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**STOCKHOLDING: RECENT LESSONS FROM THEORY AND
COMPUTATIONS**

Michael Haliassos

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Stockholding: Recent Lessons from Theory and Computations*

Michael Haliassos
University of Cyprus, HERMES, and IMOP

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Abstract

Household-level portfolio data show a tendency of the majority of households in each country to hold no stocks despite a historical expected-return premium on equity relative to riskless assets. This paper first explains why such a tendency constitutes a puzzle in economic theory (the “stockholding puzzle”). It discusses why simple popular notions regarding the source of non-participation (risk aversion, risky labor income, and borrowing constraints) are not confirmed by careful analysis of portfolio models and presents recent conclusions on what causes non-participation. Based on this, it revisits the popular view on non-participation and shows how it can be qualified to be consistent with lessons from economic theory. It also explains how this view can be extended to account for exits from the stock market and for limited diversification. Then, the paper describes three unsolved empirical puzzles concerning the share of stocks in portfolios of households that do participate in the stock market. It points to basic underlying mechanisms producing these theoretical results and discusses briefly possible future directions for research that may help resolve the puzzles. Finally, the paper draws lessons for practitioners interested in expanding the stockholder base.

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1. Introduction

This paper presents recent developments in the theory of optimal portfolio design in a non-technical manner, provides the intuition behind these results, and uses them to interpret important findings in the empirical literature based on high-quality, household-level portfolio data. Where theoretical predictions are confirmed by empirical observation, theory provides a way to interpret empirical findings. Where the two disagree, the mechanisms stressed by theory serve as a first step towards identifying the full set of factors at work and the extent to which household behavior can be modified to fit objectives better.

Household-level portfolio data show a tendency of the majority of households in each country to hold no stocks despite a historical expected-return premium on equity relative to riskless assets. The paper first explains why such a tendency constitutes a puzzle in economic theory (the “stockholding puzzle”). It discusses why popular notions regarding the source of non-participation (risk aversion, risky labor income, and borrowing constraints) are not confirmed by careful analysis of portfolio models and presents the state-of-the-art view on what causes non-participation. Based on this, it revisits the popular view on non-participation and shows how it can be qualified to be consistent with lessons from economic theory. It also explains how this view can be extended to account for exits from the stock market and for limited diversification.

Then, the paper describes three unsolved empirical puzzles concerning the share of stocks in portfolios of households that do participate in the stock market. It points to the sources of theoretical results on optimal portfolio composition¹ and discusses briefly

¹ Gollier (2001 a, b) provides an excellent discussion of the portfolio implications of models that can be solved exactly using analytical methods, which complements the analysis in this paper. Campbell and

possible future directions for research that may help resolve the puzzles. Finally, the paper draws lessons from theory that can be of use to practitioners in their efforts to expand the stockholder base.

Section 2 discusses the main factors that are likely to prevent households from participating in the stock market. Section 3 examines what might cause households that previously held stocks to exit the stock market, while section 4 distinguishes stock market participation from portfolio diversification. Section 5 investigates whether households that do participate in the stock market choose an optimal portfolio share of stocks as the latter is implied by theory. Section 6 draws lessons from the theory of household portfolios that can be useful to practitioners.

2. The stock market participation puzzle

2.1. What is the participation puzzle and why do we care?

Despite substantial increases in stock market participation among households over the last decade, there is no country in the world where the majority of households hold stocks. This is true not only for European countries surveyed in the current project, but also for the United States where only 19% of households hold stocks directly according to the 1998 *Survey of Consumer Finances*. It remains true even when we allow for indirect holdings of stock through mutual funds and defined-contribution pension funds: the participation rate for the US then rises to just under 49%. This happens in the face of substantial realized stock returns in the later part of the 1990s, and despite estimates of an expected return premium on equity based on long historical time series (of the order of 4

Viceira (2002) provide a very useful, in-depth discussion of various aspects of portfolio theory, including lessons from models using analytical approximations.

to 6 percentage points in the United States). The puzzle can be stated simply: if one can expect to earn more by holding stocks than by holding essentially riskless financial assets (such as bank deposits), what is it that keeps the majority of households out of the stock market?

Resolving this puzzle is not simply a matter of intellectual curiosity, but can suggest important profit opportunities for financial institutions, practitioners, and even governments. If we understand what keeps people out of the stock market, we can expand the customer base by designing financial products that appeal to the average household. We can also market financial products more effectively by targeting appropriate segments of the population. Governments can ensure the maximum effectiveness of their efforts to float stock of newly privatized companies. Finally, we may be able to speculate about the likely reactions of households to recent reversals in stock market performance on both sides of the Atlantic: are the new stockholders likely to stay in the market or are they likely to abandon ship in bad weather?

2.2. The Source of the Participation Puzzle

Most people are unlikely to perceive a serious stock market participation puzzle. The most common instinctive reaction to this puzzle is that households tend not to participate in the stock market because they do not like to assume substantial financial risk. This view is strengthened by two observations. First, households face background risk arising from uncertain labor income or unpredictable health expenditures that they are unable to insure against. Assuming stockholding risk on top of this probably seems excessive to most households. Second, households face borrowing limits and may not be able to

borrow against future earnings. If they cannot borrow, why should they sacrifice their precious current resources on stockholding, especially when they are also unlikely to be able to borrow in the future in order to offset consumption effects of bad stock market outcomes? A clear lesson from economic theory, whether based on analytical or on computational methods, is that such instinctive answers are too simplistic. Let us see why.

