How Risky is the U.S. Corporate Sector?

Tetiana Davydiuk, Scott Richard, Ivan Shaliastovich, and Amir Yaron*

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Abstract

Utilizing novel market data on corporate bonds we measure the aggregate market value of U.S. corporate assets and their payouts to investors. Total asset payouts are very volatile, turn negative when corporations raise capital, and in contrast to procyclical cash payouts are acyclical. This challenges the notion of risk and return since the risk premium on corporate assets is comparable to the standard equity premium. To reconcile this evidence, we show that aggregate net issuances, which are acyclical and highly volatile, mask a strong exposure of total payouts' cash components to low-frequency growth risks. We develop an asset-pricing framework to quantitatively assess this economic channel.

*Tetiana Davydiuk (tetianad@andrew.cmu.edu) is at the Carnegie Mellon University. Ivan Shaliastovich (ivan.shaliastovich@wisc.edu) is at the University of Wisconsin-Madison. Scott Richard (scottri@wharton.upenn.edu) is at the University of Pennsylvania. Amir Yaron (yarona@wharton.upenn.edu) is at the University of Pennsylvania and the NBER. We thank Michael Roberts, Robert Stambaugh, and seminar participants at Wharton, Goethe University, Society of Economic Dynamics Meeting, and the Econometric Summer Society Meeting.

1 Introduction

How risky is the capital in the U.S. corporate sector? To answer this question, the finance literature typically considers the returns and the payouts per one equity share of the aggregate stock market.[1] As such, these measures ignore the proceeds from changes in the total number of asset shares (i.e., issuances and repurchases), as well as the contributions from the debt of corporations. In contrast, in our paper we focus on the aggregate investment strategy which is the claim to the entire supply of corporate capital. The aggregate strategy is appropriate for the macroeconomic and macro-finance research which features aggregate transfers of resources to and from the corporate sector at the economy-wide level. The aggregate, rather than per share, payouts and valuations are the relevant measures to assess the nature and magnitude of risks in the corporate sector, and to evaluate the risk and return implications of such models.

To measure aggregate payouts and valuations, we use the market data on prices, shares, and distributions associated with equity, debt, and total asset side of the corporations. While equity measurements are standard, we bring a novel source of corporate debt data from Barclay indices to uncover the market value of U.S. corporate bonds and their corresponding payouts to investors. The aggregate payouts include both cash (dividend and interest payments) and non-cash (share issuances and repurchases) distributions associated with debt and equity of the U.S. corporate sector. The aggregate valuations represent the total market capitalizations of equity and debt of the corporate sector.[2]

We show novel empirical evidence that risk properties of aggregate payouts are quite different from those of typical per share equity dividends. First, accounting for net issuances, total payouts are often negative, meaning that there are periods when the corporate sector receives funds from investors rather than paying them out. Indeed, in our 1975-2014 sample total payouts go below zero about 40% of the time for bonds, and 30% of the time for equity and total assets. Second, net issuances are highly volatile, and are a dominant component of the total payouts. They significantly raise the volatility of the total payouts relative to smooth cash distributions. Third, while cash payouts are strongly pro-cyclical, total payouts

[1] This is a standard approach in the macro-finance literature, from the business cycle risk models of Mehra and Prescott (1985) and Campbell and Cochrane (1999) to the long-run risks of Bansal and Yaron (2004) or rare disaster of Rietz (1988) and Barro (2006).

[2] The aggregate value of a corporation is commonly called the "Enterprise Value". Hence, we are examining the enterprise value of the entire US corporate sector.

are generally acyclical, both at short and long horizons. For example, the correlations of consumption growth with changes in asset cash payouts increase from 20% at a 1 quarter horizon to 40% at a 5-year horizon. On the other hand, the correlations of consumption growth with changes in total asset payouts are nearly zero at all the considered horizons. Intuitively, both aggregate issuances and repurchases tend to increase during expansion periods, leading to acyclical net issuances and thus total payouts. Our market value of debt reveals that much of these adjustments take place along the debt side of the corporation.

The evidence for the acyclicality of total payouts is especially puzzling given that asset returns are predominantly equity-like. The asset return averages 6.4%, comparable to 7.8% for the equity, and the correlation between the two is in excess of 99%. The asset returns are also considerably exposed to movements in economic growth, especially at long horizons. Taken together, the payout and return evidence challenges standard notions of risk and return in the finance literature.

The evidence of acyclical total payouts raises an important question about the economic nature and sources of risk in financial markets, i.e., what risks are being compensated? In addition, negative payouts provide a methodologically challenging aspect for standard models as well as data characterization.[3] We develop a long-run risk type model that helps explain the above features of the asset market data while accounting for the dynamics of total payouts and specifically, for the possibility of negative payouts. In the model payouts are indeed not procyclical, yet their exposure to long run growth risk generates a sizeable premium over the risk free rate. This mechanism, which underlies many long run risk model calibrations, emphasizes that it is not the business cycle risk that drives the unconditional risk premium, but a risk of a longer duration. In this regard the model highlights the tension between matching the acyclical dynamics, higher volatility, and lower persistence of total payouts relative to standard dividend cashflows and the large asset premium.

Related Literature. Our focus on broader notions of cashflows which account for repurchases and issuances is related to several strands of the literature. Fama and French (2001) and Grullon and Michaely (2002) are among the early papers that highlight the changing nature of firms' payouts. Dittmar and Dittmar (2004), Guay and Harford (2000), and Jagannathan, Stephens, and Weisbach (2000) discuss the role of repurchases as the preferred form of distributing the transitory component of earnings, as dividend policy

[3] Indeed, it is no longer feasible to work with log growth rates because total payouts are often zero or negative.

requires financial commitment. **?** incorporate repurchases to their alternative measure of dividends to measure cash flow risk. Boudoukh, Michaely, Richardson, and Roberts (2007) find that total equity payouts, which include repurchases and issuances, provide stronger evidence of return predictability than cash dividends alone. Closest to our work are Larrain and Yogo (2008) and Bansal and Yaron (2007). Larrain and Yogo (2008) analyze, using standard VAR return decomposition, the connection between total payouts and asset price fluctuations. Importantly, their measures of payouts are based on book, rather than market values of debt, as in our work. In addition, our main focus is on understanding the cyclicality and the exposure of the payouts to economic risks. Bansal and Yaron (2007) focus on total payouts in the equity market, and provide strong evidence for equity return and equity payout growth predictability.

Our findings are consistent with the evidence in Julliard and Parker (2005), **?**, Hansen, Heaton, and Li (2008) and the basic premise of the long-run risks model of Bansal and Yaron (2004), which identifies low-frequency movements in economic growth as a key source of risk in financial markets. While these studies focus on equity markets, we show the relevance of these growth risk channels in bond and total asset markets. In terms of related work on corporate bond returns, Chen (2010) and Bhamra, Kuehn, and Strebulaev (2010) show the importance of low-frequency economic growth risks for the choice of the capital structure, dynamics of the leverage, and the riskiness of corporate bonds. Ferson, Nallareddy, and Xie (2013) show the role of growth risks in the cross-section of equity and corporate bond returns.

Our empirical findings are also important for interpreting the expanding literature of production based asset pricing; see Jermann (1998), Lochstoer and Kaltenbrunner (2010), Croce (2014), Kung and Schmid (2014), among many others. In that literature dividend dynamics are often counter-cyclical as large TFP improvements are associated with the desire to invest and not pay dividends. In these models the notion of dividends is an encompassing one and thus more closely related to our measure of total payouts. In that case, the production based models implications for dividends would accord better with the data, and the asset pricing would still be relevant with regard to the level of the observed risk premia.

The remainder of the paper continues as follows: Section 2 provides the data analysis. In Section 3 we consider an economic model, show how to address negative payouts, calibrate the model and provide quantitative results. Section 4 provides concluding remarks.

2 Empirical Analysis

2.1 Payouts and Valuations

In this section we lay out key relationships between valuations and payouts which underlie our empirical analysis. Unlike the majority of the literature which considers a per share investment strategy in equity, our main focus is on the aggregate strategy which is the claim to the entire supply of corporate capital. The payoff on this aggregate strategy includes standard cash distributions in the form of dividends and interest payments, and, importantly, non-cash distributions, such as share issuances and repurchases associated with the equity and debt sides of the corporate balance sheet.[4]

Consider a standard gross return on holding one share of an asset between period t and $t+1$, R_{t+1} :

$$R_{t+1} = \frac{P_{t+1} + CF_{t+1}}{P_t}, \tag{1}$$

where P_t is the price per share, and CF_t is the cash payout per share of an asset. Cash payout refers to cash dividends or coupon/interest payments for equity or bond, respectively.

Multiplying the numerator and denominator by the number of outstanding shares N_t, we can rewrite the gross return equation in the following way:

$$R_{t+1} = \frac{V_{t+1} + N_t \cdot CF_{t+1} - (N_{t+1} - N_t) \cdot P_{t+1}}{V_t}, \tag{2}$$

where $V_t = N_t \times P_t$ is the total market capitalization. The right-hand side of the above equation can be interpreted as the return to the aggregate investment strategy. Its value is given by the total market capitalization V_t, and its payoff corresponds to the total resource distribution $D_{a,t+1}$ in the form of aggregate cash distributions and share issuances and repurchases:

$$D_{a,t+1} \equiv D_{t+1} - NI_{t+1}, \tag{3}$$

[4] Larrain and Yogo (2008), Boudoukh, Michaely, Richardson, and Roberts (2007) and Bansal and Yaron (2007) also consider broader notions of payouts which incorporate share issuances and repurchases.

where $D_{t+1} \equiv N_t \cdot CF_{t+1}$ is the aggregate cash payout, and $NI_{t+1} \equiv ISS_{t+1} - REP_{t+1}$ is the aggregate net issuance. The issuances ISS_{t+1} and repurchases REP_{t+1} capture the transfer of resources in and out of the firm, respectively. The outflow at date $t+1$ is given by,

$$REP_{t+1} \equiv - \{N_{t+1} - N_t\}^{-} P_{t+1} \geq 0. \tag{4}$$

It is positive when there is a repurchase of the existing shares, i.e. when $N_{t+1} - N_t \leq 0$. Similarly, define issuances as:

$$ISS_{t+1} \equiv \{N_{t+1} - N_t\}^{+} P_{t+1} \geq 0. \tag{5}$$

This represents the inflow of resources into the corporation following a new issuance of shares when N_{t+1} is greater than N_t. As can be seen from the above equations, total payout to the aggregate strategy is directly affected by net issuances, above and beyond standard cash distributions. Share repurchases increase total aggregate payout, while share issuances reduce it.

Notably, equations (1) and (2) define very different investment strategies: the former is a per share strategy typical for an individual investor, while the latter is an investment into the aggregate supply of firm's capital. These strategies have very different valuations and payouts, even though by construction they have identical returns (see also Bansal and Yaron (2007) and Larrain and Yogo (2008)). They also differ in applicability: the aggregate strategy is particularly relevant in the context of macroeconomic and macro-finance literature which features transfers of resources between the representative firm and the representative agent at the economy-wide level. The aggregate, rather than per share, payouts and valuations should then be used to assess the nature and magnitude of risks in the corporate sector, and to evaluate the risk and return implications of such models. In subsequent sections we describe our approach to measure aggregate payouts and valuations associated with debt, equity, and asset side of the U.S. corporate sector, and highlight their economic implications relative to the standard measurements.

2.2 Data and Empirical Measurements

We use market data on prices, shares, and distributions to measure market valuations and payouts. The latter includes both cash (dividend and interest payments) and non-cash (share issuances and repurchases) distributions associated with debt, equity, and asset side of the U.S. corporate balance sheet. For accurate and relevant measurements, we emphasize the importance of using the market price data, whenever possible. This is especially pertinent to debt-related variables. The market data for bond valuations and distributions are not as widely available as for equities, so the majority of studies in the literature have resorted to book rather than market valuations, which can affect empirical measurements.[5]

To measure equity-related variables, we use the Center for Research in Security Prices (CRSP) Monthly Stock File. The dataset provides equity price per share (*prc*) and share data (*shrout*) at an individual security level, as well as holding period returns including and excluding dividends, *ret* and *retx*, respectively. We include only common stock listed on NYSE, AMEX, NASDAQ, and NYSE Arca stock exchanges.[6] Similar to Boudoukh, Michaely, Richardson, and Roberts (2007) and Larrain and Yogo (2008), we measure individual stock i net issuance in month t as a change in shares outstanding valued at the month-end share price:[7,8]

$$ni_{it} = prc_{it} \times shrout_{it} - prc_{it-1} \times shrout_{it-1} \times (1 + retx_{it})\,. \tag{6}$$

Different from Boudoukh, Michaely, Richardson, and Roberts (2007) but similar to Larrain and Yogo (2008), we also account for changes in the entity structure due to initial public offerings, mergers, acquisitions, and exchanges, which is necessary to fully capture total transfers of resources in and out of the corporations. Specifically, we use firm's market capitalization on the first trading month, $shrout \times prc$, to measure net issuances during the IPO. We use CRSP delisting data to identify securities with delisting codes of $2xx$ and

[5]It has been common either to use book values to capture debt valuations or approximate market values by imputing the maturity distribution of long-term debt as pioneered by Brainard and Shoven (1980). See also Bernanke and Campbell (1988), Hall, Cummins, Laderman, and Mundy (1988), Richardson and Sloan (2003), and Larrain and Yogo (2008).

[6]We have checked that including preferred stocks and/or excluding government-sponsored enterprises (GSEs) does not have a material effect on our results.

[7]This is equivalent to measuring net issuances as the value of the change in the number of shares over the period, appropriately adjusted by the cumulative adjustment share and price factors *cfacshr* and *cfacpr* that account for splits and other corporate events:

$$ni_{it} = (shrout_{it} \times cfacshr_{it} - shrout_{it-1} \times cfacshr_{it-1}) \times prc_{it}/cfacpr_{it}.$$

[8]Valuing net issuances at the average of beginning-of-month and end-of-month prices, as in Boudoukh, Michaely, Richardson, and Roberts (2007), instead of the month-end prices as in Larrain and Yogo (2008) does not impact our results

$3xx$, and use their delisting price (*dlprc*) and the delisting return (*dlretx*) to account for the repurchases during mergers and acquisitions. We aggregate the firm-level data and compute market valuations, dividends, returns, and net issuances at the total market level.[9]

We face several challenges associated with measuring the payouts and valuations of the debt side of the corporate balance sheet. U.S. corporations issue a wide variety of debt instruments, and most of the trade takes place at the over-the-counter (OTC) dealer's market. As such, there is no convenient centralized platform to obtain market valuations for firm's debt. Further, there is a double-counting concern: corporate loans made by financial institutions (banks), which are financed by the debt and equity of the banks themselves, should be excluded from the analysis.

To tackle these issues, we bring novel bond market value data from Barclays Indices. The Barclays Indices are widely used throughout the financial industry because of their accuracy and wide range of market coverage. Reported market capitalizations and month-to-date index returns are updated on daily basis, and our data is taken on the last trading day of the month when bond prices are hand marked by traders. Reported total returns are decomposed into coupon returns and price returns which facilitates calculation of monthly coupon cash flows and net issuances.[10]

Barclays Indices represent many types of debt instruments, varying from debentures and asset-backed bonds to commercial paper issues, and our goal is to measure all of the outstanding corporate debt. To capture long duration debt, we include the following sub-indices of the Barclays U.S. Universal Index: Corporate Investment Grade (IG), Corporate High Yield (HY), 144A Ex Aggregate, Commercial Mortgage-Backed Securities (CMBS) and Fixed Rate Asset-Backed Securities (ABS). All of the bonds represented in the above sub-indices have fixed-rate coupon, are fully taxable, include both senior and subordinate debt, and must have at least one year-to-final maturity.[11] Additional details for the characteristics

[9]Bansal and Yaron (2007) and Welch and Goyal (2008) measure aggregate net issuances directly in the market index data as $MCAP_t - MCAP_{t-1} \times (1 + VWRETX_t)$, where $MCAP$ is the market capitalization and $VWRETX$ is the value-weighted return excluding distributions. The index and firm-based approaches treat differently firm exits for reasons other than mergers, acquisitions and exchanges; e.g., defaults and bankruptcies would show up as negative net issuances using the index data, but not in our approach using the firm level data. Empirically, however, the two measures are quite similar.

[10]Unlike for equities, we do not have access to individual bond data, so the payout and valuation computations are done at the index level.

[11]The Universal Index excludes bonds that has less than 1 year to maturity as they become money market eligible. ABS and CMBS must have a remaining average life of at least one year, while bonds that convert from fixed to floating rate will exit the sub-indices one year prior to conversion.

of the bonds are given in the Appendix A, Table A.1. We further augment our debt measure with corporate issues of taxable municipal bonds, in particular Industrial Development Revenue Bonds (IDR), Pollution Control Revenue Bonds (PCR), and U.S. Convertibles Composite Index, since those are outside of the Universal Index.

To measure debt of short duration, we include the following Barclays sub-indices: Asset-Backed Securities Floating Rate (ABS FRN), Floating Rate Notes (FRN), Floating Rate Notes High Yield (FRN HY) and Short-Term Corporate Index (STI). The floating-rate securities in the above sub-indices may have longer maturity, but their interest rate durations are typically less than 1 year. More details are given in the Appendix A (Table A.1). We further augment our measure with short-term debt instruments, such as commercial paper and certificates of deposits, using Compustat/CRSP Merged Database. Specifically, "Debt in Current Liabilities" (item 34, dlc) serves as a good proxy for the market value of outstanding short-term debt. Short duration notes payable tend to be quite insensitive to changes in interest rates, hence, book values provide reasonable assessments of their valuations. As in Richardson and Sloan (2003), we employ income statements and measure net issuance directly as "Current Debt Changes" (item 301, dlcch).[12] To construct coupon cash flows, we use one month repo rate, which is obtained from Bloomberg.

