Fight Or Flight? Portfolio Rebalancing By Individual Investors*

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Abstract

This paper investigates the dynamics of individual portfolios in a unique dataset containing the disaggregated wealth and income of all households in Sweden. Between 1999 and 2002, the average share of risky assets in the financial portfolio of participants fell moderately, implying little aggregate rebalancing in response to the decline in risky asset prices during this period. We show that these aggregate patterns conceal strong household-level evidence of active rebalancing, which on average offsets about one half of idiosyncratic passive variations in the risky asset share. Sophisticated households with greater education, wealth, and income, and with better diversified portfolios, tend to rebalance more actively. We find some evidence that households rebalance towards a higher risky share as they become richer. We also study the decisions to enter and exit risky financial markets, and patterns of rebalancing for individual assets. We find that households are more likely to fully sell directly held stocks if those stocks have performed well, and more likely to exit direct stockholding if their stock portfolios have performed well; but these relationships reverse for mutual funds. These results are consistent with previous research on the disposition effect among direct stockholders and performance sensitivity among mutual fund investors. When households continue to hold individual assets, however, they rebalance both stocks and mutual funds to offset about one sixth of the passive variations in individual asset shares.

Keywords: Asset allocation, disposition effect, diversification, participation, portfolio rebalancing.

JEL Classification: D5, D9, E3, O1.

1. Introduction

What drives time series variations in the asset allocation of individual investors? How do households adjust their risk exposure in response to the portfolio returns that they experience? Are household portfolios characterized by inertia or high turnover? Financial theory suggests a wide range of motives for active trading and rebalancing at the household level. Realized returns on financial assets induce mechanical variations in portfolio allocation to which an investor is passively exposed. An investor might fight passive changes by actively rebalancing her portfolio when asset returns are expected to be time-invariant. Changes in perceived investment opportunities, on the other hand, might lead the investor to adopt a flight strategy that would amplify the decline in the share of the worst-performing assets. Furthermore, trading decisions may reflect not only asset allocation objectives, but also a disposition to hold losing and sell winning securities (Shefrin and Statman 1985; Odean 1998).

Equilibrium considerations suggest that aggregate flows from the household sector provide limited and potentially misleading information on individual rebalancing. Consider for instance an economy in which households own all financial assets. If the aggregate value of risky securities falls, the average share of risky assets in household portfolios must necessarily fall as well. Thus, the average individual investor cannot fight aggregate variations in equity returns. When households have heterogeneous portfolios, however, there could still be substantial rebalancing at the individual level. For instance, it is an open question whether households with higher passive losses tend to buy or sell risky assets.

The empirical investigation of household rebalancing therefore requires high-quality and comprehensive micro data. Traditional datasets do not meet these requirements and have unsurprisingly led to conflicting answers on household behavior. Surveys, which have been widely used in the household finance literature, only report the allocation of household financial wealth into broad asset classes (e.g. Bilias, Georgarakos and Haliassos 2005; Brunnermeier and Nagel 2007). They permit the analysis of changes in the share of risky assets in the financial portfolio, but not the computation of active and passive changes. Thus, surveys do not permit us to analyze whether households attempt to offset passive variations in their risky share. Account datasets, such as 401k and brokerage accounts, present a partial view of financial wealth and do not permit the computation of the risky share. Research based on discount brokerage accounts finds evidence of intense trading activity (e.g. Odean 1999; Barber and Odean 2000), while substantial inertia is observed in 401k accounts (e.g. Agnew, Balduzzi and Sunden 2003; Ameriks and Zeldes 2004; Choi, Laibson, Madrian and Metrick 2002, 2004; Madrian and Shea 2001). These seemingly contradictory results may result from a selection bias in account datasets. For example, households may choose a discount broker precisely because they are (over)confident in their ability to process information and intend to engage in high-frequency trading. And households may trade less actively in retirement accounts than in other accounts that they control.

The Swedish dataset used in Calvet Campbell and Sodini (2007a, henceforth "CCS 2007a") allows us to overcome these issues. We assembled data supplied by Statistics Sweden into a panel covering four years (1999-2002) and the entire country (about 4.8 million households). The information available on each resident is systematically compiled by financial institutions and corporations, and includes demographic characteristics, wealth portfolio, and income. The wealth information is highly disaggregated and provides the worldwide assets owned by the resident at the end of a tax year. All financial assets held outside retirement accounts are reported, including bank accounts, mutual funds and stocks. However the database does not report the exact date of a sale nor information on asset purchases.

In CCS (2007a) we found that household portfolios of risky assets have important idiosyncratic exposure, accounting for just over half the variance of return for the median household. While underdiversification causes only modest welfare losses for most of the population ex ante, the realized returns on household portfolios are heterogeneous ex post. In this paper we exploit this cross-sectional variation to analyze the determinants of portfolio rebalancing. The Swedish dataset is well suited for such an investigation because we can compute the risky share of every household and decompose its changes into passive and active components.

The main results of this paper are the following. First, we study the dynamics of the risky asset share among participating households. The equal-weighted share of household financial wealth invested in risky assets fell from 57% in 1999 to 45% in 2002, a decline that implies very weak active rebalancing by the Swedish household sector as a whole in response to the equity bear market of the early 2000's. In striking contrast to this aggregate result, individual households actively rebalanced their portfolios in response to their own returns. Household-level regressions show that on average, active rebalancing compensates about one half of idiosyncratic passive variations in the risky share.

We estimate a partial adjustment model for the risky share, with heterogeneous adjustment speeds, and find that financially sophisticated households holding well diversified portfolios adjust more rapidly towards their target risky share. We also find some evidence that the target risky share increases when households become richer, consistent with theories of declining relative risk aversion, portfolio insurance, or habit formation (Brennan and Schwartz 1988; Campbell and Cochrane 1999; Carroll 2000, 2002; Constantinides 1990; Dybvig 1995).

Second, we study patterns of entry to and exit from risky financial markets. The overall stock market participation rate increased slightly between 1999 and 2002. At the microeconomic level, household demographics influence entry and exit as one would expect: financially sophisticated households, with greater income, wealth, and education, are more likely to enter, and less likely to exit. We are able to go beyond this familiar result to see how portfolio characteristics influence exit decisions. We find that households with initially more aggressive investment strategies are generally less likely to exit, although poorly diversified households and those with extremely high initial risky shares are slightly more likely to exit. If we consider mutual funds and directly held stocks as separate asset classes, we find that households are slightly more likely to exit mutual fund holding when their mutual funds have performed badly, but much more likely to exit direct stockholding when their stocks have performed well.

Third, we explore decisions to adjust positions in individual stocks and mutual funds. We begin by examining decisions to fully sell positions. We find that the return on an individual directly held stock has a strong positive influence on the probability that a household will fully sell the stock, while the return on a mutual fund has a weaker negative influence on the probability of a full sale. The impact of a stock's return on the probability of selling it is weaker for wealthy households with a high share of directly held stocks that have high betas. Next we estimate a model of rebalancing for households that do not fully sell positions. We find that the passive change in the share of a stock or mutual fund in the risky portfolio does explain the active change, but the effect is weaker than we found when we treated all risky assets as a homogeneous asset class. Instead of a rebalancing coefficient of one half, we obtain coefficients of about one sixth which are only slightly greater for stocks than for mutual funds. Thus the asymmetry in household decisions with respect to stocks and mutual funds shows up primarily in full sales rather than in partial rebalancing decisions.

Both our entry and exit results, and our results on full sales, are consistent with two branches of the literature. The disposition effect, that investors hold losing stocks and sell winning stocks, has been documented using account data on direct stockholdings by Odean (1998) and many others. The literature on mutual fund flows, on the other hand, finds evidence of performance chasing by individual investors (Chevalier and Ellison 1997; Frazzini and Lamont 2007; Gruber 1996; Ippolito 1992; Sirri and Tufano 1998; Ivkovic and Weisbenner 2007a). We find similar patterns using different data and a different approach for classifying stocks as losers or winners.

The organization of the paper is as follows. In Section 2 we present some basic facts about the evolution of risk-taking among Swedish households in the period 1999-2002. In Section 3, we assess the magnitude of active rebalancing by decomposing household-level portfolio variations into their passive and active components. In Section 4, we estimate a partial adjustment model of portfolio risk and use it to ask which types of households adjust their portfolios more rapidly. This section also asks whether increases in financial wealth increase households' desired risk exposure. Section 5 explores entry and exit decisions and asset-level rebalancing in relation to the disposition effect, and Section 6 concludes. An Appendix available online (Calvet, Campbell and Sodini 2007b) presents details of data construction and estimation methodology.

2. How Has Risk-Taking Changed Over Time?

2.1. Data Description and Definitions

Swedish households pay taxes on both income and wealth. For this reason, the national Statistics Central Bureau (SCB), also known as Statistics Sweden, has a parliamentary mandate to collect highly detailed information on the finances of every household in the country. We compiled the data supplied by SCB into a panel covering four years (1999-2002) and the entire population of Sweden (about 4.8 million households). The information available on each resident can be grouped into three main categories: demographic characteristics, income, and disaggregated wealth.

Demographic information includes age, gender, marital status, nationality, birthplace, education, and place of residence. The household head is defined as the individual with the highest income. The education variable includes high school and post-high school dummies for the household head.

Income is reported by individual source. For capital income, the database reports the income (interest, dividends) that has been earned on each bank account or each security. For labor income, the database reports gross labor income and business sector.

The panel's distinguishing feature is that it contains highly disaggregated wealth information. We observe the worldwide assets owned by each resident on December 31 of each year, including bank accounts, mutual funds and stocks. The information is provided for each individual account or each security referenced by its International Security Identification Number (ISIN). The database also records contributions made during the year to private pension savings, as well as debt outstanding at year end and interest paid during the year.

We will refer to the following asset classes throughout the paper. Cash consists of bank account balances and money market funds. Stocks refer to direct holdings only. Risky mutual funds are classified as either bond funds or "equity" funds. The latter category is somewhat broad and includes any fund that invests a fraction of its assets in stocks; it therefore includes pure equity, balanced and stock index funds.

A *participant* is a household that owns risky financial assets in its non-retirement wealth. In Table 1A, we report summary statistics on the assets held by participating households. To facilitate international comparisons, we convert all financial quantities into US dollars. Specifically, the Swedish krona traded at $0.1127 at the end of 2002, and this fixed conversion factor is used throughout the paper. The aggregate value of risky holdings declined by about one half during the bear market. Between 1999 and

2002, household stockholdings fell from \$62 to \$30 billion, and fund holdings from \$53 to \$29 billion. Cash, on the other hand, increased from \$49 to \$57 billion over the same period.

In the same panel we also report aggregate statistics on stock and fund holdings compiled by the SCB and by the Swedish mutual fund association, Fondbolagens Förening (FF).[1] The official statistics are incomplete because the SCB does not specifically report the aggregate cash holdings of participants and the FF series only start in 2000. The aggregate estimates obtained with our dataset closely match available official statistics. In the Appendix, we also match quite closely official aggregate statistics on flows into stocks and mutual funds. The aggregate flow into an asset class is generally quite modest and never exceeds a few percentage points of the total household wealth invested in the class. Thus, the strong reduction in aggregate risky holdings reported in Table 1A primarily results from price movements and not from large outflows from the household sector.

Following CCS (2007a), we define the following variables for each household h. The *complete* portfolio contains all the stocks, mutual funds and cash owned by the household. The *risky* portfolio contains stocks and mutual funds but excludes cash. The *risky share* $w_{h,t}$ at date t is the weight of the risky portfolio in the complete portfolio. Since the risky share is model-free, we use it extensively throughout the paper. The household's risky portfolio is also characterized by its standard deviation $\sigma_{h,t}$, and by its systematic exposure $\beta_{h,t}$ and Sharpe ratio $S_{h,t}$ relative to a global equity benchmark, the MSCI World Index. The definition and estimation of these quantities are discussed in the Appendix.

The results presented in this paper are based on households that exist throughout the 1999-2002 period. We impose no constraint on the participation status of these households, but require that they satisfy the following financial requirements at the end of each year. First, disposable income must be strictly positive and the three-year rolling average must be at least 1,000 Swedish kronas (\$113). Second, financial wealth must be no smaller than 3,000 kronas (\$339). For computational convenience, we have selected a random panel of 100,000 households from the filtered population. Unless stated otherwise, all the results in the paper are based on this fixed subsample, and unreported work confirms the strong robustness of the reported estimates to the choice of alternative subsamples.