A risk-averse household that maximizes expected utility will always want to invest some, albeit small, amount in stocks if stocks offer an expected return premium over the riskless asset.² The intuition behind this result stems from the idea that a risk-averse household dislikes riskiness of its consumption stream. It will, therefore, evaluate all assets not only according to their expected returns but also according to the *contribution* each asset makes to the riskiness of the consumption stream. If a risky asset offers a higher expected return than a riskless asset, then it will be deemed superior to the riskless asset unless the household values its contribution to riskiness of consumption more than its contribution to the expected return on the portfolio.

Consider a household with riskless labor income and no stocks in its portfolio that contemplates adding a small amount of stocks versus adding an equal amount of the riskless asset. Since there is an expected return premium on stocks, stocks are more attractive than the riskless asset in this respect. If the household is to be discouraged from undertaking stock investment, stocks must contribute to the riskiness of consumption. But since the household holds no stocks, stock returns are not correlated with the household's consumption and a marginal addition of stocks does not contribute to consumption

² An early statement of this result is in Arrow (1974).

riskiness. A marginal addition of stocks should be preferred to a marginal addition of the riskless asset by someone that holds no stocks. Of course, this holds for small additions of stocks starting from no stocks. Once households include stocks in their portfolios, their risk aversion will clearly influence the amount they do invest in stocks. Risk aversion is irrelevant for *whether* they hold stocks in this basic setup, not for *the portfolio share* of stocks among stockholders.

The argument holds even when labor income is risky or when the household faces other sources of background risk, as long as such risk is uncorrelated with stock returns.³ It continues to hold even if the household is not allowed to be a net borrower (in the sense of having negative net wealth) in any period of life. This is because constraints on net wealth (the algebraic sum of assets and liabilities) treat each component of this sum symmetrically, and they fail to reverse the superiority of stocks to riskless assets for a household that has no holdings of stock.⁴

Thus usual notions of risk aversion and standard types of risky labor income and borrowing constraints cannot induce an optimizing household to adopt a zero position in stocks in the face of a perceived expected return premium over riskless assets (Haliassos and Bertaut, 1995). On the basis of the discussion so far, there seems to be no basis for the popular belief that non-participation in the stock market can be attributed to these reasons. But later on we will see how this popular belief can be modified to be consistent with our theoretical understanding of stockholding behavior.

³ If there is negative correlation between labor incomes and stock returns, then this provides an additional reason to hold stocks, namely as an insurance against earnings fluctuations. The case of positive correlation poses subtler issues, and we will return to it below.

⁴ It should be stressed that this discussion refers to constraints on *net* wealth. We will see below that borrowing constraints of other types can justify zero stockholding.

2.3. *Could a Different Type of Risk Aversion account for Non-participation?*

Realization that the standard notion of aversion to financial risk embodied in expected-utility models of portfolio choice cannot account for non-participation in the stock market has encouraged attempts to consider alternative specifications of household preferences. Put simply, researchers have explored the idea that grandma may be right in attributing non-participation to risk aversion but we may have been too conservative in the way we model risk aversion.

In standard models, households are assumed to compute the utility of each possible consumption outcome and weight it by the probability of its occurrence. The optimal portfolio is then chosen so as to maximize expected utility of consumption. Note that this specification is flexible enough to allow for very low utility in bad states of the world. The investor may be quite miserable if his portfolio returns end up being very bad, but he is still assumed to weight the probability of such misery by its objective probability of occurrence.

What could happen if the investor weighted the probability of misery much more heavily than its objective probability of occurrence (with suitable modifications to the rest of the probability weights so that they sum to unity)? A first reaction maybe to say that not much will happen. After all, what matters for a household is the weight assigned to each outcome *times* the utility arising from the outcome. Standard preferences allow us to consider cases where the investor experiences very low utility in bad outcomes, so the ability to manipulate the first term in the product, the weight, may not seem to add much to our ability to explain zero stockholding. Yet such a reaction would be wrong. Powerful portfolio effects emerge when weights (and hence the household's objective function)

depend on the *ranking* of outcomes that can be influenced by portfolio choices. Depending on the particular assumptions underlying the weighting scheme, this approach has been termed “rank-dependent utility”, “dual theory of choice”, and “probability weighting”.⁵

Consider a simple example in which stock returns can either take a high or a low value, and this is the only source of uncertainty facing the household with zero stocks in its portfolio. The household contemplates investing a positive amount in stocks. If it does so, then the good outcome for the household is to experience a high stock return, and the bad is to experience a low stock return. Suppose that the household can also short stocks, i.e. borrow an amount today by offering to deliver a certain number of stocks tomorrow. In this case, the household borrows at the risky stock return rate, and the good outcome is for stock returns to turn out low. This means that, starting from zero stockholding, a household with non-standard preferences will be using different weights to evaluate the utility resulting from positive investment in stocks than the weights it will be using to evaluate the results from short sales of stock. It thus becomes possible for the household to prefer zero stockholding to either positive holdings or short sales (Epstein and Zin, 1990).⁶

This novel type of aversion to risk, termed “first-order risk aversion” seemed capable of generating and justifying zero stockholding. However, it turns out that labor income risk invalidates this possibility for resolving the stock market participation puzzle. As the simple example without background labor income risk illustrated,

⁵ See Quiggin, 1982; Yaari, 1987; Epstein and Zin, 1990; Haliassos and Hassapis, 2001; Donkers, 2000.

