Heckman, 1976).

As one may suspect differences in the determinants of the ratio of stocks to financial assets for homeowners and for renters, we run our regression on both sub-samples. This sample splitting is likely to be endogenous, thus we control for the tenure status by adding in the tobit regression the mills ratio of a probit estimates for this tenure choice. As instruments in the probit equation describing the probability of being homeowner we use: heterogeneity in local housing prices (taken into account through the urban or rural environment and the urban size), housing consumption need (size of family) and whether the households benefits from past inheritance.[21]

[21]The results of the probility of being homeowners versus renters are presented in annexe A2.

5.2 Main results

Tables 4a and 4b report probit and tobit estimates respectively for homeowners and renters. The marginal effects of variables on the likelihood to be stockholder and on the ratio of stocks to financial wealth are computed in Tables 5a and 5b. For both subsamples, our results emphasize the significant role played by transaction and information costs, the attitude toward risk and the exposition to various risks in explaining the share of stocks in the financial portfolio.

5.2.1 Transaction and information costs

The significant positive effect of income in the probit model is consistent with the presence of fixed transaction costs both for homeowners and renters when they decide to own stocks or not, although the quantitative impact is low. Although, this quantitative effect is high both for renters and homeowners, the income impact seems larger for the last ones: moving a household from the 10th to the 90th percentile of the labor income distribution increases the probability of being a stockholder by 23.9 percentage points for a homeowners and by 12.4 percentage points for a renter. Income is also (in quantitative terms) a main determinant of the share of financial wealth invested in stocks which increases from 3.1% to 8.7% (respectively from 0.7% to 3.3%) when moving a homeowner (respectively a renter) from the first decile to the last decile of the income distribution of the subsample (and holding the other variables constant at their means).

The significant impact of financial wealth is also consistant with the existence of transaction costs although the quantitative effect is low. For instance, an increase in the amount of homeowners' financial wealth from the 10th percentile (around 3,000 euros) to the 90th percentile (around 152,600 euros) increases their probability of being a stockholder by 2.7 percentage points and the share of stocks to financial wealth from 5.0 to 5.7%, when holding the other variables in the regression constant at their means.

The stock of information inherited from parents proxied by the ownership of the same assets in parents' wealth increases also the stocks investment. Households (both renters and homeowners) whose parents owned stocks are about 10 percentage points more likely to hold stocks directly, again keeping the other regression variables constant at their means. Moreover, education has a strong positive effect on stockholding, especially for homeowners: with graduate households stockownership increases by 15.6% compared to those without diploma and the share of financial wealth invested in stocks increases from 4.9 to 7.7.

We find significant positive age effects on the stockownership before age 50 for renters and only between 40 and 50 years old for homeowners. A part of the age effect is probably captured by the housing variables and the mills ratio that takes into account the endogeneity of the tenure status. Indeed, the estimation of the probability for being homeowners (Table A2 in the annexes) shows a strong correla-

tion between homeownership and age. This life-cycle profile is characterized by an increasing positive correlation until age 60, then a stabilization and a small decrease.

Table 4a. Estimates of direct stockholding (discrete and continuous choice)
Sample: Homeowners

