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Borja Larrain

Motohiro Yogo
University of Pennsylvania

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Does firm value move too much to be justified by subsequent changes in cash flow?*

Borja Larrain[†], Motohiro Yogo[‡]

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The appropriate measure of cash flow for valuing corporate assets is net payout, which is the sum of dividends, interest, and net repurchases of equity and debt. Variation in net payout yield, the ratio of net payout to asset value, is mostly driven by movements in expected cash flow growth, instead of movements in discount rates. Net payout yield is less persistent than dividend yield and implies much smaller variation in long-horizon discount rates. Therefore, movements in the value of corporate assets can be justified by changes in expected future cash flow.

JEL classification: G12; G32; G35

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[†] Pontificia Universidad Católica de Chile, Escuela de Administración, Avda, Vicuña Mackenna 4860, Macul, Santiago, Chile

[‡] Finance Department, The Wharton School, University of Pennsylvania, 3620 Locust Walk, Philadelphia, PA 19104, USA and National Bureau of Economic Research, Cambridge, MA 02138, USA
Corresponding author.
E-mail address: yogo@wharton.upenn.edu (M. Yogo).

1. Introduction

This paper examines the present-value relation between the asset value and cash flow of US corporations. The total cash outflow from firms is *net payout*, which is the sum of dividends, interest, equity repurchase net of issuance, and debt repurchase net of issuance. Variation in *net payout yield*, the ratio of net payout to asset value, is mostly driven by movements in expected cash flow growth, instead of movements in discount rates. A variance decomposition of net payout yield shows that 12% of its variation is explained by asset returns, while 88% is explained by cash flow growth. Moreover, net payout yield is less persistent than other valuation ratios with an autoregressive coefficient of 0.78. A model of expected returns based on net payout yield implies relatively small variation in long-horizon discount rates. Therefore, movements in the value of corporate assets can be explained by changes in expected future cash flow.

Our findings are somewhat surprising in light of previous studies on the present-value relation between stock prices and dividends. Variation in dividend yield is mostly driven by movements in discount rates, instead of movements in expected dividend growth (Campbell and Shiller, 1988). A variance decomposition of dividend yield shows that 83% of its variation is explained by stock returns, while 17% is explained by dividend growth. Moreover, dividend yield is highly persistent with an autoregressive coefficient of 0.93. A model of expected returns based on dividend yield implies large variation in long-horizon discount rates. Therefore, movements in stock prices cannot be explained by changes in expected future dividends (LeRoy and Porter, 1981; Shiller, 1981).

Our focus on net payout, instead of dividends, is motivated by three considerations. First, a recent literature on corporate payout policy has broadened the scope of payout beyond ordinary dividends (see Allen and Michaely, 2003, for a survey). Because firms jointly determine all components of net payout, instead of dividends in isolation, a comprehensive measure of cash flow is necessary for understanding asset valuation (Modigliani and Miller, 1961). Firms tend to use dividends to distribute the permanent component of earnings because dividend policy requires financial commitment (Lintner, 1956). Consequently, dividends change slowly and remain mostly independent of asset value. In contrast, firms tend to use repurchases to distribute the transitory component of earnings because repurchase and issuance policy retains financial discretion. Consequently, repurchases and issuances of both equity and debt are cyclical and move together with asset value (Hall, 2001a).[1]

The second motivation for focusing on net payout is the difference between the portfolio view and the macro view of investment. Dividends are the appropriate measure of cash flow for an individual investor who owns one share of a value-weighted portfolio. The investor essentially follows a portfolio strategy in which dividends are received and net repurchases of equity are reinvested. In contrast, net payout is the appropriate measure of cash flow for a representative investor who owns the entire corporate sector. From a macro view, net repurchases of equity and debt are cash outflows from the corporate sector that (by definition) cannot be reinvested. The value of corporate assets, instead of a stock price index, is related to the underlying quantity of capital and ultimately enters the representative household's intertemporal budget constraint (Abel, Mankiw, Summers, and Zeckhauser, 1989; Hall, 2001b).

The third motivation for focusing on net payout is a recent literature that has shown the shortcomings of dividend yield in measuring the magnitude of variation in discount rates. Dividend yield is highly persistent, or even nonstationary, leading to fairly uninformative inference on the exact magnitude of return predictability (see Stambaugh, 1999; Lewellen, 2004; Torous, Valkanov, and Yan, 2004; Campbell and Yogo, 2006). In addition, the forecasting relation between stock returns and dividend yield appears to suffer from structural instability (see Viceira, 1996; Goyal and Welch, 2003; Lettau and Van Nieuwerburgh, 2006). Partly in response to these problems, Robertson and Wright (2006) and Boudoukh, Michaely, Richardson, and Roberts (2007) reexamine the evidence for return predictability using valuation ratios that include equity repurchase in addition to dividends. This paper is in the

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[1] See Guay and Harford (2000), Jagannathan, Stephens, and Weisbach (2000), and Dittmar and Dittmar (2004) for related evidence on equity repurchase.

same spirit, but we focus on implications for long-horizon discount rates. We also use a more comprehensive measure of cash flow than includes payout to debt holders.

The rest of the paper proceeds as follows. Section 2 develops an empirical framework for studying the present-value relation between net payout and asset value, starting with the firm's intertemporal budget constraint. Section 3 describes our data on payout, issuance, and asset value. Section 4 uses the present-value framework to decompose the variation in net payout yield and asset returns. Section 5 presents analogous variance decompositions for market equity, which allows us to compare and understand our main results for assets (i.e., market equity plus liabilities). Section 6 concludes.

2. Empirical framework

2.1. The firm's intertemporal budget constraint

To develop the firm's intertemporal budget constraint, we first introduce the following quantities.

- Y_t: Earnings net of taxes and depreciation in period t.
- C_t: Net payout, or the net cash outflow from the firm, in period t. It is composed of dividends, interest, equity repurchase net of issuance, and debt repurchase net of issuance.
- I_t: Investment net of depreciation in period t.
- A_t: Market value of assets at the end of period t.
- C_t/A_t: Net payout yield at the end of period t.
- $R_{t+1} = 1 + Y_{t+1}/A_t$: Return on assets in period $t+1$.

Investment includes both capital expenditures (on property, plant, and equipment) and investment in working capital. Because we are interested in the market value of assets, the relevant notion of depreciation is economic, not accounting. Economic depreciation includes capital gains and losses from changes in the market value of assets.

The flow of funds identity states that the sources of funds must equal the uses of funds,

$$Y_t = C_t + I_t. \tag{1}$$

The capital accumulation equation is

$$A_{t+1} = A_t + I_{t+1}. \tag{2}$$

Eqs. (1) and (2) together imply that

$$A_{t+1} + C_{t+1} = R_{t+1} A_t. \tag{3}$$

This equation can be interpreted as the firm's intertemporal budget constraint. It is analogous to a household's intertemporal budget constraint: C represents consumption, A represents wealth, and R represents the return on wealth.

2.2. Present-value relation between net payout and asset value

We use the firm's intertemporal budget constraint to study the present-value relation between net payout and asset value. The particular framework that we adopt is the log-linear present-value model of Campbell and Shiller (1988), which can be interpreted as a dynamic version of the Gordon growth model that allows for time variation in discount rates and expected cash flow growth.

Let lowercase letters denote the log of the corresponding uppercase variables, and let Δ denote the first-difference operator. Let $v_t = \log(C_t/A_t)$ denote the log of net payout yield.

Log-linear approximation of Eq. (3) leads to a difference equation for net payout yield

$$v_t \approx r_{t+1} - \Delta c_{t+1} + \rho v_{t+1}, \tag{4}$$

where $\rho = 1/(1+\exp\{\mathbf{E}[v_t]\})$. The constant in the approximation is suppressed (equivalently, all the variables are assumed to be de-meaned) to simplify notation here and throughout the paper.

Solving Eq. (4) forward H periods,

$$v_t = r_t(H) - \Delta c_t(H) + v_t(H), \tag{5}$$

where

$$\begin{aligned} r_t(H) &= \sum_{s=1}^{H} \rho^{s-1} r_{t+s}, && (6) \\ \Delta c_t(H) &= \sum_{s=1}^{H} \rho^{s-1} \Delta c_{t+s}, && (7) \\ v_t(H) &= \rho^H v_{t+H}. && (8) \end{aligned}$$

In the infinite-horizon limit, Eq. (5) becomes

$$v_t = \sum_{s=1}^{\infty} \rho^{s-1}(r_{t+s} - \Delta c_{t+s}). \tag{9}$$

The convergence of the sum is assured by the assumption that net payout yield is stationarity (i.e., net payout and asset value are cointegrated).

Eq. (9) also holds ex ante as a present-value model

$$v_t = \mathbf{E}_t \sum_{s=1}^{\infty} \rho^{s-1}(r_{t+s} - \Delta c_{t+s}). \tag{10}$$

Net payout yield summarizes a firm's expectations about future changes in asset value and cash flow, just as the consumption-wealth ratio summarizes a household's expectations about future changes in wealth and consumption (Campbell and Mankiw, 1989). Eq. (10) says that net payout yield is high when expected asset returns are high or expected cash flow growth is low. If movements in discount rates were perfectly offset by movements in expected cash flow growth, then net payout yield would be constant. Therefore, net payout yield must forecast independent (as opposed to common) variation in asset returns or net payout growth.

Rearranging Eq. (10),

$$a_t = c_t + \mathbf{E}_t \sum_{s=1}^{\infty} \rho^{s-1} \Delta c_{t+s} - \mathbf{E}_t \sum_{s=1}^{\infty} \rho^{s-1} r_{t+s}. \tag{11}$$

The first two terms on the right side of this equation can be interpreted as expected net payout under a constant discount rate. The last term on the right side is long-horizon discount rates, which measures the magnitude of deviation from the constant discount rate present-value model. We use Eq. (11) to assess whether changes in expected future cash flow justify movements in asset value.

In addition to the variation in expected long-horizon asset returns, the present-value model allows us to measure the variation in unexpected asset returns. Subtracting the expectation of Eq. (9) in period t from its expectation in period $t+1$,

$$r_{t+1} - \mathbf{E}_t r_{t+1} = -(\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=2}^{\infty} \rho^{s-1} r_{t+s} + (\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=1}^{\infty} \rho^{s-1} \Delta c_{t+s}. \tag{12}$$

This equation takes the view of an investor who rationalizes realized asset returns through changes in discount rates and changes in expected cash flow growth. Asset return is unexpectedly high when discount rates fall or expected cash flow growth rises.

2.3. VAR estimation

We model the joint dynamics of asset return, net payout growth, and net payout yield through a vector autoregression (VAR). Let $x_t = (r_t, \Delta c_t, v_t)'$ be a column vector consisting of the three variables. To simplify notation, assume that the variables are de-meaned so that $\mathbf{E}[x_t] = 0$. The VAR model is

$$x_{t+1} = \Phi x_t + \epsilon_{t+1}, \tag{13}$$

where $\mathbf{E}[\epsilon_t] = 0$ and $\mathbf{E}[\epsilon_t \epsilon_t'] = \Sigma$. The first two rows of the model can be interpreted as a vector error-correction model under the maintained assumption that net payout yield is stationary. The vector of variables has the covariance matrix

$$\Gamma = \mathbf{E}[x_t x_t'] = \text{vec}^{-1}[(I - \Phi \otimes \Phi)^{-1}\text{vec}(\Sigma)]. \tag{14}$$

The VAR model is identified by the moment restriction

$$\mathbf{E}[(x_{t+1} - \Phi x_t) \otimes x_t] = 0. \tag{15}$$

Let I denote an identity matrix of dimension three, and let e_i denote the ith column of the identity matrix. The present-value model, that is, the expectation of Eq. (4) in period t, requires that the coefficients satisfy the linear restrictions

$$(e_1' - e_2' + \rho e_3')\Phi = e_3'. \tag{16}$$

The VAR model is therefore overidentified.[2] We estimate the model by continuous-updating generalized method of moments (GMM) (Hansen, Heaton, and Yaron, 1996). We test the overidentifying restrictions of the model through the J-test (Hansen, 1982).

