Ferdinand, The Unpredictable Bull

Cash Flow Behavior During U.S. Recessions - An Event Time Analysis

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Abstract:

The paper uses an event study approach to investigate the behavior of aggregate cash flows and prices in the U.S. stock market around recessions. Aggregate prices anticipate low aggregate dividend and economic growth until adjusting for the diverse time measurement methodologies. Once adjusted, aggregate prices fall contemporaneously with aggregate cash flow measures at the onset of recessions. Prices drop substantially more than dividends. We find the inverse is true for net repurchases. This indicates a misalignment in the present-value relationship between aggregate prices and aggregate cash flows around U.S. recession event time. Further, the predictive power of recessions by the aggregate unadjusted price-dividend ratio is lost when substituting the cash flow component with aggregate net repurchases and net payout.

Keywords:

Event Time Study, Net Repurchases, Aggregate Dividends, Net Payout, Predictability Of The Price-Dividend Ratio

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1. Introduction

We study how cash flows distributed to equity holders behave in the US financial market during U.S. recessions between 1968 and 2001 by examining an aggregate view of quarterly dividends, prices, net repurchases, and net payouts in the S&P 500 index. Applying an event time study approach, we align data relative to the peaks of each business cycle, and average the values between the six economic recessions. Our analytical process is twofold. First, we examine the patterns of the individual aggregate variables. Secondly, we investigate the predictability of the aggregate price-dividend ratio as it is altered by time adjustments, and incorporates net repurchases or net payouts.

We find that, on average, aggregate dividends fall by 6.16% while aggregate prices decrease by 21.87% from the beginning of the recessions to four quarters out. This reveals an excess drop in aggregate prices compared to aggregate dividends. These disproportionate drops can be attributed to either the present value relationship, expected returns and dividend growth, or an incomplete measurement of cash flows paid to equity holders. The former is proposed by Campbell and Shiller (1988), we choose to investigate the latter. More specifically we look at net repurchases and net payout (the sum of net repurchase and dividends) as additional measurements of cash flows paid to equity holders.

We show that the price-to-dividend ratio predicts recessions in the U.S. six recession sample. However, prices are measured to reflect timing in the moment, while dividends are measured over a 12 month period. This “time aggregation bias” mentioned in (Working, 1960; Taio, 1972) gives rise to this predictability of prices. Using the approach Kroencke (2022) employs on a per-share basis, after accounting for the time-aggregation bias phenomenon in the measurement of aggregate prices, the adjusted price-dividend ratio is void of recession predictability.

To supplement our analysis of aggregate dividends, we incorporate aggregate net repurchases. We intend to treat aggregate dividends and aggregate net repurchase equally by following the same methodology for both. We find aggregate net repurchases fall significantly more than aggregate dividends, dropping 125.59%[1] in the first four quarters from the beginning of the recession. Further, we find that the predictability of recessions using the unadjusted ratio, in this case price over net repurchases, is lost. This is due to the substantial volatility of net repurchases around recessions and its excess decreased cumulative growth rate compared to prices.

To incorporate and analyze a full sample of payouts to shareholders we sum aggregate net repurchases and aggregate dividends which yields net payout. The drop in aggregate net payout post recessions is deviates less than that of net repurchase, but still substantially more decreased growth rate in aggregate dividends. Similar to net repurchases, the unadjusted price to net payout ratio lacks predictability; the seemingly aggressive bull loses his predictive behavior as he *cash flow adjusts* under the cork tree.

[1] Values have been shifted to their local peaks to y=0 making it possible to observe a negative cumulative log change of over 100%.

This study finds that all aggregate component measures decrease during recessions. Aggregate net repurchases drop the most, followed by net payouts, price and lastly dividends. By incorporating these component measures into ratios we reveal that the price-dividend ratio loses predictability after accounting for time aggregation bias, however the price to net repurchase ratio and the price to net pay payout measure fails to predict recessions regardless of accounting for the time aggregation bias. Likewise, dividends along with the additional components of net repurchases and net payout support Campbell and Shiller's (1988) previous findings that prices do not drop contemporaneously with the cash flow components. This results in the discrepancy in the present-value relationship that investors hold, implying that either expected returns or the expected future net payout growth vary considerably during recessions.

1.1 Background and Related Literature

Kroencke (2022) studies the behavior of per share dividends and prices as stock market drivers around recessions. Our research furthers this analysis by using an aggregate approach and including net repurchases and net payout in Kroencke's recession event time framework.

Repurchases refer to a company buying back its own stock, leading to a decrease in the total number of its outstanding shares. Repurchases are argued to be a substitute for dividends as a method to distribute cash to equity holders, generating popularity over recent decades (Grullon, Gustavo, and Roni Michaely, 2002). The substantial increase for firms using repurchases can largely be attributed to the enactment of SEC rule 10b-18 in 1982 which, in short, legalized stock buybacks by not directly attributing them to stock manipulation (Grullon et al., 2002).

Boudoukh, Michaely, Richardson, and Roberts (2007) suggest that the concept of present value relationship is related to the distribution of all cash flows to equity investors rather than only dividends. Thus, they reinforce the notion that it's important to include stock repurchases in the analysis when considering the relationship between yields and expected returns. To incorporate cash flows from investors to the firm, we also include equity issuances on top of repurchases to arrive at net repurchases. Ultimately the net repurchases are then added to dividends, arriving at a complete net payout. The substitutional behavior of repurchases and dividends allows us to analyze the behavior of net repurchases as well as net payout around recessions by themselves and in relation to stock market price in a similar manner as dividends.

Recent research, such as Pruitt (2023), shows that the present value identity can be applied towards stock buybacks and issuances in addition to dividends. Pruitt builds off Campbell and Shiller's (1988) research. Campbell and Shiller, as well as other studies such as Muir (2017), find that the ratio of stock prices to dividends does not predict the future growth of dividends. This suggests that deviations in the price to dividend ratio, during events like economic recessions, are likely due to a change in investors expected returns rather than an anticipation in the change of dividend growth. Inspired by Pruitt's approach, we focus on supplementing dividends with net repurchases and net payouts. Doing this allows us to use net repurchases and net payout as two additional means to analyze the cumulative growth of cash flows to equity holders around recessions.

As such our fundamental question concerns how aggregate cash flows and prices within the S&P 500 behave around recessions. The focus is on dividends and stock repurchases as key methods of cash flow distributions to shareholders which are then jointly analyzed as net payouts.

We conduct an event study approach to analyze aggregate cash flow payout methods around U.S. recessions. We choose not to include recessions defined by war, crisis, or rampant inflation to avoid biasing our results with non-economically driven events. Our study focuses on the S&P 500, as it allows us to directly contribute to Kroencke's (2022) findings. By delimiting our study to the S&P 500 we are able to access similar raw datasets, albeit from different data providers.

To construct our aggregate prices, dividends, and net repurchases we utilize a "bottom-up" approach. This entails extracting our measures on an individual firm level and then constructing aggregate measures through summing them across firms. In that way we reconstruct the S&P 500 to extract our variables. This deviates from the conventional "top-down" approach, used by Kroencke (2022), which typically involves directly extracting variables from an index. Using the bottom up to reconstruct the S&P 500 allows us to aggregate net repurchases. However, we leverage the top down approach to gather an extended sample and test if our conclusions made using the bottom up approach are robust.

Related Literature: Our paper mainly contributes to Kroencke (2022). He analyzes the economic mechanisms that drive stock prices around non-financial crisis recessions using an event study approach. Kroencke leverages dividends as the sole variable when investigating the present-value relationships, contributing the excess drop in prices compared to dividends to their expected returns. Kroencke solely analyzes dividends as a measure of cash flows being paid out to equity holders, and does not mention other possible payout methods which could be affecting his analysis. Our paper aims to fill this gap in Kroenke's literature. We also use an event study approach to study the potential economic mechanisms that drive the stock market around "normal" recessions, but have a different view on these mechanisms. We build upon Kroencke's analysis by adopting a broader perspective on cash flows distributed to shareholders, incorporating an analysis of net repurchases and net payout alongside dividends.

Various literature contributes to the analysis of cash flows paid out to equity holders. Boudoukh et al. (2007) argues that asset pricing frameworks should consider using total payouts instead of solely analyzing dividends. They demonstrate that the ratio of repurchases to total payouts in regards to aggregate cash flows received by corporate shareholders rose to nearly 50% by 2003. Stating that the perceived reduction in dividend yields as a predictor of equity returns is largely a result of mismeasurement due to the exclusion of net repurchases. He discovers that the most robust relation is found between return and net payout yields. We adopt their insights and examine net payout, and net repurchases as components of stock market drivers around recessions.

Compared to Kroencke, we aggregate all variables using a "bottom-up" approach to include net repurchases instead of handling them on a per share basis. We calculate prices and dividends in the same approach to have uniformity across sample and scale. Thus we further contribute to Kroencke by using the same event study approach to study aggregate prices and dividends on a separate sample around recessions. This is further supported by Boudoukh et al. (2007) who conclude that the growth rate of total payout rather than dividend growth rates should be analyzed at both the individual firm and aggregate level.

Previous literature such as Floyd, Li, Skinner (2015) choose to segregate or exclude financial firms from payout analysis. The choice to exclude or segregate financial firms is done because they include a different payout structure compared to nonfinancial firms. When reconstructing the S&P500 using the bottom-up approach, we choose to include all of its constituents across the time period, even financial firms. This approach is deliberately chosen to minimally diverge from accurately reconstructing the complete S&P 500. This method is in line with that of Kroencke (2022), who similarly analyzes the S&P 500.

Sabbatucci (2022) makes the argument that "the majority of individual shareholders does not receive any cash when buy back transactions occur" for example many individual shareholders do not participate in buybacks and do not directly tender their shares. Our analysis does not delve into the difference between individual shareholders, and the aggregate economy perspective. Following Koijen and Van Nieuwerburgh's (2011) perspective, it is crucial to emphasize that our analysis focuses on investors involved in all stock repurchases. Consequently, we aggregate our net repurchases to reflect cash flows on a broader, economy-wide scale.

Section two outlines our data collection, handling, and methodology. Section three presents our findings, as well as two robustness tests. We then discuss implications, limitations, and future research prospects, and finally end with a conclusion.

2. Data Collection, Description and Econometric Methodology

We begin by describing our methodology for gathering aggregate stock market data by reconstructing the S&P 500 using the "bottom-up" approach. Next, we log and demean our data. Finally we use real GDP as a proxy for our event time analysis to define business cycle peaks as well as explain our statistical approach which we apply in the empirical results.

2.1 Gathering Aggregate Prices, Dividends, Net Repurchases, and Net Payout

We rely exclusively on the Center for Research in Security (CRSP) to rebuild an aggregate dataset of the S&P 500 index with firm specific data on prices, dividends, net repurchases, and net payouts. For the specific data set we rely on the annually updated dataset sampled at the monthly frequency, which we then convert to quarterly data for our analysis.

Rebuilding the S&P 500 Portfolio: Extracting data through the "top-down" approach from an index has been extensively used in previous literature such as Kroencke (2022). However, this approach falls short in accurately deriving data on net repurchases or payouts. Instead, we construct our own database from the individual firm level constituents of the S&P 500. This firm-level data contains the necessary granularity for us to be able to aggregate and then calculate net repurchases and net payout on a monthly basis.