2.2. Cross-Sectional Dynamics of Participation and Risk-Taking

Household participation in risky asset markets increased from 61% to 65% between 1999 and 2002, as is reported in Table 1B. The inflow is equal to 20% of nonparticipating

[1] These statistics can be downloaded at www.scb.se and www.fondbolagen.se.

households, or about 8% of the entire population. The outflow on the other hand is 7% of participants, or about 4% of the entire household population. These patterns are consistent with the "participation turnover" documented for US data (Hurst, Luoh and Stafford 1998, Vissing-Jorgensen 2002b). In Section 5, we will further investigate the microeconomic and portfolio determinants of entry and exit.

In any year t, we focus on the large group of households that maintain participation in risky asset markets throughout the year. Between 1999 and 2002, the equal-weighted average risky share $w_{h,t}$ of these households fell from 57% to 45% (Table 1B). As illustrated in Figure 1A, this lower mean reflects a downward shift in the cross-sectional distribution of $w_{h,t}$, which is most pronounced in the tails.

The downward shift in the risky share translates into a downward shift in complete portfolio risk. We illustrate in Figure 1B how the standard deviation of the complete portfolio, $w_{h,t}\sigma_{h,t}$, varies with the risky share $w_{h,t}$. The relation is almost linear and has similar slopes in all years. Consistent with this finding, we verify in the Appendix that the standard deviation of the risky portfolio, $\sigma_{h,t}$, has a stable cross-sectional distribution over time and is almost a flat function of the risky share.[2]

These results imply that Swedish households adjust their overall risk exposure primarily by scaling up or down their risky portfolio, passively or actively, rather by altering its composition. This justifies our emphasis on modelling $w_{h,t}$ in the next sections.

3. Passive and Active Rebalancing of the Risky Share

3.1. Decomposition of Risky Shares

The dynamics of household risky shares are partly driven by active trades and partly by returns on risky securities. For instance, the risky share tends to mechanically fall in a severe bear market. For this reason, we now decompose the change in the risky share between year t and year $t+1$, $w_{h,t+1} - w_{h,t}$, into a passive change, driven by the returns on risky assets, and an active change resulting from household rebalancing decisions. This decomposition is empirically meaningful because of the comprehensive individual asset information available in our dataset.

The *passive return* $1 + r_{h,t+1}$ is the proportional change in value of a household's risky portfolio if the household does not trade risky assets during the year. It is easily computed from the initial risky portfolio and asset returns. Let $w^*_{h,j,t}$ denote the share of asset j ($1 \leq j \leq J$) in the risky portfolio. If the investor does not trade between date t and date $t+1$, the risky portfolio value at $t+1$ is its value at t times its gross return $1+r_{h,t+1} = \sum_{j=1}^{J} w^*_{h,j,t}(1+r_{j,t+1})$. We compute returns $r_{j,t+1}$ excluding dividends, as is

[2] Of course, the stability of average $\sigma_{h,t}$ across risky share bins does not imply that all households own the same risky portfolio. We will indeed show in Section 3 that there is substantial heterogeneity in individual portfolio returns.

appropriate if households consume dividends rather than reinvesting them, but we verify in the Appendix that our empirical results are essentially unchanged when dividends are included in returns.

The corresponding *passive risky share* is

$$w^p_{h,t+1} = \omega^p(w_{h,t}; r_{h,t+1}),$$

where

$$\omega^p(w;r) \equiv \frac{w(1+r)}{w(1+r)+(1-w)(1+r_f)}.$$

The *passive change*

$$P_{h,t+1} = w^p_{h,t+1} - w_{h,t}$$

reflects the impact of asset returns on the risky share. It is equal to zero if the investor is initially invested exclusively in cash ($w_{h,t} = 0$) or exclusively in risky assets ($w_{h,t} = 1$). The passive change is a hump-shaped function of the initial share if $r > r_f$, as investors presumably expect, but a U-shaped function of the initial share if $r < r_f$, as in our data from the bear market of 2000–2002.

The *active change* $A_{h,t+1} = w_{h,t+1} - w^p_{h,t+1}$ reflects portfolio rebalancing, i.e. changes that do not mechanically result from realized returns. The total variation in the risky share can then be decomposed as the sum of the active and passive changes:

$$w_{h,t+1} - w_{h,t} = P_{h,t+1} + A_{h,t+1}.$$

We will also use the analogous decomposition in logs:

$$\ln(w_{h,t+1}) - \ln(w_{h,t}) = p_{h,t+1} + a_{h,t+1},$$

where $p_{h,t+1} = \ln(w^p_{h,t+1}) - \ln(w_{h,t})$ and $a_{h,t+1} = \ln(w_{h,t+1}) - \ln(w^p_{h,t+1})$ respectively denote the active and passive changes in logs.

These decompositions treat changes in riskless asset holdings, caused by saving, dissaving, or dividends received on risky assets, as active rebalancing. An alternative approach would be to calculate the passive risky share that would result from household saving or dissaving, assumed to take place through accumulation or decumulation of riskless assets, in the absence of any trades in risky assets. This alternative decomposition is attractive to the extent that households build up and run down their riskless balances for liquidity reasons that are unrelated to their investment policies. We do not pursue this alternative decomposition further here, but in our structural model of active rebalancing we do allow for a white noise error that may capture high-frequency savings effects.

3.2. Rebalancing Regressions

Portfolio variations tend to be strongly affected by the initial risky share. One reason for this is purely mechanical: the total change $w_{h,t+1} - w_{h,t}$ is bounded between $-w_{h,t}$ and $1 - w_{h,t}$ in the presence of short sales and leverage constraints. In addition, there may be behavioral reasons, including sluggish rebalancing and high-frequency variation in riskless balances, why the risky share may be subject to transitory shocks and gradual reversion to a long-term mean.

The scatter plots in Figure 2 illustrate the passive, active and total changes in levels between 2001 and 2002 versus the initial risky share for a subsample of 10,000 households. In panel A, the passive change is a U-shaped function of the initial share, as one expects in a bear market. Panel B reveals that the active change is close to zero for a sizeable group of households, who trade very little or not at all during the year. This observation is consistent with the inertia documented on other datasets. There is, however, considerable heterogeneity, and substantially positive or negative values of the active change are observed for many households. Moreover, the active change appears to decrease with the initial share, which suggests that the risky share tends to revert towards its cross-sectional mean. In panel C, the total change is contained in the band defined by $-w_{h,t}$ and $1 - w_{h,t}$. The U-shaped influence of passive change is apparent, consistent with the inertia of some households. Overall, the scatter plots reveal substantial heterogeneity and strong dependence with respect to the initial risky share $w_{h,t}$.

The effects of passive change and initial portfolio weight on active change are clearly visible when we group households into bins according to their initial portfolio weight, and plot the equal-weighted average within each bin of the total change, the passive change and the active change. Figure 3 shows the results for the entire 2000-2002 period (Panel A) and for each year separately (Panels B to D). Because of the bear market during our sample period, the passive change is a U-shaped function of the initial exposure $w_{h,t}$. Active rebalancing is hump-shaped and overall decreasing with the initial share, which is consistent with both mean reversion in the risky share and a tendency to offset passive changes.

In Table 2, we investigate the household-level relation between active and passive changes in the risky share by estimating in levels and in logs the OLS regression:

$$a_{h,t+1} = \gamma_{0,t+1} + \gamma_1 p_{h,t+1} + \gamma_2(\ln w_{h,t} - \overline{\ln w_{h,t}}) + u_{h,t+1}, \tag{3.1}$$

where $\overline{\ln w_{h,t}}$ denotes the equal-weighted average of the log risky share. We do this both for pooled data, with year fixed effects, and for each separate cross-section. The regressor $(\ln w_{h,t} - \overline{\ln w_{h,t}})$ is included in (3.1) to capture the dependence between the active change and the initial share that was illustrated in Figure 2. We include in the regression only households that participate both in year t and in year $t+1$. This allows us to disentangle inframarginal rebalancing from entry and exit decisions. A fully passive household would be characterized by zero regression coefficients: $\gamma_{0,t+1} = \gamma_1 = \gamma_2 = 0$. The estimates of γ_1 are in fact close to -0.5 in the pooled regressions, and range between -0.8 and -0.4 in yearly cross-sections. Thus we find that households offset about one half of the passive change through active rebalancing. We obtain negative estimates of γ_2, implying that households with a large initial risky share have reduced their risk exposure more aggressively than other investors.

To understand the parameter estimates in Table 2 we now examine a few numerical examples. Consider a household invested in the value-weighted average household portfolio, with an initial share equal to the average equal-weighted share at the end of 2001: $w_{h,t} = 52.3\%$. In 2002, the average household portfolio yields -32.1%, and the household's corresponding passive share is 41.7%. We infer from the pooled regression reported in Table 2A that the predicted active change equals 2.4%.

Now consider an unlucky household with the same initial share but with a realized risky return of -55.1%. Among all participants, the household is in the 5th percentile of the risky return distribution. The corresponding passive change is -20.0% and the predicted active change then equals 7.1%. Alternatively, consider a lucky household with the same initial share but a realized risky return in the 95th percentile ($r_{h,t} = -7.3\%$). The active change is then -1.4%. Agents with returns below the cross-sectional average buy risky assets from agents with higher returns. An agent with an average share and an average return, on the other hand, makes fewer trades. The intuition that extreme agents trade more than average agents is familiar in equilibrium models.[3]

The regression also predicts the effect of the initial share. For instance a household that has an initial share in the 5th percentile ($w_{h,t} = 3.9\%$) and owns the value-weighted average household portfolio would select an active change of 6.2%. Similarly, a household with an initial share in the 95th percentile ($w_{h,t} = 95.5\%$) with an average portfolio would select an active change of -10.8%. Thus, the initial share and the realized return both have substantial quantitative effects on the active change.

In the online appendix (CCS 2007b), we verify the robustness of the rebalancing regressions by classifying households into initial risk share bins and regressing the active change onto the passive change within each bin. The estimate of the slope coefficient γ_1 is again strongly negative in each risky share bin, with a coefficient typically between -0.75 and -0.4. The rebalancing regression are thus strongly robust to various estimation methods.

The bin regressions also reveal that a boundary effect impacts our rebalancing results in the lowest risky share bin, and that this phenomenon is less pronounced in logs than

[3] See Calvet, Gonzalez-Eiras and Sodini (2004) for an example based on idiosyncratic nontradable risk.

in levels. During the bear market, most households with low initial exposure ($w_{h,t} \approx 0$) incur small passive losses in levels, which bring them closer to the short sales constraint $w_{h,t+1} \geq 0$. Such households may substantially increase their risky share, which will be associated with a strongly positive active change. Very negative active changes, on the other hand, are infeasible in levels (but are still in principle feasible in logs). The rebalancing regression in levels is therefore driven by observations with small negative passive and large positive active changes, and produces a very negative slope coefficient γ_1 as a result. The boundary effect is much weaker in logs, and we therefore use a log specification in our subsequent analysis.

In Table 3 we investigate the role of demographic variables by adding observable characteristics to the intercept of (3.1). The set of regressors includes demographic, financial and portfolio characteristics. Because education data are not available for some households, we include a missing education dummy in the set of regressors. The private pension savings rate is defined as the ratio of the yearly voluntary contributions to a private pension scheme divided by the three-year rolling average of disposable income. Using these variables, we run:

$$a_{h,t+1} = \gamma_{0,t+1} + \zeta' x_{h,t} + \gamma_1 p_{h,t+1} + \gamma_2 (\ln w_{h,t} - \overline{\ln w_{h,t}}) + u_{h,t+1}. \tag{3.2}$$

Each characteristic is standardized to have zero cross-sectional mean. We also normalize to unity the cross-sectional standard deviation of each continuous characteristic, so the reported regression coefficient reveals the effect on the rebalancing propensity of a one-standard-deviation change in the characteristic. The regression coefficient of the passive change, γ_1, remains essentially unchanged at around -0.5. The reduction in the risky share is in all years less pronounced for households with higher financial wealth or debt. These households were more willing to maintain their proportional investments in risky assets than were other Swedish households. In unreported regressions, we interact demographic variables with the passive change, but find that the interacted coefficients are generally unstable and insignificant. We address demographic effects on rebalancing behavior in the context of a structural model in the next section.

In the previous analysis, we do not take account of the fact that the managers of balanced funds periodically rebalance their holdings of cash and risky assets to maintain a stable risky share. We have treated balanced funds like any other fund, and in particular have assumed that they have stable characteristics. We anticipate that explicitly controlling for delegated forms of rebalancing in our regressions would strengthen the evidence reported here.

3.3. Robustness Checks

Churning. One might worry that households do not deliberately rebalance the risky share, but instead randomly buy and sell risky assets—that is, churn their portfolios.

