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RIDING THE BUBBLE? CHASING RETURNS INTO ILLIQUID ASSETS

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ABSTRACT

Household investors chase stock market returns. Surveys suggest that households intend to "ride the bubble" by buying stocks early in a boom and selling stocks early in a bust. This implies that households use only liquid assets to chase returns. I test this prediction using inflows to fixed annuities---illiquid tax-preferred assets that lock wealth out of the stock market for five to ten years. I find that fixed annuity inflows spike after poor stock market returns, inconsistent with ride-the-bubble intentions and instead indicating buy-and-hold intentions. The results are consistent with households extrapolating recent stock market returns into the long run.

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I Introduction

Household (non-institutional) investors reallocate wealth to stocks after stock prices rise: Figure 1 displays this well-known effect of recent stock market returns on net inflows to equity mutual funds. Such "return chasing" by household investors is a robust empirical phenomenon (Ippolito 1992; Chevalier and Ellison 1997; Sirri and Tufano 1998; Teo and Woo 2004; Frazzini and Lamont 2008; Choi, Laibson, Madrian, and Metrick 2009; Chiang, Hirshleifer, Qian, and Sherman 2011) and underlies a class of models seeking to explain asset pricing anomalies (DeLong, Shleifer, Summers, and Waldman 1990; Hong and Stein 1999; Barberis and Shleifer 2003; Barberis, Greenwood, Jin, and Shleifer forthcoming). This paper investigates why households chase stock market returns.

When asked, households report expectations consistent with a "ride the bubble" strategy of buying stocks at the beginning of a market rally and selling stocks at the beginning of a market decline, also called "greater fool" and "buy low, sell high" strategies (Harrison and Kreps 1978; Frankel and Froot 1990; Lamont and Thaler 2003). Specifically, household investors report expectations of short-run stock market momentum (Amromin and Sharpe 2014; Greenwood and Shleifer 2014) and medium-run reversals, suggesting that households believe they can beat the market by timing their exit and entry (Vissing-Jorgensen 2003). For example, the Yale Stock Market Confidence Index survey (2014) finds that near the end of the late-1990s market rally, half or more of household investors stated that stock prices exceeded fundamental value but that prices would nevertheless rise over the next year.[1] Similarly, UBS/Gallup surveys show that household investors' stated expectations of the one-year stock market return declined ten percentage points between 2000 and 2003 while stated expectations of the annualized ten-year return declined only two per-

[1] In April 2000, 72% responded "Too high" to the question: "Stock prices in the United States, when compared with measures of true fundamental value or sensible investment value, are (a) Too low, (b) Too high, (c) About right, (d) Do not know." In the same survey, 76% responded with a positive number to: "How much of a change in percentage terms do you expect in the Dow Jones Industrial Average over the next 1 year?" Thus at least 48% believed stocks were overpriced but that prices would nevertheless rise in the next year.

centage points (Vissing-Jorgensen); short-run momentum combined with long-run stability implies medium-run reversals.

If household investors chase returns in order to benefit from temporary stock market rallies and to avoid temporary declines ("ride-the-bubble intentions"), they will not chase returns into illiquid assets that lock owners into a specific equity position for several years at a time. I test this prediction using the time series of inflows to U.S. annuities. Annuities in the United States are sold by life insurers but are not annuities in the traditional economic sense: only 3% of the \$2.5 trillion of U.S. annuity assets are annuitized into lifetime income streams. Instead, annuities are tax-preferred savings vehicles into which households nearing retirement make large one-time contributions; 10.5% of Americans over sixty years old have an annuity. Households choose either a fixed (fixed-return) annuity or a variable (equity-linked) annuity at the time of contribution and face substantial early withdrawal fees until the pre-specified maturity of typically five to ten years. Households can costlessly reallocate balances across asset classes within variable annuities but not within fixed annuities. Hence, a rise in aggregate fixed annuity inflows reflects households locking additional wealth out of the stock market for several years at a time.[2]

This paper uses quarterly data on aggregate fixed annuity inflows from 1986 to 2006 to test whether past S&P returns negatively affect fixed annuity inflows, inconsistent with ride-the-bubble intentions and consistent instead with buy-and-hold intentions. I find that past S&P returns have a large negative effect on fixed annuity inflows: one-standard-deviation-lower S&P returns last year, two years ago, three years ago, and four years ago reduce the current quarter's fixed annuity inflows by 17%, 13%, 9%, and 5%, respectively, amounting to an annual reduction of \$32 billion on a base of \$72 billion. In fact, lagged S&P returns explain most of the time series variation in fixed annuity inflows. This effect is not an overall annuity effect: S&P returns have a similarly strong negative

[2] Though housing is also illiquid, households are on both sides of the vast majority of home sales, whereas institutional investors are often on the other side of the bond sales underlying new fixed annuities.

effect on the fixed annuity share of total (fixed plus variable) annuity inflows and a similarly strong positive effect on variable annuity inflows. I conclude that household investors chase returns even into fixed annuities, in spite of their illiquidity and inconsistent with ride-the-bubble intentions.

This basic finding could in principle be limitedly consequential if households use their non-annuity financial assets to offset their fixed annuity allocations, leaving their overall equity exposures unchanged. Turning to the 2007-2009 Survey of Consumer Finances panel, I find no such offset: the average new fixed annuity investor between 2007 and 2009 placed 33% of her household's financial assets into annuities and reduced her household's equity share of financial assets by 30 percentage points. This large reduction in equity exposure is unique to new fixed annuity investors: new variable annuity investors of the same age, 2007 wealth, and 2007 equity exposure instead increased their overall equity exposure over the same period. Hence, the household decision to invest in a fixed annuity is associated with a large reduction in the household's overall equity exposure.

In a final descriptive exercise that quantifies one candidate explanation of the results, I use the time series of fixed annuity inflows to parameterize a reduced-form model of expectation formation. Under the strong assumption that household demand for fixed annuities is affine in the expected long-run equity premium akin to the affine portfolio rules in Kim and Omberg (1996) and Campbell and Viceira (1999), the sensitivity of fixed annuity inflows to lagged S&P returns implies that the average annuity investor behaves as if she raises her expectation of the long-run equity return by 6.6%, 5.1%, 3.7%, and 2.0% of the first-through-fourth S&P lags. Such long-run extrapolation of recent stock market returns would accord with households' choices for financial advice during stock market rallies and would imply large revisions over time in expectations of the long-run equity return, including an 8.7-percentage-point reduction from 1999 to 2003.[3] I stress, however, that

[3]The books *The Roaring 2000s: Building the Wealth and Lifestyle You Desire in the Greatest Boom in History* (Dent 1998) and *Dow 36,000: The New Strategy of Profiting from the Coming Rise in the Stock Market* (Glassman and Hassett 1999) predicted that stock prices would continue to climb toward very large fundamental values and were *New York Times* and *Business Week* bestsellers through early 2000.

time variation in expected returns, risk aversion (e.g. due to wealth changes), and discount factors could each have driven the observed variation in fixed annuity inflows and are equivalent in standard models. Regardless of the underlying source, return chasing into illiquid assets is inconsistent with ride-the-bubble intentions.

This paper connects to several strands in the literature. An influential set of papers documents return chasing into liquid financial assets. Ippolito (1992), Chevalier and Ellison (1997), Sirri and Tufano (1998), Teo and Woo (2004), and Frazzini and Lamont (2008) document strong effects of mutual fund past performance on subsequent fund inflows. Choi, Laibson, Madrian, and Metrick (2009) show that household investors chase their own historical 401(k) returns when choosing their 401(k) savings rates, and Chiang, Hirshleifer, Qian, and Sherman (2011) show that household investors chase their own historical IPO returns when choosing whether to bid on subsequent IPOs.[4] Greenwood and Nagel (2009) demonstrate similar return chasing by inexperienced mutual fund managers. Schultz (2003), Baker and Wurgler (2006), and Dong, Hirshleifer, and Teoh (2012) present evidence consistent with firms taking advantage of return chasers by issuing stock at temporary stock price peaks.

This paper contributes to this literature by using flows into a prominent *illiquid* financial asset—fixed annuities—to investigate the motives underlying return chasing. The finding that household investors chase stock market returns into illiquid assets indicates that return chasing is not just driven by intentions to ride a temporary bubble. Instead, recent stock market returns strongly affect household decisions to lock wealth out of the stock market for several years at a time.

Though Americans rarely annuitize wealth into fixed lifetime income streams (Modigliani 1986; Brown 2009), my analysis is most closely related to contemporaneous work by Previtero (2014) who shows that poor recent stock market returns increase annuitization rates. He notes that poor

[4] The exception in this literature is that the reverse pattern is observed among individual securities already owned by the household investor (Shefrin and Statman 1985; Odean 1998).

stock market returns also seem to increase fixed annuity inflows, but his paper is not fundamentally concerned with testing return-chasing motives, does not evaluate alternative explanations using variable annuity inflows, and does not test for offsetting allocations at the household level.

