Stock Repurchase Waves: An Explanation of the Trends in Aggregate Corporate Payout Policy

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Abstract

In this paper, we provide evidence that repurchases are replacing dividends. We show this first by examining the source of earnings that drives each distribution mechanism. Contrary to prior research, we find that *both* dividends and repurchases are a means to distribute permanent earnings and therefore potential substitutes. Additionally, consistent with previous research, we find that repurchases are also a mechanism to distribute temporary earnings. Second, we show that the sensitivity of the change in dividend payments to a change in permanent earnings decreased significantly with the onset of the of stock repurchases. This decrease partially explains the aggregate pattern of stock repurchases. Thus, the evidence in this paper adds to the extensive literature on the importance of stock repurchases and to the growing literature on the aggregate use of dividends over time.

In 1997, corporate payout policy rounded a dramatic corner: in aggregate, firms spent more on stock repurchases than on cash dividends. The eclipsing of dividend payments by repurchases potentially reflects two trends that have emerged over the past several decades. The first is the striking increase in firms' use of stock repurchases over the 1980s and 1990s. The second is a simultaneous decline in the proportion of firms paying dividends. Specifically, during the 1990s, the share of public firms paying dividends reached an all time low of 24%. Despite this decline in the overall proportion of firms paying dividends, the aggregate volume of dividends paid has not decreased, as shown in DeAngelo, DeAngelo, and Skinner (2003). However, the dividend payout ratio has declined over time. According to Brav, Graham, Harvey, and Michaely (2002), "... the increased amount that firms spend on repurchases and the decline in the number of firms that pay dividends indicate that corporate payout policies have changed over the past 50 years."

This evidence implies that stock repurchases may be replacing dividends as the dominant form of distribution. However, it is also possible that these are two unrelated trends. Despite recent investigations of aggregate distributions, it remains unclear if repurchases are replacing dividends as a primary means of distributing earnings and how the potential substitution of these distribution mechanisms impacts aggregate payout policy. For instance, Fama and French (2001) show that the non-dividend paying firms are not the firms repurchasing stock; rather, firms that repurchase continue to pay some dividends. DeAngelo, DeAngelo, and Skinner (2003) question the disappearance of dividends, showing that real dividends increased by 16% between 1978 and 2000. This increase is driven by substantial increases in dividends by large dividend-paying firms, the same group of firms that Fama and French (2001) show are repurchasing stock. Thus, the current evidence does not show nor rule out the possibility that repurchases are replacing dividends, but rather indicates that the firms that have funds to pay dividends also have funds to repurchase stock. The question therefore remains, is there a connection between the increased use of stock repurchases and the changes in dividend payouts?

In this paper, we begin to shed light on this question by first investigating if repurchases are a *potential* replacement for dividends. Our premise is simple: repurchases can only replace dividends if the funds used to repurchase stock are the same or similar to the funds that would have been used to pay dividends. Since both repurchases and dividends are mechanisms to distribute earnings, we examine if the earnings that are distributed through stock repurchases derive from the same source as those distributed through dividends. We

then use this analysis to estimate the decline in expected dividends and determine if this decline relates to aggregate stock repurchases. Our analysis is therefore an extension of the recent examinations of aggregate dividend policy in that it examines the change in expected dividends and investigates the impact that repurchases have on aggregate dividends. This paper is also an extension of Grullon and Michaely (2002), which examines the cross-sectional relation between dividends and repurchases. Grullon and Michaely find that some firms are gradually substituting repurchases for dividends and that young firms prefer to initiate distributions via repurchases rather than dividends. Our paper examines the aggregate impact of this effect to determine if repurchases are replacing dividends.

In order to answer these questions, it is necessary to better understand the components of earnings. We follow Lintner (1956) in the hypothesis that earnings contain both a temporary and a permanent component. As part of this permanent earnings hypothesis, he hypothesizes that dividends represent payments of the permanent component of earnings. Thus, as a first condition for understanding whether repurchases are replacing dividends, we must understand whether repurchases distribute *permanent* earnings. We define permanent shocks to earnings as those that persist, and are consequently non-stationary, whereas temporary shocks are transitory, and consequently stationary. While it seems sensible to define permanent earnings as the component of earnings that is nonstationary and temporary earnings as the component that is stationary, it is less straightforward to identify these two components from the single time series of earnings. In order to separate these components, we hypothesize a relation between earnings and an exogenous variable. Specifically, we hypothesize that earnings are a measure of firms' economic income, and thus, of aggregate output. We then use gross domestic product (GDP) as a proxy for aggregate output and model the joint dynamics of these two variables. Under the hypothesis that earnings and GDP are *cointegrated* [Granger (1983) and Engle and Granger (1987)], we are able to use the relation of earnings and GDP to separate permanent and temporary earnings.[1]

We find that aggregate repurchases increase with both temporary and permanent earn-

[1]Lee (1996) uses the cointegration of earnings and dividends to separate permanent from temporary earnings, and finds support for the permanent earnings hypothesis as an explanation for aggregate dividend dynamics. We utilize GDP rather than repurchases (or dividends) to decompose permanent and temporary earnings for a number of reasons. First, GDP is exogenous to the system studied. We are interested in assessing whether repurchases represent a payout of permanent and/or temporary earnings. Using repurchases to define what is permanent or temporary affects our ability to answer this question. A simpler reason is that we do not have a sufficiently long time series of repurchases to detect a cointegrating relation in repurchases and earnings. However, we examine a related approach in Section 3.4

ings. Specifically, we find that a one standard deviation positive shock to permanent earnings leads to an 18.6% cumulative increase in future repurchases, or $29.3 billion. In contrast, a one standard deviation increase in temporary earnings leads to an 8.5%, or $13.4 billion increase in future repurchases.[2] Thus, both permanent and temporary earnings have an economically significant impact on the volume of repurchases. Though both sources of earnings influence aggregate repurchases, temporary earnings do not significantly impact aggregate dividends. Rather, as shown in Lee (1996), aggregate annual dividends change with permanent earnings. Our evidence suggests that a one standard deviation change in permanent earnings results in a 1.5% increase in annual dividends, or $1.75 billion, whereas temporary earnings have no impact on dividend changes. Thus, while repurchases are affected by both temporary and permanent components of earnings, dividends are affected only by permanent components, and are considerably less sensitive to changes in these permanent components. This evidence suggests that a portion of aggregate repurchases could substitute for dividends. When permanent earnings increase, firms modestly increase dividends and substantially increase repurchases. When temporary earnings increase, firms use the funds only to repurchase stock. Thus, to investigate if repurchases are replacing dividends, we are most interested in the effects of changes in permanent earnings.

Having documented that aggregate repurchases are influenced by the same portion of earnings that drives dividends and that the two payout mechanisms are potential substitutes, we next investigate if repurchases are replacing dividends. Specifically, we ask whether the sensitivity of dividends to changes in permanent earnings has changed with the increased use of stock repurchases. To do this, we compare the sensitivity of dividends to changes in permanent earnings in the period before and after 1977. We use 1977 as our breakpoint because Bagwell and Shoven (1989) indicate that this is the first year in which a firm engaged in a major stock repurchase program.[3] Our results are striking: the sensitivity of dividends to changes in permanent earnings falls by more than 75% after 1977. This evidence suggests that a decrease in the sensitivity of dividends to changes in permanent earnings accompanies the onset of stock repurchases. We next use the change in this sensitivity to predict the aggregate dividends that *would* have been paid after 1977 had the pre-1977 sensitivity remained constant. We use the difference in this predicted dividend and the actual dividends paid to assess whether this difference drives repurchase behavior. Our results indicate that this difference Granger causes the growth in repurchases that is related to the payment of

[2]Dollar quantities are based on 2000 actual payouts.

[3]We would like to thank Laurie Hodrick for bringing this event to our attention.

permanent earnings. In other words, the evidence suggests that firms are using repurchases to pay out earnings that, prior to 1977, would have been paid out as dividends. These results are consistent with firms using repurchases to replace dividends.

The evidence presented in this paper is related to cross-sectional findings by Jagannathan, Stephens, and Weisbach (2000), who show that a firm is more likely to repurchase stock if it has temporary earnings. Our results confirm that changes in temporary earnings also impact aggregate distribution policy. However, our paper extends the analysis in Jagannathan, Stephens, and Weisbach (2000) in a number of ways. First, Jagannathan, Stephens, and Weisbach use non-operating (operating) cash flows to measure temporary (permanent) earnings, and find that repurchases are used by firms with higher non-operating cash flows. This evidence provides insight into the mechanisms that firms use to distribute accounting earnings and allows the authors' to examine firms' use of financial flexibility. However, relying on accounting definitions to decompose permanent and temporary earnings is problematic because the breakdown into these categories (operating and non-operating) is somewhat subjective and at the discretion of management. In fact, it is quite feasible that both operating and non-operating earnings will have permanent and temporary components. Consequently, it is not clear that the fact that firms with higher non-operating cash flows are the dominant repurchasers shows that firms distribute only temporary earnings with repurchases. We extend their study by relying on economic factors that drive earnings to distinguish permanent from temporary components. In doing so, we find that repurchases not only increase with temporary earnings, but also with permanent earnings.

Second, our study examines the aggregate effect of the relation between dividends and repurchases to determine if aggregate distributions change over time. Thus, our study investigates a time series rather than a cross-section of payouts. The question of whether distribution policy changes over time, or if repurchases have started to substitute for dividends, can only be addressed using a time series of data. In principle, this question could be addressed by examining the time series properties of individual firms' earnings and repurchases and aggregating the results. Unfortunately, firm specific earnings are highly volatile, seasonal, and affected by managerial discretion. Consequently, detecting relations between the driver of earnings, firm output, and earnings is quite difficult at the firm level. Since we are interested in the aggregation of the firm-level data, and since these data are less affected by these measurement issues, we directly deal with the aggregate data.

The rest of the paper is organized as follows: Section 1 describes the pattern in repur-

chases and dividends. Section 2 explains the methods and analyzes the relation between earnings and the economy to develop measures of permanent and transitory earnings. Section 3 relates transitory and permanent earnings to payout policy. Section 4 concludes the paper.