We combine two data sets to reconstruct a bottom-up view of aggregate prices, dividends, net repurchases, and net payout. First, CRSP provides us with a monthly list of S&P 500 constituents dating back to 1960 which includes start and end dates indicating when an individual firm is part of the index. Second, based on the list of monthly constituents, we extract CRSP firm specific data, ie. every firm's required variables from 1960 and onwards on a monthly basis.

Having extracted firm specific prices, dividends, and net repurchases on a monthly firm level, we reference the other data set which contains the start and end dates of when firms have been part of the S&P 500. We create a new data set adding only a firm's data for a certain month if that month coincides with the start and end date of being a constituent in the S&P 500. The data is then grouped by a monthly date and summed, yielding an aggregate monthly data set of all S&P 500 constituents from 1965 and onwards.

The price variable PRC in CRSP is defined as either the "price on the last trading date of the month" or "the bid/ask average for a trading day" denoted as a negative value "-" to separate it from the former. To counter this placeholder negative sign, we take the absolute value of all prices resulting in a uniformly positive price for each month. Additionally, to ensure unbiased results, any PRC observation recorded as zero is converted to NaN. Since we are using an aggregate index approach rather than per share, we extract the monthly amount of shares outstanding through a variable called SHROUT. Since SHROUT is given in thousands, we multiply each variable by 1,000. To make the data comparable at different times during the history of a security we adjust for split events. CRSP dataset allows for such adjustments through the cumulative factor to adjust price (CFACPR) and shares (CFASHR).

For every firm i, for every month t

$$\mathrm{p}_{i,t} = \frac{\mathrm{PRC}_{i,t}}{\mathrm{CFACPR}_{i,t}}$$

$$\mathrm{SHR}_{i,t} = \mathrm{SHROUT}_{i,t} \cdot \mathrm{CFASHR}_{i,t}$$

To construct the aggregate price component (MCAP), we then calculate the total market capitalization of every firm at the end of every month. This is done by multiplying its adjusted end of period price with the adjusted amount of shares outstanding.

Although CRSP does not provide a specific variable for aggregate ordinary dividends, we can compute this amount by employing the methodology outlined by Pruitt in 2023. Using

CRSP, we calculate dividends per share by first subtracting the holding period return without dividends (RETX) from the holding period return (RET). RETX excludes ordinary dividends and certain other regularly taxable dividends. Therefore, only when CRSP classifies a dividend as non-ordinary do the returns with and without dividends match, resulting in the dividend amount being zero.

$$RET_{i,t} - RETX_{i,t} = \left(\left[\frac{p_{i,t} \cdot f_{i,t} + d_{i,t}}{p_{i,t-1}}\right] - 1\right) - \left(\left[\frac{p_{i,t} \cdot f_{i,t}}{p_{i,t-1}}\right] - 1\right)$$

$$RET_{i,t} - RETX_{i,t} = \frac{d_{i,t}}{p_{i,t-1}} \tag{1}$$

The ratio in Equation (1) demonstrates the dividend contribution to the total return. To collect the aggregate amount of dividends we multiply this ratio by the aggregate price of the month before.

$$d_{i,t} = (RET_{i,t} - RETX_{i,t}) \cdot MCAP_{i,t-1}$$

Since we need one month's lagged values to calculate the dividends, we fill in missing PRC and SHROUT observations using the previous month's data to avoid miscalculating dividends when multiplying by zero. This forward-fill gap method, which Pruitt (2022) also leverages, adds an additional 4,766 and 1,333 PRC and SHROUT observations respectively. Allowing us to extract a complete sample of aggregate dividends.

Employing a bottom-up approach to extract dividends deviates from the conventional method of directly capturing time-aggregate dividends, used by Kroencke (2022). Subsequently, we sum a trailing 12 month dividend value, yielding the time aggregated dividend to account for seasonality effects.

An alternative method to extract dividends based on the CRSP monthly stock-level data set leverages CRSP distribution codes (DISTCD) and applicable dividend amount (DIVAMT). CRSP defines dividends with distribution codes (DISTCD) starting with 1,000's as ordinary dividends. Thus whenever DISTCD = 1,000's, the DivAmt equals our previously extracted dividend for that month. This relationship between monthly return and DIVAMT extraction is demonstrated in Pruitt (2022). We validate this relationship in the robustness section, and add liquidation dividends on top of ordinary dividends to see how our results change. Our results show minimal effect using this alternative method for extracting dividends and adding liquidation dividends.

Net repurchases are defined as repurchases subtracted by equity issuances. To calculate net repurchases, we use Boudoukh (2007) alternative net payout definition which stems from Goyal and Welch (2005) and Fama and French (2005). We calculate net repurchases by taking the monthly difference in split adjusted shares outstanding, multiplied by the average split adjusted share price between these two months, and negating this output.

$$NRE_t = -\frac{1}{2}\left((\mathrm{SHROUT}_t \cdot \mathrm{CFACSHR}_t - \mathrm{SHROUT}_{t-1} \cdot \mathrm{CFACSHR}_{t-1}) \cdot (\mathrm{Prc}_t/\mathrm{CFACPR}_t + \mathrm{Prc}_{t-1}/\mathrm{CFACPR}_{t-1})\right)$$

This measure's limitation lies in its inclusion of issuances that don't produce cash flows, such as acquisitions or stock grants. However, it enables us to measure net repurchases beginning in 1960, thus enhancing the comprehensiveness of our analysis.

Since we want to compare dividends with net repurchases, we want to treat the two identically to each other and also account for the seasonality effects of net repurchases. Thus, we take the 12 month rolling sum of net repurchases, as we did for dividends, resulting in time adjusted net repurchase. Next, aggregate net payout is calculated by summing the aggregate net repurchases with the aggregate dividends. Lastly, all variables are inflation adjusted using 2017 as a base year as it is a recent and economically stable date not biased by crisis events such as war, rampant inflation, or Covid-19.

Having computed real monthly aggregate market cap, dividends, and net repurchases of S&P 500 constituents on a monthly firm level from 1960 and onwards, we sum the monthly data sets into a quarterly view to align with our quarterly event time methodology. Our approach to cash flow summation is consistent with Campbell and Shiller's (1988) methodology, favoring a zero-rate between months instead of compounding each month's cash flows by the risk-free rate until the end of the quarter before summing them.

2.2 Logarithmic Normalization and Accounting for Time Fixed Effects

Once the data is in an aggregate quarterly view, we compare the disproportionate variables with each other by analyzing their change. We do this by demeaning the cumulative log change (DCLC) of our variables (c) as seen in Equation (2) and (3). As the equations show, we first find the log change mean (μ) based on the data sets range. This calculated mean is subsequently subtracted from each individual change. Adopting this approach allows us to effectively analyze all components by normalizing the data. Additionally by demeaning the then normalized data we are able to account for time-fixed effects.

Using recessions between 1968-2001, we will look at a 25 quarter range surrounding each recession; as such our dataset will include values dating twelve quarters before 1968 and twelve quarters after 2001. To account for these additional quarters we demean the dataset based on a range from 1965 to 2004 rather than 1968-2001.

$$\mu = \frac{1}{n}\sum_{i=1}^{n}\left|\log\left(\frac{c_t}{c_{t-1}}\right)\right| \tag{2}$$

$$DCLC = \log\left(\frac{c_t}{c_{t-1}}\right) - \mu \tag{3}$$

2.3 Graphing Event Times, Adjusted T-Statistic, and Defining the Business Cycle Peak

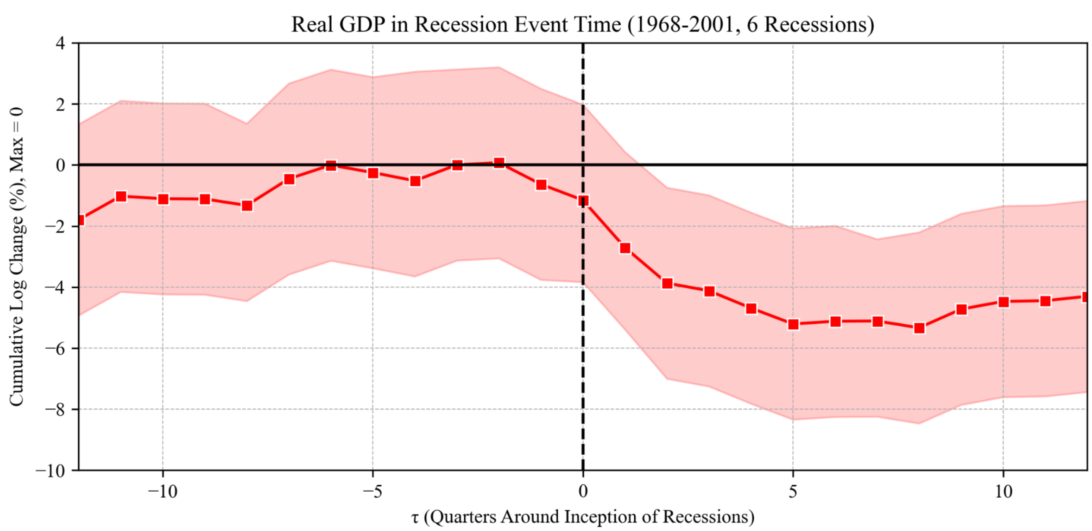
After demeaning and normalizing the data, we take a cumulative mean grouped by event time. The cumulative mean allows us to rearrange the chronologically linear datasets, into an overlapping event-timeview. This is done by identifying recession data within the 25 quarter range of each recession and labeling it with its relative proximity to the recession (from τ=-12 to τ=+12 quarters). If a quarter does not pertain to a specific recession the data point is dropped. We then take the mean of each event time (τ), resulting in a single line graph representing all recessions from 1968-2001. This is shown for real GDP in Figure 1. We use Figure 1 as an introductory example for how the methodology is applied to our empirical results.

To define the recession event time, we rely on the quarterly data provided by the National Bureau of Economic Research (NBER). Between 1965 onwards, NBER identified eight recessions. However, we have chosen to focus our study on the six "normal recessions" in order to avoid biasing the results of economically driven recessions with irregular crisis events. The recession event time associated with financial crises are specifically identified using Muir's (2017) approach. Thus, we remove the financial crisis of 2007, and the Covid Recession of 2019, leaving us with six "normal" recessions to analyze between 1969 and 2001. Alternative methods for defining the recessions exist. We have chosen to align our study with prior literature (e.g., Lustig and Verdelhan, 2012; Muir, 2017; Krockre, 2022) to ensure consistency and mitigate any sample selection biases. To make the graph clearer, we adjust each variable so that its highest point within one year (from τ=-4 to τ=4 quarters) around τ=0 is aligned at a y-axis value of zero. This is shown in Figure 1 as the demeaned cumulative log change, which normalizes the values on the graph, making them easier to compare.