	Probit		Tobit	
Variables	Coef.	Std. Err.	Coeff.	St. Err.
Financial wealth (E-6)	0.277	0.039 ***	0.158	0.072 **
Housing wealth/net wealth	-0.583	0.167 ***	-0.212	0.047 ***
Business wealth/net wealth	-0.165	0.169 ***	-0.108	0.053 **
Other real estate/net wealth	0.133	0.211	0.023	0.061
housing debt/net wealth	0.360	0.197 **	0.129	0.059 **
Mortgage pay./ income	0.194	0.147	0.036	0.015 **
log(income)	0.406	0.079 ***	0.128	0.023 ***
Unemployment risk (E+10)	-0.796	0.157 ***	-0.092	0.037 **
Age				
less than 30	*ref.*		*ref.*	
30-40	0.274	0.443	0.028	0.128
40-50	0.214	0.463	0.027	0.135
50-60	0.364	0.467	0.091	0.135
60-70	0.469	0.495	0.220	0.143
70-80	0.430	0.500	0.208	0.145
more than 80	0.366	0.505	0.165	0.147
Self-employed	0.019	0.151	0.028	0.044
Retired self-employed	0.392	0.214 **	0.062	0.059
Retired employed	-0.011	0.168	-0.070	0.048
Employed (ref)				
Health (past diseases=1)	-0.394	0.256	-0.120	0.078
Education				
No diploma	*ref.*		*ref.*	
Primary level	0.017	0.169	-0.005	0.051
Primary level (vocational)	0.070	0.165	0.027	0.050
Secondary level	0.145	0.200	0.089	0.060
Baccalaureate	0.481	0.216 **	0.115	0.064 *
Graduate studies	0.326	0.190 *	0.104	0.056 *
Post graduate studies	0.410	0.184 **	0.143	0.055 ***
Grandes écoles	0.398	0.174 **	0.154	0.051 ***
Parents stockholder (yes=1)	0.278	0.110 ***	0.092	0.030 **

Table 4a (continued). Estimates of direct stockholding (discrete and continuous choice)
Sample: Homeowners

	Homeowners			
	Probit		Tobit	
Variables	Coef.	Std. Err.	Coeff.	St. Err.
Relative risk aversion				
No response	-0.109	0.150	-0.007	0.044
CRRA>=3.76	ref.		ref.	
2<CRRA<=3.76	0.148	0.097	0.054	0.028 **
1<CRRA<=2	0.391	0.136 ***	0.096	0.038 **
CRRA<1	0.434	0.227 *	0.139	0.062 **
Time preference scale				
No response	-0.128	0.208	-0.011	0.061
First quartile	ref.		ref.	
Second quartile	0.064	0.110	0.028	0.031
Third quartile	-0.005	0.105	0.005	0.031
Fourth quartile	-0.036	0.114	-0.026	0.033
inv. Mills	0.311	0.179 *	0.119	0.053 **
Constant	-5.338	1.059 ***	-1.639	0.309 ***
Number of observations	1442		1442	
Number of stockholders	458		458	
Log-Likelihood	-723.86		-530.32	

Source: Patrimoine 2004 (Insee survey)
The dependent variable in the probit model is a dichotomous variable equals to one if households hold directly stocks. The dependent variables in the tobit model is the ratio of direct stockholding on financial assets.
*/**/*** indicates that the variable is statistically significant at respectively 10%-5%-1%.

Table 4b. Estimates of direct stockholding (discrete and continuous choice)
Sample: Renters

	Renters					
	Probit			Tobit		
Variables	Coef.	Std. Err.		Coeff.	St. Err.	
Financial wealth (E-6)	3.580	0.851	***	0.630	0.184	***
Business wealth/net wealth	-0.046	0.099		-0.024	0.033	
Other real estate/net wealth	0.209	0.084	**	0.031	0.018	*
log(income)	0.427	0.092	***	0.133	0.030	***
Unemployment risk (E+10)	-1.150	0.479	**	-0.275	0.209	
Age						
less than 30						
30-40	0.360	0.207	*	0.117	0.068	*
40-50	0.597	0.270	**	0.172	0.089	*
50-60	0.564	0.285	**	0.187	0.093	**
60-70	0.235	0.482		0.170	0.154	
70-80	0.211	0.500		0.130	0.159	
more than 80	0.358	0.527		0.200	0.169	
Self-employed	0.442	0.227	*	0.121	0.071	*
Retired self-employed	1.602	0.493	***	0.380	0.152	**
Retired employed	0.764	0.405	*	0.131	0.129	
Employed (ref)						
Health (past diseases=1)	-0.265	0.466		-0.086	0.149	
Education						
No diploma						
Primary level	0.034	0.259		0.010	0.084	
Primary level (vocational)	0.184	0.245		0.049	0.080	
Secondary level	-0.180	0.346		-0.032	0.109	
Baccalaureate	0.392	0.314		0.082	0.103	
Graduate studies	0.387	0.284		0.175	0.091	*
Post graduate studies	0.369	0.267		0.094	0.087	
Grandes écoles	0.609	0.248	**	0.161	0.081	**
Parents stockholder (yes=1)	0.677	0.142	***	0.183	0.046	***