We face two issues of double counting: banks and insurance companies. Banks make direct non-marketable loans to corporations. Buying all of the banking sectors equity and debt includes the rights to the cash flow from the direct loans. To avoid double counting we exclude the value of bank borrowing from the market liabilities of the non-financial corporate sector. The issue of insurance companies is more difficult because they invest heavily in marketable corporate debt. We have not been able to find time-series data on the market value of insurance company corporate debt holdings. Instead, we assume that corporate bond holdings of insurance companies can be partially offset by their bond issuance. As such, we exclude bonds issued by insurance companies within the major Barclays indices, in particular, IG, HY, Convertibles and FRN. The remaining Barclays indices are not disaggregated by the corporate sector and, hence, bonds issued by insurance companies can not be excluded. However, as of December 2014 IG, HY, Convertibles and FRN indices constituted around

[12] An alternative approach is to employ the balance sheet data and measure net issuance as the change in "Debt in Current Liabilities" (item 34, dlc). As discussed in Richardson and Sloan (2003), this method suffers a number of limitations. Specifically, debt can be added to the balance sheet through mergers and acquisitions rather than through the issuance of new debt. Also, open market repurchases of bonds can involve cash payments that differ from the carrying value of the debt.

70% of the market value of all Barclays indices included in our measure of debt market and as such the measurement error should be minimal.[13]

In addition to the asset prices, we also use aggregate macroeconomic data. We collect the data on GDP and consumption, defined as the sum of expenditures on non-durable goods and services, from the BEA tables. The data on CPI inflation come from the Bureau of Labor Statistics. The price level is normalized to 1 in December of 2009. All the nominal quantities are deflated by the CPI to obtain real measures.

Our benchmark sample covers the period from 1975 until 2014, due to the availability of the bond data from Barclays. For some of our supplemental analysis we also use equity only data that go back to the 1930s.

2.3 Empirical Evidence

2.3.1 Market Prices and Returns

We start our empirical analysis by describing the key properties of market capitalizations and returns to equity, debt, and assets of the U.S. corporate sector.

Figure 1 shows the evolution of the components of corporate debt. As can be seen on the top panel, investment grade bonds made up the entirety of our measure of long-term debt in the beginning of the sample. The role of other debt instruments, especially high-yield bonds and 144A issues, has significantly increased over time and helped fuel growth in the corporate debt market. By the end of the sample, the real market value of the long-term corporate debt has reached 7.09 trillion (in December 2009 dollars), and more than half of it is comprised of non-IG bonds.

The bottom panel of Figure 1 shows that short-term non-bank corporate debt is nearly entirely made up of short-term loans (STL), with Floating rate notes (FRN) and asset-backed securities (ABS) entering in early 2000s into the dataset. Unlike the long-term corporate debt whose value has been generally growing over time, the market value of short-term debt increased from 0.29 trillion in 1975 to its maximum of 8.72 trillion in 2007, then precipitously

[13] Other liabilities of insurance companies, such as policy liabilities, do not represent ownership claims, and thus do not need to be included in our asset and payouts measures. We also tried excluding the insurance companies all together by removing their equity, which did not have any impact on our key results.

fell during the Financial Crisis. It remains at its mid-1990s value of about 3.87 trillion at the end of 2014.[14]

Figure 2 shows the dynamics of the market capitalization of aggregate debt, equity, and assets, where the latter corresponds to the sum of the first two. Aggregate equity is on average twice as large as debt, which leads to a typical estimate of debt-to-equity ratio of 1/2. Asset and equity values tend to be more volatile and more procyclical than debt, and also experience a larger growth over time. Our estimates suggest that the real market value of U.S. corporate assets grew from 3.79 trillion in mid-1975 to nearly 37.60 trillion at the end of 2014, which is comprised of 2.89 to 26.63 trillion increase for equity and 0.79 to 10.97 for bonds.

To assess the riskiness of aggregate equity, debt, and assets, we provide basic summary statistics for the returns on these claims. Table 1 shows that in our sample, the average real equity return is 7.8%, with a standard deviation of 16.3%. The debt return is smaller on average, and is much less volatile: its mean is 2.9%, and its standard deviation is 5.4%. The asset return is the weighted average of the two, with the weight tilted more to equities which represent a larger fraction of the asset value. As shown in Table 1, the average asset return is 6.4%, and its volatility is 12%. Further, the asset and equity returns are nearly perfectly correlated. Hence, the aggregate assets of the U.S. corporate sector are quite risky, and the magnitude and nature of risk is comparable to that of equities.

2.3.2 Payouts

We next consider the empirical evidence for the payouts to debt, equity, and assets of U.S. corporations. Following the discussion in Section 2.1, for each of these components the aggregate payouts can be broken down into cash (total dividends or interest payments) and non-cash (net share issuance) distributions.

Figure 3 shows the time series of the total payouts and their cash and net issuance components. Naturally, cash payouts are positive. On the other hand, net issuances are not restricted to be of any sign. At times when firms opt for a net distribution of resources

[14]This is consistent with the evidence in Kacperczyk and Schnabl (2010) who document a significant decline in the commercial paper during the Financial Crisis. They suggest substitution to other sources of financing, adverse selection and the inability of issuers to issue the commercial paper, and institutional constraints as potential reasons for the collapse.

through repurchases, net issuances are negative, and they become positive when firms attract capital through new share issuances. In our sample, net issuances of equity, debt, and corporate assets are mostly positive: the firms generally draw resources from the investors. Figure 3 also shows that net issuances are much more volatile than cash distributions, and thus are a dominant component of total payouts. Compared to cash distributions, total corporate payouts are very volatile, and can actually be negative: in our sample, they go below zero about 40% of the time for bonds, and 30% of the time for equity and total assets.

To analyze formally statistical properties of the aggregate payouts, we need to convert them into stationary variables: in levels, payouts are a random walk. However, the standard method of using logarithms to define growth rates does not work in our setting because payouts can be less than or equal to zero. Instead, we rely on alternative measures of growth in which we normalize the level change by the consumption level C_t , e.g. $\frac{\Delta D_{a,t}}{C_t} = \frac{D_{a,t} - D_{a,t-1}}{C_t}$, or by the aggregate output Y_t, e.g. $\frac{\Delta D_{a,t}}{Y_t} = \frac{D_{a,t} - D_{a,t-1}}{Y_t}$. [15] At the same time, we continue to use the standard log growth rate to measure consumption and output growth, $\Delta c_t \equiv log\left(\frac{C_t}{C_{t-1}}\right)$ and $\Delta y_t \equiv log\left(\frac{Y_t}{Y_{t-1}}\right)$, respectively. One of the advantages of our growth measure is that it is additive. For example, because the level of asset payouts is the sum of equity and debt, our measure of growth rate in asset payouts is also equal to a simple sum of growth rates in equity and debt payouts.

Figure 4 shows the time-series of growth in cash payouts $\frac{\Delta D}{C}$, net issuance $\frac{\Delta NI}{C}$, and the total payouts $\frac{D_a}{C}$ for equity, debt and total assets. Table 2 documents the key summary statistics for these variables. The presented evidence highlights the significance of our novel payout components related to firms' debt and net issuances, which are missed by the typical measures of per-share cash payouts on equity.

First, one can see that debt payouts contribute a significant fraction to the fluctuations in asset payouts. For the cash component, the growth in debt payouts is twice as volatile as the growth in equity cash payouts, so that the asset cash payout growth mostly reflect variations in debt payments: the correlation between the growth rates in debt and total asset cash payouts is 93%. The volatilities of growth rates in equity and debt net issuances

[15] We have also examined alternative normalizations by a previous period consumption level, $\frac{\Delta D_{a,t}}{C_{t-1}}$, by the average consumption level in the current and previous period, $\frac{\Delta D_{a,t}}{\frac{1}{2}(C_{t-1}+C_t)}$, by the constant non-linear trend of consumption, $\Delta \tilde{D}_{a,t} \equiv \frac{\Delta D_{a,t}}{exp\{gt\}}$ with $g = \frac{1}{T}\sum_{t=1}^{T} \Delta c_t$, and by excluding the scaling all together. The results are very similar to our benchmark. Further, in Section 2.4 we show that using normalized changes versus log growth rates does not make any difference for our key correlation results for positive cash distributions.

are more comparable (3.0 and 3.8, respectively), so the fluctuations in asset net issuances are more evenly split between equity and debt. The growth rates in total payout on assets have a 60% correlation with growth in total payouts on debt, and 35% with total payouts on equity.

Second, it is evident from Figure 4 and Table 2 that growth rates in net issuances are much more volatile than growth rates in the corresponding cash payouts. For example, the volatility of net equity issuance growth is 10 times larger than the volatility of the equity cash dividends, and for debt, the volatility of changes in net issuances is 6 times larger than that of bond cash payouts. This implies that total payouts, which are equal to the difference between cash and net issuances, are very volatile, and are driven predominantly by shocks to net issuances. Indeed, the volatilities of the changes in total payouts are very similar to those of net issuances, and are several times larger than the volatilities of the corresponding cash flows.

Overall, the evidence suggests that our total asset payouts have very different properties relative to typical measures of corporate distributions, such as equity dividends. It is also quite distinct from other, earnings-based measures popular in the literature. Earnings capture profits generated by the firm during the period, and aggregate earnings are often used to measure total performance of the corporate sector. Aggregate earnings, however, are conceptually distinct from the asset payouts. They are an accounting, rather than an economic measure based on actual distributions. They contain retained earnings, which represent the capital not paid out to the investors. Most importantly, earnings do not incorporate asset repurchases and issuances, which we showed are the dominant part of the asset payouts. Because of that, aggregate earnings are more aligned with asset cash distributions, rather than asset total payouts. Indeed, in our sample, growth rate in aggregate earnings (EBIT) has a 70% correlation with changes in asset cash payouts, while its correlation with changes in total asset payouts is actually negative, -20%.

2.3.3 Economic Growth Risk Exposure

Our earlier analysis shows that total asset payouts are very volatile relative to equity payouts, and asset returns are about as risky as equity returns. We next assess the economic nature of risk in asset returns and payouts through their exposure to high and low frequency variations in macroeconomic growth. The exposure to fluctuations in economic growth is one of the main tenets of the macro-finance research, from the business cycle risk models of Mehra and Prescott (1985) and Campbell and Cochrane (1999) to the long-run risks approach of Bansal and Yaron (2004). It is a natural starting point for the analysis of the economic nature of risk in the financial markets.

First, we consider the business-cycle behavior of the payouts. Table 3 shows contemporaneous correlations of the growth rates in payouts with consumption or output growth. We show the results for the benchmark annual sample from 1975 to 2014, for the 1975 to 2006 sample which excludes the Financial Crisis, and at a quarterly frequency. Notably, cash, net issuances, and asset payouts have very different business cycle properties. Cash payouts tend to be procyclical: in the benchmark sample, the correlations of consumption growth with changes in cash payouts range from 0.21 for debt to 0.34 for assets; these correlations increase to 0.34 and 0.44, respectively, using output growth to measure cyclicality. The correlations remain positive excluding the Financial Crisis and at a quarterly frequency, and are typically above 10%. These results are consistent with the evidence in the literature that per share equity dividend growth rates are positively correlated with aggregate growth, and extend it to cash payments on debt and total assets.

Table 3 further shows that changes in net issuances are acyclical and even counter-cyclical. The correlation estimates for net issuances are virtually always smaller, in absolute value, than those for the cash payouts, and are negative in almost half of the cases. For example, in our benchmark sample the correlation of consumption growth with equity net issuances is -0.17, and it is 0.14 and 0.00 for debt and total assets, respectively. The fact that net issuances drive a large part of the variations in total payouts implies that the aggregate payouts are much less procyclical than the cash payouts. In fact, our estimates suggest that the total payouts on the assets of the corporate sector are essentially acyclical. In the benchmark sample, the correlation of consumption growth with total asset payouts is 0.07, and it drops to zero excluding the Crisis and in quarterly data. The reduction in the cyclicality of total payouts is due to both accounting for debt and net issuance data. Indeed, in the benchmark sample the equity payout correlations with consumption growth drop from 0.34 to 0.20 when we account for the net issuances of equity, and it drops further to 0.07 when we also incorporate debt.

The correlation results suggest that total asset payouts are essentially unrelated to the short-run (i.e., quarterly or annual) fluctuations in economic growth. To expand the evidence beyond the short run, we consider the term structure of the payout cyclicality, and compute the multi-horizon correlations of consumption growth with changes in the payouts, e.g.

$$\rho_h \equiv Corr\left(\frac{\Delta D_{a,t}}{C_t}+\frac{\Delta D_{a,t+1}}{C_{t+1}}+...+\frac{\Delta D_{a,t+h}}{C_{t+h}}, \Delta c_t+\Delta c_{t+1}+...\Delta c_{t+h}\right),$$

for h equal to $0,1,...,20$ quarters. We focus on quarterly growth rates to address the short sample concerns, and compute the GMM standard errors. We plot these correlations as a function of the horizon h for cash payouts, net issuances, and total payouts on equity, debt and assets in Figures 5 and 6.

Our results for $h = 0$ confirm our short-run evidence in Table 3. The cash payouts are procylical. The correlations are statistically significant for all cases except for the correlation of debt payout with consumption, which is marginally significant (the debt correlation is significant for the output growth measure). The correlations of aggregate growth with changes in the net issuances or total payouts are economically and statistically indistinguishable from zero. Interestingly, our cyclicality evidence remains similar in the medium and long run. The correlations for cash payouts remain stable, positive, and statistically significant up to the considered 5 year horizon. Growth in net issuances is acylical, and the correlations for the total payouts are smaller, in absolute value, than those for the cash components. While the equity and asset payout growth correlations with economic growth tend to be positive at all the frequencies, they are indistinguishable from zero. Thus, the evidence suggests that cash payouts are exposed to economic risks at short and long frequencies, but changes in net issuances do not seem to respond to high or low frequency movements in the fundamentals. Because they are so volatile, net issuances drive most of the fluctuations in aggregate payouts, and significantly reduce the cyclicality of the total payouts on equity, debt, and assets.

We use a similar approach to assess the exposure of asset valuations to low and high frequency movements in aggregate economic growth. We consider the term structure of return cyclicality, and compute multi-step correlations of equity, debt, and asset returns with consumption or output growth, e.g.

$$\rho_h \equiv Corr\left(r_t+r_{t+1}+...+r_{t+h}, \Delta c_t+\Delta c_{t+1}+...\Delta c_{t+h}\right),$$

for h equal to $0,1,...,20$ quarters. We plot these correlations as a function of the horizon

h for equity, debt, and assets returns in Figure 7. Nearly all of the correlations are positive, which suggests that the returns are risky with respect to growth fluctuations. The estimates tend to be smaller and insignificant in the short run. The correlations increase in the medium and long run, and most of them become significant, especially when we use output growth to measure cyclicality. For example, the asset return correlations with consumption growth are below 20% at a quarterly horizon, and increase to 30% at annual or lower frequencies. The asset return correlations with output growth are statistically and economically indistinguishable from 0 on a quarterly frequency, and reach 45% at a 3-year horizon. These findings indicate that equity, bond, and total asset valuations are strongly exposed to economic growth concerns, especially at lower frequencies.

2.4 Robustness and Extensions

In this section we expand and verify our main empirical results. We document the importance of using market relative to book values to measure debt, extend and economically interpret the findings for acyclicality of net issuances, present further evidence for the long-term behavior of payouts using spectral analysis, consider a global perspective, and provide additional robustness checks with respect to measurements and samples.

Book versus market values. One of the key novel features of our analysis is the reliance on the market rather than book values to measure prices and payouts. The availability of reliable bond market data from Barclays Indices imposes limitations in terms of the sample size and the coverage; however, we find that using it has important implications for the measured payouts. Indeed, we follow Larrain and Yogo (2008) and construct book values of debt from the Flow of Funds. We plot the time series of cash, net issuance, and total payouts from debt on Figure 8. The corresponding market and book payout growth rates are positively correlated and share common patterns, however there are several key differences. The book value quantities are much smoother, and are two to three times less volatile than the market value ones. For example, the unconditional volatility of the total payouts on debt goes up from 1.14 to 3.55 once we switch from book to market measurements. They also have different cyclical properties. Figure 9 contrasts the term structures of payout cyclicality when we use book versus market values of debt. We continue to use market values to measure equity payouts to focus on an incremental impact of debt measurements. The Figure shows that the book value cash payouts from debt and therefore, total assets, are much less procyclical than the market-based ones, and are essentially acyclical in the short and the long run. Hence, using book values to measure debt would suggest that that asset payouts are not exposed to economic growth risk, while market-based estimates strongly point to a large sensitivity of (the cash components of) the payouts to low-frequency growth fluctuations.[16]

Acyclicality of Net Issuances. Our evidence suggests that acyclicality of net issuances is responsible for the a-cylicality of total payouts, in spite of a strong procyclicality of cash payments. To help interpret the acyclicalilty of net issuances themselves, it is helpful to consider the issuances and repurchases components separately. This, however, requires individual firm data, which we can only obtain for equities from the CRSP Monthly Stock File. With this caveat in mind, we focus on the term structure of cyclicality for the equity payouts, and split the equity net issuances into issuances and repurchases.[17] Figure 10 shows the results for the benchmark sample from 1975 to 2014, while in Figure 11 we consider a longer sample which starts in 1949. The results from both samples are consistent with our main findings: cash payout growth rates are procyclical, especially in the long run; changes in net issuances are acyclical, and total payout growth appears acyclical as well.

