Stock Investors' Returns are Exaggerated

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Abstract

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Keywords: All-shareholder returns; capital flows; dividend reinvestment; equity premium; market timing; total shareholder returns.

JEL Classifications: G11, G12, G51

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The stock market generates less wealth than it appears. We show that total shareholder return (TSR), the standard measure of stock investor performance, substantially exaggerates returns earned by these investors in aggregate, and thus by most investors. The main reason: from investors' collective perspective, dividends cannot be reinvested in public equity, as TSR assumes, but only in other lower-yielding assets. In addition, TSR is inflated by well-timed repurchases and equity issuances that merely transfer value among investors. We put forward another measure—"all-shareholder return" (ASR)—which better captures the wealth generated by the stock market for investors. We estimate that the ASR equity premium is 17 to 73% lower than the TSR-implied equity premium, depending on the investment alternative. We also estimate that the wedge between ASR and TSR is primarily driven by the reinvestment effect. However, over time, the reinvestment effect declines while the timing effect of cash flows increases, consistent with rising stock issuances and buybacks.

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1 Introduction

Long-run buy-and-hold stock market returns with dividend reinvestment ("total shareholder returns" or "TSR") are significantly higher than risk-free returns, leading to an annual equity risk premium of about 6% (see, e.g., DeLong and Magin, 2009, for a review of the "equity risk premium" puzzle). Stocks are thus pitched as a key component of wealth accumulation strategies (e.g., Seigel, 2014), and have become an important savings vehicle for American families: from 1989 to 2016, the share of families owning equity, either through retirement accounts or direct investments, has grown from 35% to 50% (Bricker *et al.*, 2019). The high equity premium has also led policymakers to consider investing Social Security funds in the stock market (Burtless *et al.*, 2016).

In this paper, we explain that the stock market generates much less wealth for investors as a group than it appears. While individual investors who hold stock and reinvest dividends ("TSR investors") earn the equity premium, investors as a group cannot. The main reason: because TSR requires dividend reinvestment in shares previously held by other investors, it is by construction impossible for all investors to achieve. As a group, investors cannot plow dividends back into public firms, and must invest them in lower-yielding assets. Thus, every TSR investor who earns the equity premium necessarily involves another investor not earning that premium. The same holds for cash distributed via net repurchases (stock buybacks less issuances), which now exceed dividends (Fried and Wang, 2019). In addition, TSR is boosted by well-timed repurchases and equity issuances that merely transfer value from trading to continuing stockholders (Sloan and You, 2015). The returns for stock investors collectively therefore must be lower than that implied by TSR, as public firms distribute considerable amounts of cash and engage in market-timed equity transactions with their own shareholders.

To measure aggregate shareholder returns and the effective premium enjoyed by the typical stock investor, we put propose and implement a new approach: "all-shareholder return" or "ASR." Using this ASR approach, we estimate that TSR overstates the effective premium for stock investors (the "ASR premium") by between 21% and 268%, depending on alternative investment options. Most investors cannot, and do not, earn the 6% equity premium available to TSR investors.

While we are not the first to stress the importance of measuring aggregate shareholder returns, prior research has employed an internal rate of return (IRR) methodology (Dichev, 2007; Bessembinder *et al.*, 2019) that has well-known and significant conceptual and computational drawbacks. To begin, IRR is generally not a valid measure for the effective rate of returns earned by investors unless net cash distributions are reinvested at the IRR rate (Lin, 1976; Phalippou, 2008), a restrictive condition that cannot be satisfied for stock investors as a group. In addition, IRR can produce multiple or no real solutions, be sensitive to measurement windows (Keswani and Stolin, 2008; Johnston *et al.*, 2015), or be subject to a "hindsight bias" (Hayley, 2014). Thus, the actual return obtained by all stock market investors remains an open question.

Our ASR approach avoids the problem with IRR by explicitly taking into account actual reinvestment possibilities for net cash distributions to investors. As a first and partial step, we examine the effect of relaxing the dividend-reinvestment assumption embedded in TSR, and assume that buy-and-hold investors invest dividends in alternative assets—treasuries of different maturities, corporate bonds, and housing—instead of the stock market. On this modified TSR approach, the premium earned by market investors is between 14% (assuming dividends reinvestment into housing) and 51% (assuming dividends reinvestment into 1-month treasuries) lower than the TSR-implied equity premium.

We then integrate into the analysis repurchases and equity issuances, using a modified IRR (mIRR) approach that circumvents IRR's shortcomings (Phalippou, 2008) and that has been applied to measure returns of private equity (Franzoni *et al.*, 2012). We find that the ASR premium is 17%-73% lower than the TSR-implied equity premium or, equivalently, that TSR overstates the effective premium for stock investors by 21% to 268%. These findings are robust in the three 30-year sub-periods in our sample.

Finally, we analyze the sources of the ASR-TSR gap. The main reason why ASR is significantly lower than TSR is due to the reinvestment effect: large cash payouts by public firms that, from shareholders' collective perspective, can only be invested in other assets (such as bonds) that tend to yield significantly lower returns. We estimate that 70-92% of the ASR-TSR gap is due to this reinvestment effect. We also find that the timing of cash flows, either with respect to TSR or alternative investment asset's returns, explains between 8-32% of the ASR-TSR gap. And, over time, the reinvestment effect's contribution to the ASR-TSR gap declines while the market-timing effect becomes more important, consistent with the increasing prevalence of stock issuances and buybacks. Nevertheless, the reinvestment effect is the predominant effect in each 30-year sub-period in our sample.

Our findings contribute to the literature on the returns of stock market investors as a group. Like Dichev (2007), which uses an IRR approach, we find that aggregate shareholder returns are significantly lower than TSR suggests. But we argue that our mIRR approach is a more appropriate and robust measure of value creation by the stock market. In addition, while Dichev (2007) suggests that the difference between aggregate shareholder returns and TSR is likely driven by the market timing of equity issuances and buybacks, which tends to shift value from trading investors to buy-and-hold investors (including TSR investors), we show instead that the main driver is non-TSR investors' need to reinvest the cash in lower-returning assets.

Our findings are also broadly related to recent work seeking to quantify the stock market's wealth-generation effects (Bessembinder, 2018; Bessembinder *et al.*, 2019; Bessembinder, 2020). These papers highlight skewness in the performance of public firms: aggregate value creation in the stock market is driven by a very small subset (4%) of firms, while remaining firms collectively only match the performance of U.S. treasury bills. Thus, investors who are not extremely skilled stock-pickers should invest in index funds. Our findings suggest, however, that while individual TSR investors can capture the full benefit of this indexing strategy, as a group investors cannot: because all index investors cannot be TSR investors, the typical investor investing through an index will still earn a premium that is substantially lower than that implied by TSR.