Table 4b. (continued). Estimates of direct stockholding (discrete and continuous choice)
Sample: Renters

	Renters			
	Probit		Tobit	
Variables	Coef.	Std. Err.	Coeff.	St. Err.
Relative risk aversion				
No response	-0.159	0.252	-0.016	0.080
CRRA>=3.76				
2<CRRA<=3.76	0.342	0.140 **	0.076	0.045 *
1<CRRA<=2	0.641	0.179 ***	0.199	0.057 ***
CRRA<1	0.404	0.239 *	0.151	0.076 **
Time preference scale				
No response	-0.033	0.364	-0.097	0.120
First quartile				
Second quartile	-0.035	0.165	0.002	0.053
Third quartile	0.030	0.158	0.008	0.051
Fourth quartile	-0.147	0.158	-0.027	0.051
Mills	-0.186	0.121	-0.060	0.041
Constant	-6.652	0.968 ***	-2.073	0.327 ***
Number of observations	1010		1010	
Number of stockholders	160		160	
Log-Likelihood	-326		-259.5	

Source: Patrimoine 2004 (Insee survey)

The dependent variable in the probit model is a dichotomous variable equals to one if households hold directly stocks. The dependent variables in the tobit model is the ratio of direct stockholding on financial assets.

*/**/*** indicates that the variable is statistically significant at respectively 10%-5%-1%.

5.2.2 Attitudes and preference

The coefficients of the individual measures of risk aversion exhibits the expected effect: one observes a decreasing effect of the risk aversion variables. In particular, homeowners classified in the group of high risk averters are, ceteris paribus about 14.1 percentage points less likely to hold stocks directly (relatively to the group of low risk averters), and the share of financial wealth invested in stocks is twice as less (4.7% versus 9.1%). Our subjective time preference scale does not reveal any significant impact of time preference on the share of stocks invested in financial wealth.

5.2.3 Background risks

Labour market risks

We find a significant negative effect of unemployment and income risks[22]: households whose future income is more risky are also those who invest less in risky assets. In other words, the exogenous unemployment risk and the endogenous risk associated with households' decision to include stocks in their portfolio appear to be substitutes. However, the size of the effect is limited (homeowners without any unemployment risk on their labour income were, ceteris paribus, about 0.5 percentage points less likely to hold stocks directly compared to households who are in the highest risky income decile).

Real estate exposure

All housing-related variables have significant effects on homeowners stockmarket participation decisions and investments.

The ratio of housing to net wealth has a crucial negative impact on stockholding for a given financial wealth. When reimbursing their mortgages, homeowners increase their net wealth (which lowers the housing to net wealth ratio) and become more prone to invest in stocks. In other words, homeowners moderate their total exposure to risk by reducing their equity investment. For instance, a homeowner, moving from the last decile of the distribution of the housing to net wealth ratio to the first one (i.e. from a ratio greater than 1.3 to a ratio smaller than 0.3) increases the probability to own stocks by 13.4 percentage point and the share of financial wealth invested in stocks from 4.7% to 8.6%.

As previously stated by other empirical studies, we obtain significant positive effects for the housing debt to net wealth ratio and the annual mortgage payment to income ratio. An increase in the housing debt ratio from the first to the ninth decile increases the probability to own stocks by 4 percentage point. This can be interpreted as a permanent income effect not fully taken into account by the income variable: for a given housing wealth, more educated household that enjoy also higher future expected labor income are able to borrow more (for home acquisition), and are also more prone to invest more in stockmarkets. Moreover, a higher "human wealth" can be considered as a less risky and more liquid asset than stocks and thus leads to invest in more risky financial assets like equities.