2.4. Variance decompositions

As shown in the literature, long-horizon regressions have poor finite-sample properties (see Hodrick, 1992; Valkanov, 2003; Boudoukh, Richardson, and Whitelaw, 2006). We therefore

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[2] An alternative estimation methodology is to drop one of the three forecasting equations from the VAR, thereby imposing exact identification. The results reported in the paper are essentially unchanged using this alternative methodology.

estimate long-horizon variances and covariances through the VAR model (see Ang, 2002, for a similar approach). We obtain point estimates as sample analogs of the corresponding population moments and standard errors through the delta method using numerical gradients.

2.4.1. Variance of net payout yield

We decompose the variance of net payout yield into its covariance with future asset returns, future net payout growth, and future net payout yield (Cochrane, 1992). The intertemporal budget constraint, Eq. (5), implies the variance decomposition

$$\mathrm{Var}(v_t) = \mathrm{Cov}(r_t(H), v_t) + \mathrm{Cov}(-\Delta c_t(H), v_t) + \mathrm{Cov}(v_t(H), v_t). \tag{17}$$

The VAR model implies that

$$\begin{aligned}
\mathrm{Var}(v_t) &= e_3'\Gamma e_3, && (18)\\
\mathrm{Cov}(r_t(H), v_t) &= e_1'\Phi[I - (\rho\Phi)^H](I - \rho\Phi)^{-1}\Gamma e_3 \to e_1'\Phi(I - \rho\Phi)^{-1}\Gamma e_3, && (19)\\
\mathrm{Cov}(-\Delta c_t(H), v_t) &= -e_2'\Phi[I - (\rho\Phi)^H](I - \rho\Phi)^{-1}\Gamma e_3 \to -e_2'\Phi(I - \rho\Phi)^{-1}\Gamma e_3, && (20)\\
\mathrm{Cov}(v_t(H), v_t) &= e_3'(\rho\Phi)^H\Gamma e_3 \to 0, && (21)
\end{aligned}$$

where the limits are taken as $H \to \infty$.

2.4.2. Variance of long-horizon discount rates

The VAR model implies that the present-value model, Eq. (10), can be written as

$$v_t = e_1'\Phi(I - \rho\Phi)^{-1}x_t - e_2'\Phi(I - \rho\Phi)^{-1}x_t. \tag{22}$$

We estimate the variance of long-horizon discount rates and expected cash flow growth through the equations

$$\begin{aligned}
\mathrm{Var}\left(\mathbf{E}_t \sum_{s=1}^{\infty} \rho^{s-1} r_{t+s}\right) &= e_1' \Phi (I - \rho\Phi)^{-1} \Gamma (I - \rho\Phi)^{-1\prime} \Phi' e_1, && (23) \\
\mathrm{Var}\left(\mathbf{E}_t \sum_{s=1}^{\infty} \rho^{s-1} \Delta c_{t+s}\right) &= e_2' \Phi (I - \rho\Phi)^{-1} \Gamma (I - \rho\Phi)^{-1\prime} \Phi' e_2. && (24)
\end{aligned}$$

2.4.3. Variance of unexpected asset returns

We decompose the variance of unexpected asset returns into the sum of the variance of changes in discount rates, the variance of changes in expected cash flow growth, and minus twice the covariance between the two changes (Campbell, 1991). Eq. (12) implies the variance decomposition

$$\begin{aligned}
\mathrm{Var}(r_{t+1} - \mathbf{E}_t r_{t+1}) &= \mathrm{Var}\left((\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=2}^{\infty} \rho^{s-1} r_{t+s}\right) + \mathrm{Var}\left((\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=1}^{\infty} \rho^{s-1} \Delta c_{t+s}\right) \\
&\quad -2\mathrm{Cov}\left((\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=2}^{\infty} \rho^{s-1} r_{t+s}, (\mathbf{E}_{t+1} - \mathbf{E}_t) \sum_{s=1}^{\infty} \rho^{s-1} \Delta c_{t+s}\right). \quad (25)
\end{aligned}$$

The VAR model implies that Eq. (12) can written as

$$e_1' \epsilon_{t+1} = -e_1' \rho \Phi (I - \rho\Phi)^{-1} \epsilon_{t+1} + e_2' (I - \rho\Phi)^{-1} \epsilon_{t+1}. \quad (26)$$

We estimate the variance of unexpected asset returns through the equation

$$\begin{aligned}
e_1' \Sigma e_1 &= e_1' \rho \Phi (I - \rho\Phi)^{-1} \Sigma (I - \rho\Phi)^{-1\prime} \rho \Phi' e_1 + e_2' (I - \rho\Phi)^{-1} \Sigma (I - \rho\Phi)^{-1\prime} e_2 \\
&\quad -2 e_1' \rho \Phi (I - \rho\Phi)^{-1} \Sigma (I - \rho\Phi)^{-1\prime} e_2. \quad (27)
\end{aligned}$$

3. Data on payout, issuance, and asset value

3.1. *Flow of Funds* data

Our primary data source is the *Flow of Funds Accounts of the United States* (Board of Governors of the Federal Reserve System, 2005), which has been available annually since 1946. We construct net payout and the market value of assets for the nonfarm, nonfinancial corporate sector. We obtain the book value of liabilities (Line 21) and net worth (Line 44) from Table B.102: Balance Sheet of Nonfarm Nonfinancial Corporate Business. We obtain net dividends (Line 3), net new equity issues (Line 38), net increase in commercial paper (Line 40), and net increase in corporate bonds (Line 42) from Table F.102: Nonfarm Nonfinancial Corporate Business. We obtain net interest payments from the National Income and Product Accounts (NIPA) Table 1.14: Gross Value Added of Nonfinancial Domestic Corporate Business.

We extend the sample back to 1926 with data from original sources, following the Federal Reserve Board's basic methodology.[3] We refer to Wright (2004) for a related construction that focuses on equity. We obtain the book value of liabilities and net worth from various volumes of the *Statistics of Income* (US Treasury Department, 1950, Table 4). Liabilities are the sum of accounts payable; bonds, notes, and mortgages payable; and other liabilities. Net worth is assets minus liabilities. We exclude the liabilities and net worth for the industrial groups "agriculture, forestry, and fishery" and "finance, insurance, real estate, and lessors of real property." We obtain net issues of equity and corporate bonds from Goldsmith (1955, Table V-14). Net issues of equity are the sum of net issues of common stock (Table V-19) and preferred stock (Tables V-17 and V-18). We aggregate net issues over industrials, utilities, railroads, the Bell system, and new incorporations. For the period 1926–1928, we obtain dividends and interest payments, excluding the agriculture and finance sectors, from Kuznets (1941, Tables 54 and 55). For the period 1929–1945, these data are from NIPA

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[3] Although all of the reported results are for the full sample 1926–2004, the results are essentially the same for the postwar sample 1946–2004.

Table 1.14.

To compute the market value of net worth, we first compute the book-to-market equity ratio for all NYSE, Amex, and Nasdaq stocks. Following Davis, Fama, and French (2000), we compute the book equity for Compustat firms and merge it with the historical data from *Moody's Manuals*, available through Kenneth French's webpage. We then merge the book equity data with the Center for Research in Security Prices (CRSP) Monthly Stock Database to compute the aggregate book-to-market ratio at the end of each calendar year. We exclude the standard industrial classification (SIC) codes 100–979 and 6000–6799 to focus on nonfarm, nonfinancial firms. The market value of net worth is the book value of net worth divided by the aggregate book-to-market ratio.

An alternative way of constructing the market value of net worth is to use the market value of equities outstanding (Line 35) from the *Flow of Funds* Table B.102. Because these data are available only since 1946, our procedure has the advantage of yielding a consistent time series since 1926. For the 1946–2004 subsample, we obtain essentially the same results when we use the market value of equities outstanding from the *Flow of Funds*.

Net payout is the sum of dividends and interest payments minus the sum of net equity and corporate debt issues. The market value of assets is the sum of the book value of liabilities and the market value of net worth. The return on assets is computed from the market value of assets and net payout through Eq. (3). All nominal quantities are deflated by the December value of the consumer price index (CPI) from the Bureau of Labor Statistics.

In constructing the market value of assets, we do not subtract the market value of financial assets.[4] This procedure is appropriate for our application because we are interested in total firm value. Equity and debt are ultimately claims to the firm's cash flow, whether they are generated by the firm's physical or financial assets. Financial assets provide liquidity in the

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[4] A potential concern with this procedure is the issue of double accounting. Financial assets of one firm can be equity or debt of another firm within the nonfarm, nonfinancial corporate sector. However, because accounting rules make significant cross-ownership between firms a matter of public information, the *Flow of Funds* properly accounts for this potential problem through consolidation. Although some double accounting could still be possible because of cross-ownership classified as short-term investment, such effects are bound to be small in practice.

productive process and can be considered a part of the firm's working capital. In a related data construction involving the *Flow of Funds*, Hall (2001b) subtracts off financial assets because his objective is to measure the quantity of physical capital in the corporate sector.

3.2. Compustat data

Our secondary data source is a merge of the Compustat Annual Industrial Database and the CRSP Monthly Stock Database. Because our construction requires the statement of cash flows, the data are available at annual frequency only since 1971. We exclude the SIC codes 6000–6799 to focus on nonfinancial firms. We construct net payout and the market value of assets for publicly traded nonfinancial firms by aggregating firm-level data.

Table 1 lists the relevant variables from Compustat. We construct payout and securities issuance from the statement of cash flows as

$$\begin{aligned} D &= \mathrm{DIV} + \mathrm{EQ\_REP} + \mathrm{INT} + \mathrm{LTD\_REP} + [-\mathrm{DEBT\_NET}]^+, && (28) \\ E &= \mathrm{EQ\_ISS} + \mathrm{LTD\_ISS} + [\mathrm{DEBT\_NET}]^+, && (29) \end{aligned}$$

where $[\cdot]^+$ is an operator that takes the positive part of the expression inside the brackets (and takes the value zero if the the expression is negative). We refer to Richardson and Sloan (2003) for a related construction. We use CRSP's delisting data to account for equity repurchases that occur during mergers, acquisitions, and liquidations. The terminal cash outflow D from the firm is the delisting amount times the number of shares outstanding (both from CRSP), whenever the delisting code is 233, 261, 262, 333, 361, 362, or 450.

We construct the market value of each firm as the sum of the market value of its common stock, preferred stock, long-term debt, and other liabilities. The market value of common stock is the price of common stock times the number of shares outstanding at the end of calendar year. The market value of preferred stock is DIV_PREF divided by Moody's medium-grade preferred dividend yield at the end of calendar year. Other liabilities consists of LIAB_CUR, and, if available, LIAB_OTH, TAX, and MINORITY.