Portfolio turnover causes measurement error in the passive share, so churning biases the regression coefficient of the active change on the passive change towards -1. In this case our results tell us who trades actively, but are not informative about deliberate rebalancing. A simple robustness check consists of confining attention to households that do not purchase new risky assets during the year. In other words, we exclude any household that has strictly positive holdings in period $t+1$ of a risky security that it did not own at all in period t. In the Appendix, we report that the corresponding rebalancing propensity is about -0.3, which is weaker than the estimates in Tables 2 and 3 but still substantial. These estimates are conservative, since they exclude households that purchase new assets as part of an active rebalancing strategy. This analysis suggests that churning alone cannot explain the strongly negative estimates of the passive change coefficient reported in our rebalancing regressions.

Automatic Investment Plans. Automatic investment plans are another source of apparent rebalancing. Consider a household that invests a fixed monetary amount in a basket of risky assets every year, and makes no other trades. The active change is then a decreasing function of the risky portfolio's performance, while the passive change increases with performance. Automatic investment schemes can therefore generate a negative correlation between active and passive changes.

Automatic investment plans typically imply the purchase of the same assets every year. We have already found, in our robustness check for churning, that households that purchase no new assets have a weaker rebalancing propensity, suggesting that automatic investment plans cannot be driving our results. Further, a household that only trades automatically will neither buy nor sell assets and will therefore own the same set of assets at the end of years t and $t+1$. We show in the Appendix that such households also have rebalancing propensities that are slightly lower than those reported in Table 2. It is thus very unlikely that automatic investments account for our results.

We complement this analysis with a regression on a simulated dataset of automatic savers. The automatic investment is assumed to be an exogenous percentage s of initial financial wealth. We set s equal to the average ratio in each year of savings to financial wealth for households purchasing no new assets during the year. In the Appendix, we regress the implied active change on the passive change and obtain only modest rebalancing propensities. Results are similar when we set s equal to a constant 3%, close to the time-series average of the yearly s ratios used in our main approach.

Cash Balances. Random fluctuations in cash balances are another concern. In the next section we develop a partial adjustment model that allows high-frequency shocks to affect the target risky share. In the Appendix, we instead use a bootstrap simulation to investigate this issue. Specifically, we assume that households do not rebalance or trade risky assets during the year, and that their cash balances $cb_{h,t}$ follow the process:

$cb_{h,t+1} = R^{cb}_{h,t+1} cb_{h,t}$. The shocks $R^{cb}_{h,t+1}$ are i.i.d. across households, and sampled from the empirical cross-sectional distribution of the growth rates of cash balances. The simulation generates only modest rebalancing propensities, which shows that random fluctuations in cash balances cannot explain the rebalancing results of this section.

4. An Adjustment Model of the Risky Share

4.1. Specification

The regressions of Section 3 have shown that rebalancing is influenced by both the initial share and the passive change. This motivates the development of a model with sluggish adjustment to a desired risky share $w^d_{h,t+1}$. Our approach is based on three main assumptions.

First, the natural log of the observed risky share $w_{h,t+1}$ is a weighted average of the log of the desired share $w^d_{h,t+1}$ and the log of the passive share $w^p_{h,t+1}$:

$$\ln(w_{h,t+1}) = \phi_h \ln(w^d_{h,t+1}) + (1 - \phi_h) \ln(w^p_{h,t+1}) + \varepsilon_{h,t+1}. \tag{4.1}$$

The error $\varepsilon_{h,t+1}$ is assumed to be iid, resulting from measurement error, high-frequency variations in riskless balances, and any other idiosyncratic factors influencing portfolio composition. The coefficient ϕ_h controls the household's speed of adjustment. It can take any real value, but values between zero and one are economically most sensible. If $\phi_h = 1$, the household adjusts instantaneously, and the observed share is equal to the desired share plus an error: $\ln(w_{h,t+1}) = \ln(w^d_{h,t+1}) + \varepsilon_{h,t+1}$. A sluggish household ($\phi_h < 1$), on the other hand, is also sensitive to the passive share.

Second, we assume that the speed of adjustment coefficient ϕ_h is a linear function of observable characteristics:

$$\phi_h = \varphi_0 + \varphi' x_{h,t}, \tag{4.2}$$

where the vector $x_{h,t}$ is independent of the errors $\varepsilon_{h,t}$ and $\varepsilon_{h,t+1}$. This specification captures the empirical relation between speed of adjustment and measures of financial sophistication such as wealth and education.

Third, we specify variations in the desired risky portfolio by

$$\Delta \ln(w^d_{h,t+1}) = \delta_{0,t+1} + \delta' x_{h,t}. \tag{4.3}$$

This equation has a convenient interpretation when the household has constant relative risk aversion γ_h and returns on the risky asset are iid. The optimal risky share is then $w^d_{h,t+1} = S_{h,t+1}/(\gamma_h \sigma_{h,t+1})$, and variations in the log target portfolio, $\Delta \ln(w^d_{h,t+1}) = \Delta \ln(S_{h,t+1}/\sigma_{h,t+1})$, are driven only by perceived variations in investment opportunities and not by risk aversion. Equation (4.3) can then be viewed as expressing changes in perceived investment opportunities as a function of a time-specific intercept and household characteristics. This convenient property does not hold in levels, which supports our choice of a log specification. In practice, many other factors can of course affect the target change, including changes in real estate holdings, human capital, background risk, or net wealth if the agent has decreasing relative risk aversion.

4.2. Estimation

We now turn to the estimation of the adjustment model. In our specification, a household's target share $\ln(w^d_{h,t+1})$ is not observed but its change $\Delta\ln(w^d_{h,t+1})$ is a parametric function of characteristics (4.3). The first step is therefore to difference the portfolio share (4.1):

$$\Delta\ln(w_{h,t+1}) = \phi_h \Delta\ln(w^d_{h,t+1}) + (1-\phi_h)\Delta\ln(w^p_{h,t+1}) + \varepsilon_{h,t+1} - \varepsilon_{h,t}.$$

We then substitute out ϕ_h and $\Delta\ln(w^d_{h,t+1})$, using (4.2) and (4.3), and obtain the reduced-form specification:

$$\begin{aligned}\Delta\ln(w_{h,t+1}) &= a_{t+1} + b_0\Delta\ln(w^p_{h,t+1}) + b'x_{h,t}\Delta\ln(w^p_{h,t+1}) \\ &\quad + c'x_{h,t} + x'_{h,t}Dx_{h,t} + \varepsilon_{h,t+1} - \varepsilon_{h,t}. \end{aligned} \tag{4.4}$$

The reduced-form coefficients easily relate to the parameters of the adjustment model: $a_{t+1} = \varphi_0\delta_{0,t+1}$, $b_0 = 1-\varphi_0$, $b = -\varphi$, $c = \delta\varphi_0 + \delta_{0,t+1}\varphi$, and $D = \varphi\delta'$.

The error term of the reduced-form specification (4.4), $\varepsilon_{h,t+1} - \varepsilon_{h,t}$, follows a first-order moving average process. A high realization of $\varepsilon_{h,t}$ feeds into a high share $w_{h,t}$ and a high passive share $w^p_{h,t+1}$. The error $\varepsilon_{h,t+1} - \varepsilon_{h,t}$ and the regressor $\Delta\ln(w^p_{h,t+1}) = \ln\omega^p(w_{h,t}; r_{h,t+1}) - \ln(w^p_{h,t})$ are negatively correlated. Because of this problem, equation (4.4) cannot be consistently estimated by ordinary least squares (OLS). We handle this by finding a set of instruments that are correlated with the explanatory variables in (4.4) but uncorrelated with the error term. The *period-$t+1$ zero-rebalancing passive change*

$$\ln\omega^p(w^p_{h,t}; r_{h,t+1}) - \ln(w^p_{h,t})$$

is the passive change that would be observed at $t+1$ if the household did not rebalance at t. Because rebalancing is limited, this variable should be positively correlated with the actual change in the passive share. At the same time, if the return $r_{h,t+1}$ is independent of the errors, the period-$t+1$ zero-rebalancing passive change is uncorrelated with $\varepsilon_{h,t}$ and can therefore be used in a set of instruments.

In Table 4, we estimate the structural model for the special case where all households have identical adjustment speed and target change, which corresponds to the restriction

$\varphi = \delta = 0$. The OLS regression of the total change on the passive share change and a time fixed effect

$$\Delta \ln(w_{h,t+1}) = a_{t+1} + b_0 \Delta \ln(w^p_{h,t+1}) + u_{h,t+1}$$

implies a coefficient b_0 of -0.12. The regressor $\Delta \ln(w^p_{h,t+1})$ and the residual $u_{h,t+1}$ are negatively correlated, which implies that the OLS estimate b_0 is in principle negatively biased. Instrumental variables (IV) estimation of this relation confirms this intuition. Specifically, we consider the following set of instruments: an intercept, the log of the passive share, and the zero-rebalancing passive change. The IV estimate b_0 is then 0.36, which is substantially higher than the OLS estimate. The difference is also economically meaningful. The OLS estimate implies an adjustment speed $\varphi_0 = 1 - b_0$ that is larger than unity. The IV procedure, on the other hand, implies a speed $\varphi_0 = 0.64$, which is broadly consistent with the rebalancing regressions in Section 3.

The next step is to estimate the adjustment model with observable characteristics. A new difficulty is that we would like to include the household's financial wealth F_{ht} as one of the explanatory variables. Financial wealth depends on the random cash balance observed at the end of year t, and is therefore correlated with the measurement error $\varepsilon_{h,t}$. A natural solution is to use passive financial wealth $F_{h,t-1}(1 + r^c_{h,t})$, where $1 + r^c_{h,t} \equiv w_{h,t-1}(1 + r_{h,t}) + (1 - w_{h,t-1})(1 + r_f)$ denotes the gross passive return on the complete portfolio. This leads us to define the following set of instruments: 1) an intercept, 2) the period-t log passive share; 3) the period-$t+1$ zero-rebalancing passive change; 4) the period-t passive financial wealth; 5) a vector of characteristics uncorrelated with the measurement error, and 6) the log passive share, zero-rebalancing passive change, passive financial wealth and characteristics interacted with the vector of characteristics.

The corresponding IV estimates are reported in Table 5. To keep the table at a manageable size, we only report the structural vectors φ and δ of the full regression. The average value of the speed parameter is 0.65 and the average log target change is -0.165 in 2002. These numbers are consistent with the rebalancing regressions in Section 3 and imply a modest revision in the target share. The estimates of φ and δ are robust to the inclusion of the interacted term $x'_{h,t} D x_{h,t}$. The speed of adjustment tends to increase with variables associated with financial sophistication, such as education, disposable income, debt, and financial and real estate wealth. Entrepreneurial activity and retirement, on the other hand, tend to reduce the adjustment speed.

We next examine the factors driving changes in the target share. Households with larger financial wealth are less prone to subsequent reductions in the target. Real estate wealth, on the other hand, tends to work in the opposite direction, perhaps because the booming Swedish real estate market reduced the attractiveness of stocks in 2001 and 2002. We also note that household size, age and immigrant status, which are associated with cautious behavior, tend to reduce the target share.

The effect of portfolio characteristics is examined in the next set of two columns. We observe that households with higher Sharpe ratios and higher systematic exposures in their risky portfolios tend to have higher adjustment speeds, and revise downwards more aggressively their target share. More aggressive and efficient investors thus adjust more rapidly to a more variable target share.

Overall, the adjustment model in Table 5 generates reasonable results. More sophisticated households adjust more quickly to their target share, which is more stable for wealthier households. The estimates in Table 5 can be used to compute the predicted speed parameter and target change of every household. The cross-sectional distribution of the speed ϕ_h has a median value of 0.66, a 5th percentile equal to 0.50 and a 95th percentile of 0.78, which seems quite reasonable. Similarly, the target change $\Delta \ln(w^d_{h,t+1})$ has 5th percentile of -28%, a median value of -20% and a 95th percentile of 3%, which again seems quite reasonable in a severe bear market.

4.3. Impact of Wealth Changes on Risk-Taking

In Table 5 we have used slowly evolving demographic and financial variables as household characteristics that may influence portfolio adjustment. We now explore the possibility that portfolio decisions are also affected by high-frequency variation in financial wealth. Several branches of financial theory suggest that an increase in financial wealth might increase the propensity to take risk. In the presence of borrowing constraints, individuals become less risk-averse as they become richer and thus less likely to face a binding constraint in the future. Even in the absence of such frictions, investors with decreasing relative risk aversion tend to hold a higher risky share as their wealth goes up. Carroll (2000, 2002) builds such a utility function, and documents a positive empirical relation between household wealth and the risky share. Models of portfolio insurance (Brennan and Schwartz 1988) and habit formation (Constantinides 1990, Dybvig 1995, Campbell and Cochrane 1999) also imply a positive relation between wealth and the risky share, because richer agents are more willing to take risk as their wealth moves further above the minimum level guaranteed by the portfolio insurance policy or the present value of the future habit.