A similarly large theoretical literature considers the implications of trend extrapolation on asset prices. Barberis, Shleifer, and Vishny (1998); Fuster, Hebert, and Laibson (2011), Hirshleifer and Yu (2013), and Alti and Tetlock (2014) model asset prices when some investors extrapolate trends in fundamentals. Cutler, Poterba, and Summers (1990), DeLong, Shleifer, Summers, and Waldman (1990), Hong and Stein (1999), Barberis and Shleifer (2003), and Barberis, Greenwood, Jin, and Shleifer (forthcoming) allow for a class of investors who extrapolate returns. In addition to providing new evidence of household return chasing, this paper motivates a distinction between investors who extrapolate returns only into the short run and those who extrapolate returns into the long run, with potential implications for liquidity premia.

The results provide a mixed view of the reliability of household investors' stated expectations. Recent stock market returns have a large effect on households' reported expectations of the one-year stock market return (Amromin and Sharpe 2014; Greenwood and Shleifer 2014) but a small effect on reported expectations of the ten-year market return (Vissing-Jorgensen 2003). Yet the return chasing estimated in this paper is consistent with a large effect of recent market returns on expected long-run market returns as well, raising the possibility that households misreport their long-run expectations, in line with earlier skepticism (Campbell 2003; Lamont 2003; Cochrane 2011).[5]

Finally, a small but growing literature asks what incentives (Duflo, Gale, Liebman, Orszag, and Saez 2006), defaults (Carroll, Choi, Laibson, Madrian, and Metrick 2009), and other interventions like information provision (Lusardi and Mitchell 2011) may reduce the welfare costs of apparent investment mistakes (Campbell 2006). This paper indicates that households use annuities to

[5] One possibility is that household investors are more confident in short-run than long-run market momentum.

make large sudden changes in equity allocations based on recent stock market returns. This raises the possibility that subsidizing small annual retirement contributions (as in 401(k) accounts and Individual Retirement Accounts) generates more balanced household portfolios over time than subsidizing large one-time contributions (as in annuities).

The paper is organized as follows. Section II provides institutional background on U.S. annuities. Section III describes the data. Section IV presents the main results. Section V evaluates robustness. Section VI documents the relevance of annuity investments for household portfolio allocations. Section VII provides an interpretation of the results. Section VIII concludes.

II Institutional Background on U.S. Annuities

I test for return chasing into illiquid assets using quarterly inflows into U.S. annuities. Annuities in the United States are not annuities in the traditional economic sense: Americans rarely annuitize their retirement assets into lifetime income streams (Modigliani 1986; Brown 2009), and only \$79 billion (3.1%) of the \$2.45 trillion of U.S. annuity assets are annuitized into lifetime income streams (LIMRA 2013). Rather, U.S. annuities are several-year investment vehicles that offer tax deferral on investment income at the expense of substantial early withdrawal fees. The pre-specified durations are typically five to ten years; shorter durations are rare because tax deferral yields little value over short horizons. Annuities must be provided by a life insurance company in order to qualify for tax deferral and are not federally insured.[6]

Annuities share key features of 401(k) accounts and IRAs—tax deferral and a 10% federal tax penalty on nominal earnings if distributions are made before age 59.5—but are inferior to those other retirement accounts because annuity contributions are made with post-tax assets *and* nominal earnings are subject to income tax upon withdrawal. Yet unlike these other retirement

[6] The six companies that each manage at least \$100 billion in annuity assets are in order of market share: TIAA-CREF, MetLife, AIG, Prudential Annuities, Lincoln Financial Group, and Jackson National Life (LIMRA 2013).

accounts, there is no legal limit to annuity contributions, and, unlike 401(k)s and traditional IRAs in particular, annuity withdrawals can be postponed indefinitely.[7] Annuities do not strictly dominate brokerage accounts because of the tax penalties on withdrawals before age 59.5, because annuities do not offer single-stock trading, because annuities typically require a minimum balance of $10,000 or more, and because annuity providers assess penalties for withdrawals before the preset duration.[8] A typical annuity contract may assess a 7% surrender fee on the full amount of annual withdrawals, with the fee decreasing by 1% until the seven-year maturity.[9] Hence, withdrawals after only a year or two are heavily penalized.

Annuities are therefore attractive investments for households that have maxed out their Individual Retirement Account (IRA) contribution limits and are willing to sacrifice liquidity for higher after-tax returns (Brown and Poterba 2006). Based on the 2007-2009 Survey of Consumer Finances panel (introduced in the next section), 10.5% of U.S. households over age sixty hold assets in an annuity, and the typical new annuity investor is at or near retirement age, has over $200,000 in liquid financial wealth, and immediately places over $50,000 in the new annuity.[10]

Annuities are offered in two broad varieties: fixed and variable. I focus on inflows to fixed annuities. Fixed annuities guarantee a fixed rate of return on invested assets. The fixed rate depends on the yield curve at the time of contract signing. Variable annuities offer investors asset allocation options across a handful of pre-specified equity and other types of mutual funds.[11] Variable annuity assets can periodically be reallocated across funds and in particular be converted

[7] A minority of annuity assets are held within IRAs, for example as an easy way to purchase a death benefit rider.

[8] Annuity income is taxed at ordinary income tax rates regardless of source, so variable annuities (defined below) which generate dividends and capital gains can be particularly inferior to brokerage accounts when held for short periods (Brown and Poterba 2006).

[9] Some fixed annuities carry higher surrender fees with higher fixed returns. "Section 1035" exchanges of one annuity contract for another are not considered withdrawals for tax purposes but are considered withdrawals for surrender fee purposes. There is a secondary market for fixed annuities but it is small and carries high transaction costs.

[10] The 10.5% figure refers to 2009; the analogous figure from the 2010 Survey of Consumer Finances which does not impose panel structure is nearly identical (10.4%). Age refers to the responding member of the household.

[11] Variable annuities can include riders such as minimum benefit riders that put a floor on returns.

to fixed annuities before the pre-specified maturity and without a surrender fee. In contrast, fixed annuity assets cannot be reallocated to equities or converted into variable annuities. Hence, fixed annuity inflows are a consistent measure of households allocating wealth away from equities for several years at a time. In preferred specifications, I estimate the effect of lagged S&P returns on inflows to fixed annuities.

Finally, note that a unique subset of fixed annuities called indexed annuities offer limited equity exposure but do not confound the results below. Indexed annuities offer investors a variable return within a tight band; for example, a typical indexed annuity might offer a return of 0% if the S&P declines in a given year, a return of 3.5% if the S&P returns more than 3.5%, and the actual S&P return if the S&P returns between 0% and 3.5%. Indexed annuities were invented in the mid-1990s, are classified as fixed annuities in LIMRA data, and have grown from composing less than one-tenth of fixed annuity inflows in 2001 to just under one-third in 2006. I obtained indexed annuity inflows data for only a subset (quarters 2001-2006) of the time series used below; all qualitative results below hold when subtracting indexed annuity inflows from fixed annuity inflows.[12]

III Data

This paper uses three types of data: quarterly data on annuity inflows and terms, quarterly data on the Standard & Poors 500 (S&P) price index, and the 2007-2009 Survey of Consumer Finances panel. The sample frame, variable definitions, and summary statistics are as follows. All dollar values are inflated to 2010 dollars using the Consumer Price Index for all urban consumers; rates of return are not adjusted for inflation.

[12] Under the main specification below (Table 2 column 4) using either the full sample or just the 2001-2006 period, estimated effects of lagged S&P returns on fixed annuity inflows are approximately 18% smaller when excluding indexed annuity inflows.

III.A Annuity Inflows

This paper uses quarterly data on fixed annuity inflows, variable annuity inflows, and fixed annuity terms for the 84 quarters encompassing years 1986 through 2006. The data were compiled by LIMRA (2008), the leading life insurance industry research group in the United States. LIMRA obtains its data from surveys of life insurance companies. It estimates that its surveys of sixty annuity providers in 2007 covered 97% of the market.

Fixed annuity inflows equals the assets committed to new fixed annuity accounts. Variable annuity inflows equals the assets committed to new variable annuity accounts. Total annuity inflows equals fixed annuity inflows plus variable annuity inflows. Outflows are not reported so these inflows variables are not measured net of outflows; however, outflows are small due to the substantial surrender costs. The fixed annual rate of return on new fixed annuities ("fixed rate") equals the fixed rate of return offered on the typical new fixed annuity as reported by LIMRA. Though LIMRA has compiled more recent statistics on annuity inflows, it stopped collecting fixed rate information in 2006.