Our work is also connected to the literature on market timing by firms issuing or buying shares (Baker and Wurgler, 2002; Sloan and You, 2015). It is most closely related to Sloan and You (2015), which estimates that the wealth-transfer effect of repurchases and equity issuances each year is about 40% of net income, transfers that can be expected to accrue to the benefit of long-term investors. Our work shows that such wealth transfers among investors do in fact boost returns for TSR investors and contribute to the gap between TSR and ASR.

Finally, our findings contribute to various policy discussions about the role of the stock market as a savings and wealth creation vehicle. First, while wealthier families are more likely to invest in equities (Diamond, 2000; Burtless *et al.*, 2016), our work suggests that the stock market does not contribute as much to income and wealth inequality as TSR returns may suggest. Second, our work has implications for the debate over the potential role of the stock market in buttressing the Social Security Trust Fund (Diamond, 2000; Burtless *et al.*, 2016). It suggests that returns will not be as great as might be expected unless the Trust Fund sticks to a TSR strategy; but if it does so, its outsize returns will simply come at the expense of other investors. Third, our work has implications for efforts aimed at inducing Americans to save more. Others have examined the role of American investors' understanding of the rates of equity returns to explain the low retirement savings rate (Beshears *et al.*, 2017) and the potential importance of financial education for increasing savings rates (Angrisani *et al.*, 2012) To the extent that the TSR-implied equity premium and the relatively low savings rates suggest that Americans should increase their pre-retirement savings in the stock market to sustain their standards of living (Poterba, 2014), our findings suggest that the typical American should save *even more* because she is unlikely to earn TSR returns in the stock market.

2 Building Intuition

2.1 TSR and Non-TSR- Investors

The equity premium can be earned by a hypothetical TSR investor. But TSR investors are likely only a small subset of all investors of any given firm. First, dividends are rarely reinvested (Hartzmark and Solomon, 2019; Baker *et al.*, 2007; Kaustia and Rantapuska, 2012; Bräuer *et al.*, 2020; Di Maggio *et al.*, 2020). Second, any investor actually reinvesting dividends in the firm's shares necessarily displaces another investor from that firm (unless the firm issues additional shares to the reinvesting shareholder). To be sure, for a particular firm during any period, there may well be some TSR investors: they own stock at the beginning of the period, do not sell any of this stock during the period, and reinvest any dividends issued on this stock in additional shares of the firm's stock. But most investors in this firm during this period will be non-TSR investors, as they will engage in one or more of the following transactions: (1) buying stock other than when reinvesting dividends; (2) selling stock, and investing the proceeds in some other assets; and (3) investing the firm's dividends in some asset other than the firm's own stock. Thus, TSR is highly unlikely to capture what all of a firm's investors—TSR and non-TSR—actually earn. Moreover, because dividends and net repurchases cannot be reinvested in the firm by investors in aggregate, TSR does not capture what the firm's investors as a whole could earn, unless the firm completely refrains from shareholder payouts and equity issuances.

2.2 Numerical Example

Imagine an economy in which there are two investment options: an account at Bank, which generates 0%, and a single publicly-traded firm, ABC. ABC is funded exclusively by equity and has 2 shares: one held by investor X and one held by investor Y.

At T_0, ABC has $10 in cash in Bank and $20 in other assets. Without loss of generality, the investors do not expect any future cash flows, so that the price of each share is $15. ABC then unexpectedly earns $10 between T_1 and T_2.

Consider ABC investors' returns from the following two scenarios. (1) No-dividend scenario: ABC does not distribute any dividends, so that the stock price remains at $15 per share at T_1 and increases to $20 per share at T_2. (2) Dividend scenario: ABC distributes $10 in dividends ($5 per share) at T_1, so that the stock price falls to $10 per share at T_1 and increases to $15 per share at T_2. Any dividends distributed by ABC enter investors' personal Bank accounts.

From the perspective of X and Y collectively, both scenarios generate the same returns. In each case, X and Y collectively begin with a total of 2 ABC shares worth $30 and end up with $40. In the no-dividend scenario, investors end up with 2 ABC shares worth $40; in the dividend scenario, investors end with 2 ABC shares worth $30 and $10 in the Bank. The only difference is that in the dividend scenario $10 moves from ABC's Bank account to the personal Bank accounts of X and Y. In both scenarios, because investors start with $30 and end with $40, all-shareholder return (ASR) is 33% ($40/$30-1).

However, TSR changes dramatically based on whether ABC issues dividends at T_1. In the no-dividend scenario, TSR is 33% ($20/$15-1), the same as ASR. But in the dividend scenario, TSR assumes the $5 dividend per share is reinvested in ABC's stock at the ex-dividend price in T_1 ($10). Take X as the hypothetical TSR investor: she starts with 1 share worth $15 at T_0, then receives a $5 dividend that is assumed to be reinvested in an additional 0.5 share at the T_1 price of $10 per share. At T_2, X is assumed to own 1.5 shares worth $15 per share (for a total of $22.50), generating a TSR return of 50% ($22.50/$15-1). If X does not in fact reinvest, the 17% higher return imputed by TSR to X is purely illusory; both X and Y earn 33%. If X does in fact reinvest by buying 0.5 of Y's 1 share, X would in fact achieve the 50% TSR return; but this would not reflect the value generated by ABC for all of its shareholders, an ASR of 33%, as Y's return would drop to 16.7%.[1]

[1] Y starts with a single share worth $15, and ends with a 0.5 share worth $7.50, a $5 dividend in the bank, and $5 proceeds from the 0.5 share sale to X, or $17.50. Y's returns would thus be 16.7% ($17.50/$15-1).

3 Methodology and Findings

Just as ASR provides a better estimate than TSR for the returns earned by investors in a single firm, it does so for the returns earned by investors in the entire market as a whole. We thus now proceed to calculate ASR for the entire market by (a) eliminating the dividend-reinvestment assumption and assuming dividends are invested in non-stock assets; and (b) taking into account all sources of cash flows from public firms to investors, including repurchases and equity issuances. As a first and partial step, we do away with the dividend reinvestment assumption and assume reinvestment in alternative assets. Next, we integrate share repurchases and equity issuances into the analysis.

