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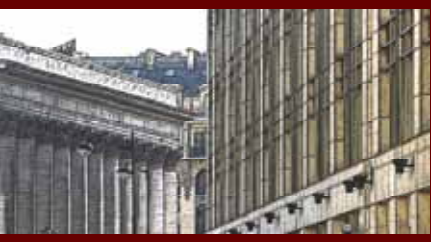

Why Is the Behaviour of French Savers so Inconsistent with Standard Portfolio Theory?

- Part One -

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Abstract

A static analysis of the behaviour of French savers reveals several stylised facts that are inconsistent with normative portfolio theory. The first is a frequent absence of equity ownership, both direct and indirect through investment funds and unit-linked life insurance policies. The second is the quantitative and qualitative under-diversification of portfolios, which exhibit, in particular, a heavy home bias. While these two characteristics are common to many countries, in the case of France they have to be analysed in the light of the huge number of small portfolios, many of which were created as a result of successive rounds of privatisation.

There are four possible ways to build a framework within which to explain the behaviour of French investors. The first remains true to the portfolio theory approach. Here, non-participation in markets could be attributed to strong risk aversion. However, a better illustration may be obtained by defining maximum acceptable risk, which depends on the excess return on risky assets over the risk-free rate.

A second route focuses on the lack of information available to investors, which prevents participation and leads to incomplete portfolios. There is clear evidence that a deep lack of understanding persists, either because investors choose to exclude themselves from the market or because financial intermediaries use selective sales and marketing practices. From an analytical perspective, this generates high participation costs (e.g. the need for information about companies, products, markets and investment rules).

High participation costs form one of the arguments put forward as part of the more traditional challenge to the perfect markets assumption. This third source of bias is also based on tax treatment and transaction costs, which, especially when fixed, introduce a bias against portfolio creation and diversification. Broadly, French tax rules seem to be viewed as a disincentive to holding securities portfolios. Simulations confirm that this is true for holdings above the authorised ceiling for French equity savings plans (PEAs). Furthermore, complex tax treatment increases participation costs.

The fourth approach is based chiefly on behavioural finance. It entails a critical analysis of the utility functions that supposedly explain households' financial behaviour and introduces new analytical frameworks that more accurately reflect actual attitudes. Three avenues seem especially worth exploring. The first consists in linking decision-making to other criteria than just the risk/return trade-off on financial securities. For example, investors whose labour income is highly exposed to risk may prefer to have their wealth in liquid – and hence non-risky –assets. Second, reflecting their financial illiteracy, households with an aversion to ambiguity or uncertainty seem not only to demand extremely high expected returns before participating in markets, but also concentrate their portfolios on the few companies offering the least sense of uncertainty. Third, investors' inability to view portfolios as a whole, combined with their aversion to loss, have given rise to behavioural portfolio theory. This approach supplies a framework with which to explain why heavy investments in non-risky assets occur simultaneously with small portfolios of risky assets that are seen as lotteries.

Introduction

Although many questions have been asked about the application of portfolio theory to real-life situations, for finance professionals (Basjeux-Besnaimou and Portait, 1999) and especially for individual savers, this theoretical framework laid the foundations for several universal investment principles. Notably, it works on the basis of the diversification rule, which is used to reduce portfolio risk to the level of the market as a whole.

However, portfolio theory and its extension, the Capital Asset Pricing Model (CAPM), do a relatively poor job of explaining the behaviour of households in France and elsewhere in the world. From a static perspective, two problems are encountered. First, rates of ownership of risky securities remain surprisingly low, even today. In the benchmark model, such low levels of financial market participation by households can be explained only by extremely strong risk aversion – far stronger than that generally predicted by standard theory. This is known as the equity premium puzzle, where investors demand an abnormally high risk premium. Second, the minority of households that do have a securities portfolio are under-diversified relative to the theory's predictions.

In his presidential address on household finance to the American Finance Association, Campbell (2006) identifies two categories of investor, using a principle that could definitely be applied in France. He takes two ideas from this. A minority of households seem to have received enough education to behave according to the normative principles of portfolio theory. Their lack of participation in financial markets or their irrational investment decisions can therefore be attributed to market imperfections, such as transaction costs or tax treatment. In the second investor category, a lack of education, linked to the prohibitive cost of disseminating information, appears to be the cause of several biases, including primarily a lack of participation in financial markets.

The purpose of this paper is to take stock of the factors that explain non-participation and non-diversification. In the first section we recall the normative principles of portfolio theory and describe the actual behaviour of French households. In the second, we analyse three key arguments: access to information, market imperfections and behavioural assumptions. We propose introducing the concept of maximum acceptable risk, beyond which the saver will put all his financial wealth into non-risky assets.

Section I. Normative approach and actual behaviour

Without going into a full formal presentation of portfolio theory, which can be found in any textbook[1], we will begin by reviewing the theory's underlying behavioural assumptions and main conclusions. By comparing these against actual observations, we reveal the scale of the disconnect between the normative and positive approaches.

1. NORMATIVE FRAMEWORK FOR MANAGING A SECURITIES PORTFOLIO

Established by Markowitz's seminal 1952 article, modern portfolio theory introduced two investment principles that were essential in a static setting and that held up to more sophisticated, dynamic versions of the theory (Merton, 1971). First, to be efficient, a portfolio of risky assets must be broadly diversified. Second, as long as the expected return on a portfolio of risky assets is greater than the return on a non-risky asset, non-ownership of risky securities is a particular case that can be explained only by strong risk aversion.

1.1 Refresher on portfolio theory

The theory's behavioural assumptions are well known. Each investor selects a number of assets based on two criteria: expected return and risk. In other words, the investor is capable of assigning a probability of occurrence to different states of nature. The investor is also averse to risk[2] measured by deviation from the mean return (variance or standard deviation of return), i.e. the same weight is assigned to returns above and below the mean.

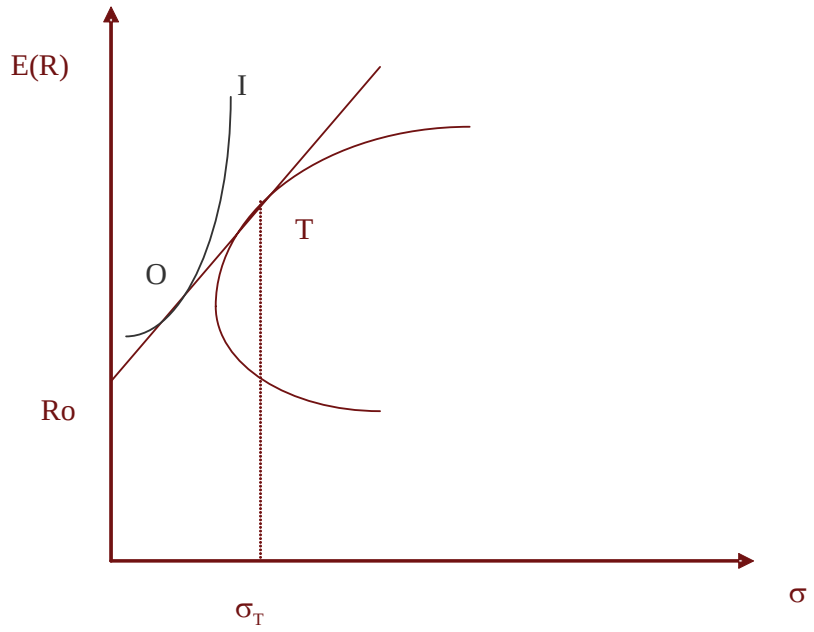
Markowitz's utility function captures these behaviours and satisfies the Von Neumann-Morgenstern axioms. As quadratic function, it has two drawbacks: it increases with wealth, but only over an interval (whereas one can imagine satisfaction increasing continually with wealth); and it shows risk aversion increasing with wealth, a situation not borne out by survey data. The main advantage of the function is that it relies solely on the first two moments of the distribution of returns (mean and standard deviation), which is one of the two possible conditions for obtaining an optimal solution[3].

The investor wants to maximise the expected utility of his final wealth, i.e. either to achieve maximum wealth at a given level of risk or to minimise the risk for an expected return. Given this objective, an efficient frontier representing a set of optimal solutions can be defined for each investor based on his own expectations within a risk/expected return reference (σ; E(R)). In the presence of a non-risky asset (earning a rate of Ro), it can be demonstrated that everyone will hold portfolio T, i.e. where the capital market line is tangent to the

[1] See for example Amenc and Le Sourd (2002).
[2] In 1964, Pratt introduced the idea of absolute risk aversion, a key component of utility functions, with the –U''/U' coefficient.
[3] The other possible condition is that returns are normally distributed.

efficient frontier. Depending on his risk aversion, the investor will then distribute his financial assets between the non-risky asset and portfolio T **(Figure 1)**. The optimal solution is reached at O, the point of tangency between the capital market line and an iso-utility curve I.

Figure 1: Optimal portfolio under standard portolio theory



Whether there is a non-risky asset or not, the investor diversifies his portfolio across the securities that are available. By doing so, the specific risks associated with each security tend to disappear and risk is reduced to the covariance of the assets in the portfolio, or market risk (cf. appendix). This solution is specific to each agent because it is dependent on his or her expectations[4]. At this stage, we should point out that an outstanding question under this approach concerns the expectations process[5]. While all modes of expectation-forming can be justified, enlightened investors will use some type of instrumentation. For example, they may look at the past by examining numerous time series and performing relatively complex calculations (notably measuring the variance-covariance matrix). This initial technical difficulty, to which we will add other arguments below, may make it hard to build up an efficient portfolio of risky assets, as defined by Markowitz. However, pooled management techniques, such as index investing, offer access to a broad range of securities in return for a small initial outlay and may therefore be viewed as an alternative to direct portfolio management, making it possible to obtain satisfactory solutions[6].