III.B S&P Returns

The main analysis dataset comprises the quarterly annuity inflows data merged with lagged S&P returns as published by Shiller (2014). For a given quarter q, the n^{th} lagged S&P return equals the percentage change between the average closing price of the S&P in the month preceding quarter $q-4(n-2)$ and quarter $q-4(n-1)$. For example, consider the S&P lags for the first quarter of year 2000. The first S&P lag equals the percentage difference between the average S&P closing price in December 1998 and the average closing price in December 1999. The second S&P lag equals the percentage difference between the average S&P closing price in December 1997 and the average closing price in December 1998. Etcetera. The main specification utilizes the first-through-fourth

S&P lags.

III.C 2007-2009 Survey of Consumer Finances Panel

For supplemental household-level analyses of new annuity investors, I use data on new annuity investors from the 2007-2009 Survey of Consumer Finances panel. The Surveys of Consumer Finances are triennial surveys of randomly selected American households, stratified by income in order to over-sample the wealthy. These surveys are typically repeated cross sections, but in order to study the effects of the recent financial crisis, in 2009 the Federal Reserve Board sponsored a special re-interview of the 2007 survey respondents. Eighty-nine percent (3,862) of eligible 2007 respondents completed the 2009 re-interview.[13] I utilize the resulting public-use panel and weight observations by their sampling probability in all analyses.

I define new annuity investors as households that held no assets in annuities in 2007 but held positive assets in annuities in 2009. I define new fixed annuity investors as new annuity investors whose annuity assets have no exposure to stocks; I define all other new annuity investors as new variable annuity investors. Financial assets equals the sum of balances across the household's annuity, checking, savings, 401(k), individual retirement, Keogh, brokerage, and revocable trust accounts. The equity share of financial assets equals the share of financial assets invested in stocks.[14] Age refers to the age of the member of the household who completed the survey.

III.D Summary Statistics

Figure 2a displays the time series of total annuity inflows. Consistent with large rises over time in stock market participation rates and democratization of various financial instruments,[15] total

[13] Approximately 2% of the 2007 respondents were ineligible for a re-interview because both the respondent and the spouse (if applicable) had died or left the United States. The 2007 SCF enjoyed an overall response rate of 51%, broadly in line with previous versions of the SCF (Kennickell 2010).

[14] When respondents report not knowing a particular account type's asset allocation, I code the type's equity allocation as 0%.

[15] For example, stock market participation rates measured in the Panel Study of Income Dynamics rose from 23% in 1984 to 37% in 1994 (Vissing-Jorgensen 2002). Nonstockholders are argued to be at a corner solution in portfolio allocation (Mankiw and Zeldes 1991), and steadily declining costs to financial optimization is a common explanation

annuity inflows grew from \$59.5 billion in 1986 to \$258.2 billion in 2006. The growth was quite linear and relatively stable over time. However, Figure 2b shows that the split in allocations of annuity inflows across fixed annuities and variable annuities varied substantially over time. Fixed annuity inflows grew at a slower overall rate than variable annuity inflows, but around those long-run time trends, inflows fluctuated dramatically. Conditional on time trends, fixed annuity inflows and variable annuity inflows are very negatively correlated.

Table 1a displays summary statistics on quarterly annuity inflows and the fixed annual rate of return offered on new fixed annuities. In the average quarter, \$18.0 billion flowed into fixed annuities while \$24.0 billion flowed into variable annuities. The fixed rate offered on new fixed annuities averaged 6.0%. Table 1b reports that S&P returns averaged 11.0% over this period with standard deviation 15.6%. Figure 3 shows the time series of the fixed rate and S&P returns; S&P returns exhibited no consistent trend while the fixed rate declined over time in line with other interest rates. Importantly for this paper's analysis of determinants of quarterly annuity inflows, there is substantial independent variation at high frequencies in the fixed rate and S&P returns, due to high frequency changes in S&P returns.

Table 1c displays summary statistics as of 2009 on new annuity investors. The average new annuity investor in 2009 was 65.7 years old, held \$470,459 in financial assets, held 35.3% of those financial assets in annuities, and allocated 40.3% of her financial assets to equities. Not displayed, the average new fixed annuity investor held 32.8% of her financial assets in annuities while the average new variable annuity investor held 36.0%. The large share of financial assets held in annuities suggests that a household's choice between fixed and variable annuities will correlate strongly with the household's change in asset allocations between equities and other asset classes; I report these tabulations below in Table 4.

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for rising participation rates (Alan 2006).

The 25^{th} percentile new annuity investor age was 56 years old and held \$92,785 in financial assets, so most new annuity investors are around retirement age and hold substantial financial assets. Not tabulated, new annuity investors hold an average of \$85,646 and a median of \$51,060 in annuities. New fixed annuity investors hold somewhat more in annuities (average of \$116,906, median of \$60,737) than new variable annuity investors (average of \$76,744, median of \$50,813).

IV S&P Returns and Fixed Annuity Inflows

If household investors chase stock market returns in order to ride a temporary bubble, they will not chase returns into illiquid assets that are expensive to sell in the short run. Fixed annuity inflows are a consistent measure of individual investors allocating wealth away from equities for years at a time. I now test whether past S&P returns have a negative effect on fixed annuity inflows and a positive effect on variable annuity inflows. If so, I conclude that household investors chase returns into annuities in spite of their liquidity, inconsistent with ride-the-bubble intentions and instead indicating buy-and-hold intentions.

To test whether lagged S&P returns affect fixed annuity inflows, I estimate OLS regressions of the form:

$$(1) \qquad FIXED\_INFLOWS_q = \alpha + \beta_1 R_q^{eq} + \beta_2 R_{q-4}^{eq} + \beta_3 R_{q-8}^{eq} + \beta_4 R_{q-12}^{eq} + \gamma R_q^f + \delta q + \varepsilon_q$$

where $FIXED\_INFLOWS_q$ denotes fixed annuity inflows in quarter q, R_q^{eq} denotes the first S&P annual return lag (the percentage change in the S&P over the twelve months preceding q), R_q^f denotes the average fixed rate of return offered on fixed annuities purchased in quarter q, and q denotes a linear time trend as motivated by the trend visible in Figure 2. I include four S&P annual return lags because four minimize the Bayes information criterion; I present results with only one lag as well. In such time series regressions in which both dependent and independent variables are persistent, errors ε_q can be autocorrelated. The standard correction is to estimate

Newey-West standard errors allowing for autocorrelation across a sufficient number of lags; here, I allow for autocorrelation across sixteen quarterly lags, corresponding to the four S&P annual return lags.

The β terms are the coefficients of interest: the effect of lagged S&P returns on fixed annuity inflows. The identifying assumption is that, conditional on the fixed rate and time trend, lagged S&P returns are orthogonal to unobserved determinants ε_q of fixed annuity inflows; I investigate potential identification threats in Section V. If the β coefficients are negative and statistically significant, I conclude that household investors chase returns into fixed annuities. If on the contrary the β coefficients are statistically indistinguishable from zero, I conclude that there is no evidence that household investors chase returns into fixed annuities.

Figure 4 illustrates the core result of the paper. Each panel displays the actual time series of fixed annuity inflows and a fitted time series using equation (1). Figure 4a displays the fit from estimating (1) without lagged S&P returns. This specification explains almost none of the variation around the linear trend. Figure 4b displays the fit from estimating (1) with the first S&P return lag. The addition of this one regressor dramatically improves the fit, with high lagged S&P returns corresponding to low fixed annuity inflows. Figure 4c displays the fit from estimating (1) with four S&P return lags, the preferred specification. This fit closely matches the time series fluctuations in fixed annuity inflows, including the large and sustained spike after the dot-com bust as well as smaller fluctuations throughout the time series. This is simple evidence that lagged S&P returns predict subsequent fixed annuity inflows.

Table 2 reports the coefficient estimates and standard errors from the regressions underlying Figure 4. Columns 1, 3, and 4 correspond to Figures 4a-c, respectively. Column 4 is the preferred specification. The coefficients imply that a one-standard-deviation (15.6-percentage-point) higher S&P return last year, two years ago, three years ago, and four years ago reduce this quarter's fixed annuity inflows by \$3.0 billion, \$2.3 billion, \$1.7 billion, and \$0.9 billion, respectively, amounting to \$31.7 billion over the course of a full calendar year relative to mean annual fixed annuity inflows of \$72.0. These magnitudes amount to respective reductions of 16.7%, 12.9%, 9.4%, and 5.1% of the mean quarterly inflow amount of \$18.0 billion. t-statistics on these effects range from 3.7 to 12.2. This specification explains 86% of the variance in fixed annuity inflows, relative to 34% without S&P return lags (column 1). I conclude that S&P returns have a strong negative effect on subsequent fixed annuity inflows, in spite of their illiquidity and inconsistent with ride-the-bubble intentions.