3.1 Allowing Alternative Reinvestments: Modified TSR

We begin by examining the impact of eliminating TSR's assumption that dividends are reinvested into the market (which, by definition, is impossible for all stock investors). We compute an alternative—modified TSR—that computes the total returns to shareholders when dividends are reinvested in a non-equity security available to investors.[2]

We define modified TSR (mTSR) over a period of time (from 0 to T) as

$$mTSR^{j}_{0,T} = \frac{\sum_{\tau=0}^{T} D_\tau \times R^{j}_{\tau,T} + P_T}{P_0}, \tag{1}$$

where P_τ is the price per share at τ, D_τ is the dividend per share distributed at τ, and $R_{\tau,T}$ is the cumulative rate of return of asset j from τ to T. For example, if a shareholder receives \$1 of dividend at τ and reinvests it in housing, then R_τ is the cumulative return on housing from τ to T. Note that TSR is simply a special case of mTSR in which the reinvestment

[2] In estimating the amount of wealth created by the stock market, Bessembinder (2018), Bessembinder *et al.* (2019), and Bessembinder (2020) make a similar observation about shareholders' inability to reinvest net cash outflows back in the stock market in the aggregate. Whereas their computations assume that investors save net cash outflows in accounts earning treasury bill yields, our estimation of investors' returns from the stock market examines a variety of plausible non-equity investment returns.

asset is the market portfolio:

$$TSR_{0,T} = \frac{\sum_{\tau=0}^{T} D_\tau \times TSR_{\tau,T} + P_T}{P_0}. \tag{2}$$

Table 2 compares TSR to mTSR under various reinvestment assumptions. The first row reports annualized TSR and the TSR-implied equity risk premium (annualized TSR minus the annualized risk-free rate) for the period January 1926-December 2015. TSR is annualized by taking the geometric annual average of cumulative monthly returns of the CRSP value-weighted index (i.e., reinvesting all distributions into the index each month). The annualized risk-free rate is obtained by taking the geometric annual average of cumulative 1-month treasury yields. We find that annualized TSR is 9.74%, implying an annual equity premium of 6.33%.

The remaining rows of Table 2 report mTSR estimates over the same period under various dividend-reinvestment options (Eq. (1)). We consider eight plausible alternative reinvestment options for U.S. stock market investors. Five involve reinvesting dividends into treasuries: the 1-month treasury bill, the 1-year treasury bill, the 5-year treasury note, the 10-year treasury note, and the 30-year treasury bond. Two involve reinvesting dividends into corporate bonds: Moody's corporate AAA bond yield, and the BAA bond yield. The eighth and last involves reinvesting dividends into housing. The last column of the panel reports the percentage reduction in the premium relative to the TSR-based equity premium (second column of Panel A). Reinvestment rates are detailed in Appendix A.1 and their summary statistics are reported in Appendix 1.

Our findings suggest that eliminating the dividend-reinvestment assumption significantly lowers investors' returns. For example, reinvesting dividends into 1-month U.S. treasuries results in an annualized return of 6.51% and an annualized "mTSR premium" of 3.1%, 33% and 51% lower than annualized TSR and the equity premium respectively. We similarly obeserve a significant decline when dividends are reinvested in longer maturity treasuries or long-maturity investment-grade corporate bonds. Reinvesting dividends in housing produces the highest annualized returns and mTSR premium, but even under this reinvestment option the mTSR premium is 14% lower than the equity premium.

These mTSR measures not only better capture the returns that stock market investors in the aggregate could earn, given that investors cannot collectively reinvest dividends in the market, but they also better reflect the returns that most stock market investors do earn, as dividends are in fact rarely reinvested (Baker *et al.*, 2007; Hartzmark and Solomon, 2019).[3]

Notwithstanding what investors actually do with dividends, or how investors perceive dividends, the main takeaway from this analysis is that even if investors wanted to reinvest stock dividends, they could not collectively reinvest in the stock market. A proper measure of the overall returns from investing in the stock market needs to therefore take into account alternative reinvestment options, which significantly lower the effective investment returns.

3.2 Incorporating Stock Buybacks and Issuances: Estimating Market-Level Net Distributions

To capture aggregate shareholder returns, we must consider not only the investment of dividends into other assets, but also the effects of repurchases (which, like dividends, move cash from firms to investors) as well as equity issuances (which move cash in the opposite direction), both of which are significant (Fried and Wang, 2019).

These transactions have two types of effects on investor wealth. First, like dividends, they move capital between types of investment. Positive net equity issuances (issuances minus repurchases) cause investors to "withdraw" capital from alternative investments. Negative net equity issuances generate cash that must be invested in alternative investments. In addition, positive or negative net equity issuances driven by market-timing will shift wealth among

[3]These patterns are consistent with behavioral biases due to investors mentally accounting for dividends differently than for capital gains, biases that prevail across different markets (e.g., Kaustia and Rantapuska (2012), Bräuer *et al.* (2020), and Di Maggio *et al.* (2020)). Hartzmark and Solomon (2020) suggests that one reason investors separately account for dividends could be because major stock indices report performance on the basis of price changes and do not include dividends.

stock investors, from trading investors to buy-and-hold and TSR investors. Following Fama and French (2005) and Fried and Wang (2019), we use a "share count" method for capturing firm-shareholder cash flows from net equity issuances.

We estimate aggregate monthly net payouts to market investors (dividends less net equity issuances) as follows. First, we compute net shareholder payouts for each continuing firm (i.e., trading at the end of the prior and the current month) following Fried and Wang (2019):

$$\text{Net Shareholder Payouts}_{i,t} = \text{Dividend Payouts}_{i,t} - \text{Net Equity Issuances}_{i,t}. \tag{3}$$

where net equity issuances are estimated as the change in share count times the average daily closing price over the month. Then, we compute market-level net distributions as follows:

$$\text{Net Distributions}_t = \sum_i \left(\text{Net Shareholder Payouts}_{i,t}\right) + \text{Exit Outflows}_t - \text{Entry Inflows}_t. \tag{4}$$

Exit outflows represents the capital leaving the stock market due to firms no longer trading on public exchanges, and is estimated using the end-of-month (or last available in the month) market capitalization of exiting firms (i.e., those without a valid stock price next month). Entry inflows represents the capital entering the stock market due to firms listing on public exchanges, and is estimated using the end-of-month market capitalization of entering firms (i.e., those without a valid stock price in the prior month). We thus treat exiting firms as making a final dividend payment equal to their final market capitalization, and entering firms as issuing stock equal to their initial market capitalization. Table A.1 details the construction of the cash flow components and Table 1 report their summary statistics.

Our method for computing net payouts to stock market investors is conceptually very similar to that of Dichev (2007), which compute net distributions to market investors as $\text{Market Capitalization}_{t-1} \times (1 + r_t) - \text{Market Capitalization}_t$ using monthly market capitalizations and the market's value-weighted monthly returns (r_t). This alternative measure also takes into account indirect equity issuances as well as capital flows due to entering and exiting firms. The primary difference between his measure and ours is the assumed price at which shares are being issued and repurchased. Our method applies the average daily price, while his applies the end-of-month price.