Our treatment of long-term debt follows the conventional procedure in the literature (Brainard, Shoven, and Weiss, 1980; Bernanke and Campbell, 1988; Hall, Cummins, Laderman, and Mundy, 1988). We compute the market value of long-term debt by first imputing the maturity structure of bonds for each firm. All long-term bonds are assumed to be issued at par at the end of calender year, with semiannual coupons payments, and with maturity of 20 years. For a firm that exists in Compustat in 1958, its initial maturity structure is given by Hall, Cummins, Laderman, and Mundy (1988, Table 2.3). For a firm that enters Compustat in subsequent years, its initial maturity structure is given by the global maturity structure for existing Compustat firms in that year. For a given firm, let LTD_t^i be the book value of bonds with i years to maturity at the end of year t. For each maturity $i = 1, \ldots, 19$, the book value of bonds is updated from year t to $t+1$ through the formula

$$\mathrm{LTD}_{t+1}^i = \begin{cases} \mathrm{LTD}_t^{i+1} & \text{if } \mathrm{LTD}_{t+1} - \mathrm{LTD}_t + \mathrm{LTD}_t^1 > 0 \\ \mathrm{LTD}_t^{i+1} \frac{\mathrm{LTD}_{t+1}}{\mathrm{LTD}_t\text{-}\mathrm{LTD}_t^1} & \text{otherwise} \end{cases}. \tag{30}$$

New issues of 20-year bonds are given by the formula

$$\mathrm{LTD}_{t+1}^{20} = [\mathrm{LTD}_{t+1} - \mathrm{LTD}_t + \mathrm{LTD}_t^1]^+. \tag{31}$$

The market value of long-term debt is the book value of bonds multiplied by the respective price, summed across all maturities. The price of bonds at each maturity is computed from Moody's seasoned Baa corporate bond yield, assuming a flat term structure.

One advantage of Compustat is that repurchase and issuance are separately observed. Another advantage is that the market value of equity is directly observed, and the market value of long-term debt can be imputed by explicitly accounting for the maturity structure. This procedure leads to an arguably better measure of the market value of assets. The disadvantages of Compustat are the short sample period and the lack of coverage of private corporations. We therefore view the *Flow of Funds* as our main evidence and Compustat as supporting evidence. In an average year during 1971–2004, firms in Compustat represent 54% of the assets in the *Flow of Funds*.

3.3. Description of payout, issuance, and asset value

Table 2 reports descriptive statistics for the main variables. In the *Flow of Funds*, net payout is 1.7% of assets on average with a standard deviation of 1%. Dividends are the largest component of net payout. Net equity and debt repurchases represent a smaller component of net payout on average, but they are as volatile as dividends. The autocorrelation of net payout yield is 0.81, and its components are similarly persistent. The Compustat sample paints a similar picture. Net repurchases of both equity and debt are smaller than dividends. However, equity repurchase and issuance are comparable to dividends on average, while long-term debt repurchase and issuance represent a larger fraction of assets.

Fig. 1 shows the time series of net payout yield (Panel A) and its components (Panel B) in the *Flow of Funds*. Net payout has been positive in every year since 1926, which has been cited as evidence that the US economy is dynamically efficient (Abel, Mankiw, Summers, and Zeckhauser, 1989). The 1930s and the 1980s are periods of high net payout compared with the other decades. These two peaks are driven by different forces. The 1930s is a decade of high dividends and high debt repurchase. This is explained by the difficulty that firms had in issuing new debt during the Great Depression (Hickman, 1952). In contrast, the 1980s is a decade of high equity repurchase and low debt repurchase. The high equity repurchase is partly explained by merger activity in the 1980s (Baker and Wurgler, 2000; Andrade, Mitchell, and Stafford, 2001). Allen and Michaely (2003) argue that cash distributions related to merger activity are an important source of payout to shareholders (that is often neglected by researchers).

Panel B of Fig. 1 shows that dividends have fallen relative to asset value throughout the sample period. The downward trend is explained by the fact that earnings have fallen relative to asset value, although dividends have not fallen relative to earnings (Fama and French, 2001; DeAngelo, DeAngelo, and Skinner, 2004). Equity repurchase has increased recently, particularly after the adoption of the Securities and Exchange Commission Rule 10b-18 in 1982 (Grullon and Michaely, 2002). As reported in Panel A of Table 2, the correlation between dividends and net equity repurchase, both as fractions of assets, is -0.47. In the most recent decade, dividends are clearly low relative to asset value, but net payout is not unusually low when put into historical perspective. Panel B of Fig. 1 also shows that periods of high net equity repurchase tend to be periods of low net debt repurchase. As reported in Panel A of Table 2, the correlation between net equity and debt repurchase, both as fractions of assets, is -0.26.

As shown in Panel A of Fig. 2, net payout in Compustat is on average a higher fraction of assets than in the *Flow of Funds*. This can be explained by the fact that firms that go private disappear from Compustat but remain in the corporate sector as defined by the *Flow of Funds*. In Compustat, the terminal cash flow (as equity repurchase) from a firm that goes private is recorded as an outflow from the publicly traded sector. The *Flow of Funds* nets out such transactions between public and private corporations. For example, the leveraged buyouts of the 1980s explain why net payout yield peaks at 6% in Compustat and at only 3% in the *Flow of Funds* during the same period. As reported in Panel B of Table 2, the correlation between equity repurchase and long-term debt issuance, both as fractions of assets, is 0.34 in the Compustat sample. Kaplan (1991) reports that 62% of large leveraged buyouts during the period 1979–1986 remained privately owned in 1990.

Panel B of Fig. 2 identifies hot markets for equity issuance during the period 1971–2004. Equity issuance, as a fraction of assets, peaked in 1983. Equity issuance again peaked in 2000, but not at an unusually high level when put into historical perspective. Much of the equity issuance around 2000 resulted from equity-financed mergers and executive compensation, which are not part of cash transactions recorded in the statement of cash flows. As shown in Panel C, the market for long-term debt was particularly depressed in 1983, coinciding with the hot equity market. Debt issuance rose throughout the rest of the 1980s and peaked in 1992.

Table 3 performs a simple accounting decomposition that summarizes the sources of time variation in net payout yield. By definition, the variance of net payout yield is equal to the sum of the covariances of net payout yield with its components. The covariances, scaled by the variance of net payout yield, represent the fraction of the time variation in net payout yield explained by each component. In the *Flow of Funds* sample, each of the four components (dividends, interest, net equity repurchase, and net debt repurchase) accounts for a similar fraction of the variation in net payout yield, between 20% and 30%. In the Compustat sample, net equity repurchase plays a more prominent role, accounting for 45% of the variation in net payout yield, while net debt repurchase accounts for only 5% of the variation. Most of the variation in the net equity flow is explained by repurchase (47%) instead of issuance (−2%).

3.4. Description of asset returns

Panel A of Fig. 3 shows the time series of real asset returns, together with real returns on the CRSP value-weighted index. The correlation between asset returns and equity returns is 0.97. As reported in Table 2, asset return has mean of 5.4% and a standard deviation of 12.2% (see Fama and French, 1999, Table V). Panel B shows the time series of real net payout growth, together with real dividend growth for the CRSP value-weighted index. The correlation between net payout growth and dividend growth is 0.01. As reported in Table 2, net payout growth has a mean of 3.8% and a standard deviation of 38.4%, which is much more volatile than dividend growth.

A key empirical finding of this paper, shown in Section 4, is that the variation in net payout yield is mostly explained by future net payout growth, instead of future asset returns. Fig. 3 provides a simple intuition for our finding. Net payout growth is more volatile than asset returns in the short run. If net payout yield is stationary, the volatility of net payout growth must fall, through mean reversion, to that of asset returns in the long run. In contrast, equity returns are more volatile than dividend growth in the short run. If dividend yield is stationary, the volatility of equity returns must fall, through mean reversion, to that of dividend growth in the long run.

4. Valuation of corporate assets

4.1. Variance decomposition of net payout yield

In Table 4, we estimate the joint dynamics of asset return, net payout growth, and net payout yield through a VAR. Panel A reports estimates for the *Flow of Funds*, and Panel B reports estimates for Compustat. As shown in the first column, past asset returns and past net payout growth have little forecasting power for asset returns; the coefficients are not significantly different from zero. However, net payout yield is a better predictor of asset returns. The evidence for predictability is stronger in Compustat with a t-statistic of two and an R^2 of 9%. As shown in the second column, past asset returns and past net payout growth have little forecasting power for net payout growth. However, high net payout yield strongly predicts low net payout growth, implying strong mean reversion in net payout. The evidence for predictability is stronger in the *Flow of Funds* with a t-statistic of three and an R^2 of 15%. As shown in the last column, net payout yield has an autoregressive coefficient of 0.78 in the *Flow of Funds*.

Panel A of Table 5 reports the variance decomposition of net payout yield for the *Flow of Funds* [see Eq. (17)]. At a one-year horizon, 2% of the variation in net payout yield is explained by future asset returns, 21% is explained by future net payout growth, and 76% is explained by future net payout yield. At longer horizons, the variation in net payout yield is increasingly explained by future net payout growth. In the infinite-horizon limit, 12% of the variation is explained by future asset returns, while 88% is explained by future net payout growth. The hypothesis that none of the variation in net payout yield is explained by future asset returns cannot be rejected. The results are similar for Compustat as reported in Panel B, but the shorter sample leads to somewhat larger standard errors.

We can summarize the variance decomposition in Table 5 in the language of cointegration. Net payout, the cash outflow from the corporate sector, and the value of corporate assets are cointegrated. When net payout yield deviates from its long-run mean, either net payout or asset value must revert to the common trend to restore the long-run equilibrium. Asset value is the permanent component of net payout yield, while any deviation in net payout from asset value is transitory. Therefore, net payout yield mostly predicts net payout growth instead of asset returns, especially over long horizons.

The dynamics of net payout yield, revealed by the variance decomposition, has important implications for the present-value relation between asset value and net payout. The solid line in Fig. 4 is the log real asset value of nonfinancial corporations in the *Flow of Funds*. The dashed line is expected future net payout discounted at a constant rate, which is the sample analog of the first two terms in Eq. (11). The wedge between the two time series represents long-horizon discount rates, which is the sample analog of the last term in Eq. (11). As reported in Table 5, the standard deviation of long-horizon discount rates is 8% and within one standard error of zero. Because the variation in long-horizon discount rates is relatively small, asset value moves in lockstep with expected future net payout.

4.2. The role of debt payout

Debt plays a key role in reducing the implied volatility of long-horizon discount rates. To understand its role, we break up net payout into the sum of two pieces. Equity payout is the sum of dividends and equity repurchase net of issuance, and debt payout is the sum of interest and debt repurchase net of issuance. Because firms tend to offset equity issuance through debt repurchase, equity payout can understate the total cash outflow from the corporate sector during periods of high equity issuance.

Table 6 reports estimates of a VAR in asset return, net payout growth, net payout-equity payout ratio, and equity payout-assets ratio. Because net payout yield is the sum of the net payout-equity payout ratio and the equity payout-assets ratio in logs, Table 6 can be interpreted as an unconstrained version of the VAR model in Table 4. We loosely refer to the net payout-equity payout ratio as debt payout because net payout minus equity payout is equal to debt payout in levels.