⁶ Technically, indifference curves under such specifications exhibit kinks, thus making it possible for an investor to be “stuck” at one of those kinks for a range of slopes of the budget line.

stockholding levels at which the household can be “stuck” are those around which reversals in rankings of outcomes take place. The crucial question is whether the objective function changes at zero stockholding, thus justifying non-participation in the stock market. When the labor income realization also matters for the ranking of outcomes, it can be shown that reversals in rankings do not in general occur at zero stockholding.⁷ Recent computational research has indeed demonstrated that overweighting of the worst state cannot justify by itself nonparticipation in the stock market (Haliassos and Hassapis, 2001). Other weighting schemes that overweight the worst and the best states relative to their objective probabilities of occurrence have also been shown to result in predictions of positive stock holdings (Donkers, 2000).

Overall, rank-dependent utility can lower predicted stockholding considerably, but it cannot by itself account for non-participation in the stock market of households that do face uninsurable background risk (such as earnings risk). However, the tendency of such preferences to lower predicted stockholding can be useful when combined with a different fundamental explanation for zero stockholding, as will be discussed below.

2.4. How About Correlation between Labor Incomes and Stock Returns?

We saw above that risky labor income does not justify zero stockholding when earnings shocks are uncorrelated to stock returns, because it does not induce correlation between stock returns and household consumption. Other households with risky labor income that tends to move in the opposite direction from stock returns can even reduce consumption

⁷ In the example, the two relevant states with ambiguous ranking are (r_H, Y_L) and (r_L, Y_H) , where r is the return on stocks, Y is labor income, H denotes the high realization, and L denotes the low realization. Reversal in the rankings does not occur at zero stockholding, but at that (positive) level of stockholding for which the difference in portfolio income exactly offsets the difference in labor income across the two states. Ranking reversals for other states can be ruled out through a more sophisticated argument.

risk by including stocks in their portfolios. However, households whose labor incomes tend to move in the same direction as stock returns lower their demand for stocks for this reason. Theory tells us that such households may well find it optimal to sell stocks short, i.e. to borrow at the risky rate of return on stocks. For those who engage in short sales of stock, having low stock returns is the “good” outcome and high stock returns the “bad” outcome. If low (high) stock returns tend to occur when earnings are also low (high), short sales of stock can help mitigate some of the adverse consequences of low earnings. Still, short sales are far from implying abstention from the stock market. If anything, they require more stock market involvement by households and impose heavy informational requirements on them, since the process and the rules governing short sales tend to be quite involved.

Thus, positive correlation between earnings and stock returns cannot be used by itself as an explanation for zero stockholding. Theory and computational studies indicate, however, that we can obtain optimal portfolios with zero stockholding if the household faces sufficiently high positive correlation between labor income and stock returns *combined with* restrictions preventing households from engaging in short sales of stock (Heaton and Lucas, 2000a, b; Haliassos and Michaelides, 1999).

A theoretical possibility is not necessarily a valid explanation of an observed phenomenon. Despite the mathematical sophistication of portfolio models with positive correlation, the relevance of positive correlation and short-sales constraints as an explanation of the zero stockholding puzzle is ultimately an empirical matter. Survey data in many countries have established that households that do not participate in the stock market tend to be low-education, low-income, low-wealth, and more risk averse than

those that do participate. On a purely introspective level, it is hard to imagine that such households hold no stocks because they tried to sell stocks short and found out that they were unable to do so.

Luckily, there is more to rely on than mere introspection. The few existing empirical studies of the correlation between earnings shocks and stock returns at the household level find rather small, if any, positive correlation and more importantly a pattern of estimated correlations across household groups that is inconsistent with their relative tendencies to abstain from the stock market. Davis and Willen (2000) obtain correlation estimates ranging between .1 and .3 over most of the working life for college educated males and around -.25 at all ages for male high school dropouts Heaton and Lucas (2000b) estimate positive correlation of entrepreneurial risk with stock returns at levels around .2. Besides being fairly small, these numbers imply at best that zero stockholding should be predominant among college graduates or entrepreneurs who in fact tend to hold stocks, and that low education households should actually hold stocks as a hedging instrument when in fact they tend not to do so. Thus, the theoretical possibility notwithstanding, it does not seem that positive correlation between earnings and stock returns can account for the observed pattern of zero stockholding across different population segments.

Further empirical support to the notion that earnings-return correlations are not central to stockholding behavior is provided by Vissing-Jorgensen (2002). She uses income data from the PSID (1983-1992), and three observations of portfolio choice from the 1984, 1989, and 1994 PSID wealth supplements. She applies a two-step procedure, first estimating relevant moments of the income processes and then using them as

regressors to explain portfolio choice. She finds no evidence of an effect of the earnings-return correlation on portfolio composition.

2.5. *Can Borrowing Constraints Justify Zero Stockholding?*

The third commonly invoked factor for stock market non-participation is the inability of some households to borrow as much as is warranted by their expected lifetime earnings and any accumulated wealth. Such borrowing constraints can arise from various types of imperfections in the credit market, they can take various forms (such as quantity constraints, wedges between borrowing and saving interest rates, down-payment ratios), and they have been extensively explored in the literature on saving.