To analyze the significance of our results we follow Kroencke (2022)'s methodology to calculate an altered T-statistics. We compute the T-statistics by dividing the mean cumulative sum of the demeaned log change by the standard error over a specific period, such as minus twelve to minus one quarter from the peak business cycle (shown as -12:-1 in the relevant tables). For periods before the recessions we reference τ=-1, whilst for periods after the start of the recession we reference τ=0. This adjusted T-statistics provides insight into the magnitudes of the cumulative change in relation to the event time or peak business cycle allowing us to observe trends and fluctuations that standard T-statistics may not always reveal. For the T-statistic we used the cumulative sum between a range rather than a single quarters data point, however for τ=-1 and τ=0 we use the relative reference points.

Figure 1: Real GDP during Recession Event Time, Quarterly Data 1968-2001

Figure 1 illustrates the adjusted cumulative log change in real Gross Domestic Product (GDP) in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of real GDP growth, followed by demeaning GDP based on its mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The real GDP data is extracted from the Federal Reserve Economic Data (FRED) repository. GDP has been adjusted for inflation to 2017 dollar values, it is seasonally adjusted at an annualized rate. The data is presented in a quarterly frequency. Furthermore, the figure incorporates a 90% confidence band which is calculated based on the mean values of the dataset.



To confirm that the recession event times are reasonably assumed for our six recession sample, we construct Figure 1, showing the real GDP growth around NBER's recession dates. The graph also allows us to visualize and define when real GDP growth peaks. To clarify the timing of real GDP growth peaks and recession event times, p-values are shown in Table A.1 and the figure presents a 90% confidence interval of the mean in the figure. In recessionary periods from 1968 to 2001, Figure 1 reveals a peak of real GDP growth in quarter τ=-2.

Broadening our scope, we analyze a wider dataset ranging from 1956 to 2001 to include nine "normal recessions. "The extended selection of the 1956 to 2001 period is strategic, representing the longest consistent phase in U.S. economic history devoid of major war-induced recessions or periods characterized by financial crises and rampant inflation. This period, therefore, offers a more representative frame for analyzing economic cycles and trends. Moreover, this choice aligns with the methodology employed in the paper by Krockre (2022), which also utilizes the 1956 to 2001 dataset to define the peak point in the U.S. economic cycle. As seen in Table A.1

this expanded dataset reveals that the peak of adjusted GDP growth occurs at τ=-2. The extended graph is shown in appendix Figure A.1.

However, for both time periods, the decline observed at τ=-2 is not statistically significant, with a T-statistic of -0.35 for the nine-recession set and -0.82 for the six-recession set. In contrast, the drop at τ=-1 is statistically significant, evidenced by a T-statistic of -2.46 for the nine-recession sample and -5.36 for the six-recession sample. To ensure a more precise and historically representative analysis, we base our definition of the GDP growth peak on both time periods. We define the beginning of a recession starting at τ = 0, whilst we define the peak business cycle at τ=-1. We can now use these definitions to analyze our empirical results. If stock prices drop before τ = -1 (the business cycle peak) then stock prices are able to predict real GDP drops during the event time recessions. In summary, the real GDP growth of Figure 1 validates our event time definitions as well as explains how the event time methodology will be deployed for the other variables on our empirical dataset.

3. Empirical Results

This section is split into four sub-sections. We begin by explaining the time aggregation effect. The following two sections analyze the aggregate cash flow components paid out to equity holders along with their respective ratios. Finally, to validate the robustness of our findings, we replicate the analysis using a per share "top-down" approach as done in Kroencke (2022), and examine an alternative dividend measure.

3.1 Addressing Time-Aggregation Bias

When rebuilding the S&P 500 from the bottom up, the monthly data observations are gathered as end-of-month values. To align our methodology with Kroencke (2022) and account for seasonality effects, we take a 12-month rolling sum of the aggregate dividends. This adjustment creates an artificial lag between the end of month extracted stock prices and the 12-month aggregate dividends. This discrepancy fosters an inherent lead-lag dynamic between the two variables, referred to as the time-aggregation bias (Working, 1960; Taio, 1972). To adjust for this time-aggregation bias, we follow Cochrane (1996) and Kroencke (2022). Their approach entails calculating time-aggregated price which counters the lead-lag relationship. We account for the time aggregation bias by calculating a 12-month trailing mean for prices. This gives us two different types of price outputs: the first, a regular end-of-period price, and the second a time-aggregated price. The time-aggregated price is a better comparable to the cash flows paid out by equity holders, as it accounts for the time-aggregation bias.

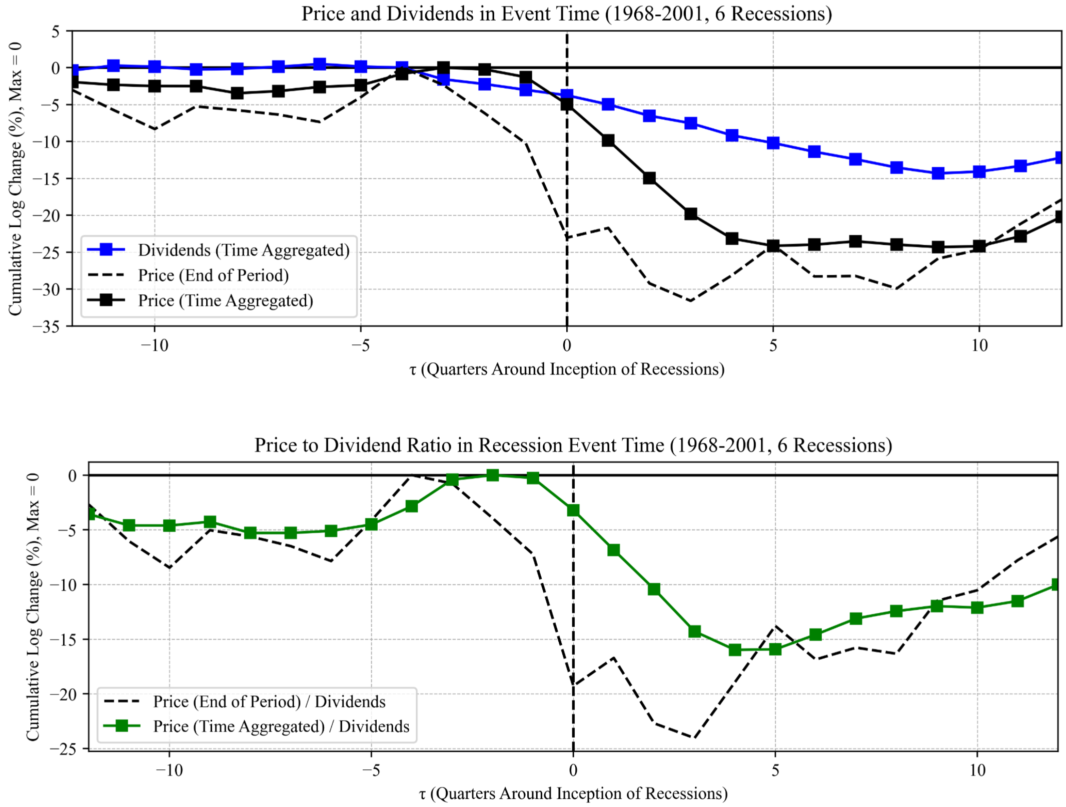
3.2 Comparing Aggregate Stock Prices, Dividends, and Net Repurchases Around Recessions

Figure 2 depicts the S&P 500's price and dividends behavior during six U.S. recessions from 1968 to 2001 along with the price to dividend ratio. To enhance the clarity of the graph we vertically shift all variables to their own local peak within one year (τ=-4 to τ=4 quarters) from τ=0, indicated by a y-axis value of zero. The figure shows the demeaned cumulative log change, which effectively normalizes the graphed values to each other to make them more comparable. Table A.2 in the appendix provides the ranged values for Figure 2 as well as the corresponding T-statistics.

Figure 2 shows how time-aggregated price compares to end of period price around recessions. Our analysis of dividends reveals a parallel decrease with real GDP during recessions and our defined peak business cycle at τ=1. Specifically, dividends show a reduction of -10.52% (T-statistic: -12.73) from the beginning of recession (τ=0) to eight quarters out (τ=+8). The time-aggregated price shown in the upper graph of Figure 2 demonstrates a similar trend. Following the onset of recessions (τ=0), it exhibits a significant decline. Prior to the recessions at τ=-1, the ratio shows a marginal decrease of 1.29% (T-statistic: -1.58). From the start of the recession to four quarters later (τ=+4), there is a substantial cumulative drop of -21.87% (T-statistic: -12.09). Contrastingly, the end-of-period price starts to decline well before the beginning of recessions, from τ=-4 to τ=-1 end of period price drops -6.27 (T-statistic: -0.83) with a meaningful and significant drop three and two quarters before the recession begins. The magnitude of the cumulative price drop is over twice that of the dividends, reinforcing the theory of a significant role in increased expected returns during recessions, consistent with the findings of Lustig and Verdelhan (2012), and Kroencke (2022).

Figure 2: Aggregate Stock Prices and Dividends during U.S. Recession Event Time, 1968-2001

Figure 2 illustrates the adjusted cumulative log change in real aggregate price and dividends in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and dividend growth, followed by demeaning price and dividends based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time-aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and dividend data is extracted from CRSP.

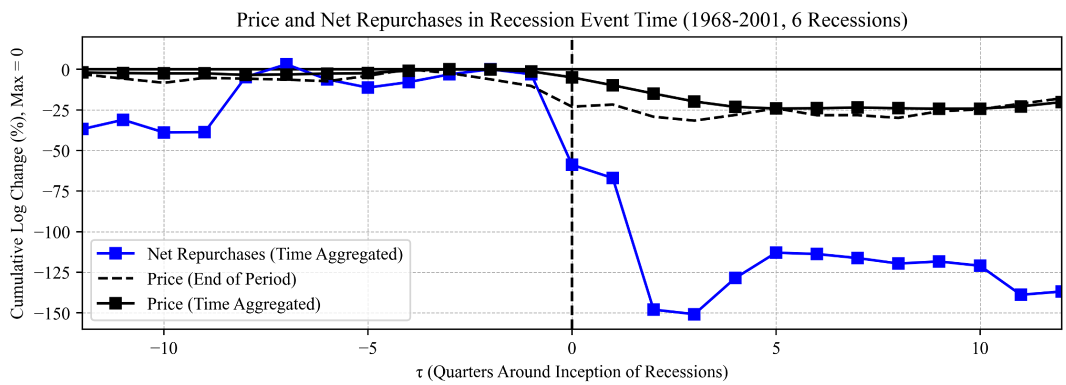


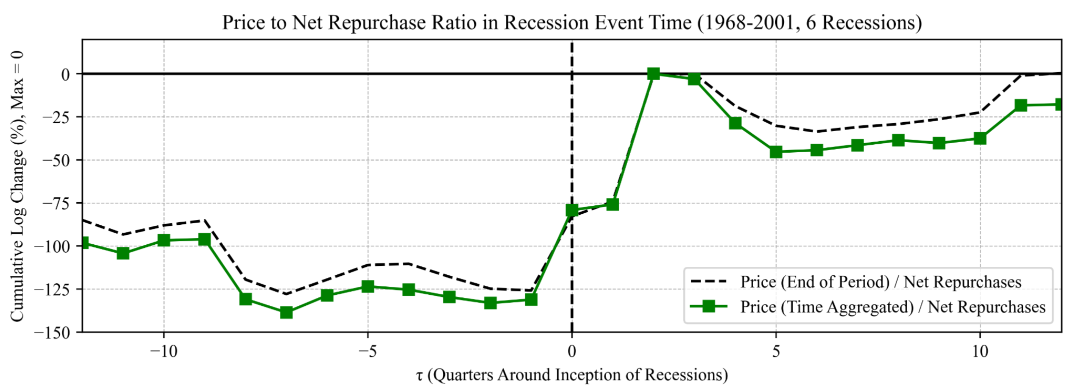
When examining the time-aggregated ratio of prices to dividends, its predictive capacity for forecasting recessions are negligible, with the first statistically and numerically significant decrease happening after the peak business cycles at τ=0 with a -2.94 drop (T-statistic: -7.90). This time-aggregated perspective fails to forecast recessions effectively. The end of period price to dividend ratio predicts recessions, dropping three quarters before the time-aggregated price to dividend ratio. From τ=-4 to τ=-1 the end of period price to dividend ratio drops by 6.27% (T-statistic: -0.83). This demonstrates that the predictability by aggregate prices of recessions stems from a mismeasurement.