[4] Unlike in the CAPM, where investors have identical expectations.
[5] For an overview, see, Fabozzi, Gupta and Markowitz (2002).
[6] The theoretical justification for this question is usually provided by Fama's two-fund separation theorem (1972).

The objective with a portfolio of risky assets is to derive the maximum benefit from diversification by incorporating securities with the lowest possible correlation with the rest of the portfolio. This is achieved through sector diversification and geographical diversification, the latter being only partly a consequence of the former in a globalised economy.

1.2 Working towards a universal fund

There are three reasons for the international diversification of securities portfolios. First, it provides an opportunity to access the securities of new companies and hence new risk/return combinations. Second, it makes it possible to invest in indices with different sector weightings. Third, cross-border diversification enables investors to take advantage of cyclical lags between different geographical regions caused, among other things, by desynchronised economic policies. Overall, international diversification is supposed to benefit from the fact that domestic and world indices are not perfectly correlated.

Despite the growing integration of world markets, empirical tests confirm that this correlation remains imperfect (Bekaert *et al*, 2005), even if it has increased markedly across European indices since the switch to the euro (Friedman and Shachmurove, 2005). As a result, political and currency risks notwithstanding, the efficiency frontier of international portfolios dominates that of domestic portfolios. Accordingly, while an investor holding 20 or so domestic stocks comes close to the maximum gain possible through diversification on the domestic market, the level of non-diversifiable risk can be further lowered by including foreign securities. In the absence of constraints and assuming perfect markets, every saver should reserve a portion of his portfolio for foreign assets and ideally aim to build up a universal fund, potentially hedging against currency risk.

2. ANALYSIS OF ACTUAL BEHAVIOUR

When dealing with the question of saving, it is hard to talk about typical investor behaviour because the differences between agents are so great. Even so, we know that in France, there does appear to be a hierarchy in terms of households' take-up of products: savings books are most popular, followed by home savings plans (PELs) and life insurance policies (mostly in euros), with securities portfolios bringing up the rear (2000 wealth survey by INSEE, France's national statistics institute). Relatively few households participate directly or indirectly in financial markets. Of those investors that do participate directly, most hold underdiversified portfolios, especially from a cross-border perspective. Setting aside the usual characterisation of investor categories by economic, social, age and other criteria, in the case of France, it might also be worth examining the circumstances under which portfolios were put together.

2.1 The split between risky and non-risky assets

Surveys that look at rates of asset ownership consistently point to low household participation in equity markets (with sharp differences across countries). This is the oft-cited non-participation puzzle (see Campbell, 2006). France is no exception to the rule. A 2005 survey by pollster TNS Sofres found that 6.3 million people held equities directly, or 13.7% of French people aged 15 and over, while 2.1 million people held equity

funds directly. Meanwhile, 9% of households held unit-linked life insurance policies in 2004. On the face of it, portfolio theory is unable to explain these low rates of participation in equity markets if the expected return on these markets exceeds the return on a non-risky asset, which seems to be the case over a long-term horizon in France (Arbulu and Gallais-Hammono, 1995) and in the United States (Jagannathan and Kocherlakota, 1997)[7].

Several criteria can be used to identify the standard profile of an individual investor. Surveys conducted in France by INSEE, the Banque de France and TNS Sofres provide much information in this regard. However, a straightforward reading generally blurs the analysis because of the high correlation rates across the various criteria. A senior executive usually has a high level of education, along with substantial income and financial wealth. For this reason, econometric techniques, including probit and logit models, are needed to isolate the decisive factors.

A simple reading of the statistics tells us that the standard profile of a French equity holder, whether a direct or indirect investor, is similar to that of equity holders in other European countries (Guiso *et al*, 2002). This investor is usually a member of the workforce, is middle-aged (hence has some job stability) and belongs to one of the higher net-worth categories, meaning that some diversification across several asset types is assumed. This investor also has a superior level of education (making him receptive to financial information) and so belongs to one of the "upper-level" social classes, which include managerial and professional staff. When these factors are isolated, most of the criteria are corroborated both for securities overall and for equities only (Arrondel and Masson, 2002). The most decisive factor, however, seems to be the size of financial wealth, especially with regard to equities, which may thus be viewed as "luxury items" (Arrondel, 2003) since an increase in financial wealth leads to a more than proportional increase in demand. However, note that in France and elsewhere (Guiso *et al*, 2002), it is only the probability of owning equities that increases with wealth and not necessarily the share of wealth assigned to equities or risky assets more generally.

More recently, Calvet *et al* (2005) used a relatively rich data base drawn from Swedish tax records to confirm that participation in financial markets is chiefly attributable to wealth and income. Education and property ownership also play a smaller favourable role, while age is a negative factor. Once again, though, these factors have far weaker explanatory power when it comes to the share of wealth reserved for investment in risky assets. Only three factors are retained in this regard: the level of wealth exerts a positive influence, while entrepreneurship and family size have a negative impact. This second observation is interesting because it corroborates the relative stability by age category of the share of financial wealth invested in risky assets[8].

[7] However, we will see below that this assumption clearly does not always hold in the medium term.
[8] Cf. Guiso et alii, 2002, and Americks and Zeldes, 2004 for the US. This aspect will be explored further in a future issue of the AMF Scientific Working Papers.

2.2 Diversification of securities portfolios

a) Direct management

Most of the French households that manage their own portfolios do not reach the recommended 20 or so stocks. In 1996, for example, they held an average of six stocks[9] in their portfolios. But here, too, attitudes differ depending on portfolio size. The minority of large portfolios seem to be correctly diversified, as measured by number of stocks only[10]. Meanwhile, holders of smaller portfolios display non-optimal attitudes. For example, more than 40% of shareholders in privatised companies held just one stock, and 80% held fewer than five stocks in their portfolio.

US statistics, in the form of the *Survey of Consumer Finances*, enable some comparisons to be drawn, while at the same time supplying a finer level of detail (Polkovnichenko, 2005). In 2001, the median number of stocks held was... 3! A full 80% of shareholders held fewer than five stocks[11]. However, if this overall population is segmented, we see that, as in France, the size of financial wealth has a considerable impact. In the case of the 6.6% of shareholders with the largest holdings of financial assets (over USD 1 million), the median number of stocks held rises to 14. Goetzmann and Kumar (2005) believe that two other individual criteria exert a positive influence on diversification: age, which points to an experience effect; and the level of economic and financial literacy, as proxied by occupation category.

Furthermore, Polkovnichenko's study is useful because it demonstrates that while US shareholders are poorly diversified in terms of their direct holdings, a majority of them also hold indirect portfolios via investments in funds, meaning that they are diversified on this segment. This is an interesting point because Calvet *et al* (2005), using a more complex method, also show that a large proportion of Swedish households choose reasonably efficient portfolios, not only by diversifying their direct portfolios but also, and more importantly, by participating in pooled management schemes.

Polkovnichenko also demonstrates that US savers are partly aware of the risk associated with directly held portfolios, a finding corroborated by Goetzmann and Kumar. In this case, the specific risk caused by non-diversification may be justified by the search for higher expected returns. Whether the situation in France is comparable remains an open question. On the one hand, for now it is impossible to say whether the under-diversification of many direct equity portfolios is offset by participation in investment funds. On the other, while to the best of our knowledge no-one has conducted a comparable study to Polkovnichenko's, as we will see below, several arguments can be put forward to suggest that a large number of French savers are unaware of their exposure to financial risk.

[9] Sofres survey for the Banque de France, COB, SBF-Bourse de Paris.
[10] At the survey date, portfolios in excess of FRF 250,000 held more than 15 different stocks on average.
[11] Goetzmann and Kumar (2005) have however observed a trend towards increased diversification.

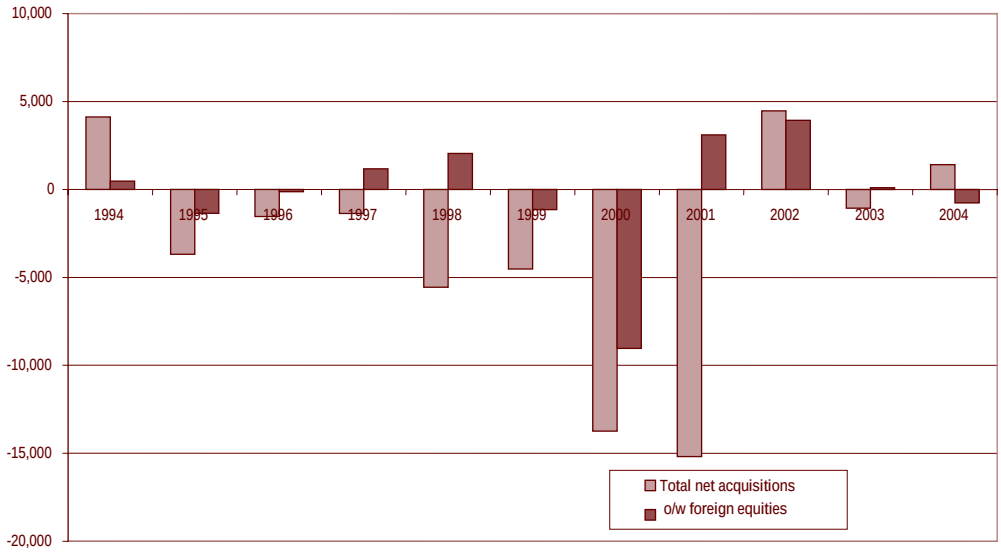
b) International diversification

Naturally, some of the benefits of cross-country diversification may be obtained indirectly by acquiring the stocks of multinational firms listed on the domestic market. However, the 2005 TNS Sofres survey revealed that of the 6.3 million holders of listed equities, just 1.9 million had made the move to diversify internationally – a strong signal of home bias. Furthermore, a significant proportion of those that did acquire foreign stocks probably tried to avoid currency risk, because 1.7 million of them invested only in European companies, while a mere 300,000 acquired interests in other foreign firms. Once again, from a strategic viewpoint, this is a far from optimal approach, insofar as correlation coefficients are higher between European financial centres (related sectors of activity, highly mobile capital, goods and services, budget policy rules, single monetary policy causing some convergence in inflation and especially interest rates) than relative to other geographical regions, like Asia, the United States and South America, reflecting less appetite for cross-country diversification[12].