3.3 All-Shareholder Return

Having described the various forms of cash flow to and from investors, we propose a measure of aggregate shareholder returns—all-shareholder return (ASR)—–using a modified IRR (mIRR) approach and the net distributions estimate in Eq. (4). We estimate all-shareholder return (ASR) as follows:

$$ASR^j_{0,T} \quad = \quad \frac{\sum_{\tau=0}^{T} \text{Net Distribution}^+_\tau \times R^j_{\tau,T} + MCAP_T}{MCAP_0 + \sum_{\tau=0}^{T} \text{Net Distribution}^-_\tau / R^j_{0,\tau}}, \tag{5}$$

$$\text{where} \qquad \text{Net Distribution}^+_\tau = |max(0, \text{Net Distribution}_\tau)|$$

$$\text{and} \qquad \text{Net Distribution}^-_\tau = |min(0, \text{Net Distribution}_\tau)|.$$

mIRR is a generalization of IRR (Hirschleifer, 1958; Lin, 1976) that, like IRR, can be used to measure aggregate shareholder returns from investing in the stock market.[4] But unlike IRR, mIRR treats interim capital inflows differently from interim capital distributions: interim inflows are considered investments and accounted for in the investment base whereas interim outflows are treated as distributions to shareholders. In doing so, mIRR represents a measure of the effective returns on an investment earned by investors over a period, defined as the ratio of the future value of the investment (i.e., the future value of all cash distributions) to the present value of the investment base:

$$Return_{0,T} = \frac{FV(Distributions)}{PV(Investments)}. \tag{6}$$

[4] Biondi (2006) provides a detailed account of the history of the modified IRR approach, which traces back to the 18th century and attracted the attention of financial economists in the 1950s (Hirschleifer, 1958).

Both mTSR and TSR satisfy this definition (Eq. (1) and (2)).

More importantly, mIRR does not suffer from IRR's numerous pitfalls. First, IRR is a valid effective rate of returns measure if (and only if) distributions are reinvested at the IRR rate, an assumption that does not hold for stock market investors as a group (Lin, 1976; Phalippou, 2008). Second, for a given cash flow stream, there may be multiple conflicting IRR values or no real IRR values at all, particularly when the cash flow stream has multiple sign changes (Yoon and Choi, 2002). IRR has thus generally been viewed as a highly imperfect measure for investment returns, and its use has been widely criticized.[5] As a result mIRR is a better measure of effective returns earned by investors (Phalippou, 2008).

Our approach is related to Dichev (2007), which also measures aggregate shareholder returns, but which uses IRR instead of mIRR: i.e., solving for the IRR that equates the stock market's capitalization at the beginning of the investment period to the present value of the net distributions to investors and the ending-period market capitalization. The literature has also identified several flaws with the analysis of Dichev (2007) and its use of IRR. For example, Keswani and Stolin (2008) and Johnston *et al.* (2015) show that the findings of Dichev (2007) are sensitive to the choice of time periods.

Our paper is also related to Franzoni *et al.* (2012), which like our paper, uses realized returns of alternative assets as reinvestment and discount rates to measure actual returns from investments. But while Franzoni *et al.* (2012) utilize mIRR to estimate investors' actual returns from private equity, we utilize mIRR to estimate stock market investors' returns from the stock market.

Table 3 reports our estimates of ASR under the same eight reinvestment options considered in the computation of mTSR (Table 2). We find that aggregate shareholder returns from investing in the U.S. stock market between 1926 and 2015 is significantly lower than TSR suggests. The ASR premium is between 72% (when reinvesting net distributions in 1-month

[5] Brealey and Myers (2003, p.104) criticizes IRR as "a derived figure without any simple economic interpretation." Phalippou (2008) notes that IRR is "probably the worst performance metric" in an investment context. In addition to the above-mentioned flaws, IRR can be artificially inflated, due to its sensitivity to a "hindsight bias" (Hayley, 2014).

treasuries) and 17% (when reinvesting in housing) lower than the TSR-implied equity premium. Compared to the mTSR results in Table 2, the inclusion of all sources of cash flow further attenuates our estimate of the effective premium earned by stock market investors.

3.4 ASR by Sub-Period

We examine the robustness of the main findings in Table 3 by examining the ASR-TSR gap across sub-periods. In Table 4, we compute ASR for three sub-periods of approximately thirty years each: 1926-1956 (Panel A), 1956-1986 (Panel B), and 1986-2015 (Panel C). We find consistent results across the three sub-periods in our sample. In every investment alternative considered across these sub-periods, the ASR premium is significantly lower than the TSR-implied equity premium. For example, in the 1926-1956 period, the ASR premium is between 21% (housing) to 47% (1-month treasuries) lower than the equity premium. In the 1986-2015 period, the ASR premium is between 11% (housing) to 39% (1-month treasuries) lower than the equity premium.

Overall, our results suggest that ASR is consistently lower than TSR over time, and economically significantly so. In untabulated results, we find that in *every* 30-year window ASR is lower than TSR, regardless of the reinvestment. On average, over all 30-year windows in our sample, the realized ASR equity premium is between 38% (1-month treasuries) to 16% (housing) lower than the TSR equity premium.

The stability of the differences between ASR and TSR contrasts with the sensitivity of IRR, which prior work has shown to depend critically on the measurement window (Keswani and Stolin, 2008; Johnston *et al.*, 2015), because IRR is boosted when there are large cash distributions after periods of relatively high returns and lowered when there are large cash distributions after periods of relatively low returns (Phalippou, 2008; Hayley, 2014). Thus, IRR values are sensitive to the relationship between the size of terminal cash flows (e.g., the ending market capitalization) and prior-periods' returns in a given return-measurement window.

In untabulated results, we confirm that, when examining all rolling 30-year windows in our sample, IRR is significantly more volatile than ASR. For example, the standard deviation of the IRR-implied equity premium is twice as high as the ASR equity premium. Moreover, in about a quarter of the 30-year windows, the IRR-implied equity premium is in fact higher than the TSR-implied equity premium. Finally, IRR also produces significantly larger equity premiums compared to ASR. Across all 30-year windows, the average IRR equity premium is 6.44% compared to a 3.38%-5.88% average ASR equity premium. These observations are broadly consistent with the findings in Keswani and Stolin (2008) and Johnston *et al.* (2015).