Business risks

Having a business wealth seems to be a risk that homeowners take into account when deciding to participate in stockmarkets: an increase in the business to net wealth ratio from the first to the last decile is associated with a decrease in share of financial wealth invested in stocks from 5.5% to 4.8%. For renters, the effect of business wealth does not appear significant. However, we notice the significant

[22]See Table A4 in annexes for the regressions with the income risk variable as a proxy for the labour market risks.

positive impact of being a retired self-employed: those people are less risk averse and the business risk have disappeared for them, thus they are now more prone to invest in stocks.

Our regression also take into account health risk through a dummy variable reflecting the occurrence of diseases in the past. But we do not find a significant coefficient for this variable.

Finally, as all previous results are obtained by considering direct stockownership, we run similar regression taking into account both direct and indirect stockhlding. The results are presented in Table A3 in the annexes and confirm our main findings.

6 Conclusion

One of the main puzzle faced by the empirical literature on wealth portfolio deals with the so-call "equity premium puzzle". How to explain the low participation of households to the stockmarkets, and when they do participate, why do they underinvest compared to the main results of the theoretical models? Indeed, the standard portfolio theory (with expected and discounting utility and homothety) predicts that households' portfolio are fully diversified and so invest in stocks. Various explanations of this puzzle are investigated in the literature: modifications of rationality assumptions, introduction of transactions costs, unavoidable risks on the job market, liquidity constraints, labour flexibility. In this paper, we focused on a more recent approach that links housing investment and stockmarkets participation. Housing represents the main assets in the households' wealth and is associated with various constraints and risks (housing price evolution, illiquidity, indebtedness over a long period). These characteristics may lead households to limit their investment in risky financial assets by temperance.

We use the French wealth survey (Enquête Patrimoine 2004, Insee) that gives us detailed information on households portfolio composition (housing and financial wealth, mortgages), socio-demographic variables, and several measures of attitudes (risk aversion, scales on time preference) and exposition to various risks (income, unemployment, health, business).

We obtain a strong impact of real estate exposure to risk on the share of financial wealth invested in stocks. An increase in the housing to net wealth ratio crowds out stock market investment for a given total financial wealth. In other words, when facing real estate exposure to risk (for instance, a large housing asset associated with high mortgages), households tend to moderate their global exposure to risk by limiting the share of their financial wealth invested in risky assets. We find that a homeowner facing higher housing risks and moving from the last to the first decile of the housing to net wealth ratio decreases his probability to participate in stockmarkets by 13.4 percentage point and his share of financial wealth invested in stocks from 8.6% to 4.7%.

Among the other significant determinants of the equity premium puzzle, we emphasize the role of transaction and information costs, the attitude toward risk and the exposition to various risks (we find significant effect of income, unemployment and business risks) in limiting investments in stocks.

Finally, this paper may help to evaluate the impact of the current economic crisis that reinforces households exposure to risks and which is associated with large uncertainty about the effect of housing market evolution on households wealth allocation.

Table 5a. Estimated probabilities and amount (stock/financial assets) of stock demand for homeowners

Variables	Estimated Probabilities of stockholding	Estimated (stock/financial assets) (%)
Housing wealth/net wealth (d1)	0.380	8.6
Housing wealth/net wealth (d9)	0.246	4.7
Housing debt (d1)	0.253	4.9
Housing debt (d9)	0.293	6.0
Financial wealth (d1)	0.256	5.0
Financial wealth (d9)	0.283	5.7
Income (d1)	0.175	3.1
Income (d9)	0.384	8.7
Risk aversion ($\gamma > 3.76$)	0.244	4.7
Risk aversion ($\gamma < 1$)	0.395	9.1
Income risk*(d1)	0.280	5.6
Income risk (d9)	0.277	5.5
Unemployment risk*(d1)	0.270	5.4
Unemployment risk (d9)	0.265	5.2
Self-employed	0.320	6.7
Retired self-employed	0.357	7.9
Retired employed	0.220	4.1
Employed (ref)	0.289	5.9
Business wealth/net wealth (d1)	0.267	5.5
Business wealth/net wealth (d9)	0.250	4.8
Parents own stocks (yes)	0.352	7.7
Parents own stocks (no)	0.254	4.9
No diploma	0.200	3.6
High school	0.356	7.8
Mean values	0.291	6.1
Estimated value (average household)	0.267	5.3

Source: Patrimoine 2004 (Insee survey)

Note: This table is computed using the tobit estimates presented in table 4a.

d1/d9 indicate the value computed respectively for the first decile/last decile of the variable.