1 Aggregate Patterns in Payout Policy

Data on repurchases and dividends are from Compustat. Dividends are measured as Cash Dividends Paid, quarterly item number 89. Repurchases are measured as Purchases of Common and Preferred Stock, quarterly item 93. As explained in Stephens and Weisbach (1998), this measure of repurchases may overstate repurchase activity because it includes items such as conversion of preferred stock. Thus, similar to Dittmar (2000), Bhattacharya and Dittmar (2002), and Kahle (2002), we reduce repurchases by any decrease in preferred stock measured by Compustat quarterly data item 55. Our sample includes all firms on Compustat and CRSP with share codes 10 and 11, domestic ordinary common shares. We make this adjustment because: 1) the adjustment eliminates foreign companies and ADRs; and 2) Compustat began covering these firms during our sample period and including these firms would create an inconsistent sample over time.

Data are converted to real using the Personal Consumption Expenditure (PCE) deflator from the National Income and Product Accounts (NIPA) tables at the Bureau of Economic Analysis. Past literature investigating the joint behavior of aggregate dividends and macroeconomic analysis has deseasonalized dividend data by representing the dividend series as a moving sum of the annual dividend payments through the current quarter [Hodrick (1992), Bollerslev and Hodrick (1995)]. As repurchases display similar seasonal behavior, we also construct the moving sum of the repurchase series. The growth rate in dividends, Δd_{t+1}, and repurchases, Δr_{t+1}, are the first differences in the log real moving sum of dividends and repurchases. These data are available from the first quarter of 1984 through the fourth quarter of 2000. Due to the need to sum over four quarters, the growth rate data start in the first quarter of 1985.

Table 1 and Figure 1 detail the trends in payouts between 1984 and 2000.[4] The overall

[4]In 1982, the SEC passed the approval of Rule 10b-18, which provides safe-harbor restrictions against SEC anti-manipulation provision for repurchasing firms. Grullon and Michaely (2002) indicate that this

use of stock repurchases fluctuates dramatically during this period. In 1984, firms spent 20.3 billion dollars on stock repurchases; repurchases totaled only 27% of total payouts. Aggregate stock repurchases increased to 38.2 billion dollars or 36% of payouts in 1988 and remained at these higher levels throughout the 1980s. In the early 1990s, as the economy began contracting, firms dramatically curtailed their use of stock repurchases. Stock repurchase activity reached its low in 1991, when aggregate repurchases were 14.4 billion dollars or 16% of total payouts. However, repurchase activity dramatically increased in the late 1990s through 2000; aggregate repurchases reached an all time high of 157.5 billion dollars or 57% of payouts in 2000. Figure 1 illustrates these dramatic fluctuations in aggregate repurchase activity. We are by no means the first to document the trend in repurchase activity. However, no other paper that we are aware of explains the pattern of stock repurchases.

This pattern of stock repurchase is surprising when compared to that of equity issues. The fluctuation in equity issues is similar to that of stock repurchases with peaks in the late 1980s and late 1990s and a trough in the early 1990s. Hot equity issue markets are often attributed to market valuation or investor sentiment [Baker and Wurgler (2002), Ibbotson, Sindelar, and Ritter (1994) Lowry and Schwert (2002), and Lowry (2002)], indicating that the peaks are periods of overvaluation or over-optimism. Because repurchases and equity issues are opposing corporate actions, we would not expect that aggregate repurchases to mirror the pattern of equity issues and the similarity in these patterns casts doubt on the possibility that both are driven by widespread misvaluation. In our later analysis, we will test this relation more directly.

To get a better understanding of what impacts the aggregate pattern of distributions, we divide the sample by size, market-to-book ratio, and industry. Size and market-to-book groups are defined as the top and bottom 30% based on market capitalization and market to book ratios in the year prior to the repurchase, respectively. Industries are defined similar to Fama and French (1997): 1) Nondurable Goods, 2) Durable Goods, 3) Manufacturing, 4) Chemicals and Allied Products, 5) Oil, Gas, and Coal Extraction, 6) Telecommunications, 7) Utilities, 8) Wholesale and Retail, 9) Financial, and 10) Other. Market value data are taken from CRSP and represent market values at the beginning of the calendar year. As in Fama and French (1993), a firm's market to book ratio is calculated as the most recent June

regulatory change partially explains the dramatic increase in repurchase in 1984, documented by Bagwell and Shoven (1989), whereas Cook, Krigman, and Leach (2001) document the degree to which firms comply with this regulation. We therefore focus our analysis in the period following this approval.

CRSP market value divided by the firm's book value as of the most recent fiscal year end. Book value is defined as common shareholder's equity (annual item 60) plus taxes (annual item 74) plus investment tax credits (annual item 208) minus the book value of preferred stock. Depending on availability, the book value of preferred stock is given by redemption (annual item 56), liquidation (annual item 10), or par value (annual item 130) of preferred stock in order of preference. Panels A through J of Figure 2 illustrate that the pattern of distributions documented in Figure 1 exists in almost every industry except utilities, but is most pronounced in manufacturing, wholesale/retail, consumer nondurables, and financial firms. Thus, the aggregate pattern of stock repurchases, as compared to dividends, is not driven by a small subset of firms but is, rather, indicative of the overall market.

Panels A and B of Figure 3 show that though the pattern of stock repurchases for both high and low market to book firms resembles that of the overall market, the peak in the late 1990s is more pronounced for high market to book firms. Specifically, the high market to book firms repurchased approximately 2.5 times as much stock as the low market to book firms. These firms are often considered overvalued, and thus their use of stock repurchases casts doubt on misvaluation driving stock repurchases waves. Similarly, as shown in Panels A and B of Figure 4, large firms spend more on repurchases than small firms. However, the pattern of repurchases for large and small firms mirrors that of the overall market. The pattern for small firms is much less pronounced but is similar in shape.

Overall, Figures 1 through 4 illustrate that the aggregate pattern of distributions is not driven by a small subset of firms. It is present in almost every industry, in high and low market to book firms, and larger and small firms. Thus, in section 4, we investigate what influences the aggregate pattern of stock repurchases and how these influences compare to the factors driving dividend payouts. We infer that the influences on the aggregate exist for most of these subsets, and discuss the results accordingly.

Also shown in Figure 1 and detailed in Table 1, dividend activity is not nearly as volatile as aggregate repurchases. Aggregate dividends steadily increase over the sample period. This is not surprising; since Lintner (1956), it has been widely accepted that firms' dividend policy is rather stable and that firms are reluctant to cut their dividends. However, aggregate dividend payout ratios fluctuate due to changes in earnings while dividends remain stable. Specifically, dividend payout ratios increase in the late 1980s through 1991 and then decline, with the most significant drop in between 1991 and 1994, when the aggregate dividend payout ratio dropped from 56 to 30 percent.

Table 1 also details the repurchase payout ratio and shows that, similar to aggregate repurchases and the ratio of repurchases and total payouts, the repurchase payout ratio fluctuates over the 1984 to 2000 period. The pattern in the repurchase payout ratio very closely mirrors the pattern of aggregate repurchases and differs from that of the dividend payout ratio. Thus, the change in the use of repurchases cannot be fully explained by changes in total earnings; firms alter repurchases by a greater percentage change than the corresponding change in earnings. For this reason, we focus not on total earnings but on estimates of the permanent and temporary components of earnings. We discuss the measurement of these variables in Section 3.2.

2 Repurchases and Earnings

As discussed in the previous section, the patterns of aggregate repurchases fluctuates dramatically over time. We hypothesize that a principal motivation for paying dividends and repurchasing stock is to distribute firms' cash flows, as reflected in earnings; we will discuss and examine other motives in Section 3.3. Consequently, fluctuations in firms' payouts are likely to be related to fluctuations in firms' earnings. According to Lintner (1956), firms' log earnings, e_t, can be decomposed into two components:

$$e_t = e_t^{perm} + e_t^{temp} \tag{1}$$

where e_t^{perm} denotes log *permanent* and e_t^{temp} denotes log *temporary* earnings. In this context, permanent earnings are non-stationary, whereas temporary earnings are stationary. A shock to permanent earnings is expected to permanently alter the earnings stream, whereas the impact of a temporary shock is expected to decay over time. A principal goal of our analysis is to ascertain whether repurchases represent a payout of permanent or temporary earnings, or both, and compare this composition to dividends.

Evidence from Lee (1996), among others, suggests that dividends represent a payout of permanent earnings, e_t^{perm}, rather than temporary earnings, $e_{i,t}^{temp}$. We are interested in investigating whether repurchases represent a distribution of similar and/or different sources of earnings than dividends in order to understand the relation between these distribution methods. In section 2.1, we discuss our approach for disentangling the permanent and temporary components for earnings. However, we recognize that there may be alternative

approaches that decompose permanent and temporary earnings. We discuss some of these alternatives in Section 3.4 to verify the robustness of our results. We present our framework for analyzing how these earnings components affect repurchases in section 2.2.

2.1 Separating Permanent and Temporary Earnings

In this section, we discuss our approach for disentangling the stationary and non-stationary components of earnings. In general, we cannot identify these components from the univariate time series of earnings. However, if earnings are fundamentally related to other variables in the economy, it may be possible to separate the two components. In particular, we assume that we can use the relation between earnings and aggregate output to disentangle permanent from temporary components in earnings. Formally, define log earnings at time t as e_t and log aggregate output at time t as x_t. We hypothesize that

$$e_t = \gamma_0 + \gamma_1 x_t + \epsilon_t \tag{2}$$

The quantity e_t is comprised of three components. The first component, γ_0 represents mean earnings that may arise due to factors unrelated to aggregate output. The component $\gamma_1 x_t$ represents a systematic portion of earnings, reflecting conditions that drive all firms' profitability. Intuitively, in an expanding economy, firms as a whole have better economic profit opportunities than in a contracting economy. The variable x_t captures these common opportunities. The final component, ϵ_t, represents the idiosyncratic portion of earnings, which may reflect earnings management or an individual firms' management's abilities to generate superior or inferior earnings.