In terms of total amounts, Banque de France statistics indicate that foreign equities accounted for 26% of the listed shares held by households in 2004, which is proportionately close to the ownership ratios noted above. Flow data reveal a trend that differs somewhat from the overall pattern of disposals **(Figure 2)**. Since 1994, the data reveal few large-scale movements and offsetting effects, giving an overall balance of close to zero. The non-definitive statistics for 2001 to 2004 even suggest a slight trend towards net acquisitions, which, aside from valuation effects, contributed to the growing international openness of portfolios towards the end of the period **(Figure 3)**.

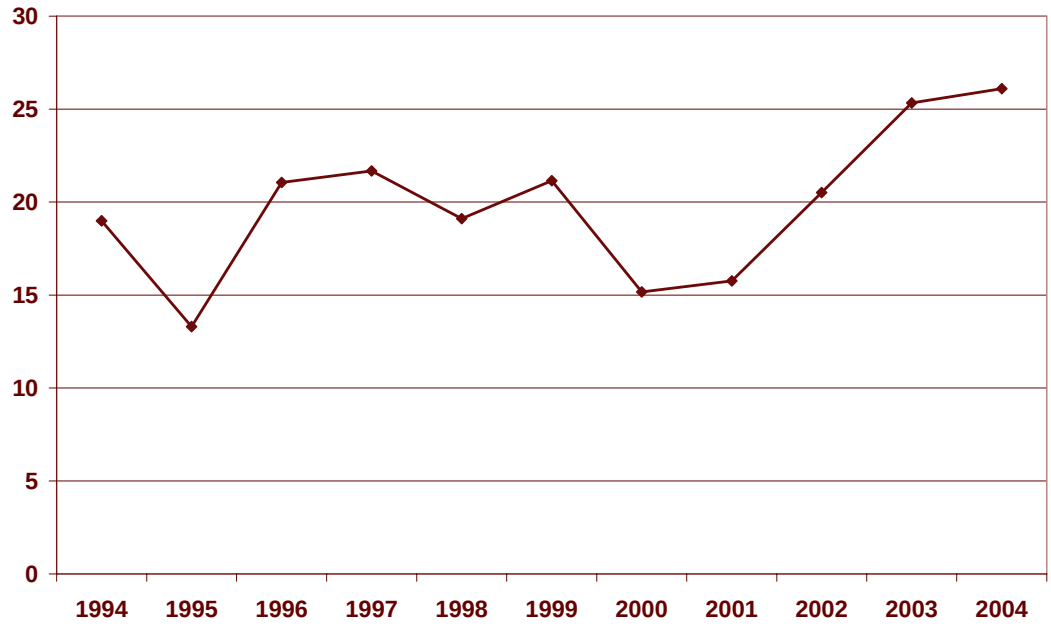
Figure 2: Net acquisitions of listed equities by French households

(EUR million — Source: Banque de France)



[12] No statistics currently exist that can assess the cross-border diversification of households' indirect holdings of securities portfolios. Reviewing investment scheme balance sheets would give an idea of this diversification, but all final holders would be grouped together.

Figure 3 : Share of foreign equities in portfolios of listed equities held by French households (% — Source: Banque de France)



A December 2004 survey by the Banque de France (Table 1) provided further evidence that foreign securities are more affected by the abovementioned concentration trend. The largest accounts (over €152,000), which represent 1.5% of the population, accounted for 56.4% of overall holdings in foreign equities, compared with “only” 35.6% in the case of French equities. Portfolio size, therefore, is an even more discriminating criterion for foreign securities than for domestic securities. Note that the concentration proportions are not the same when the discriminating factor is age or occupation category. At the international level, several papers have demonstrated the link between the size of home bias, wealth, income and education (Vissing-Jorgensen, 2003).

Table 1: Distribution of securities portfolios by size

(% - Source: Banque de France)

2004	Number of accounts	Portfolio value						
		Equities		Bonds		Shares/units in investment funds		Total portfolio
		French	Foreign	French	Foreign	Money market	Other	
Under €7,600	59.4	9.4	5.8	3.6	1.8	3.6	10.3	8.0
€7,601 to €15,000	14.6	7.7	4.4	8.5	3.1	5.5	11.7	9.1
€ 15,001 to €38,000	14.9	15.9	9.2	23.9	7.3	12.4	22.9	19.5
€38,001 to €76,000	6.4	15.4	10.3	22.4	7.2	13.1	19.0	17.7
€76,001 to €152,000	3.1	16.1	13.9	19.0	11.5	15.1	15.9	16.3
Over €152,000	1.5	35.6	56.4	22.7	69.2	50.3	20.2	29.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

c) Investment funds

The above research shows that, whether through cause or effect, savers receive most of the benefits of diversification not via the financial assets they manage directly but rather through pooled management mechanisms, in the shape of investment funds. What light can be shed on this strategy, notably in the case of French investors? We propose a two-part response. First, as mentioned, from a quantitative perspective, we lack the statistics needed to say exactly how many people simultaneously hold equities and investment fund shares/units, either directly or through life insurance policies[13]. Similarly, we lack the requisite statistical information to pinpoint the quantities and types of funds selected. According to TNS, however, only 2.1 million people were invested in equity funds in 2005, while 800,000 held balanced funds. In other words, the majority of direct equity holders do not also hold shares or units in investment funds.

From a qualitative perspective, while pooled mechanisms are unquestionably a step towards the diversification recommended by portfolio theory, several issues remain unresolved. First, an investor holding just one sector or domestic fund cannot reap the full benefits of diversification. Second, the growing prominence of index investing indirectly raises the question of the over-representation of certain sectors in the indices (Romey, 2005). Third, participation in pooled mechanisms does not exempt the saver from analysing correlations across his portfolio as a whole – the key to successful diversification. In the US, for example, Benartzi and Thaler (2001) studied 401(k) retirement savings plans and found that the distribution across proposed funds reflected a naive approach and was broadly insufficient. In France, although robust information is not available in this area, we can nevertheless hypothesise that at the end of the 1990s many portfolios were overweight technology, media and telecommunications stocks, not just in terms of direct equity holdings (Lepinay and Rousseau, 2000) but also in the context of their index investments, disregarding the correlation between these two components of their portfolio.

[13] However this information could be obtained by applying specific analytical methods to INSEE's wealth survey.

In sum, France is no exception to the general rule (Campbell, 2006). We are thus confronted by two issues: the non-participation puzzle and what we will by extension call the non-diversification puzzle, which applies both overall and specifically from an international perspective. It seems, furthermore, that these two puzzles cannot be analysed separately from economic issues such as the size of income, wealth and, consequently, securities portfolios.

2.3 Portfolios: size and background

A key feature of securities ownership in France is that most portfolios are small. The Banque de France's December 2004 survey is instructive on this point[14]. Almost six out of every ten portfolios are under €7,600 and three-quarters are under €15,000 (all assets combined, i.e. including equities, bonds and investment funds – cf Table 1). These small portfolios are essentially made up of non-money market funds and French equities (Table 2).

Table 2: Portfolio composition, by size
(% - Source: Banque de France)

	Portfolio value						
	Equities		Bonds		Shares/units in investment funds		Total
	French	Foreign	French	Foreign	Money market	Other	
Under €7,600	33.7	2.6	8.0	0.1	4.2	51.4	100.0
€7,601 to €15,000	24.3	1.8	16.8	0.2	5.6	51.4	100.0
€ 15,001 to €38,000	23.4	1.7	22.0	0.2	5.9	46.9	100.0
€38,001 to €76,000	25.1	2.1	22.7	0.2	6.8	43.0	100.0
€76,001 to €152,000	28.3	3.1	20.9	0.4	8.6	38.8	100.0
Over €152,000	34.7	6.9	13.9	1.2	15.8	27.4	100.0

A fairly high level of concentration results from this profusion of small portfolios, with 1.5% of investors (those with portfolios in excess of €152,000) accounting for almost 30% of the total value of all portfolios (Table 1).

The way these portfolios were constructed may be one reason for their small size, and, perhaps consequently, for their under-diversification. As in other European countries, including the UK and Italy (Guiso *et al*, 2002), successive waves of privatisations in France over the last 20 years seem to have played a pivotal role and have certainly had a far greater impact than tax incentives (Table 3). Receiving heavy media coverage, privatisation was the catalyst for the creation of numerous small portfolios, whose size was partly con-

[14] *Gest and Grandjean, 2005.*

strained by the small number of securities offered. In 1996, i.e. after the first two rounds of privatisations (1986-1987 and 1993-1996), almost one-half (46%) of portfolios had been created as a result of a privatisation. By 2001 (latest available statistics), 39% of individual shareholders had shares solely in privatised companies[15] (thus excluding the principle of international diversification). Clearly, this raises the question of continued portfolio development beyond the initial impetus.