Interestingly, while changes in net issuances are acyclical, both of its components are quite procyclical in the data: the correlations of changes in issuances and repurchases with consumption growth are positive, and in many cases statistically significant. A potential explanation for these findings is that our measures aggregate across firms which may have different needs for capital. In good times, some firms in the cross-section face good investment opportunities and thus acquire more capital through issuances. Other firms may opt for the distribution of profits to the investors, which can be done either through cash dividends or through the repurchases. The repurchases may be the preferred form of distributing the transitory component of earnings, as dividend policy requires financial commitment (e.g., Lintner (1956)), consistent with the evidence in Dittmar and Dittmar (2004), Guay and Harford (2000), and Jagannathan, Stephens, and Weisbach (2000). In both cases, issuances

[16]The Flow of Funds data include both the public and private sector. This raises a concern whether the difference in results reflects an inclusion of private firms, or the market versus book measurements. We instead use Compustat database to measure book value of debt, and obtain very similar results that the book-value-based correlations of debt cash payouts are much lower, by about 0.2 correlation units, than the market-based quantities.

[17]Following the literature, we attribute firm's net issuances to issuances (repurchases) if the number of shares outstanding increases (decreases) over the month, and aggregate the firm-level measures to aggregate index issuances and repurchases.

and repurchases increase. This makes them procyclical separately, while on net basis the two effects offset each other, which leads to acyclical net issuances at the aggregate level.

Wavelet Analysis. The high volatility of acyclical net issuances makes it challenging to identify the risks associated with total payouts. To help uncover the long-run properties of the series, we perform a decomposition of the correlation between the payout changes and the economic growth using a discrete wavelet transform. Specifically, we estimate a sample wavelet correlation between the two on a scale by scale basis, where each scale is associated with specific frequency interval (e.g. the wavelet correlation for the wavelet scale 16 corresponds to periods of 32-64 quarters). In this part of the analysis we use quarterly growth rates adjusted by x12 ARIMA model which helps reduce the seasonality patterns in the data. All other computational details are provided in Appendix C.

In Table 4 we show the estimates of wavelet correlations at different frequencies and the associated 5% confidence interval. For cash payouts on equity, debt, and assets, a significant portion of their correlation with consumption is due to low frequency variation: for example, for assets, the wavelet correlation equals to 55% associated with period of 32-64 quarter, and 21% at 2-4 quarter frequency. The wavelet correlation for net issuances is statistically close to zero at both short and long frequencies. Finally, consistent with the benchmark evidence, the correlations for the total payouts are much lower than for the cash components, and are measured with a substantial noise. For asset payouts, the estimated correlations are positive at lower frequencies beyond 16 quarters.

Global Perspective. Our main results are conducted from the U.S. perspective and analyze the exposures to the economic risks in the U.S. consumption and output data. To the extent that investors are diversified in international markets, they may instead care about the exposures to global macroeconomic shocks. To confirm the robustness of our results, we construct several alternative measures of aggregate economic risks using the international macroeconomic data. We collect quarterly GDP data from major industrialized countries, and measure global output as a value-weighted GDP across countries. Alternatively, to reduce the impact of the U.S., we remove the U.S. from the GDP sample or use equal weights. Figure B.1 in the Appendix shows the term structures of asset payout when we use global GDP to measure aggregate output. The results are very similar to the benchmark findings: growth rates in cash payouts are strongly procyclical, while growth rates in net issuances and total payouts are acyclical. For brevity, the Figure only reports the results for the total assets; our findings for equity and debt are very similar to the benchmark as well.

Alternative Samples and Measurements. We perform several other robustness checks to assess the validity of our results. Specifically, we consider: i) equity payouts in longer samples going back to 1949 or 1930; ii) using different sampling frequencies, such as annual growth rates at quarterly frequency, and seasonally adjusted quarterly growth rates either by band-pass, x12 ARIMA model, or by looking at year-to-year changes. The results reported in Table B.1-B.3 are consistent with our benchmark findings.

Finally, for our empirical analysis we use normalized changes in payouts to measure their growth rates, e.g. $\frac{\Delta D_{a,t}}{C_t} = \frac{D_{a,t}-D_{a,t-1}}{C_t}$. This is necessitated by the fact that payouts are often negative, and thus typical log growth computations can not be performed. To assess whether the use of non-traditional growth measures can have an impact on our findings, we consider cash dividends, which are always positive, and contrast the term structures of the correlations based on our growth measure,

$$\rho_h \equiv Corr\left(\frac{\Delta D_t}{C_t} + \frac{\Delta D_{t+1}}{C_{t+1}} + ... + \frac{\Delta D_{t+h}}{C_{t+h}}, \Delta c_t + \Delta c_{t+1} + ...\Delta c_{t+h}\right),$$

with the one based a more standard log growth measure,

$$\rho_h \equiv Corr\left(\Delta d_t + \Delta d_{t+1} + ...\Delta d_{t+h}, \Delta c_t + \Delta c_{t+1} + ...\Delta c_{t+h}\right).$$

Figure B.2 shows that the two term structures are virtually identical. Thus, using normalized changes to measure growth rates does not seem to cause statistical issues for our results.

3 Model

Our novel empirical evidence suggests that total asset payout growth is acyclical at short and low frequencies. However, corporate assets demand a risk premium and are significantly exposed to economic growth risk, especially in the long run. To explain this puzzling empirical evidence, we argue that total assets payouts are dominated by acyclical net issuances which mask economic growth risk of the cash payouts. We develop a long-run risks valuation framework to quantitatively assess the plausibility of our economic explanation. Independently, we make a methodological contribution to the literature by providing an alternative log-linearization framework of Campbell and Shiller (1988) to the cases with negative payouts.

3.1 Economic Setup

Preferences. We consider a discrete-time endowment economy, in a spirit of Bansal and Yaron (2004) and a subsequent long-run risks literature. The preferences of the representative agent over the future consumption stream are characterized by the Kreps and Porteus (1978) recursive utility of Epstein and Zin (1989) and Weil (1989):

$$U_t = \left[(1-\beta)C_t^{\frac{1-\gamma}{\theta}} + \beta(E_t U_{t+1}^{1-\gamma})^{\frac{1}{\theta}}\right]^{\frac{\theta}{1-\gamma}}, \tag{7}$$

where C_t is consumption, β is the subjective discount factor, γ is the risk-aversion coefficient, and ψ is the elasticity of intertemporal substitution (IES). For ease of notation, the parameter θ is defined as $\theta \equiv \frac{1-\gamma}{1-\frac{1}{\psi}}$. Note that when $\theta = 1$, that is, $\gamma = 1/\psi$, the recursive preferences collapse to the standard case of expected power utility, in which case the agent is indifferent to the timing of the resolution of uncertainty of the consumption path. When risk aversion exceeds the reciprocal of IES ($\gamma > 1/\psi$), the agent prefers early resolution of uncertainty of consumption path, otherwise, the agent has a preference for late resolution of uncertainty.

Epstein and Zin (1989) show that the asset pricing restriction for any asset return $r_{j,t+1}$ satisfies a standard Euler condition

$$E_t\left[exp\left\{m_{t+1} + r_{j,t+1}\right\}\right] = 1, \tag{8}$$

where m_{t+1} is the log of the intertemporal marginal rate of substitution (IMRS), defined as

$$m_{t+1} = \theta log\delta - \frac{\theta}{\psi}\triangle c_{t+1} + (\theta - 1)\, r_{c,t+1}. \tag{9}$$

$\Delta c_{t+1} = \log(C_{t+1}/C_t)$ is the log growth rate of aggregate consumption, and $r_{c,t}$ is a log return on the asset which delivers aggregate consumption as dividends (the wealth portfolio).

Consumption dynamics. As in Bansal and Yaron (2004), the consumption growth rate contains a small predictable component x_t which determines the conditional expectation of consumption growth, and the volatility of fundamental shocks is time-varying and is captured by the state variable σ_t^2 :

$$\triangle c_{t+1} = \mu_c + x_t + \sigma_t \eta_{t+1}, \tag{10}$$

$$x_{t+1} = \rho_x x_t + \varphi_x \sigma_t e_{t+1}, \tag{11}$$

$$\sigma_{t+1}^2 = \sigma_0^2 + \nu\left(\sigma_t^2 - \sigma_0^2\right) + \sigma_\omega \omega_{t+1}. \tag{12}$$

The parameters ρ_x and ν capture the persistence of the expected growth and volatility news, and σ_0, φ_x, and σ_w govern the unconditional scales of shocks to realized and expected consumption and consumption volatility, respectively.

Corporate sector payouts. To model the corporate sector, we focus on the total asset side of the balance sheet and provide a parsimonious exogenous specification for the cash and net issuances components of the aggregate asset payouts. For simplicity, we do not consider the issues of optimal capital structure and issuance and repurchase decisions, and leave these model extensions for future research.

Following Hansen, Heaton, and Li (2008), Bansal and Yaron (2007) and **?**, cash payouts are co-integrated in logs with the consumption level:

$$\log\left(\frac{D_t}{C_t}\right) \equiv s_t. \tag{13}$$

The co-integrating residual s_t is stationary, persistent, and is exposed to the low-frequency growth risk:

$$s_{t+1} = \mu_s + \rho_s\left(s_t - \mu_s\right) + \phi_s x_t + \varphi_s \sigma_t u_{t+1}. \tag{14}$$

Parameters μ_s, ρ_s, and φ_s determine the unconditional level, persistence, and the volatility of the cash payout dynamics, and ϕ_x govern the sensitivity to the expected growth risks.

To accommodate net issuances, we first define the adjusted net issuance H_t as

$$H_t \equiv C_t + NI_t = C_t + ISS_t - REP_t. \tag{15}$$

Economically, we expect the adjusted net issuances to be always positive: the repurchase component of net issuances is a capital distribution from firms to investors, supplemental to cash dividends and coupons, all of which are used to finance consumption expenditures.

Hence, even ignoring issuances, we expect $C_t > REP_t$, and therefore $H_t > 0$.[18] Then, we assume that the log of the adjusted net issuances to consumption is driven by i.i.d. shocks:

$$\log \frac{H_t}{C_t} = \mu_h + \varphi_h \sigma_t \varepsilon_t, \tag{16}$$

where μ_h and φ_h capture the unconditional level and volatility of the net issuances. Unlike cash flows, net issuances are not directly exposed to low-frequency fluctuations in economic growth. Further, different from the cash flow dynamics, the process for net issuances is specified in levels and not in logs, because they can be negative.[19]

The four shocks $\eta_{t+1}, e_{t+1}, \omega_{t+1}$ and ε_{t+1} are $i.i.d$ standard Normal. We allow for the correlation between the transitory shocks to consumption growth and cash payout growth:

$$Cov\left(\eta_{t+1}, u_{t+1}\right) = \alpha. \tag{17}$$

3.2 Model Solution

For tractability, we consider an approximate solution to the model based on the log-linearization of the consumption and asset return.

Valuation of consumption claim and the IMRS. The log-linearization of the consumption return is standard and follows from Campbell and Shiller (1988). Specifically,

$$r_{c,t+1} = \log\left(\frac{V_{c,t+1} + C_{t+1}}{V_{c,t}}\right) \approx \kappa_{0,c} + \kappa_{1,c} vc_{c,t+1} + \Delta c_{t+1} - vc_{c,t}, \tag{18}$$

where $vc_{c,t} = log\left(\frac{V_{c,t}}{C_t}\right)$ is the valuation of the consumption claim, and $\kappa_{0,c}$ and $\kappa_{1,c}$ are the linearization coefficients which are determined in equilibrium by the unconditional level of the consumption asset valuation. Under the log-linearized consumption return, the value of the consumption claim, the consumption return, and hence, the stochastic discount factor are linear in the underlying states of the economy, and can be solved in a closed form. As

[18] This is also strongly supported by the data. In our sample, equity repurchases are on average below 10% and never exceed 40% of the level of consumption. Adding issuances, the issuances net of repurchases never fall below 15% of the total consumption at equity, debt, or asset levels.

[19] Our approach is different from Boudoukh, Michaely, Richardson, and Roberts (2007) who add a constant to net yield to make it positive. Adjusting net issuances by the level of consumption allows us to impose co-integration between the key aggregate quantities while guaranteeing positivity of adjusted net issuances.

shown in Appendix D and elsewhere in the literature, the value of the consumption claim is given by:

$$vc_{c,t} = A_{0,c} + A_{1,c}x_t + A_{2,c}\sigma_t^2, \tag{19}$$

and the equilibrium log stochastic discount factor satisfies,

$$m_{t+1} = m_0 + m_x x_t + m_\sigma \sigma_t^2 - \lambda_\eta \sigma_t \eta_{t+1} - \lambda_e \varphi_e \sigma_t e_{t+1} - \lambda_w \sigma_w \omega_{t+1}, \tag{20}$$

The exposures of the consumption asset and the market prices of risks are pinned down by the model and preference parameters, and are provided in Appendix D. The economic content of the long-run risks model is that when agents have a preference for timing of uncertainty resolution, the short-run, long-run, and volatility risks (η, e, and ω, respectively) are priced, and determine the risk compensation in asset markets. Specifically, for $\gamma > 1$ and $\psi > 1$, the consumption claim requires a positive risk premium because the consumption asset return is low in bad times of low realized or expected consumption growth ($\lambda_\eta, \lambda_e > 0$ and $A_{1,c} > 0$), or high consumption volatility ($\lambda_w < 0$ and $A_{2,c} < 0$). Quantitatively, the risk premium is dominated by the compensations for the expected consumption and volatility risks, which are magnified due to a large persistence of these shocks.

Valuation of corporate assets. The payouts from the corporate sector are determined by the cash and net issuance components in (13) and (16), respectively. Notably, unlike for typical consumption and dividend claims, these payouts can be negative when firms need capital and issue a large amount of equity or debt. Hence, we can not use a standard Campbell and Shiller (1988) approximation, and derive an alternative approach to log-linearize the return. We rewrite the return on the corporate assets in (2) as follows:

$$\begin{aligned} 1 + R_{d,t+1} &= \frac{V_{d,t+1} + D_{t+1} - NI_t}{V_{d,t}} \\ &= \frac{V_{d,t+1} + D_{t+1} + C_{t+1} - H_{t+1}}{V_{d,t}} \\ &= \frac{C_{t+1}}{C_t} \cdot \frac{1 + \frac{V_{d,t+1}}{C_{t+1}} + \frac{D_{t+1}}{C_{t+1}} - \frac{H_{t+1}}{C_{t+1}}}{\frac{V_{d,t}}{C_t}}, \end{aligned}$$

where $V_{d,t}$ is the value of the asset. Notably, all the ratios in the last equation are positive: consumption, prices, cash payouts, and adjusted net issuances are all above zero. We can then log-linearize the expression above around the unconditional log values of $\overline{vc}_d$, $\overline{dc}$ and $\overline{hc}$

to derive the log-linear approximation for the asset return:

$$r_{d,t+1} \approx \kappa_{0,d} + \kappa_{1,d} vc_{d,t+1} + \Delta c_{t+1} + \kappa_{2,d} dc_{t+1} + \kappa_{3,d} hc_{t+1} - vc_{d,t}, \tag{21}$$

where $vc_{d,t} = log\left(\frac{V_{d,t}}{C_t}\right)$ is the log asset value to consumption ratio, $dc_t = log\left(\frac{D_t}{C_t}\right)$ is the log ratio of the asset cash payouts to consumption, and $hc_t = log\left(\frac{H_t}{C_t}\right)$ is the ratio of the net issuance to consumption. The expressions for the log-linearization coefficients κ are provided in the Appendix D.

Our log-linear approximation in (21) nests a standard one for the consumption asset in (18). Indeed, when there are no net issuances and cash payouts are equal to consumption, then $hc_t = dc_t = 0$. When net issuances are part of the payouts, the total payout can now be negative and can no longer be used to scale valuations and define growth rates. This is why we have to switch to consumption to scale all the quantities, and rewrite the payouts in terms of positive cash and the adjusted net issuance components. Finally, our approach is also different from the linearizations in Larrain and Yogo (2008) and Bansal and Yaron (2007). These papers effectively log-linearize the returns around the positive issuance and repurchase components of the net issuances. The disadvantage of this method is that it requires modeling issuances and repurchases separately. Recall that due to the data limitations, we can not separate the issuances and repurchases at the asset level, and thus prefer modeling the issuances net of repurchases directly.

Using our log-linearization solution to asset returns in (21), we can now use the corporate payout dynamics in (13)-(16) and the equilibrium stochastic discount factor in (20) to solve for the equilibrium asset valuations. The corporate valuations are linear in the economic states:

$$vc_{d,t} = A_{0,d} + A_{1,d} x_t + A_{2,d} \sigma_t^2 + A_{3,d} s_t. \tag{22}$$

Similar to the consumption asset, for typical model parameters corporate assets are risky: they fall in bad times of low economic growth ($A_{1,d} > 0$) or high consumption volatility ($A_{2,d} < 0$). The asset prices also increase at times of a positive gap between cash payouts and consumption ($A_{3,d} > 0$): because the gap s_t is persistent, it signifies higher cash payments to investors in the future.

3.3 Implications for Payouts and Valuations

We calibrate the model, and assess whether it can quantitatively account for our empirical evidence. As is common in this literature, we calibrate the model at a monthly frequency, and use simulations to target the data at an annual horizon. Specifically, we time-aggregate the simulated monthly output from the model and construct annual growth rates and payout changes, asset returns, and valuation ratios. We report the median and percentiles for the model statistics based on $10,000$ Monte-Carlo simulations with 40×12 monthly observations each that match the length of the historical data. We also show the population values that correspond to a long-sample of 10,000 annualized observations.

Consumption and corporate payouts. Table 5 reports the parameter values for the model. In a spirit of the long-run risks literature, the consumption calibration features persistent low-frequency movements in the expected growth and consumption volatility. The persistence of the expected growth component is set at 0.985, and that of the volatility shocks at 0.999. The scales of the expected growth and volatility shocks are rather small to account for the empirical properties of the macroeconomic fundamentals in the data.