Why would a constraint on *borrowing* preclude somebody from *investing* in stocks? The idea is that people with low current resources, especially the young among them, would like to borrow both in order to consume and to invest in stocks, in view of higher expected future earnings and of the expected return premium on equity. Restrictions on their ability to do so would force them to curtail both their consumption and their stock investment and might push them to a corner with zero stockholding.

It should already be clear that zero stockholding cannot arise from any arbitrary type of borrowing constraints faced by households. As mentioned above, a constraint that restricts overall financial net wealth to be nonnegative does not induce zero stockholding. Since this constraint restricts the algebraic sum of assets and liabilities, it does not prevent positive stockholding financed entirely through borrowing in a way that leaves net financial wealth unaffected. More generally, a non-negativity constraint on net wealth allows stockholding as long as the size of debt outstanding is matched by the size of total

asset holdings. More stringent borrowing constraints are needed if we are to justify zero stockholding.

What if the household is not allowed to borrow at all at the riskless rate, regardless of what it would do with the loan? Under this rather extreme type of borrowing constraint, young low-resource households that would have liked to short the riskless asset will end up holding none of it. Will they also end up holding no stocks? Not necessarily. Computational studies (such as Heaton and Lucas, 1997, 2000a; and Haliassos and Michaelides, 1999, 2001) have found that young households that are particularly impatient (that is, eager to boost their consumption by borrowing against their future earnings) may even seek to borrow by shorting stocks. Zero stockholding is not justified even by ruling out borrowing at the low riskless rate.

However, if there is an additional restriction preventing short sales of stock, then sufficiently impatient households will be eager to borrow at either the riskless or the risky rate and, prevented from doing so, they will end up with zero holdings of both assets.⁸ Although it is the combination of these two severe borrowing restrictions that produces zero stockholding, the second assumption of no short sales of stock is not inconsistent with the first. Young households that are denied credit even at the riskless rate are unlikely to be allowed to engage in short sales at the stock exchange. The possibility seems both theoretically valid and intuitively plausible.

Is it also empirically relevant in accounting for observed non-stockholders? The computational models themselves provide some guidance as to the characteristics of optimizing households that could run into both short sales constraints and thus exhibit

⁸ Technically, the imposition of two separate short sales constraints, one on stocks and the other on bonds, breaks the symmetry of treatment between bonds and stocks by allowing the shadow values of these two constraints to differ.

zero stockholding. Contributing factors are young age, low current cash on hand,⁹ and considerable impatience that induces households to want to borrow at either rate. The findings of Cocco, Gomes, Maenhout (1999) and Haliassos and Michaelides (2001) imply that a crucial factor behind the influence of age on portfolios is the large ratio of human wealth (the present value of expected future earnings) to accumulated financial wealth typically observed when households are young.¹⁰

It should be stressed that this borrowing-constraint explanation of zero stockholding applies at best only to households that hold no assets at all, risky or riskless. Thus, it cannot explain the behavior of households who choose to put all their savings in bank accounts and other riskless assets. Nor does it apply to households with large amounts of cash on hand because of high current incomes (or asset holdings), as these are predicted to invest positive amounts in stocks. This makes it virtually impossible to apply this explanation to savers, and especially the wealthier or middle- to high-income non-stockholders in household-level data. Moreover, the relevance of binding borrowing constraints tends to diminish as households age and climb the upward-sloping age-earnings profile. Binding borrowing constraints are far from being a universal explanation of the widespread non-participation in the stock market observed to different extents across age, income and wealth groups.

⁹ Cash on hand is defined as the sum of current wealth and of labor income, and it is normalized by either current labor income or by the permanent component of labor income.

¹⁰ Cocco, Gomes and Maenhout offer a possible intuitive explanation for why this ratio matters so much for portfolio composition. Future labor income, though risky, has a positive minimum value in each future period. This value is guaranteed without risk, in the sense that the household will receive at least this labor income in each future period. Thus, it serves as a surrogate riskless asset, displacing (some of) the riskless asset that the household would otherwise include in its portfolio and encouraging the household to devote more of its financial wealth to stocks. As age progresses and the household gets closer to retirement, the importance of this labor income floor diminishes and households are predicted to shift their portfolios more into the riskless asset and away from stocks.

2.6. *Fixed Entry and Participation Costs: Could Grandma Still Have a Point?*

Economic theory serves to sharpen our understanding of economic phenomena but has seldom proved popular beliefs and intuition to be totally unfounded. While economic theory challenges the popular notion that risk aversion, uncertain earnings, and borrowing limitations are *sufficient* to account for zero stockholding in the face of an equity return premium, it does not imply that these factors are irrelevant to stock market non-participation. Indeed, the prevailing current view in the theory of stock market participation seems to be that all these factors *contribute* to non-participation in the face of another, more fundamental factor.

This fundamental factor is fixed costs of entry or participation in the stock market, broadly interpreted. Households are assumed to decide whether to pay the cost of obtaining access to stocks or not based on a comparison of well being (expected lifetime utilities) under both options. One option is to gain access to stocks but having to pay the costs, while the other saves the costs but gives access only to riskless assets (Haliassos and Bertaut, 1995; Haliassos and Michaelides, 1999; Polkovnichenko, 2000).