Table 3: Source of equity portfolios in 1996

(% - Sources: Banque de France, COB, SBF-Bourse de Paris)

Portfolio created in response to	
a company privatisation	46
a government measure, like the Monory Act or the introduction of equity savings accounts/plans	23
Other	49

Several answers

[15] *Privatisation Observatory, TNS Sofres July 2002*.

Section II. Do the fundamental principles need to be revisited?

Portfolio theory tells us why financial wealth may be under-invested in risky assets, purely as a result of strong risk aversion. In France, Arrondel *et al* (2005) analyse one section[16] of the INSEE 1998 wealth survey and find that the distribution of estimators is skewed towards a fear of risk. This is true whether the authors construct the estimator themselves or whether it is generated from household self-assessments. In particular, households estimate that they show the greatest aversion to risk when it comes to managing their assets (family issues also come top of the list). The outlier case, which occupies a marginal role under Markowitz's approach even though it applies to the majority of French savers, is that of a portfolio totally invested in non-risky assets. Risk aversion here is such that the point of contact between the iso-utility curve and the capital market line is at R_o (cf. 1.1). And while it might seem unrealistic on a medium/long term view, this would theoretically also be the case if the economic agent expected $R_o > E(R_T)$ over his horizon, which would correspond to a negatively sloped capital market line. Such expectations should not be merely rejected, since psychological arguments (Shefrin, 2001) can be backed up, as we will see, by an analysis of economic conditions. But these are still two outlier situations. They certainly do not explain why such a large proportion of households hold no risky assets in their portfolios under "normal" economic and financial conditions, i.e. where the risk premium is positive. Three avenues are worth exploring in this regard. For some years now, finance theory has addressed the question of tax treatment and transaction costs as barriers to optimal outcomes. More recently, behavioural finance has brought the utility function back under the microscope. Before looking at these two approaches, however, we will begin by considering the assumption that investors have inadequate knowledge of securities, which is inherently a factor in non-participation.

1. KNOWLEDGE OF PRODUCTS AND MARKETS

In this day and age, can we really assume that households – specifically, French households – do not hold equities or shares/units in investment funds simply because they are profoundly ignorant about how these products work, or, in the most extreme cases, are actually unaware that they exist? The question may seem provocative, but in fact it is not. Some individuals do not have access to financial information because their environment, e.g. their social background, is not conducive to this, and because they behave in a way that excludes them from accessing this information (for example, by not paying attention to the press). An increase in equity ownership rates in the early part of the lifecycle in many countries may moreover signal growing awareness of this issue. In their study of Italian data[17], Guiso and Jappelli (2005) found that in 1998, 36.3% of respondents "did not know about" equities and 44.5% did not know about investment funds. Unsurprisingly, an econometric analysis of the individual data reveals that familiarity with these two asset classes increases with the level of education, wealth, income, interest in the press, duration of bank relationships

[16] *Questionnaire on reactions to different risky situations.*
[17] *Bank of Italy Surveys of Household Income and Wealth.*

and the "intensity of social interactions[18]". There also appears to be a cohort effect, with younger generations being better informed than older ones.

Sadly, data analogous to those collected in Italy are not, to our knowledge, available in France. Still, a survey conducted by TNS Sofres for the Autorité des Marchés Financiers (AMF) provides a substantial amount of useful information. Overall, 21% of survey respondents said that they had never invested in financial assets (directly or indirectly in securities, life insurance) because they felt "overwhelmed, not well enough informed". This was not the number-one reason given, which was insufficient resources (65%), but it is extremely likely that individuals who cited a lack of resources would also be faced with the first constraint if their wealth grew. Also, 34% of people claimed to know very little about financial investments, and 39% said they knew fairly little. Moreover, while on aggregate agents felt they did not really understand how the stock market worked and did not know how to place an order, this feeling was far greater among those who did not hold securities[19]. This result is as unsurprising as the other finding that, as elsewhere in the world, financial literacy increases with the level of education and standard-of-living criteria. Arrondel and Masson (2002), who analysed the 1997-1998 INSEE wealth survey using econometric techniques, found that a family tradition of equity ownership, measured by whether the respondent's parents held an equity portfolio, seemed to be another factor that explains ownership rates. The survey also showed that 50% of respondents believe that financial investments are only for insiders.

On a theoretical level, recent developments have concerned the production – hence the supply – of information. Given that 96% of French households use banking facilities, they might be expected to receive information through their financial intermediary, especially since intermediaries have an incentive to market a range of commission-generating products, including equities, investment funds, managed securities accounts, PEAs and multi-fund life insurance policies. Furthermore, in 2004, individuals polled by TNS Sofres for the AMF put their financial advisor at the top of the list of sources of information about the stock exchange and financial investments, ahead of the mainstream media, friends and acquaintances. Yet there are questions over how systematically this information is disseminated.

Following the static model used by Guiso and Jappelli (2005), we capture this problem by linking the gross additional income (Rb) that financial intermediaries earn through securities investments to the product knowledge (C) of a population N, as follows:

$$Rb = b.p(C).p(S/C).M.N \qquad (1)$$

where:

[18] *proxied by the density of community groups.*
[19] *"L'éducation financière des Français", a survey on financial education in France, conducted by Sofres for the AMF (2004).*

b: commission

p(C): probability of knowing about the product

p(S/C): probability of investing in a product conditional on knowledge of the product

M: average size of investment

The probability of knowing about a financial product increases with the amount of information I sent (I ϵ {0,∞}) per potential investor:

$$p(C) = \frac{I / N}{\beta + I / N} \qquad (2)$$

where the β parameter (β ϵ {0,∞}) measures the inefficiency of technologies used to disseminate information (a decline in β causes an increase in p(C)).

The intermediary selects the amount of information I to send, at unit cost c, so as to maximise net additional income (Rn):

$$\text{Max } Rn(I) = b.\left[\frac{I / N}{\beta + I / N}\right].p(S/C).M.N - c.I \qquad (3)$$

The first order condition is used to obtain the optimal number of signals per individual:

$$\left(\frac{I}{N}\right)^{*} = \sqrt{\frac{\beta.b.p(S/C).M}{c}} - \beta \qquad (4)$$

This reveals a necessary condition for the dissemination of information by the financial intermediary:

$$\sqrt{\frac{\beta.b.p(S/C).M}{c}} > \beta$$

i.e.: $p(S/C).b.M > \beta.c$ (5)

If this condition is satisfied, relations (4) and (2) give the probability of receiving information from the financial intermediary and thus of knowing about the product:

$$p(C)^{*} = 1 - \sqrt{\frac{\beta.c}{b.p(S/C).M}} \qquad (6)$$

This probability increases with the likelihood of the financial institution receiving a large commission, via the probability that the information will give rise to an investment, the unit cost (b) and the average amount invested (M). It decreases with the cost of this information (c) and the inefficiency of the technologies used to disseminate information (β).

Since it is expensive to produce information (via advertising, meetings, etc.) the intermediary, who wants to maximise profit, contributes to the non-participation trend by targeting only part of his client base for information dissemination, namely the segment displaying the highest probability of investment, and especially customers who are likely to invest large amounts. Obeying this rationale, the intermediary will target customers based on the typically observable characteristics of individuals who are associated with securities ownership, e.g. occupation category and wealth. The intermediary will also employ in-house customer relationship management procedures. Overlapping information costs, in particular, will play a part: someone who holds certain types of securities, such as bonds or funds, should be more likely to invest in equities than someone who holds only a tax-exempt passbook[20].

This kind of model offers an illuminating way to consider the non-participation puzzle. However, it does suffer from a few lacunae, as far as the issue at hand is concerned.

1) Simply knowing whether a stock or a securities class exists is a necessary condition for holding a portfolio, but is not enough by itself. The question needs to be extended to encompass financial literacy, which could be approached, for example, in terms of how the portfolio is managed once it is in place.

2) Positive externalities are not taken into account. Earlier, we mentioned the existence of overlapping participation costs. Taking a dynamic view, knowledge of one product opens up the possibility of marketing similar products, such as shares of other companies or different types of investment fund. If savers have already been introduced to securities, future information and marketing campaigns concerning similar products may be more effective. Accordingly, a dynamic aspect could usefully be added to the model, via an experience effect.

The first of the above comments is equivalent to saying that even if all households were aware of the existence of these products, a significant proportion of them would not hold them $\left(p(S/C)<1\right)$. The model allows for this outcome, which, moreover, is suggested by the Italian study. This seems to be the situation in France, which is why we explore other factors that can help piece together the non-participation puzzle.

[20] *Similarly, it has frequently been observed that holders of securities accounts are priority targets for offers of shares in privatised companies or initial public offerings.*

Also, during successive rounds of privatisations in France, a vast amount of information was directed towards the general public. The impetus for this came from a powerful seller, namely the government, while financial intermediaries pass on the message. This situation clearly facilitated the creation of new portfolios. As we said before, the lack of follow-up, notably in terms of education about the principles of portfolio management, may explain the small size of some portfolios and the fact that they are under-diversified outside the category of privatised companies.

2. MARKET ASSUMPTIONS

An extension of portfolio theory, the CAPM is based on the assumption that markets are perfect. This assumption has been challenged on several fronts. For one thing, transaction costs, or participation costs more generally, need to be considered, as does tax treatment. Accordingly, we arrive at a variety of explanations for non-participation in financial markets and the non-efficiency of portfolios.