Unfortunately, we cannot observe aggregate output. However, we can observe instruments that are functions of aggregate output, in particular macroeconomic variables such as consumption, industrial production, and gross domestic product (GDP). Assuming that this instrument is log gross domestic product, we can write[5]

$$gdp_t = \delta_0 + \delta_1 x_t + \zeta_t \tag{3}$$

[5]Our results are not sensitive to the use of other macroeconomic aggregates such as consumption or industrial production.

This expression allows us to rewrite (2) as

$$e_t = \kappa_0 + \kappa_1 gdp_t + \nu_t \tag{4}$$

Both earnings and GDP are nonstationary, which is visually apparent in Figure 5 and verified by Dickey-Fuller tests as discussed in the Appendix. Expression (4) represents a *cointegrating* relation between log earnings and log GDP [Granger (1983) and Engle and Granger (1987)]. Two cointegrated variables are individually non-stationary, but contain both stationary and non-stationary components. In particular, the two variables share a common non-stationary trend, but either may wander arbitrarily far from this trend. These departures from the trend are stationary; that is, the overall levels of the variables are continually being pulled back toward the overall trend. This too can be seen in Figure 5, which shows that both earnings and GDP follow a steady upward trend. However, earnings fluctuate around this trend; these fluctuations represent the stationary or temporary component of earnings. Consequently, by modeling log earnings and log GDP as cointegrated, we can separate the non-stationary component of earnings from the stationary component:

$$e_t^{perm} = \kappa_0 + \kappa_1 gdp_t \tag{5}$$

$$e_t^{temp} = \nu_t \tag{6}$$

It is important to note that we are not stating the permanent component of earnings is completely driven by GDP. Rather, we hypothesize that both earnings and GDP are driven by aggregate output, which causes these two variables to share a common trend. We can then use the cointegration of these two related variables to separate their permanent and temporary components.

In the following section, we discuss an econometric specification for measuring these two components of earnings. This specification will more clearly delineate the residual in (4) as the temporary shock to earnings. Moreover, the specification will allow us to separate the *change* in temporary earnings from the change in permanent earnings, which can then be used to predict repurchase and dividend growth.

2.2 Econometric Specification

As explained above, we hypothesize that earnings and GDP are characterized by a cointegrating relation [Granger (1983) and Engle and Granger (1987)], which is consistent with the notion that earnings are comprised of a permanent (stationary) component and a temporary (non-stationary) component. In this context, $e_t^{temp} = \nu_t$, the shock to the relation between GDP and earnings, is stationary and $e_t^{perm} = (\kappa_0 + \kappa_1 gdp_t)$, the trend, is nonstationary. Two precautions must be taken in interpreting these variables. First, to interpret these components as temporary and permanent components in *earnings* rather than *GDP*, we must show that this description is reflected in the data. Although the cointegrating relation establishes a common shared trend in earnings and GDP, it does not imply a causal relation. In order to establish this relation, and ensure that ν_t represents shocks to temporary earnings and $(\kappa_0 + \kappa_1 gdp_t)$ represents shocks to permanent earnings, we investigate the *error-correction* representation of (4) [Engle and Granger (1987)]:

$$\begin{aligned} \Delta e_t &= \delta_{10} + \sum_{l=1}^{L} \delta_{11,l} \Delta e_{t-l} + \sum_{l=1}^{L} \delta_{12,l} \Delta gdp_{t-l} + \delta_{13} \nu_{t-1} + u_{1,t} \\ \Delta gdp_t &= \delta_{20} \sum_{l=1}^{L} \delta_{21,l} \Delta e_{t-l} + \sum_{l=1}^{L} \delta_{22,l} \Delta gdp_{t-l} + \delta_{23} \nu_{t-1} + u_{2,t} \end{aligned} \tag{7}$$

If $\delta_{13} \neq 0$, then shocks to the cointegrating relation between earnings and GDP, (4), feed back into earnings, implying that $\nu_t = e_{i,t}^{temp}$ captures transitory movements in earnings. In addition, if $\delta_{23} = 0$, these shocks do not feed back into GDP, implying that these shocks do not represent transitory movements in GDP. Consequently, if both $\delta_{13} \neq 0$ and $\delta_{23} = 0$, we characterize $\nu_t = e_{i,t}^{temp}$ as the temporary shock to earnings. We provide evidence below to show that this conjecture holds.

The second precaution has to do with the precision of our estimates. Our methods presume that earnings completely measures firm output and that GDP completely measures aggregate output. However, due to data and accounting considerations, it is possible that one or both of these variables is unable to accurately proxy for their intended quantities. If this mismeasurement is systematic, it may cause noise in our estimate of temporary earnings, since this is the residual from the cointegrated VAR and thus, by definition, less precisely measured. We discuss some ways in which we deal with these issues in Section 2.4, where we define our sample and data. However, because some noise remain, or power to test the

influence of temporary earnings may suffer.

The error-correction vector autoregression (7) also allows us to express earnings in the more familiar changes rather than levels representation. This modification will also be useful for relating changes in earnings to changes in repurchases. Based on expression (7), we can define *shocks* to permanent and temporary earnings as follows:

$$\begin{aligned} \Delta e_t^{perm} &= \sum_{l=1}^{L} \delta_{11,l} \Delta e_{t-l} + \sum_{l=1}^{L} \delta_{12,l} \Delta gdp_{t-l} + u_{1,t} \\ \Delta e_t^{temp} &= \delta_{13} \nu_{t-1} \end{aligned} \tag{8}$$

From the cointegrating relation (4), we know that temporary earnings shocks are embodied in the cointegration residual, ν_{t-1}. Thus, $\delta_{13}\nu_{t-1}$ represents the shock to earnings at time t caused by a shock to temporary earnings. The remaining components of the model are orthogonal to this shock to temporary earnings and therefore represent shocks to permanent earnings.

In the following section, we complete the economic and econometric framework, linking the payout of dividends and repurchases to the permanent and temporary components of earnings.

2.3 Payouts, Earnings, and GDP

The time series specification of earnings presented in (4) suggests a two-variable cointegrated system. As stated above, we hypothesize that a primary motivation for repurchasing stock and paying dividends is to distribute firm cash flows. Consequently, this hypothesis suggests a link between the levels of repurchases and dividends observed to the level of earnings and, therefore from (4), GDP. In particular, we hypothesize a VAR for log dividends and repurchases. The first equation of these VARs is our primary interest, and is presented in the following expressions:

$$\Delta r_t = \beta_0 + \sum_{l=1}^{L} B_l' \begin{pmatrix} \Delta r_{t-l} \\ \Delta e_{t-l}^{perm} \\ \Delta e_{t-l}^{temp} \end{pmatrix} + \upsilon_t \tag{9}$$

$$\Delta d_t \quad = \quad \gamma_0 + \sum_{l=1}^{L} \Gamma_l' \begin{pmatrix} \Delta d_{t-l} \\ \Delta e_{t-l}^{perm} \\ \Delta e_{t-l}^{temp} \end{pmatrix} + \omega_t \tag{10}$$

where r_t and d_t represent log repurchases and dividends, respectively. If repurchases are payouts of permanent innovations in earnings, then the appropriate element of B, $\beta_{12,l} > 0$. If repurchases represent distributions of temporary earnings, then $\beta_{13,l} > 0$.[6]

One last point should be addressed. Firm-specific earnings and dividends are highly seasonal and volatile. From a measurement standpoint, this issue suggests that capturing the relation between earnings and GDP will be difficult at the firm level. Consequently (and for other reasons detailed above), we focus on *aggregate* earnings and repurchases. This specification does not allow us to investigate how a *particular* firm distributes earnings among repurchases and dividends. However, our question of interest focuses on how firms in *aggregate* distribute these earnings and whether repurchases are replacing dividends. Consequently, the econometric gain from investigating (9) and (10) for aggregate data outweighs the information lost.

2.4 Data and Estimation

Earnings are obtained from Compustat, and are calculated as the sum across included firms of Earnings Before Extraordinary Items (Compustat Data Item 8). In section 3.4, we will discuss the robustness of the results to alternative specifications of earnings. Similar to repurchases and dividends, earnings are computed as a four-quarter moving sum of this variable, and the level of earnings is converted to real using the PCE deflator. The growth rate in earnings, Δe_{t+1}, is calculated as the first difference in the log real moving sum of earnings. These data are available from the first quarter of 1961 through the fourth quarter of 2000; again, due to the moving sum, growth rate data are calculated from the first quarter of 1962.

GDP is obtained at the quarterly frequency from the NIPA tables and, similar to repur-

[6]Note that this approach is different than simply regressing the change in repurchases on the change in earnings. Earnings contains both permanent and temporary components; consequently, as suggested in Granger (1983), a VAR in earnings changes is misspecified. Consequently, regressing changes in repurchases on changes in earnings would result in a biased coefficient. Moreover, this regression would not separate earnings changes into their permanent and temporary components.

chases, dividends, and earnings, is converted to real using the PCE deflator. No smoothing is necessary for this series, and the growth rate in GDP, Δgdp_{t+1}, is also calculated as the first difference in the log real level of GDP. These data, as with the earnings data, are calculated from the first quarter of 1962 through the fourth quarter of 2000.

A subset of normalized earnings and GDP are depicted in Figure 5 and discussed in Section 2.1. As shown in the figure, the series exhibit common trend behavior, as exhibited by the common upward trajectory; this pattern is more pronounced when examining these data over the past four decades. Marked departures from these trends are apparent, most notably in periods of economic contraction or expansion, such as the behavior in the 1990s. A comparison of Figure 5 and Figure 1 suggests that the macroeconomy, aggregate earnings, and aggregate repurchases all appear to follow a similar pattern. This pattern is the cyclicality of repurchases noted in Jagannathan, Stephens, and Weisbach (2000).