Some entry or participation costs are tangible and observable, while others are much more difficult to quantify. Households usually have to pay a certain fee to engage the services of brokers or to participate in a mutual fund. In addition, they need to spend some time selecting advisors and investment programs, picking winners, and generally keeping up with developments in the stock market. We may be able to measure or at least approximate the value of a household's time spent on such activities, by considering the opportunity cost of this time. In practice, it will be quite difficult to have reliable

estimates of the number of hours spent by the household on such activities, and this may contaminate estimates with sizeable measurement error.

Far more difficult to assess are household's *perceptions* as to how much it would cost to get involved in stockholding activities, monitor financial advisors or fund operators, and keep abreast of stock market developments. Yet, it is household perceptions that ultimately determine whether the household will enter the stock market, and exaggerated perceptions can generate inertia despite their inaccuracy.¹¹

Thus, it seems almost impossible to infer the perceived entry/participation cost for each household. However, it is possible to compute the minimum level of entry cost that would keep a household of given characteristics out of the stock market (Haliassos and Michaelides, 1999; Polkovnichenko, 2000, Paiella, 2000, Vissing-Jorgensen, 2002). The conclusion from existing computational and econometric work on this issue is that such threshold entry costs tend to be fairly small.

The main intuition for why small costs deter marginal investors from entry in the stock market is that, if these potential investors entered, they would invest very little in stocks anyway. If the planned stock investment is limited, then benefits from entry are relatively small, and small entry costs can discourage stock market participation. Although it is not possible to compare the computed costs to the objective costs of entry for each household, the low levels of such required costs for various household

¹¹ It is worth noting that household perceptions relevant for the participation choice are not confined to perceptions about entry costs alone. They notably include household perceptions as to the size of the equity premium. The larger the perceived premium on the expected return on equity, the more likely is the household to participate in the stock market for any given level of perceived entry costs. Econometric research has shown that the size of the equity premium is difficult to estimate, even with full access to available historical data (Cochrane, 1997). Moreover, full knowledge of the equity premium is unlikely for households that have never invested in the stock market and are contemplating entry for the first time. The formation of perceptions and their influence on both the decision of households to enter and the threshold costs computed by researchers are useful areas for future research.

characteristics suggest that an entry cost explanation of the participation puzzle could apply to a wide range of households.

A bridge between popular beliefs about stock market nonparticipation and modern research on entry costs should now be apparent. Although risk aversion, earnings risk, and borrowing constraints are incapable of explaining widespread zero stockholding alone, they all serve to reduce the amount of stockholding that a household would undertake if it had access to the stock market. In so doing, they also serve to reduce the threshold entry costs sufficient to keep households out of the stock market. Thus, for any objective level of entry costs, households that are more risk averse, or disproportionately concerned about bad outcomes, or face considerable background earnings risk, or severe borrowing and short sales constraints are more likely to stay out of the stock market. Rather than being protagonists, as commonly thought, these factors are regarded by modern economic theory as supporting actors in a show produced by stock market entry and participation costs.

3. Accounting for stock market exits

Up to now, I have referred to “entry” and “participation” costs almost interchangeably. One is forced to draw a distinction between these two concepts when looking more closely at the evolution of stock market participation patterns of households over time. This exercise requires panel household-level data on portfolios that are less readily available than cross-sectional data. Although most of the observed transitions in stockholder status are from being a non-stockholder to being a stockholder, opposite transitions are also observed in panel data (Bertaut, 1998).

Transitions out of the stock market make it difficult to sustain the view that there are no costs associated with continued stock market participation. Entry fees are sunk costs for those who have participated in the stock market: once paid, they allow access to the stock market forever. If we try to explain the choice of some households not to hold stocks in subsequent periods without reference to any participation costs, we are pushed back almost to the same position as before, namely trying to justify zero stockholding in the absence of fixed costs. In fact, the task is even more formidable, since we now have to justify zero stockholding among households that tend to be older, more educated, and richer than those without previous stock market experience.

It is, of course, still possible to justify temporary absences from the stock market even without participation costs. Occasional bad spells of cash on hand may well force some households into a situation of zero asset holding where both short sales constraints are binding (as discussed above). How often households will be pushed to such corners depends on various household characteristics, but mainly on how wealthy they are. In saving and portfolio models, the amount of accumulated wealth is heavily influenced by the degree of impatience characterizing the household (Deaton, 1991; Carroll, 1997). Impatient households, that is those who discount future utility significantly relative to current utility, tend to accumulate fewer assets and to run into binding borrowing constraints more often.

Some preliminary idea of how often this happens in theory can be obtained from the findings of Haliassos and Michaelides (1999) who calibrate a portfolio model for a

household assumed to have an infinite horizon.¹² Highly impatient infinite-horizon households¹³ accumulate very little and are predicted to run into binding short sales constraints and zero stockholding 35% of the time. More patient households¹⁴ accumulate more assets and are predicted to have zero stockholding only 5% of the time. There is substantial room both for econometric work to establish the frequency and duration of exits from the stock market for various demographic groups, and for computational models that handle the thorny problem of participation costs contingent on previous stock market experience.

4. Participation versus diversification

Households that participate in the stock market do not necessarily hold well-diversified portfolios. It has long been known that household portfolios do not tend to be well diversified (e.g., Blume et al., 1974), and this has stood in direct contrast to the implications of complete portfolios in very standard models in Finance, such as the Capital Asset Pricing Model (CAPM). Given the above discussion, it should not be difficult to see that entry and participation costs may prove useful for explaining limited diversification as well as limited participation.