2.1 Transaction and participation costs

When they invest in risky assets, savers have to pay transaction costs. Some of these are purely financial and take the shape of part-fixed, part-variable expenses paid on purchases and sales of assets or charged in connection with the management of holdings. Over and above these quantifiable expenses, other costs have to be factored in that are far harder to measure because they vary from person to person. We will call these non-financial costs. They include the time and money spent obtaining information about companies, how markets work, or the basics of portfolio management (e.g. buying books, reading the trade press). The academic literature now groups these expenses under "participation costs" (Vissing-Jorgensen, 2003). Here again, we encounter fixed and variable costs, some of which are incurred before the portfolio is created while others arise more regularly as part of monitoring activities.

The complex task of taking variable transaction costs into account does not necessarily call into question the investment principles recommended by portfolio theory from a static perspective (Magill and Constantinides, 1976). However, the huge amount of information needing regular analysis creates participation costs that may prompt investors to follow fewer companies and concentrate on related sectors of activity, because of the scale economies that such an approach permits. This will leave them not just under-diversified, but under-diversified in closely correlated securities (Van Nieuwerburgh and Veldkamp, 2006). The same applies to fixed costs. As early as 1976, Goldsmith demonstrated that in the presence of fixed costs, the optimal number of securities is reduced relative to the perfect markets assumption. Beyond the incentive to under-diversify, savers with modest financial wealth may actually consider staying away from securities markets altogether (Gollier, 2002).

It is highly likely that non-financial participation costs currently play a greater role than expenses in explaining portfolio under-diversification and especially non-participation in securities markets. This takes us back to the issue of financial education raised in the previous part of this section. Specifically, the presence of mutual investment schemes should help to considerably reduce participation costs (Allen and Santomero, 2001), addressing the question of the non-participation puzzle. Yet, as we saw above, indirect securities ownership remains relatively low in France.

2.2 Tax treatment

Though often cited, the impact of tax treatment on securities ownership is hard to identify. Typically, the reason for this lies with complex tax regimes, which create openings for arbitrages and stand in the way of linear formalisation. France is no exception, offering, for example, a choice between withholding and income tax regimes. The French system also includes tax envelopes, with threshold effects linked to the duration of the holding period. This last aspect means that tax treatment differs depending on whether an envelope is present (PEAs, employee savings, life insurance), depending on whether there are recurrent dividend payments (where income can be reinvested in investment funds) and, naturally, depending on the lifespan of the investment. For the most part, French households avoid paying tax on their securities holdings in return for illiquidity (cf. 3.3). Thus, simple models that consider a non-risky asset (tax exempt or not) and taxed risky assets, without introducing this time dimension, and that conclude that the investor's choice is determined by expected return and covariance (net of tax in both cases), offer a flawed reflection of reality (Poterba, 2002).

These problems notwithstanding, an analysis of survey data reveals several results that are borne out by study after study in other countries (Agell and Edin, 1990, King and Leape, 1998, Poterba and Samwick, 1999). Research has found that in the United States, where different tax rules apply to different types of securities, the marginal tax rate is an explanatory factor in the discrete choice to invest in a given category of securities. However, the marginal rate has insignificant influence on the amounts held in the selected products. Transposed to the French case, this analysis may well help to explain the low rate of direct bond ownership relative to other securities categories. Turning to equities, simulations by Aubier *et al* (2005) show that:

- French tax rules are structured such that individuals with strong risk aversion or average aversion but a small portfolio of financial assets are encouraged to avoid holding equities except in PEAs;
- highly risk-averse investors are encouraged to overweight tax-exempt cash equivalents (such as Livret A passbooks). Here, the tax-exempt status of the non-risky asset plays a crucial role. However, the overweight vanishes if risk aversion is average or low. In other words, criteria associated with risk aversion, which is generally considered to be relatively strong, combine here with tax-related factors.

French households appear to be aware that French taxation discourages equity ownership (67% find that the tax rules act as a disincentive, while 27% find that they act as an incentive). This is especially true in the over-55 category, where largest fortunes are concentrated[21]. Also, from an arbitrage perspective, the tax rules for securities should be considered against the taxation of other assets, notably property.

In addition, complex tax rules for securities push up participation costs. The investor has to select the optimal tax regime, which may require the use of simulations, including expected tax rates at the forecast maturity horizon. In the main, these costs are fixed and so are diluted as portfolio size increases.

Overall, a portion of these participation and transaction costs may explain why households with the smallest financial portfolios are reluctant to invest directly or even indirectly in financial markets (Guiso *et al*, 2002, Polkovitch, 2004). However, this argument gradually loses its power as portfolio size increases (Vissing-Jorgensen, 2003). INSEE's 2004 wealth survey indicates that in the category of people with the largest portfolios (assets worth over €450,000), the ownership rate is just 69.8% for securities, and a mere 54% for equities. The non-participation in markets by a significant proportion of the largest fortunes remains a puzzle at this stage.

3. BEHAVIOURAL ASSUMPTIONS

Behavioural finance re-examines the way in which investors behave and, hence, their utility function. It is playing an increasingly important role in financial theory, and its analytical scope has been constantly broadened in recent years (Barberis and Thaler, 2003, Broihanne *et al*, 2004). It challenges the generally held view of investor rationality, based on a Bayesian adaptation to new information and on decisions that are consistent with the concept of expected subjective utility (Savage, 1954). Some of the behaviours that come under scrutiny relate to dynamic portfolio management, others to the static aspects examined here. Working on an ad hoc basis, we intend firstly to establish an acceptable level of risk beyond which households are reluctant to invest in a risky asset portfolio, whether directly or indirectly. Then using research that, in some cases has been behaviourally tested in a laboratory setting, we will show that the concept of risk aversion used in modern portfolio theory may not be sufficient to elucidate investor behaviour and that we need to look at three other concepts: ambiguity aversion, illiquidity aversion and loss aversion. This latter argument allows us to introduce behavioural portfolio theory, which provides further explanations for the low level of portfolio diversification. Lastly, some of this material will enable us to shed theoretical light on the home bias.

[21] *Cf. TNS-Sofres survey for Dexia in November 2003.*

3.1 Acceptable risk

As early as 1958, Tobin demonstrated the relationship between market portfolio risk and the portion of wealth allotted to that risky portfolio. For any given payoff, an increase in financial risk reduces the risky portfolio's share of the agent's overall financial wealth. But this does not necessarily cause him to exclude himself from the market in risky assets. A more radical proposition is to introduce the concept of a maximum level of risk (σ_A) that is acceptable to the investor – in this case, households. The investor assesses the risk premium paid by the market for a given horizon. Because the market portfolio is his benchmark ($E(R_T)$; σ_T), there are two possibilities:

- If $\sigma_T<\sigma_A$ he includes the market portfolio in his financial wealth;

- If $\sigma_T>\sigma_A$ he makes do with the non-risky asset.

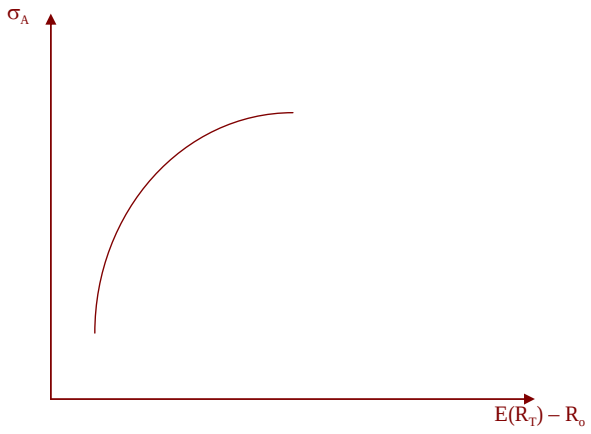
The maximum acceptable risk level must be related to the excess returns generated by the market portfolio ($E(R_T) – R_o$). As with all utility functions representing investor behaviour, σ_A and ($E(R_T) – R_o$) must be linked in an increasing relation: the higher the expected payoff on the risky portfolio, the higher the acceptable risk level. In other words:

$$d\sigma_A /d(E(R_T) – R_o)>0$$

Further, if the investor is risk averse, the curve is not only ascending but also concave **(Figure 4):**

$$d^2\sigma_A /d(E(R_T) – R_o)^2<0$$

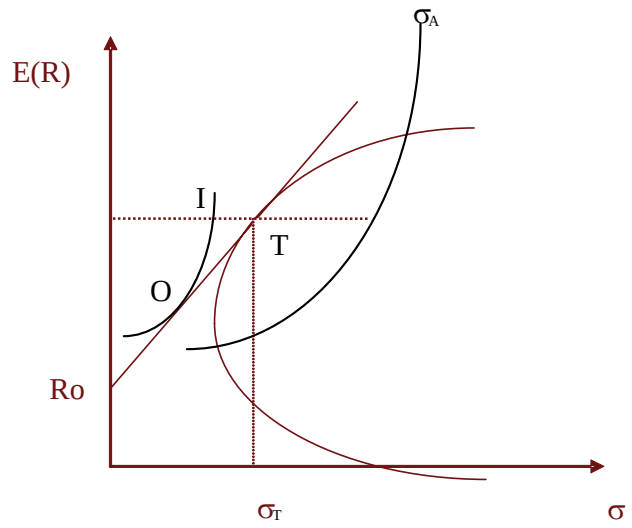
Figure 4 : Maximum risk curve



Used in the standard reference (σ, E(R)), σ_A takes the shape of an indifference curve but does not follow its exact arc (the parallelism between I and σ_A can only be a special case). Thus by comparing σ_A and σ_T, the agent determines his optimum situation.