These figures provide qualitative evidence of a link in economic activity, firm earnings, and repurchases. In the following section, we provide formal statistical evidence pertaining to this issue. We first show that earnings and GDP are cointegrated, implying that we can interpret earnings as composed of two components: a nonstationary, permanent trend component and a stationary, temporary deviation. We then use this decomposition to analyze the relation between these permanent and temporary components of earnings and firms' repurchase and dividend activity.

3 Estimation Results

3.1 Estimating Permanent and Temporary Earnings

As discussed in Section 2, our analysis is based on the idea that earnings and GDP are cointegrated, and that departures from the long-run trend in GDP and earnings can be characterized as temporary earnings shocks. In this section, we investigate both of these hypotheses. Our formal tests for cointegration find that log earnings and log GDP are cointegrated; the Phillips and Ouliaris (1990) residual test and Johansen (1991) trace tests suggest that the series are cointegrated. We present the parameters of the cointegrating relation in Table 2, Panel A. The point estimate $\beta = 1.683$ indicates that a 1% increase in quarterly real GDP translates into a 1.68% increase in permanent earnings. Further details

of the cointegration tests and methods are presented in the Appendix.

We have previously noted that the presence of a cointegrating relation does not allow us to say that shocks to the relation between GDP and earnings represent temporary shocks to earnings. Again, the reason is that the cointegration relation does not establish a causal relation between earnings and GDP. Therefore, we also investigate the error-correction representation, (7). This specification allows us to assess whether the deviations in the cointegrating relation represent shocks to earnings or to GDP. The results of the estimation of this specification are presented in Table 2, Panel B. As shown in the table, the coefficient on ν_{t-1} in the earnings AR representation, δ_{13}, is -0.029 (p-value 0.035); thus, we reject the hypothesis that ν_{t-1} does not influence earnings growth. In contrast, we cannot reject the hypothesis that that the coefficient in the GDP equation, δ_{12}, is equal to 0. (p-value 0.820). This evidence indicates that ν_{t-1} is better described as transitory movements in earnings rather than GDP, and as a result, we will proceed with the interpretation of $\nu = e^{temp}$, that is as temporary earnings. Further, by construction, the remaining components of earnings changes are orthogonal to this temporary piece, and consequently represent permanent innovations to earnings.

Note that the sign of the coefficient on ν_{t-1} is negative in the error-correction VAR. This sign is consistent with the interpretation of ν as the temporary component of earnings. The negative sign suggests that a positive shock to temporary earnings today is likely to result in a negative shock to earnings next period; that is, the shock tends to mean revert. Although earnings may be above trend in period $t-1$, the cointegrating relation will pull earnings back toward trend, implying an average mean reversion. This dynamic is displayed graphically in Figure 6. In the remainder of this section, we analyze the implications of changes in these permanent and temporary components of earnings for the dynamics of aggregate dividends and repurchases.

3.2 How do Earnings Influence Payout Decisions?

In this section, we investigate and discuss the ways in which permanent and temporary earnings influence changes in repurchases and dividends. In particular, we consider the empirical representations (9) and (10), which constitute VARs for growth in either repurchases, Δr_t, or dividends, Δd_t, permanent earnings, Δe_t^{perm}, and temporary earnings e_t^{temp}. The coefficients associated with lagged permanent and temporary earnings changes indicate the influence of

these sources of earnings on the aggregate repurchase and dividend policy of firms. The coefficients on the lagged repurchase or dividend changes reflect dynamic repurchase or dividend motives not directly linked to either of these components of earnings. In all of our tests, we use a VAR of order two (VAR(2)); that is, we incorporate two lags in the VAR.[7]

Estimation results for the VAR representation (10) are presented in Table 3, Panel A. As noted in the previous section, expression (10) represents the first equation of the VAR for growth in dividends, permanent, and temporary earnings. Results for dividend growth are presented in Panel A. Consistent with the evidence in Lee (1996), shocks to permanent earnings influence repurchase growth, whereas shocks to temporary earnings do not. The test statistics suggest that dividends respond to permanent earnings with a two-quarter lag; the point estimate for two-quarter lagged permanent earnings growth of 0.276 (p-value 0.075) implies that a one standard deviation shock to permanent earnings growth translates into a 1.33% increase in dividends at time t. Given that the average quarterly change in dividends paid over the sample period is 0.64% and the maximum is 6.71%, 1.33% represents a sizeable impact.

Results for the impact of permanent and temporary earnings on changes in repurchases are presented in Table 3, Panel B. The results presented in the table show that, similar to the impact on dividends, we find that *permanent* earnings impact repurchase growth with a two-quarter lag. The point estimate of 2.412 (p-value 0.010) indicates that a one standard deviation shock in permanent earnings leads to an 11.6% increase in repurchases. The average change in quarterly repurchases is 2.78%, whereas the maximum is 33.96%, suggesting that 11.6% represents a substantial influence on aggregate repurchases. In the analysis that follows, we will employ an impulse response function to determine the full impact of a change in permanent earnings on aggregate repurchases. This evidence suggests that repurchases serve to pay out permanent earnings. This result is particularly interesting in that it suggests that repurchases serve as a vehicle to pay out a set of earnings that is often associated with dividends. Hence, the result indicates that repurchases and dividends may be substitutes in that they pay out similar forms of earnings and further that it is possible that repurchases could replace dividends.

The results also suggest that the net impact of temporary earnings on repurchases is positive. The response of repurchases at time t to a shock to temporary earnings at time

[7]Specification tests indicate that two lags are preferred to one and that three lags are not preferred to two. These tests are not reported, but are available from the authors upon request.

$t-1$ is positive as indicated by the point estimate of 53.743 (p-value 0.072). However, the dynamics of this variable are somewhat complicated, as indicated by the response of repurchases to a shock in temporary earnings at time $t-2$ of -53.184 (p-value 0.063). This result is not surprising, insofar as temporary earnings tend to mean revert as discussed in the previous section. However, the dynamics make the net impact of a shock to temporary earnings on repurchase activity difficult to detect. In order to more precisely investigate this question, we utilize the VAR structure of the model to investigate the impulse response function for the variables [see Hamilton (1994)]. The impulse response function is a forecast of the impact of a shock to the VAR system on future values of the variables. More concretely, the impulse response function forecasts the impact that a one standard deviation shock to lagged payout, permanent earnings, and temporary earnings growth will have on payout growth $\tau = \{1, ...\infty\}$ periods into the future. We also cumulate the impact of these shocks to estimate the cumulative impact of a shock in a variable at time t to dividends and repurchases in future periods.

Impulse response functions and cumulative impulse responses for shocks to permanent and temporary earnings to dividends and repurchases are presented in Figures 7 and 8 respectively. The impulse response function is plotted in Panel A and the cumulative response is plotted in Panel B. The plot for dividends shown in Figure 7 suggests an oscilliatory response for dividends in the near term. However, the graph indicates that at two lags, that a one standard deviation shock to permanent earnings results in a 0.27% increase in dividends, and the impact gradually dies out over approximately 30 quarters. As shown in Panel B, the ultimate impact of this shock is to increase dividends by approximately 1.5%, reflected after 24 quarters. As shown in the figure, the impact of temporary earnings on dividends is relatively negligible. These results are consistent with those discussed above.

The impact of permanent and temporary components of earnings on repurchases is more dramatic. These results are presented in Figure 8. A one standard deviation shock to temporary earnings results in an increase in repurchases of 2.45% in the subsequent quarter, dying out to a 0.12% impact 12 quarters into the future. A one standard deviation shock to permanent earnings results in a 3.83% increase in repurchases two quarters into the future, decaying to a 0.09% impact 16 quarters into the future.[8] As shown in Panel B, the cumulative impact of a one standard deviation shock in permanent earnings at time t on

[8]Note that this quantity reflects the projected impact of a shock only at time $t-1$ on future repurchases and does not account for any subsequent permanent or temporary earnings.

repurchases 16 quarters into the future is 18.59%. Similarly, the cumulative impact of a one standard deviation shock to temporary earnings 16 quarters into the future is 8.48%. Again, as compared to an average change in repurchases of 2.78% and a maximum change of 33.95%, these influences represent a substantial impact.

The results of this section suggest that shocks to both permanent and temporary earnings have a substantial impact on future repurchase activity. As stated above, the long-run impact of a standard deviation shock to permanent earnings is to increase repurchases in excess of 18%, whereas the long-run impact of a standard deviation shock to temporary earnings is to increase repurchases in excess of 8%. These results suggest that repurchases represent a payout of both permanent and temporary earnings. The payout of permanent earnings is of particular interest because, as indicated by the evidence in this section, dividends represent a payout of only permanent, not temporary earnings. Since repurchases are payouts of permanent earnings, it is possible that they may represent a substitute for dividends.

3.3 Alternative Motives for Repurchasing Stock

Distributing earnings is only one factor influencing firms' distribution decisions, and thus only one factor potentially impacting the aggregate pattern of dividends and stock repurchases. Dittmar (2000) details an extensive set of these motives. Baker and Wurgler (2003b) provides an additional explanation of firm dividend decisions. We therefore control for several of these motives by including the following variables:[9]

1. mkt_{t+1}, mkt_{t-1}, the return on the value-weighted market at time $t+1$ and at $t-1$.
2. Δtax_t, the differential in the highest marginal personal income tax rate and the capital gains rate in quarter t.
3. Δmb_{t-1}, the market to book ratio in quarter $t-1$.
4. Δis_{t-1}, the investment to sales ratio in quarter $t-1$.

[9]We do not control for the takeover deterrence hypothesis because this motive is most related to tender offers, and aggregate repurchase activity is dominated by open market repurchases. We also do not examine the capital structure hypothesis because although this motive may affect a firm's decision to repurchase, it is less likely to have an effect on all firms at the same time.

5. $\Delta divprem_t$, the difference in the market-to-book ratio of dividend-paying and non dividend-paying firms.

6. $\Delta option_{t-1}$, option grants in quarter t.