In the first set of columns of Table 6, we reestimate the adjustment model using the contemporaneous change in financial wealth as the only household characteristic: $\Delta \ln(w^d_{h,t+1}) = \delta_{0,t+1} + \delta \Delta \ln(F_{h,t+1})$ and $\phi_h = \varphi_0 + \varphi \Delta \ln(F_{h,t+1})$. As before, we use passive financial wealth and the zero-rebalancing passive change as instruments. The coefficient δ is significantly positive, which shows that an increase in financial wealth leads to a higher target risky share. An increase in wealth also has a negative impact on the adjustment speed.

In the second set of columns of Table 6, we also include all the household characteristics considered in Table 5; but to save space, we do not report their coefficients which are very close to those already reported in Table 5. An increase in financial wealth again has a significant positive impact on the target change $\Delta \ln(w^d_{h,t+1})$, but it now has an insignificant effect on the adjustment speed.

In a recent study, Brunnermeier and Nagel (2007) assess the empirical relation between wealth and the risky share using US data from the Panel Study of Income Dynamics (PSID). They regress the change in the risky share (in levels) on the change in financial wealth (in logs) and control variables, and obtain a small and slightly negative wealth coefficient. They attribute this result to inertia. When a household saves in the form of cash during the year and only partially rebalances its financial portfolio, its risky share tends to fall mechanically. In the Appendix, we estimate the Brunnermeier-Nagel regression on our Swedish dataset. The OLS estimate of the regression coefficient is slightly negative, consistent with Brunnermeier and Nagel's finding; but it becomes positive when we estimate the regression by instrumental variables. Similarly, we find a positive relation between the change in the risky share and the *lagged* change in financial wealth. Thus, controlling for endogeneity problems and household inertia allows us to uncover evidence for a positive link between wealth changes and risk-taking.

4.4. Connection with Rebalancing Regressions

The adjustment model of this section is intimately related to the rebalancing regressions we estimated in section 3. When the adjustment speed ϕ is constant across the population, the adjustment model implies:

$$a_{h,t+1} = \phi\delta_{0,t+1} + \phi\delta' x_{h,t} - \phi p_{h,t+1} - \phi(\ln w_{h,t} - \ln w^d_{h,t}) + \varepsilon_{h,t+1}, \tag{4.5}$$

which is analogous but not exactly identical to the rebalancing regression with characteristics (3.2). The apparent similarity suggests that the adjustment speed should be close to the regression coefficients reported in Table 2B; this prediction holds in our empirical results since the median speed ϕ_h and the linear regression coefficient $-\gamma_1$ are both about one half. The distance to the target, $\ln w_{h,t} - \ln w^d_{h,t}$, represents the only difference between (3.2) and (4.5). We can therefore view (3.2) as a reduced-form specification in which all households have the same speed of adjustment and the distance to the target, $\ln w_{h,t} - \ln w^d_{h,t}$, is proxied by a rescaled distance to the cross-sectional mean, $\lambda(\ln w_{h,t} - \overline{\ln w_{h,t}})$.

We show in the Appendix that the model with heterogeneous adjustment speeds leads to additional terms in the rebalancing regressions. Section 4 thus improves on the earlier specifications by: (1) providing more precise micro foundations; (2) correctly estimating the structural parameters even though the target is unobserved; and (3) allowing for heterogeneity in the adjustment speed.

5. Disposition Effect and Asset-Level Rebalancing

We now turn our attention to participation decisions and rebalancing at the individual asset level, and their relation to the disposition effect. The disposition effect is usually defined as a tendency to realize gains and hold on to losses, where gains and losses are measured relative to the asset's purchase price. The disposition effect was identified by Shefrin and Statman (1985) and has been widely documented (e.g. Odean 1998).

The Swedish dataset unfortunately does not provide the date and price of asset trades. For this reason, we use the asset's return during the year as an alternative measure of performance. This implies that we are assessing the robustness of the disposition effect to this alternative benchmark. The Swedish dataset also allows us to analyze the impact of other portfolio characteristics, such as the Sharpe ratio or the performance of the household's other risky assets, as well as demographic and financial characteristics.

5.1. Entry and Exit at the Risky Portfolio and Asset Class Levels

We begin by investigating the probability that a household enters and exits risky asset markets. In Table 7, we run pooled probit regressions of the form $y_{h,t} = \Phi(x'_{h,t}\gamma + \gamma_{0,t})$, where $y_{h,t}$ denotes the participation status, $x_{h,t}$ is the vector of characteristics, and $\gamma_{0,t}$ is a time-dependent intercept. The time interval is annual, and we pool data from 2000, 2001, and 2002.

In the first two columns, we analyze the probability that a nonparticipant in year t holds risky assets in year $t+1$. The probability of entry increases with standard measures of financial sophistication such as education, financial and real estate wealth, and the private pension savings rate. Conversely, the exit probability decreases with variables associated with investor sophistication, as shown in the middle columns of Table 7. The entry and exit regressions are thus remarkably symmetric. Household characteristics that predict participation in a cross-section (e.g. Guiso, Haliassos, and Jappelli 2002, CCS 2007a) also help to explain entry and exit in the panel.

In the last two columns of Table 7, we investigate how the exit probability is affected by portfolio characteristics. The exit probability generally decreases with the initial risky share. More aggressive agents have higher risk-tolerance and are less likely to entirely give up the benefits of financial market participation. A complementary explanation is that households sluggishly adjust their portfolios, as in Section 4; more aggressive investors are then more reluctant to dispose of all their risky assets.

The exit probability, however, increases with extreme risk-taking, as measured by a dummy equal to unity if the risky share exceeds ninety five percent. Extreme risk-takers presumably have limited understanding of financial risk and may be prone to panic selling in a bear market. A household is also more likely to exit if it is severely undiversified (low Sharpe ratio $S_{h,t}$), or if its risky portfolio has performed badly during the year.

These findings are consistent with the theme of CCS (2007a) that nonparticipants are likely to be among the least efficient investors. Investors may be out of risky financial markets because their portfolios have been down in the past.

We investigate in Table 8 the separate roles of direct stock and mutual fund holdings, and the effect of their performance on exit decisions. We consider the same explanatory variables as in Table 7, as well as the following characteristics of each asset class in the household portfolio: its share of financial wealth, beta, Sharpe ratio and most notably its performance during the year. These variables are used to explain the probability that a participating household disposes of all its risky assets (first two columns), all its mutual funds (next two columns) or all its direct stockholdings (last columns).

The probability of exiting risky asset markets decreases with the share and Sharpe ratio of the risky and mutual fund portfolios. The impact of the mutual fund share is higher than the share of direct stockholdings. The exit probability *decreases* with the return on the mutual fund portfolio, but *increases* with the return on direct stockholdings. This finding and similar results in the next two sets of columns are consistent with the disposition effect on direct stockholdings: the owner of a winning stock portfolio is more likely to sell it and leave financial markets. The disposition effect does not arise, however, with mutual funds, since the owner of a winning mutual fund portfolio is less likely to liquidate it. This finding on sales is consistent with the literature on performance-sensitivity of mutual fund holdings (Chevalier and Ellison 1997; Frazzini and Lamont 2007; Gruber 1996; Ippolito 1992; Sirri and Tufano 1998; Ivkovic and Weisbenner 2007a).

5.2. Dynamics of Individual Asset Shares

We now investigate how a household adjusts during year $t+1$ the asset positions that it holds at the end of year t. Since exit decisions have been addressed in Section 5.1, we consider only households that own risky assets in both years. Also, we confine attention to assets which are held at the end of year t and do not attempt to model household decisions to purchase new assets.

A household owning a stock at the end of 2000 had, by the end of 2001, partially sold it with probability 27%, fully sold it with probability 16%, held on to it with probability 22%, and bought additional units of the same stock with probability 35%. Partial sales and partial purchases are thus more frequent than full sales or continued holdings. As reported in the Appendix, this property holds in all years and is even more pronounced for mutual funds: the probability of a fund's full sale is less than 10% while the probability of a partial purchase is about 60%. The large probability of partial purchases for funds originates from the dividend reinvestment plans offered by most investment companies. Even though full sales are a relatively limited phenomenon, we begin by studying them separately given their importance in the disposition effect literature.

Full Sales. In Table 9, we analyze the probability that a household owning a risky asset j at date t has fully disposed of it by the end of year $t+1$. The regression distinguishes between stocks and funds, and includes demographic variables both directly and interacted with the return on an asset during the year.[4] For both stocks and funds, the probability of fully selling an asset diminishes with its initial share in the portfolio. The probability of fully selling a stock is higher if the stock performs well during the year, as predicted by the disposition effect; but the probability of fully selling a mutual fund decreases with its performance.

The return on other stocks is also relevant for the decision to fully sell a stock. Given a stock's own performance, it is less likely to be fully sold if other stocks in the portfolio have done well, suggesting that relative performance of a stock influences the sales decision. The interacted coefficients show that the tendency to sell winning stocks is weaker for households with high financial wealth or debt that are heavily invested in stocks with high betas. That is, more sophisticated and aggressive households, with larger portfolios of directly held stocks, appear to be less prone to the disposition effect.

Partial Sales, Continued Holdings and Partial Purchases. We have shown in previous sections that households fight idiosyncratic passive variations in the risky share. We now investigate whether they also rebalance individual security positions in the risky portfolio. The analysis excludes full sales, but considers partial sales, continued holdings and partial purchases. In the Appendix, we check that the evidence of asset-level rebalancing is even stronger when we include full sales.

For every household h, we consider the following definitions: $w^*_{h,j,t}$ is the share of asset j in the risky portfolio at the end of period t; $r_{h,t+1}$ is the net return on the risky portfolio between t and $t+1$; $r_{j,t+1}$ is the net return on asset j; and $r_{h,-j,t+1}$ is the return on the portfolio of risky assets other than j held by household h. We also call $r_{j,t+1} - r_{h,-j,t+1}$ the *relative performance* of asset j.

If the household does not trade risky assets in the next period, the asset's *passive share* at the end of $t+1$ is:

$$w^{*p}_{h,j,t+1} = w^*_{h,j,t} \frac{1 + r_{j,t+1}}{1 + r_{h,t+1}}.$$

Let $A^*_{h,j,t+1} = w^*_{h,j,t+1} - w^{*,p}_{h,j,t+1}$ and $P^*_{h,j,t+1} = w^{*,p}_{h,j,t+1} - w^*_{h,j,t}$ denote the corresponding active and passive changes in levels, and $a^*_{h,j,t+1}$ and $p^*_{h,j,t+1}$ their equivalents in logs.

[4] In Table 8, we assign a value of zero to the characteristic of an asset class if the household has no investments in this class. A similar convention is used in the remainder of the section.

We verify in the Appendix that the passive change in levels is a U-shaped function of the initial share if asset j outperforms other assets in the risky portfolio ($r_{j,t+1} > r_{h,-j,t+1}$), and is hump-shaped otherwise. In contrast, the passive change in logs,

$$p^*_{h,j,t+1} = \ln\left(\frac{1 + r_{j,t+1}}{1 + r_{h,t+1}}\right) \approx (1 - w^*_{h,j,t})(r_{j,t+1} - r_{h,-j,t+1}), \tag{5.1}$$

increases with the asset's performance and decreases with the performance of other assets.

The empirical relation between the active change and asset performance is investigated nonparametrically in the Appendix. We classify observations into bins of the initial risky share $w^*_{h,j,t}$ and asset class c (stock or fund), and regress in each bin the active change in levels on the asset's relative performance $r_{j,t+1} - r_{h,-j,t+1}$. The bin-specific intercepts are decreasing and approximately linear in the initial share $w^*_{h,j,t}$. The relative performance coefficients are negative in each bin, as one would expect if households rebalance at the asset level. A striking pattern is that the performance coefficient is U-shaped in the initial share, which suggests that the active change is chosen to offset the passive change. Consistent with this, when we allow separate bin-specific coefficients on the own return $r_{j,t+1}$ and the return of other assets in the risky portfolio $r_{h,-j,t+1}$, we find a U-shaped pattern for the own return coefficients, particularly for directly held stocks, and a hump-shaped pattern for the other-asset return coefficients. We perform a similar analysis for the active change in logs and obtain results that are broadly consistent with (5.1).