As shown in the first column of Panel A, the coefficient on debt payout is negative, and the coefficient on the equity payout-assets ratio is positive. A high equity payout-assets ratio predicts high asset returns, which implies that expected returns are low when net equity issuance is high (Baker and Wurgler, 2000). At the same time, high debt payout predicts low asset returns, which implies that expected returns are low when net debt repurchase is high. However, high equity issuance tends to coincide with high debt repurchase as shown in Table 2. Therefore, the combination of high equity issuance and high debt repurchase implies much smaller variation in expected returns than that implied by the equity payout-assets ratio alone.

4.3. Variance decomposition of asset returns

Table 7 reports the variance decomposition of unexpected asset returns [see Eq. (25)]. Panel A reports the results for the *Flow of Funds*, and Panel B reports the results for Compustat. In each panel, the first estimate is based on the VAR in Table 4, in which the main predictor variable is net payout yield. The second estimate is based on the VAR in Table 6, in which the main predictor variables are the net payout-equity payout ratio and the equity payout-assets ratio. Because the results are similar, we focus our discussion on the first estimate in Panel A.

Holding constant discount rates, 124% of the variation in asset returns is explained by changes in expected cash flow growth. The covariance between changes in discount rates and expected cash flow growth accounts for 38% of the variation in asset returns. That is, news about rising discount rates are related to news about rising expected cash flow growth.

This offsetting effect between asset returns and net payout growth explains why unexpected asset returns are 24% less volatile than changes in expected cash flow growth.

In contrast to equity returns (Campbell, 1991), the volatility of unexpected asset returns can be mostly explained by expected cash flow growth for two reasons. First, asset returns are less volatile than equity returns (see Panel A of Fig. 3), so there is less volatility to explain. Second, and more important, changes in expected cash flow growth are larger when debt payout is included. Our findings are broadly consistent with previous empirical evidence. Campbell and Ammer (1993) find that bond returns are mostly driven by inflation expectations, instead of discount rates. Because nominal payments are fixed for pure-discount bonds, a change in expected inflation is effectively a change in expected cash flow growth. Because net payout includes cash flows to debt holders, changes in expected cash flow growth become a relatively important source of variation in asset returns.

5. Valuation of market equity

This paper shows that the dynamics of net payout yield and its implications for long-horizon discount rates are substantially different from those for dividend yield. These differences can arise not only because net payout incorporates cash flows to debt holders, but also because it incorporates cash flows to equity holders in the form of net equity repurchases. To isolate the latter channel, this section explains the role of equity repurchase and issuance in the valuation of total market equity. The appropriate measure of cash flow for valuing market equity is *equity payout*, which is the sum of dividends and equity repurchase net of issuance.

5.1. Dividend yield versus equity payout yield

Let P and D denote the price and dividend per share of equity. The return on equity from period t to $t+1$ is

$$R_{t+1} = \frac{P_{t+1} + D_{t+1}}{P_t}. \tag{32}$$

Let $[\cdot]^+$ be an operator that takes the positive part of the expression inside the brackets (and takes the value zero if the expression is negative). Multiplying the numerator and the denominator of Eq. (32) by the number of shares outstanding in period t,

$$R_{t+1} = \frac{\text{ME}_{t+1} + \text{DIV}_{t+1} + \text{REP}_{t+1} - \text{ISS}_{t+1}}{\text{ME}_t}, \tag{33}$$

where

$$\begin{aligned}
\text{ME}_t &= P_t \times \text{Shares}_t, && (34)\\
\text{DIV}_{t+1} &= D_{t+1} \times \text{Shares}_t, && (35)\\
\text{REP}_{t+1} &= P_{t+1} \times [\text{Shares}_t - \text{Shares}_{t+1}]^+, && (36)\\
\text{ISS}_{t+1} &= P_{t+1} \times [\text{Shares}_{t+1} - \text{Shares}_t]^+. && (37)
\end{aligned}$$

Eq. (32) is the return on one share of equity, and Eq. (33) is the return on all outstanding shares of equity. Equity return is the same in both cases, but they have different implications for cash flow. An investor who owns one share receives dividends as the cash outflow from the firm. An investor who owns all outstanding shares receives dividends and equity repurchase as the cash outflow from the firm but, in addition, invests equity issuance as the cash inflow to the firm. We refer to the ratio D_t/P_t as dividend yield, and the ratio $(\text{DIV}_t + \text{REP}_t - \text{ISS}_t)/\text{ME}_t$ as *equity payout yield*. The two valuation ratios coincide only in a world in which the number of outstanding shares remains constant over time.

Dividend yield and equity payout yield represent a subtle but important difference between a microeconomic and a macroeconomic view of investment. This conceptual difference can be understood in terms of portfolio strategies. Dividend yield is the appropriate valuation ratio for an investor who owns one share of equity; this investor receives dividends, reinvests repurchases, and never invests additional capital. Equity payout yield is the appropriate valuation ratio for an investor who owns all outstanding shares of equity; this investor receives dividends, receives repurchases, and invests issuances as additional capital. At the macroeconomic level, a net repurchase of equity is an outflow from the corporate sector that cannot be reinvested (except through a net issuance of debt). Therefore, the portfolio strategy implicit in dividend yield is feasible only at the microeconomic level, whereas the portfolio strategy implicit in equity payout yield is also feasible at the macroeconomic level.

5.2. Description of equity payout yield

Fig. 5 shows the time series of dividend yield and equity payout yield for all NYSE, Amex, and Nasdaq stocks for the period 1926–2004. As in Boudoukh, Michaely, Richardson, and Roberts (2007), we construct equity payout yield for a monthly rebalanced value-weighted portfolio using the CRSP Monthly Stock Database. We keep track of all cash flows in Eq. (33) for individual stocks, including potentially important terminal cash distributions through CRSP's delisting data. We then aggregate returns and cash flows across all stocks in the portfolio.

Dividend yield is less volatile and more persistent than equity payout yield. The high persistence of dividend yield has led Boudoukh, Michaely, Richardson, and Roberts (2007) to question its stationarity, finding evidence for a structural break in 1984. Dividend yield is above equity payout yield for most of the sample period, indicating a net capital inflow to the market equity of US corporations. Equity payout can be negative whenever issuance exceeds dividends plus repurchase. The two striking troughs in equity payout yield at the end of 1929 and 2000 are such episodes, which are interestingly at the end of stock market booms.

Equity issuance, as measured by changes in shares outstanding, can represent transfer of ownership instead of actual cash flow. Important examples of such transactions are equity-financed mergers and equity issued as part of executive compensation. In 2000, equity issued through mergers accounted for 4.31%, and equity issued as executive compensation accounted for 1.23% of the assets of Standard & Poor's 100 firms (Fama and French, 2005,

Table 7). These transactions partly explain why equity payout yield falls to a historical low in 2000.

5.3. Variance decomposition of dividend yield

In Panel A of Table 8, we estimate the joint dynamics of equity return, dividend growth, and dividend yield through a VAR. As shown in the first column, past equity returns and dividend growth have little forecasting power for equity return; the coefficients are not significantly different from zero. However, high dividend yield predicts high equity returns with a t-statistic of almost two (Campbell and Shiller, 1988; Fama and French, 1988). As shown in the second column, neither past equity returns, dividend growth, nor dividend yield have forecasting power for dividend growth. As shown in the last column, dividend yield has an autoregressive coefficient of 0.93.

Panel A of Table 9 reports the variance decomposition of dividend yield. At a one-year horizon, 10% of the variation in dividend yield is explained by future equity returns, none is explained by future dividend growth, and 90% is explained by future dividend yield. At longer horizons, the variation in dividend yield is increasingly explained by future equity returns. In the infinite-horizon limit, 83% of the variation in dividend yield is explained by future equity returns, while only 17% is explained by future dividend growth. The variance decomposition shows that the transitory variation in discount rates is large relative to the transitory variation in expected dividend growth. Roughly speaking, the permanent component of dividend yield is dividends, while any deviation in stock price from dividends is transitory.

The dynamics of dividend yield, revealed by the variance decomposition, has important implications for the present-value relation between stock prices and dividends. The solid line in Panel A of Fig. 6 is the log real value of the CRSP value-weighted index. The dashed line is expected future dividends discounted at a constant rate. The wedge between the two time series represents long-horizon discount rates, implied by a forecast of equity returns by dividend yield. As reported in Panel A of Table 9, the standard deviation of long-horizon discount rates is 35%, although this estimate is within two standard errors of zero. Because the variation in long-horizon discount rates is large, the stock price index wanders far away from expected future dividends. At the end of 2000, for example, the stock price index was approximately 100% higher than expected future dividends discounted at a constant rate.

5.4. Variance decomposition of equity payout yield

In Panel B of Table 8, we estimate the joint dynamics of equity return, equity payout growth, and equity payout yield through a VAR. As shown in the first column, high equity payout yield predicts high equity returns with a t-statistic of four (Boudoukh, Michaely, Richardson, and Roberts, 2007; Robertson and Wright, 2006). The R^2 of the regression is 8%, compared with 4% for the regression in Panel A that uses dividend yield. Equity payout yield leads to stronger evidence for short-run predictability than dividend yield, in the sense that implied expected returns have greater variation at the one-year horizon. As shown in the second column, high equity payout yield also predicts low equity payout growth with a t-statistic above two and an R^2 of 29%. In contrast to dividends, there is strong mean reversion in equity payout. As shown in the last column, equity payout yield has an autoregressive coefficient of 0.81, which is less persistent than dividend yield.

Panel B of Table 9 reports the variance decomposition of equity payout yield. The fact that equity payout can be negative requires a technical (not conceptual) modification to the variance decomposition, which is explained in the Appendix. At a one-year horizon, 4% of the variation in equity payout yield is explained by future equity returns, 20% is explained by future equity payout growth, and 76% is explained by future equity payout yield. At longer horizons, the variation in equity payout yield is increasingly explained by future equity payout growth. In the infinite-horizon limit, only 16% of the variation in equity payout yield is explained by future equity returns, while 84% is explained by future equity payout growth. The variance decomposition shows that the transitory variation in discount rates is small relative to the transitory variation in expected equity payout growth. Changes in equity repurchase and issuance are highly predictable, while changes in dividends are not.

The solid line in Panel B of Fig. 6 is the log real market equity of NYSE, Amex, and Nasdaq stocks. The dashed line is expected future equity payout discounted at a constant rate. The wedge between the two time series represents long-horizon discount rates, implied by a forecast of equity returns by equity payout yield. The figure shows that movements in market equity cannot be explained entirely by changes in expected future cash flow. At the end of 2000, for example, market equity was approximately 50% higher than expected future equity payout.

However, the wedge between the two time series in Panel B is smaller than the wedge between the two time series in Panel A. Because equity payout yield is less persistent than dividend yield, it implies smaller variation in long-horizon discount returns. As reported in Panel B of Table 9, the standard deviation of long-horizon discount rates implied by equity payout yield is 25%, which is smaller than the 35% implied by dividend yield. Ackert and Smith (1993) report similar evidence for the Toronto Stock Exchange.

5.5. The role of equity repurchase and issuance

A case study of the period 1945–1955 illustrates the role that equity repurchase and issuance play in reducing the implied volatility of long-horizon discount rates. In the postwar period, firms issued equity to finance high investment. Therefore, dividends remained unusually high, while equity payout was much closer to the historical norm (see Fig. 5). Based on an unusually high dividend yield, Panel A of Fig. 6 suggests that discount rates were high in relation to expected dividend growth. Based on a lower equity payout yield, Panel B suggests that discount rates were in line with expected cash flow growth.