7. $\Delta merger_{t-1}$, the change in percentage of market capitalization acquired in quarter $t-1$.[10]

We include mkt to control for the undervaluation hypothesis, which states that firms repurchase stock when they perceive their stock to be undervalued. Consistent with Lowry (2002), we include a lagged market return because firms may perceive their stock as undervalued after a market downturn and we include lead market return as a measure of investor sentiment. Since we are examining aggregate repurchases, this motive will only influence our results if a large portion of the market perceives itself as undervalued, thus we measure these returns as the return on the value weighted market.

As in Grullon and Michaely (2002), we include tax to control for the tax differential between repurchases and dividends. Stock repurchases may be preferred to dividends because they are taxed at the potentially lower capital gains tax rate, whereas dividends are taxed as personal income. Thus, in periods when the capital gains rate is reduced relative to the personal tax rate, firms may increase repurchases. As we use the differences in payouts from quarter to quarter, we use the change in TAX from the previous quarter. Our reason for doing so is that we are comparing changes in repurchase or dividend activity induced by a change in the tax environment.

Stock repurchases and dividends are potential mechanisms to distribute excess earnings. Thus, it is important to control for investment opportunities in the analysis. Changes in investment opportunities may influence aggregate distributions. We measure investment opportunities as 1) the aggregate market to book ratio, mb_t, and 2) the investment to sales ratio, $invest_t$. In this setting, we calculate the book value of the firm as discussed in Section 2; however we use Compustat data as of the most recent calendar quarter. The market value used in the calculation is the CRSP market value in the quarter for which the book value data are available. Though we use the market to book ratio as a control for investment opportunities, based on the evidence presented in Ikenberry, Lakonishok, and Vermaelen

[10]Mergers and option data are available only annually. We allocate the annual growth equally across quarters.

(1995), it may also control for potential undervaluation. The investment to sales ratio is likewise calculated using Compustat data for the most recent calendar quarter available. We calculate this ratio as the sum of capital expenditures (Compustat quarterly item 90) and R&D expenditures (quarterly item 4) divided by sales (quarterly item 2).

Based on Baker and Wurgler (2003b), investors may have time-varying preferences for dividend paying firms. These preferences are driven by mispricing, and managers respond to the security mispricing by altering dividend payout policy. Following Baker and Wurgler (2003b), we measure this dividend premium as the change in the difference in the dividend yields of high book-to-market and low book-to-market firms. The resulting variable is called $divprem_t$ and is included in our tests. Finally, we also control for the aggregate use of stock options and merger activity. As shown in Jolls (1998), Kahle (2002), and Fenn and Liang (2001), stock repurchases may increase with the use of employee stock options. As discussed in Bagwell and Shoven (1989), repurchases may be used to fend off takeover attempts. If merger and acquisition activity is more intense in certain periods, then this may somewhat explain repurchase waves [see Dittmar (2000)]. We control for mergers and acquisitions by including the change in the percentage of firms' market capitalization acquired as provided in Holmström and Kaplan (2003).

To investigate the influence of permanent and transitory earnings on payout policy in the presence of these alternative motivations, we analyze subsets of the following equations

$$\begin{aligned}
\Delta r_t &= \beta_{00} + \beta_{01} t + \sum_{l=1}^{2} \beta_{11,l} \Delta r_{t-l} + \sum_{l=1}^{2} \beta_{12,l} \Delta e_{t-l}^{perm} + \sum_{l=1}^{2} \beta_{13,l} \Delta e_{t-l}^{temp} \\
&+ \beta_{14} mkt_{t-1} + \beta_{15} \Delta tax_t + \beta_{16} \Delta invopp_{t-1} + \beta_{17} mkt_{t+1} + \beta_{18} \Delta option_{t-1} \\
&+ \beta_{19} \Delta divprem_t + \beta_{10} \Delta merger_t + \upsilon_t \qquad (11) \\
\Delta d_t &= \gamma_{00} + \gamma_{01} t + \sum_{l=1}^{2} \gamma_{11,l} \Delta d_{t-l} + \sum_{l=1}^{2} \gamma_{12,l} \Delta e_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{13,l} \Delta e_{t-l}^{temp} \\
&+ \gamma_{14} mkt_{t-1} + \gamma_{15} \Delta tax_t + \gamma_{16} \Delta invopp_{t-1} + \gamma_{17} mkt_{t+1} + \gamma_{18} \Delta option_{t-1} \\
&+ \gamma_{19} \Delta divprem_t + \gamma_{10} \Delta merger_t + \xi_t \qquad (12)
\end{aligned}$$

where $invopp_{t-1}$ is either is_{t-1} or mb_{t-1}. For consistency, we control for each of these variables in both our dividend and repurchase regressions, although many of the motives discussed above are pertinent only to stock repurchases. Results of these regressions are reported in Tables 4 and 5. Two points are of note from these regressions. First, the inclusion

of the alternative variables does not materially alter the relation between repurchases and either temporary or permanent components of earnings. The relation between changes in repurchases and the components of earnings remains fairly stable, with both influencing changes in repurchases paid in a statistically significant manner throughout the regressions. The second point of note is that, with the exception of the undervaluation hypothesis, none of the alternative motivations appear to have an incrementally significant impact on changes in repurchases.[11] However, this result may hold true because our data are aggregated; these motives may be more important at the firm than at the aggregate level. Specifically, as shown in Dittmar (2000), in some periods undervaluation, investment opportunities, mergers and acquisitions, and the use of stock options each influence a firm's decision to repurchase stock. However, our results imply that though a subset of firms may be influenced by these motives, aggregate stock repurchases change primarily because firms have more or less permanent and temporary earnings to distribute.

Our evidence on the undervaluation hypothesis deserves some additional attention. As shown in Table 4, there is a positive and significant relation between growth in repurchases at time t and returns on the market at time $t+1$. This evidence has been interpreted as indicating that firms repurchase stock when it is relatively undervalued [Lowry (2002)]. The puzzling result that we show in Table 5 is that there is also a statistically significant positive relation between dividend growth at time t and returns on the market at time $t+1$. This evidence is a bit more difficult to reconcile with undervaluation; it is not clear why firms would pay out dividends when they perceive themselves to be undervalued. An alternative interpretation on this evidence can be drawn from the return decomposition of Campbell and Shiller (1988). The authors decompose return shocks into two components: revisions in future expected discount rates and revisions in current and future expected cash flow growth rates. If we consider dividends and repurchases as measures related to firms' cash flow, and these measures exhibit persistence, growth rates in dividends and repurchases at time t are potentially correlated with returns at times $t+1, ..., t+k$. Consequently, market returns at time $t+1$ may appear to significantly impact dividend and repurchase behavior at time t not because of undervaluation motives, but rather because returns at time $t+1$ depend on cash flows at time $t+1$, which are correlated with cash flows at time t.

[11] The insignificance of the dividend premium in Table 5 differs from the results presented in Baker and Wurgler (2003a). These differences result from a subtly different question of interest. Baker and Wurgler explain the proportion of firms paying dividends, whereas we explain aggregate dividend payouts.

In summary, our results show that firms distribute permanent earnings through both dividends and repurchases. These results indicate that repurchases and dividends are substitutes, and that it is feasible that repurchases could be replacing dividends. Additionally, we confirm prior research that shows that repurchases are a mechanism to distribute temporary earnings. In section 3.5, we will more directly address the question of whether repurchases are replacing dividends.

3.4 Additional Robustness Checks

As discussed above, our interpretation of the results depends on the idea that we have accurately separated permanent from temporary earnings. In this section, we briefly discuss some alternative measures of permanent and temporary earnings and show that these measures produce similar results to those presented in the preceding sections. We maintain that our approach is advantageous relative to these alternatives because it relies on an exogenous variable (GDP) to separate stationary and non-stationary components of earnings. The alternative approaches do not focus on the stationarity of permanent vs. temporary earnings or do not let these components be driven by an exogenous variable.

The first alternative that we consider follows Jagannathan, Stephens, and Weisbach (2000) and measures permanent earnings via operating earnings (Compustat Data Item 21). We define temporary earnings as the difference in operating income and earnings before extraordinary items (Compustat Data Item 8). We then examine the specifications (9) and (10), substituting change in operating income for change in permanent earnings, and the change in the difference in operating income and earnings before extraordinary items for temporary earnings. These results are not tabulated, but are qualitatively similar to those discussed above. At one lag, the change in operating income has a positive and significant impact on the change in repurchases; the point estimate is 3.295 (p-value 0.007), indicating that a one standard deviation increase in operating income translates to an 8% increase in repurchases. A result that is less consistent is that this measure of temporary earnings negatively impacts repurchase activity; the point estimate for one lag is -1.599 (p-value 0.066). We conjecture that this result may be attributable to the fact that these measures of permanent and temporary earnings do not adequately separate stationary and non-stationary components of earnings.

Lee (1996) separates the permanent and temporary components of earnings using a coin-

tegrating relation between dividends and earnings. We pursue a second alternative and follow Lee (1996) by directly measuring permanent and temporary earnings via a cointegrating relation between earnings and repurchases. There are two issues with this approach. First, it is necessary to have a long time series to detect a cointegrating relation. The repurchase data in this paper span only 60 quarters, making it difficult to detect cointegration in repurchases and earnings. The second issue is that we rely on repurchases to separate permanent and temporary components of earnings. It is difficult to ascertain whether the deviations in the relation between earnings and repurchases represent temporary movements in repurchases or earnings. Nevertheless, following Lee, we investigate the implications of this framework for permanent and temporary components of repurchases.

The evidence for cointegration in repurchases and earnings is weak. As suggested previously, Dickey-Fuller tests indicate that the earnings series contains a unit root, but does not detect a unit root in repurchases. The Johansen (1991) trace statistic suggests that the two series are cointegrated, but the eigenvalue statistic does not. We proceed with the analysis as if the series are cointegrated with the caveat that cointegration evidence is weak. The qualitative findings resulting from this alternative measure of permanent and temporary earnings are nearly identical to those presented above. Permanent earnings have a positive and significant impact on changes in repurchases; the point estimate is 1.111 (p-value 0.005) at one lag. Temporary earnings have a positive impact and significant impact at one lag; the point estimate is 2.110 (p-value 0.010). The impact of temporary earnings at two lags is negative and significant; the point estimate is -1.253 (p-value 0.005).