Table 6 shows that our model can match salient properties of the consumption data. The Table reports the mean, standard deviation, and the persistence of the consumption growth at 1,2 and 5 lags in the data and in the model. The data moments are computed for the benchmark 1975-2014 sample, as well as for a long sample going back to 1929. The median model values are close to the data, and in all the cases the data values are within the confidence interval of the model.

We next calibrate the dynamics of the cash payouts and net issuances. The cash payouts are moderately persistent ($\rho_s = 0.96$) and are exposed to the expected growth fluctuations ($\phi_s = 6$). Recall that in the model the ratio of net issuances to consumption is unpredictable and driven by its own i.i.d. shock, so we only need to set its overall level and scale. As shown in Table 7, the model can successfully capture the key moments of cash payout, net issuance, and total payout dynamics in the data. Changes in net issuances are several times more volatile that changes in cash payouts. This leads to a highly volatile total asset payout growth dominated by shocks to net issuance. Its volatility of 3.15 is comparable to 4.36 in the model. The Table also shows that, unlike cash dividends which are always positive, net issuances and total payouts can go negative. In the model, net issuances become negative about 5% of the time, while total payouts turn negative 25% of the time. These estimates are consistent with the data.

Changes in annual cash payouts are mildly persistent both in the model and the data. Changes in net issuances actually have a negative persistence in the data. This is also captured by the model structure because i.i.d. shocks to the levels of net issuances lead to negative autocorrelation for the changes. Changes in total payouts behave like net issuances, and have a negative persistence both in the data and in the model. The Table also shows that the model can capture well the short-run cyclicality evidence in the data. Cash payouts are positively correlated with annual consumption growth: the correlation is 0.30 in the data and 0.34 in the model. Net issuances are acyclical, and total payouts are essentially acyclical as well: their correlation with consumption growth 0.00 in the data relative to 0.02 in the model. The confidence intervals on the asset payout correlations are quite large, which is consistent with the idea that the net issuances introduce a substantial noise in measuring the exposures of aggregate payouts to economic risks.

Perhaps surprisingly, the model does not match the means of net issuances and aggregate payouts, even though these are effectively governed by the exogenous parameters in the model (the data value is within the 5% confidence interval of the model). The unconditional mean net issuance changes in the data is actually larger than the mean of changes in cash payouts, which implies that the mean of total payout changes is negative (see Table 7). Taking these estimates at the face value, this suggests that future payouts from the corporate sector are negative on average, which would lead to negative asset valuations. This is counterfactual in the data, and is ruled out in our model solution approach which forces prices to be positive. Because there is a substantial statistical uncertainty about the estimates of the mean, we instead target a lower value for the average net issuances which is below the average of the cash payouts. Under these values, the average total payouts are positive, and their present value is positive as well.[20]

Asset prices and economic risk. To study the implications for the asset prices, we calibrate the preference parameters to standard values in the literature. The risk aversion is set at 10, and the IES parameter is 1.5. This configuration implies a preference for early

[20]Asset payouts which are positive on average is a necessary but not a sufficient condition for the convergence and positivity of asset valuations. Due to aggregate risk compensation, states with negative payouts in general contribute more to total asset valuations than states with positive payouts. This places further discipline on the payout parameters to ensure that the solution to asset prices exists.

resolution of uncertainty and a strong substitution effect. These margins play an important role to generate sizeable risk compensations and realistic dynamics of the asset prices (see Bansal and Yaron (2004)).

Table 8 shows the model implications for the key asset-pricing moments, such as the mean and standard deviation of the risk-free rate and the asset return. The model replicates quite well a relatively low level and volatility of the risk-free rate in the data. The level is 0.86% in the data relative to 1.64% in the model, and its volatility is 1.78% in the data and 0.82% in the model. The asset returns are risky: the asset risk premium is 6.42% in the data relative to 6.25% in the model, and the asset return volatility is about 12% both in the model and in the data.

What is the nature and sources of risk in corporate assets? The key source of risk in our economy is the news to the expected consumption growth, which accounts for about a half of the compensation for the total asset risk premium, with volatility and short-run consumption risks explaining the rest. This expected growth risk compensation reflects the exposure of the cash component of the aggregate payouts to low-frequency fluctuations in expected consumption through the parameter φ_s. Indeed, zeroing out net issuance components from the total payouts by setting $\varphi_h = 0$ does not materially affect the model implied asset risk premium.[21]

The term structures of cyclicality help further assess and validate the expected growth risk channel for the payouts and valuations. As shown in Figure 12, asset returns co-move positively with consumption growth at short and long horizons in the data, and the model can quantitatively capture these correlations. The model also replicates very well the correlation patterns across different components of the payouts and at different frequencies. Both in the data and in the model, the cash payouts are procyclical at all horizons, while the net issuances and total payouts are effectively acyclical. The correlations are very similar in the model and in the data.

Hence, even though corporate payouts are dominated by shocks to net issuances which are uncorrelated with the aggregate economy, the large exposure of cash payouts to low-frequency growth fluctuations makes total payouts risky, and generates a large risk premium

[21]The volatility of net issuances is exposed to consumption volatility, so that net issuances affect the asset exposure to the volatility risks. Net issuances also impact the values of the steady states for the log-linearization of returns. These effects are quite small.

for asset returns.

4 Conclusions

We measure the market value of U.S. corporate assets and their payouts to investors. Our measure of total payout includes not only the cash dividends and interest payments (cash payouts), but also net transfers in the form of repurchases and new issuances of equity and debt.

We document several novel empirical findings. First, total asset payouts often turn negative, meaning that there are periods when investors finance the corporate sector. Second, net issuances are highly volatile, and are a dominant component of the total payouts. Third, while cash payouts are procyclical, total payouts appear acyclical. This holds for equity, debt and especially for asset payouts. This evidence challenges standard notions of risk and return, because asset returns are risky and comparable to equities.

We develop a long-run risk model to account for the empirical evidence. In the model, net issuances are acyclical and highly volatile, which masks the exposure of cash components of total payouts to low frequency economic risks. The model matches acyclical dynamics of the total payout, while generating a sizeable asset risk premium.

There are several extensions of our paper that would be fruitful to pursue in future work. On the empirical side, it would be interesting to consider properties of the valuations and payouts across firms, and not just at the aggregate level. Theoretically, it would be useful to develop an economic model which endogenizes the payout decisions. As a next step, one can calibrate or estimate the economic environment and quantify the role of economic risks for payout policy and asset valuations. We leave these extensions for future research.

Appendix

A Barclays Index Data

Table A.1: **Barclays Index Data**

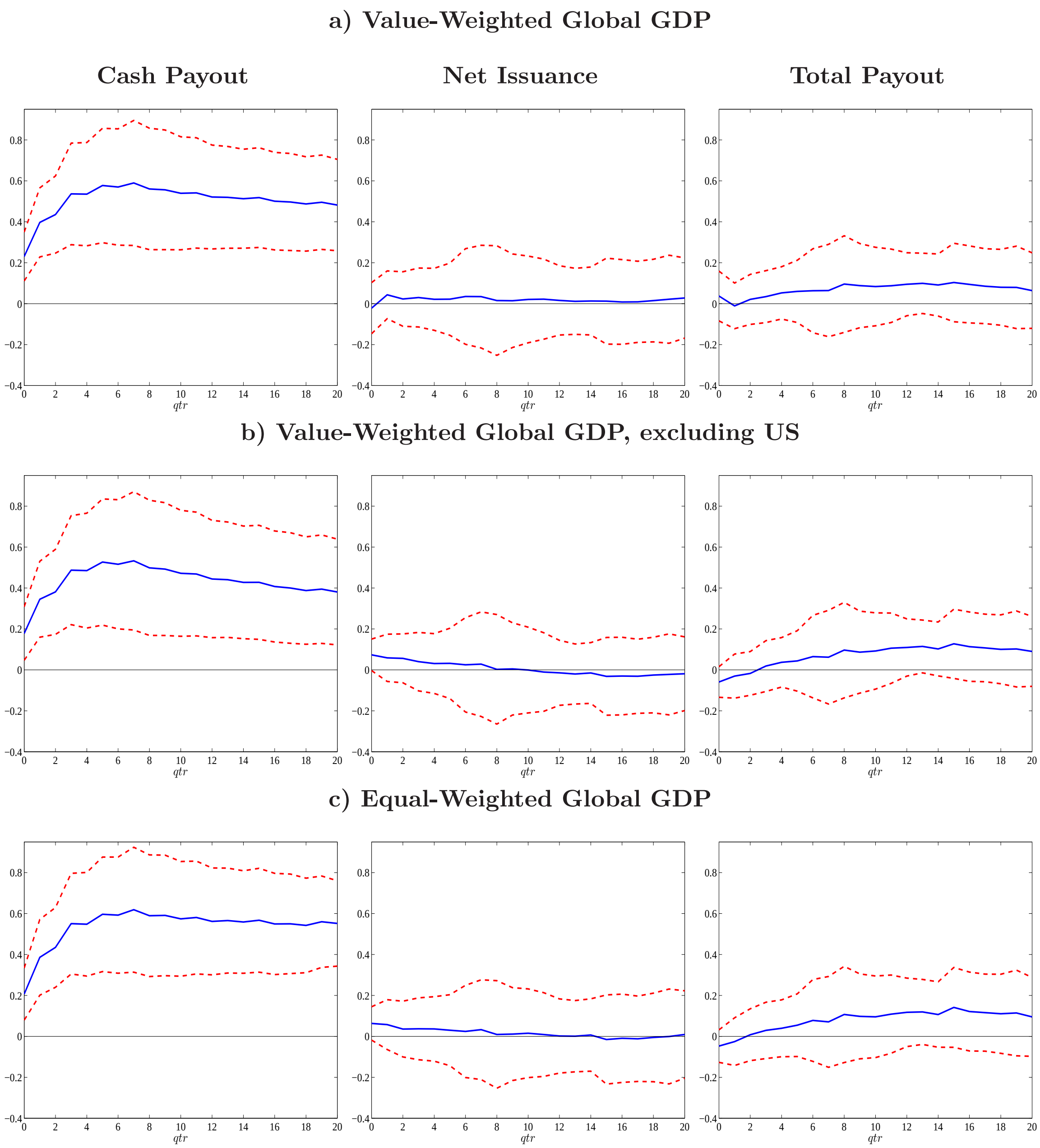
Index	**Start Date**	**Quality**	**Minimum Issue Size**	**Minimum Maturity (or Average Life)**	**Size ($billion)** Dec-2014
			Long-Term Debt Components:		
U.S. Corporate IG	Jan-73	IG	$250 m	1 year	$ 3,892
U.S. Corporate HY	Jan-83	HY	$150 m	1 year	$ 1,311
U.S. 144a Ex-Aggregate	Feb-98	IG	$250 m	1 year	$ 1,287
U.S. Commercial MBS	Jun-99	IG, HY	$250 m	1 year	$ 390
U.S. Fixed-Rate ABS	Jan-92	IG	$500m Deal Size $25m Tranche Size	1 year	$ 96
U.S. Tax-Exempt Municipals	Jan-73	IG	$250 m	1 year	$ 42
U.S. Convertibles Composite	Jan-03	IG, HY	$250 m	1 month	$ 220
			Short-Term Debt Components:		
U.S. Floating-Rate ABS	May-05	IG	$500m Deal Size $25m Tranche Size	1 year	$ 109
U.S. Floating Rate Notes	Oct-03	IG	$300 m	1 month (13 months prior Apr-07)	$ 278
U.S. Floating Rate Notes HY	March-06	HY	$150 m	1 year	$ 6
U.S. Short-Term Corporate Index	June-04	IG		1 month	$ 298

B Cyclical Properties of Payouts: Robustness

Figure B.1 shows the term structure of asset payout cyclicality based on value-weighted global GDP, value-weighted global GDP excluding the United States, and equal-weighted global GDP. To compute global GDP, we use the OECD quarterly output data for 17 major industrialized countries, such as the United States, Canada, France, Germany, Italy, Japan, the United Kingdom, Australia, Belgium, Denmark, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, and Switzerland.

We perform a variety of checks to assess the robustness of our payout cyclicality results. Specifically, in addition to the benchmark sample from 1975 to 2014, we consider shorter sample which stops in 2006 before the Financial Crisis, as well as the most recent sample from 2007 to 2014. For equity data, we also provide the results for the 1949-2014 and 1949-2006 samples. The benchmark results are based on the changes in annual payouts sampled at annual frequency. To extend the sample size, we consider sampling the data at quarterly frequency. First, we consider changes in annual payouts (that is, the payouts over the past four quarters relative to the payouts over the same four quarters in the previous year), sampled at quarterly frequency. Next, we look at changes in quarterly payouts, which are seasonally adjusted through the band-pass filter or the X-12 ARIMA filter. Finally, we consider year-to-year changes in quarterly payouts (that is, quarterly payouts this year relative to the payout in the same quarter in a previous year), again sampled at quarterly frequency. The results are consistent across all the specifications, and show that cash payouts are generally procyclical, while changes in net issuances and total payouts seem acyclical to mildly counter-cyclical.

Figure B.1: **Term structure of Asset Payout Cyclicality: Global Risks**



The Figure shows multi-horizon correlations between changes in total asset payouts, scaled by the global output level, and measures of global output growth. The left panel shows the results for the cash payouts, the middle panel is for the net issuances, and the right panel plots the correlations for the total payouts. Measures of global output include value-weighted GDP, value-weighted GDP excluding the U.S., and equally-weighted GDP. The data are real quarterly observations, sampled on a quarterly frequency and from Q1.1975 to Q4.2014.

Table B.1: **Equity Payout Cyclicality**

$Corr\,(\cdot, \Delta c_t)$	$\frac{\Delta D_t}{C_t}$	$\frac{\Delta NI_t}{C_t}$	$\frac{\Delta ISS_t}{C_t}$	$\frac{\Delta REP_t}{C_t}$	$\frac{\Delta D_{a,t}}{C_t}$
			Sample 1949-2014:		
Annual change	0.16	0.11	0.18	0.16	-0.10
Quarterly change, band-passed	0.27	0.21	0.27	0.19	-0.20
Quarterly change, x12 ARIMA	0.16	0.08	0.12	0.09	-0.09
Quarterly change, year-to-year	0.25	0.10	0.16	0.15	-0.09
			Sample 1949-2006:		
Annual change	0.12	0.18	0.21	0.12	-0.17
Quarterly change, band-passed	0.16	0.26	0.28	0.13	-0.25
Quarterly change, x12 ARIMA	0.16	0.11	0.13	0.04	-0.12
Quarterly change, year-to-year	0.27	0.15	0.18	0.09	-0.14
			Sample 1975-2014:		
Annual change	0.23	-0.12	0.07	0.25	0.14
Quarterly change, band-passed	0.30	0.02	0.17	0.29	0.00
Quarterly change, x12 ARIMA	0.19	0.01	0.08	0.16	-0.01
Quarterly change, year-to-year	0.23	-0.03	0.13	0.22	0.05
			Sample 1975-2006:		
Annual change	0.19	-0.06	0.09	0.21	0.07
Quarterly change, band-passed	0.02	0.11	0.18	0.18	-0.11
Quarterly change, x12 ARIMA	0.18	0.05	0.09	0.08	-0.05
Quarterly change, year-to-year	0.22	0.04	0.14	0.14	-0.03
			Sample 2007-2014:		
Annual change	0.53	-0.34	-0.03	0.28	0.39
Quarterly change, band-passed	0.51	0.09	0.23	0.16	-0.03
Quarterly change, x12 ARIMA	0.33	-0.13	0.15	0.37	0.09
Quarterly change, raw series	0.56	-0.34	0.22	0.58	0.40

The Table reports correlations between changes in the equity payouts, scaled by the consumption level, and consumption growth. The equity payouts include cash payouts, net issuances, issuances, repurchases, and total payouts. Payouts are sampled at quarterly frequency, and are either annual or quarterly, seasonally adjusted through a band-pass filter, X12-ARIMA filter, or by computing year-to-year changes.

Table B.2: **Debt Payout Cyclicality**

$Corr\,(\cdot, \Delta c_t)$	$\frac{\Delta D_t}{C_t}$	$\frac{\Delta NI_t}{C_t}$	$\frac{\Delta D_{a,t}}{C_t}$
	Sample 1975-2014:		
Annual change	0.21	0.13	-0.10
Quarterly change, band-passed	0.33	0.17	-0.14
Quarterly change, x12 ARIMA	0.19	0.11	-0.09
Quarterly change, year-to-year	0.30	0.11	-0.08
	Sample 1975-2006:		
Annual change	0.03	0.08	-0.08
Quarterly change, band-passed	0.09	-0.06	0.07
Quarterly change, x12 ARIMA	0.03	-0.03	0.03
Quarterly change, year-to-year	0.08	-0.01	0.02
	Sample 2007-2014:		
Annual change	0.26	0.24	-0.23
Quarterly change, band-passed	0.39	0.45	-0.44
Quarterly change, x12 ARIMA	0.34	0.22	-0.20
Quarterly change, year-to-year	0.63	0.48	-0.44

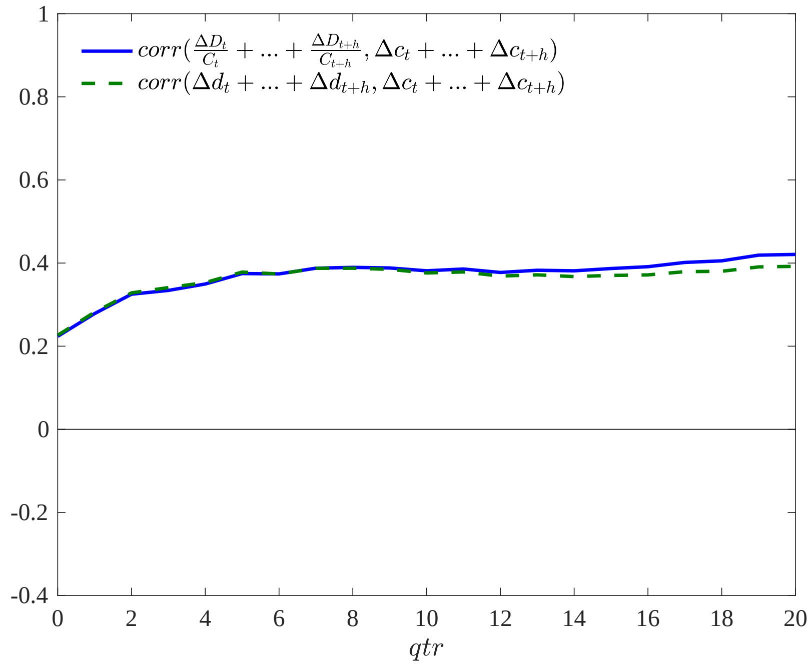
The Table reports correlations between changes in debt payouts, scaled by the consumption level, and consumption growth. The debt payouts include cash payouts, net issuances, and total payouts. Payouts are sampled at quarterly frequency, and are either annual or quarterly, seasonally adjusted through a band-pass filter, X12-ARIMA filter, or by computing year-to-year changes.