The two VAR models in Table 8 use different sets of conditioning information and consequently represent different models of expected returns. Table 10 explicitly links the two models to clarify the role of equity payout in reducing the magnitude of variation in long-horizon discount rates. We estimate a VAR in equity return, equity payout growth, equity payout-dividend ratio, and dividend yield. Because equity payout yield is the sum of the equity payout-dividend ratio and dividend yield in logs, Table 10 can be interpreted as an unconstrained version of the VAR model in Panel B of Table 8. We loosely refer to log equity payout-dividend ratio as net equity repurchase because equity payout minus dividends is equal to net equity repurchase in levels.

On the one hand, a high net equity repurchase predicts high equity returns, implying that expected returns are low when equity issuance is high. On the other hand, a high net equity repurchase predicts low equity payout growth. Therefore, net equity repurchase captures independent variation in expected returns and expected equity payout growth. A high dividend yield predicts, although not significantly, both high equity returns and high equity payout growth. Therefore, dividend yield captures common variation in expected returns and expected equity payout growth. In the ratio of equity payout to market equity, persistent variation in discount rates implied by dividend yield is partly offset by variation in expected equity payout growth.

5.6. Variance decomposition of equity returns

Panel A of Table 11 reports a variance decomposition of unexpected equity returns, taking the perspective of an investor who owns one share of equity and receives dividends as the cash flow. Holding constant discount rates, only 38% of the variation in equity returns is explained by changes in expected dividend growth.

Panel B reports a variance decomposition of unexpected equity returns, taking the perspective of an investor who owns all outstanding shares of equity and receives equity payout as the cash flow. The first estimate is based on the VAR in Table 8, in which the main predictor variable is equity payout yield. The second estimate is based on the VAR in Table 10, in which the main predictor variables are the equity payout-dividend ratio and dividend yield. Holding constant discount rates, at most 61% of the variation in equity returns can be explained by changes in expected equity payout growth. The rest must be explained by variation in discount rates, implying that equity returns cannot be explained entirely by movements in expected cash flow growth.

The covariance between changes in expected returns and expected equity payout growth is positive, while the same covariance is negative in the case of dividend growth. That is, news about rising discount rates are related to news about rising expected equity payout growth. This is consistent with our finding in Table 10, that there is much common variation in expected returns and expected equity payout growth.

6. Conclusion

A large volume of research has shown that stock returns are predictable, and financial economists are in general agreement that discount rates are time varying. However, there is still active debate on the exact magnitude of variation in discount rates, especially at long horizons. Because true discount rates are ultimately unobservable, we can only infer their movements based on variables that forecast returns. Valuation ratios are natural predictor variables because they must forecast returns or cash flow growth, provided that they are stationary. We find that valuation ratios based on comprehensive measures of cash flow to investors have important implications for the magnitude of variation in long-horizon discount rates. Equity payout yield, which incorporates equity repurchase and issuance, implies variation in long-horizon discount rates that is about two-thirds of that implied by dividend yield. Movements in discount rates are important for explaining stock market valuation, but perhaps not to the degree suggested by previous research.

In this paper, we focus on a different but related question of whether time-varying discount rates are important for the valuation of firms. Net payout yield, which incorporates net repurchases of both equity and debt, implies small variation in long-horizon discount rates. The value of corporate assets is mostly driven by changes in expected future cash flow, instead of changes in discount rates. Therefore, the constant discount rate present-value model is a useful approximation for the valuation of corporate assets.

Appendix. Present-value relation between equity payout and market equity

The return on equity, Eq. (33), takes the same form as the return on assets, Eq. (3). However, Eq. (5) does not apply directly to equity payout yield because equity payout can be negative. This appendix describes a technical (not conceptual) modification to Eq. (5) that handles this problem.

To make the connection with net payout yield explicit, we adopt the following notation in this appendix.

- D_t: Dividends plus equity repurchase in period t.
- E_t: Equity issuance in period t.
- $C_t = D_t - E_t$: Equity payout in period t.
- A_t: Market equity at the end of period t.
- C_t/A_t: Equity payout yield at the end of period t.

In this notation, Eq. (33) is

$$A_{t+1} + D_{t+1} - E_{t+1} = R_{t+1}A_t. \tag{38}$$

Let lowercase letters denote the log of the corresponding uppercase variables. Assume that $d_t - a_t$ and $e_t - a_t$ are stationary, and define the parameters

$$\phi = \frac{1}{1+\exp\{\mathbf{E}[d_t - a_t]\} - \exp\{\mathbf{E}[e_t - a_t]\}}, \tag{39}$$

$$\theta = \frac{\exp\{\mathbf{E}[d_t - a_t]\}}{\exp\{\mathbf{E}[d_t - a_t]\} - \exp\{\mathbf{E}[e_t - a_t]\}}. \tag{40}$$

Empirically relevant values are $\phi < 1$ and $\theta > 1$ because $\mathbf{E}[d_t - a_t] > \mathbf{E}[e_t - a_t]$. Define the variable

$$v_t = \theta d_t - (\theta - 1)e_t - a_t. \tag{41}$$

This is essentially the log of equity payout yield. The outflow and inflow must be treated separately in Eq. (41) because equity payout can be negative.

Rewrite Eq. (38) as

$$\log(1 + \exp\{d_{t+1} - a_{t+1}\} - \exp\{e_{t+1} - a_{t+1}\}) = r_{t+1} - \Delta a_{t+1}. \tag{42}$$

First-order Taylor approximation of the left side of this equation leads to a difference equation for equity payout yield

$$v_t \approx r_{t+1} - \theta \Delta d_{t+1} + (\theta - 1)\Delta e_{t+1} + \phi v_{t+1}, \tag{43}$$

up to an additive constant. Solving Eq. (43) forward H periods,

$$v_t = r_t(H) - \Delta d_t(H) + \Delta e_t(H) + v_t(H), \tag{44}$$

where

$$\begin{aligned}
r_t(H) &= \sum_{s=1}^{H} \phi^{s-1} r_{t+s}, && (45)\\
\Delta d_t(H) &= \sum_{s=1}^{H} \phi^{s-1} \theta \Delta d_{t+s}, && (46)\\
\Delta e_t(H) &= \sum_{s=1}^{H} \phi^{s-1} (\theta - 1) \Delta e_{t+s}, && (47)\\
v_t(H) &= \phi^{H} v_{t+H}. && (48)
\end{aligned}$$

We estimate the joint dynamics of equity return, equity payout growth, and equity payout yield through the VAR, Eq. (13), where $x_t = (r_t, \theta \Delta d_t - (\theta - 1)\Delta e_t, v_t)'$. We estimate the variance decompositions of equity payout yield and unexpected equity returns through the VAR model, as described in Subsection 2.4.

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Table 1: Compustat variables used in data construction

Variable	Data item	Item number
DEBT_NET	Changes in Current Debt	301
DIV	Cash Dividends	127
DIV_PREF	Dividends – Preferred	19
EQ_ISS	Sale of Common and Preferred Stock	108
EQ_REP	Purchase of Common and Preferred Stock	115
INT	Interest Expense	15
LIAB_CUR	Current Liabilities – Total	5
LIAB_OTH	Liabilities – Other	75
LTD	Long-Term Debt – Total	9
LTD_ISS	Long-Term Debt – Issuance	111
LTD_REP	Long-Term Debt – Reduction	114
MINORITY	Minority Interest	38
TAX	Deferred Taxes and Investment Tax Credit	35

Table 2: Descriptive statistics for net payout and asset value

The table reports descriptive statistics for net payout and its components as fractions of the market value of assets. It also reports descriptive statistics for asset return and net payout growth, which are both in logs and deflated by the consumer price index. LTD = long-term debt; STD = short-term debt.

		Standard		Correlation with								
	Mean	deviation			Net equity	Equity	Equity		Net debt	LTD	LTD	Net STD
As fraction of assets	(percent)	(percent)	Autocorrelation	Dividends	repurchase	repurchase	issuance	Interest	repurchase	repurchase	issuance	repurchase
Panel A: *Flow of Funds* 1926–2004												
Net payout	1.69	0.97	0.81	0.45	0.34			0.53	0.55			
Dividends	1.55	0.57	0.84		-0.47			-0.13	0.37			
Net equity repurchase	-0.08	0.56	0.78					0.38	-0.26			
Interest	0.85	0.44	0.93						-0.13			
Net debt repurchase	-0.63	0.53	0.72									
Asset return	5.36	12.20	0.09									
Net payout growth	3.83	38.37	-0.04									
Panel B: Compustat 1971–2004												
Net payout	2.65	1.22	0.73	0.42	0.57	0.64	0.08	0.51	0.08	0.14	0.10	-0.02
Dividends	1.68	0.63	0.92		-0.30	-0.18	0.41	0.92	-0.57	-0.55	-0.16	0.01
Net equity repurchase	0.34	0.96	0.57			0.95	-0.38	-0.18	0.05	0.33	0.30	-0.23
Equity repurchase	1.32	0.89	0.67				-0.07	-0.01	-0.01	0.32	0.34	-0.26
Equity issuance	0.98	0.31	0.54					0.54	-0.20	-0.11	0.05	-0.04
Interest	1.80	0.67	0.87						-0.58	-0.38	0.07	0.00
Net debt repurchase	-1.17	0.79	0.62							0.58	-0.15	0.25
LTD repurchase	3.23	1.05	0.84								0.69	-0.13
LTD issuance	4.37	0.82	0.50									-0.11
Net STD repurchase	-0.03	0.24	0.40									
Asset return	6.36	10.77	0.04									
Net payout growth	6.73	25.83	-0.03									

Table 3: Accounting for time variation in net payout yield

The table reports fraction of the variance in net payout yield explained by each of the components of net payout. Heteroskedasticity- and autocorrelation-consistent standard errors are in parentheses.

Fraction of variance explained by	*Flow of Funds* 1926–2004	Compustat 1971–2004
Dividends	0.27	0.22
	(0.08)	(0.08)
Net equity repurchase	0.20	0.45
	(0.08)	(0.15)
Equity repurchase		0.47
		(0.14)
Equity issuance		-0.02
		(0.04)
Interest	0.24	0.28
	(0.05)	(0.07)
Net debt repurchase	0.30	0.05
	(0.06)	(0.09)
Long-term debt repurchase		0.12
		(0.14)
Long-term debt issuance		-0.06
		(0.12)
Net short-term debt repurchase		0.00
		(0.03)

Table 4: Vector autoregression (VAR) in asset return, net payout growth, and net payout yield

The table reports estimates of a VAR in real asset return, real net payout growth, and log net payout yield. Estimation is by continuous-updating generalized method of moments. Heteroskedasticity-consistent standard errors are in parentheses. The J-statistic for the VAR model in Panel A is 14.22 (p-value of 0%). The J-statistic for the VAR model in Panel B is 0.06 (p-value of 100%).