A final robustness check that we consider is to use alternative measures of macroeconomic activity to separate permanent and temporary earnings. In particular, we consider growth in per capita consumption of nondurables and services and industrial production growth. Both series are obtained from the NIPA tables at the Bureau of Economic Analysis. We find qualitatively similar results using these alternative measures of macroeconomic activity and do not report the results in the interest of brevity.

In summary, these results largely corroborate the findings of our original approach to measuring permanent and temporary components of earnings. In both alternatives, permanent earnings have a positive and significant impact on repurchase activity. The evidence for temporary earnings is a bit weaker; when we use operating earnings to define permanent earnings, we obtain a counterintuitive negative relation between temporary earnings and repurchases. However, when we use deviations in the cointegrating relation between

repurchases and earnings, we find results consistent with those shown previously.

3.5 Are Repurchases Replacing Dividends?

A provocative question in the payout policy literature is the question of whether dividends are disappearing. Fama and French (2001) suggest that this is indeed the case, but that repurchases are not replacing the dividends that would have been paid. DeAngelo, DeAngelo, and Skinner (2003) contradict this conclusion, showing that real dividends paid has continued to increase. This evidence suggest that dividends are not disappearing *per se*. However, the fraction of earnings paid out in dividends has steadily decreased over the course of the 1990s. As shown in Table 1, the fraction of earnings paid out as dividends has decreased from a peak of 55.6% in 1991 to 26.3% in 1999. In this section, we ask whether the introduction of repurchases has influenced this trend, and whether firms are using repurchases to replace dividends in their payout policy in aggregate.

We approach this question in two steps. In the first step, we ask whether the relation between dividends paid and permanent and temporary earnings has changed over time. This question might be addressed via a number of methods; e.g. appealing to regime switching or structural breaks in the relation. We are less concerned with identifying an exact date in which the relation changed than the question of whether this functional relation has changed. Consequently, we adopt a simpler specification and define the indicator variable:

$$I_{1977} = \begin{cases} 1 & \text{If } t \geq 1977.1 \\ 0 & \text{Otherwise} \end{cases} \tag{13}$$

We utilize the year 1977 because, as reported in Bagwell and Shoven (1989), IBM initiated the first significant repurchase program in that year. We investigate an augmented version of the VAR, expression (10)[12]:

$$\Delta d_t = \gamma_0 + \gamma_{1977} I_{1977,t} + \sum_{l=1}^{L} \Gamma_l' \begin{pmatrix} \Delta d_{t-l} \\ \Delta e_{t-l}^{perm} \\ \Delta e_{t-l}^{temp} \end{pmatrix} + \sum_{l=1}^{2} \delta_l \Delta e_{t-l}^{perm} I_{1977,t} + \omega_t \tag{14}$$

[12]We include only the interaction of the indicator variable and the change in permanent earnings because this variable is our main variable of interest. Further, this reduces the number of parameters, improving the precision of our estimates. However, all of the results of this section hold if we allow for an interaction in the indicator variable and the lagged dividend growth terms as well.

In order to extend our sample prior to 1984, we utilize an alternative measure of dividends paid. In particular, we define

$$D_t = DY_t V_t \tag{15}$$

where DY_{t+1} is the CRSP dividend yield on the aggregate portfolio, calculated as the difference in the with-dividend and price-appreciation return, and V_t represents the market value of the portfolio at the beginning of quarter $t+1$. This measure of dividends is used in Campbell (2000) and Bansal, Dittmar, and Lundblad (2001).

We present results for this specification in Table 6. Our first concern is whether the alternative measure of dividends suggests similar conclusions as those implied by the Compustat dividends. Thus, we first estimate the parameters of equation (14) restricting $\alpha_{1977} = \delta_1 = 0$. These results are shown in the first row of the Table, and suggest that, consistent with the results above, there is a positive impact of changes in permanent earnings at time $t-2$ on dividend growth at time t; the point estimate of the coefficient is 0.186 (p-value 0.004). As in our previous results, the impact of permanent earnings on dividends occurs with two lags; the $t-1$ coefficient is not significant. Further, temporary earnings do not contribute to predicting dividend growth. In the second row of the Table, we relax the restrictions on α_{1977} and δ_1. The results are consistent with the hypothesis that the relation between dividend payouts and permanent earnings has changed over time. The point estimate for the coefficient on changes in earnings at time $t-2$ is 0.466 (p-value 0.000), and the estimate on the interaction coefficient, δ_1, is -0.361 (p-value 0.011). These results suggest that the sensitivity of dividend growth to growth in permanent earnings changed after 1977; the pre-1977 sensitivity of 0.466 is over four times higher than the implied post-1977 sensitivity of 0.105. The sensitivity to temporary earnings remains insignificant.

This evidence indicates that the response of payout policy to permanent earnings shifted subsequent to 1977, but it does not indicate whether the slack in dividend payments was taken up by repurchases. In order to address this question, we construct the predicted dividend growth based on the pre-1977 point estimates. Specifically, we form the difference in the dividends that firms *would* have paid had the dividends been as sensitive to permanent earnings changes after 1977 as they were prior to this year. This series is constructed as follows:

$$\text{diff}_t = \Delta \hat{d}_{1977,t} - \Delta d_t = -\left(\hat{\alpha}_{1977,d} I_{1977,t} + \sum_{l=1}^{2} \hat{\delta}_{l,d} \Delta e_{t-l}^{perm} I_{1977,t} + \upsilon_t \right) \tag{16}$$

where $\hat{\alpha}_{1977,d}$ and $\hat{\hat{\delta}}_{l,d}$, are the point estimates from the dividend equation in the augmented VAR presented in expression (14).

Our question of interest is whether this difference is related to the growth in repurchase activity. In particular, if repurchases are replacing dividends, the growth in repurchases should be driven by differences in predicted dividends and dividends actually paid. Using our interpretation of the VAR, expression (9), we can further refine this hypothesis. We expect that, since dividends are used to pay permanent earnings, that the difference in predicted and paid dividends will be accounted for in the portion of repurchases used to pay permanent earnings. That is, we can decompose the growth in repurchases into three components:

$$\begin{aligned}
\Delta r_t^{perm} &= \sum_{l=1}^{2} \hat{\beta}_{12,l} \Delta e_{t-l}^{perm} \\
\Delta r^{temp} &= \sum_{l=1}^{2} \hat{\beta}_{13,l} \Delta e_{t-1}^{temp} \\
\Delta r_t^{other} &= \hat{\beta}_{10} + \sum_{l=1}^{2} \hat{\beta}_{11,l} \Delta r_{t-1} + \upsilon_{1,t}
\end{aligned}$$

where $\hat{\beta}_{1j,l}$ represent the estimates from expression (9). The series Δr_t^{perm} represents the portion of repurchases related to permanent earnings, the series Δr_t^{temp} represents the portion related to temporary earnings, and the series Δr_t^{other} represents repurchases unexplained by either of these motives.

In order to investigate the hypothesis of whether the difference in predicted and actual dividends is driving changes in repurchase activity related to permanent earnings, we specify the following empirical model:

$$\begin{aligned}
\Delta r_t^{perm} &= \gamma_{10} + \sum_{l=1}^{2} \gamma_{11,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{12,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{13,l} \text{diff}_{t-l} + \eta_{1,t} \\
\Delta r_t^{temp} &= \gamma_{20} + \sum_{l=1}^{2} \gamma_{21,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{22,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{23,l} \text{diff}_{t-l} + \eta_{2,t} \qquad (17) \\
\text{diff}_t &= \gamma_{30} + \sum_{l=1}^{2} \gamma_{31,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{32,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{33,l} \text{diff}_{t-l} + \eta_{3,t}
\end{aligned}$$

The significance of the point estimates $\gamma_{13,l}$ indicate whether the difference in actual and predicted dividends at time $t-l$ significantly impacts the portion of repurchases related to to permanent earnings paid at time t.

Results for this estimation are presented in Table 7. For brevity, we present results only of the first equation in model (17) since this equation most directly tests our hypothesis. As shown in the table, there is a strong and positive relation between the difference in predicted and paid dividends in period $t-1$ and permanent repurchases paid at time t. As shown in the table, there is strong evidence that the growth in permanent repurchases is driven by the difference in predicted and actual dividends. This evidence is indicated by the Granger causality tests, which suggest that we cannot reject the hypothesis that the difference causes the growth in repurchases at the 1% significance level. The results for the remaining equations support this conjecture. These results suggest that the difference in predicted and actual dividends is not driven by permanent (p-value 0.242) or temporary (p-value 0.652) components of repurchases. Further, the temporary component of repurchases is not driven by this difference (p-value 0.126).

4 Conclusion

In an influential and provocative paper, Fama and French (2001) show that the percentage of firms paying dividends has fallen over time. Further, although the aggregate volume of dividends paid has risen [DeAngelo, DeAngelo, and Skinner (2003)], the dividend payout ratio has declined. Over a similar time period, several papers have documented that the volume of stock repurchases has increased dramatically. These trends culminated in 1997, when the dollar value of stock repurchases surpassed that of dividends paid. Thus, the question arises: are stock repurchases replacing dividends?

In this paper, we address this question and find that the answer is *yes*; repurchases are indeed replacing dividends. Our approach to answering this important question is simple: we hypothesize that 1) if the primary driver of dividends and repurchases derive from the same source; 2) if the sensitivity of dividends to this factor changes with the onset of repurchases; and 3) if the changes in expected dividends paid explain the increased use of stock repurchases, then repurchases are replacing dividends. This evidence documents a dramatic change in aggregate payout policy and requires us to rethink our definition of future expected

firm distributions.

Although our approach is simple, our methods are a bit more complex. Specifically, to estimate permanent and temporary earnings, we employ a proxy for firm output, GDP, and estimate the stationary and non-stationary components of earnings using the cointegrating relation between earnings and GDP. We do so in order to clearly and carefully distinguish temporary from permanent earnings. The complexity of the methods are required in order to cleanly separate earnings into these two components.