Figure 3 demonstrates how net repurchases react around recessions. The figure is constructed in an identical manner to Figure 2 using the same aggregate prices, while incorporating net repurchases instead of dividends. This additional perspective allows us to evaluate present-value relationships around recessions on a more detailed level whilst keeping the perspective of equity holders at the forefront of the analysis. The addition of the net repurchases in Figure 3 also allows us to examine the predictive capabilities of the price to net repurchase ratio.

Figure 3: Aggregate Stock Prices and Net Repurchases during U.S. Recession Event Time, 1968-2001

Figure 3 illustrates the adjusted cumulative log change in real aggregate price and net repurchases in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and net repurchase growth, followed by demeaning price and net repurchases based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time-aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and net repurchase data is extracted from CRSP.





Net repurchases demonstrate a larger downwards change in comparison to prices and previously analyzed dividends. From τ=0 to τ=+8, net repurchases drop by 116.62%[2] (T-statistic: -1.16) whilst time-aggregated prices drop by -22.70% (T-statistic: -3.28), and end of period prices drop by -19.66% (T-statistic: -1.21). Another key observation is that on the component level of Figure 3, net repurchases do not fall until after the peak business cycle is defined. From τ=-4 to τ=-1, net repurchases increased by 8.25% (T-statistic: 1.19) with its first substantial drop of 55.76% (T-statistic: -11.54) occurring at τ=-1. We analyze the ratio of prices to net repurchases which reveal similar results to the individually analyzed net repurchases. The ratio is formulated using a more volatile net repurchase value in the denominator compared to the dividends used in Figure 2. This high volatility in net repurchases leads to an inversion of the ratio graph's trend, presenting an upward trend during recession event times. While the graph

[2] Values have been shifted to their local peaks to y=0 making it possible to observe a negative cumulative log change of over 100%.

contrasts the downward trend of the price-dividend ratio, it does not contradict the results in Figure 2.

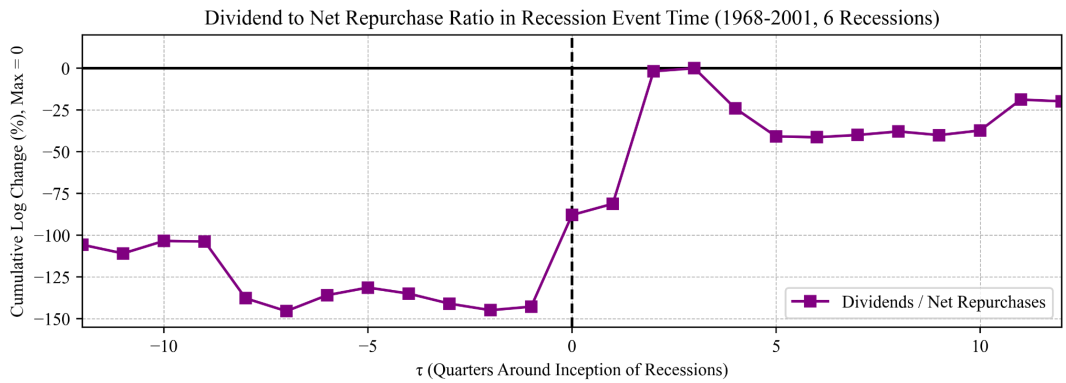
From τ=0 to τ=+8, the time-aggregated price to net repurchase ratio increases by 96.66% (T-statistic: 1.10), while the end of period price to net repurchase ratio increases by 92.61% (T-statistic: 0.95). From τ=-4 to τ=-1, the time-aggregated price to net repurchases ratio decreases by -7.66% (T-statistic: -1.39) while the end of period ratio decreases by -14.78% (T-statistic: -1.78). These outputs showcase the large deviation between periods as well as the lack of recession predictability for both the time-aggregated price to net repurchase ratio and the end of period price to net repurchase ratio. The substitution of dividends with net repurchases in the end-of-period price-dividend ratio voids the ratio's ability to predict recessions. This lack of prediction can be attributed to the excessive deviation of net repurchases compared to dividends. Furthermore, because of the volatile numerator, the time-aggregated price to net repurchase ratio and the end of period to net repurchase ratio trend closely with each other from τ=-1 to τ=+1.

3.2.1 A Comparison Between Net Repurchase and Dividends

Next, we conduct an analysis using a ratio that compares aggregate dividends to net repurchases. This approach is adopted to thoroughly examine the extent to which net repurchases exert a dominating influence in the dividend-to-net repurchase relationship during recessional periods.

Figure 4: Aggregate Dividend to Net Repurchase Ratio During U.S. Recession Event Time, 1968-2001

Figure 4 illustrates the adjusted cumulative log change in real aggregate dividend to net repurchase ratio in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of the price to net repurchase ratio growth, followed by demeaning the ratio based on its mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and net repurchase data is extracted from CRSP. data utilized in this study is derived.



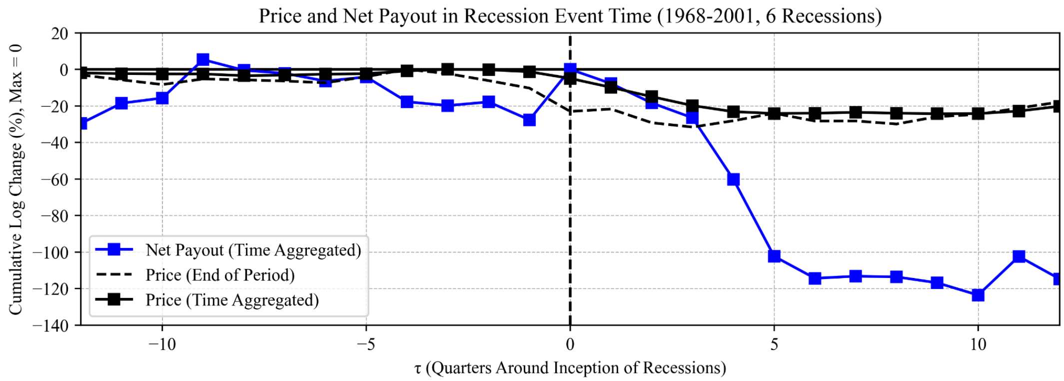
Note that the same inversion seen in Figure 3 is evident in Figure 4, attributable to dividends being less volatile as the numerator in contrast to the more volatile net repurchases as the denominator. From τ=0 to τ=8 the dividend to net repurchase ratio increases by 104.92% (T-statistic: 1.04). Looking at pre-recession trends from τ=-4 to τ=-1, the ratio decreases by 11.46% (T-statistic: -1.65). This substantial change in net repurchases compared to dividends around recessions aligns with our previous results, and that of Floyd, Li, and Skinner (2015).

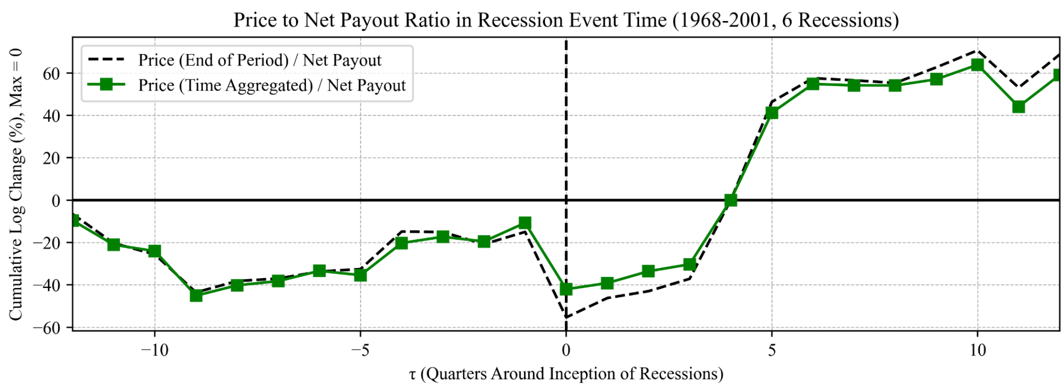
3.3 Bringing It Together With Net Payout

In Figure 5 we use a complete view of cash flows to equity holders, summing net repurchases and dividends. As net payout is simply a summation of net repurchases and dividends, our intention is that net payout will yield a more complete understanding of the stock market surrounding a recession. Figure 5 uses net payout as the medium through which to analyze the recession event time and is tied to Table A.5 in the appendix.

Figure 5: Aggregate Stock Prices and Net Payout During U.S. Recession Event Time, Quarterly Data 1968-2001

Figure 5 illustrates the adjusted cumulative log change in real aggregate price and net payout in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and net payout growth as well as its ratios. This is followed by demeaning price, net payout, and the ratio based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and net payout data is extracted from CRSP.





On the component level of Figure 5, net payouts don't show a substantial fall until after the beginning of a recession. From τ=-4 to τ=-1, net payouts show a decrease of -23.50 (T-statistic: -1.66). However at time τ=0 the net payout increases 27.65% (T-statistic: 10.33) signifying an unstable trend. It is not until after the beginning of the recession i.e. τ=0 to τ=+1 that a sharp (downwards) trend emerges. From τ=0 to τ=+8, net payouts fell 85.97% (T-statistic: -1.42), encompassing the most substantial development in the graph.

Next we examine the ratio of prices to net payouts. Similar to the net repurchase ratio depicted in Figure 3, the price to net payout ratio is also formulated using a volatile denominator. This inverts the trend compared to the price to dividend ratio in Figure 2. From τ=0 to τ=+8, the time-aggregated price to net payout ratio increases by 64.82% (T-statistic: 1.05), and the end of period price to net payout ratio increases by 70.29% (T-statistic: 0.95).

Regarding the predictability of recessions, between τ=-4 and τ=-1, the time-aggregated price to net payout ratio exhibits a modest decline of -7.65% (T-statistic: -1.39). Simultaneously, the end-of-period price to net payout ratio shows a decrease of -3.09% (T-statistic: -0.44). This implies that neither ratio holds any predictive power (note the inverted relationship).