3.5 Understanding the Drivers of the ASR-TSR Difference

Our final analysis examines the drivers of the gap between ASR and TSR, or the difference between what all shareholders and buy-hold-and-reinvesting shareholders earn from the stock market. Dichev (2007) suggests that this gap is driven by cash-flow timing reasons. As evidence, it reports a negative correlation between current net distributions and past returns and a positive correlation between current net distributions and future returns, implying that infusions of market capital tend to occur after superior past performance and prior to subsequent inferior returns (and conversely for capital distributions). However, as we showed above, how distributions are reinvested—the difference between market returns and reinvestment asset returns—can also contribute to the wedge between ASR and TSR.

To understand the sources of the ASR-TSR gap, we utilize a simulation approach. Specifically, we construct counterfactual ASR and TSR values over our sample period by randomizing cash flows, randomly re-shuffling the actual net distributions as a percentage of beginning-period market capitalization across time.[6] We also compute counterfactual ASR values under alternative reinvestment options.

[6]Inspired by Dichev (2007), this approach assumes that the distributions as a proportion of beginning market value are stationary over time.

Using these counterfactual values, the ASR-TSR gap can be decomposed as follows:

$$\begin{aligned} ASR - TSR &= [ASR - ASR(Random, Alt)] \\ &+ [ASR(Random, Alt) - ASR(Random, TSR)] \\ &+ [ASR(Random, TSR) - ASR(Actual, TSR)] \\ &+ [ASR(Actual, TSR) - TSR]. \end{aligned} \tag{7}$$

$ASR(Random, Alt)$ denotes the counterfactual ASR from randomizing the timing of cash flows, which are reinvested and discounted at the alternative asset's returns. $ASR(Random, TSR)$ denotes the counterfactual ASR obtained from randomizing the timing of cash flows, which are reinvested at the subsequent TSR and discounted at past cumulative TSR. And $ASR(Random, TSR)$ denotes the ASR obtained from actual cash flows, which are reinvested at the subsequent TSR and discounted at past cumulative TSR.

There are four main effects driving the ASR-TSR gap in this decomposition. The first stems from the effect of the timing of cash flows relative to the alternative investment's returns (i.e., the first term of the decomposition).[7] To the extent large cash distributions to (contributions from) market investors occur prior to periods of high (low) returns in the alternative asset, all else equal, ASR would tend to be higher and the ASR-TSR gap would be more positive. The decomposition shows that the timing of cash flows also impacts the ASR-TSR gap another way. The third term captures the timing of cash flows relative to the market's returns. To the extent that corporate managers issue more shares when stock prices are relatively high (and subsequent TSRs are relatively low) or buy back more stocks when stock prices are relatively low (and subsequent TSRs are relatively high), all else equal, TSR would tend to be higher and the ASR-TSR gap would be more negative.

The second term of the decomposition captures a pure reinvestment effect, reflecting the differences between the alternative investment returns and market returns. This is

[7] Note that ASR is equivalent to $ASR(Actual, Alt)$, thus the computation of $ASR(Random, Alt)$ is identical to ASR except for the randomized cash flows (and the implied market capitalization path).

a "pure" effect in the sense that its computation considers only randomized cash flows (i.e., $ASR(Random, Alt)$ and $ASR(Random, TSR)$), thereby removing any cash-flow timing effect. This component will tend to increase (decrease) the ASR-TSR gap to the extent the alternative investment returns are higher (lower) than market returns.

Finally, the last term of the decomposition captures the effect of incorporating all non-dividend cash flows. Both components of this term—$ASR(ASR, TSR)$ and TSR—assume the same reinvestment assumption (at the market TSR rate) and incorporate market dividends payouts. However, whereas $ASR(ASR, TSR)$ also incorporates net equity distributions, TSR does not. As our empirical results below show, this term generally does not contribute to the ASR-TSR wedge.

To empirically assess the importance of each component of the decomposition in Eq. (8), we simulate randomized cash flows 1,000 times. For each permutation, we compute the dollar amount of net distributions, infer a new market capitalization path, and determine ASR under different reinvestment options. The market capitalization path for each permutation is determined by first fixing the initial market capitalization, and iteratively determining the following period's market capitalization as $mcap_{t+1} = mcap_t \times (1 + ret_t)$-$Net\ Distribution_t$, where ret_t is the sum of the actual price appreciation in that period ($retx_t$) and the randomized dividend yield for period t. Thus, a critical assumption of this approach is that shuffling the distributions in this way does not impact the stock market's counterfactual return path.

Table 5 reports the components of the ASR-TSR decomposition based on the average values over 1,000 simulations. The last three columns of the table report the estimates corresponding to the first, second, and third terms of the decomposition, expressed as a percentage of the total ASR-TSR gap. The last term of the decomposition is negligible in its contribution to the ASR-TSR spread over the full sample and in each of the 30-year sub-periods.

Overall, we find that the reinvestment effect plays a primary role in driving the wedge between ASR and TSR. On average, reinvestments in non-stock-market securities lower all-shareholder returns, reflecting the on average lower returns of the alternative assets compared to market returns. Our estimates suggest that the reinvestment effect explains between 70% to 92% of the overall ASR-TSR gap. The remainder of the gap is explained by the two timing effects: the market timing of issuances and buybacks with respect to TSR (the last column) and with respect to the alternative investment asset returns (third-to-last column). Together, these timing effects contribute between 8% to 30% of the ASR-TSR gap over the full sample period. Our estimates are consistent with public firms' tendency to make larger issuances when stock prices are relatively high (future stock returns are relatively low) and alternative asset prices are relatively low (future returns of alternative assets are relatively high) or to engage in larger stock buybacks or dividends when stock prices are relatively low (future stock returns are relatively high) and alternative asset prices are relatively high (future returns of alternative assets are relatively low).

Finally, Table 6 reports the components of the ASR-TSR decomposition over time, in each of the three 30-year sub-periods in our sample: 1926-1956 (Panel A), 1956-1986 (Panel B), and 1986-2015 (Panel C). In general, our findings suggest that the reinvestment effect remains the dominant force contributing to the TSR-ASR gap in each sub-period; however, its importance is declining over time. Correspondingly, timing effects' contributions to the gap are generally increasing over time. These trends are consistent with the increasing importance of equity issuances and stock buybacks over time, and the timing of these cash flows (Baker and Wurgler, 2002) that could systematically shift value from interim shareholders to buy-and-hold shareholders, lowering ASR relative to TSR.[8]

[8]Before the 1980s, most cash was distributed by regular or special dividends (Grullon and Michaely, 2002). After the SEC adopted Rule 10b-18 in 1982, which provides repurchasing firms a "safe harbor" from anti-manipulation liability when they repurchase their shares in accordance with the rule's "manner, timing, price, and volume" conditions (Fried, 2005), repurchases have become an important mechanism for distributing cash (Skinner, 2008). During the last two decades, many firms began using repurchases as their exclusive means of distributing cash, and many traditionally dividend-paying firms began to repurchase shares in addition to using dividends (Fama and French, 2001; Grullon and Michaely, 2002; DeAngelo *et al.*, 2006).