A Appendix

A.1 Cointegration

0 In this appendix, we discuss the evidence for and methods used to assess the cointegrating relation between earnings and gross domestic product. The standard approach to estimating a cointegrating relation is to perform an OLS regression in levels. However, in dealing with macroeconomic relations, concerns about endogeneity among the variables frequently arise. Consequently, Stock and Watson (1993) advocate a dynamic least squares procedure, in which the log level of GDP is augmented by leads and lags of the change in log GDP:

$$e_t = \alpha + \beta gdp_t + \sum_{i=L}^{L} \delta \Delta gdp_{t-i} + \nu_t \tag{18}$$

This procedure ameliorates the aforementioned endogeneity issues.[13] There is no formal test for the lead/lag length L; we utilize $L = 4$, but our results are not sensitive to this specification.

Formal tests for cointegration in e and gdp are performed using the Phillips and Ouliaris (1990) residual and Johansen (1991) trace tests. Results of these tests are reported in Table A.. The residual test assumes that each variable (earnings and GDP) contain a unit root; Dickey-Fuller tests (not reported) confirm this hypothesis. The test results in Panel A are for the Phillips-Ouliaris test, which is designed to distinguish a system with a cointegrating relation from one without one. The null hypothesis in the test is that the residual contains a unit root; consequently, rejection of the null implies that the residual is stationary and that a cointegrating relation exists. As shown in the table, the null is rejected with one through four lags at the 5% critical level, indicating the presence of a cointegrating relation in earnings and GDP.

In Panel B of Table A., we present results of the Johansen (1991) trace test. This test is designed to distinguish the number of cointegrating relations in a system. Since we have only two variables of interest, we will be testing the null of zero cointegrating relations against the alternative of one. We present two versions of this test, the 'Trace' and 'Eigenvalue' tests, and allow for a constant and a linear trend in the data, similar to Lettau and Ludvigson

[13] Our results are insensitive to the use of DLS, which includes the differenced terms, and OLS, which removes them. These results are also insensitive to the presence or absence of a detmerinistic trend, $\delta \cdot t$.

Table A.: Cointegration Tests

Panel A: Phillips-Ouliaris Residual Tests

Dickey-Fuller t-statistic				Critical Value
Lag=1	Lag=2	Lag=3	Lag=4	5%
-2.342	-2.788	-2.412	-1.952	-1.945

Panel B: Johansen Trace and Eigenvalue Tests

	Dickey-Fuller t-statistic				Critical Value	
	Lag=1	Lag=2	Lag=3	Lag=4	90% crit.	95% crit.
Trace	10.416	17.261	17.481	22.691	16.162	18.398
Eigen.	10.142	17.177	16.674	19.591	15.001	17.148

(2001). As shown in the table, at 2 lags, the likelihood ratio for the Johansen tests suggest that we reject the null of no cointegrating relation. The trace test is rejected at the 10% significance level, whereas the eigenvalue test is rejected at the 5% significance level. In sum, the test results indicate the presence of a cointegrating relation in earnings and GDP.

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Table 1: Descriptive Statistics

Table 1 presents the aggregate annual repurchases and dividend and the ratio of repurchases to total payouts, repurchases to earnings, and dividends to earnings. Earnings are defined as income before extraordinary items (Annual Data Item 18). Dividends are the sum of Compustat Cash Dividends (Annual Data Item 127) for listed firms. Repurchases are the sum of Compustat Purchase of Common and Preferred Stock (Annual Data Item 115), less any change in preferred stock over the calendar year shown in the column marked "Year." Repurchases and Dividends are stated in millions of dollars.

	REP	DIV	REP/PAY	REP/EARN	DIV/EARN
1984	20302	53915	27.4	13.5	35.8
1985	33163	54935	37.6	25.4	42.1
1986	27638	57139	32.6	20.9	43.1
1987	37576	61236	38.0	25.7	41.9
1988	38196	68053	35.9	20.0	35.7
1989	37271	71256	34.3	21.0	40.2
1990	33852	73738	31.5	20.5	44.7
1991	14360	73289	16.4	10.9	55.6
1992	23370	77671	23.1	14.3	47.4
1993	29692	82632	26.4	14.2	39.6
1994	32739	85354	27.7	11.7	30.5
1995	57835	91433	38.7	17.8	28.1
1996	66524	99115	40.2	18.2	27.1
1997	107151	104895	50.5	27.5	26.9
1998	146200	114216	56.1	38.1	29.7
1999	156594	115035	57.6	35.8	26.3
2000	157539	116871	57.4	40.8	30.2

Table 2: **Cointegrating Relation Between Earnings and GDP**

Table 2 presents coefficient estimates from the cointegrating relation between earnings and GDP. Panel A presents results for the cointegrating relation in levels in GDP and earnings. Parameters are estimated via dynamic least squares [Stock and Watson (1993)]:

$$e_t = \alpha + \beta gdp_t + \sum_{l=-4}^{4} \delta \Delta gdp_{t-l} + \nu_t$$

Panel B presents results for the error correction version of the relation [Engle and Granger (1987)]:

$$\begin{aligned} \Delta e_t &= \sum_{l=1}^{2} \delta_{11,l} \Delta e_{t-l} + \sum_{l=1}^{2} \delta_{12,l} \Delta gdp_{t-l} + \delta_{13} \nu_{t-1} + u_{1,t} \\ \Delta gdp_t &= \sum_{l=1}^{2} \delta_{21,l} \Delta e_{t-l} + \sum_{l=1}^{2} \delta_{22,l} \Delta gdp_{t-l} + \delta_{23} \nu_{t-1} + u_{2,t} \end{aligned}$$

Data cover the period 1962.1 through 2000.4.

Panel A: Cointegrating Parameter Estimates

	α	β
Coefficient	6.830	1.707
p-value	(0.000)	(0.000)

Panel B: Error Correction Representation

	Constant	Δgdp_{t-1}	Δgdp_{t-2}	Δe_{t-1}	Δe_{t-2}	ν_{t-1}	$\bar{R}^2$
Δgdp_t	0.004	0.162	0.179	0.036	-0.042	0.001	0.054
p-value	(0.000)	(0.060)	(0.046)	(0.131)	(0.085)	(0.381)	
Δe_t	-0.006	0.803	0.382	0.642	0.075	-0.036	0.477
p-value	(0.129)	(0.020)	(0.280)	(0.000)	(0.431)	(0.036)	

LR Test, 3 vs. 2 Lags: 2.5286 (0.640)
LR Test, 2 vs. 1 Lags: 18.283 (0.001)

Table 3: **Influences on Dividends and Repurchases**

Table 3 investigates the influence of temporary and permanent earnings on stock repurchases and dividends. The models investigated are:

$$\begin{pmatrix} \Delta r_t \\ \Delta e_t^{perm} \\ \Delta e_t^{temp} \end{pmatrix} = \beta_0 + \sum_{l=1}^{L} B_l' \begin{pmatrix} \Delta r_{t-l} \\ \Delta e_{t-l}^{perm} \\ \Delta e_{t-l}^{temp} \end{pmatrix} + \upsilon_t$$

$$\begin{pmatrix} \Delta d_t \\ \Delta e_t^{perm} \\ \Delta e_t^{temp} \end{pmatrix} = \gamma_0 + \sum_{l=1}^{L} \Gamma_l' \begin{pmatrix} \Delta d_{t-l} \\ \Delta e_{t-l}^{perm} \\ \Delta e_{t-l}^{temp} \end{pmatrix} + \omega_t$$

where Δr_t is the change in log real repurchases, Δe_t^{perm} is the expected change in permanent earnings, as described in (8) and Δe_{t+1}^{temp} is the change in temporary earnings, as described in (4). Data are sampled at the quarterly frequency over the period 1985 through 1999.

Panel A: Dividends

	Constant	Δd_{t-1}	Δd_{t-2}	Δe_{t-1}^{perm}	Δe_{t-2}^{perm}	Δe_{t-1}^{temp}	Δe_{t-2}^{temp}	$\bar{R}^2$
Coeff	0.007	-0.309	0.049	-0.026	0.276	7.215	-7.380	0.122
p-value	(0.047)	(0.035)	(0.735)	(0.698)	(0.075)	(0.148)	(0.122)	

Panel B: Repurchases

	Constant	Δr_{t-1}	Δr_{t-2}	Δe_{t-1}^{perm}	Δe_{t-2}^{perm}	Δe_{t-1}^{temp}	Δe_{t-2}^{temp}	$\bar{R}^2$
Coeff	-0.003	0.264	-0.054	0.061	2.412	53.743	-53.184	0.291
p-value	(0.861)	(0.050)	(0.674)	(0.875)	(0.010)	(0.072)	(0.063)	

Table 4: Impact of Alternative Explanations on Aggregate Repurchases

Table 4 presents parameter estimates of several variations of equation (11),

$$\begin{aligned}\Delta r_t &= \beta_{00} + \beta_{01} t + \sum_{l=1}^{2} \beta_{11,l} \Delta r_{t-l} + \sum_{l=1}^{2} \beta_{12,l} \Delta e_{t-l}^{perm} + \sum_{l=1}^{2} \beta_{13,l} \Delta e_{t-l}^{temp} \\ &+ \beta_{14} mkt_{t-1} + \beta_{15} \Delta tax_t + \beta_{16} \Delta invopp_{t-1} + \beta_{17} mkt_{t+1} + \beta_{18} \Delta option_{t-1} \\ &+ \beta_{19} \Delta divprem_t + \beta_{10} \Delta merger_t + \upsilon_t\end{aligned}$$

where Δr_t is the change in log real repurchases, Δe_t^{perm} is the expected change in permanent earnings, as described in (8) and Δe_{t+1}^{temp} is the change in temporary earnings, as described in (4). The variables mkt_{t-1}, Δtax_t, $\Delta invopp_{t-1}$, mkt_{t+1}, $\Delta option_{t-1}$, $\Delta divprem_t$, and $\Delta merger_t$ are the lagged return on the value-weighted CRSP index, the change in the difference in the top marginal and capital gains tax rates, a measure of the change investment opportunities, the leading return on the market, the change in option grants, the change in the difference in the market-to-book ratio of dividend paying and non-dividend paying firms, and the change in the percentage of market capitalization acquired in the quarter. The investment opportunity set is proxied by the change in either the market to book ratio, Δmb_{t-1}, or the investment-sales ratio, Δis_{t-1}. The regression also includes a time trend, t. Data cover the first quarter 1985 through the fourth quarter 1999.