*These two risk variables are separately introduced in the regression (see tables 4.a and A.4).

Table 5b. Estimated probabilities and amount (stock/financial assets) of stock demand for renters

Variables	Estimated Probabilities of stockholding	Estimated (stock/financial assets) (%)
Financial wealth (d1)	0.080	1.3
Financial wealth (d9)	0.101	1.7
Income (d1)	0.050	0.7
Income (d9)	0.174	3.3
Risk aversion ($\gamma > 3.76$)	0.072	1.1
Risk aversion ($\gamma < 1$)	0.147	2.7
Income risk*(d1)	0.073	1.1
Income risk (d9)	0.068	1.1
Unemployment risk*(d1)	0.071	1.1
Unemployment risk (d9)	0.068	1.0
Self-employed	0.127	2.2
Retired self-employed	0.348	8.1
Retired employed	0.133	2.3
Employed (ref)	0.068	1.1
Parents own stocks (yes)	0.183	3.5
Parents own stocks (no)	0.077	1.2
No diploma	0.059	0.9
High school	0.135	2.4
Mean values	0.140	2.9
Estimated value (average household)	0.090	1.4

Source: Patrimoine 2004 (Insee survey)

Note: This table is computed using the tobit estimates presented in table 4b.

d1/d9 indicate the value computed respectively for the first decile/last decile of the variable.

*These two risk variables are separately introduced in the regression (see tables 4.b and A.4).

7 Appendix

Table A1. Samples characteristics

	Sub-sample of respondents	Full sample
Number of households	3,872	9,692
Wealth		
Total gross wealth (mean in euros)	190,000	170,000
Median gross wealth	131,500	100,000
Financial wealth (mean in euros)	38,000	32,500
Housing wealth (mean in euros)	100,000	87,000
Household income (mean in euros)	32,500	29,000
Percent. holding directly risky assets[(1)]	19.6	15.4
Percent. holding directly or indirectly risky assets[(2)]	24.9	19.8
Percent. holding housing wealth (%)	62.3	55.7
Age of head (%)		
Less than 30	10.5	10.2
30-40	19.3	18.5
40-50	19.7	19.8
50-60	19.0	17.9
60-70	13.7	13.1
More than 70	17.9	20.5
Social Status of head (%)		
Farmer	4.2	4.6
Self-employed (small production unit)	6.4	7.7
Self-employed (large production unit)	1.1	1.1
Liberal profession	1.2	1.3
Executive	17.5	13.6
High qualified employee	22.2	19.5
Low qualified employee	17.5	19.3
High qualified workers	20.5	22.0
Low qualified workers	7.5	9.0
Retired or other not working	2.0	2.0

Table A1. (continued). Samples characteristics

	Sub-sample of respondents	Full sample
Number of households	3,872	9,692
Education of head (%)		
No diploma	14.9	20.6
Primary level	16.0	16.9
Secondary level	32.2	30.9
Baccalaureate	13.6	12.6
Graduate	10.0	8.0
Post-graduate	13.3	11.1
Family structure (%)		
Single	26.8	30.1
Couple, no child	30.0	27.6
Couple, one child	13.8	12.6
Couple, two children	14.4	12.7
Couple, three children or more	6.1	6.5
Single, children	6.2	7.7
Other cases	2.7	2.8
Relative risk aversion (CRRA)[3]		
$3.76 \leq CRRA$	58.3	-
$2 \leq CRRA < 3.76$	39.4	-
$1 \leq CRRA < 2$	11.2	-
$CRRA < 1$	4.8	-

Source: Patrimoine 2004 (Insee survey)

(1) Direct stockholding: households hold equities directly

(2) Direct or indirect stockholding: households hold equities directly or through mutual funds

(3) The measure of risk aversion is described below.