3.4 Robustness

3.4.1 Ordinary Distributions, An Alternative Measurement Reaction Around Recessions

Next we test for robustness in our dividend measurement. We include liquidation dividends on top of the previously analyzed ordinary dividends. This new dividend measurement is classified as ordinary distributions. Ordinary distributions include a more representative sample of cash dividends. Ultimately, we are only changing the dividend measurement, and not the end-of-period or the time-aggregated price.

To extract ordinary distributions, we leverage a similar methodology of recreating the S&P 500 index from the bottom up, but use a different approach to extracting dividends. We utilize the CRSP database to identify the dividend amount (DIVAMT) and its corresponding distribution code (DISTCD) for each firm and month. CRSP classifies dividend distributions into seven distinct categories. This categorization by different distribution codes enables us to differentiate between types of dividend payments, ensuring accuracy and avoiding double-counting in our study.[3] We only extract dividend amounts with distribution codes in the 1,000's for ordinary dividends and 2,000's for liquidation dividends.[4] Therefore, DISTCD in the 1,000's is equal to the dividend amount used for our main empirical method. Dividend amount is already shown on a per share basis. Given this, we calculate the aggregate stock split-adjusted dividend by applying the previously adjusted SHROUT. We define this new dividend amount as the ordinary distributions (DIS).

$$\mathrm{DIS}_t = \mathrm{DIVAMT}_t \times \mathrm{SHROUT}_{t-1}$$

The result is an aggregate ordinary distributions data set for all S&P 500 constituents on a monthly frequency. We then time-aggregate dividends with a rolling 12 month sum, and filter the monthly data set into a quarterly view to align with our quarterly event time methodology.

Finally, the data is rearranged relative to NBER recessions and graphed below in Figure 6 related to appendix Table A.6. The Figure also shows the price to dividend and price to ordinary distribution.

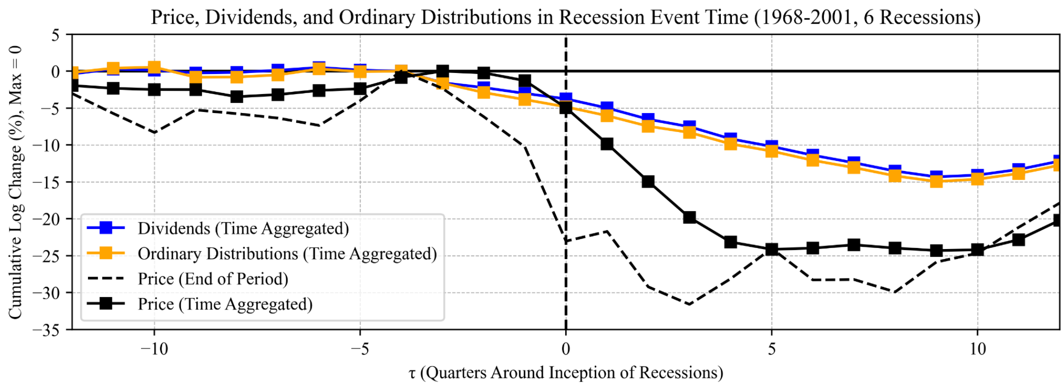
Figure 6: Aggregate Stock Price, Dividend, and Ordinary Distributions During Recession Event Time, Quarterly Data 1968-2001

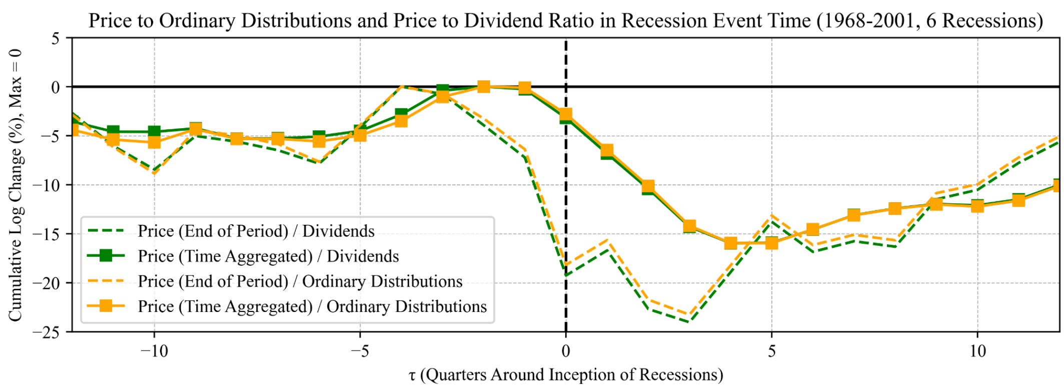
Figure 6 illustrates the adjusted cumulative log change in real aggregate price, dividends and ordinary distributions in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and net payout

[3] Ordinary dividends and liquidation dividends are sometimes paid during the same month. These are separated by the distribution code leading to duplicate observations for certain (date, firm) pairs. We aggregate the dividend amounts for this month, and retain the first monthly observation.

[4] Sabbatucci (2022) writes that M&A cash dividends should be included whenever analyzing the predictability of cash flows. However, our analysis doesn't focus on this distinction and thus we have actively excluded distribution codes 3000 and on. .

growth as well as its ratios. This is followed by demeaning price, dividends, and ordinary distributions and their ratios based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time-aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price, dividends, and ordinary distributions data is extracted from CRSP.





The immediate observation is the graphical similarity between the dividends and the ordinary distributions, with a less than 2% difference in relative (non-cumulative) mean log change across the recession event time. Because of the similar results between dividends and ordinary distributions, the analysis reaches a similar conclusion.

Prices fall substantially more than both aggregate dividends and ordinary distributions. Looking at Table A.6 from τ=0 to τ=+8 ordinary distributions fall by -10.34% (T-statistic: -14.75) compared to dividends -10.52% (T-statistic: -12.73).

The price to ordinary distribution ratio is similar to that of the price to dividends ratio. From τ=-2 to τ=-1 end of period prices drop by 5.67% (T-statistic: -9.36) whilst the time-aggregated ratio shows minimal positive change of 0.95% (T-statistic: 0.82). The end of period price-dividend ratio predicts recessions, while the time-aggregated price-dividend ratio does not. The similarity in results when applying a different methodology shows robustness to our method of calculating aggregate dividends throughout the empirical results.

3.4.2 Top-Down Collection of Stock Prices and Dividends

To ensure the robustness of our aggregate outcomes, we examine the same components on a per-share basis using a top-down perspective, extracting our variables from the index. We test for robustness in our six recession sample between 1968 and 2001 as well as a time-expanded view from 1953 to 2001. We can analyze a time-expanded view because we are no longer constrained by the same 1960 data limitations faced when re-building the S&P 500 index.

This robustness test creates commonality with Kroencke's study who solely analyzes prices and dividends on a per share basis. We obtain the S&P 500 index price, dividend, and Consumer Price Index (CPI) from Shiller's online database.[5]

Since the data is provided on an index level, dividends are already time-aggregated. As such we do not need to take a rolling 12 month sum. However, we still need to time aggregate the newly extracted price. We do this by computing a 12 month mean of price. To keep consistent with the other data sets, we inflation adjust prices and dividends to 2017 values. After this we change the dataset from a monthly frequency to quarterly. Next, we apply the same log, demeaning, and graphing methods as written about in section 2. The resulting data is shown in Figure 7, linked to Table A.7 in the appendix. We also provide the extended Table A.9 and Figure A.2 in the appendix.

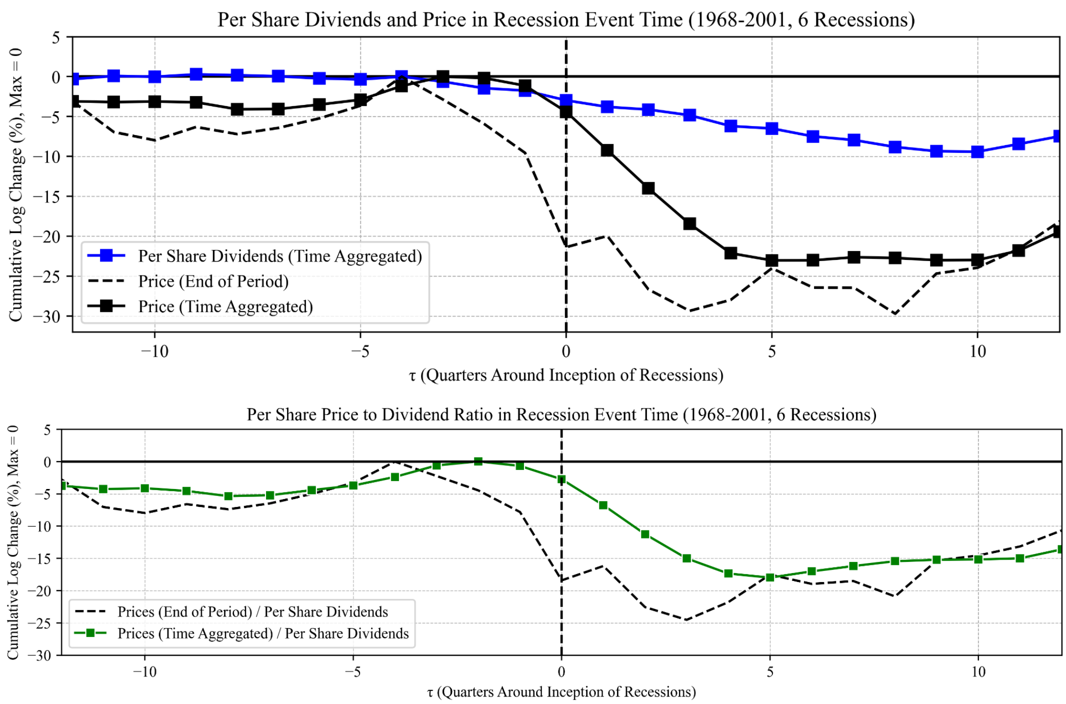
Using a top-down individual shareholder approach to analyze the stock market drivers around our six recession sample concludes very similar results to our aggregate bottom up approach. Dividends show a statistically significant reduction of -7.08% from the beginning of recessions ($\tau = 0$) to eight quarters later (τ=+8) (T-statistic: -6.25). Simultaneously, end of period stock prices drop by 20% (T-statistic: -1.41), and time-aggregated prices by 22% (T-statistic: -3.25). The excess decline in prices relative to dividends arrives at the same conclusion as in our aggregate bottom-up approach analysis. It highlights the possibility of heightened expected returns during recessions, and a further investigation into other price to cash flow relationships.

When examining the time-aggregated ratio of prices to dividends, its predictive capacity for forecasting recessions are negligible, with the first statistically significant -2.07% decrease after the peak business cycles at τ=0 (T-statistic: -4.98). Contrastingly, the end-of-period price-dividend ratio starts to decline well before the beginning of recessions with a statistically significant drop from τ=-4 and onwards.

[5] Similar commonly used methodology to extract aggregate dividends using the top-down method employs the CRSP NYSE-AMEX-NASDAQ value-weighted market index. Aggregate dividends are calculated by multiplying the difference between cum-dividend (VWRETD) and ex-dividend (VWRETX) returns by the prior ex-dividend index level (Sabbatucci, 2022).