Note that the estimated impact of lagged S&P returns decays: more distant lags have a smaller impact on current fixed annuity inflows than more recent lags do. On average across the four most recent S&P lags, each S&P lag has an estimated effect on fixed annuity inflows equal to 68.2% of the effect of the one-year-more-recent lag. This qualitative pattern of decay accords with recent parameterizations of the impact of lagged S&P returns on the reported expectations of stock market returns (Greenwood and Shleifer 2014) and on the portfolio allocation decisions (Malmendier and Nagel 2011) of household investors. Interestingly, the annual decay rate estimated here (31.8% per year) is about one-third as fast as the decay rate estimated in Greenwood and Shleifer's analysis of reported expectations of short-term stock market returns (approximately 90% per year) and about 1.5 times faster than the decay rate estimated in Malmendier and Nagel's analysis of stock market participation (approximately 13% per year).[16] This pattern is perhaps unsurprising given the volatility of these different outcomes: reported expectations of short-run market returns are more volatile than fixed annuity inflows, which in turn are more volatile than stock market participation rates. However, each of these three decay rates is measured with substantial error and under parametric assumptions, so caution is warranted in comparing their precise magnitudes.

[16] The Malmendier-Nagel annual decay rate varies by age and by lag length; 13% equals the average annual decay rate for the Malmendier-Nagel example of a fifty year old (details available upon request).

V Robustness

The previous section found that S&P returns strongly negatively predict subsequent fixed annuity inflows. This suggests that individual investors respond to poor S&P returns by allocating their wealth away from equities for years at a time, inconsistent with market-timing motives. However, there are at least three potential challenges to this conclusion. First, perhaps poor S&P returns cause fixed annuity inflows to rise for features unrelated to its zero equity allocation; for example, perhaps household investors prefer both fixed-return and equity-linked investment accounts offered by life insurance companies after incurring poor returns in brokerage accounts. Second, perhaps the results of equation (1) are confounded by a misspecified time trend. Third, perhaps new fixed annuity investors increase the equity share of their remaining assets, leaving their overall asset allocation unchanged and minimizing the relevance of the fixed annuity results. I address the first two challenges in this section; I address the third in the next section.

V.A Fixed-versus-Variable Annuity Inflows

Figure 4 and Table 2 examined the effect of S&P returns on fixed annuity inflows in isolation, motivated by the unique illiquidity of fixed annuity allocations. However, perhaps S&P returns negatively affect both fixed and variable annuity inflows, indicating that the earlier results reflect an overall annuity effect and not a return chasing effect. I address this possibility by repeating the previous section's analyses for the alternative outcome of the fixed annuity share of total (fixed plus variable) annuity inflows. Analysis of the fixed annuity share of total annuity inflows asks: conditional on a dollar being an invested in annuity, do lagged S&P returns predict whether the dollar is invested in a fixed annuity rather than a variable annuity?

Figure 5 replicates Figure 4 for the fixed annuity share of total annuity inflows. As in Figure 4, each panel of Figure 5 displays the actual time series of the fixed annuity share of total annuity inflows along with a fitted time series using equation (1) with different sets of regressors. The regression underlying the fit displayed in panel A excludes S&P return lags; the fit underlying panel B includes one S&P return lag; and the fit underlying panel C includes four S&P return lags. If S&P returns simply predict total annuity inflows and not fixed annuity inflows in particular, S&P return lags should not predict the fixed share of total annuity inflows. Yet as in Figure 4, Figure 5 shows that the addition of a single S&P return lag substantially improves the fit, and the addition of four S&P return lags yields a relatively tight fit of the overall time series.

Table 3 columns 1-4 formalize these results. Column 4 is the preferred specification. The coefficients imply that a one-standard-deviation (15.6-percentage-point) higher S&P return last year, two years ago, three years ago, and four years ago reduce this quarter's fixed annuity inflows by 5.9 percentage points, 4.4 percentage points, 5.0 percentage points, 4.0 percentage points, respectively. These magnitudes amount to respective reductions of 12%, 9%, 10%, and 8% of the mean fixed share of total annuity inflows (47.8%)—broadly similar to the magnitudes of the preferred specification of column 4. t-statistics on these effects range from 3.7 to 8.2. Hence, the negative effect of S&P returns on subsequent annuity inflows is not simply an overall annuity effect.

Table 3 columns 5-8 present analogous evidence for variable annuity inflows considered in isolation. The ability to rebalance variable annuity portfolios minimizes the direct relevance of these results, but analysis of variable annuity inflows evaluates whether S&P returns have the anticipated positive effect on equity-linked annuity inflows, rather than the feared negative effect. Indeed I find that across the specifications, lagged S&P returns have large positive and significant effects on subsequent variable annuity inflows. Hence, individual investors respond to poor S&P returns by contributing to fixed annuities in particular, not just annuities generally.

V.B Multiplicative Time Trend

Equation (1) assumes that the dollar effect of a given lagged S&P return on fixed annuity inflows is time-invariant. However, Figure 2 showed an upward time trend in inflows, suggesting that the responsiveness of inflows to a given S&P lag may have increased over time and thus that (1) is mispsecified. I therefore replicate Table 2 columns 1-4 using the following alternative specification that allows for a multiplicative time trend:

$$(2)\ \ FIXED\_INFLOWS_q = (1+\delta q)\times(\alpha+\beta_1 R_q^{eq}+\beta_2 R_{q-4}^{eq}+\beta_3 R_{q-8}^{eq}+\beta_4 R_{q-12}^{eq}+\gamma R_q^f)+\varepsilon_q$$

estimated with nonlinear least squares and with q beginning at 0. This specification allows the sensitivity of fixed annuity inflows to the regressors to rise over time alongside the rise over time in fixed annuity inflows.

The results are reported in Table 2 columns 5-8. Column 8 shows that the coefficients on the lagged S&P returns remain highly statistically significant. Using δ to scale the β coefficients for the mean quarter, the coefficients imply that a one-standard-deviation (15.6-percentage-point) higher S&P return last year, two years ago, three years ago, and four years ago reduce this quarter's fixed annuity inflows by \$2.9 billion, \$2.1 billion, \$1.6 billion, and \$1.2 billion, respectively—similar to the magnitudes of the preferred specification of column 4.[17] Thus the qualitative and quantitative results of the main specifications of Section IV hold under these alternative specifications.

VI Relevance for Household-Level Portfolios

The previous two sections documented the central finding of the paper: household investors respond to poor S&P returns by allocating wealth to fixed annuities and thus away from equities for years at a time, inconsistent with ride-the-bubble motives. However, this fact may be minimally relevant if new fixed annuity investors increase the equity share of their non-annuity assets, leaving their

[17] Each statistic here is evaluated at the mean quarter $\bar{q}$ and equals $(.156)\,(1-\hat{\delta}\bar{q})\hat{\beta}_p$ for a given lag p.

overall asset allocations unchanged. Thus in this section, I use the 2007-2009 Survey of Consumer Finances introduced in Section III.C to measure whether the average household's decision to allocate assets to fixed annuities is associated with a substantial change in the household's share of financial assets allocated to equities. By examining mean changes in household-level equity *shares*, I produce estimates for the typical U.S. annuity investor.

Column 1 of Table 4a displays the simple result: the average household that invested in a fixed annuity between 2007 and 2009 reduced its equity share of financial assets over the same period by 29.9 percentage points, with a t-statistic of 4.4. Hence, fixed annuity investments are associated with large reductions in household-level equity exposure in the household's full financial asset portfolio. In contrast, column 2 shows that the average household that invested in a variable annuity between 2007 and 2009 modestly and insignificantly increased its equity share of financial assets by 5.6 percentage points. The difference in these changes is large (35.5 percentage points) and in line with the fact from Table 1c that new annuity investors hold 35.3% of their assets in annuities.

Table 4b shows that these differences in equity exposure changes between new fixed annuity investors and new variable annuity investors are not driven by differences in age, wealth, or initial equity exposure. The panel displays estimates from OLS regressions of the form:

$$(3) \qquad \Delta EQUITY\_SHARE_i = \alpha + \beta NEW\_FIXED\_INVESTOR_i + \mathbf{X}_i \boldsymbol{\gamma} + \varepsilon_i$$

on the sample of households that held no annuity assets in 2007 and where $\Delta EQUITY\_SHARE_i$ equals the share of household i's 2009 equity share of financial assets minus the household's 2007 equity share of financial assets, $NEW\_FIXED\_INVESTOR_i$ is an indicator for whether household i held a fixed annuity in 2009, and $\mathbf{X}_i$ is a possibly empty vector of household-level controls. The β term is the coefficient of interest: the correlation between the household's decision to invest in a fixed rather than a variable annuity and the change in the average household's equity share.