Table A2. Determinants of homeownership (Probit)

	Coef.	Std. Err.	
Spouse (yes=1)	-0.502	0.067	***
Number of children	0.082	0.019	***
Net wealth (E-6)	0.000	0.000	***
log(income)	0.146	0.034	***
Unemployment risk (E+10)	-0.086	0.106	
Age			
less than 30			
30-40	0.897	0.168	***
40-50	1.624	0.169	***
50-60	2.019	0.168	***
60-70	2.409	0.215	***
70-80	2.404	0.220	***
more than 80	2.264	0.236	***
Activity			
Self-employed	0.129	0.117	
Retired self-employed	0.023	0.178	
Retired employed	0.038	0.137	
Employed	ref.		
Education			
No diploma	ref.		
Primary level	0.037	0.113	
Primary level (vocational)	0.383	0.111	***
Secondary level	0.351	0.149	**
Baccalaureate	0.203	0.167	
Graduate studies	0.542	0.143	***
Post graduate studies (except "grandes écoles")	0.530	0.135	***
Grandes écoles	0.367	0.125	***
Inheritance received (yes=1)	0.406	0.063	***
Heterogenity in housing prices			
Rural area	1.154	0.243	***
urbain (less than 20,000 inhabitants)	0.815	0.237	***
urbain (20,000-100,000 inhabitants)	0.564	0.240	**
urbain (more than 100,000 inhabitants)	0.549	0.240	**
Paris area (except Paris itself)	0.472	0.159	***
Paris	ref.		

Table A2. Determinants of homeownership- Probit (continued)

	Coef.	Std. Err.	
Geographical area			
Ile de France	-0.360	0.210	*
Rest of Bassin parisien	-0.341	0.116	***
North	-0.163	0.139	
East	-0.259	0.139	*
West	-0.128	0.118	
South-West	-0.139	0.129	
Center-East	-0.244	0.122	**
Mediterranean cost	ref.		
Relative risk aversion			
No response	-0.232	0.107	**
CRRA>=3.76	ref.		
2<CRRA<=3.76	0.002	0.079	
1<CRRA<=2	-0.047	0.110	
CRRA<1	-0.355	0.164	**
Time preference scale			
No response	-0.113	0.158	
First quartile	ref.		
Second quartile	-0.045	0.092	
Third quartile	-0.096	0.085	
Fourth quartile	-0.234	0.083	***
Constant	-3.604	0.450	***
Log-likelihood	-1158		
Number of homeowners	1442		
Number of observations	2452		

Source: Patrimoine 2004 (Insee survey)

The dependent variable in the probit model is a dichotomous variable equals to one if households are homeowners.

*/**/*** indicates that the variable is statistically significant at respectively 10%-5%-1%.

Table A3. Estimates of direct and indirect stockholding (Homeowners and renters)

	Tobit					
	Homeowners			Renters		
Variables	Coeff.	St. Err.		Coeff.	St. Err.	
Financial wealth (E-6)	0.185	0.068	***	0.762	0.177	***
Housing wealth/net wealth	-0.225	0.043	***	-	-	
Business wealth/net wealth	-0.115	0.048	**	-0.022	0.031	
Other real estate/net wealth	0.004	0.056		0.013	0.017	
Housing debt/net wealth	0.124	0.053	**	-	-	
Mortgage pay./ income	0.030	0.015	**	-	-	
log(income)	0.122	0.021	***	0.111	0.026	***
Unemployment risk (E+10)	-0.103	0.034	***	-0.049	0.066	
Age						
less than 30	*ref.*			*ref.*		
30-40	0.081	0.121		0.137	0.062	**
40-50	0.037	0.127		0.104	0.083	
50-60	0.097	0.127		0.140	0.086	*
60-70	0.253	0.135	*	0.121	0.142	
70-80	0.250	0.136	*	0.164	0.146	
more than 80	0.189	0.137		0.201	0.155	
Self-employed	0.032	0.040		0.143	0.066	**
Retired self-employed	0.056	0.054		0.397	0.140	***
Retired employed	-0.077	0.044	*	0.151	0.118	
Employed	*ref.*			*ref.*		
Health (past diseases=1)	-0.045	0.064		0.086	0.105	
Education						
No diploma	*ref.*			*ref.*		
Primary level	-0.019	0.046		0.007	0.078	
Primary level (vocational)	0.032	0.044		0.091	0.073	
Secondary level	0.138	0.053	***	0.091	0.093	
Baccalaureate	0.135	0.058	**	0.104	0.096	
Graduate studies	0.082	0.051	*	0.245	0.083	***
Post graduate studies	0.138	0.049	***	0.169	0.080	**
Grandes écoles	0.156	0.046	***	0.203	0.075	***
Parents stockholder (yes=1)	0.090	0.028	***	0.178	0.042	***