4 Conclusion

In this paper, we show that TSR, the standard measure of stock investor performance, substantially exaggerates returns earned by stock investors in aggregate. We thus propose and implement a measure of "all-shareholder return" in order to provide a more realistic estimate of aggregate shareholder returns or the effective premium enjoyed by the typical stock investor. Our measure differs from TSR by taking into account non-dividend equity cash flows and recognizing that dividends are not actually reinvested by the firm in its own operations, but rather must be invested in other (potentially lower-yielding) assets. We also provide an empirical assessment of the drivers of the dispreancy between ASR and TSR.

Our finding that a typical stock investors' returns are substantially smaller than that of a TSR investor is broadly consistent with Dichev (2007). However, we highlight several significant conceptual and substantive differences in our analyses. First, we apply a more appropriate concept (modified IRR) for measuring effective returns from investing in the stock market and thus for assessing the market's value creation. Second, whereas Dichev (2007) suggests that the difference between aggregate shareholders' returns and TSR is likely driven by the market timing of equity issuances and buybacks, we show that the main driver is for non-TSR investors' need to reinvest cash distributions in lower-returning assets: 70 to 92% of the ASR-TSR gap is due to this reinvestment effect. The effects of market timing explain another 8 to 32% of the ASR-TSR gap. However, we also find that, over time, the contribution of the reinvestment effect on the ASR-TSR gap declines and the contribution of the market-timing effect becomes more important, consistent with the increasing prevalence of stock issuances and buybacks by firms. Together, our findings have important implications for how much pre-retirement savings typical families should allocate to the stock market to sustain their standards of living.

In principle, our measure can be applied to study investors' aggregate returns from investing in worldwide stock markets. Such an application would require broader classes of non-stock-market investment assets available to investors around the world. By focusing on the US stock market and alternative investment assets based in the US, our study's empirical estimates inform the differences between aggregate worldwide stock market investors' returns and TSR investors' returns.

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Table A.1.
Data Construction

This table reports the definitions of the main variables, and their inputs, reported in our analyses. Our sample is based on all firms available in CRSP between 1926 to 2015 with share codes of 10 or 11 (ordinary common shares) and exchange code of 1, 2, or 3 (trading on NYSE, AMEX, or NASDAQ). Panel A reports the definitions of main inputs to the computation of the cash-flow variables, which are defined in Panel B. Panel C describes the various reinvestment rates used in the computation of mTSR and ASR.

Variable	Definition	Source
Panel A: Definition of Basic Variables		
Market Cap$_t$	$prc_{it} \times shrout_{it}$	CRSP
prc_{it}	Firm i price per share at the end of month t divided by $cfacpr_{it}$	CRSP
$\overline{prc}_{it}$	Firm i average daily closing price per share over month t	CRSP
ret_{it}	Firm i cum-dividend returns over month t	CRSP
$retx_{it}$	Firm i ex-dividend returns over month t	CRSP
$shrout_{it}$	Firm i shares outstanding at the end of month t $\times cfacshr_{it}$	CRSP
Panel B: Computation of Cash Flows		
Entry Inflows$_t$	$\sum_i$ IPO Firms' Market Cap$_t$, where we infer IPO firms as those with missing Market Cap$_{t-1}$	CRSP
Net Equity Issuances$_t$	$\sum_i (shrout_{it} - shrout_{it-1}) \times \overline{prc}_{it}$	CRSP
Dividend Payouts$_t$	$\sum_i (ret_{it} - retx_{it}) \times shrout_{it} \times prc_{it}$	CRSP
Exit Outflows$_t$	$\sum_i$ Exiting Firms' Market Cap$_t$, where we infer exiting firms as those with missing Market Cap$_{t+1}$	CRSP
Net Distributions$_t$	Dividend Payouts$_t$ + Exit Outflows$_t$ - Net Equity Issuances$_t$ - Entry Inflows$_t$	CRSP
Panel C: Reinvestment Rates		
US Treasuries	1-month, 1-year, 5-year, 10-year, 30-year US treasury constant maturity rate	FRED
Corporate Bonds	Moody's Seasoned AAA and BAA bonds yields (based on averages of corporate bonds with maturities of 20 years and above)	FRED
US Housing	US housing appreciation with imputed rental income	Jordà *et al.* (2019)

Table 1.
Summary Statistics

This table reports the distributional summary statistics on the monthly aggregate market-level metrics that are inputs to the computations of mTSR and ASR. Market Cap, Dividend Payouts, Net Equity Issuances, Exit Outflows, Entry Inflows, and Net Distributions are measured in billions of U.S. dollars. All other variables are expressed in percentage points of monthly returns. Variable definitions are detailed in Appendix A.1. We report the following summary statistics over 1,080 monthly observations from 1926 to 2015: the arithmetic average (Mean), median (Median), standard deviation (Std. Dev.), minimum (Min), and maximum (Max).

	Mean	Median	Std. Dev.	Min	Max
Market Cap	3,568.66	568.29	5,666.05	9.08	22,686.76
Dividend Payouts	5.80	1.36	8.84	0.03	53.63
Net Equity Issuances	4.90	0.10	18.95	-51.30	215.19
Exit Outflows	9.85	0.58	21.91	0.00	213.43
Entry Inflows	5.89	0.60	15.42	0.00	218.15
Net Shareholder Payouts	4.85	0.29	27.48	-222.01	212.54
CRSP Value-Weighted Index (RET)	0.93	1.33	5.50	-29.32	41.64
1-month Treasuries	0.28	0.25	0.25	-0.06	1.35
1-year Treasuries	0.31	0.28	0.27	-0.06	1.30
5-year Treasuries	0.35	0.32	0.27	-0.06	1.24
10-year Treasuries	0.36	0.34	0.26	-0.06	1.19
30-year Treasuries	0.38	0.35	0.26	-0.06	1.15
Corporate AAA Bonds	0.47	0.41	0.22	0.20	1.21
Corporate BAA Bonds	0.56	0.51	0.23	0.24	1.33
Housing	0.68	0.70	0.52	-1.10	2.15

Table 2.
TSR vs. Modified TSR

The first row of this table reports the annualized total shareholder returns (TSR) and the equity risk premium implied by TSR (annualized TSR minus the annualized risk-free rate) for the period from January 1926 to December 2015. Total shareholder returns are annualized by taking the geometric annual average of cumulative monthly returns of the CRSP value-weighted index (i.e., reinvesting all distributions into the index each month). Annualized risk-free rate is obtained by taking the geometric annual average of the cumulative 1-month treasury yields.