Lagged regressor	Asset return	Net payout growth	Net payout yield
Panel A: *Flow of Funds* 1926–2004			
Asset return	0.10	0.49	0.39
	(0.13)	(0.31)	(0.35)
Net payout growth	-0.01	0.05	0.06
	(0.04)	(0.13)	(0.14)
Net payout yield	0.03	-0.21	0.78
	(0.02)	(0.07)	(0.07)
R^2	0.01	0.15	0.61
Panel B: Compustat 1971–2004			
Asset return	0.07	0.21	0.15
	(0.18)	(0.42)	(0.51)
Net payout growth	-0.02	0.07	0.09
	(0.08)	(0.12)	(0.16)
Net payout yield	0.08	-0.19	0.75
	(0.04)	(0.09)	(0.11)
R^2	0.09	0.12	0.60

Table 5: Variance decomposition of net payout yield

The variance of log net payout yield is decomposed into future asset returns, future net payout growth, and future net payout yield. The last row of each panel reports the standard deviation of expected asset returns and expected cash flow growth in the infinite-horizon present-value model. The log-linearization parameter is $\rho = 0.98$. Estimation is through the vector autoregression reported in Table 4. Heteroskedasticity-consistent standard errors are in parentheses.

	Fraction of variance in net payout yield explained by future		
Horizon	Asset returns	Net payout growth	Net payout yield
Panel A: *Flow of Funds* 1926–2004			
One year	0.02	0.21	0.76
	(0.02)	(0.08)	(0.07)
Two years	0.05	0.38	0.58
	(0.05)	(0.11)	(0.11)
Five years	0.09	0.66	0.25
	(0.10)	(0.16)	(0.12)
Ten years	0.12	0.82	0.06
	(0.13)	(0.15)	(0.06)
Infinite	0.12	0.88	
	(0.14)	(0.14)	
Infinite: standard deviation	0.08	0.53	
	(0.09)	(0.11)	
Panel B: Compustat 1971–2004			
One year	0.07	0.18	0.75
	(0.04)	(0.10)	(0.10)
Two years	0.13	0.32	0.54
	(0.07)	(0.15)	(0.16)
Five years	0.24	0.55	0.21
	(0.12)	(0.20)	(0.17)
Ten years	0.29	0.66	0.04
	(0.16)	(0.20)	(0.07)
Infinite	0.31	0.69	
	(0.17)	(0.19)	
Infinite: standard deviation	0.13	0.30	
	(0.09)	(0.09)	

Table 6: Decomposing the vector autoregression (VAR) in asset return, net payout growth, and net payout yield

The table reports estimates of a VAR in real asset return, real net payout growth, log net payout-equity payout ratio, and log equity payout-assets ratio. Estimation is by continuous-updating generalized method of moments. Heteroskedasticity-consistent standard errors are in parentheses. The J-statistic for the VAR model in Panel A is 17.54 (p-value of 0%). The J-statistic for the VAR model in Panel B is 0.06 (p-value of 100%).

Lagged regressor	Asset return	Net payout growth	Net payout−equity payout	Equity payout−assets
Panel A: *Flow of Funds* 1926–2004				
Asset return	0.12	0.48	0.26	0.11
	(0.12)	(0.31)	(0.30)	(0.32)
Net payout growth	0.00	0.05	0.11	-0.06
	(0.04)	(0.12)	(0.11)	(0.09)
Net payout−equity payout	-0.04	-0.21	0.67	0.18
	(0.03)	(0.12)	(0.09)	(0.10)
Equity payout−assets	0.07	-0.23	0.03	0.68
	(0.03)	(0.08)	(0.09)	(0.11)
R^2	0.10	0.15	0.49	0.48
Panel B: Compustat 1971–2004				
Asset return	0.06	0.21	-0.84	0.99
	(0.18)	(0.40)	(0.50)	(0.44)
Net payout growth	-0.02	0.05	-0.17	0.24
	(0.08)	(0.14)	(0.12)	(0.19)
Net payout−equity payout	0.06	-0.03	0.64	0.28
	(0.05)	(0.12)	(0.14)	(0.21)
Equity payout−assets	0.08	-0.29	0.05	0.59
	(0.04)	(0.09)	(0.08)	(0.13)
R^2	0.10	0.23	0.44	0.38

Table 7: Variance decomposition of asset returns

The variance of unexpected asset returns is decomposed into the sum of the variance of changes in expected asset returns, the variance of changes in expected cash flow growth, and minus twice the covariance between the two changes. The sum need not equal one because of log-linear approximation error. Estimation is through the vector autoregression (VAR) reported in Tables 4 and 6. Heteroskedasticity-consistent standard errors are in parentheses.

	Fraction of variance explained by changes in expected		
VAR model	Asset returns	Net payout growth	$-2\times$covariance
Panel A: *Flow of Funds* 1926–2004			
Table 4A	0.14	1.24	-0.38
	(0.28)	(0.40)	(0.63)
Table 6A	0.40	1.14	-0.54
	(0.34)	(0.34)	(0.63)
Panel B: Compustat 1971–2004			
Table 4B	0.65	1.12	-0.66
	(0.65)	(0.47)	(1.11)
Table 6B	0.54	0.92	-0.34
	(0.46)	(0.26)	(0.68)

Table 8: Vector autoregression (VAR) in equity return, dividend growth, and dividend yield
Panel A reports estimates of a VAR in real equity return, real dividend growth, and log dividend yield. Panel B reports estimates of a VAR in real equity return, real equity payout growth, and log equity payout yield. Estimation is by continuous-updating generalized method of moments. Heteroskedasticity-consistent standard errors are in parentheses. The sample period is 1926–2004. The *J*-statistic for the VAR model in Panel A is 0.75 (*p*-value of 86%). The *J*-statistic for the VAR model in Panel B is 2.90 (*p*-value of 41%).

Lagged regressor	Equity return	Cash flow growth	Cash flow yield
Panel A: Cash flow = dividend			
Equity return	-0.02	-0.15	-0.13
	(0.15)	(0.09)	(0.10)
Dividend growth	0.14	0.00	-0.15
	(0.18)	(0.14)	(0.14)
Dividend yield	0.09	-0.01	0.93
	(0.05)	(0.04)	(0.04)
R^2	0.04	0.05	0.88
Panel B: Cash flow = equity payout			
Equity return	0.13	-1.79	-1.96
	(0.13)	(0.73)	(0.79)
Equity payout growth	0.02	-0.26	-0.29
	(0.02)	(0.13)	(0.14)
Equity payout yield	0.04	-0.17	0.81
	(0.01)	(0.07)	(0.07)
R^2	0.08	0.29	0.69

Table 9: Variance decomposition of dividend yield and equity payout yield

In Panel A, the variance of log dividend yield is decomposed into future equity returns, future dividend growth, and future dividend yield. The log-linearization parameter is $\rho = 0.97$. In Panel B, the variance of log equity payout yield is decomposed into future equity returns, future equity payout growth, and future equity payout yield. The log-linearization parameters are $\phi = 0.98$ and $\theta = 2.5$. The last row of each panel reports the standard deviation of expected equity returns and expected cash flow growth in the infinite-horizon present-value model. Estimation is through the vector autoregression reported in Table 8. Heteroskedasticity-consistent standard errors are in parentheses. The sample period is 1926–2004.

	Fraction of variance in cash flow yield explained by future		
Horizon	Equity returns	Cash flow growth	Cash flow yield
Panel A: Cash flow = dividend			
One year	0.10	0.00	0.90
	(0.05)	(0.04)	(0.04)
Two years	0.18	0.02	0.80
	(0.10)	(0.07)	(0.07)
Five years	0.37	0.07	0.57
	(0.21)	(0.16)	(0.14)
Ten years	0.57	0.11	0.32
	(0.30)	(0.26)	(0.16)
Infinite	0.83	0.17	
	(0.38)	(0.38)	
Infinite: standard deviation	0.35	0.08	
	(0.19)	(0.15)	
Panel B: Cash flow = equity payout			
One year	0.04	0.20	0.76
	(0.02)	(0.06)	(0.07)
Two years	0.07	0.35	0.59
	(0.03)	(0.10)	(0.11)
Five years	0.12	0.61	0.28
	(0.05)	(0.13)	(0.14)
Ten years	0.15	0.77	0.08
	(0.06)	(0.09)	(0.08)
Infinite	0.16	0.84	
	(0.06)	(0.06)	
Infinite: standard deviation	0.25	1.27	
	(0.10)	(0.19)	

Table 10: Decomposing the vector autoregression (VAR) in equity return, equity payout growth, and equity payout yield
The table reports estimates of a VAR in real equity return, real equity payout growth, log equity payout-dividend ratio, and log dividend yield. Estimation is by continuous-updating generalized method of moments. Heteroskedasticity-consistent standard errors are in parentheses. The sample period is 1926–2004. The J-statistic for the VAR model in is 3.13 (p-value of 54%).

Lagged regressor	Equity return	Equity payout growth	Equity payout−dividends	Dividend yield
Equity return	0.13	-1.74	-1.56	-0.35
	(0.13)	(0.70)	(0.74)	(0.12)
Equity payout growth	0.02	-0.19	-0.19	-0.03
	(0.02)	(0.14)	(0.14)	(0.02)
Equity payout−dividends	0.05	-0.34	0.63	-0.01
	(0.02)	(0.11)	(0.11)	(0.02)
Dividend yield	0.01	0.31	0.35	0.98
	(0.06)	(0.20)	(0.22)	(0.04)
R^2	0.08	0.31	0.61	0.89

Table 11: Variance decomposition of equity returns

The variance of unexpected equity returns is decomposed into the sum of the variance of changes in expected equity returns, the variance of changes in expected cash flow growth, and minus twice the covariance between the two changes. The sum need not equal one because of log-linear approximation error. Estimation is through the vector autoregression (VAR) reported in Tables 8 and 10. Heteroskedasticity-consistent standard errors are in parentheses. The sample period is 1926–2004.

	Fraction of variance explained by changes in expected		
VAR model	Equity returns	Cash flow growth	$-2\times$covariance
Panel A: Cash flow = dividend			
Table 8A	0.49	0.38	0.14
	(0.41)	(0.13)	(0.31)
Panel B: Cash flow = equity payout			
Table 8B	0.58	0.61	-0.20
	(0.39)	(0.14)	(0.38)
Table 10	0.93	0.31	-0.25
	(0.64)	(0.06)	(0.63)