Figure 7: Top Down, Per Share Stock Prices and Dividends in Component and Ratio View During Recession Event Time, Quarterly Data 1968-2001

Figure 7 illustrates the adjusted cumulative log change in real per share price and dividends in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and dividend growth, followed by demeaning price and dividends based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time-aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and dividend data is from Schiller's Online Database.



We conduct the same top-down analysis on an expanded view from 1953 to 1968, including nine "normal" U.S. recessions rather than six. This nine U.S. recession top down analysis aligns with Kroencke's (2022) results who also extracts per share prices and dividends from the S&P 500 index for the same time period. Expanding our six recessions time period and confirming these results with Kroencke (2022) further strengthens our event time methodology used throughout the paper with regards to cash flows to equity holders. Our expanded time period results are shown in Appendix Figure A.9.

4. Discussion and Limitations

4.1 Discussion

In exploring the behavior and factors that drive stock market declines during recessions, research should consider adopting a more comprehensive view on cash flow distributions. In recent decades, there has been a notable shift where repurchases have increasingly served as an alternative to dividends for distributing cash to equity holders. We find that aggregate dividends fall minimally compared to stock market prices from the beginning of recessions, whereas net repurchases drop substantially more than prices. Further, the end of period price dividend ratio predicts the low economic growth and future cash flows, while the time-aligned price ratio falls contemporaneously with real GDP. When analyzing the same ratios using net repurchases and net payout as cash flow components, the predictability even of the unadjusted price ratio is voided. This change in predictability can be largely ascribed to the substantial fluctuations in the growth rate of repurchases and issuances. Ferdinand the bull was never inherently aggressive; rather, the matadors had merely misunderstood the influence of cash flows on his behavior.

Kroencke (2022) argues that the excess fall in per share prices compared to per share dividends can be directly attributed to either variations in expected returns or expected future dividend growth based on present-value relationships. However, we suggest that similar research should consider whether the excessive decline in stock prices around recessions can be partially attributed to a mismeasurement of the cash flows driving the stock market. Thus we advocate applying the aggregate present-value relationship outlined in Campbell and Shiller (1988), and to approach net repurchases as cash flow distributions, following the methodology established by Pruitt (2023). Consequently, a broader analysis of cash flows distributed to investors should be considered in event time studies focusing on the determinants of stock market downturns during recessions.

The analysis of inclusive cash flows to equity holders can also apply to the extracted dividends. In our robustness section we included liquidation dividends on top of ordinary dividends to arrive at ordinary distributions. This inclusion of extra cash flows paid out to equity holders did not statistically affect the cumulative log growth of aggregate dividends around recessions. However, we excluded other various dividend distribution codes in the CRSP data set, such as those related to M&A cash flows. Riccardo (2022) analyzes this extra cash flow and argues that these should be treated the same as ordinary distributions in empirical research. Using this further inclusive measurement of payouts to shareholders could add another level of reference to study around recession event time using the same methodology.

Our empirical results reveal that dividends drop substantially less than net repurchases around the U.S. recession event time. These results relate to Floyd, Li, Skinner (2015), who analyze payouts and dividends in relation to the 2008 crisis. While our analysis is fundamentally distinct due to our focus on normal recession periods, they also conclude that net repurchases react much more than dividends. Floyd, Li, Skinner's then segment firms into either industrial or financial firms due to their different payout policies. They conclude that even when in segmented samples, both types of firms experience the same results. While our event study focuses on reconstructing the S&P 500, further research can include segmenting the constituents into industrials and financial firms to analyze if the similar results are made around "normal" recessions with a wider view of cash flow distributions.

4.2 Limitations

Certain limitations exist regarding data sourcing and the recessions studied in our paper. The S&P 500 monthly constituents dataset we extract from CRSP only extends up to the year 1960. This hinders us from studying aggregate cash flows on a wider sample of U.S. recessions. Specifically the 1950's, which included three "normal" U.S. recessions. Expanding our constituents data over a broader time frame would improve the robustness and validity of our results by including an analysis of more economic cycles.

Our net repurchase formula includes issuances that do not generate cash flows such as stock grants and acquisitions. To mitigate this bias, there are other net repurchase measurements that could be leveraged, laid out in Boudakh (2007). One such measurement is characterized by the sum of all spending on acquiring common and preferred stocks, combined with any decrease in the net value of outstanding preferred stocks. The data required for this measurement is to our knowledge available starting in 1971. Rather than expanding the event time approach over a longer period, it might be more effective to use this repurchase measurement for an in-depth analysis of the recessions that occurred since 1971. This approach could be especially intriguing, given the significant rise in the popularity of repurchases starting in 1982, largely attributable to the introduction of SEC Rule 10b-18. Additionally, it would be insightful to examine the behavior of repurchases independently of issuances around recessions with this measurement.

The decision to focus on six specific recession events within a defined time frame provides a complete dataset to make statistically significant inferences. However, this reduced time horizon represents certain limitations. By not extending the time horizon, the research potentially overlooks long-term trends and broader market dynamics that could influence the findings. Notably, the last "normal" recession in the U.S. happened in 2001, and the scarcity of recessions in the 21st century results in a constrained dataset for contemporary analysis. This limitation hinders our understanding of how current payout policies of S&P 500 firms might respond to a modern economic crisis.

The study excludes recent recession shocks, such as the COVID-19 pandemic and the 2008 financial crisis, due to their classification as crises or a period of rampant inflation rather than traditional "normal" recessions. Future research could benefit from including these significant economic events to understand better how markets respond to different types of economic shocks.

The study's focus on the U.S. and specifically the S&P 500 index limits its applicability to other geographical regions and market indices. Kornekce (2022) leverages this event time methodology to study the stock market around recessions for a sample of 14 countries. Different economies and markets may exhibit unique characteristics and reactions to economic downturns in regards to aggregate cash flows paid to equity holders. Expanding future research to include a more diverse range of countries and market indices could provide a more holistic view of global market dynamics during recessions.

5. Conclusions

We report the behavior of aggregate cash flow distributions and stock market prices for S&P 500 firms during six U.S. recessions spanning from 1968 to 2001. Aggregate stock market prices are inherently measured at the end of a month while aggregate dividends and real GDP are summed over multiple months. This deviation in measurements leads to a time-aggregation bias where prices predict low dividend and economic growth. Adjusting for this bias leads to prices and cash flow distributions dropping contemporaneously around business cycles. This allows us to analyze aggregate cash flow distributions in relation to each other, and compare them both with time-aligned and unadjusted aggregate prices.

In conclusion, we make two key contributions to Kroencke (2022), expanding the research surrounding event studies for U.S. recessions. i) The predictive power of recessions by the aggregate end of period price-dividend ratio is lost when substituting the cash flow component with aggregate net repurchases and net payout. ii) While aggregate prices drop substantially more than aggregate dividends around recessions, the inverse is true for aggregate net repurchases and net payout. This demonstrates that there is a misalignment in present-value relationship between aggregate prices and aggregate cash flows around U.S. recession event time.

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Appendix

Tables and Additional Figures

Figure A.1: Extended Real GDP during Recession Event Time, Quarterly Data 1953-2001

Figure A.1 illustrates the adjusted cumulative log change in real Gross Domestic Product (GDP) in relation to nine recessionary periods, spanning from 1953 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of real GDP growth, followed by demeaning GDP based on its mean growth value from 1950 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The real GDP data is extracted from the Federal Reserve Economic Data (FRED) repository. GDP has been adjusted for inflation to 2017 dollar values, it is seasonally adjusted at an annualized rate. The data is presented in a quarterly frequency. Furthermore, the figure incorporates a 90% confidence band which is calculated based on the mean values of the dataset.

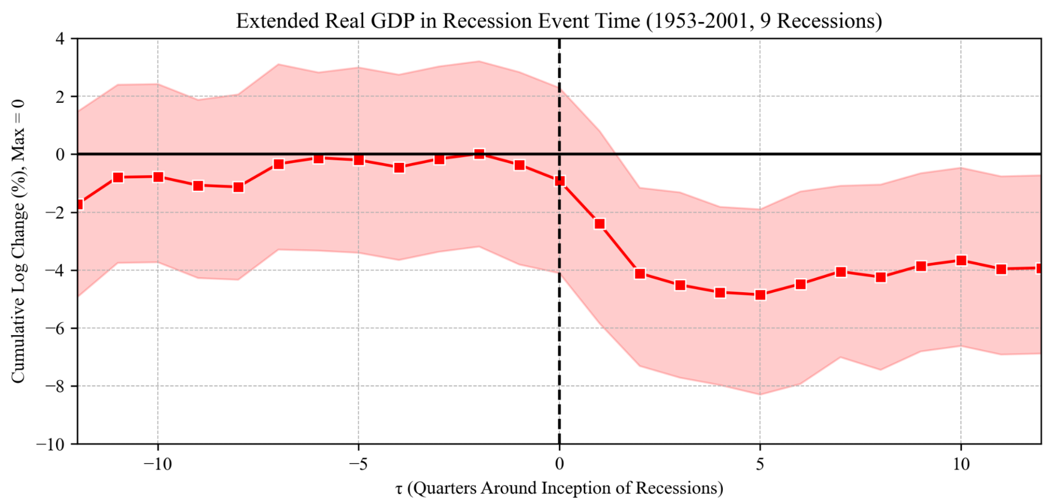

Figure A.2: Top Down, Per Share Stock Prices and Dividends in Component and Ratio View During Recession Event Time, Quarterly Data 1953-2001

Figure 7 illustrates the adjusted cumulative log change in real per share price and dividends in relation to nine recessionary periods, spanning from 1953 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of price and dividend growth, followed by demeaning price and dividends based on their mean growth value from 1950 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. We use a time aggregated and end of period price for both the component and ratio graph. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The price and dividend data is from Schiller's Online Database.