Table B.3: **Asset Payout Cyclicality**

$Corr\,(\cdot, \Delta c_t)$	$\frac{\Delta D_t}{C_t}$	$\frac{\Delta NI_t}{C_t}$	$\frac{\Delta D_{a,t}}{C_t}$
	Sample 1975-2014:		
Annual change	0.25	0.00	0.05
Quarterly change, band-passed	0.41	0.16	-0.11
Quarterly change, x12 ARIMA	0.26	0.05	-0.02
Quarterly change, year-to-year	0.34	0.06	-0.02
	Sample 1975-2006:		
Annual change	0.10	-0.01	0.02
Quarterly change, band-passed	0.08	0.07	-0.06
Quarterly change, x12 ARIMA	0.12	0.03	-0.01
Quarterly change, year-to-year	0.17	0.03	-0.01
	Sample 2007-2014:		
Annual change	0.39	0.09	-0.00
Quarterly change, band-passed	0.59	0.38	-0.35
Quarterly change, x12 ARIMA	0.43	0.06	-0.02
Quarterly change, year-to-year	0.70	0.30	-0.20

The Table reports correlations between changes in asset payouts, scaled by the consumption level, and consumption growth. The asset payouts include cash payouts, net issuances, and total payouts. Payouts are sampled at quarterly frequency, and are either annual or quarterly, seasonally adjusted through a band-pass filter, X12-ARIMA filter, or by computing year-to-year changes.

Figure B.2: **Term structure of Asset Cash Payout Cyclicality: Normalized Changes versus Log Growth Rate**



The Figure shows multi-horizon correlations of consumption growth with changes in total asset cash payouts scaled by the consumption level (solid line) or the log growth rates in asset cash payouts (dashed line). The data are real quarterly observations, sampled on a quarterly frequency and from Q1.1975 to Q4.2014.

C Wavelet Analysis

The wavelet correlation between two stochastic processes x and y for scale $\lambda_j = 2^{j-1}$ equals to

$$\rho_{xy}(\lambda_j) = \frac{Cov\left(\overline{W}_{j,t}^{(x)}, \overline{W}_{j,t}^{(y)}\right)}{\left\{Var\left(\overline{W}_{j,t}^{(x)}\right) Var\left(\overline{W}_{j,t}^{(y)}\right)\right\}^{\frac{1}{2}}},$$

where $\overline{W}_{j,t}^{(x)}$ and $\overline{W}_{j,t}^{(y)}$ are the scale λ_j maximal overlap discrete wavelet transform (MODWT) coefficients for x and y, respectively. Since this is just a correlation coefficient between two random variables on a scale by scale basis, $-1 \geq \rho_{xy}(\lambda_j) \leq 1$ for all j. The MODWT coefficient for a stochastic process u is defined as

$$\overline{W}_{j,t}^{(u)} = \sum_{l=0}^{L_j-1} \tilde{h}_{j,l} u_{t-l},$$

where $\left\{\tilde{h}_{j,0}, ..., \tilde{h}_{j,L_j-1}\right\}$ are the wavelet filter coefficients from a Daubechies compactly supported wavelet family, with $L_j = (2^j - 1)(L-1) + 1$.

We estimate the sample wavelet correlation by simply using the estimators of wavelet covariance and wavelet variance, respectively,

$$\hat{\gamma}_{xy}(\lambda_j) = \frac{1}{T_j} \sum_{t=L_j-1}^{T-1} \overline{W}_{j,t}^{(x)} \overline{W}_{j,t}^{(y)} \qquad \& \qquad \hat{\nu}_x^2(\lambda_j) = \frac{1}{T_j} \sum_{t=L_j-1}^{T-1} \left(\overline{W}_{j,t}^{(x)}\right)^2,$$

with $T_j = T - L_j + 1$.

Whitcher, Guttorp, and Percival (2000) establish a central limit theorem for the estimator of wavelet correlation,

$$\hat{\rho}_{xy}(\lambda_j) = \frac{\hat{\gamma}_{xy}(\lambda_j)}{\hat{\nu}_x(\lambda_j)\hat{\nu}_y(\lambda_j)},$$

and construct an approximate confidence interval (CI). An approximate $100(1-2p)\%$ CI for $\rho_{xy}(\lambda_j)$ is given by

$$tanh\left\{tanh^{-1}(\hat{\rho}_{xy}(\lambda_j)) \pm \frac{\Phi^{-1}(1-p)}{\sqrt{T_j - L_j' - 3}}\right\},$$

with $L'_j = (L-2)(1-2^{-j})$.

D Model Solution

The equilibrium consumption claim loadings are given by

$$\begin{aligned}
A_{0,c} &= \frac{1}{1-\kappa_{1,c}}\left(log\left(\delta\right)+\left(1-\frac{1}{\psi}\right)\mu_c+\kappa_{0,c}+\kappa_{1,c}A_{2,c}\left(1-\nu\right)\sigma_0^2+\frac{\theta}{2}\left(\kappa_{1,c}A_{2,c}\sigma_\omega\right)^2\right),\\
A_{1,c} &= \frac{1-\frac{1}{\psi}}{1-\kappa_{1,c}\rho_x},\\
A_{2,c} &= -\frac{\left(1-\frac{1}{\psi}\right)\left(\gamma-1\right)}{2\left(1-\kappa_{1,c}\nu\right)}\left(1+\left(\frac{\kappa_{1,c}\varphi_x}{1-\kappa_{1,c}\rho_x}\right)^2\right).
\end{aligned}$$

The market prices of risks are,

$$\begin{aligned}
\lambda_\eta &= \gamma,\\
\lambda_e &= -\left(\theta-1\right)\kappa_{1,c}A_{1,c}\varphi_x,\\
\lambda_\omega &= -\left(\theta-1\right)\kappa_{1,c}A_{2,c}.
\end{aligned}$$

The log-linearization coefficients for the corporate asset satisfy,

$$\begin{aligned}
\kappa_{0,d} &= log\left(1+exp\left\{\overline{vc}_d\right\}+exp\left\{\overline{dc}\right\}-exp\left\{\overline{hc}\right\}\right)-\kappa_{1,d}\overline{vc}_d-\kappa_{2,d}\overline{dc}-\kappa_{3,d}\overline{hc},\\
\kappa_{1,d} &= \frac{exp\left\{\overline{vc}_d\right\}}{1+exp\left\{\overline{vc}_d\right\}+exp\left\{\overline{dc}\right\}-exp\left\{\overline{hc}\right\}},\\
\kappa_{2,d} &= \frac{exp\left\{\overline{dc}\right\}}{1+exp\left\{\overline{vc}_d\right\}+exp\left\{\overline{dc}\right\}-exp\left\{\overline{hc}\right\}},\\
\kappa_{3,d} &= -\frac{exp\left\{\overline{hc}\right\}}{1+exp\left\{\overline{vc}_d\right\}+exp\left\{\overline{dc}\right\}-exp\left\{\overline{hc}\right\}}.
\end{aligned}$$

The loadings for the corporate claim are given by,

$$A_{0,d} = \frac{1}{1-\kappa_{1,d}} \left(m_0 + \mu_c + \kappa_{0,d} + \kappa_{1,d} A_{2,d} \left(1-\nu\right) \sigma_0^2 + \left(\kappa_{1,d} A_{3,d} + \kappa_{2,d}\right) \mu_s \left(1-\rho_s\right) + ...\right.$$
$$\left. + \kappa_{3,d}\mu_h + 0.5 \left(\kappa_{1,d} A_{2,d} - \lambda_\omega\right)^2 \sigma_\omega^2\right),$$
$$A_{1,d} = \frac{1}{1-\kappa_{1,d}\rho_x} \left(\left(1-\frac{1}{\psi}\right) + \frac{\kappa_{2,d}\phi_s}{1-\kappa_{1,d}\rho_s}\right),$$
$$A_{2,d} = \frac{1}{1-\kappa_{1,d}\nu} \left(m_2 + 0.5 \left(\left(1-\lambda_\eta\right)^2 + \left(\kappa_{1,d} A_{1,d} \varphi_x - \lambda_e\right)^2 + ...\right.\right.$$
$$\left.\left. + \left(\kappa_{1,d} A_{3,d} + \kappa_{2,d}\right)^2 \varphi_s^2 + 2\alpha \left(1-\lambda_\eta\right) \left(\kappa_{1,d} A_{3,d} + \kappa_{2,d}\right) \varphi_s + \kappa_{3,d}^2 \varphi_h^2\right)\right),$$
$$A_{3,d} = \frac{\kappa_{2,d}\rho_s}{1-\kappa_{1,d}\rho_s}.$$

References

Bansal, Ravi, and Amir Yaron, 2004, Risks for the long run: A potential resolution of asset pricing puzzles, *The Journal of Finance* 59, 1481–1509.

Bansal, Rav, and Amiri Yaron, 2007, The Asset Pricing Macro Nexus and Return Cash-Flow Predictability, in *2007 Meeting Papers* no. 18. Society for Economic Dynamics.

Barro, Robert, 2006, Rare Disasters and Asset Markets in the Twentieth Century, *Quarterly Journal of Economics* 121.

Bernanke, Ben, and John Campbell, 1988, Is There a Corporate Debt Crisis?, *Brookings Papers on Economic Activity* 19, 83–140.

Bhamra, Harjoat, Lars-Alexander Kuehn, and Ilya Strebulaev, 2010, The Levered Equity Risk Premium and Credit Spreads: A Unified Framework, *Review of Financial Studies* 23, 645–703.

Boudoukh, Jacob, Roni Michaely, Matthew Richardson, and Michael R Roberts, 2007, On the importance of measuring payout yield: Implications for empirical asset pricing, *The Journal of Finance* 62, 877–915.

Brainard, William C., and John B. Shoven, 1980, The financial valuation of the return to capital, *Brookings Papers on Economic Activity* pp. 453–511.

Campbell, John, and John Cochrane, 1999, By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior, *Journal of Political Economy* 107, 205–251.

Campbell, John Y, and Robert J Shiller, 1988, The dividend-price ratio and expectations of future dividends and discount factors, *Review of financial studies* 1, 195–228.

Chen, Hui, 2010, Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure, *Journal of Finance* 65, 2171–212.

Croce, Mariano M., 2014, Long-Run Productivity Risk. A New Hope for Production-Based Asset Pricing?, *Journal of Monetary Economics* 66, 13–31.

Dittmar, A., and R. Dittmar, 2004, Stock Repurchase Waves: An Explanation of the Trends in Aggregate Corporate Payout Policy, Working paper.

Epstein, Larry G, and Stanley E Zin, 1989, Substitution, risk aversion, and the temporal behavior of consumption and asset returns: A theoretical framework, *Econometrica: Journal of the Econometric Society* pp. 937–969.

Fama, Eugene, and Kenneth French, 2001, Disappearing dividends: Changing firm characteristics or lower propensity to pay?, *Journal of Financial Economics* 60, 3–43.

Ferson, Wayne, Suresh Nallareddy, and Biqin Xie, 2013, The 'out of sample' Performance of Long-run Risk Models, *Journal of Financial Economics* 107, 537–56.

Grullon, Gustavo, and Roni Michaely, 2002, Dividends, Share Repurchases, and the Substitution Hypothesis, *Journal of Finance* 57, 1649–1684.

Guay, Wayne, and Jarrad Harford, 2000, The Cash-Flow Permanence and Information Content of Dividend Increases Versus Repurchases, *Journal of Financial Economics* 57, 385–415.

Hall, Bronwyn H., Clint Cummins, Elizabeth Laderman, and Joy Mundy, 1988, The R D Master File Documentation, NBER Working Paper No. t0072.

Hansen, Lars Peter, John C Heaton, and Nan Li, 2008, Consumption Strikes Back? Measuring Long-Run Risk, *Journal of Political Economy* 116, 260–302.

Jagannathan, Murali, Clifford P. Stephens, and Michael Weisbach, 2000, Financial flexibility and the choice between dividends and stock repurchases, *Journal of Financial Economics* 57, 355–384.

Jermann, Urban J., 1998, Asset pricing in production economies, *Journal of Monetary Economics* 41, 257–275.

Julliard, Christian, and Jonathan Parker, 2005, Consumption Risk and the Cross-Section of Expected Returns, *Journal of Political Economy* 113, 185–222.

Kacperczyk, Marcin, and Philipp Schnabl, 2010, When Safe Proved Risky: Commercial Paper during the Financial Crisis of 20072009, *Journal of Economic Perspective* 24, 29–50.

Kreps, David M., and Evan L. Porteus, 1978, Temporal Resolution of Uncertainty and Dynamic Choice Theory, *Econometrica* 46, 185–200.

Kung, Howard, and Lukas Schmid, 2014, Innovation, Growth, and Asset Prices, *Journal of Finance forthcoming.*

Larrain, Borja, and Motohiro Yogo, 2008, Does Firm Value Move Too Much to be Justified by Subsequent Changes in Cash Flow?, *Journal of Financial Economics* 87, 200–226.

Lintner, John, 1956, Distribution of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes, *The American Economic Review* 46, 97–113.

Lochstoer, L., and G. Kaltenbrunner, 2010, Long-Run Risk through Consumption Smoothing, *Review of Financial Studies* 23, 3141–89.

Mehra, Rajnish, and Edward C. Prescott, 1985, The Equity Premium: A Puzzle, *Journal of Monetary Economics* 15, 145–161.

Richardson, Scott A., and Richard G. Sloan, 2003, External Financing and Future Stock Returns, Rodney l. white center for financial research working paper no. 03-03.

Rietz, Thomas, 1988, The Equity Risk Premium: A Solution, *Journal of Monetary Economics* 22, 117–131.

Weil, Philippe, 1989, The Equity Premium Puzzle and the Risk-free Rate Puzzle, *Journal of Monetary Economics* 24, 401–421.

Welch, Ivo, and Amit Goyal, 2008, A comprehensive look at the empirical performance of equity premium prediction, *Review of Financial Studies* 21, 1455–1508.

Whitcher, Brandon, Peter Guttorp, and Donald B. Percival, 2000, Wavelet analysis of covariance with application to atmospheric time series, *Journal of Geophysical Research* 105, 14,941 – 14,962.

Tables and Figures

Table 1: **Asset Returns in the Data**

	Equity	Debt	Asset
Mean	7.80	2.94	6.42
Std	16.33	5.36	12.00
AC(1)	-0.08	0.20	-0.06
	Cross-Correlations:		
Debt	0.46		
Asset	0.99	0.54	

The Table reports summary statistics for equity, debt, and total asset returns. The mean and standard deviation are in percentage terms. The data are real annual observations from 1975 to 2014.

Table 2: **Asset Payouts in the Data**

(a) **Cash Payout**

	Equity	Debt	Asset
Mean	0.14	0.13	0.27
Std	0.30	0.63	0.78
AC(1)	0.11	0.34	0.37
	Cross-Correlations:		
Debt	0.35		
Asset	0.66	0.93	

(b) **Net Issuance**

	Equity	Debt	Asset
Mean	0.17	0.19	0.36
Std	3.02	3.78	3.32
AC(1)	-0.13	-0.29	-0.36
	Cross-Correlations:		
Debt	-0.54		
Asset	0.29	0.64	

(c) **Total Payout**

	Equity	Debt	Asset
Mean	-0.03	-0.06	-0.10
Std	3.08	3.55	3.15
AC(1)	-0.09	-0.36	-0.35
	Cross-Correlations:		
Debt	-0.56		
Asset	0.35	0.58	

The Table reports summary statistics for the changes in equity, debt, and asset payouts, scaled by the consumption level. The payouts include cash payouts, net issuances, and total payouts. The mean and standard deviation are in percentage terms. The data are real annual observations from 1975 to 2014.