- If $\sigma_T < \sigma_A$

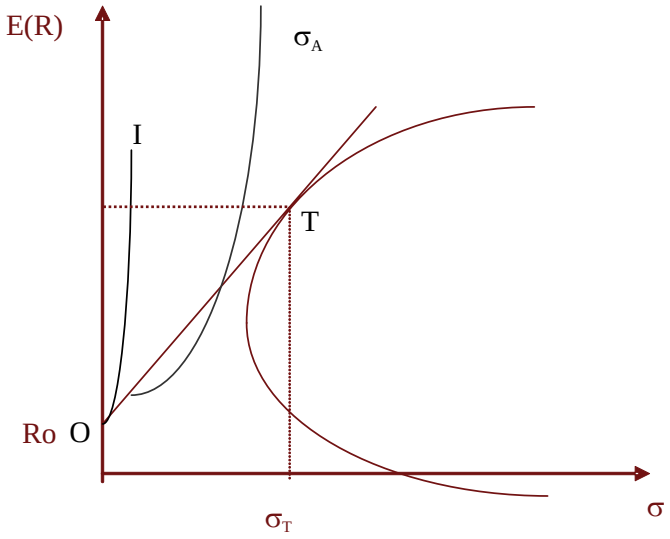
Figure 5: Optimum situation for an acceptable level of risk on the market portfolio



Portfolio T is to the left of curve σ_A **(Figure 5)**, meaning that its risk is acceptable to the investor. According to portfolio theory, because he is risk averse, the investor will divide his wealth between the non-risky asset and the market portfolio T in order to reach the optimum O.

- If $\sigma_T > s_A$

Figure 6: Optimum situation for an unacceptable level of risk on the market portfolio



The only possibility is a corner solution **(Figure 6)**. The investor does not accept the risk on the market portfolio. So he refuses to include the portfolio in his financial wealth and holds the non-risky asset only. This situation arises when the excess return expected on the market portfolio relative to the non-risky asset is considered too low in view of the portfolio's risk or, alternatively, when market portfolio risk is considered too high in view of the expected return. In both cases, the slope of the capital market line is deemed too shallow (it no longer has to be negatively sloped).

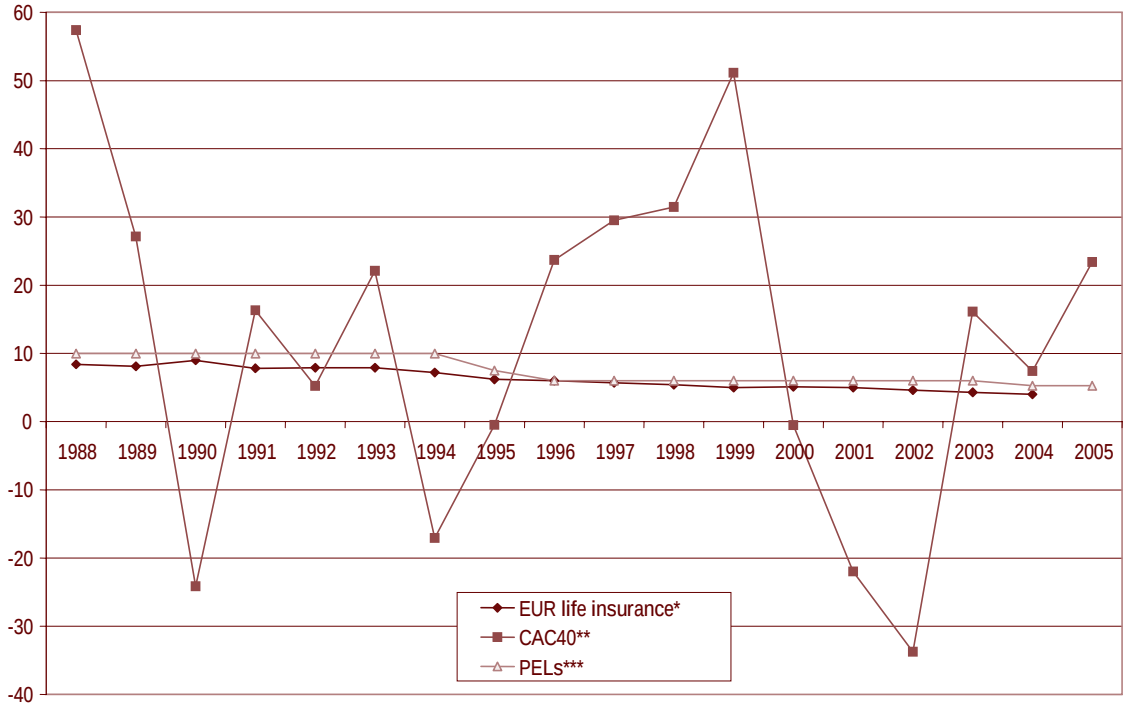
How far does this rationale apply to French investors? It would be wrong to surmise that in France, the non-risky asset is a passbook or an asset yielding money market returns. The recent protracted decline in nominal interest rates has increased the appeal of assets with either a fixed rate or returns that smoothed over time. The first category includes PELs and some types of popular savings plans (PEPs); the second, euro-denominated life insurance contracts. These long-term assets have competed head-on with securities while offering much higher returns than short-term assets. Considering that 82% of the PELs open in 2003 did not give rise to a home loan, most were therefore utilised as building-block assets in wealth management strategies, delivering particularly high rates of return and, in some cases, total liquidity.

A comparison of annual returns to the CAC40 index, PELs and euro life insurance contracts **(Figure 7)** shows that, in several cases, the non-risky asset outperformed the main domestic equity market, especially between 2000 and 2003. Accordingly, although the equity portfolio clearly dominates over the long-term, its superiority is often challenged in the medium term (and naturally in the short term). However, the frequency of such data (cf. 3.4), combined with expectations of an inadequate risk premium, would justify the investor's preference for the non-risky asset.

In a 2004 poll, only 45% of French households said that securities provided a sufficient return while 69% considered them risky[22] – although there were no direct questions about the risk/return trade-off. On its own, that finding is not enough to support our argument about maximum acceptable risk. But it would be instructive to test the $\sigma_T > \sigma_A$ assumption, from two angles: a behaviour pattern that is almost permanent for some investors (possibly depending on wealth and financial literacy) and a more cyclical pattern for others. In the second case, when the investor's assessment of the risk on the securities portfolio increases, he falls back heavily on non-risky assets. This may help to explain the phenomenon identified by Chapman *et al* (2004) in the United States, characterised by phases of round-tripping (in particular, ownership rates increase when the risk premium rises).

[22] *"L'éducation financière des Français", Sofres survey for the AMF.*

Figure 7: Comparative annual returns on non-risky long-term investments and an investment in the CAC40[23].
(% - Sources: FFSA, author's calculations)



3.2 Temperance and the liquidity constraint

Most households experience income fluctuations more in terms of income from their labour than from their financial assets. This is attributable to the volatile valuation of human capital, not financial capital. Obviously, the uncertainty caused by fluctuating levels of labour income is tied to the risk of unemployment. And that uncertainty can affect investors' financial choices. It is easy to understand intuitively why an agent experiencing major uncertainty about future wages is reluctant to invest his wealth in risky assets and will therefore prefer safe assets. Through a trade-off relation, as labour market conditions worsen, some agents may be prompted to select non-risky assets only, or at least to reduce the proportion of risky assets in their portfolio.

Kimball describes this attitude in formal terms by citing special conditions for the representative utility function. In 1990, he showed that a prudent individual (absolute prudence measured by –u'''/u'') increases his saving rate when faced with an uninsurable exogenous risk, such as income risk. In 1993, Kimball took this analysis a step further by introducing the concept of temperance (measured by –u''''/u'''), which leads the agent to reduce his portfolio's exposure to financial risks when the same income risk arises. Accordingly,

[23] ** interest plus profit sharing*
*** excluding dividends*
**** best rates for the generations still in the portfolio*

absolute risk aversion and absolute prudence are both decreasing functions, given by the class of utility functions known as Constant Relative Risk Aversion (CRRA), which does not include Markowitz quadratic functions. When using this theory, it is necessary to look beyond the financial dimension and introduce exogenous factors of a cyclical nature, such as labour market conditions.

Another possibility is that financial risk and labour income risk may be correlated to some degree. This observation is crucial when it comes to discriminating between holders of risk securities. Individuals exhibiting a strong correlation between income risk and financial risk – typically, an equity fund manager with a "stake" in the performance of his fund (El Mekkaoui de Freitas *et al*, 2001) – are considered to hold very few risky assets. By contrast, civil servants should invest most of their portfolio in equities.

Both these issues – the influence of labour market conditions on risky asset ownership, and differing behaviours that depend on income stability – have been analysed in relation to France. Building on the pioneering work of Arrondel and Masson (1996), El Mekkaoui de Freitas *et al* (2001) showed that, through a memory effect, households that have experienced extended periods of forced idleness in the past will steer clear of financial markets. (Since the size of wealth effect is neutralised, the explanation for this must lie either in precautionary behaviour or in a higher level of risk aversion.) Using macroeconomic data, Bourgeois and Séjourné (2000) found that the proportion of risky assets in household financial wealth is sensitive in the long term to income risk, measured by the semi-variance of gross disposable income or by the unemployment rate. It should also be remembered that demand for risky assets among retirees is relatively strong, i.e. at an age when income risk disappears, contrary to the predictions derived from lifecycle approaches[24]. Moreover, behaviours do indeed differ according to the degree of exposure to income risk, but the relation is not the expected one (El Mekkaoui de Freitas *et al*, 2001). Whereas the social classes with the greatest exposure to income risk, i.e. the self-employed, are highly likely to hold risky assets, public-sector workers are the most fearful in their financial choices. Accordingly, there is a link between professional and financial risk aversion!