These findings motivate the construction of a simpler parametric specification. In the first two columns of Table 10, we regress the log active change $a^*_{h,j,t}$ on the asset's performance and its initial share using separate coefficients for each asset class. Consistent with our earlier results, performance tends to strongly reduce the active change of stocks; households tend to sell winning stocks. The active change for funds is also negatively affected by performance, but the effect is substantially weaker for funds than for stocks. In addition, the active change tends to be negatively affected by the share of the asset in the risky portfolio.

In the next set of columns, we add the effect of the performance of other assets in the portfolio. The performance of other assets increases the active change, and the corresponding regression coefficient is almost identical for stocks and funds. A household tends to buy asset j if other risky securities in the portfolio have done well. The own return and the initial share coefficients remain negative and close to the previous estimates. Like the nonparametric results, these findings suggest that households do rebalance individual asset holdings. Rebalancing can explain why the active change is negatively affected by own performance, but positively affected by the performance of other assets in the portfolio. Furthermore, sluggishness in rebalancing is a possible explanation for the negative relation between the active change and the initial risky share, as discussed in Section 4.3.

These results lead us to estimate a rebalancing model for individual assets. In the last two columns of Table 10, we regress the log active change on the initial share and the log passive change:

$$a^*_{h,j,t+1} = \sum_c \left(\rho_{c,t} + \varphi_c w^*_{h,j,t} + \gamma_c p^*_{h,j,t+1}\right) 1_{h,j,t}(c) + \varepsilon_{h,j,t+1}. \tag{5.2}$$

The reported R^2, 6.21%, is slightly higher than the R^2 of the regression on own performance and other asset's performance. Since $p_{h,j,t+1} \approx (1 - w^*_{h,j,t})(r_{j,t} - r_{h,-j,t+1})$ from (5.1), the higher R^2 coefficient in (5.2) shows that the interaction between the initial share and returns helps to explain the log active change.[5]

The rebalancing coefficient γ_c is only slightly more negative for stocks than for funds, and approximately equal to one sixth. Thus, when we focus on partial sales, the rebalancing coefficient is roughly constant across funds and stocks. At first sight this may appear strange since the performance coefficients we estimated in the first two specifications in Table 10 are much smaller for funds than for stocks. The explanation is that the average mutual fund has a higher portfolio share than the average directly held stock, so (5.1) implies that a given performance $r_{j,t}$ generates a smaller log passive change for a mutual fund than for a stock. Similar rebalancing coefficients for stocks and funds therefore imply a smaller performance effect for stocks than for funds, as is reported in the first two columns of Table 10. This illustrates the benefits of considering the passive change and not simply performance in an analysis of rebalancing.

The interpretation of Table 10 is complicated by the ambiguous predictions of financial theory. In a mean-variance portfolio choice problem with constant investment opportunities, the optimal weights of individual assets in the risky portfolio are time-invariant, which implies complete rebalancing with $A^*_{h,j,t+1} = -P^*_{h,j,t+1}$; but partial rebalancing might be justified by a variety of factors such as changes in risk and return expectations, taxes, transactions costs, or Bayesian updating of beliefs about mutual fund management. In the Appendix, we ask how the propensity to rebalance individual assets varies with household and portfolio characteristics, but do not find any strong effects.

In this section we have shown that households are more likely to fully sell a stock (but not a mutual fund) when it has performed well, particularly in relation to other directly held stocks. This finding is consistent with the literature on the disposition effect. If a household continues to own a stock or mutual fund, however, its behavior is

[5] The analysis in levels yields very similar conclusions. Furthermore when full sales are included in the regression, the estimated R^2 is higher and the rebalancing coefficient γ_c more negative, which stems from the fact that full sales satisfy the exact relation $A^*_{h,j,t+1} = -w^*_{h,j,t} - P^*_{h,j,t+1}$

well described by a rebalancing model with a rebalancing coefficient of about one sixth, and the rebalancing propensity is almost the same for stocks and for mutual funds.

6. Conclusion

The burgeoning field of household finance asks how households manage their financial affairs, and whether they act in a way that is consistent with the normative literature on portfolio choice. Our previous paper (CCS 2007a) studied household diversification at a point in time, while this paper looks at changes in household behavior over time, specifically decisions to scale up or down the share of risky assets in the total portfolio, to enter or exit risky financial markets, and to scale up or down the share of individual assets in the risky portfolio. These decisions are important in themselves, and are also particularly revealing because households rarely delegate these decisions to financial intermediaries.

Although other papers have looked at the dynamics of household risk-taking, our dataset gives us the unique ability to relate household decisions to the properties of the initial portfolio. When studying movements in the risky asset share, we find that households overall have a surprisingly large propensity to rebalance, offsetting about half the passive changes in the risky share with active changes.

We can identify the propensity to rebalance, distinguishing it from mean-reversion in the risky share and aggregate shifts in the desired risky share, because households have heterogeneous portfolios which generate cross-sectional variation in passive changes in the risky share. This implies that households can rebalance actively even in a closed economy general equilibrium; households with lower than average returns can buy stocks from households with higher than average returns. The microeconomic nature of our results means that we have little to say about rebalancing by the Swedish household sector as a whole in response to aggregate shocks, but such rebalancing appears to be quite limited in our short dataset.

We find that more educated and wealthier households, holding better diversified portfolios, tend to rebalance more actively. Wealthier households also reduced their target risky shares less during the bear market of the early 2000's. Campbell (2006) and CCS (2007a) have reported that educated, better off households typically conform more closely to the predictions of standard finance theory. Rebalancing behavior is yet another example of this phenomenon.

Some financial theories imply that as a household becomes richer, its target risky share should increase. This will be the case, for example, if households have declining risk aversion, follow portfolio insurance policies, or derive utility from consumption that is surplus to a slowly evolving habit level. We find evidence consistent with this view once we control for sluggish portfolio adjustment.

Our results on decisions to exit risky financial markets and to fully sell individual risky positions are intriguingly consistent with previous research on the disposition effect among stockholders and performance sensitivity among mutual fund investors. We find that high returns on a directly held stock portfolio increase the probability that a household will exit direct stockholding, whereas high returns on a mutual fund portfolio slightly reduce the probability that a household will sell all its mutual funds. At the level of individual assets, a household is considerably more likely to fully sell a stock if it has performed well, and slightly less likely to fully sell a mutual fund if it has performed well. One possible explanation for these patterns is that individual investors buy stocks that they perceive to be undervalued, and maintain fixed beliefs about fundamental value in the face of market price movements; but they buy mutual funds that they perceive to be well managed, and update their beliefs about manager skill in response to mutual fund performance.

We note however that this asymmetry disappears when households adjust the shares of individual risky assets within their risky portfolios, without fully selling them. A model of rebalancing for assets that households continue to own is close to symmetric, and we find that households actively offset about one sixth of the passive changes in individual asset shares caused by individual asset performance.

References

[1] Agnew, J., P. Balduzzi and A. Sunden, 2003, Portfolio choice and trading in a large 401(k) plan, *American Economic Review* 93(1), 193–215.

[2] Ameriks, John, and Stephen Zeldes, 2004, How do household portfolio shares vary with age?, working paper, Columbia University.

[3] Banks, James, Richard Blundell, and James P. Smith, 2005, Wealth portfolios in the United Kingdom and the United States, in David A. Wise ed. *Perspectives on the Economics of Aging* (University of Chicago Press, Chicago, IL).

[4] Barber, Brad M., and Terrance Odean, 2000, Trading is hazardous to your wealth: The common stock investment performance of individual investors, *Journal of Finance* 55, 773–806.

[5] Barber, Brad M., and Terrance Odean, 2001, Boys will be boys: gender, overconfidence, and common stock investment, *Quarterly Journal of Economics* 116, 261–292.

[6] Barberis, Nicholas, and Richard Thaler, 2003, A survey of behavioral finance, in George Constantinides, Milton Harris and René Stulz eds., *Handbook of the Economics of Finance*, Elsevier.

[7] Benartzi, Shlomo, and Richard Thaler, 2001, Naive diversification strategies in defined contribution saving plans, *American Economic Review* 91, 79–98.

[8] Bergstresser, Daniel, and James Poterba, 2004, Asset allocation and asset location: Household evidence from the Survey of Consumer Finances, *Journal of Public Economics* 88, 1893–1915.

[9] Bertaut, Carol, and Martha Starr-McCluer, 2002, Household portfolios in the United States, in Luigi Guiso, Michael Haliassos and Tullio Jappelli eds. *Household Portfolios*, MIT Press, Cambridge, MA.

[10] Bilias, Yannis, Dimitris Georgarakos and Michael Haliassos, 2005, Portfolio inertia and stock market fluctuations, working paper.

[11] Black, Fischer (1972), Capital Market Equilibrium with Restricted Borrowing, *Journal of Business* 45, 444-454.

[12] Blume, Marshall, and Irwin Friend, 1975, The asset structure of individual portfolios and some implications for utility functions, *Journal of Finance* 30, 585–603.

[13] Blume, Marshall, and Irwin Friend, 1978, *The Changing Role of the Individual Investor*, John Wiley, New York, NY.

[14] Bodie, Zvi, and Dwight Crane, 1997, Personal investing: Advice, theory and evidence, *Financial Analysts Journal* 53 (6), 13–23.

[15] Brennan, Michael, and Eduardo Schwartz, 1988, Time invariant portfolio insurance strategies, *Journal of Finance* 43, 283–299.

[16] Brunnermeier, Markus, and Stefan Nagel, 2007, Do wealth fluctuations generate time-varying risk aversion? Micro-evidence on individuals' asset allocation, forthcoming *American Economic Review*.

[17] Calvet, Laurent E., John Y. Campbell and Paolo Sodini, 2007a, Down or out: Assessing the welfare costs of household investment mistakes, forthcoming *Journal of Political Economy*.

[18] Calvet, Laurent E., John Y. Campbell and Paolo Sodini, 2007b, Appendix to Fight or flight? Portfolio rebalancing by individual investors, available online at http://kuznets.fas.harvard.edu/~campbell/papers.html.

[19] Calvet, Laurent E., Martín Gonzalez-Eiras and Paolo Sodini, 2004, Financial innovation, market participation and asset prices, *Journal of Financial and Quantitative Analysis* 39, 431–459.

[20] Campbell, John Y., 2006, Household finance, *Journal of Finance* 61, 1553–1604.

[21] Campbell, John Y., and John Cochrane, 1999, By force of habit: A consumption based explanation of aggregate stock market behavior, *Journal of Political Economy* 107, 205-251.

[22] Carroll, Christopher D., 2000, Why do the rich save so much?, in J.B. Slemrod ed. *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, Harvard University Press, Cambridge, MA.

[23] Carroll, Christopher D., 2002, Portfolios of the rich, in Luigi Guiso, Michael Haliassos and Tullio Jappelli eds. *Household Portfolios*, MIT Press, Cambridge, MA.

[24] Chevalier, Judith, and Glenn Ellison, 1997, Risk taking by mutual funds as a response to incentives, *Journal of Political Economy* 105, 1167-2000.

[25] Choi, James J., David Laibson, Brigitte Madrian, and Andrew Metrick, 2002, Defined contribution pensions: Plan rules, participant decisions, and the path of least resistance, in James Poterba ed. *Tax Policy and the Economy* 16, 67–113.

[26] Choi, James J., David Laibson, Brigitte Madrian, and Andrew Metrick, 2004, For better or for worse: Default effects and 401(k) savings behavior, in David Wise ed. *Perspectives on the Economics of Aging*, University of Chicago Press.

[27] Constantinides, George M., Habit formation: A resolution of the equity premium puzzle, *Journal of Political Economy* 98, 519–543.

[28] Dybvig, Philip H., 1995, Duesenberry's ratcheting of consumption: Optimal dynamic consumption and investment policies given intolerance for any decline in standard of living, *Review of Economic Studies* 62, 287–313.

[29] Fama, Eugene, and Kenneth French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

[30] Flavin, Marjorie, and Takashi Yamashita, 2002, Owner-occupied housing and the composition of the household portfolio, *American Economic Review* 92 (1), 345-362.

[31] Frazzini, Andrea, and Owen Lamont, 2007, Dumb money: Mutual fund flows and the cross-section of stock returns, forthcoming *Journal of Financial Economics*.

[32] Goetzmann, William N., and Alok Kumar, 2004, Why do individual investors hold under-diversified portfolios?, working paper, Yale University and University of Texas.

[33] Graham, John R., Campbell R. Harvey, and Hai Huang, 2006, Investor competence, trading frequency, and home bias, NBER working paper 11426.