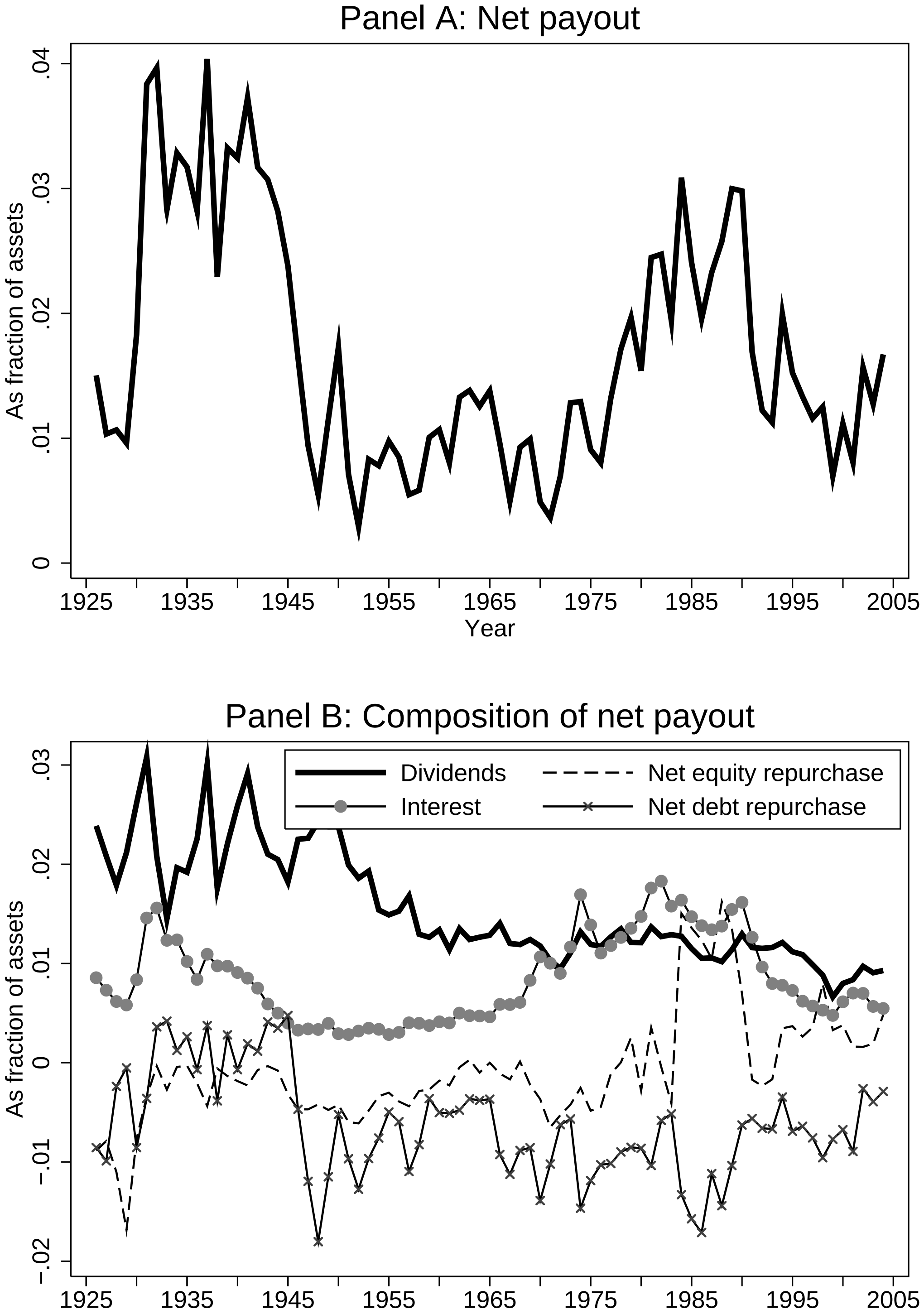
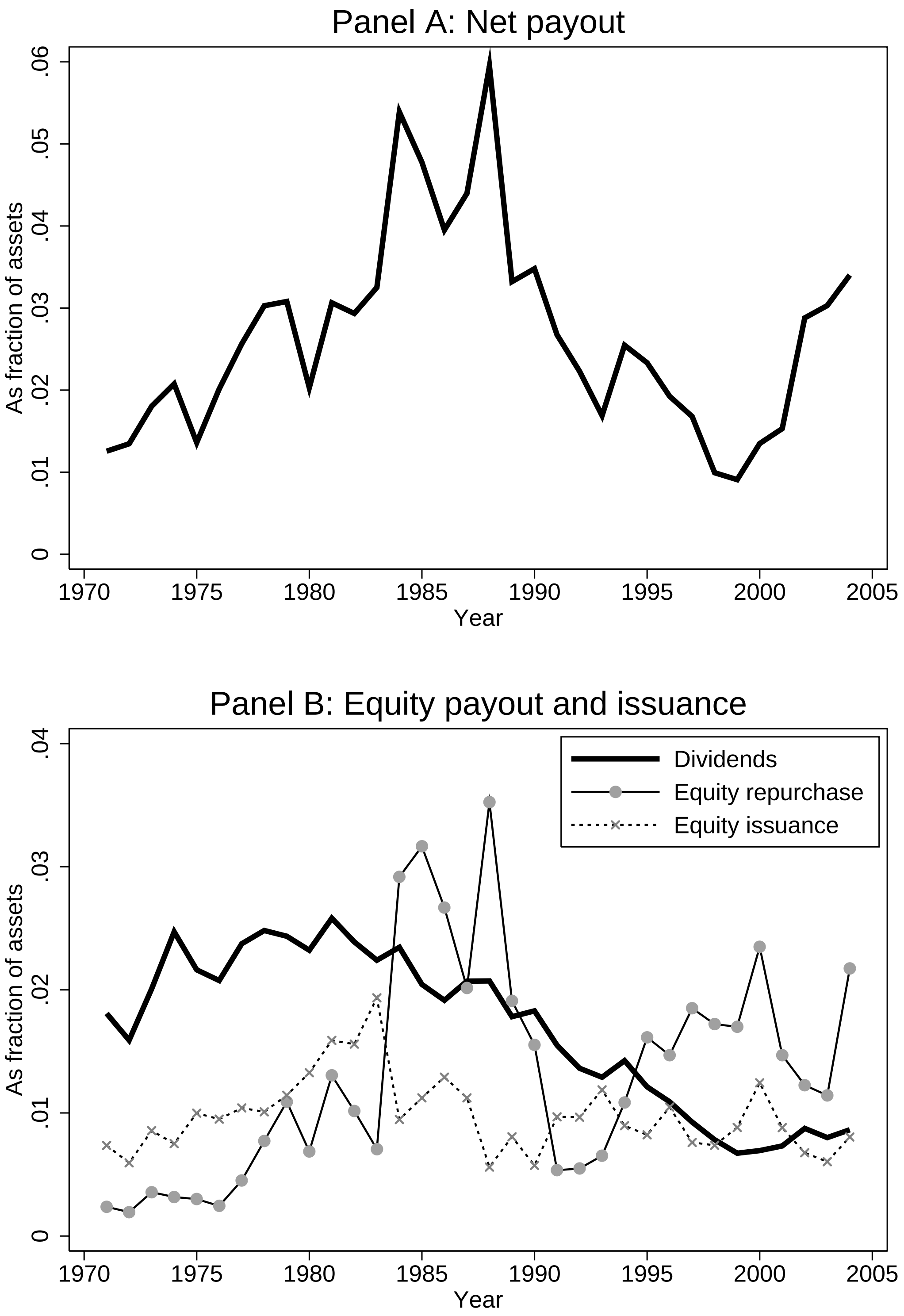


Figure 1: Net payout yield in the *Flow of Funds*

Net payout in Panel A is the sum of dividends, interest, net equity repurchase, and net debt repurchase in Panel B. The data represent nonfinancial corporations in the *Flow of Funds* for the period 1926–2004.


Panel A: Net payout
As fraction of assets
0
.01
.02
.03
.04
.05
.06
1970
1975
1980
1985
1990
1995
2000
2005
Year
Panel B: Equity payout and issuance
Dividends
Equity repurchase
Equity issuance
As fraction of assets
0
.01
.02
.03
.04
1970
1975
1980
1985
1990
1995
2000
2005
Year

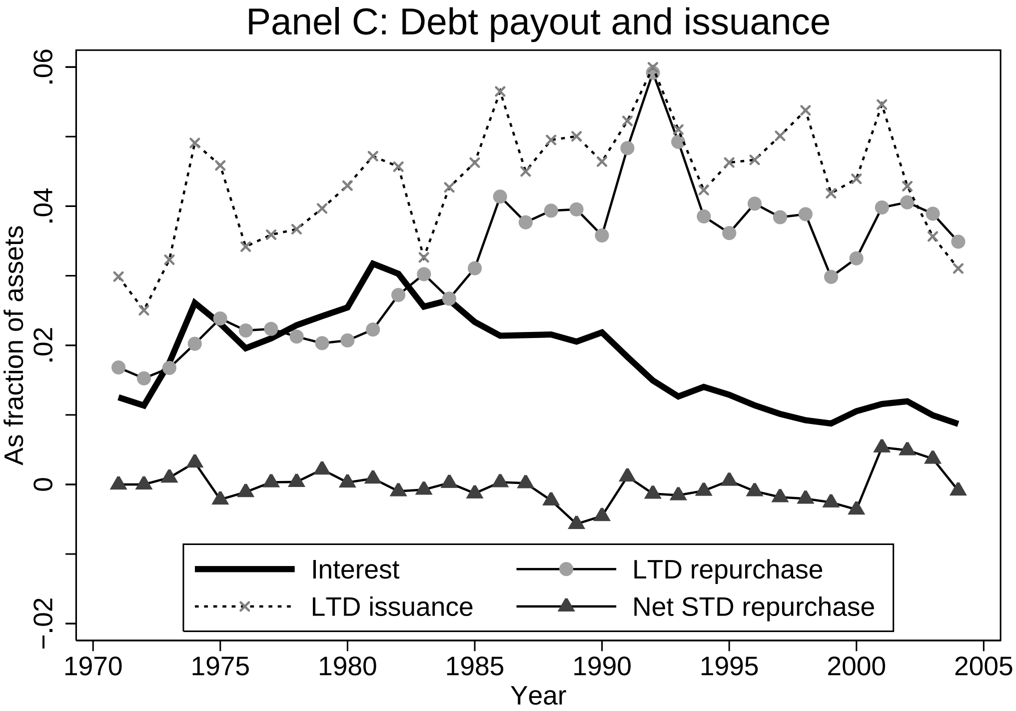


Figure 2: Net payout yield in Compustat

Net payout in Panel A is the sum of Panel B, dividends plus equity repurchase minus equity issuance, and Panel C, interest plus long-term debt (LTD) repurchase minus LTD issuance plus net short-term debt (STD) repurchase. The data represent nonfinancial firms in Compustat for the period 1971–2004.