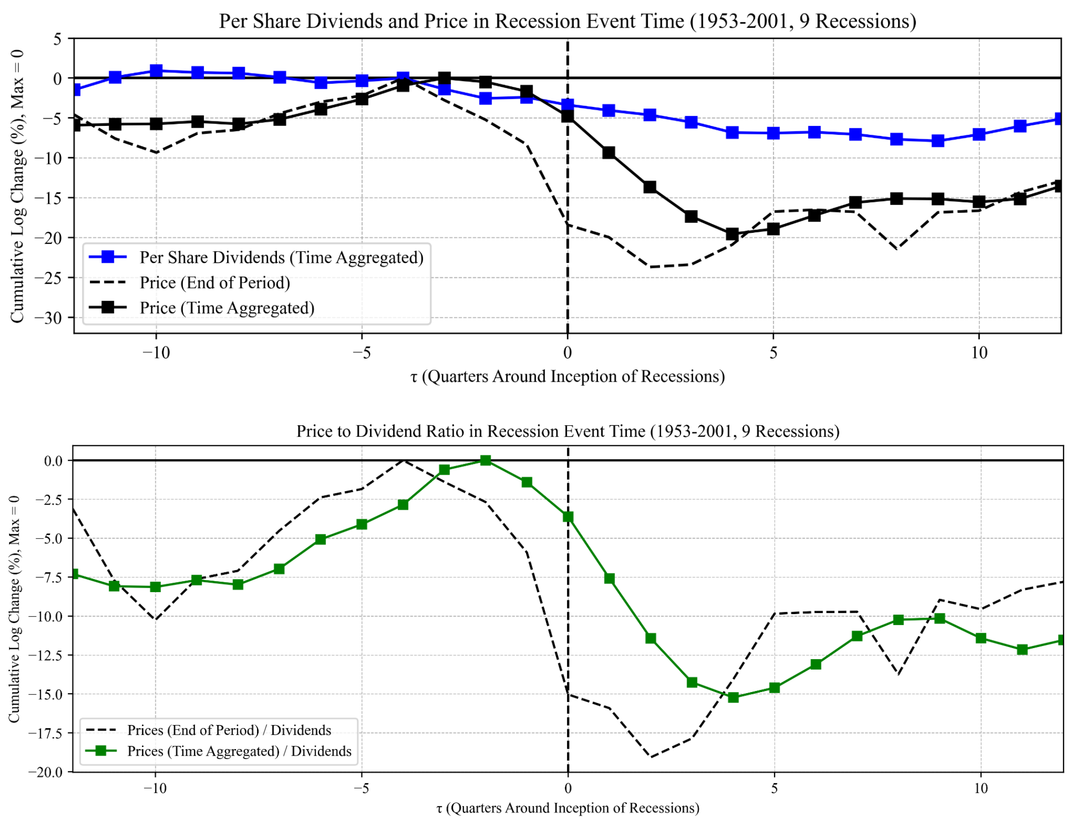

Table A.1: Real GDP during Recession Event Time, Quarterly Data

Table A.1 illustrates the adjusted cumulative log change in real Gross Domestic Product (GDP) in relation to six recessionary periods, spanning from 1968 to 2001 and 1953 to 2001 respectively. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of real GDP growth, followed by demeaning GDP based on its mean growth value from 1965 to 2004 and 1950 to 2001 respectively. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The real GDP data is extracted from the Federal Reserve Economic Data (FRED) repository. GDP has been adjusted for inflation to 2017 dollar values, it is seasonally adjusted at an annualized rate. The data is presented in a quarterly frequency. Furthermore, the figure incorporates a 90% confidence band which is calculated based on the mean values of the dataset. The table provides the demeaned cumulative changes of real GDP log growth relative to τ=-1 (left side, pre-Recession) and relative to τ=0 (right side, after beginning of recession) from 1968 to 2001 and 1953 to 2001, encompassing a total of 6 and 9 recessions respectively. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The GDP data is sourced from FRED which has been chained to 2017 Dollars, seasonally adjusted based on an annual rate, and sampled with a quarterly frequency.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: US, 1953-2001 (# Recessions: 9)											
ΔGDP_t	1.35	0.71	-0.16	-0.20	-0.37	-0.54	-2.03	-3.75	-4.41	-3.88	-3.56
t-stat	0.96	0.69	-0.25	-0.35	-2.46	-3.93	-2.15	-3.49	-2.94	-1.75	-1.48
p-val	0.36	0.51	0.82	0.78	0.02	0.00	0.28	0.07	0.04	0.12	0.16
Panel: US, 1968-2001 (# Recessions: 6)											
ΔGDP_t	0.99	0.48	-0.38	-0.63	-0.71	-0.52	-2.07	-3.24	-4.06	-4.70	-3.67
t-stat	0.60	0.33	-0.37	-0.82	-5.36	-3.71	-2.01	-3.59	-3.41	-2.93	-1.73
p-val	0.56	0.75	0.74	0.56	0.00	0.00	0.29	0.07	0.03	0.02	0.11

Table A.2: Aggregate Stock Prices and Dividends Components and Ratio During Recession Event Time, Quarterly Data 1968-2001

Table A.2 illustrates the adjusted cumulative log change of aggregate stock prices and dividends in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of stock prices and dividends growth, followed by demeaning stock prices and dividends based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The data has been adjusted for inflation to 2017 dollar values. The data is presented in a quarterly frequency. The table provides the demeaned cumulative changes of stock prices and dividends log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of six recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The stock prices and dividends sourced from CRSP and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Components, 1968-2001 (# Recessions: 6)											
ΔDiv_t	-2.98	-2.78	-3.16	-1.44	-0.79	-0.74	-1.98	-3.50	-6.16	-10.52	-9.16
t-stat	-1.45	-1.52	-2.65	-10.07	-1.99	-1.64	-3.96	-5.07	-7.46	-12.73	-2.93
$\Delta Price_t, T.A.$	0.60	1.22	1.09	-1.29	-1.05	-3.68	-8.56	-13.66	-21.87	-22.70	-18.92
t-stat	0.24	0.49	0.48	-1.58	-0.78	-7.19	-7.19	-10.32	-12.09	-3.28	-2.02
$\Delta Price_t, E.o.P.$	-3.64	-5.01	-6.27	-7.91	-4.09	-12.78	-11.46	-18.97	-17.87	-19.66	-7.60
t-stat	-0.35	-0.59	-0.83	-28.96	-4.38	-14.83	-0.81	-1.54	-1.21	-1.21	-0.41
Panel: Ratios, 1968-2001 (# Recessions: 6)											
$\Delta P/D_t, T.A.$	3.58	4.00	4.25	0.15	-0.26	-2.94	-6.58	-10.16	-15.71	-12.17	-9.75
t-stat	1.05	1.29	1.75	0.22	-0.05	-7.90	-9.53	-15.26	-7.96	-1.80	-1.29
$\Delta P/D_t, E.o.P.$	-0.61	-2.20	-3.09	-6.46	-3.30	-12.03	-9.48	-15.46	-11.70	-9.10	1.61
t-stat	-0.06	-0.28	-0.44	-49.64	-4.15	-15.01	-0.65	-1.22	-0.76	-0.55	0.09

Table A.3: Aggregate Stock Prices and Net Repurchase Components and Ratio During Recession Event Time, Quarterly Data 1968-2001

Table A.3 illustrates the adjusted cumulative log change of aggregate stock prices and net repurchases in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of stock prices and net repurchases growth, followed by demeaning stock prices and net repurchases based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The stock prices and net repurchase have been adjusted for inflation to 2017 dollar values, it is seasonally adjusted at an annualized rate. The data is presented in a quarterly frequency. The table provides the demeaned cumulative changes of stock prices and dividends log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of 6 recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The stock prices and net repurchases sourced from CRSP and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Components, 1968-2001 (# Recessions: 6)											
ΔRep_t	25.42	35.64	8.25	0.10	-3.02	-55.76	-63.99	-145.00	-125.59	-116.62	-133.82
t-stat	0.63	0.96	1.19	0.02	0.30	-11.54	-1.35	-2.27	-1.33	-1.16	-1.32
$\Delta Price_t, T.A.$	0.60	1.22	1.09	-1.29	-1.05	-3.68	-8.56	-13.66	-21.87	-22.70	-18.92
t-stat	0.24	0.49	0.48	-1.58	-0.78	-7.19	-7.19	-10.32	-12.09	-3.28	-2.02
$\Delta Price_t, E.o.P.$	-3.64	-5.01	-6.27	-7.91	-4.09	-12.78	-11.46	-18.97	-17.87	-19.66	-7.60
t-stat	-0.35	-0.59	-0.83	-28.96	-4.38	-14.83	-0.81	-1.54	-1.21	-1.21	-0.41
Panel: Ratios, 1968-2001 (# Recessions: 6)											
$\Delta P/Rep_t, E.o.P.$	-28.84	-40.65	-14.78	-7.88	-1.01	43.05	51.70	125.27	107.15	96.66	126.18
t-stat	-0.67	-1.06	-1.78	-1.34	-1.22	9.74	1.50	2.23	1.30	1.10	1.44
$\Delta P/Rep_t, T.A.$	-24.70	-35.10	-7.66	-1.47	1.92	52.03	55.33	131.19	102.57	92.61	113.42
t-stat	-0.60	-0.92	-1.39	-0.28	-0.38	11.27	1.14	2.05	1.09	0.95	1.16

Table A.4: Bottom-Up Stock Prices and Net Payout Components and Ratios During Recession Event Time, Quarterly Data 1968-2001

Table A.4 illustrates the adjusted cumulative log change of aggregate stock prices and net payouts in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of stock prices and payouts growth, followed by demeaning stock prices and dividends based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The data has been adjusted for inflation to 2017 dollar values, it is seasonally adjusted at an annualized rate. The data is presented in a quarterly frequency. The table provides the demeaned cumulative changes of stock prices and net payouts log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of six recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The stock prices and net payouts are sourced from CRSP and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Components, 1968-2001 (# Recessions: 6)											
$\Delta Payout_t$	5.03	-32.97	-23.50	-7.83	-9.81	27.65	19.89	9.23	-32.52	-85.97	-87.11
t-stat	0.16	-2.11	-1.65	-0.66	-2.18	10.33	0.56	0.25	-0.66	-1.42	-1.30
$\Delta Price_t, T.A.$	0.60	1.22	1.09	-1.29	-1.05	-3.68	-8.56	-13.66	-21.87	-22.70	-18.92
t-stat	0.24	0.49	0.48	-1.58	-0.78	-7.19	-7.19	-10.32	-12.09	-3.28	-2.02
$\Delta Price_t, E.o.P.$	-3.64	-5.01	-6.27	-7.91	-4.09	-12.78	-11.46	-18.97	-17.87	-19.66	-7.60
t-stat	-0.35	-0.59	-0.83	-28.96	-4.38	-14.83	-0.81	-1.54	-1.21	-1.21	-0.41
Panel: Ratios, 1968-2001 (# Recessions: 6)											
$\Delta P/Payout_t, E.o.P$	-7.79	28.55	17.53	0.06	5.79	-40.35	-31.21	-27.98	15.02	70.29	83.77
t-stat	-0.24	1.49	0.87	0.01	0.82	-12.87	-0.63	-0.60	0.24	0.95	1.08
$\Delta P/Payout_t, T.A.$	-4.19	34.35	24.68	6.58	8.78	-31.31	-28.41	-22.83	10.75	64.82	69.81
t-stat	-0.13	2.13	1.65	0.60	2.07	-11.42	-0.83	-0.64	0.22	1.05	1.04

Table A.5: Bottom-Up Dividend to Repurchase Ratio During Recession Event Time, Quarterly Data 1968-2001

Table A.4 illustrates the adjusted cumulative log change of the dividend to net repurchase ratio in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of the ratios growth, followed by demeaning the ratio based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The data has been adjusted for inflation to 2017 dollar values. The table provides the demeaned cumulative changes of the ratios log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of 6 recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The dividend to net repurchases are sourced from CRSP and has been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Ratios, 1968-2001 (# Recessions: 6)											
$\Delta D/Rep_t$	-29.15	-38.99	-11.46	-1.80	2.10	54.89	61.61	140.97	118.78	104.92	122.96
t-stat	-0.73	-1.05	-1.65	-0.30	-0.37	11.55	1.28	2.20	1.26	1.04	1.22