[34] Gruber, Martin, 1996, Another puzzle: The growth in actively managed mutual funds, *Journal of Finance* 51, 783-810.

[35] Guiso, Luigi, Michael Haliassos, and Tullio Japelli, 2002, *Household Portfolios*, MIT Press.

[36] Haliassos, Michael, and Carol Bertaut, 1995, Why do so few hold stocks?, *Economic Journal*, 105, 1110-1129.

[37] Heaton, John, and Deborah Lucas, 2000, Portfolio choice and asset prices: The importance of entrepreneurial risk, *Journal of Finance* 55, 1163-1198.

[38] Huberman, Gur, 2001, Familiarity breeds investment, *Review of Financial Studies* 14, 659-680.

[39] Hurst, Erik, Ming Ching Luoh, and Frank Stafford, 1998, The wealth dynamics of American families, 1984-94, *Brookings Papers on Economic Activity* 1998 (1), 267-329.

[40] Ippolito, Richard, 1992, Consumer reaction to measures of poor quality: Evidence from the mutual fund industry, *Journal of Law and Economics* 35, 45-70.

[41] Ivković, Zoran, and Scott Weisbenner, 2005, Local does as local is: information content of the geography of individual investors' common stock investments, *Journal of Finance* 60, 267-306.

[42] Ivković, Zoran, and Scott Weisbenner, 2007a, "Old" money matters: the sensitivity of mutual fund redemption decisions to past performance, working paper, University of Illinois.

[43] Ivković, Zoran, Clemens Sialm, and Scott Weisbenner, 2007b, Portfolio concentration and the performance of individual investors, forthcoming *Journal of Financial and Quantitative Analysis.*

[44] Juster, Thomas, James Smith, and Frank Stafford, 1999, The measurement and structure of household wealth, *Labor Economics* 6, 253—275.

[45] Kelly, Morgan, 1995, All their eggs in one basket: Portfolio diversification of US households, *Journal of Economic Behavior and Organization* 27, 87–96.

[46] King, Mervyn A., and Jonathan I. Leape, 1987, Asset accumulation, information and the life cycle, NBER Working Paper 2392.

[47] King, Mervyn A., and Jonathan I. Leape, 1998, Wealth and portfolio composition: Theory and evidence, *Journal of Public Economics* 69, 155–193.

[48] Kopczuk, Wojciech, and Emmanuel Saez, 2004, Top wealth shares in the United States, 1916–2000: evidence from estate tax returns, NBER working paper 10399.

[49] Madrian, Brigitte and Dennis Shea, 2001, The power of suggestion: Inertia in 401(k) participation and savings behavior, *Quarterly Journal of Economics* 66, 1149–1188.

[50] Massa, Massimo, and Andrei Simonov, 2006, Hedging, familiarity and portfolio choice, *Review of Financial Studies* 19, 633-685.

[51] Odean, Terrance, 1998, Are investors reluctant to realize their losses?, *Journal of Finance* 53, 1775–1798.

[52] Odean, Terrance, 1999, Do investors trade too much?, *American Economic Review* 89, 1279–1298.

[53] Poterba, James, and Andrew Samwick, 2001, Portfolio allocation over the life cycle, in Seiritsu Ogura, Toshiaki Tachibanaki, and David Wise eds. *Aging Issues in the United States and Japan*, University of Chicago Press.

[54] Schlarbaum, Gary G., Ronald C. Lease, and Wilbur G. Lewellen, 1978, The common-stock-portfolio performance record of individual investors: 1964–1970, *Journal of Finance* 33, 429–441.

[55] Shefrin, Hersh, and Meir Statman, 1985, The disposition to sell winners too early and ride losers too long: Theory and evidence, *Journal of Finance* 40, 777–782.

[56] Shiller, Robert, 2000, Human behavior and the efficiency of the financial system, in John B. Taylor and Michael Woodford eds., *Handbook of Macroeconomics*, North-Holland.

[57] Sinai, Todd and Nicholas Souleles, 2005, Owner-occupied housing as a hedge against rent risk, *Quarterly Journal of Economics* 120, 763–789.

[58] Sirri, Erik, and Peter Tufano, 1998, Costly search and mutual fund flows, *Journal of Finance* 53, 1589-1622.

[59] Swedish Tax Agency, *Taxes in Sweden 2004*. Available from the Agency's website, www.skatteverket.se.

[60] Tracy, Joseph, Henry Schneider, and Sewin Chan, 1999, Are stocks overtaking real estate in household portfolios?, *Current Issues in Economics and Finance* 5:5, Federal Reserve Bank of New York.

[61] Tracy, Joseph, and Henry Schneider, 2001, Stocks in the household portfolio: A look back at the 1990s, *Current Issues in Economics and Finance* 7:4, Federal Reserve Bank of New York.

[62] Vissing-Jorgensen, Annette, 2002*a*, Limited asset market participation and the elasticity of intertemporal substitution, *Journal of Political Economy* 100, 825–853.

[63] Vissing-Jorgensen, Annette, 2002*b*, Towards an explanation of household portfolio choice heterogeneity: Nonfinancial income and participation cost structures, NBER Working Paper 8884.

[64] Vissing-Jorgensen, Annette, 2003, Perspectives on behavioral finance: does "irrationality" disappear with wealth? Evidence from expectations and actions, in Mark Gertler and Kenneth Rogoff eds. *NBER Macroeconomics Annual 2003* (MIT Press, Cambridge, MA).

[65] Wermers, Russ, 2000, Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses, *Journal of Finance* 55, 1655–1695.

[66] Zhu, Ning, 2002, The local bias of individual investors, unpublished paper, Yale University.

TABLE 1. SUMMARY STATISTICS

A. Aggregate Holdings of Participants (Billion Dollars)

	1999		2000		2001		2002	
	Data	Official	Data	Official	Data	Official	Data	Official
Stocks	61.7	64.3	54.6	54.6	45.3	47.1	29.8	32.2
Risky funds:	53.4		50.4	52.7	44.0	45.4	29.4	29.5
° *Equity funds*	*49.5*		*46.6*	*48.8*	*39.7*	*40.9*	*24.8*	*25.2*
° *Bond funds*	*3.9*		*3.8*	*3.9*	*4.3*	*4.5*	*4.5*	*4.3*
Cash	48.7		47.5		54.3		56.7	
Total financial wealth	163.9		152.5		143.7		115.9	

B. Participation and Average Risky Share

	1999	**2000**	**2001**	**2002**
Rate of participation	61.5%	66.3%	65.9%	64.8%
Average risky share (equal weighted)	56.5%	56.6%	52.3%	45.2%
Average risky share (wealth weighted)	74.9%	73.7%	66.1%	54.7%

C. Asset Returns

	1999	**2000**	**2001**	**2002**
Interest rate	3.1%	3.9%	4.1%	4.1%
MSCI Sweden index	79.2%	-18.0%	-26.8%	-48.6%
Pooled index (equal weighted)	NA	-4.3%	-11.1%	-32.1%
Pooled index (value weighted)	NA	-6.1%	-11.6%	-32.2%
MSCI World index (in Swedish Krona)	27.2%	-7.1%	-11.3%	-37.9%
MSCI World index (in US dollars)	19.0%	-18.5%	-20.7%	-22.4%

Notes: The table reports summary statistics of aggregate holdings (panel A), participation rates and the risky share (panel B) and asset returns (panel C). Panel A also includes the official statistics reported by Statistics Sweden (stocks) and Fondbolagens Förening (funds) when they are available.

TABLE 2. REGRESSION OF ACTIVE CHANGE ON PASSIVE CHANGE

A. In Levels

	All years		2000		2001		2002	
	Estimate	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Passive change	-0.504	-53.10	-0.640	-27.90	-0.608	-28.70	-0.443	-35.50
Initial share (demeaned)	-0.186	-144.00	-0.194	-88.10	-0.176	-82.40	-0.189	-78.70
Intercept			0.026	33.40	-0.030	-34.10	-0.022	-18.20
1999 dummy	0.028	40.40						
2000 dummy	-0.027	-38.10						
2001 dummy	-0.027	-26.70						
Adjusted R^2	0.12		0.12		0.10		0.10	
Number of observations	187,780		60,341		64,119		63,320	

B. In Logs

	All years		2000		2001		2002	
	Estimate	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Passive change in logs	-0.442	-45.40	-0.745	-35.80	-0.534	-24.30	-0.423	-30.40
Log of risky share (demeaned)	-0.199	-137.00	-0.275	-123.00	-0.152	-62.90	-0.161	-56.40
Intercept			0.098	37.50	-0.067	-22.50	-0.066	-15.00
1999 dummy	0.112	42.80						
2000 dummy	-0.060	-22.70						
2001 dummy	-0.071	-20.30						
Adjusted R^2	0.14		0.24		0.09		0.10	
Number of observations	187,780		60,341		64,119		63,320	

Notes: This table reports the regression of the active change on the passive change for all participants (first column of each panel) and for groups of households sorted by their initial risky share (next five columns). The computations are carried out in levels (panel A) and in logs (panel B).

TABLE 3. REBALANCING AND DEMOGRAPHIC CHARACTERISTICS

	All years		2000		2001		2002	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Portfolio Characteristics								
Passive change in logs	-0.453	-21.40	-0.742	-12.40	-0.542	-9.97	-0.465	-19.20
Log of risky share (demeaned)	-0.218	-144.00	-0.299	-144.00	-0.167	-144.00	-0.178	-144.00
Financial Characteristics								
Disposable income	-0.005	-2.58	-0.002	-0.99	-0.006	-1.40	-0.008	-2.12
Private pension premia/Income	0.001	0.49	0.003	1.18	0.003	0.69	-0.005	-1.74
Financial wealth (in logs)	0.087	40.00	0.086	22.20	0.068	19.10	0.115	29.80
Real-estate wealth (in logs)	-0.014	-7.84	-0.004	-1.34	-0.020	-6.85	-0.020	-5.94
Total liability (in logs)	0.017	8.93	0.013	4.16	0.012	3.70	0.027	7.21
Retired dummy	0.016	2.83	-0.009	-0.97	0.039	3.90	0.014	1.27
Unemployment dummy	-0.007	-1.22	-0.010	-1.06	-0.005	-0.56	-0.012	-0.99
Entrepreneur dummy	-0.059	-6.69	-0.068	-4.72	-0.071	-4.69	-0.037	-2.28
Student dummy	-0.063	-5.29	-0.071	-3.86	-0.031	-1.55	-0.071	-2.95
Demographic Characteristics								
Age	-0.003	-16.80	-0.002	-7.00	-0.003	-10.70	-0.004	-10.80
Household size	-0.010	-6.73	-0.013	-5.20	0.005	2.00	-0.024	-9.24
High-school dummy	0.010	2.23	0.024	3.19	0.015	2.06	-0.011	-1.34
Post high-school dummy	-0.001	-0.40	0.004	0.66	0.001	0.21	-0.016	-2.32
Dummy for unavailable education data	0.036	5.93	0.003	0.31	0.040	4.08	0.054	4.66
Immigration dummy	0.001	0.13	0.015	1.81	0.005	0.62	-0.019	-2.02
Intercept			0.098	28.90	-0.067	-13.70	-0.077	-12.10
1999 dummy	0.111	42.60						
2000 dummy	-0.060	-20.40						
2001 dummy	-0.074	-13.30						
Adjusted R^2	0.16		0.25		0.10		0.12	
Number of observations	187,424		60,243		63,995		63,186	

Notes: The table reports the regression of the active change in logs on the passive change in logs, the log risky share, and financial and demographic characteristics. We exclude households for which the immigration dummy is unavailable. Disposable income is rescaled as a multiple of 100,000 SEK. All characteristics are demeaned.

TABLE 4. ADJUSTMENT MODEL WITHOUT CHARACTERISTICS

	OLS		IV	
	Estimate	**t-stat**	**Estimate**	**t-stat**
Reduced Form Estimates				
Change in log passive share	-0.121	-44.20	0.363	39.30
Intercept 2001	-0.111	-42.00	-0.139	-46.30
Intercept 2002	-0.246	-92.10	-0.119	-31.50
Structural Parameters				
Adjustment speed φ_0	1.121	410.00	0.637	69.00
Target change $\delta_{0,2001}$	-0.099	-41.50	-0.219	-35.60
Target change $\delta_{0,2002}$	-0.219	-95.60	-0.186	-40.00
Adjusted R^2	0.08			
Number of observations	120,067		120,067	

Notes: This table reports the IV and OLS estimates of the adjustment model without characteristics.