Table 3: **Asset Payout Cyclicality**

(a) **Annual Data (1975-2014)**

$corr\,(\cdot, \Delta c)$	$\frac{\Delta D}{C}$	$\frac{\Delta NI}{C}$	$\frac{\Delta D_a}{C}$	$corr\,(\cdot, \Delta y)$	$\frac{\Delta D}{Y}$	$\frac{\Delta NI}{Y}$	$\frac{\Delta D_a}{Y}$
Equity	0.34	-0.17	0.20	Equity	0.44	-0.23	0.27
Debt	0.21	0.14	-0.11	Debt	0.34	0.21	-0.16
Asset	0.30	-0.00	0.07	Asset	0.44	0.03	0.08

(b) **Annual Data (1975-2006)**

$corr\,(\cdot, \Delta c)$	$\frac{\Delta D}{C}$	$\frac{\Delta NI}{C}$	$\frac{\Delta D_a}{C}$	$corr\,(\cdot, \Delta y)$	$\frac{\Delta D}{Y}$	$\frac{\Delta NI}{Y}$	$\frac{\Delta D_a}{Y}$
Equity	0.24	-0.07	0.09	Equity	0.35	-0.17	0.19
Debt	0.06	0.09	-0.08	Debt	0.20	0.03	0.00
Asset	0.14	0.01	0.02	Asset	0.30	-0.18	0.23

(c) **Quarterly Data (1975-2014)**

$corr\,(\cdot, \Delta c)$	$\frac{\Delta D}{C}$	$\frac{\Delta NI}{C}$	$\frac{\Delta D_a}{C}$	$corr\,(\cdot, \Delta y)$	$\frac{\Delta D}{Y}$	$\frac{\Delta NI}{Y}$	$\frac{\Delta D_a}{Y}$
Equity	0.16	0.02	0.00	Equity	0.15	-0.11	0.13
Debt	0.20	0.01	0.00	Debt	0.32	-0.06	0.08
Asset	0.22	0.01	0.00	Asset	0.27	-0.11	0.13

(d) **Quarterly Data (1975-2006)**

$corr\,(\cdot, \Delta c)$	$\frac{\Delta D}{C}$	$\frac{\Delta NI}{C}$	$\frac{\Delta D_a}{C}$	$corr\,(\cdot, \Delta y)$	$\frac{\Delta D}{Y}$	$\frac{\Delta NI}{Y}$	$\frac{\Delta D_a}{Y}$
Equity	0.17	0.06	-0.05	Equity	0.10	-0.06	0.07
Debt	0.08	-0.06	0.06	Debt	0.22	-0.10	0.11
Asset	0.17	-0.00	0.01	Asset	0.19	-0.11	0.11

The Table reports correlations between changes in payouts, scaled by the aggregate level of the economy, and measures of economic growth. The payouts include cash payouts, net issuances, and total payouts, and are computed for equity, debt, and assets. The left and right panels use consumption or output, respectively, to measure the aggregate level of the economy. The data are real, and correspond to (a) annual observations from 1975 to 2014; (b) annual observations from 1975 to 2006; (c) quarterly observations from Q1.1975 to Q4.2014; (d) quarterly observations from Q1.1975 to Q4.2006.

Table 4: **Wavelet Correlation between Asset Payout and Consumption Growth**

Equity

Scale	Cash Payout	Net Issuance	Total Payout
2 - 4 Quarters	0.05 (-0.18, 0.26)	-0.02 (-0.24, 0.20)	0.02 (-0.20, 0.24)
4 - 8 Quarters	0.15 (-0.17, 0.44)	0.00 (-0.31, 0.31)	0.01 (-0.31, 0.32)
8 - 16 Quarters	0.35 (-0.11, 0.69)	0.04 (-0.41, 0.47)	-0.03 (-0.47, 0.42)
16 - 32 Quarters	0.63 (0.01, 0.90)	-0.14 (-0.71, 0.53)	0.19 (-0.50, 0.73)
32 - 64 Quarters	0.15 (-0.53, 0.71)	0.21 (-0.49, 0.74)	-0.14 (-0.71, 0.54)

Debt

Scale	Cash Payout	Net Issuance	Total Payout
2 - 4 Quarters	0.03 (-0.19, 0.25)	-0.00 (-0.22, 0.22)	-0.01 (-0.23, 0.21)
4 - 8 Quarters	0.03 (-0.28, 0.34)	0.06 (-0.25, 0.37)	-0.07 (-0.38, 0.24)
8 - 16 Quarters	0.23 (-0.24, 0.61)	0.23 (-0.24, 0.61)	-0.22 (-0.61, 0.24)
16 - 32 Quarters	0.52 (-0.16, 0.87)	0.24 (-0.46, 0.76)	-0.13 (-0.70, 0.54)
32 - 64 Quarters	0.71 (0.15, 0.93)	0.35 (-0.36, 0.80)	-0.24 (-0.76, 0.46)

Asset

Scale	Cash Payout	Net Issuance	Total Payout
2 - 4 Quarters	0.21 (-0.01, 0.41)	-0.04 (-0.25, 0.18)	0.04 (-0.18, 0.26)
4 - 8 Quarters	0.25 (-0.06, 0.52)	0.01 (-0.30, 0.32)	0.02 (-0.29, 0.33)
8 - 16 Quarters	0.34 (-0.12, 0.68)	0.27 (-0.19, 0.64)	-0.21 (-0.60, 0.25)
16 - 32 Quarters	0.58 (-0.08, 0.89)	-0.13 (-0.70, 0.55)	0.32 (-0.38, 0.79)
32 - 64 Quarters	0.55 (-0.12, 0.88)	0.06 (-0.59, 0.67)	0.11 (-0.56, 0.69)

The Table reports wavelet correlations between changes in payouts and consumption growth. The payouts include cash payouts, net issuances, and total payouts, and are computed for equity, debt, and assets. The panels report the estimates of wavelet correlation for different scales, with 5% confidence intervals reported in the brackets. The data are real quarterly observations from Q1.1975 to Q4.2014, seasonally adjusted by x12 ARIMA model.

Table 5: **Configuration of Model Parameters**

Preferences	δ	γ	ψ			
	0.9992	10	1.5			
Consumption	μ_c	ρ_x	φ_x	σ_0	ν	σ_ω
	0.0024	0.985	0.038	0.005	0.999	0.000001
Cash Payout	μ_s	ρ_s	ϕ_s	φ_s	α	
	-2.65	0.96	6	5	-0.15	
Net Issuance	μ_h	φ_h				
	0.045	18				

The Table reports the configuration of model parameters. The model is calibrated at a monthly frequency.

Table 6: **Model Implications: Consumption**

	Data		Model					
	1929-2014	1975-2014	Med	2.5%	5%	95%	97.5%	Pop
$E(\cdot)$	2.97	2.69	2.89	1.21	1.53	4.20	4.41	2.91
$\sigma(\cdot)$	2.20	1.67	1.99	1.22	1.29	3.03	3.25	2.19
$AC(1)$	0.52	0.27	0.43	0.11	0.15	0.67	0.71	0.54
$AC(2)$	0.23	0.20	0.19	-0.19	-0.14	0.50	0.55	0.35
$AC(5)$	0.04	-0.17	0.04	-0.31	-0.24	0.32	0.38	0.21

The Table reports the data and model properties of real consumption growth. The summary statistics in the data are computed in the annual samples from 1929 to 2014 and from 1975 to 2014. The median and 2.5%, 5%, 95%, and 97.5% values capture the model moment distributions across the small samples whose size equals the data. Population values correspond to a long simulation of the model. Means and volatilities are expressed in percentage terms.

Table 7: **Model Implications: Asset Payouts**

(a) **Cash Payout**

		Model					
	Data	*Median*	2.5%	5%	95%	97.5%	*Pop*
$E(\cdot)$	0.27	0.21	0.04	0.07	0.39	0.43	0.22
$\sigma(\cdot)$	0.78	0.61	0.37	0.39	1.00	1.08	0.65
$AC(1)$	0.37	0.27	-0.03	0.02	0.50	0.54	0.29
$AC(2)$	-0.21	0.00	-0.29	-0.26	0.27	0.31	0.03
$AC(5)$	-0.20	-0.06	-0.34	-0.30	0.19	0.24	-0.04
$corr(\cdot, \Delta c)$	0.30	0.34	-0.04	0.02	0.56	0.62	0.36
$\%\ of\ Neg\ Payouts$	0.00	0.00	0.00	0.00	0.00	0.00	0.00

(b) **Net Issuance**

		Model					
	Data	*Median*	2.5%	5%	95%	97.5%	*Pop*
$E(\cdot)$	0.36	0.15	-0.09	-0.05	0.36	0.40	0.15
$\sigma(\cdot)$	3.32	4.29	2.51	2.82	6.39	6.85	4.36
$AC(1)$	-0.36	-0.48	-0.68	-0.66	-0.26	-0.22	-0.50
$AC(2)$	0.08	-0.01	-0.37	-0.33	0.29	0.36	-0.01
$AC(5)$	-0.03	-0.00	-0.33	-0.29	0.28	0.33	0.01
$corr(\cdot, \Delta c)$	-0.00	0.02	-0.23	-0.19	0.23	0.26	0.02
$\%\ of\ Neg\ Payouts$	5.00	5.00	0.00	0.00	12.50	15.00	4.27

(c) **Total Payout**

		Model					
	Data	*Median*	2.5%	5%	95%	97.5%	*Pop*
$E(\cdot)$	-0.10	0.07	-0.19	-0.14	0.29	0.33	0.07
$\sigma(\cdot)$	3.15	4.36	2.57	2.82	6.51	6.91	4.40
$AC(1)$	-0.35	-0.47	-0.67	-0.65	-0.25	-0.19	-0.48
$AC(2)$	0.14	-0.01	-0.37	-0.32	0.29	0.35	-0.01
$AC(5)$	-0.02	-0.00	-0.34	-0.28	0.27	0.33	0.01
$corr(\cdot, \Delta c)$	0.07	0.03	-0.22	-0.19	0.23	0.29	0.03
$\%\ of\ Neg\ Payouts$	30.00	25.00	5.00	10.00	47.50	51.25	24.87

The Table reports the data and model properties of changes in asset payouts, scaled by the consumption level. The payouts include cash payouts, net issuances, and total payouts. The summary statistics in the data are computed in the annual sample from 1975 to 2014. The median and 2.5%, 5%, 95%, and 97.5% values capture the model moment distributions across the small samples whose size equals the data. Population values correspond to a long simulation of the model. Means and volatilities are expressed in percentage terms.

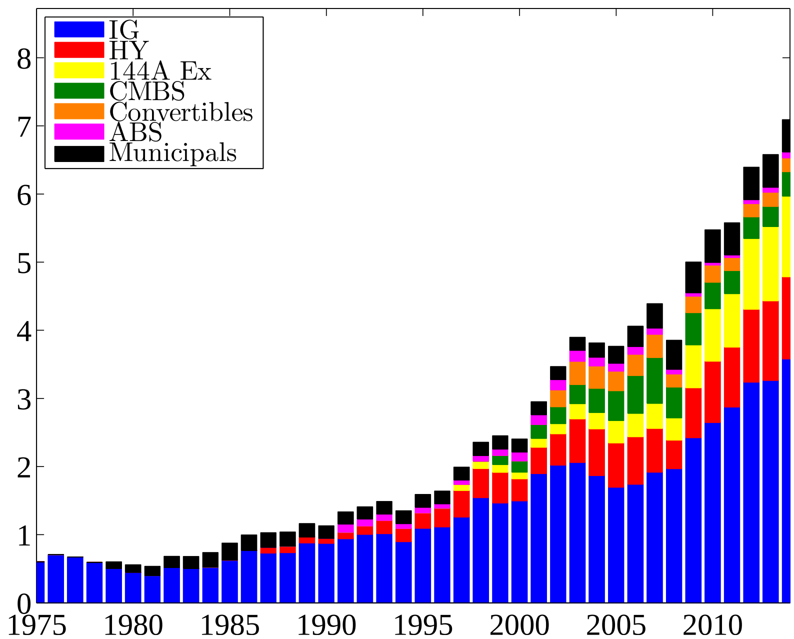
Table 8: **Model Implications for Asset Prices**

		Model					
Moment	Data	Median	2.5%	5%	95%	97.5%	*Pop*
			Risk-Free Return:				
$E(r_f)$	0.86	1.64	0.31	0.53	2.43	2.61	1.65
$\sigma(r_f)$	1.78	0.82	0.42	0.46	1.36	1.49	1.04
			Asset Return:				
$E(r_d)$	6.42	6.25	0.24	1.78	10.52	11.81	6.13
$\sigma(r_d)$	12.00	12.08	7.72	8.24	19.68	22.23	12.95

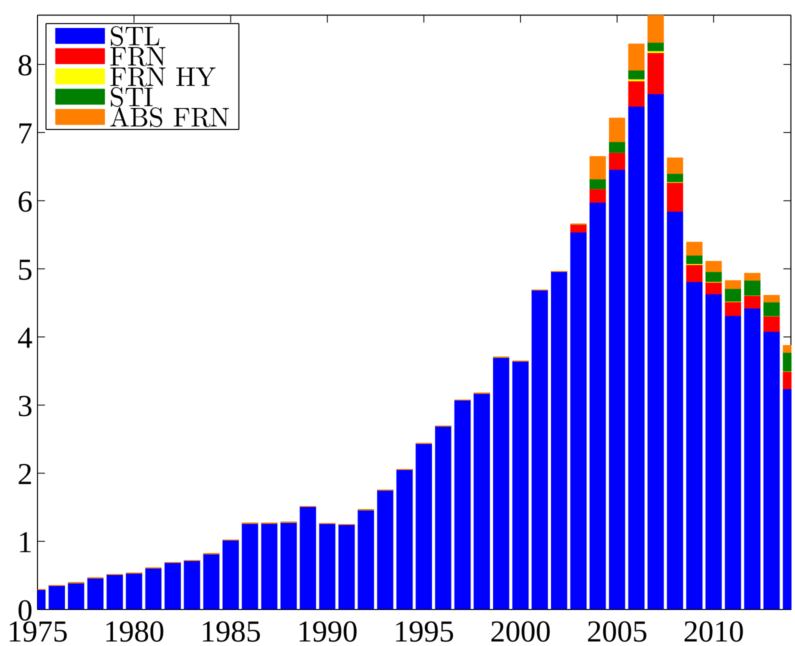
The Table reports the data and model properties of the real risk-free rate and the asset return. The summary statistics in the data are computed in the annual sample from 1975 to 2014. The median and 2.5%, 5%, 95%, and 97.5% values capture the model moment distributions across the small samples whose size equals the data. Population values correspond to a long simulation of the model. Means and volatilities are expressed in percentage terms.