The remaining rows of this table report modified TSR (mTSR) estimates over the same period under various dividend-reinvestment options (Eq. (1)). We consider five options based on reinvesting dividends into treasuries: the 1-month, treasury bill, the 1-year treasury bill, the 5-year treasury note, the 10-year treasury note, and the 30-year treasury bond. We consider two options based on reinvesting dividends into corporate bonds: Moody's corporate AAA bond yield and BAA bond yield. We also consider reinvestment of dividends in housing. The last column of the panel reports the percentage reduction in the equity premium relative to the TSR-based equity premium (second column of Panel A). Reinvestment rates are detailed in Appendix A.1.

	Annualized Return (%)	*Equity Premium (%)*	*% Change from TSR Equity Premium*
TSR	9.74	6.33	—
mTSR with 1-month Treasuries	6.51	3.10	-51.02
mTSR with 1-year Treasuries	6.60	3.19	-49.59
mTSR with 5-year Treasuries	6.79	3.37	-46.71
mTSR with 10-year Treasuries	6.89	3.48	-45.04
mTSR with 30-year Treasuries	6.97	3.56	-43.74
mTSR with Corporate AAA	7.30	3.88	-38.66
mTSR with Corporate BAA	7.77	4.36	-31.18
mTSR with Housing	8.86	5.45	-13.98

Table 3.
TSR vs. ASR

The first row of this table reports the annualized total shareholder returns (TSR) and the equity risk premium implied by TSR (annualized TSR minus the annualized risk-free rate) for the period from January 1926 to December 2015. Total shareholder returns are annualized by taking the geometric annual average of cumulative monthly returns of the CRSP value-weighted index (i.e., reinvesting all distributions into the index each month). The annualized risk-free rate is obtained by taking the geometric annual average of the cumulative 1-month treasury yields.

The remaining rows of this table report all-shareholder return (ASR) estimates over the same period under various payout-reinvestment options. We consider five options based on reinvesting net distributions into treasuries: the 1-month, treasury bill, the 1-year treasury bill, the 5-year treasury note, the 10-year treasury note, and the 30-year treasury bond. We consider two options based on reinvesting net distributions into corporate bonds: Moody's corporate AAA bond yield and BAA bond yield. We also consider reinvestment of net distributions in housing. The third column of the panel reports the percentage reduction in the equity premium relative to the TSR-based equity premium (second column of Panel A). The last column of the panel reports the percentage of the difference between TSR and ASR that is captured by the difference between TSR and mTSR, using the same reinvestment assumptions for ASR and mTSR. Reinvestment rates are detailed in Appendix A.1.

	Annualized Return (%)	*Equity Premium (%)*	*% Change from TSR Equity Premium*
TSR	9.74	6.33	—
ASR with 1-month Treasuries	5.13	1.72	-72.90
ASR with 1-year Treasuries	5.37	1.96	-69.01
ASR with 5-year Treasuries	5.66	2.25	-64.50
ASR with 10-year Treasuries	5.78	2.37	-62.62
ASR with 30-year Treasuries	5.87	2.46	-61.22
ASR with Corporate AAA	6.79	3.38	-46.59
ASR with Corporate BAA	7.57	4.16	-34.33
ASR with Housing	8.66	5.25	-17.14

Table 4.
TSR vs. ASR: Sub-Periods

This table reports TSR and ASR using various reinvestment options over three sub-periods: 1926–1956 (Panel A), 1956–1986 (Panel B), and 1986–2015 (Panel C). The first row of each panel reports the annualized total shareholder returns (TSR) and the equity risk premium implied by TSR (annualized TSR minus the annualized risk-free rate) in the sub-period. Total shareholder returns are annualized by taking the geometric annual average of cumulative monthly returns of the CRSP value-weighted index (i.e., reinvesting all distributions into the index each month). The annualized risk-free rate is obtained by taking the geometric annual average of the cumulative 1-month treasury yields. Subsequent rows report all-shareholder return (ASR) estimates over the same sub-period under various payout-reinvestment options. We consider five options based on reinvesting net distributions into treasuries: the 1-month treasury bill, the 1-year treasury bill, the 5-year treasury note, the 10-year treasury note, and the 30-year treasury bond. We consider two options based on reinvesting net distributions into corporate bonds: Moody's corporate AAA bond yield and BAA bond yield. We also consider reinvestment of net distributions in housing. The third column of the panel reports the percentage reduction in the equity premium relative to the TSR-based equity premium (second column of Panel A). The last column of the panel reports the percentage of the difference between TSR and ASR that is captured by the difference between TSR and mTSR, using the same reinvestment assumptions for ASR and mTSR. Reinvestment rates are detailed in Appendix A.1.

Table 4. [Continued]

	Annualized Return (%)	*Equity Premium (%)*	*% Change from TSR Equity Premium*
Panel A: 1926–1956			
TSR	9.12	8.00	—
ASR with 1-month Treasuries	5.37	4.24	-46.93
ASR with 1-year Treasuries	5.38	4.26	-46.74
ASR with 5-year Treasuries	5.41	4.28	-46.44
ASR with 10-year Treasuries	5.42	4.29	-46.34
ASR with 30-year Treasuries	5.42	4.29	-46.31
ASR with Corporate AAA	6.06	4.94	-38.23
ASR with Corporate BAA	6.43	5.31	-33.65
ASR with Housing	7.44	6.32	-20.99
Panel B: 1956–1986			
TSR	10.07	4.27	—
ASR with 1-month Treasuries	7.93	2.12	-50.27
ASR with 1-year Treasuries	8.22	2.41	-43.49
ASR with 5-year Treasuries	8.40	2.60	-39.14
ASR with 10-year Treasuries	8.44	2.63	-38.32
ASR with 30-year Treasuries	8.45	2.65	-37.89
ASR with Corporate AAA	8.67	2.86	-32.93
ASR with Corporate BAA	9.12	3.32	-22.32
ASR with Housing	9.68	3.88	-9.17
Panel C: 1986–2015			
TSR	10.23	6.80	—
ASR with 1-month Treasuries	7.55	4.13	-39.30
ASR with 1-year Treasuries	7.70	4.27	-37.19
ASR with 5-year Treasuries	8.04	4.62	-32.14
ASR with 10-year Treasuries	8.23	4.80	-29.41
ASR with 30-year Treasuries	8.38	4.95	-27.20
ASR with Corporate AAA	8.70	5.28	-22.40
ASR with Corporate BAA	9.07	5.64	-17.05
ASR with Housing	9.47	6.05	-11.08