¹² While the assumption of infinite horizons is clearly unrealistic, it has been found in computations that policy functions for the infinite-horizon problem are essentially the same as those derived from a finite-horizon model for young households.

¹³ Technically, this refers to households with rate of time preference equal to 10%.

¹⁴ These are assumed to have rate of time preference equal to 4%.

Striking examples of limited diversification are the tendencies to hold stocks in the employer firm, in domestic rather than foreign companies, and in newly privatized but not in other companies. Holding stocks in one's employer may be good from the employer's perspective but induces unnecessary positive correlation between labor income and portfolio return. Holding of such stocks, however, is significantly facilitated by the employer who provides them to employees directly, reducing entry costs both in absolute terms and relative to other stocks in the market.

"Home-equity bias" is the tendency of stockholders of a given country to devote most if not all of their stock portfolios to domestic stocks. This tendency has been found difficult to explain with reference to the mean-variance properties of foreign stock returns compared to those of domestic stocks even after adjusting for exchange rate risk, as well as to border restrictions (French and Poterba, 1991; Lewis, 1999). The phenomenon would be much easier to explain if there is an additional fixed cost of entering foreign stock markets, creating a second hurdle for potential stockholders to overcome. This additional cost could arise from more limited familiarity of households with foreign companies relative to those operating at home, higher costs of monitoring foreign companies from abroad, and lack of understanding of foreign policies and institutions. The computational apparatus for a model of a household investing domestically can be adapted to handle this case (Michaelides, 2000).

The case of UK stockholders in privatized utilities who did not spread their investments to other companies is also consistent with an entry-cost explanation. The new stockholders bought public utility stock only after an extensive advertising campaign. There was no similar campaign with regard to other types of stocks, and

investors may have been reluctant to acquire them because of lack of familiarity with their properties.

All three examples suggest that, in addition to general stock market entry costs, there may well be significant informational barriers across firms of different types and ownership that discourage portfolio diversification. The required size and empirical relevance of such costs are yet to be determined.

5. Portfolio composition puzzles

Portfolio composition puzzles refer to empirical findings based on household portfolio data that cannot be reconciled with existing theoretical models of portfolio behavior. In principle, such differences can be due either to poor data or to poor theory (or both). In the present context, the quality and detail of available household-level data are such that the ball seems to be in the court of theory. We will see that in some cases theory fails to explain the data because it does not fully capture the economic forces at work. In other cases, theory seems to be pointing in directions that accord with intuition and advice typically given by professionals, but households fail to behave in ways that seem optimal. The former pose a challenge to theory to find the missing mechanisms at work, while the latter probably call for better education of households as to what serves their objectives in the best possible way.

5.1. Three Portfolio Composition Puzzles

Comparison of data with existing theoretical models of household portfolios has identified three main puzzles regarding portfolio composition.¹⁵ The first is the “portfolio specialization puzzle”. Theoretical models imply that it is optimal for small savers and for younger savers to specialize their financial asset holdings completely in the asset that offers an expected-return premium, namely stocks. Only as they get richer and older should they incorporate riskless assets in their portfolios. Indeed, theoretical models suggest that young and small savers should utilize borrowing opportunities to increase not only current consumption but also stockholding above what it would be in the absence of such borrowing opportunities. Yet household-level data clearly show that small savers and young savers do not confine their financial asset holdings to stocks and, if they do specialize, they tend to hold all their financial wealth in relatively riskless assets.

The second puzzle has to do with how portfolio composition changes as the financial resources of the household change. Household-level data tend to imply positive effects of both household income and financial wealth on the portfolio share of stocks. Yet, existing theoretical models predict exactly the opposite, namely that an improvement in the financial resources of the household should lead to a decrease of the portfolio share invested in stocks among those who do invest in stocks.

The third puzzle refers to the effect of age on portfolio composition. Theory predicts that, as households age, they should reduce the portfolio share of stocks and increase that of the riskless asset for any given level of resources. This is also consistent

¹⁵ Contributions in Guiso, Haliassos, Jappelli (2001) show how stocks are combined with other assets in household portfolios.

with the advice typically given to households by financial advisors. Yet, the data seem to suggest either no effect of age on portfolio composition or a slight increase in the portfolio share of stocks as a result of aging. Here the puzzle lies more on the side of justifying actual behavior rather than of defending theoretical models, since the implications of theory seem to accord with popular intuition.

5.2. Why does Theory Imply Portfolio Specialization in Stocks?

Understanding the forces responsible for the portfolio specialization result in theoretical models is important not only in its own right, but also because it yields insights as to the causes of the other two portfolio composition puzzles. The optimal portfolio share of risky assets turns out to depend crucially on the ratio of current assets to the present value of the stream of labor incomes (“human wealth”). This ratio is usually quite different in static (one-period) models of wealth allocation compared to dynamic intertemporal models of household consumption and portfolio choice.

When current assets are large relative to human wealth (as in static, one-period wealth-allocation models without future labor income), mixed portfolios are optimal. When current assets are limited relative to the size of human wealth, models tend to predict that portfolio specialization in stocks is optimal. Modern intertemporal models of household portfolio choice recognize that households face a stream of future labor incomes. Other things equal, the younger the household and the smaller its current cash on hand, the smaller is the ratio of current wealth to future labor incomes. Thus, the more likely it is that the intertemporal model will imply portfolio specialization in stocks.