TABLE 5. ADJUSTMENT MODEL WITH CHARACTERISTICS

A. Parameter Estimates

	Speed		Target change		Speed		Target change	
	Estimate	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Intercepts								
Adjustment speed φ_0	0.654	66.60			0.701	67.00		
Target change $\delta_{0,2001}$			-0.164	-7.99			-0.149	-7.82
Target change $\delta_{0,2002}$			-0.143	-6.97			-0.153	-8.01
Portfolio Characteristics								
Beta of risky portfolio					0.036	6.66	-0.017	-4.20
Sharpe ratio of risky portfolio					0.052	7.99	-0.018	-3.77
Financial Characteristics								
Disposable income	0.009	2.11	-0.009	-0.43	0.009	2.00	0.016	0.84
Private pension premia/Income	-0.001	-0.26	-0.007	-1.15	-0.002	-0.39	-0.008	-1.33
Financial wealth (in logs)	0.021	1.76	0.047	8.62	0.024	1.98	0.046	9.30
Real-estate wealth (in logs)	0.009	0.95	-0.084	-5.90	0.008	0.89	-0.082	-6.31
Total liability (in logs)	0.040	3.40	0.021	1.94	0.027	2.28	0.021	2.16
Retired dummy	-0.099	-2.75	0.025	0.49	-0.096	-2.61	0.030	0.65
Unemployment dummy	-0.053	-1.87	0.057	1.01	-0.053	-1.90	0.054	1.03
Entrepreneur dummy	-0.097	-2.65	0.021	0.98	-0.062	-1.64	0.007	0.34
Student dummy	-0.020	-0.37	0.067	0.47	-0.040	-0.76	0.071	0.55
Demographic Characteristics								
Age	0.001	1.66	-0.002	-3.62	0.001	1.80	-0.003	-4.74
Household size	-0.004	-0.66	-0.012	-2.38	-0.013	-2.10	-0.015	-3.19
High-school dummy	0.093	4.10	-0.004	-0.34	0.086	3.76	-0.004	-0.38
Post high-school dummy	0.044	2.58	0.001	0.14	0.042	2.51	-0.001	-0.17
Dummy for unavailable education data	0.064	1.37	0.123	1.81	0.081	1.67	0.105	1.68
Immigration dummy	-0.002	-0.10	-0.025	-2.22	0.019	0.84	-0.019	-1.87

B. Cross-Sectional Distribution (2001)

	Speed	Target Change	Speed	Target change
5th Percentile	0.499	-0.280	0.522	-0.270
25th Percentile	0.586	-0.235	0.646	-0.220
50th Percentile	0.664	-0.196	0.711	-0.177
75th Percentile	0.724	-0.102	0.773	-0.089
95th Percentile	0.783	0.034	0.846	0.046

Notes: This table reports the estimates of the adjustment model with characteristics (panel A) and the corresponding cross-sectional distribution of the speed parameter and target change in 2001 (panel B). We exclude households for which the immigration dummy is unavailable. Disposable income is rescaled as a multiple of 100,000 SEK. All characteristics are demeaned.

TABLE 6. CHANGES IN FINANCIAL WEALTH

	Adjustment Model				*Adjustment Model With Controls*			
	Speed		**Target change**		**Speed**		**Target change**	
	Estimate	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**	**Estimate**	**t-stat**
Intercepts								
Adjustment speed φ_0	0.638	67.70			0.771	54.40		
Target change $\delta_{0,2001}$			-0.124	-15.30			-0.083	-3.56
Target change $\delta_{0,2002}$			-0.052	-5.08			-0.144	-5.81
Financial Characteristics								
Change in Financial wealth (in logs)	-0.244	-5.92	0.141	4.55	-0.023	-0.30	0.287	3.79

Notes: This table reports the results of the adjustment model when the change in financial wealth is included in the definitions of the target change and speed of adjustment. In the first set of columns, the change in financial wealth is the only characteristic of the model. In the second of columns, we also include all the household characteristics considered in Table 5. We exclude households for which the immigration dummy is unavailable. Disposable income is rescaled as a multiple of 100,000 SEK. All characteristics are demeaned.

TABLE 7. ENTRY AND EXIT PROBABILITIES

	Entry		Exit			
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Portfolio Characteristics						
Risky share					-0.577	-24.99
Beta of risky portfolio					-0.168	-8.69
Sharpe ratio of risky portfolio					-0.196	-2.26
Return of risky portfolio during the period					-0.242	-5.21
Dummy, risky share>95 %					0.078	2.18
Financial Characteristics						
Disposable income	0.080	13.54	0.004	3.33	0.004	3.35
Private pension premia/Income	1.449	6.11	-1.841	-6.59	-1.685	-6.06
Financial wealth (in logs)	0.154	29.42	-0.233	-46.56	-0.189	-35.77
Real-estate wealth (in logs)	0.017	15.72	-0.012	-10.67	-0.013	-11.27
Total liability (in logs)	0.013	8.51	-0.005	-3.10	-0.002	-1.54
Retirement dummy	0.000	0.005	0.018	0.69	0.011	0.43
Unemployment dummy	-0.039	-2.32	0.093	4.69	0.087	4.32
Entrepreneur dummy	0.034	0.94	-0.030	-0.85	-0.057	-1.57
Student dummy	-0.130	-4.37	0.164	4.71	0.176	5.00
Demographic Characteristics						
Age	-0.017	-28.50	0.005	7.56	0.004	6.67
Household size	-0.054	-9.17	0.015	2.72	-0.015	-2.57
High-school dummy	0.115	7.27	-0.058	-3.47	-0.047	-2.75
Post high-school dummy	0.138	8.90	-0.062	-4.01	-0.046	-2.94
Dummy for unavailable education data	-0.090	-3.12	-0.001	-0.04	0.005	0.19
Immigration dummy	-0.095	-6.03	0.201	11.81	0.203	11.77
1999 dummy	-2.000	-35.86	0.513	8.40	0.768	8.95
2000 dummy	-2.550	-44.99	0.737	12.07	0.996	11.79
2001 dummy	-2.703	-47.08	0.817	13.32	1.010	12.75
McFadden pseudo R^2	0.145		0.089		0.103	
Number of observations	105,748		193,635		193,500	

Notes: The table reports the pooled probit regression of a household's exit decision from risky asset markets on financial and demographic household characteristics. Disposable income is rescaled as a multiple of 100,000 SEK. The risky share is defined as the weight of risky assets in the complete portfolio.

TABLE 8. IMPACT OF STOCK AND MUTUAL FUND HOLDINGS ON EXIT PROBABILITY

	Risky Assets		Mutual Funds		Stocks	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Portfolio Characteristics						
Share of mutual funds in complete portfolio	-0.365	-4.63	-0.661	-31.07		
Beta of fund portfolio	0.122	1.55	-0.001	-0.05		
Sharpe ratio of fund portfolio	-1.376	-3.50	-0.808	-6.76		
Return of fund portfolio during the period	-0.360	-1.51	-0.211	-2.76		
Share of stocks in complete portfolio	-0.152	-1.66			-0.115	-3.49
Beta of stock portfolio	0.162	4.13			0.239	13.57
Sharpe ratio of stock portfolio	-1.687	-5.65			-3.680	-29.29
Return of stock portfolio during the period	0.127	1.89			0.343	12.47
Financial Characteristics						
Disposable income	0.003	1.65	0.004	3.42	0.002	1.72
Private pension premia/Income	-3.034	-3.48	-1.431	-6.05	-0.950	-3.44
Financial wealth (in logs)	-0.118	-7.13	-0.153	-33.10	-0.123	-19.32
Real-estate wealth (in logs)	-0.012	-3.31	-0.011	-9.91	-0.006	-3.83
Total liability (in logs)	-0.005	-1.00	0.000	-0.27	0.003	1.39
Retirement dummy	0.037	0.48	-0.001	-0.04	0.087	2.62
Unemployment dummy	0.196	3.04	0.095	4.89	0.038	1.26
Entrepreneur dummy	-0.030	-0.30	-0.016	-0.50	-0.063	-1.52
Student dummy	0.184	1.61	0.197	5.87	0.077	1.41
Demographic Characteristics						
Age	0.003	1.24	0.006	9.31	-0.002	-2.68
Household size	0.031	1.83	-0.045	-8.53	0.039	5.47
High-school dummy	-0.013	-0.22	-0.056	-3.47	0.008	0.35
Post high-school dummy	0.009	0.20	-0.045	-3.10	-0.022	-1.13
Dummy for unavailable education data	0.112	1.40	-0.055	-2.22	0.109	2.96
Immigration dummy	0.141	2.62	0.192	11.49	0.108	4.49
1999 dummy	-0.498	-1.36	0.558	5.19	-0.236	-2.54
2000 dummy	-0.308	-0.86	0.729	6.95	-0.119	-1.29
2001 dummy	-0.308	-0.96	0.764	8.22	-0.095	-1.05

Notes: The table reports a pooled probit regression that a household sells all its risky asset markets (first set of two columns), all its mutual funds (middle set of two columns), and all its stocks (last set of two columns). The explanatory variables include portfolio, financial and demographic household characteristics. We exclude households for which the immigration dummy is unavailable. Disposable income is rescaled as a multiple of 100,000 SEK. All characteristics are demeaned.

TABLE 9. PROBABILITY OF FULLY SELLING AN ASSET

	Stocks		Funds					
	Estimate	t-stat	Estimate	t-stat				
Return of asset j	0.454	43.70	-0.206	-9.08				
Return of other funds	0.025	2.91	-0.002	-0.25				
Return of other stocks	-0.064	-12.50	-0.018	-2.96				
Share of asset j in risky portfolio	-0.785	-36.60	-0.864	-54.50				
1999 dummy	-0.669	-85.90	-1.135	-136.00				
2000 dummy	-0.931	-119.00	-1.236	-141.00				
2001 dummy	-1.131	-120.00	-1.259	-111.00				
	Characteristics interacted with asset j return				Non-interacted characteristics (controls)			
Portfolio Characteristics								
Risky share	-0.029	-2.77	0.022	1.07	0.043	8.16	-0.026	-4.20
Share of stocks in the risky portfolio	-0.092	-7.84	0.051	1.69	0.123	19.30	0.027	2.98
Beta of fund portfolio	-0.006	-0.46	0.013	0.53	0.061	7.90	0.037	4.55
Sharpe ratio of fund portfolio	0.000	0.02	-0.063	-1.34	-0.018	-2.39	-0.070	-5.85
Beta of stock portfolio	-0.285	-22.10	0.060	2.02	0.030	3.44	0.083	8.20
Sharpe ratio of stock portfolio	-0.033	-1.72	-0.012	-0.33	-0.211	-22.00	-0.052	-4.79
Financial Characteristics								
Disposable income	0.007	1.08	0.099	3.98	0.025	3.79	0.065	4.28
Private pension premia/Income	0.009	0.85	0.000	0.01	-0.004	-0.81	-0.017	-2.40
Financial wealth (in logs)	-0.070	-5.97	-0.089	-3.11	0.015	2.16	-0.119	-14.10
Real-estate wealth (in logs)	-0.015	-1.43	-0.010	-0.50	-0.015	-2.64	-0.031	-5.09
Total liability (in logs)	-0.077	-6.58	0.031	1.16	0.030	4.90	0.042	5.49
Retirement dummy	0.001	0.02	-0.182	-2.10	0.072	3.85	-0.036	-1.57
Unemployment dummy	0.003	0.08	-0.029	-0.39	0.032	1.53	0.029	1.40
Entrepreneur dummy	0.026	0.67	-0.233	-2.18	0.011	0.50	0.003	0.08
Student dummy	0.003	0.05	0.070	0.59	-0.046	-1.16	0.099	2.80
Demographic Characteristics								
Age	0.004	3.60	-0.014	-6.27	-0.005	-8.33	0.001	0.74
Household size	-0.003	-0.39	0.040	2.35	-0.006	-1.30	-0.009	-1.82
High-school dummy	-0.019	-0.60	0.102	1.70	0.044	2.93	0.007	0.39
Post high-school dummy	0.055	2.60	0.003	0.07	0.002	0.13	0.012	0.95
Dummy for unavailable education data	-0.036	-0.69	0.091	0.87	-0.005	-0.22	-0.001	-0.03
Immigration dummy	-0.068	-2.29	0.127	2.07	0.082	5.03	0.112	6.33

Notes: This table reports the results of the asset-level rebalancing regression with characteristics. We exclude full sales and purchases of new assets. All household characteristics are demeaned. We exclude households for which the immigration dummy is unavailable. Disposable income is rescaled as a multiple of 100,000 SEK. All characteristics are demeaned.