Column 1 shows that without controls, new fixed annuity investors experienced a 35.5 percentage point decline in their equity share relative to new variable annuity investors—a magnitude equal to the difference between the two mean changes listed in Table 4a. Columns 4-6 ask whether this large difference is driven by selection into annuity type by successively controlling for quartics in household age, size of the household's 2007 financial assets, and the household's 2007 equity share of financial assets. The equity share change associated with the decision to invest in a fixed annuity remains largely constant at around 35 percentage points and very statistically significant across these specifications.

Hence, households that invest in fixed annuities do not maintain a constant overall equity allocation by increasing the equity exposure of their non-annuity financial assets. Instead, the household decision to invest in a fixed annuity is associated with a large reduction in the household's overall equity exposure that is not explained by household demographics.

VII An Interpretation

The last three sections have demonstrated that individual investors respond to poor S&P returns by allocating wealth to fixed annuities and thus away from equities for years at a time, inconsistent. This challenges the riding-the-bubble explanation of return chasing because fixed annuity assets cannot be cheaply reallocated to equities in the near term. Such long-run return-chasing is quantitatively important for household asset allocations: household-level allocations to fixed annuities are associated with large reductions in household-level equity exposure. Thus it appears that recent S&P returns affect households' long-run asset allocation plans, not just near-term trading strategies.

A natural question is what drives return chasing into illiquid assets. Time variation in asset allocations can of course be driven by time variation in expected returns, risk aversion, or discount rates, and time variation in these factors can produce observationally equivalent behavior. Return-chasing behavior is typically framed in terms of expected returns. Thus as a purely descriptive exercise in order to convey magnitudes under one candidate explanation, I ask what changes in the expected long-run equity return can explain the results, under the strong assumption that demand for fixed annuities is affine in the expected long-run equity premium akin to Kim and Omberg (1996) and Campbell and Viceira (1999).

Specifically, suppose that on average over the population, demand for fixed annuities is a linear function of the expected long-run equity premium as well as a time trend to reflect the secular trend in annuity inflows:

$$FIXED\_INFLOWS_q = \theta_0 + \theta_1 \left(E[\tilde{R}^{eq}_{q+}] - R^f_q \right) + \theta_2 q \tag{4}$$

where $\tilde{R}^{eq}_{q+}$ denotes the annualized long-run (e.g. over the five-to-ten-year maturity of a typical annuity) equity return beginning in quarter q and where R^f_q denotes the average fixed rate of return offered on fixed annuities purchased in quarter q. This affine demand approximation corresponds to the optimal portfolio rules derived in Kim and Omberg (1996) and Campbell and Viceira (1999) who consider environments with a risky asset that exhibits an AR(1) return premium over a riskless asset and investors who can rebalance frequently.[18] Further suppose that individual investors update their expectations of the long-run equity return using an unrestricted weighted average of the first-through-fourth S&P return lags:

$$E[\tilde{R}^{eq}_{q+}] = \lambda_0 + \lambda_1 R^{eq}_q + \lambda_2 R^{eq}_{q-4} + \lambda_3 R^{eq}_{q-8} + \lambda_4 R^{eq}_{q-12} \tag{5}$$

Substituting (4) into (5), one simply derives the paper's main estimating equation (1). Thus

[18] Affine demand for the risky asset does not hold in more complex environments. For example with stochastic interest rates, investors optimally hedge the risk that interest rates will decline, adding complexity to optimal portfolio rules as in Campbell and Viceira (2001).

one can use the coefficient estimates of equation (1) to parameterize the underlying expectation formation weights λ_p as the ratio of the responsiveness β_p of fixed annuity inflows to S&P return lag p and the responsiveness γ of fixed annuity inflows to the fixed rate: $\hat{\lambda}_p = -\hat{\beta}_p/\hat{\gamma}$. This is an intuitive expression: under (4), the expected equity premium rises when either the expected long-run equity return rises or when the fixed rate falls, and the responsiveness of fixed annuity inflows to lagged S&P returns relative to the fixed rate pins down the degree to which S&P return lags affect the expected long-run equity return.

Thus under these strong reduced-form assumptions, the coefficient estimates reported in Table 2 column 4 imply that fixed annuity investors behave as if they raise their expectation of the long-run equity return by 6.6%, 5.1%, 3.7%, and 2.0% of the first-through-fourth S&P lags:[19]

$$E[\tilde{R}^{eq}_{q+}] \;=\; \underset{}{\alpha +} \underset{(.006)}{.066R^{eq}_{q}} + \underset{(.007)}{.051R^{eq}_{q-4}} + \underset{(.008)}{.037R^{eq}_{q-8}} + \underset{(.005)}{.020R^{eq}_{q-12}}$$

Such updating would imply large changes in expectations of the long-run equity premium, including a decline of 8.7 percentage points from 1999 to 2003. However, I stress that this "as-if" analysis is purely descriptive and represents only one possible form of the underlying beliefs and preferences that motivate return chasing into illiquid assets.

VIII Conclusion

This paper has conducted a simple test of household motives when chasing stock market returns. Households' reported expectations suggest that they chase returns in order to "ride the bubble"—buying in advance of a temporary stock market rally and selling in advance of a temporary decline—implying that they do not chase returns into illiquid assets. Fixed annuities are illiquid assets, and

[19] The standard errors reported here are computed using the delta method with the same Newey-West covariance matrix underlying the standard errors reported in Table 2 column 4.

a rise in fixed annuity inflows reflects households locking additional wealth out of the stock market for several years at a time. I find that fixed annuity inflows rise substantially after poor stock market returns, inconsistent with ride-the-bubble intentions and instead indicating buy-and-hold intentions. The results are consistent with households extrapolating recent stock market returns into the long run.

Subsequent work could advance these results in at least two directions. Positively, surveys that solicit household intentions at the moment of asset reallocations could further distinguish among return chasing motives. Normatively, the United States subsidizes three major types of retirement accounts: employer-provided accounts with limited annual contributions (401(k)s), brokerage-provided accounts with limited annual contributions (IRAs), and insurer-provided accounts with unlimited contributions (annuities). To the extent that households face optimization frictions, detailed comparisons of how Americans use each account type could facilitate optimal retirement account design (Carroll, Choi, Laibson, Madrian, and Metrick 2009; Chetty, Friedman, Leth-Petersen, Nielsen, and Olsen forthcoming).

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TABLE 1
Summary Statistics

A. Quarterly Annuity Inflows and the Fixed Rate on New Fixed Annuities

	Inflows			Fixed rate offered on new fixed annuities
	Total	Fixed	Variable	
	($bn) (1)	($bn) (2)	($bn) (3)	(%) (4)
1986-2006 mean	42.0	18.0	24.0	6.0%
1986-2006 standard deviation	17.2	5.8	14.2	1.6%
1986-2006 number of obs.		84		
2006 mean	64.6	21.2	43.4	4.0%

B. Quarterly Lagged S&P Return

	(%) (5)
1986-2006 mean	11.0%
1986-2006 standard deviation	15.6%
1986-2006 number of obs.	84

C. 2009 Characteristics of New Annuity Investors

	Age	Financial assets	Annuity share of financial assets	Equity share of financial assets
	(Years) (6)	($) (7)	(%) (8)	(%) (9)
Mean	65.7	$470,459	35.3%	40.3%
Standard deviation	13.6	$1,446,321	29.6%	29.6%
25th percentile	56	$92,785	13.1%	17.9%
50th percentile	63	$233,224	23.2%	35.6%
75th percentile	75	$481,712	57.9%	63.9%
Number of observations		116		

Notes - Panel A reports statistics from quarterly data on annuity inflows and annuity terms as published by LIMRA, the leading life insurance industry research group. Fixed annuity inflows equals the assets committed to new fixed annuity accounts in the quarter, and likewise for variable annuity inflows. Total annuity inflows equals the sum of fixed annuity inflows and variable annuity inflows. Inflows are measured gross of outflows (outflows are not available but small). The fixed rate offered on new fixed annuities equals the fixed annual rate of return offered on the typical new fixed annuity. Panel B reports statistics on S&P returns. The lagged S&P return for a quarter that begins in month *m* equals the percentage change between the average daily closing price in month *m-13* and month *m-1* in nominal terms. Panel C reports statistics on households in the 2007-2009 Survey of Consumer Finances panel who held zero annuity assets in 2007 but held positive annuity assets in 2009, weighted by the inverse of their sampling probabilities. Age refers to the 2009 age of the member of the household who completed the 2009 survey. Financial assets equals the sum of balances across annuity, checking, savings, 401(k), individual retirement, Keogh, brokerage, and revocable trust accounts in 2009. Annuity share of financial assets equals the share of financial assets held in annuity accounts in 2009. Equity share of financial assets equals the share of financial assets invested in stocks in 2009. All monetary figures are in 2010 dollars. The data underlying panels A and B compose the main quarterly analysis dataset; the SCF data are used for supplementary analyses.