What makes the ratio of current assets to human wealth relevant for the predicted portfolio bias towards stocks? The computational literature has uncovered two complementary elements of intuition regarding this bias.¹⁶ The first is the subtle role of human wealth in providing a substitute for holdings of the riskless asset. Despite uncertainty about future earnings, there is always a minimum level below which earnings cannot fall in one's future working life. Possessing the ability to generate this minimum level of earnings is equivalent to holding a safe asset that yields an annual return equal to that same amount. The household can thus be viewed as having surrogate holdings of the safe asset, even when it does not hold any amounts of the regular safe asset. These surrogate holdings reduce the optimal amount of regular riskless asset holdings in the portfolio and create an (apparent) bias towards stocks.

The second point has to do with the ability of stocks to generate future wealth, set against their contribution to the riskiness of future consumption. In view of the equity premium, stockholders expect to earn more on their stock holdings than on an equal amount held in the riskless asset. Young households and those with low current cash on hand plan to finance most of future consumption through future labor income. Thus, by biasing their portfolios towards stocks, they expect to generate more wealth in the future without contributing significantly to the riskiness of future consumption.

Interestingly, short sales constraints on the two types of assets (safe assets and risky stocks) do not eliminate the portfolio specialization puzzle. When they are binding, short-sales constraints imply zero holdings of both assets. However, the value of relaxing

¹⁶ See Cocco, Gomes and Maenhout (1999), and Haliassos and Michaelides (2001).

each constraint is not the same to the constrained household.¹⁷ The constrained household would prefer to borrow at the riskless rate, rather than to undertake short sales of stock and face a borrowing rate that is both risky and higher in expected value than the riskless rate. As resources expand, the constrained household ceases to be willing to borrow at the risky rate at some threshold resource level, while it is still willing to borrow at the riskless rate. Thus, immediately past that threshold, its holdings of stocks become positive, while its riskless asset holdings remain constrained at zero.¹⁸

Portfolio specialization survives even when various assumptions of the model are relaxed. It is obvious that high risk aversion will not reverse the ranking of constraints. The same is true if the household is misinformed about the actual size of the equity premium (as long as it perceives a premium).

An important exception to this list regards households whose earnings tend to move closely together with stock returns. These usually have lower demand for stocks, because stockholding exacerbates their consumption risk (Heaton and Lucas, 1997). Indeed, when faced with short-sales constraints, they may be pushed to a corner with only safe assets. However, as discussed in section 2.4 above, observed patterns of participation in stockholding among various demographic groups are difficult to reconcile with available empirical evidence on the nature of correlation between stock returns and earnings shocks.¹⁹

¹⁷ Technically, the size of the Lagrange multipliers on the two constraints is not the same.

¹⁸ For a technical discussion of this point, see Haliassos and Michaelides (1999).

¹⁹ Haliassos and Michaelides (1999) also show that it remains optimal for households with positive correlation between their earnings and stock returns to borrow at the (lower) riskless rate than at the (higher expected) risky rate for plausible parameter values when both short-sales constraints are binding. Thus, portfolio specialization in stocks continues to be observed for small savers, unless we are willing to assume very high positive correlation.

5.3. Why do Financial Resources Affect Optimal Portfolio Composition?

The second puzzle arises from the fact that household-level data imply positive effects of income and wealth on the portfolio share of stocks, while existing theoretical models predict that an increase in resources leads to a decrease in the portfolio share invested in stocks. The essence of this theoretical result follows from the discussion of the forces that cause the portfolio specialization puzzle. Starting from asset holding completely specialized in stocks over a range of cash on hand that can be quite substantial, there may be a subsequent range in which the household finds it optimal to include riskless assets in its portfolio and not to rely exclusively on stocks. Effectively, at that point the ratio of current wealth to human wealth has become sufficiently large to induce an optimal portfolio share of stocks between zero and one.

Utilizing the insights in the previous subsection, this point comes when the overall size of financial resources is such that the surrogate holdings of safe assets implied by the lower bounds on future earnings are no longer deemed sufficient in relation to the holdings of stocks. Moreover, at that point the household has accumulated sufficient current resources so as not to be lured by the wealth-generating power of stocks into holding a portfolio specialized in stocks.

5.4. Why does Age Affect Optimal Portfolio Composition?

Theory predicts that, as households age, they should reduce the portfolio share of stocks and increase that of the riskless asset for any given level of resources. This result follows from the effect of aging on the ratio of current assets to human wealth. With aging, the household experiences a reduction in human wealth since the number of remaining

working years diminishes. Thus, for a given level of cash on hand, aging generates an increase in the ratio of current cash on hand to human wealth. This creates an incentive to include safe assets in portfolios previously specialized in stocks, so as to replenish some of the surrogate safe assets that were lost because of the reduction in the number of remaining working years. Moreover, since current assets are larger relative to their human wealth, households feel less of a need to rely on the equity premium for generating future financial wealth.

It is not clear that financial advisors have precisely these mechanisms in mind when they recommend to aging households to move out of stocks and into safer assets. However, these factors can rationalize the concern of financial advisors with the reduced length of horizon facing older households.

5.5. Prospects for Resolving the Portfolio Composition Puzzles

Unlike the puzzle regarding stock market participation, our understanding of the portfolio composition puzzles is quite limited and not much theoretical progress has been made towards resolving them in the brief period since they were uncovered. Consequently, the discussion regarding portfolio composition puzzles can only be tentative and preliminary.