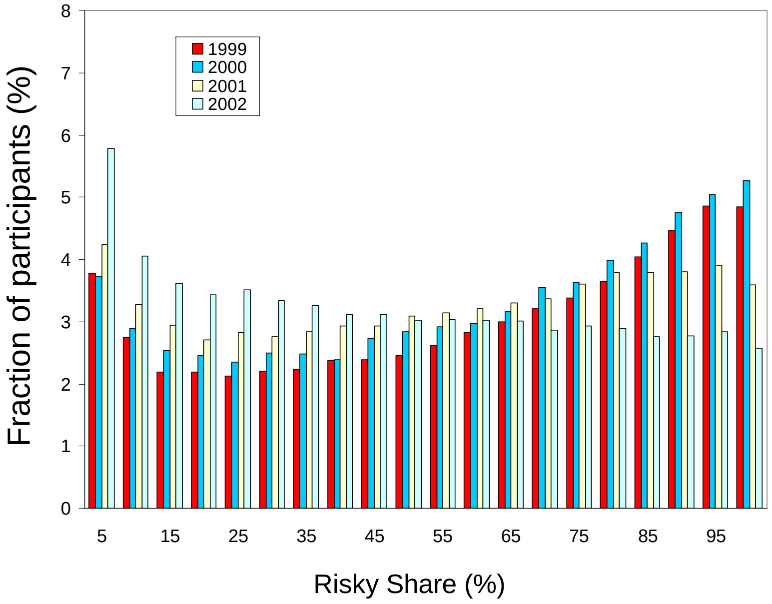
TABLE 10. ASSET-LEVEL ACTIVE CHANGE

	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Stocks						
Passive change of asset j in logs					-0.180	-56.30
Absolute performance of asset j	-0.165	-39.40	-0.179	-42.80		
Absolute performance of the other assets			0.344	23.90		
Initial risky share of j	-0.039	-44.60	-0.043	-47.30	-0.039	-44.70
Funds						
Passive change of asset j in logs					-0.155	-20.50
Absolute performance of asset j	-0.015	-2.02	-0.022	-2.96		
Absolute performance of the other assets			0.359	27.10		
Initial risky share of j	-0.092	-93.60	-0.098	-93.60	-0.093	-94.30
Dummies						
2000 stock dummy	-0.204	-48.00	-0.196	-46.40	-0.205	-48.40
2001 stock dummy	-0.130	-36.90	-0.096	-25.60	-0.119	-34.40
2002 stock dummy	-0.150	-40.80	-0.049	-8.78	-0.112	-33.00
2000 fund dummy	-0.228	-92.20	-0.220	-89.70	-0.230	-94.30
2001 fund dummy	-0.153	-63.30	-0.122	-47.10	-0.153	-68.70
2002 fund dummy	-0.193	-58.10	-0.093	-19.30	-0.189	-82.80
Adjusted R^2	5.41%		6.00%		6.21%	
Adjusted R^2 for the stock regression	2.97%		3.66%		4.69%	
Adjusted R^2 for the fund regression	6.95%		7.48%		7.18%	

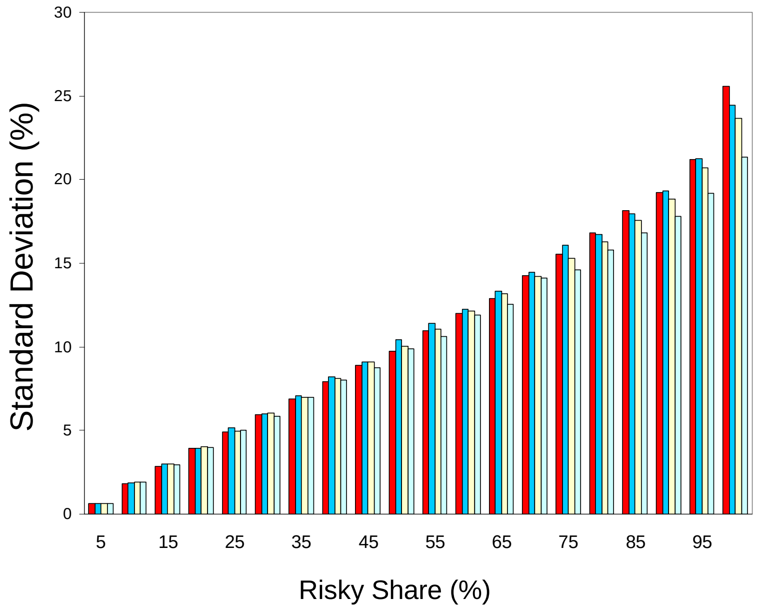
Notes: This table reports the regression of asset j's active change on the asset's passive change, own performance, and the performance of other assets. We include partial sales, continued holdings and partial purchases, but exclude full sales and purchases of securities that are not held at all at the beginning of the period.

FIGURE 1. PORTFOLIO CHARACTERISTICS OF PARTICIPANTS

A. Cross-sectional Distribution of Risky Share



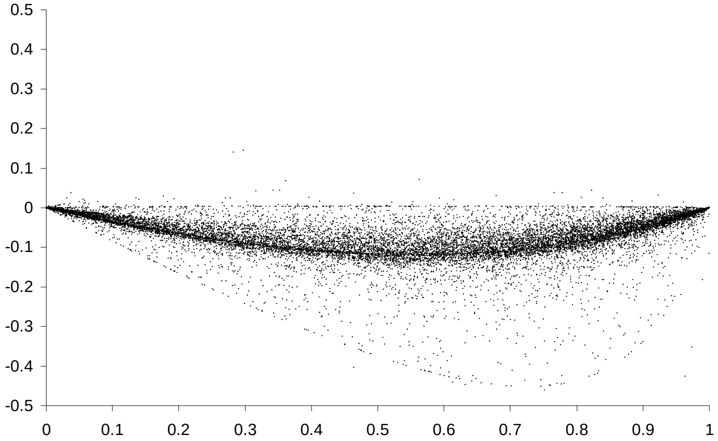
B. Standard Deviation of Complete Portfolio



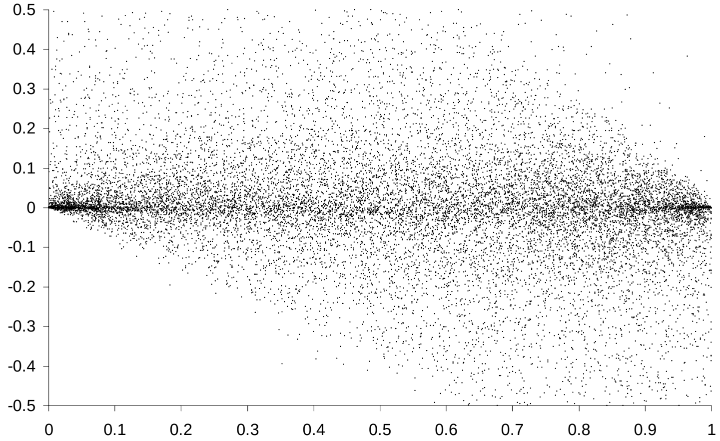
Notes: Panel A illustrates the cross-sectional distribution of the risky share $w_{h,t}$ at the end of years 1999 to 2002. Panel B reports the relation between the standard deviation of the complete portfolio $w_{h,t}\ \sigma_{h,t}$ and the risky share $w_{h,t}$.

FIGURE 2. SCATTER PLOTS OF RISKY SHARE

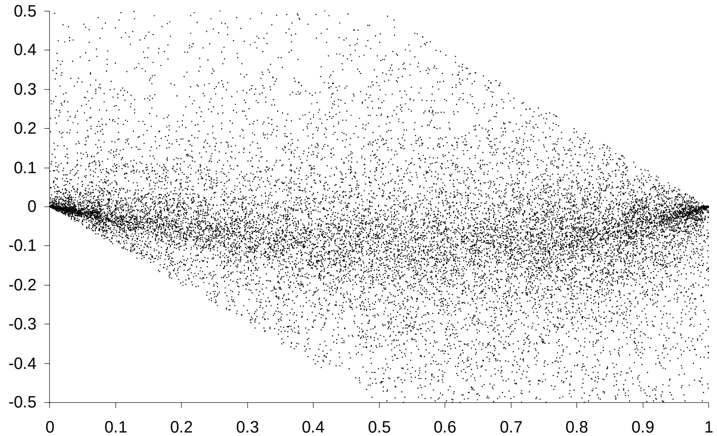
A. Passive Change



B. Active Change

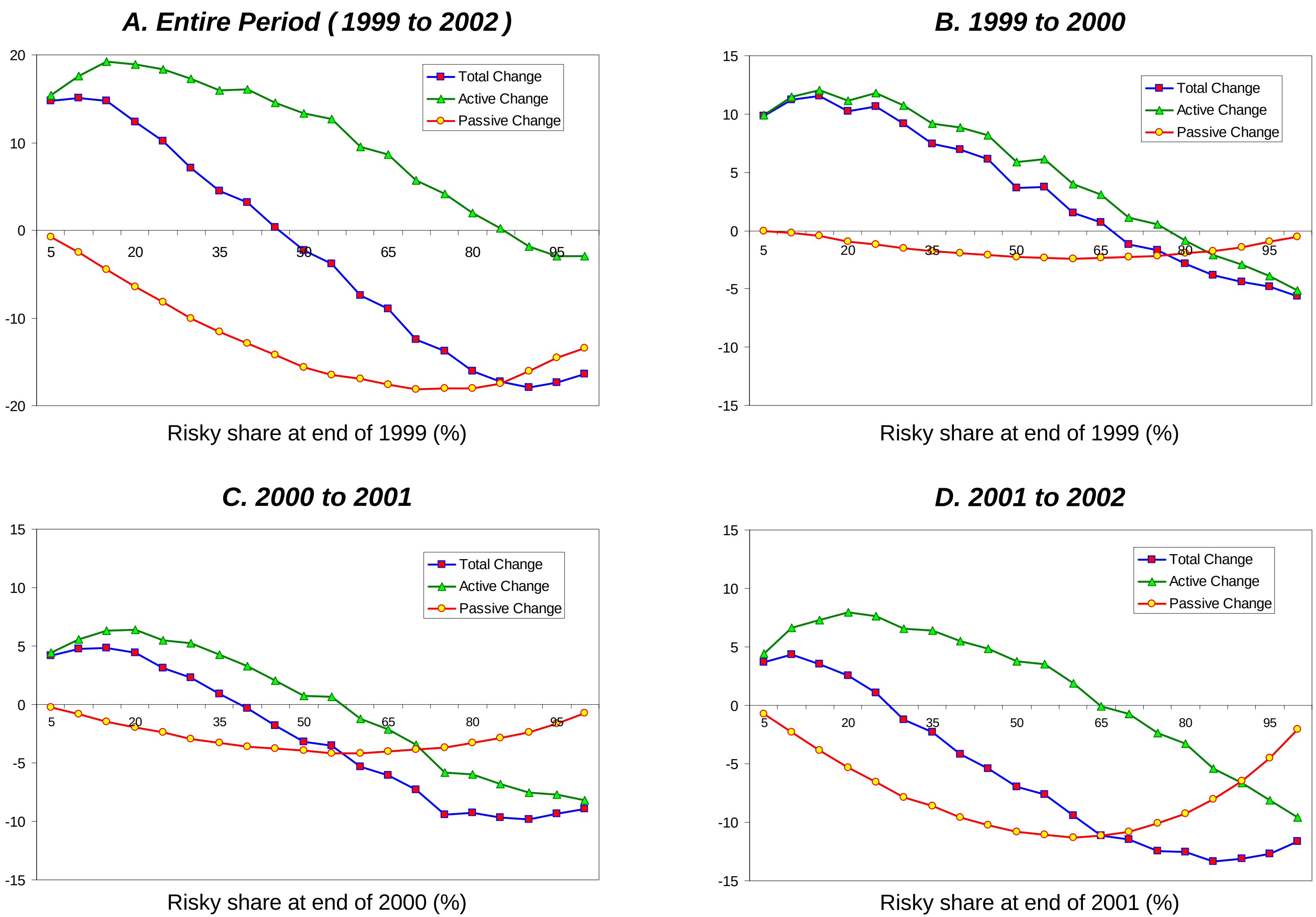


C. Total Change



Notes: The scatter plot illustrates the passive change (panel A), active change (panel B), and total change (panel C) versus the initial risky share for a random sample of 10,000 households. All changes are computed in levels between 2001 and 2002.

FIGURE 3. RISKY SHARE DECOMPOSITION



Notes: The figure illustrates the equal-weighted average of the total change, active change and passive change in bins of the initial risky share. The changes are reported in percentages and computed in levels over the entire period (panel A) and over each year of the sample (panels B to D).