TABLE 2
Lagged S&P Returns and Fixed Annuity Inflows

Dependent variable:	Fixed annuity inflows ($bn)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First S&P lag		-21.12 (3.65)	-20.47 (3.95)	-19.32 (1.38)		-16.09 (2.59)	-15.08 (2.54)	-9.58 (1.45)
Second S&P lag				-14.86 (1.83)				-6.98 (1.06)
Third S&P lag				-10.86 (1.89)				-5.19 (0.83)
Fourth S&P lag				-5.93 (1.61)				-4.08 (0.72)
Fixed return on fixed annuities	187.1 (117.4)		119.4 (112.9)	292.8 (30.6)	26.3 (42.7)		25.0 (51.8)	158.6 (11.2)
Time (quarter relative to 1Q86)	0.242 (0.057)	0.097 (0.031)	0.169 (0.060)	0.227 (0.020)	0.013 (0.005)	0.007 (0.002)	0.009 (0.004)	0.023 (0.005)
Time trend	Additive	Additive	Additive	Additive	Multiplicative	Multiplicative	Multiplicative	Multiplicative
R^2	0.34	0.60	0.61	0.86	0.30	0.61	0.61	0.86
Observations (quarters)	84	84	84	84	84	84	84	84
Dependent variable mean	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Implied effect of one-s.d.-higher S&P return lags	0.0	-3.3	-3.2	-7.9	0.0	-3.2	-3.2	-7.8

Notes - This table tests whether lagged S&P returns affect fixed annuity inflows. See the notes to Table 1 and Section III for variable definitions. Columns 1-4 report coefficients from OLS regressions of quarterly fixed annuity inflows on the displayed combination of lagged S&P returns, the fixed rate of return on fixed annuities, and a linear time trend. Newey-West standard errors allowing for autocorrelation across sixteen quarterly lags are in parentheses. The implied effect of each lagged S&P return being one standard deviation above the mean (as in the late 1990s) equals the sum of the coefficients on the lagged S&P returns, multiplied by the standard deviation of lagged S&P returns reported in Table 1. See Figures 4a-c for the time series fits generated by the regressions underlying columns 1, 3, and 4, respectively. Columns 5-8 replicate columns 1-4 while imposing a multiplicative time trend estimated using nonlinear least squares, which allows the sensitivity of fixed annuity inflows to the regressors to rise over time. The implied effect of one-standard-deviation-higher S&P return lags for these specifications is evaluated at the mean quarter; see Section V.B for the formula.

TABLE 3
Robustness: S&P Returns and Subsequent Fixed-Versus-Variable and Variable Annuity Inflows

Dependent variable:	Fixed annuity share of total annuity inflows: [0,1]				Variable annuity inflows ($bn)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First S&P lag		-0.41	-0.38	-0.38		12.12	12.63	13.10
		(0.12)	(0.13)	(0.05)		(5.15)	(5.60)	(2.50)
Second S&P lag				-0.28				8.58
				(0.04)				(3.85)
Third S&P lag				-0.32				13.26
				(0.04)				(2.31)
Fourth S&P lag				-0.25				12.48
				(0.07)				(2.68)
Fixed return on fixed annuities	5.71		4.43	9.65	52.4		94.2	-129.1
	(3.78)		(3.78)	(1.44)	(176.9)		(183.3)	(84.5)
Time (quarter relative to 1Q86)	-0.002	-0.006	-0.003	-0.002	0.581	0.569	0.626	0.549
	(0.002)	(0.001)	(0.002)	(0.001)	(0.116)	(0.051)	(0.131)	(0.069)
Time trend	Additive	Additive	Additive	Additive	Additive	Additive	Additive	Additive
R^2	0.63	0.72	0.75	0.92	0.90	0.91	0.91	0.96
Observations (quarters)	84	84	84	84	84	84	84	84
Dependent variable mean	47.8%	47.8%	47.8%	47.8%	24.0	24.0	24.0	24.0
Implied effect of one-s.d.-higher S&P return lags	0.0 pp	-6.4 pp	-6.0 pp	-19.2 pp	0.0	1.9	2.0	7.4

Notes - Columns 1-4 of this table replicate columns 1-4 of Table 2 using the outcome of the fixed annuity share of total annuity inflows, which equals fixed annuity inflows divided by the sum of fixed annuity inflows and variable annuity inflows. Columns 5-8 of this table replicate columns 1-4 of Table 2 using the outcome of variable annuity inflows. See the notes to Table 2 for details. See Figures 5a-c for the time series fits generated by the regressions underlying columns 1, 3, and 4, respectively.

TABLE 4
Asset Allocation Changes of New Annuity Investors

A. Change in Equity Share by Type of New Annuity Investor

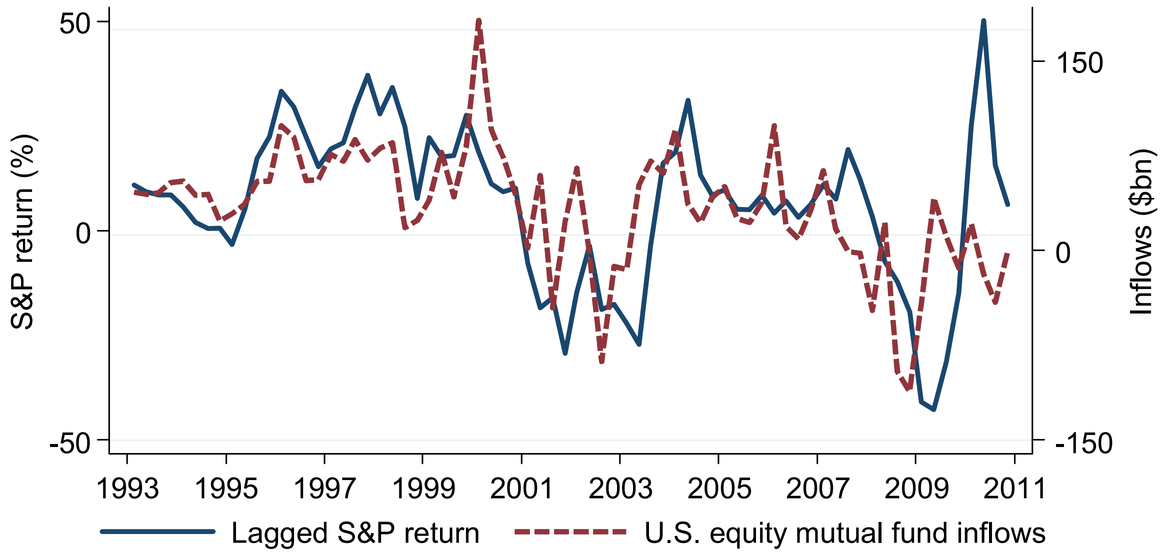
Variable:	Household's equity share change 2007-2009: [-1,1]	
Sample:	New investors in fixed annuities	New investors in variable annuities
	(1)	(2)
Mean	-0.299	0.056
Standard error	(0.067)	(0.036)
Observations	25	91

B. Change in Equity Share for New Fixed Investors Relative to New Variable Investors

Dependent variable:	Household's equity share change 2007-2009: [-1,1]			
	(3)	(4)	(5)	(6)
New fixed annuity investor: {0,1}	-0.355	-0.347	-0.322	-0.351
	(0.103)	(0.093)	(0.090)	(0.056)
Controls				
Age		X	X	X
2007 financial assets			X	X
2007 equity share				X
R^2	0.16	0.22	0.26	0.69
Observations	116	116	116	116