Table 5.
ASR – TSR Decomposition

This table reports the decomposition of the gap between ASR and TSR (i.e., column 1 minus column 5). Following Eqn. (8), we decompose the total difference into four components: i) the effect of the timing of cash flows with respect to the reinvestment returns (column 6) ii) the effect of reinvesting in an alternative asset (column 7), iii) the effect of the timing of cash flows with respect to market returns (column 8), and iv) the effect of the inclusion of non-dividend cash flows (untabulated). Column 1 (ASR) reports the actual ASR assuming cash flows are reinvested in each alternative reinvestment option. Column 2 ($ASR(Random, Alt)$) reports the average of 1,000 simulated ASRs that utilize randomly re-shuffled cash flows that are reinvested in the alternative asset. Column 3 ($ASR(Random, TSR)$) reports the average ASR assuming cash flows are randomized and then subsequently reinvested in an alternative asset that generates identical returns to TSR. Column 4 ($ASR(Actual, TSR)$) reports ASR values using actual cash flows and assumes reinvestment in the market (or an alternative asset earning market returns). Column 5 reports the market-level total shareholder return assuming full reinvestment back in the market. Column 6, summarizing the effect of cash flow timing with respect to reinvestment rates, is the difference between columns 2 and 1 scaled by the TSR-ASR gap (column 5 - column 1). Column 7, summarizing the pure reinvestment effect, is the difference between columns 3 and 2 scaled by the TSR-ASR gap (column 5 - column 1). Column 8, summarizing the effect of cash flow timing with respect to market returns, is the difference between columns 4 and 3 scaled by the TSR-ASR gap (column 5 - column 1). The difference between 100 and the sum of columns 6 to 8 provides the effect of the inclusion of non-dividend cash flows, which is trivial and suppressed for ease of reporting. All table values are in percentage points. In the computation of ASR variants, we consider five options based on reinvesting net distributions into treasuries: the 1-month treasury bill, the 1-year treasury bill, the 5-year treasury note, the 10-year treasury note, and the 30-year treasury bond. We consider two options based on reinvesting net distributions into corporate bonds: Moody's corporate AAA bond yield and BAA bond yield. We also consider reinvestment of net distributions in housing. Reinvestment rates are detailed in Appendix A.1.

	ASR	ASR (Random,Alt)	ASR (Random,TSR)	ASR (Actual,TSR)	TSR	Timing Effect (Reinvestment)	Reinvestment Effect	Timing Effect (TSR)
	(1)	(2)	(3)	(4)	(5)	(2)-(1)	(3)-(2)	(4)-(3)
1-month Treasuries	5.13	5.34	9.60	9.74	9.74	4.52	92.26	3.18
1-year Treasuries	5.37	5.61	9.60	9.74	9.74	5.34	91.27	3.36
5-year Treasuries	5.66	5.93	9.60	9.74	9.74	6.52	89.85	3.60
10-year Treasuries	5.78	6.06	9.60	9.74	9.74	7.05	89.21	3.71
30-year Treasuries	5.87	6.15	9.60	9.74	9.74	7.36	88.81	3.79
Corporate AAA	6.79	7.08	9.60	9.74	9.74	9.85	85.13	4.98
Corporate BAA	7.57	7.85	9.60	9.74	9.74	12.65	80.53	6.76
Housing	8.66	8.84	9.60	9.74	9.74	16.33	70.01	13.54

Table 6.
ASR – TSR Decomposition: Sub-Periods

This table reports the decomposition of the gap between ASR and TSR (in Table 5) for three different sub-periods in our sample: 1926–1956 (Panel A), 1956–1986 (Panel B), and 1986–2015 (Panel C). All other aspects of the table are the same as in Table 5.

	ASR (1)	ASR (Random,Alt) (2)	ASR (Random,TSR) (3)	ASR (Actual,TSR) (4)	TSR (5)	Timing Effect (Reinvestment) (2)-(1)	Reinvestment Effect (3)-(2)	Timing Effect (TSR) (4)-(3)
Panel A: 1926–1956								
1-month Treasuries	5.37	5.72	9.15	9.13	9.12	9.44	91.37	-0.72
1-year Treasuries	5.38	5.74	9.15	9.13	9.12	9.45	91.36	-0.72
5-year Treasuries	5.41	5.76	9.15	9.13	9.12	9.46	91.35	-0.73
10-year Treasuries	5.42	5.77	9.15	9.13	9.12	9.47	91.35	-0.73
30-year Treasuries	5.42	5.77	9.15	9.13	9.12	9.47	91.35	-0.73
Corporate AAA	6.06	6.60	9.15	9.13	9.12	17.58	83.41	-0.88
Corporate BAA	6.43	7.07	9.15	9.13	9.12	23.57	77.55	-1.00
Housing	7.44	7.99	9.15	9.13	9.12	32.33	69.47	-1.61
Panel B: 1956–1986								
1-month Treasuries	7.93	8.23	10.10	10.05	10.07	14.05	87.43	-2.37
1-year Treasuries	8.22	8.52	10.10	10.05	10.07	16.51	85.21	-2.74
5-year Treasuries	8.40	8.71	10.10	10.05	10.07	18.22	83.69	-3.04
10-year Treasuries	8.44	8.74	10.10	10.05	10.07	18.75	83.20	-3.10
30-year Treasuries	8.45	8.76	10.10	10.05	10.07	18.91	83.06	-3.14
Corporate AAA	8.67	8.99	10.10	10.05	10.07	22.68	79.58	-3.61
Corporate BAA	9.12	9.46	10.10	10.05	10.07	36.02	67.32	-5.33
Housing	9.68	10.10	10.10	10.05	10.07	106.20	1.92	-12.97
Panel C: 1986–2015								
1-month Treasuries	7.55	7.79	10.19	10.23	10.23	9.05	89.57	1.36
1-year Treasuries	7.70	7.93	10.19	10.23	10.23	9.43	89.11	1.43
5-year Treasuries	8.04	8.29	10.19	10.23	10.23	11.41	86.90	1.66
10-year Treasuries	8.23	8.49	10.19	10.23	10.23	13.09	85.07	1.81
30-year Treasuries	8.38	8.64	10.19	10.23	10.23	14.39	83.62	1.96
Corporate AAA	8.70	8.98	10.19	10.23	10.23	18.15	79.43	2.38
Corporate BAA	9.07	9.34	10.19	10.23	10.23	23.40	73.42	3.13
Housing	9.47	9.81	10.19	10.23	10.23	44.50	50.61	4.82

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