Table A3. Estimates of direct and indirect stockholding-continued (Homeowners and renters)

	Tobit			
	Homeowners		Renters	
Variables	Coeff.	St. Err.	Coeff.	St. Err.
Relative risk aversion				
No response	0.010	0.039	-0.032	0.071
CRRA>=3.76	*ref.*		*ref.*	
2<CRRA<=3.76	0.073	0.026 ***	0.060	0.041
1<CRRA<=2	0.093	0.035 ***	0.160	0.052 ***
CRRA<1	0.108	0.059 **	0.119	0.071 *
Time preference scale				
No response	-0.040	0.056	-0.154	0.117
First quartile	*ref.*		*ref.*	
Second quartile	0.010	0.029	-0.012	0.049
Third quartile	0.004	0.028	-0.004	0.047
Fourth quartile	-0.023	0.030	0.018	0.045
inv. Mills	0.096	0.048 **	-0.045	0.039
Constant	-1.518	0.281 ***	-1.818	0.289 ***
Number of observations	1442		1010	
Number of stockholders	553		203	
Log-Likelihood	-537.6		-301.2	

Source: Patrimoine 2004 (Insee survey)

The dependent variables in the tobit model is the ratio of direct and indirect stockholding on financial assets.

The first set of estimates is for homeowners, the second one for renters.

*/**/*** indicates that the variable is statistically significant at respectively 10%-5%-1%.

Table A4. Alternative measure for employment market risk
Estimates of direct stockholding-Homeowners and renters-