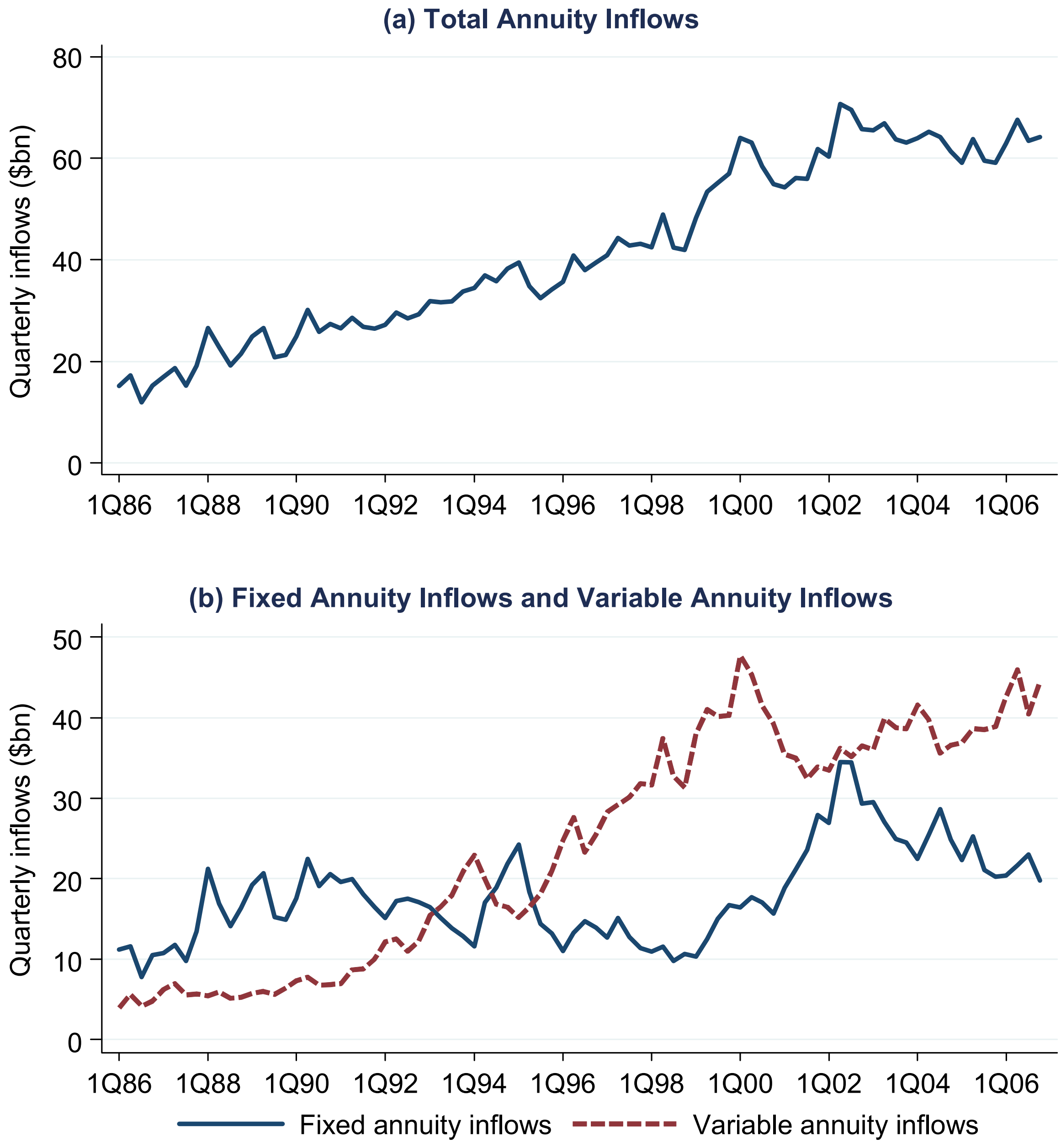
Notes - Panel A uses the 2007-2009 Survey of Consumer Finances panel to report the mean and standard error of 2007-2009 equity share changes for new annuity investors. A household's 2007-2009 equity share change equals the household's 2009 equity share of financial assets minus the household's 2007 equity share of financial assets. New fixed annuity investors are defined as new annuity investors who held no stocks in their annuities in 2009; all other new annuity investors are classified as new variable annuity investors. See the notes to Table 1 and Section III for more variable details. Panel B uses the same data to report estimates from regressions of the household's 2007-2009 equity share change on whether the household was a new fixed annuity investor. The coefficient in column 3 equals the difference between the means reported in columns 1 and 2. Columns 4-6 successively control for quartics in household age, the size of the household's 2007 financial assets, and the households 2007 equity share.

FIGURE 1
Lagged S&P Returns and Equity Mutual Fund Inflows



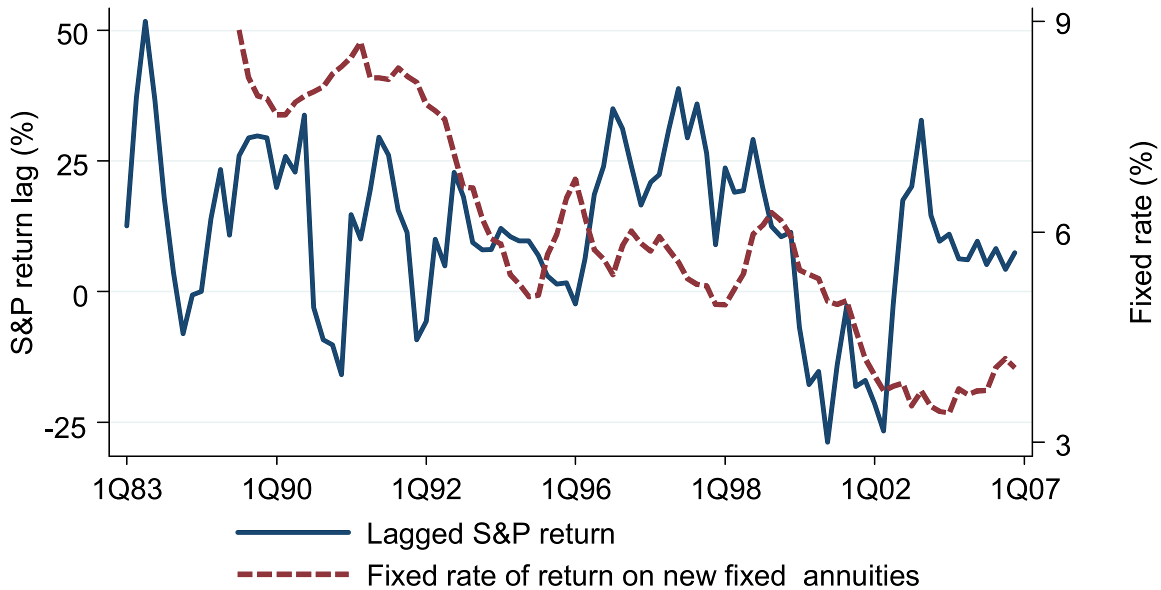
Notes: This graph plots the 1993-2011 quarterly time series of nominal lagged 12-month S&P returns and net inflows to U.S. equity mutual funds—similar to the annually published Figure 2.4 in the Investment Company Institute Fact Book. The lagged S&P return for a quarter that begins in month m equals the percentage difference between the average S&P daily closing price in month $m - 13$ and month $m - 1$. Net inflows equals gross inflows to U.S.-based equity-only mutual funds minus gross outflows from these funds in 2010 dollars and excluding reinvested dividends; gross inflows (not shown) exhibit a similar pattern. The series are correlated with coefficient 0.46. Flows data were provided by the Investment Company Institute.