Table A.6: Alternative Aggregate Stock Prices, Dividend, and Ordinary Distributions During Recession Event Time, Quarterly Data 1968-2001

Table A.7 illustrates the adjusted cumulative log change of aggregate prices, dividend, and ordinary distributions in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of prices, dividend, and ordinary distributions growth, followed by demeaning them based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The prices, dividend, and ordinary distributions have been adjusted for inflation to 2017 dollar values. The data is presented in a quarterly frequency. The table provides the demeaned cumulative changes of prices, dividend, and ordinary distributions log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of six recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The prices, dividend, and ordinary distributions are sourced from CRSP and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	–12:-1	–8:-1	–4:-1	–2:-1	–1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Components, 1968-2001 (# Recessions: 6)											
ΔDis_t	-4.00	-3.03	-3.78	-2.24	-0.95	-0.99	-2.19	-3.62	-6.01	-10.34	-8.88
t-stat	-1.44	-1.28	-2.59	-6.74	-2.62	-2.83	-10.23	-9.49	-9.03	-14.75	-2.88
ΔDiv_t	-2.98	-2.78	-3.16	-1.44	-0.79	-0.74	-1.98	-3.50	-6.16	-10.52	-9.16
t-stat	-1.45	-1.52	-2.65	-10.07	-1.99	-1.64	-3.96	-5.07	-7.46	-12.73	-2.93
$\Delta Price_t, T.A.$	0.60	1.22	1.09	-1.29	-1.05	-3.68	-8.56	-13.66	-21.87	-22.70	-18.92
t-stat	0.24	0.49	0.48	-1.58	-0.78	-7.19	-7.19	-10.32	-12.09	-3.28	-2.02
$\Delta Price_t, E.o.P.$	-3.64	-5.01	-6.27	-7.91	-4.09	-12.78	-11.46	-18.97	-17.87	-19.66	-7.60
t-stat	-0.35	-0.59	-0.83	-28.96	-4.38	-14.83	-0.81	-1.54	-1.21	-1.21	-0.41
Panel: Ratios, 1968-2001 (# Recessions: 6)											
$\Delta P/Dis_t, T.A.$	4.61	4.25	4.88	0.95	-0.10	-2.70	-6.37	-10.05	-15.86	-12.35	-10.03
t-stat	1.28	1.36	2.30	0.82	0.33	-7.07	-6.52	-10.24	-7.64	-1.81	-1.32
$\Delta P/Dis_t, E.o.P.$	0.41	-1.95	-2.47	-5.67	-3.14	-11.78	-9.27	-15.34	-11.84	-9.28	1.33
t-stat	0.04	-0.26	-0.39	-9.36	-4.00	-14.78	-0.65	-1.23	-0.79	-0.57	0.08
$\Delta P/Div_t, T.A.$	3.58	4.00	4.25	0.15	-0.26	-2.94	-6.58	-10.16	-15.71	-12.17	-9.75
t-stat	1.05	1.29	1.75	0.22	-0.05	-7.90	-9.53	-15.26	-7.96	-1.80	-1.29
$\Delta P/Div_t, E.o.P.$	-0.61	-2.20	-3.09	-6.46	-3.30	-12.03	-9.48	-15.46	-11.70	-9.10	1.61
t-stat	-0.06	-0.28	-0.44	-49.64	-4.15	-15.01	-0.65	-1.22	-0.76	-0.55	0.09

Table A.7: Top Down Per Share Stock Prices and Dividends in Component and Ratio View During Recession Event Time, Quarterly Data 1968-2001

Table A.6 illustrates the adjusted cumulative log change of the top down per share stock prices and dividends in relation to six recessionary periods, spanning from 1968 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of the stock prices and dividends growth, followed by demeaning the stock prices and dividends based on their mean growth value from 1965 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The data has been adjusted for inflation to 2017 dollar values. The table provides the demeaned cumulative changes of the ratios log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of six recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The stock prices and dividends are sourced from Schiller's Online Database and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	−12:-1	−8:-1	−4:-1	−2:-1	−1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Component, 1968-2001 (# Recessions: 6)											
$\Delta Price, T.A.$	1.84	2.07	1.76	-1.14	-0.96	-3.27	-8.08	-12.87	-21.00	-21.59	-18.29
t-stat	0.69	0.78	0.72	-1.44	-0.77	-6.59	-5.26	-8.41	-13.56	-3.25	-2.06
p-value	0.505	0.462	0.526	0.387	0.447	0.000	0.120	0.014	0.000	0.012	0.061
$\Delta Div_t, T.A.$	-1.96	-2.03	-1.40	-1.12	-0.30	-1.23	-2.05	-2.38	-4.46	-7.08	-5.72
t-stat	-1.47	-2.02	-1.36	-2.13	0.09	-7.74	-5.06	-3.08	-4.81	-6.25	-2.18
p-value	0.171	0.083	0.268	0.280	0.927	0.000	0.124	0.091	0.009	0.000	0.050
$\Delta Price_t, E.o.P.$	-3.00	-3.25	-5.92	-6.70	-3.65	-11.82	-10.42	-17.12	-18.42	-20.16	-8.58
t-stat	-0.32	-0.44	-0.86	-11.33	-4.19	-14.95	-0.79	-1.48	-1.46	-1.41	-0.51
p-value	0.753	0.674	0.452	0.056	0.000	0.000	0.575	0.276	0.219	0.197	0.622
Panel: Ratio, 1968-2001 (# Recessions: 6)											
$\Delta p/div_t, T.A.$	3.45	3.88	3.04	-0.08	-0.70	-2.07	-6.09	-10.58	-16.68	-14.77	-12.93
t-stat	1.23	1.51	1.40	-0.06	-0.93	-4.98	-3.14	-4.77	-6.99	-2.24	-1.72
p-value	0.245	0.174	0.255	0.963	0.360	0.000	0.196	0.041	0.002	0.055	0.110
$\Delta p/div_t, E.o.P.$	-1.04	-1.22	-4.52	-5.58	-3.35	-10.59	-8.37	-14.74	-13.97	-13.08	-2.85
t-stat	-0.11	-0.18	-0.76	-5.00	-4.45	-14.52	-0.65	-1.30	-1.10	-0.93	-0.18
p-value	0.911	0.859	0.505	0.126	0.000	0.000	0.632	0.322	0.335	0.380	0.861

Table A.8: Extended Top Down Per Share Stock Prices and Dividends During Recession Event Time, Quarterly Data 1953-2001

Table A.9 illustrates the adjusted cumulative log change of the top down per share stock prices and dividends in relation to nine recessionary periods, spanning from 1953 to 2001. The event window extends from τ=-12 to τ=+12 quarters, centered around the inception of each recession (τ=0). The methodology for data preparation starts with a logarithmic transformation of the stock prices and dividends growth, followed by demeaning the stock prices and dividends based on their mean growth value from 1950 to 2004. This process normalizes the data, facilitating a comparable analysis across different recessions. The data is then realigned according to the peak business cycles defined by the National Bureau of Economic Research (NBER). The data has been adjusted for inflation to 2017 dollar values. The table provides the demeaned cumulative changes of the ratios log growth relative to τ=-1 (for the left side, pre-Recession) and relative to τ=0 (for the right side, after the beginning of recessions) from 1968 to 200, encompassing a total of nine recessions. T-statistics (t-stat) are derived from the cumulative sum mean of the data. Recession dates are taken from NBER. The stock prices and dividends are sourced from Schiller's Online Database and have been chained to 2017 Dollars.

	← pre-Recession					↓	after Beginning of Recession →				
Quarter	−12:-1	−8:-1	−4:-1	−2:-1	−1	0	0:+1	0:+2	0:+4	0:+8	0:+12
Panel: Components, 1953-2001 (# Recessions: 9)											
$\Delta Div_t, T.A.$	-1.26	-3.11	-2.05	-1.02	0.14	-0.96	-1.64	-2.22	-4.42	-5.28	-2.70
t-stat	-0.44	-1.67	-1.15	-0.79	1.92	-5.22	-5.70	-6.43	-7.06	-3.90	-1.00
p-value	0.668	0.139	0.332	0.576	0.067	0.000	0.111	0.023	0.002	0.005	0.338
$\Delta Price, T.A.$	4.22	3.78	0.96	-1.67	-1.19	-3.10	-7.67	-12.02	-17.88	-13.44	-11.88
t-stat	1.46	1.31	0.37	-2.37	-2.37	-7.50	-5.24	-8.78	-8.28	-1.73	-1.41
p-value	0.173	0.232	0.739	0.254	0.026	0.000	0.120	0.013	0.001	0.122	0.185
$\Delta Price_t, E.o.P.$	0.40	-1.41	-6.12	-5.55	-3.10	-10.08	-11.64	-15.37	-12.57	-13.10	-4.59
t-stat	0.05	-0.22	-1.22	-8.51	-4.44	-15.03	-1.36	-2.00	-1.17	-1.03	-0.32
p-value	0.965	0.831	0.309	0.074	0.000	0.000	0.403	0.183	0.308	0.334	0.755
Panel: Ratios, 1953-2001 (# Recessions: 9)											
$\Delta p/d_t, T.A.$	6.33	6.29	2.71	-0.80	-1.40	-2.21	-6.18	-10.02	-13.83	-8.83	-10.14
t-stat	1.73	1.89	0.88	-0.40	-3.68	-6.08	-3.53	-5.91	-4.99	-1.27	-1.44
p-value	0.112	0.100	0.444	0.756	0.001	0.000	0.176	0.027	0.008	0.238	0.177
$\Delta p/d_t, E.o.P.$	1.65	1.71	-4.07	-4.53	-3.24	-9.12	-10.00	-13.16	-8.15	-7.82	-1.88
t-stat	0.17	0.30	-0.97	-2.33	-4.98	-14.05	-1.21	-1.78	-0.74	-0.63	-0.14
p-value	0.866	0.775	0.405	0.258	0.000	0.000	0.439	0.216	0.500	0.546	0.891

Table A.9: Recession Definitions

The table presents the identification of the initiation of recessions. The data is provided by the National Bureau of Economic Research (NBER) business cycle dating committee, and Muir (2007). We have marked recessions that occur within a three-year period surrounding World War I and World War II as war periods, denoted with the superscript 'w'. Dates marked with '*' are defined as a crisis recession.

United States Recession Years
1902, 1907*, 1910, 1913^{w}, 1918^{w}, 1920^{w}, 1923, 1926, 1937^{w}, 1945^{w}, 1948^{w}, 1953 (Q2 '53), 1957 (Q3 '57), 1960 (Q2 '60), 1969 (Q4 '69), 1973 (Q4 '73), 1980, (Q1 '80, Q3 '81), 1990 (Q3 '90), 2001 (Q1 '01), 2007* (Q4 '07)*, 2020* (Q4 '19)*

AI Appendix

Throughout the development of this thesis, we incorporated the use of artificial intelligence as a supplementary tool to assist in certain non-critical aspects of our work. Specifically, we utilized the GPT-4.0 model, developed by OpenAI, for two primary purposes: Bug fixing code when we hit a roadblock, and grammar checking individual sentences, never full paragraphs or more. The use of AI is intended to enhance our automated tasks, not to replace the critical thinking and decision-making processes that are essential to quality.