Prudence and temperance are usually associated with the problem of liquidity constraint, in other words, borrowing difficulties. In both cases, the conclusions are similar. Households with no available savings are unable to borrow and therefore can only offset financial losses by cutting their consumption expenditure (Gollier 2002). To avoid this situation, savers tend to reduce their risky asset holdings when the liquidity constraint becomes tighter. According to Arrondel and Masson (2002), French households say that the feeling of being subject to a liquidity constraint (for a mortgage or a consumer loan) has a negative impact on their direct and indirect equity holdings (but not on the percentage of equities in the holders' portfolios)[25].

[24] *See Polkovnichenko (2004).*
[25] *1997 wealth survey.*

3.3 Illiquidity aversion

In our view, the question of temperance ought to be extended to include liquidity preference. Surveys carried out in France (CREDOC, 1994, TNS[26], 2005) show that savers cite liquidity as the most important criterion when choosing an investment. But the liquidity of an asset does not depend entirely on its volatility. Illiquidity is also caused by the asset's regulatory or tax characteristics, which make long-term holding mandatory or more appealing. One such example is the PEA, where the holding period necessary to qualify for tax exemption reinforces the aforementioned phenomenon.

It is impossible to address the issue of illiquidity in a securities portfolio without looking at all the assets that make up an agent's wealth. One may intuit that a household whose wealth consists chiefly of non-risky but illiquid assets, such as property, PELs or euro-denominated life insurance contracts, would feel a need to hold liquid assets as well, particularly where borrowing is either difficult or undesirable. In this case, risky and illiquid assets, and therefore equities, would be crowded out. This relation has already been observed in property markets outside France (Cocco, 2005). If such research were to be carried out for France, it would have to be broadened to include other illiquid assets (particularly euro-denominated life insurance) and then tested using survey data.

3.4 Loss aversion and the prospect theory

Over the past thirty years, psychological and experimental laboratory research has also been used to revisit the behaviour of economic agents, defined axiomatically by Von Neuman-Morgenstern and applied by Markowitz. The most significant advances in this area stem from prospect theory, developed by Kahneman and Tversky (1979, 1992)[27]. Using the results of lottery tests, the authors note that individuals do not behave in a constant fashion but adopt different profiles (risk-seeking versus risk-averse) according to whether the lottery offers a positive or negative expected payoff and whether the probability of gain or loss is weak or strong. From these findings, they draw three main conclusions, which clash with portfolio theory:

1) Investors are not sensitive to the level of their wealth but to the extent that it changes over a given period, in other words to gain and loss.

2) The valuation function – equivalent to the utility function in standard theory – is not uniform. It is concave for gains and convex for losses and it reflects greater sensitivity on the loss side – in other words, risk aversion.

3) In addition to risk aversion, households tend to place too much importance on events with a very low probability of occurrence, such as stock market crashes.

[26] *"L'Épargne des Français", TNS—La Poste—Les Echos. Survey.*
[27] *See Polkovnichenko (2005) for a wider-ranging review of the literature.*

Prospect theory has been used as a basis for explaining non-participation and non-diversification, as highlighted above. On the first issue, the main development was posited by Benartzi and Thaler (1995) using the definition of Myopic Loss Aversion. The basic principle of MLA is that a saver who monitors stock prices regularly – through the daily press, for example – records almost as many bullish days as bearish days. But since he is risk-averse, he prefers to avoid risky assets. Accordingly, to buy and hold a portfolio of equities, it is preferable not to observe the markets too frequently (the authors estimate the critical threshold at one observation per year). This takes us back to the question raised in 3.1.

The second important development, to which Thaler (1999) contributed with his concept of "mental accounting", offers insights into the lack of diversification in risky asset portfolios. The concept contends that individuals divide up their choices into separate mental categories. As a result, the "game" of investing in a portfolio of risky assets is treated independently from other wealth-affecting choices. Because of the shape of the valuation function, therefore, two types of behaviour may be observed simultaneously: insurance behaviour for the bulk of the saver's financial wealth (with large-scale inclusion of non-risky assets) and lottery behaviour for the (small) remaining portion (Barberis and Thaler, 2003). In the case of the lottery, the saver may end up betting on one or two assets directly. But if he incurs a loss on either of them, the resulting disappointment could induce him to sell his shares, even if that feeling is assuaged by earlier gains (Barberis and Huang, 2001). As seen above, this type of behaviour may emerge when the non-risky asset outperforms the risky portfolio over several sub-periods. This may explain why French savers not only sell their securities but also stay out of the market for some time when they have incurred a loss.

3.5 Aversion to uncertainty or ambiguity

Another type of behaviour, called ambiguity aversion or uncertainty aversion, also occurs when the traditional Von Neumann-Morgenstern axioms are not fully satisfied (Camerer and Weber, 1992). This basically concerns the violation of the independence axiom, demonstrated by the Ellsberg paradox (1961), which states that an individual will prefer a lottery with known probabilities to a similar lottery with unknown probabilities. Hence the following definition of ambiguity, from Frisch and Baron (1988): "Ambiguity is uncertainty about probability, created by missing information that is relevant and could be known".

This is significant because, when it comes to portfolio choices, many investors are unable to establish a link between probabilities – even subjective probabilities – and possible outcomes. And in some cases, they are incapable of envisaging all these outcomes. Such is also the opinion of Mandelbrot, who in 2004 wrote: "People try to gauge risks, to compare equities to bonds [and] property to Treasuries. Most people have no idea how to do this systematically and numerically […]". In other words, it is necessary to re-examine Savage's definition of the behaviour of sophisticated agents, who are capable of associating probability distribu-

tions with events. In particular, the fact that many households are unaware of previous market movements prevents them from taking advantage of information about expected returns and actual risks (e.g. variances or values of alphas or betas). According to the proposals developed by Dow and Werlang (1992) and recently examined in greater detail by Mukerji and Tallon (2003), that uncertainty will prompt some agents not to sell their assets and, more importantly, will dissuade others from taking the plunge and acquiring securities. The price that a buyer is prepared to pay for an asset is lower than the seller's offering price – a difference known as the "portfolio inertia interval". From the standpoint of the potential buyer, that imbalance can be avoided by a higher expected payoff. This translates into an ambiguity premium (Becker and Brownson, 1964), just as there is a risk premium[28].

Accordingly, an ambiguity averse agent will tend to overweight the most unfavourable risk/return trade-offs[29], and this characteristic has been shown to supplement the traditional analysis of non-participation in securities markets as a consequence of risk aversion (Easley and O'Hara, 2006). It should be pointed out, however, that there is no theoretical evidence for an explicit direct link between attitudes to risk and attitudes to ambiguity (Camerer and Weber, 1992). And Gollier (2005) recently challenged the notion that ambiguity aversion systematically increases risk aversion. That notion is subject to a condition, either as regards risk attitudes (with fairly implausible coefficients for relative risk aversion and relative prudence[30]) or as regards the ranking of return probability distributions, differentiated by states.

Ambiguity aversion can also explain why portfolios are inadequately or ineffectively diversified in terms of risk mitigation. A need for familiarity pushes the saver to focus on a firm – for example, his employer – or a particular sector of activity. Moreover, if a saver feels he holds inside information, he may be over-confident in his ability to beat the market. This is how Lepinay and Rousseau (2000) defined the behaviour of some on-line traders in the late 1990s, who apparently concentrated solely on firms in the technology sector, where they worked.

Once again, the concept of ambiguity aversion (or uncertainty aversion) raises the vital question of household information, because a lack of information increases people's fear that they are taking part in a "lottery" and can hardly measure the probability with which its outcomes will occur. And although, in ambiguity theory, greater knowledge does not guarantee greater participation in financial markets, it does facilitate decision-making. Another point worth mentioning is the reliability of the information provided both by financial intermediaries and by listed companies.

[28] *Incidentally, this uncertainty may lead both buyers and sellers to hold onto their positions, resulting in underactivity in financial markets (Camerer and Weber, 1992).*
[29] *Gollier (2005) shows that an increase in ambiguity aversion can be considered as an increase in pessimism.*
[30] *Less than 1 and lass than 2, respectively.*

3.6 Layered behaviour and behavioural portfolio theory

In the main, the above arguments help explain a lack of market participation and, to a much lesser extent, the behaviour of agents who decide to enter the markets but do so sub-optimally in terms of portfolio theory, since their portfolios are insufficiently or ineffectively diversified. Likewise, it has frequently been observed that savers will hold a large proportion of non-risky assets concurrently with a portfolio predominantly exposed to financial risks (Broihanne and al, 2006), as if they were banking on a degree of financial security while also taking risks. Similarly, as we have seen, it is not unusual for a saver to hold an index fund as well as two or three directly managed holdings (Polkovnichenko, 2005)[31]. As we have said, apart from the small number of holdings, there is evidence that savers are unaware of or overlook the correlations among equities (for example, the craze for technology stocks in the late 1990s) or among funds (Kroll and Levy, 1992). Lastly, in some cases where diversification is achieved, it is done through the 1/n heuristic[32].