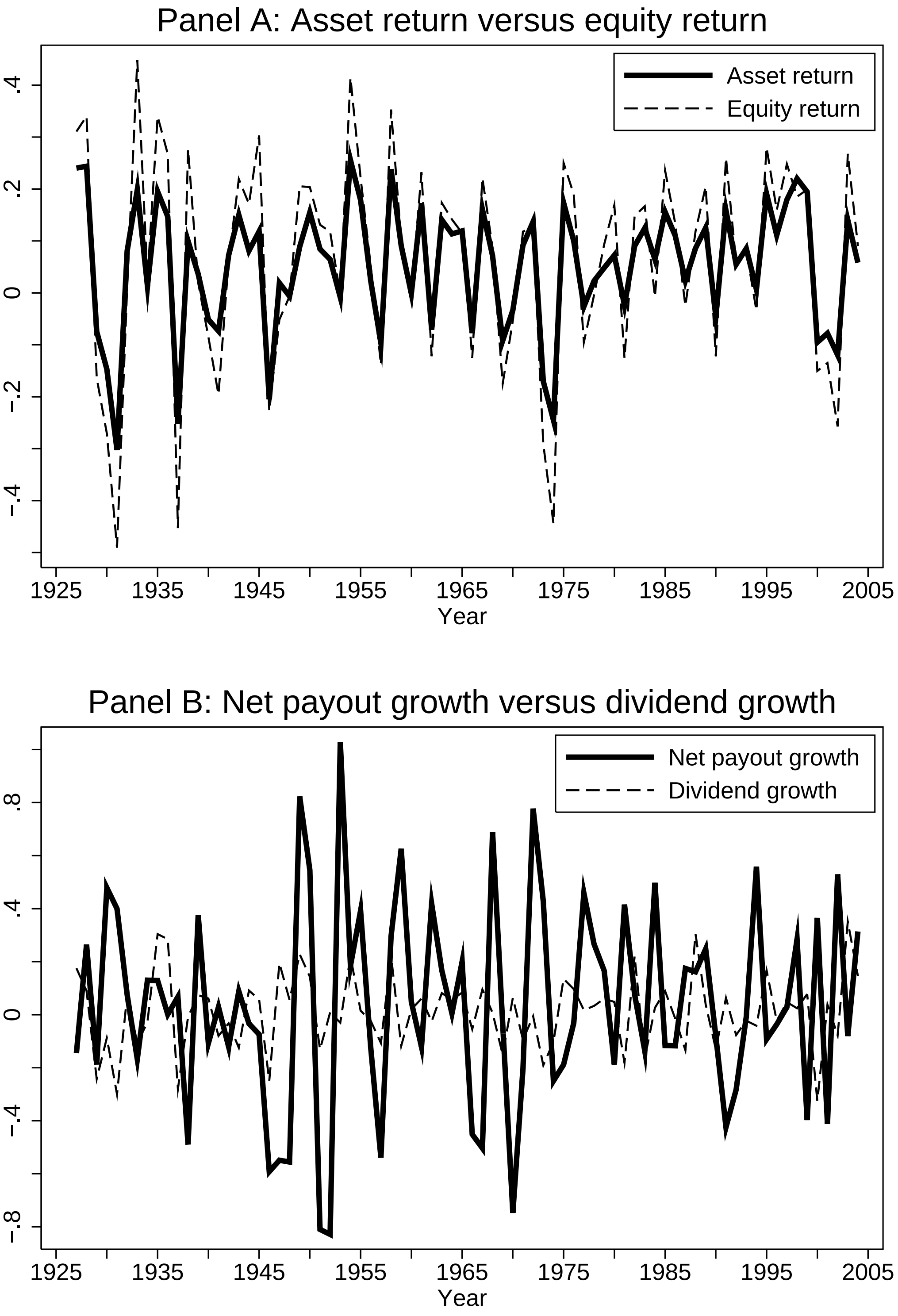


Figure 3: A comparison of returns and cash flow growth

Asset returns and net payout growth are those of nonfinancial corporations in the *Flow of Funds*. Equity returns and dividend growth are those of the CRSP value-weighted index for NYSE, Amex, and Nasdaq stocks.

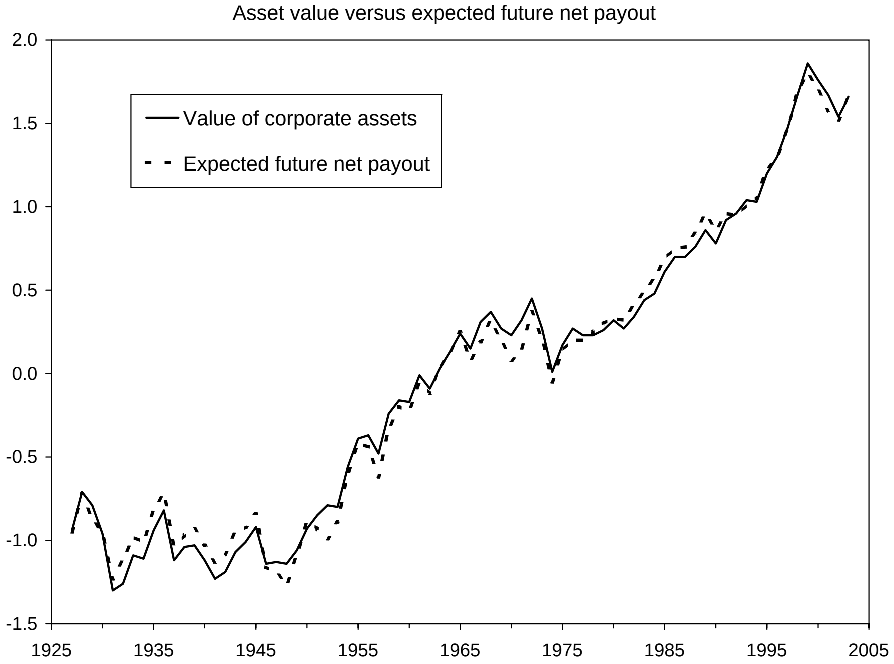


Figure 4: Expected future net payout

The figure shows the real market value of assets for nonfinancial corporations in the *Flow of Funds*. A vector autoregression in real asset return, real net payout growth, and log net payout yield (reported in Table 4) is used to estimate expected future net payout discounted at a constant rate. All series are deflated by the consumer price index and reported in demeaned log units.

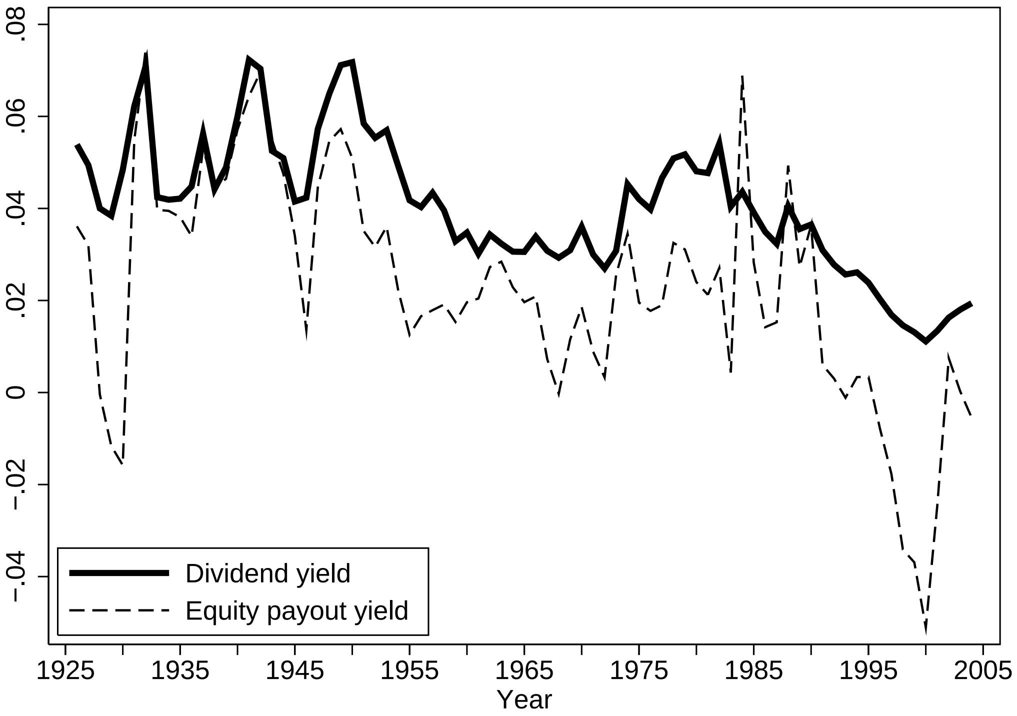
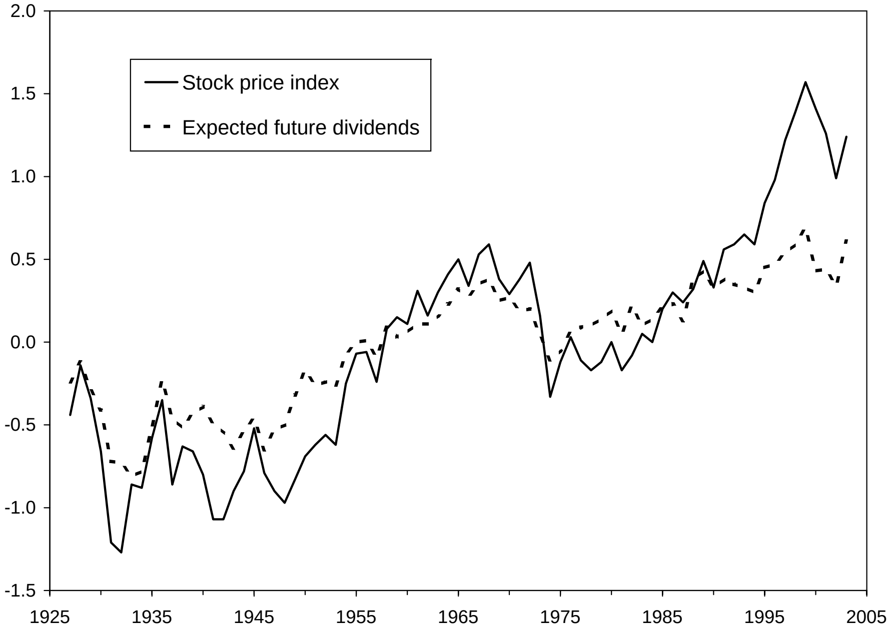


Figure 5: Dividend yield and equity payout yield
Dividend yield is dividends divided by the CRSP value-weighted index for NYSE, Amex, and Nasdaq stocks. Equity payout yield is equity payout (i.e., dividends plus equity repurchase minus equity issuance) divided by the market equity of NYSE, Amex, and Nasdaq stocks.

Panel A: Stock price versus expected future dividends



Panel B: Market equity versus expected future equity payout

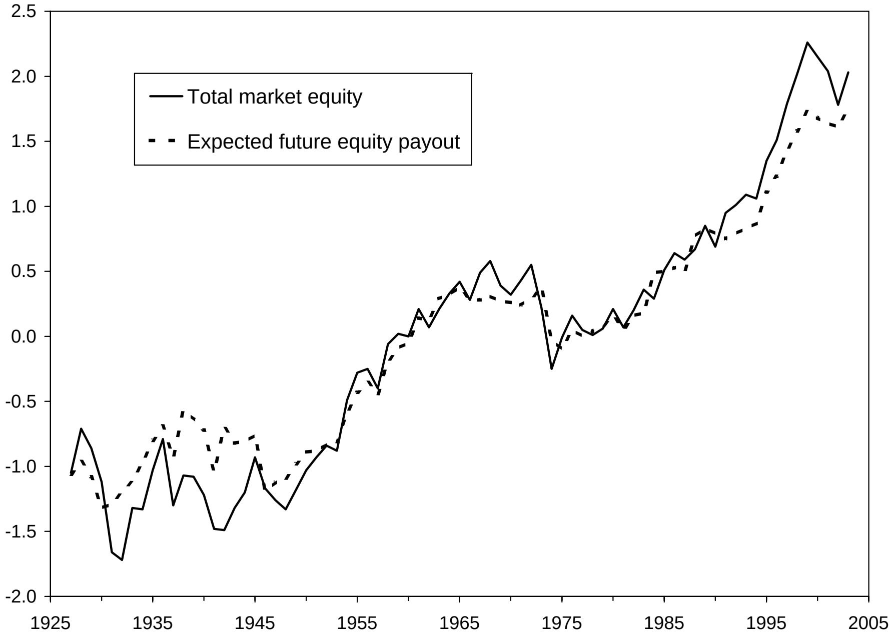


Figure 6: Expected future dividends and expected future equity payout

Panel A shows the real value of the CRSP value-weighted index for NYSE, Amex, and Nasdaq stocks. A vector autoregression (VAR) in real equity return, real dividend growth, and log dividend yield (reported in Table 8) is used to estimate expected future dividends discounted at a constant rate. Panel B shows the real market equity of NYSE, Amex, and Nasdaq stocks. A VAR in real equity return, real equity payout growth, and log equity payout yield is used to estimate expected future equity payout discounted at a constant rate. All series are deflated by the consumer price index and reported in demeaned log units.