There is some empirical evidence pointing to the conclusion that households pay much more attention to the participation decision than to the choice of portfolio composition. In other words, households appear to care more about investing in the right assets than about choosing an optimal mix of assets, let alone about continually rebalancing their portfolios. The evidence comes in two pieces. First, there is survey evidence, for example in the United States Survey of Consumer Finances, that

households do not rebalance their portfolios often, in particular their stock holdings. Responses in the Survey suggest that most households buy stocks and then refrain from trading stocks for long periods of time.

The second piece of evidence refers to the extent to which households optimize their asset selection and portfolio composition in view of the tax code and changes therein. In this context, James Poterba (2001) observes that households appear more concerned about which assets to hold than about the optimal portfolio mix dictated by the tax system. In some sense, this is even stronger evidence of inertia. Not rebalancing the stock portfolio in response to stock market movements could perhaps be justified by reference to transactions costs that dwarf the return benefits of continual rebalancing and excessive churning. It is more difficult to justify the choice of suboptimal portfolio composition and portfolio inertia when households suffer tax consequences as a result.

The leading explanation for the stockholding participation puzzle is fixed costs of entry and participation in the stock market. Existing research on the minimum cost size that would be sufficient to deter entry assumes that households know about the range of available financial assets, form a perception of participation costs (that need not be objectively accurate), and compare costs to expected benefits of stock market participation. The main finding in this literature is that, if households do know about all available assets, then relatively small costs can deter entry. Recently, survey evidence has emerged (e.g., in the case of Italy) suggesting that a sizeable fraction of households are not even aware of the full range of assets available to them. These information barriers form a more fundamental block to stock market entry, since they prevent households from even contemplating stock investment.

Could fixed costs of entry and participation in the stock market be extended to account for puzzles regarding conditional portfolio shares? Clearly, ignorance of stocks alone cannot account for anything but a zero portfolio share of stocks. However, it is possible that a household has passively acquired stocks, through inheritance or through a company reward scheme, and does not know how to trade this asset or how to figure out its optimal portfolio share given the household's circumstances. In either case, observed portfolio shares of stocks are likely to differ from optimal shares predicted by theory and to be largely insensitive to changes in wealth, income, age, or some other demographics.²⁰ With detailed household-level data, it should be possible to devise empirical tests of the extent to which changes in portfolio shares are attributable to changes in market valuations of already acquired assets rather than conscious rebalancing on the part of households.

Ignorance and cost perceptions of households are not immutably fixed, but can be influenced by information provided through issuers of stock and financial practitioners. Newly privatized companies or companies that want to widen their stockholder base have clear incentives to disseminate information to potential stockholders. So do mutual fund companies that want to advertise the range of funds they run. Whether such supply-side provision of information will be effective in reducing ignorance and perceived costs of participation and of portfolio rebalancing will crucially depend not only on the amount of disseminated information but also on whether households trust this information. In view of the incentives of firms and of mutual fund companies to oversell their stocks or stock

²⁰ The same effect could be observed in less extreme cases of ignorance, namely when households do not themselves know how to rebalance their portfolios but know that they can purchase financial advice or brokerage services (including participation in a mutual fund). High perceived costs of acquiring reliable financial advice or brokerage services could deter portfolio rebalancing, even if these cost perceptions are not accurate.

funds, some government supervision may be necessary to ensure factual accuracy and to promote trust on the part of households.

6. Some conclusions for practitioners

Perhaps the clearest message from household portfolio theory is that fixed costs faced by potential or actual investors represent the key factor in stock market participation or non-participation of households. Such costs are created not only by the fees charged by brokers and mutual funds for entry and for continuing participation, but also by inertia and ignorance about all or different stockholding opportunities. Inertia and ignorance can normally be overcome through financial education programs. Such programs, ranging from mass advertising to tailor-made training workshops, can be instrumental in alerting households to stockholding opportunities and expanding the customer base.

The recent experience in the US and in the UK can yield some useful pointers in this context. The successful privatization experience in the UK suggests that persistent advertising can be quite helpful in encouraging household participation. So does the takeoff in mutual-fund participation in the US in the 1990s, which took place only after about a decade of aggressive mass mailings and other advertising by US mutual funds. Bayer, Bernheim and Scholz (1996) studied the effects of financial education on getting employees to sign up for new types of retirement accounts in the US. They found that employer-sponsored seminars, especially frequent ones, have been much more effective than all other ways of disseminating information. They were unable to detect any effects of written materials, such as newsletters and summary plan descriptions, regardless of frequency.

If entry and participation costs are important deterrents, mutual funds and other institutional investors should also strive to simplify investment procedures and maximize the degree of financial guidance, book-keeping and other services offered to their investors. This will induce households not only to participate in the first place, but also to stay with the fund even when the stock market goes through difficult times and choices become more confusing and riskier, as currently.

Advertising campaigns or simplified procedures can be significantly reinforced by word of mouth. There is some relevant ongoing research on the influence of a household's "reference group" on portfolio behavior (Gollier, 2001c). The idea advanced in this research is that consumption is not only valued on its own, but also in comparison to consumption in the household's reference group. Since portfolio returns are important in influencing consumption, this may induce households to imitate the portfolio behavior of their peers. They will thus be more likely to invest significant amounts in stocks if other households in their reference group invest in the stock market and make gains. From the point of view of practitioners, targeting peer groups may be effective for promoting not only smoking and alcohol consumption but also other dangerous activities such as stockholding.

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