Behavioural portfolio theory (Arzac and Bawa, 1977, Statman and Shefrin, 2000,) was born from observation of these developments. Prospect theory shows that savers exhibit dual behaviours, possibly bordering on the schizophrenic. They do not consider their financial wealth as a whole, contrary to what standard portfolio theory teaches. They first seek to shield themselves against poverty and, proceeding with extreme risk aversion, to ensure a certain level of financial wealth through low-risk assets[33]. But they also want to get rich, so as soon as they have more or less achieved that security, they are prepared to take risks with the remainder of their financial wealth, investing it directly in the equity market. Thus they put together an aggressive portfolio that is particularly risky but that offers them the greatest probability of generating substantial gains. From this perspective, the portfolio is equivalent to a lottery (Polkovnichenko, 2005). In sum, agents' financial wealth is clearly segmented, or "layered" (Statman, 2004b), with a different utility function for each layer. In the standard two-layer example, one corresponds to loss aversion (or risk aversion), the other to risk-seeking.

3.7 Home bias

As mentioned earlier, the portfolio that delivers the best risk/return trade-off is an internationally diversified one. Derived from a strict financial framework, that result is enhanced by taking exogenous risks into account. According to Baxter and Jermann (1997), the fact that the risks to human capital are more closely correlated with risks on a domestic portfolio than with those on a foreign portfolio is an additional incentive for households to diversify their portfolios internationally. And yet, as we have already said, the portfolios of French savers are not immune from home bias – although, as always, it is necessary to discriminate on the basis of individual characteristics.

[31] *To our knowledge, no such precise information is available for France, only a "set of assumptions".*
[32] *This recalls the naive diversification strategies for 401(k) plans in the United States, highlighted by Benartzi and Thaler (2001).*
[33] *i.e. the concept of subsistence level, posited by Roy in 1952.*

Several of the arguments put forward above to explain why portfolios are under-diversified at the domestic level gain greater explanatory power at the international level. Access to information appears to be a key issue, for two reasons. First, since information about foreign markets is less accessible than domestic information, it is more expensive, meaning higher participation costs. Second, unfamiliarity with foreign markets (Goetzmann and Kumar, 2005) results in greater uncertainty in comparison to domestic assets. This acts as a deterrent, because of ambiguity aversion (McCrimmon, 1968).

In addition to these behavioural arguments, agents that include foreign securities in their portfolio are often worse off because of higher transaction costs and taxes. In the first instance, despite mergers between stock exchanges and the efforts made by the financial industry, transaction costs on foreign securities – plus the management costs of foreign investment funds – are still higher than those charged on domestic trades (partly justified by reliance on a larger number of intermediaries). These additional costs reduce the expected net return on foreign investments without altering the attendant risk. As regards taxation, policies to encourage the financing of domestic activity lead either to higher taxation of foreign financial income or to tax breaks on home-country investments – which comes down the same thing. France opted for the second solution for the launch of the PEA.

Lastly, in addition to the above analyses, which are entirely consistent with an overall approach to investor behaviour, we need to address three specific reasons for the lack of international exposure in portfolios. The first reason concerns the special way in which investors sometimes approach currency risk, which they see as an additional risk even though it is obviously not systematic[34]. The second has to do with economic patriotism, described by Statman (2004a) and noted in France by Lépinay and Rousseau (2000). This is no longer a question of domestic preference predicated on informational quality but of a deliberate choice, unrelated to the tax advantages it may bring. From a behavioural standpoint, this bias is similar to those observed for smaller geographical entities via local savings schemes, for example. Third, Solnik (2005) builds on the idea of the compartmentalised financial portfolio described by Thaler through the concept of mental accounting (cf.3.4). The author considers that savers certainly do not view their risky assets in a uniform manner; instead, they see their domestic portfolio as a benchmark. The periods when the foreign portfolio underperforms this domestic benchmark create disappointments that prompt the investor to abandon it or scale it down proportionally in order to avoid further frustration[35].

[34] *The additional risk on a foreign-currency investment, if any, depends on the correlation between the rate of return in the domestic currency and the rate of increase in the exchange rate.*
[35] *This type of behaviour, which the author offers as an illustration of "regret theory", is very similar to the concept of Myopic Loss Aversion (cf. 3.4).*

Conclusion

A static analysis of the financial wealth of French savers shows that the dominant behaviour pattern differs from the expected results of standard portfolio theory in at least two ways. The first is the non-participation puzzle, which cannot be explained away entirely by inadequate knowledge of financial markets and products or by strong risk aversion. The second is the non-diversification puzzle or, more generally, poor portfolio diversification.

Apart from voluntary choices, which, as we have seen, were mentioned in connection with US households, several analytical frameworks can be put forward to explain this twin conundrum. Many portfolios are too small, so that, in an imperfect market, their holders are forced to limit diversification; more drastically, they refuse to consider the possibility of setting up a risky asset portfolio on the grounds that participation costs are too high. However, these behaviours ought not to be observed in the case of the largest fortunes, firstly because fixed costs are diluted and secondly because participation costs are reduced through pooled management. We therefore need to look for more overarching analyses.

To explain the absence of risky asset ownership, our initial suggestion is to supplement portfolio theory with another concept: the maximum risk tolerated by the saver on his risky portfolio. When the risk premium is too low in relation to the estimated market risk, the saver adopts a corner solution, investing 100% of his financial wealth in the non-risky asset. While some savers systematically consider market portfolio risk to be too high and therefore stay out of the markets permanently, others are absent because of their reading of cyclical conditions. Naturally, this analysis does not apply to the problem of non-diversification.

The alternative is to revisit the utility functions that supposedly explain investors' motivations and behaviour. We have adopted two approaches for this. The first entails broadening the scope of the utility function by factoring in exogenous risks such as income risk. The advantage of this approach is that it links risky asset ownership to the economic cycle. When unemployment risk is high, households fall back on non-risky assets or on liquid assets – which, for our purposes, amounts to the same thing. (A similar conclusion can be reached by analysing liquidity constraints.) The second approach remains focused squarely on the financial issue and investigates how individuals react to contingencies. Because of ambiguity aversion or loss aversion, savers tend to give too much importance to particularly unfavourable outcomes. That is why most of their wealth is invested in non-risky assets, a result we arrive at through behavioural portfolio theory. But they are also willing – almost for a gamble – to take considerable risks with a small portion of their wealth, concentrating on a handful of stocks with which they feel familiar or, in some cases, for which they believe they have inside information. This dual behaviour can naturally lead to disappointments – witness the bursting of the tech bubble. Specifically, savers demand a higher risk premium for holding financial portfolios that are more risky than the market portfolio. This is one answer to the equity premium puzzle.

That said, when a saver holds the bulk of his financial wealth in non-risky assets, he is less prone to the consequences of inefficient direct management of a risky asset portfolio, insofar as the risk of loss is modest. By construction, the smaller the percentage of risky assets in the person's financial wealth, the less it can diverge in absolute terms from the capital market line. This would not be the case for large securities portfolios, but these seem to have been diversified more effectively. Furthermore, an alternative is to combine shares or units in an investment fund with a directly managed portfolio. This often turns out to be a sub-optimal solution – the correlations among the various holdings are not investigated – but it does allow the investor to move back closer to the capital market line. This outcome was observed in Sweden by Calvet et al (2005). It would be interesting to carry out a similar analysis for France, although a comparative analysis of the two countries might produce disparate results because ownership rates for investment fund units/ shares are lower than those for directly held equities. In any case, leaving aside the discriminating factor of wealth, research conducted in the United States and the UK seems to indicate that experience and a high "social" level go hand in hand with better management (Vissing-Jorgensen, 2003). This obviously points to a need for better investor education.

The initial conclusions drawn from this static behavioural analysis need to be fleshed out with a dynamic vision of portfolio management. This issue will be addressed, from both a short-term and a long-term perspective, in another working paper. The aim will be twofold: to examine how shareholders react to a changing environment; and to achieve a better understanding of household choices as part of their lifecycle.

Annex

To show up the importance of diversification, it is sufficient to analyse the variance of a portfolio p composed of n securities (i = 1, …, n):

$$\Gamma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n}\Gamma_{ij}x_i x_j \qquad (1)$$

where:

. x_i and x_j are the proportions of assets i and j, respectively

. Γ_{ij} the covariances of the rates of return between two assets i and j (variances when i = j)

We single out the specific case where i=j, which entails separating the terms of both the variances and the covariances:

$$\Gamma_p^2 = \sum_{i=1}^{n} x_i^2 \Gamma_i^2 + \sum_{i=1}^{n}\sum_{\substack{j=1 \\ j\neq i}}^{n}\Gamma_{ij}x_i x_j \qquad (2)$$

For simplicity, and using the naive strategies given by Benartzi and Thaler (2001), we assume that each security is held in the same proportions 1/n. This gives:

$$\Gamma_p^2 = \frac{1}{n^2}\left(\sum_{i=1}^{n}\Gamma_i^2 + \sum_{i=1}^{n}\sum_{\substack{j=1 \\ j\neq i}}^{n}\Gamma_{ij}\right) \qquad (3)$$

We denote:

. $\overline{\Gamma}_i^2$ the mean variance, and

. $\overline{\Gamma}_{ij}$ the mean covariance.

Expression (3) becomes:

$$\Gamma_p^2 = \frac{1}{n^2}\left[n\overline{\Gamma}_i^2 + n(n-1)\overline{\Gamma}_{ij}\right]$$

$$\Gamma_p^2 = \frac{\overline{\Gamma}_i^2}{n} + \frac{(n-1)}{n}\overline{\Gamma}_{ij}$$

When n increases, (1/n) tends to zero and (n-1) tends to n, so that:

The variance terms gradually disappear with diversification, and the risk borne by the investor tends to the mean covariance level.

$$\Gamma_p^2 \longrightarrow \overline{\Gamma}_{ij}$$

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