Figure 1: **Debt Market Capitalization**

(a) **Long-Term Debt**

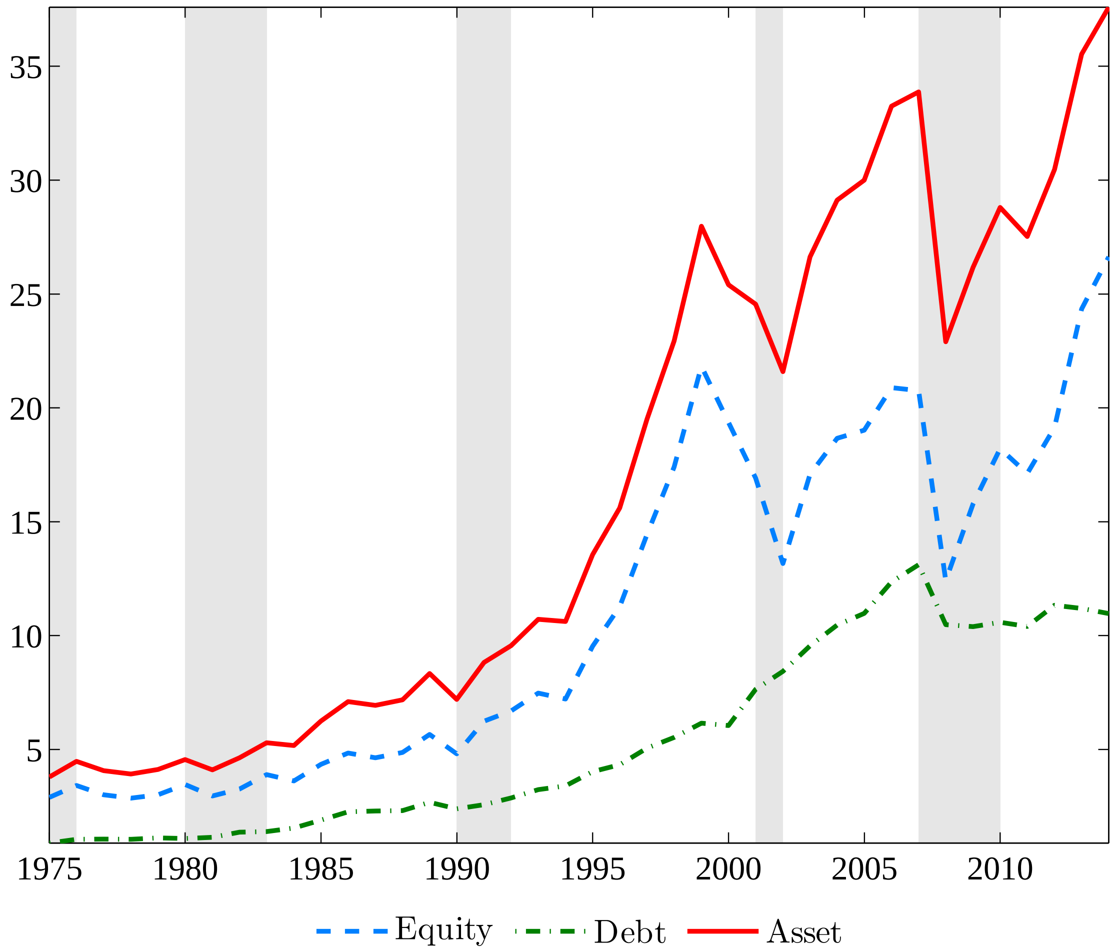


(b) **Short-Term Debt**



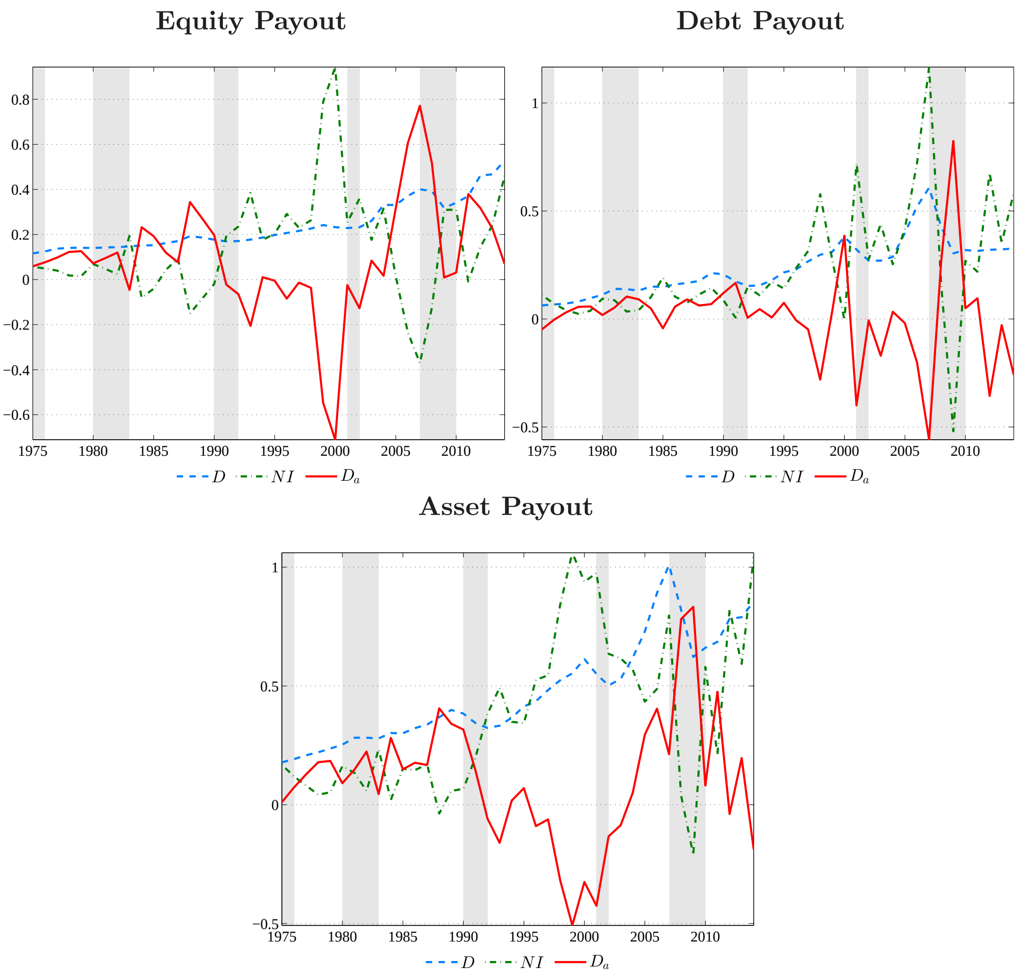
The Figure shows the market value of the components of the long-term and short-term corporate debt. The data are real annual observations from 1975 to 2014, and are expressed in trillions of December 2009 dollars.

Figure 2: **Asset Market Capitalization**



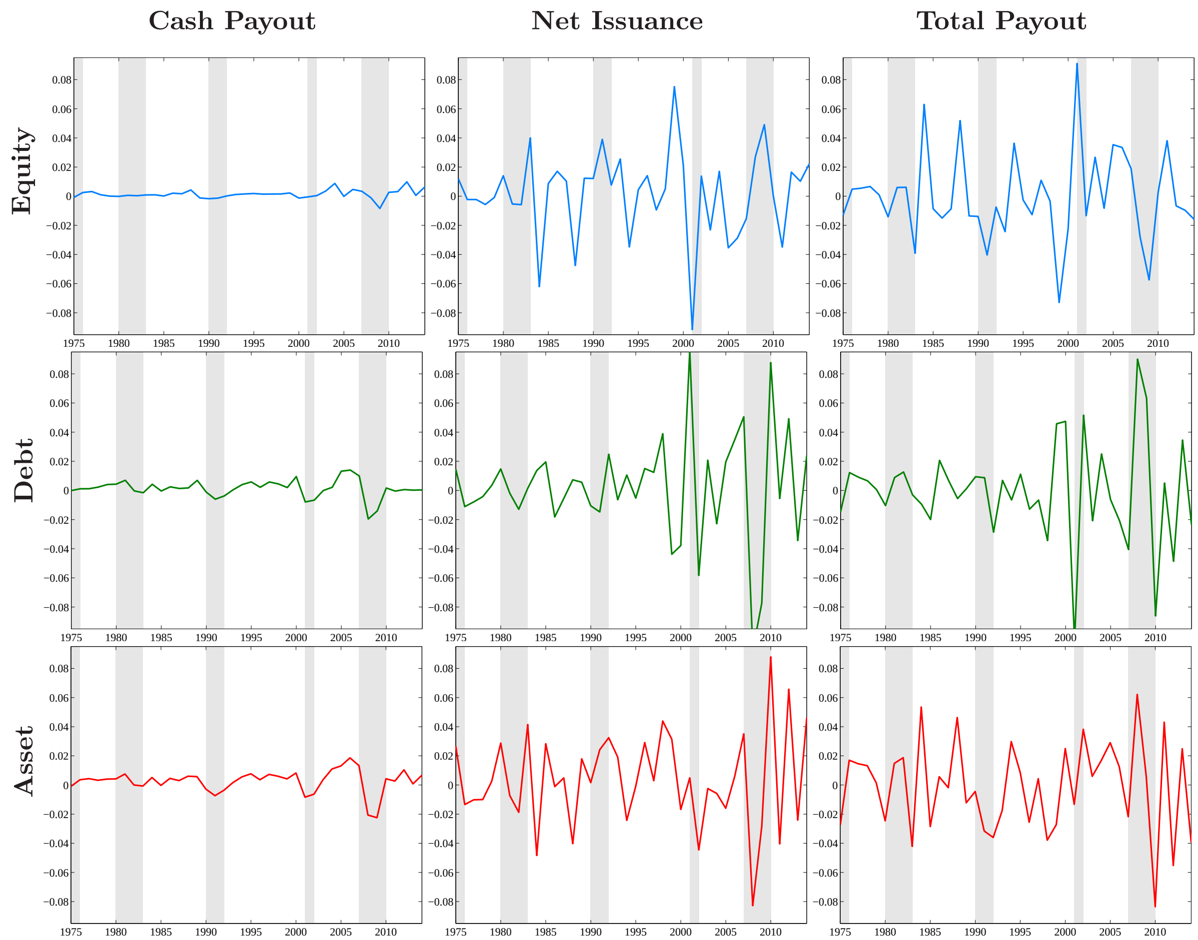
The Figure shows the market values of equity, debt, and assets. Grey bars indicate the NBER recessions. The data are real annual observations from 1975 to 2014, and are expressed in trillions of December 2009 dollars.

Figure 3: **Equity, Debt, and Asset Payouts**



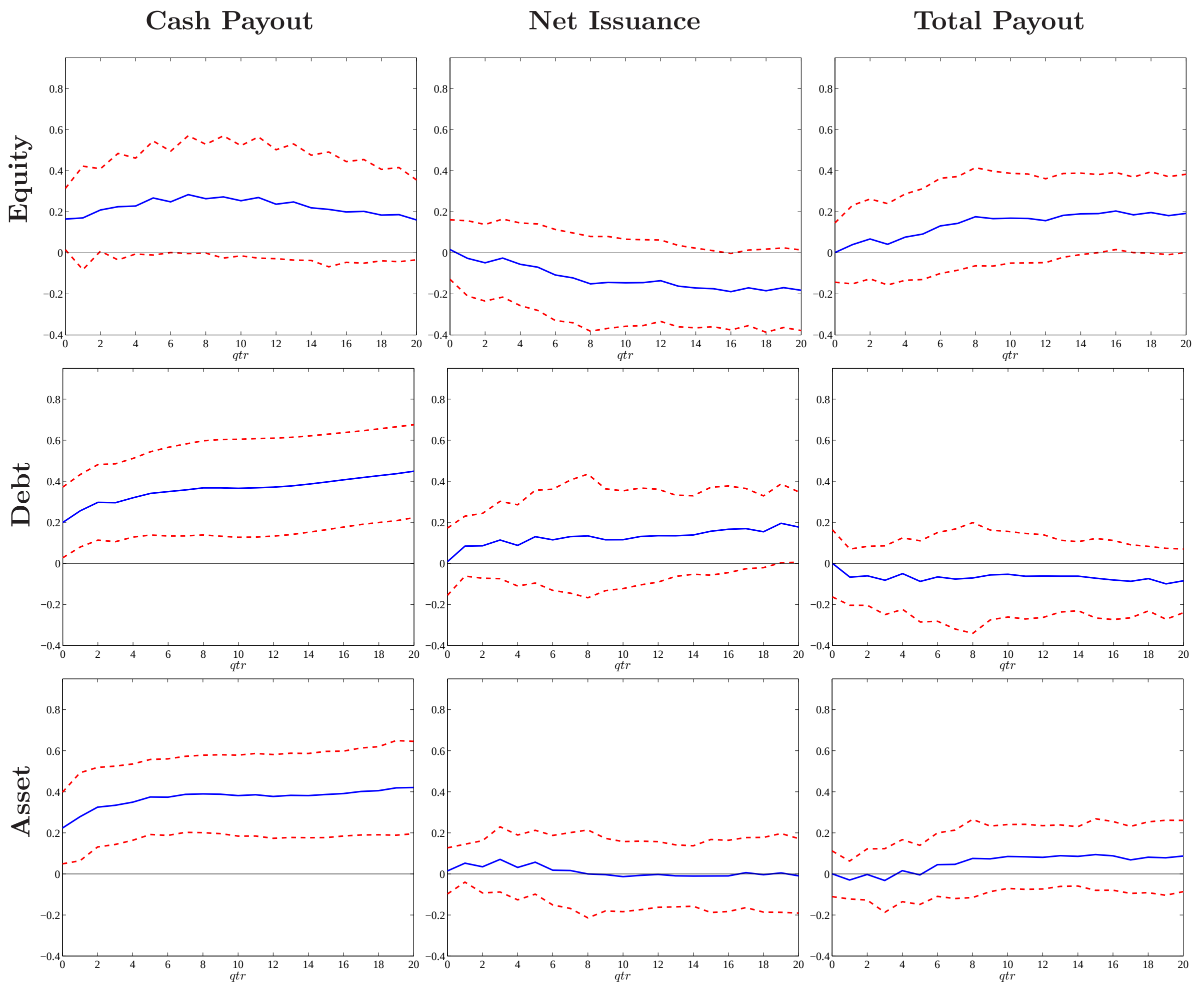
The Figure shows equity, debt, and asset payouts. The payouts include cash, net issuances, and total payouts. Grey bars indicate the NBER recessions. The data are real annual observations from 1975 to 2014, and are expressed in trillions of December 2009 dollars.

Figure 4: **Changes in Equity, Debt, and Asset Payouts**



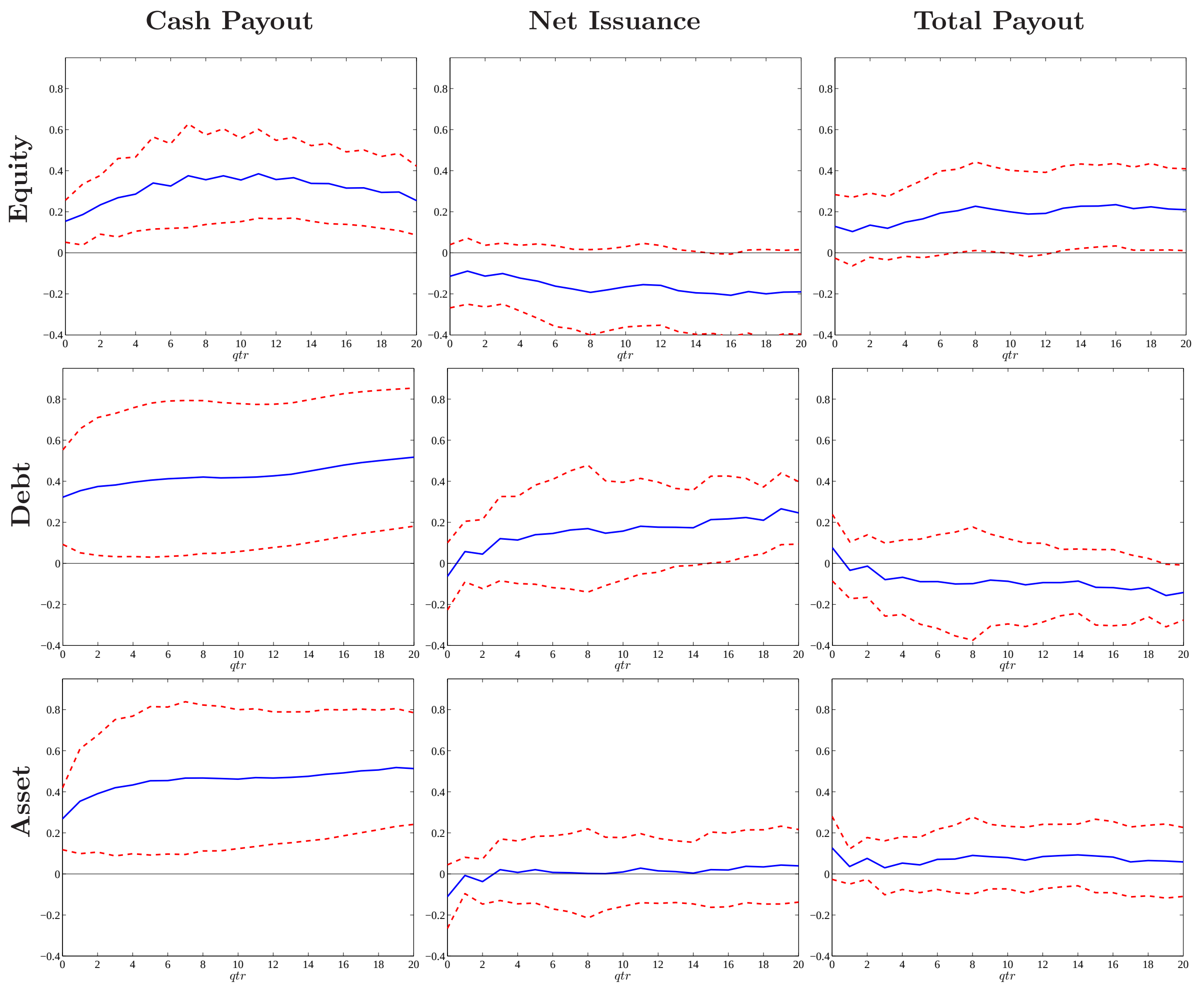
The Figure shows changes in equity, debt, and asset payouts, scaled by the consumption level. The payouts include cash, net issuances, and total payouts. Grey bars indicate the NBER recessions. The data are real annual observations from 1975 to 2014.

Figure 5: **Term Structure of Payout Cyclicality (Consumption)**



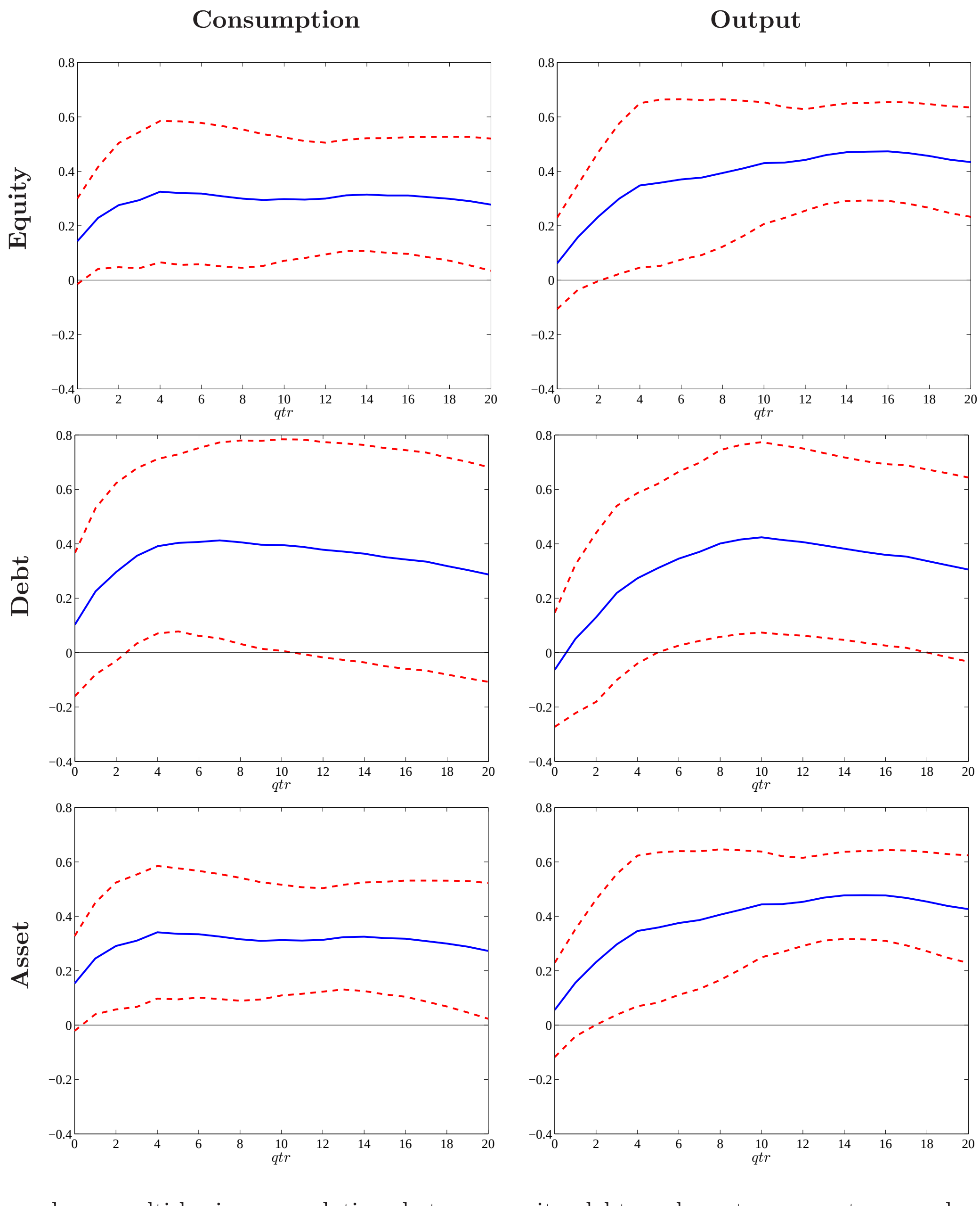
The Figure shows multi-horizon correlations between equity, debt, and asset payouts and consumption growth. The payouts include cash, net issuances, and total payouts. The data are real quarterly observations from Q1.1975 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 6: **Term Structure of Payout Cyclicality (Output)**