FIGURE 2
Time Series of Annuity Inflows



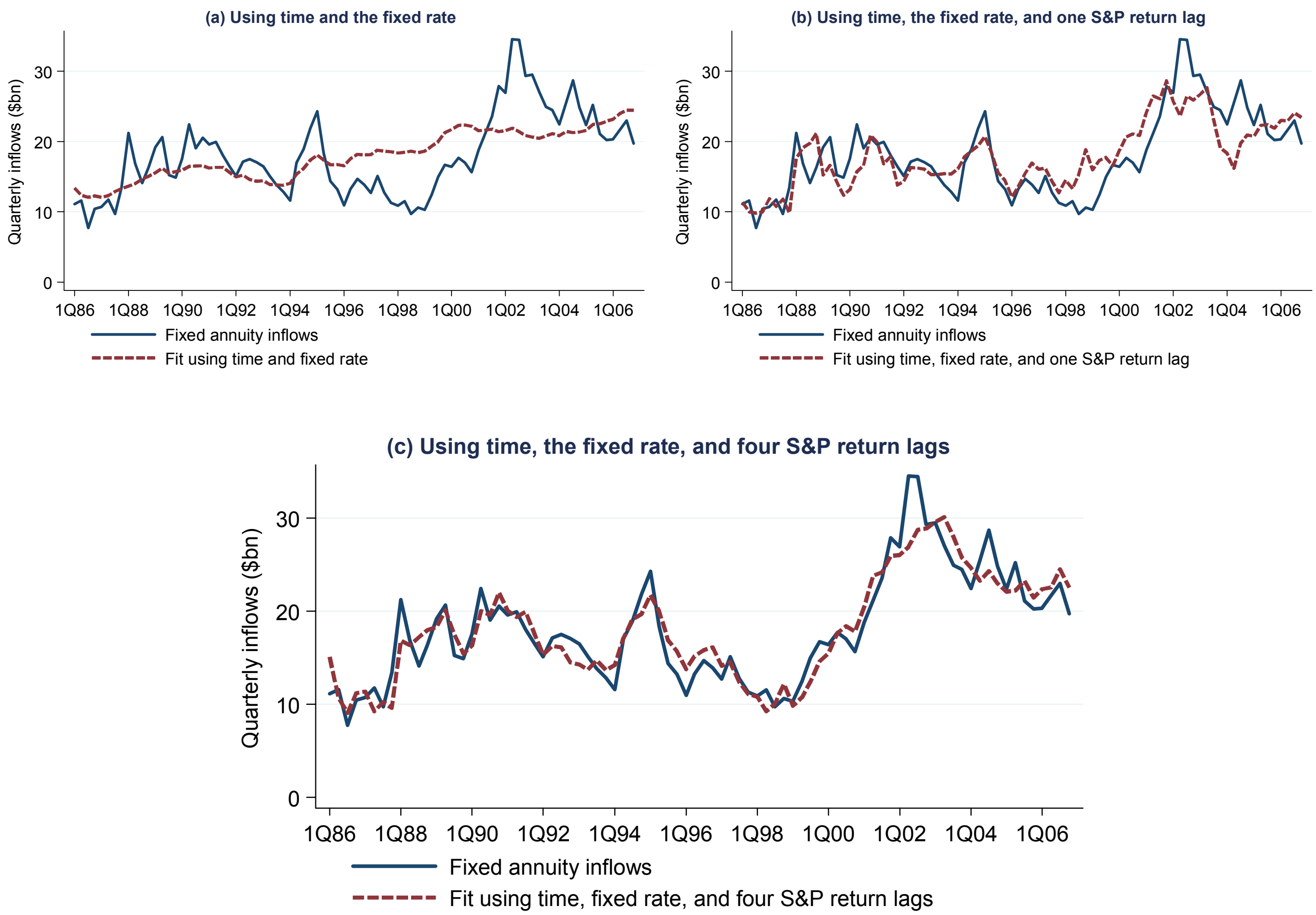
Notes: Panel A plots the quarterly time series of total annuity inflows, equal to the sum of fixed annuity inflows and variable annuity inflows. Panel B plots the time series of fixed annuity inflows and variable annuity inflows separately. U.S. annuities are not annuities in the traditional economic sense: rather than lifetime income streams, U.S. annuities are tax-preferred savings vehicles into which households nearing retirement make typically large one-time contributions. Investors choose either a fixed (fixed-return) or variable (equity-linked) annuity at the time of contribution. Unlike variable annuity contributions, fixed annuity contributions cannot be reallocated across asset classes before the annuity's pre-specified maturity of typically five to ten years without triggering substantial surrender fees. Inflows are in 2010 dollars and gross of outflows (outflows are not available but small).

FIGURE 3
Lagged S&P Returns and the Fixed Rate on New Fixed Annuities



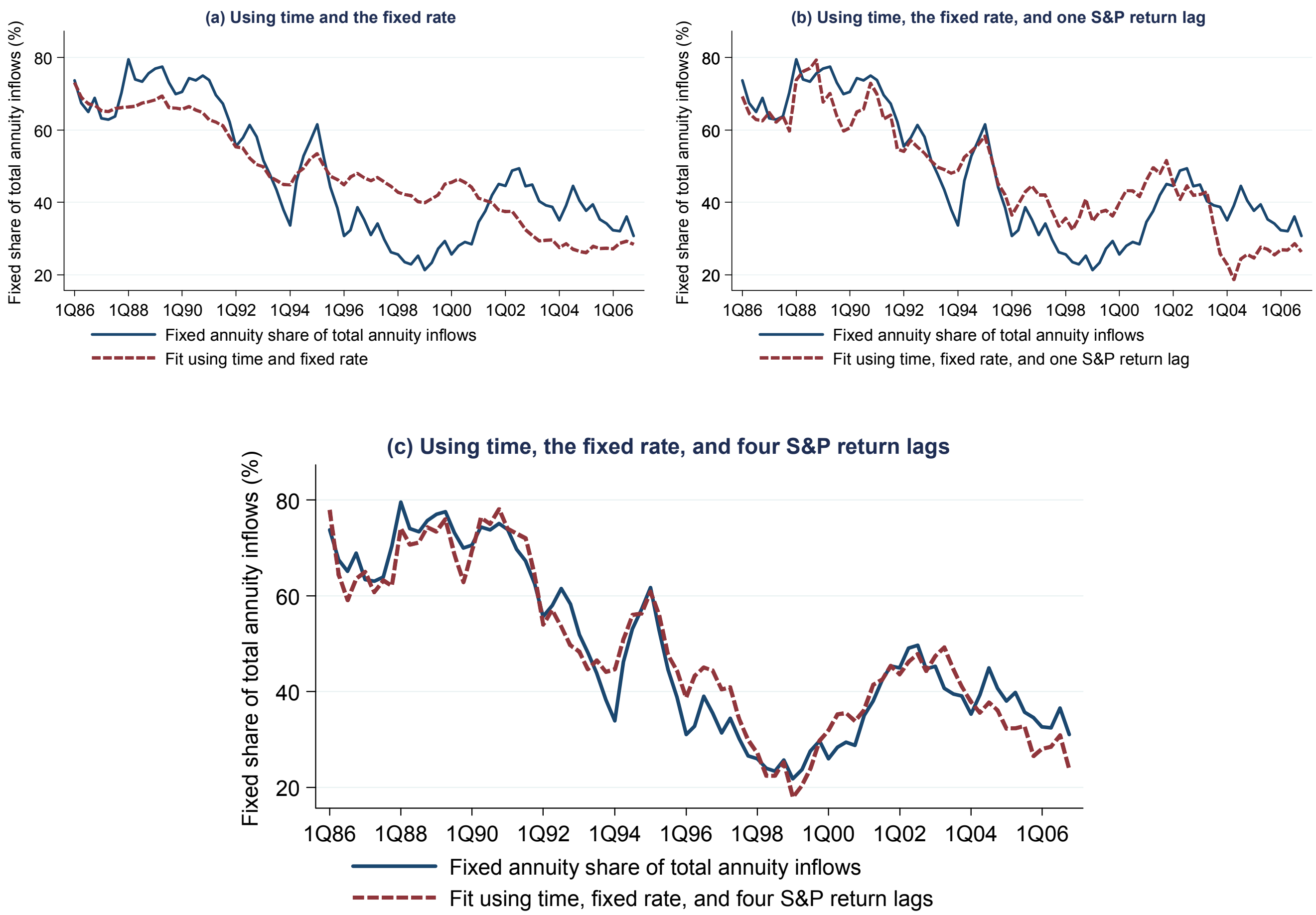
Notes: This graph illustrates independent variation in the paper's key quarterly explanatory variables: nominal lagged 12-month S&P returns and the fixed rate of return offered on new fixed annuities. The lagged S&P return for a quarter that begins in month *m* equals the percentage difference between the average S&P daily closing price in month $m - 13$ and month $m - 1$. The fixed rate offered on new fixed annuities equals the fixed annual rate of return offered on the typical new fixed annuity. The main analysis of this paper uses 84 quarters of data between 1986 and 2006; I display twelve additional quarters of lagged S&P returns because the preferred specification includes the first-through-fourth S&P return lags.

FIGURE 4
Explaining Fixed Annuity Inflows



Notes: This figure illustrates the ability of lagged S&P returns to explain quarterly fixed annuity inflows. The three panels plot the fitted time series generated by the OLS regressions underlying Table 2 columns 1, 3, and 4, respectively. Panel A plots actual fixed annuity inflows (as in Figure 2b) and the fit generated by a regression of quarterly fixed annuity inflows on a linear time trend and the fixed rate of return offered on new fixed annuities. Panel B displays the fit generated when the quarter's first S&P return lag (the 12-month S&P return preceding the quarter) is included in the regression. Panel C displays the fit generated when the quarter's first-through-fourth S&P return lags (the four successive 12-month S&P returns over the 48 months preceding the quarter) are included in the regression. See Figures 2-3 for variable definitions.

FIGURE 5
Explaining Fixed-versus-Variable Annuity Inflows



Notes: This figure replicates Figure 4 for the outcome of the fixed annuity share of total annuity inflows, which equals fixed annuity inflows divided by the sum of fixed annuity inflows and variable annuity inflows. See the notes to Figures 2-3 for variable definitions and Figure 4 for specification details.