	Tobit							
	Homeowners		Renters		Homeowners		Renters	
Variables	Coeff.	St. Err.	Coeff.	St. Err.	Coeff.	St. Err.	Coeff.	St. Err.
Financial wealth (E-6)	0.165	0.072 **	0.557	0.183 ***	0.154	0.072 **	0.627	0.186 ***
Housing wealth/net wealth	-0.225	0.048 ***			-0.226	0.048 ***		
Business wealth/net wealth	-0.110	0.053 **	-0.028	0.033	-0.108	0.053 **	-0.027	0.033
Other real estate/net wealth	-0.003	0.062	0.029	0.018 *	-0.002	0.062	0.030	0.018 *
Housing debt/net wealth	0.146	0.059 **	-	-	0.147	0.060 **	-	-
Mortgage pay./ income	0.036	0.015 **	-	-	0.037	0.015 **	-	-
log(income)	0.130	0.023 ***	0.134	0.030 ***	0.133	0.023 ***	0.130	0.030 ***
Unemployment risk (E-10)	-	-	-	-	-0.092	0.037 **	-0.279	0.224
Income risk (variance E-10)	-1.210	0.548 **	-6.740	3.140 **	-	-	-	-
Age								
less than 30	*ref.*		*ref.*		*ref.*			*ref.*
30-40	0.024	0.128	0.122	0.069 *	0.024	0.128	0.117	0.069 *
40-50	0.018	0.134	0.188	0.091 **	0.020	0.135	0.176	0.090 **
50-60	0.080	0.135	0.201	0.095 **	0.084	0.135	0.194	0.094 **
60-70	0.205	0.143	0.187	0.157	0.205	0.144	0.174	0.156
70-80	0.199	0.145	0.160	0.164	0.200	0.145	0.147	0.163
more than 80	0.154	0.147	0.231	0.173	0.157	0.148	0.218	0.172
Self-employed	0.027	0.044	0.120	0.072 *	0.027	0.044	0.119	0.072 *
Retired self-employed	0.061	0.061	0.367	0.157 **	0.062	0.061	0.357	0.156 **
Retired employed	-0.060	0.049	0.124	0.132	-0.060	0.049	0.122	0.131
Employed	*ref.*		*ref.*		*ref.*			*ref.*
Health (past diseases=1)	-0.112	0.083	-0.071	0.152	-0.111	0.083	-0.069	0.151
Education								
No diploma	*ref.*		*ref.*		*ref.*			*ref.*
Primary level	-0.020	0.052	0.031	0.093	-0.021	0.052	0.030	0.092
Primary level (vocational)	0.005	0.050	0.075	0.086	0.004	0.051	0.072	0.085
Secondary level	0.073	0.060	0.002	0.116	0.072	0.060	0.000	0.115
Baccalaureate	0.097	0.064	0.101	0.109	0.093	0.064	0.096	0.108
Graduate studies	0.086	0.057	0.207	0.098 **	0.086	0.057	0.201	0.097 **
Post graduate studies	0.121	0.055 **	0.117	0.093	0.120	0.055 **	0.114	0.092
Grandes écoles	0.131	0.051 ***	0.202	0.087 **	0.131	0.052 **	0.189	0.087 ***
Parents stockholder (yes=1)	0.079	0.031 ***	0.183	0.047 ***	0.081	0.031 ***	0.181	0.046 ***

Table A4 (Continued) Alternative measure for employment market risk
Estimates of direct stockholding-Homeowners and renters-

	Tobit							
	Homeowners		Renters		Homeowners		Renters	
Variables	Coeff.	St. Err.	Coeff.	St. Err.	Coeff.	St. Err.	Coeff.	St. Err.
Relative risk aversion								
No response	-0.019	0.046	-0.006	0.089	-0.020	0.046	-0.003	0.088
CRRA>=3.76	*ref.*		*ref.*		*ref.*		*ref.*	
2<CRRA<=3.76	0.052	0.028 *	0.069	0.046	0.052	0.028 *	0.072	0.046
1<CRRA<=2	0.090	0.038 **	0.213	0.058 ***	0.092	0.038 **	0.199	0.057 ***
CRRA<1	0.141	0.064 **	0.165	0.078 **	0.148	0.064 **	0.168	0.077 **
Time preference scale								
No response	-0.019	0.046	-0.067	0.142	-0.029	0.070	-0.066	0.141
First quartile	*ref.*		*ref.*		*ref.*		*ref.*	
Second quartile	0.052	0.028 *	-0.003	0.054	0.022	0.031	-0.008	0.054
Third quartile	0.090	0.038 **	-0.015	0.053	0.004	0.031	-0.011	0.052
Fourth quartile	0.141	0.064 **	-0.032	0.052	-0.031	0.034	-0.027	0.051
inv. Mills	0.117	0.053 **	-0.063	0.041	0.119	0.053 **	-0.061	0.041
Constant	-1.618	0.309 ***	-2.108	0.334 ***	-1.652	0.313 ***	-2.054	0.331
Number of observations	1377		944		1377		944	
Number of stockholders	448		157		448		157	
Log-Likelihood	-506.4		-251.3		-510.31		-249.8	

Source: Patrimoine 2004 (Insee survey)
The dependent variables in the tobit model is the ratio of direct stockholding to financial assets.
The first set of estimates is for homeowners, the second one for renters.
The alternative measure of labour market risk (unemployment risk) is only available for 2,321 households while the income risk is available for 2,452 households. As robustness check of our previous results, we report in the third and fourth columns the results obtained with the income risk variable on the subsample of 2,321 households.
*/**/*** indicates that the variable is statistically significant at respectively 10%-5%-1%.

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