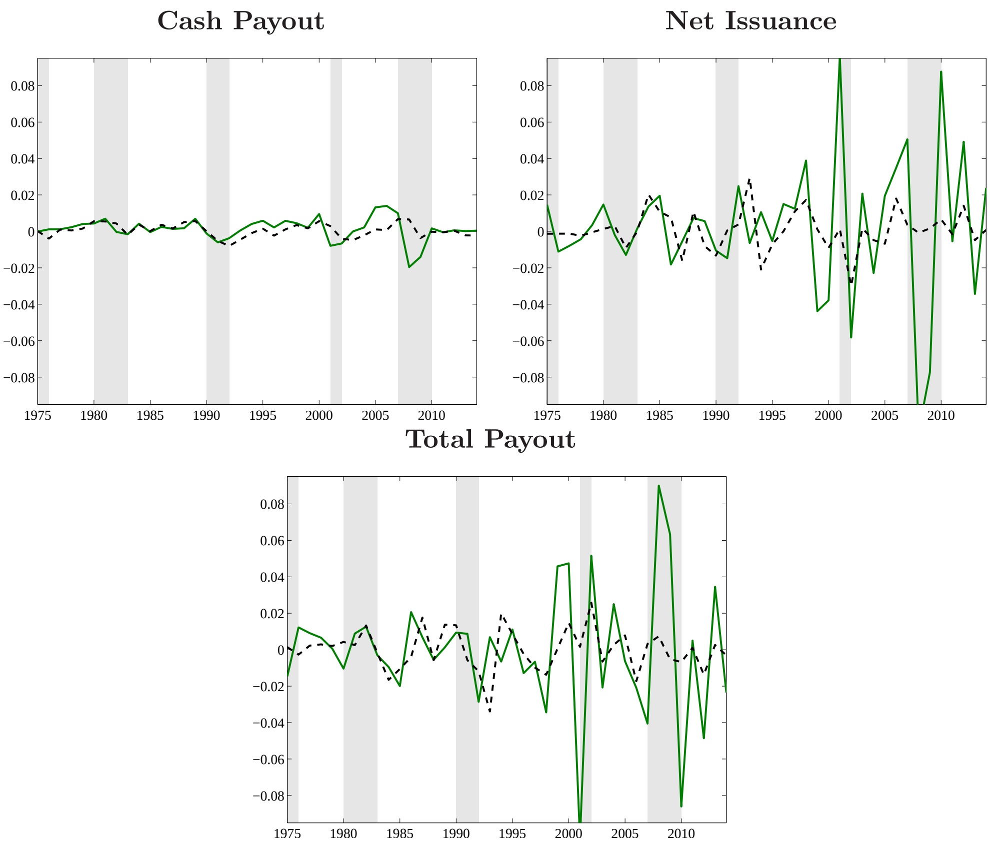
The Figure shows multi-horizon correlations between equity, debt, and asset payouts and output growth. The payouts include cash, net issuances, and total payouts. The data are real quarterly observations from Q1.1975 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 7: **Term Structure of Return Cyclicality**



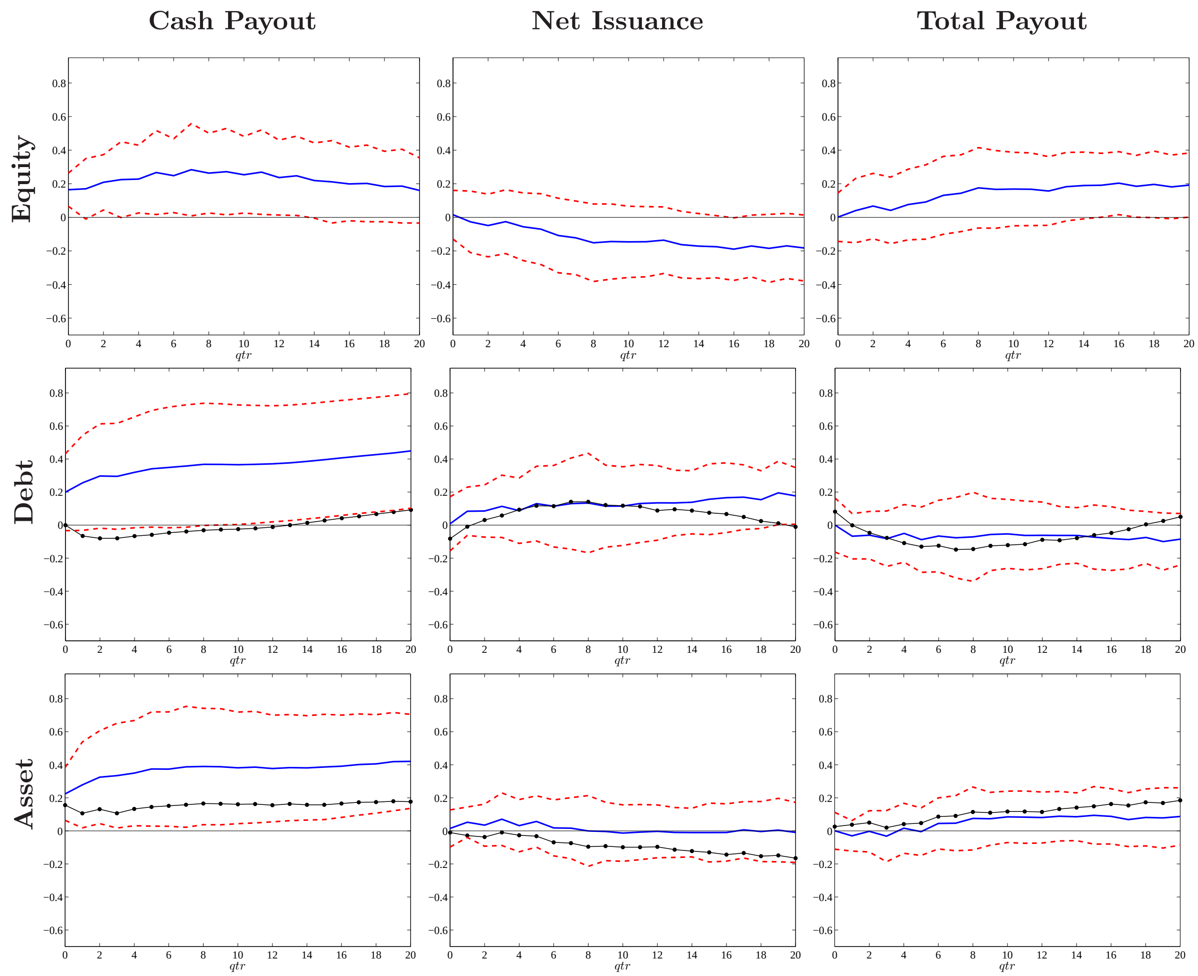
The Figure shows multi-horizon correlations between equity, debt, and asset excess returns and measures of economic growth, such as consumption (left panels) and output (right panels). The data are real quarterly observations from Q1.1975 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 8: **Change in Debt Payouts: Book and Market Values**



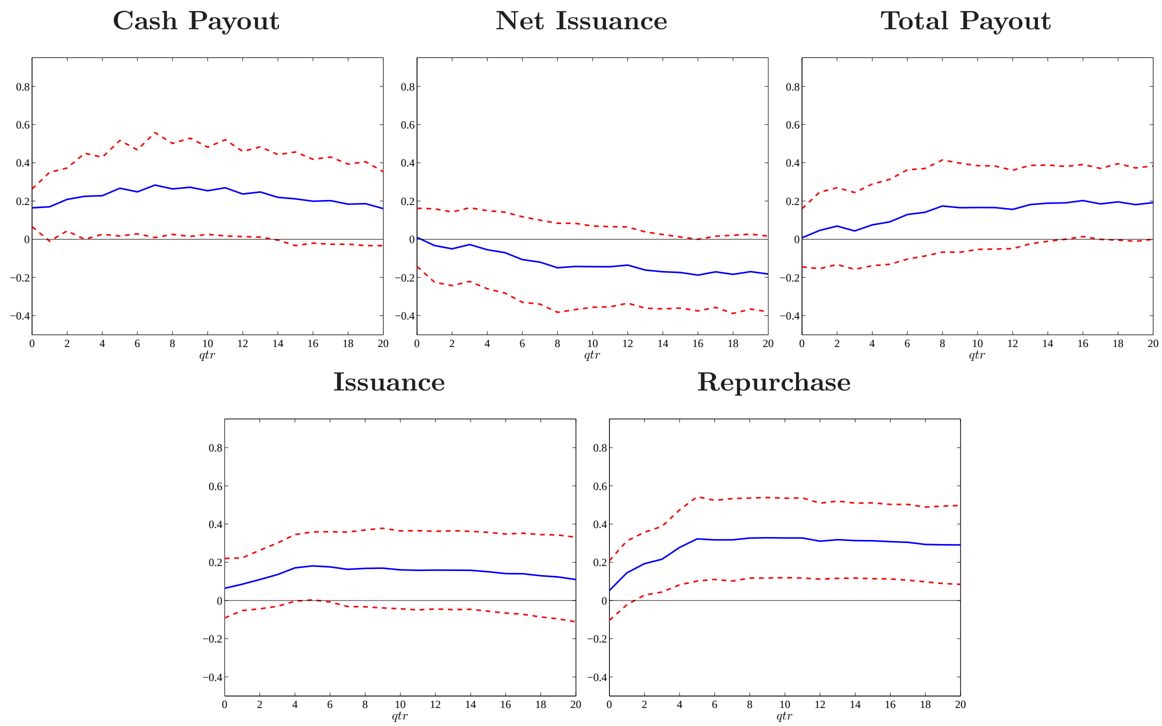
The Figure shows changes in debt payouts, scaled by the consumption level, and computed using the market (solid line) or book (dashed line) values. The payouts include cash, net issuances, and total payouts. Grey bars indicate the NBER recessions. The data are real annual observations from 1975 to 2014.

Figure 9: **Term Structure of Payout Cyclicality: Book Values of Debt**



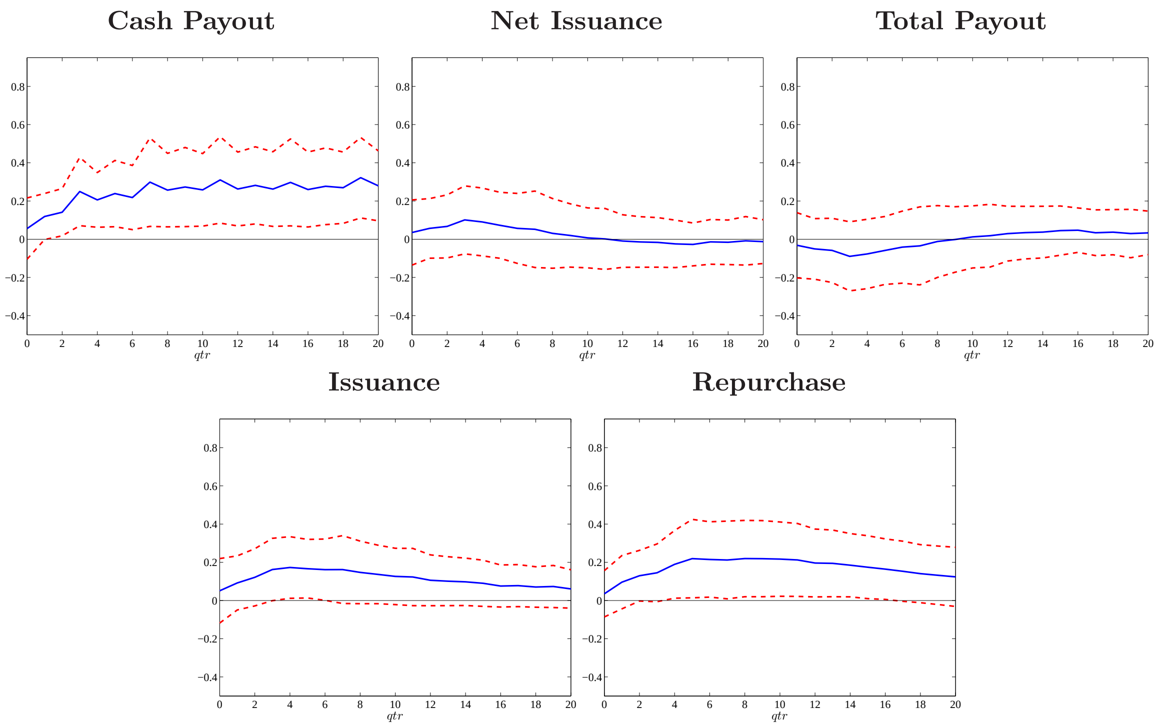
The Figure shows multi-horizon correlations between equity, debt, and asset payouts and consumption growth. Debt payouts are computed using the market (solid line) or book (dashed line) values. The payouts include cash, net issuances, and total payouts. The data are real quarterly observations from Q1.1975 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 10: **Term Structure of Equity Payout Cyclicality: 1975-2014**



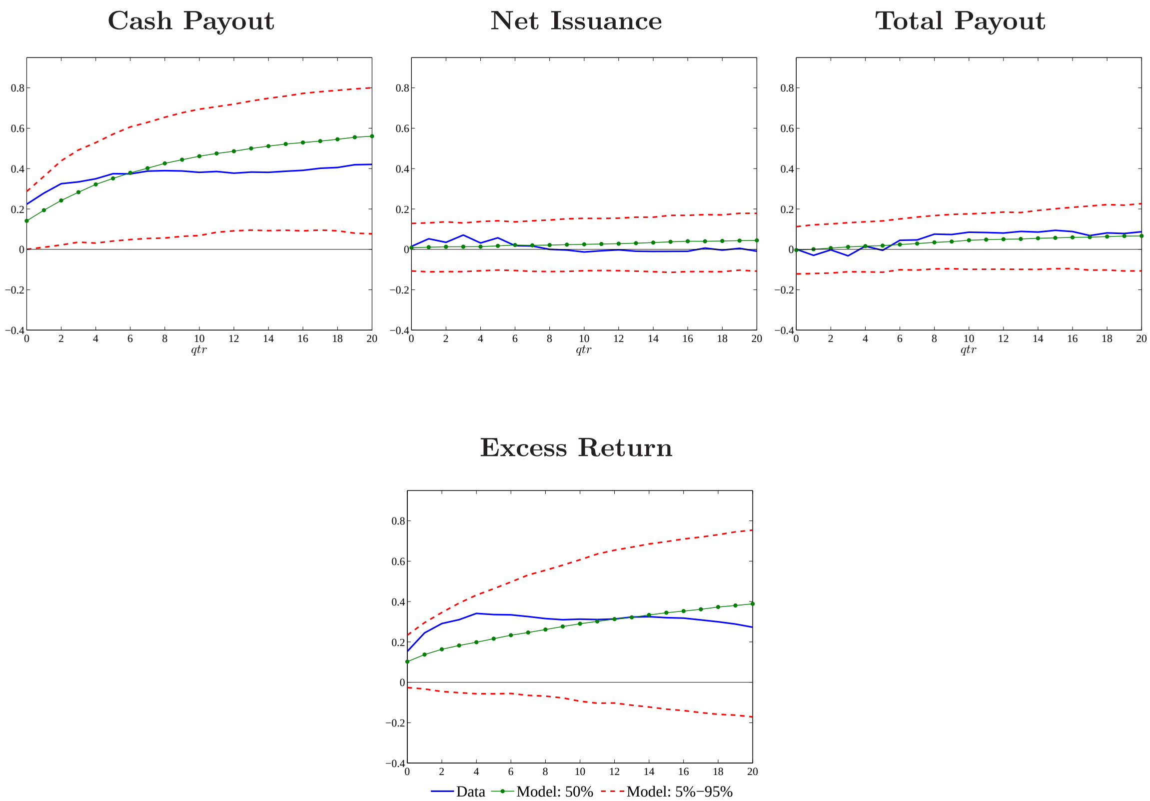
The Figure shows multi-horizon correlations between equity payouts and consumption growth. The payouts include cash, net issuances, issuances, repurchases, and total payouts. The data are real quarterly observations from Q1.1975 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 11: **Term structure of Equity Payout Cyclicality: 1949-2014**



The Figure shows the multi-horizon correlations between components of equity payout and consumption growth. The Figure shows multi-horizon correlations between equity payouts and consumption growth. The payouts include cash, net issuances, issuances, repurchases, and total payouts. The data are real quarterly observations from Q1.1949 to Q4.2014. The standard errors are Newey-West adjusted.

Figure 12: **Model Implications for Payout and Return Cyclicality**



The Figure shows multi-horizon correlations between asset payouts and consumption growth, and excess asset returns and consumption growth in the data and in the model. The payouts include cash, net issuances, and total payouts. The data (solid line) are real quarterly observations from Q1.1975 to Q4.2014. Model median (circles) and 5-95% confidence interval (dashed line) are based on a long simulation of the model.