Δr_{t-1}	0.290	(0.045)	0.308	(0.029)	0.299	(0.037)	0.290	(0.048)	0.287	(0.048)	0.289	(0.048)	0.272	(0.100)
Δr_{t-2}	-0.076	(0.590)	-0.068	(0.616)	-0.077	(0.577)	-0.075	(0.602)	-0.064	(0.650)	-0.082	(0.571)	-0.068	(0.667)
Δe_{t-1}^{perm}	0.039	(0.924)	0.253	(0.541)	0.004	(0.992)	0.043	(0.919)	-0.065	(0.879)	0.020	(0.962)	0.020	(0.969)
Δe_{t-2}^{perm}	2.473	(0.011)	2.479	(0.009)	2.493	(0.009)	2.465	(0.013)	2.775	(0.008)	2.480	(0.012)	2.806	(0.020)
Δe_{t-1}^{temp}	57.225	(0.068)	67.523	(0.030)	57.269	(0.065)	56.940	(0.075)	59.711	(0.058)	58.049	(0.069)	62.279	(0.108)
Δe_{t-2}^{temp}	-55.520	(0.063)	-64.155	(0.030)	-55.721	(0.059)	-55.236	(0.069)	-57.792	(0.054)	-56.175	(0.064)	-58.096	(0.117)
Δtax_t	0.119	(0.801)	0.035	(0.940)	0.204	(0.665)	0.118	(0.806)	0.198	(0.681)	0.128	(0.790)	0.033	(0.953)
mkt_{t-1}	0.098	(0.635)	0.204	(0.329)	0.068	(0.739)	0.096	(0.651)	0.076	(0.716)	0.099	(0.637)	0.160	(0.551)
mkt_{t+1}			0.394	(0.051)										
Δmb_{t-1}					0.070	(0.138)								
Δis_{t-1}							0.745	(0.823)						
$\Delta divprem_t$									0.060	(0.329)				
$\Delta merger_t$											-0.004	(0.653)		
$\Delta option_t$													-0.067	(0.703)
$Trend$	0.001	(0.657)	0.001	(0.565)	0.000	(0.720)	0.001	(0.660)	0.001	(0.663)	0.001	(0.667)	0.000	(0.933)
Constant	-0.026	(0.588)	-0.055	(0.255)	-0.022	(0.639)	-0.026	(0.591)	-0.025	(0.594)	-0.026	(0.592)	-0.033	(0.580)
$\bar{R}^2$	0.257		0.301		0.255		0.241		0.256		0.242		0.241	

Table 5: Impact of Alternative Explanations on Aggregate Dividends

Table 4 presents parameter estimates of several variations of equation (11),

$$\begin{aligned}\Delta d_t &= \beta_{00} + \beta_{01} t + \sum_{l=1}^{2} \beta_{11,l} \Delta d_{t-l} + \sum_{l=1}^{2} \beta_{12,l} \Delta e_{t-l}^{perm} + \sum_{l=1}^{2} \beta_{13,l} \Delta e_{t-l}^{temp} \\ &+ \beta_{14} mkt_{t-1} + \beta_{15} \Delta tax_t + \beta_{16} \Delta invopp_{t-1} + \beta_{17} mkt_{t+1} + \beta_{18} \Delta option_{t-1} \\ &+ \beta_{19} \Delta divprem_t + \beta_{10} \Delta merger_t + \upsilon_t\end{aligned}$$

where Δd_t is the change in log real dividends, Δe_t^{perm} is the expected change in permanent earnings, as described in (8) and Δe_{t+1}^{temp} is the change in temporary earnings, as described in (4). The variables mkt_{t-1}, Δtax_t, $invopp_{t-1}$, mkt_{t+1}, and $option_{t-1}$ are the lagged return on the value-weighted CRSP index, the change in the difference in the top marginal and capital gains tax rates, a measure of the change in investment opportunities, the leading return on the market, the change in option grants, the change in the difference in the market-to-book ratio of dividend paying and non-dividend paying firms, and the change in the percentage of market capitalization acquired in the quarter. The investment opportunity set is proxied by either the change in the market to book ratio, Δmb_{t-1}, or the investment-sales ratio, Δis_{t-1}. The regression also includes a time trend, t. Data cover the first quarter 1985 through the fourth quarter 1999.

Δd_{t-1}	-0.296	(0.054)	-0.314	(0.036)	-0.296	(0.057)	-0.320	(0.039)	-0.313	(0.044)	-0.336	(0.029)	-0.495	(0.018)
Δd_{t-2}	0.037	(0.804)	-0.019	(0.899)	0.037	(0.806)	0.029	(0.844)	0.067	(0.666)	0.023	(0.875)	-0.078	(0.682)
Δe_{t-1}^{perm}	-0.044	(0.540)	-0.082	(0.258)	-0.044	(0.546)	-0.050	(0.489)	-0.023	(0.761)	-0.062	(0.383)	0.004	(0.961)
Δe_{t-2}^{perm}	0.291	(0.071)	0.289	(0.064)	0.291	(0.074)	0.305	(0.058)	0.258	(0.119)	0.284	(0.072)	0.278	(0.140)
Δe_{t-1}^{temp}	7.381	(0.158)	5.494	(0.285)	7.379	(0.163)	7.955	(0.129)	6.921	(0.188)	8.090	(0.117)	7.364	(0.230)
Δe_{t-2}^{temp}	-7.549	(0.127)	-5.968	(0.218)	-7.547	(0.131)	-8.135	(0.101)	-7.115	(0.153)	-8.046	(0.098)	-7.343	(0.209)
Δtax_t	-0.071	(0.365)	-0.053	(0.491)	-0.071	(0.371)	-0.066	(0.399)	-0.083	(0.299)	-0.059	(0.445)	-0.070	(0.434)
mkt_{t-1}	-0.024	(0.477)	-0.044	(0.198)	-0.024	(0.703)	-0.020	(0.558)	-0.020	(0.553)	-0.027	(0.417)	-0.023	(0.586)
mkt_{t+1}			-0.066	(0.050)										
Δmb_{t-1}					-0.000	(0.976)								
Δis_{t-1}							0.898	(0.092)						
$\Delta divprem_t$									-0.009	(0.391)				
$\Delta merger_t$											-0.001	(0.546)		
$\Delta option_t$													-1.080	(0.287)
t	0.000	(0.861)	0.000	(0.971)	0.000	(0.861)	0.000	(0.875)	0.000	(0.861)	0.000	(0.920)	0.000	(0.928)
Constant	0.006	(0.444)	0.012	(0.165)	0.006	(0.450)	0.007	(0.408)	0.006	(0.455)	0.007	(0.445)	0.008	(0.461)
$\bar{R}^2$	0.102		0.156		0.083		0.109		0.097		0.137		0.172	

Table 6: Shift in Permanent/Temporary Earnings and Dividend Relation

Table 6 presents results for the model

$$\Delta d_t \quad = \quad \gamma_{10} + \gamma_{1977} I_{1977,t} + \sum_{l=1}^{2} \gamma_{1,l} z_{t-l} + \sum_{l=1}^{2} \delta_l \Delta e_{t-l}^{perm} I_{1977,t} + \upsilon_t$$

where Δd_t represents changes in log real dividends at time t and $z_t = \{\Delta d_t, \Delta e_t^{perm}, \Delta e_t^{temp}\}$, changes in log real dividends, permanent earnings, and temporary earnings. The variable I_{1977} is an indicator variable:

$$I_{1977} = \begin{cases} 0 & \text{if } t < 1977.1 \\ 1 & \text{otherwise} \end{cases}$$

Panel A presents results of a restricted version of this model with $\gamma_{1977} = \delta_1 = \delta_2 = 0$. Panel B presents the full specification. Data span the first quarter 1963 through the fourth quarter 1999.

Panel A: CRSP Dividends: Full Sample

	Constant	Δdiv_{t-1}	Δdiv_{t-2}	Δe_{t-1}^{perm}	Δe_{t-2}^{perm}	Δe_{t-1}^{temp}	Δe_{t-2}^{temp}	$\bar{R}^2$
Coeff	0.005	-0.095	0.137	0.021	0.186	2.778	-2.982	0.114
p-value	(0.004)	(0.249)	(0.092)	(0.678)	(0.004)	(0.146)	(0.110)	

Panel B: Full Sample with Indicator Variable

	Constant	I_{1977}	Δdiv_{t-1}	Δdiv_{t-2}	Δe_{t-1}^{perm}	Δe_{t-2}^{perm}	$\Delta e_{t-1}^{perm} * I_{1977}$	$\Delta e_{t-2}^{perm} * I_{1977}$	Δe_{t-1}^{temp}	Δe_{t-2}^{temp}	$\bar{R}^2$
Coeff	0.001	0.00625	-0.151	0.124	-0.149	0.466	0.207	-0.361	1.201	-1.534	0.147
p-value	(0.624)	(0.073)	(0.070)	(0.120)	(0.235)	(0.000)	(0.129)	(0.011)	(0.545)	(0.425)	

Table 7: Are Repurchases Replacing Dividends?

Table 7 presents results of the first equation of the vector autoregression

$$\begin{aligned}
\Delta r_t^{perm} &= \gamma_{10} + \sum_{l=1}^{2} \gamma_{11,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{12,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{13,l} \text{diff}_{t-l} + \eta_{1,t} \\
\Delta r_t^{temp} &= \gamma_{20} + \sum_{l=1}^{2} \gamma_{21,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{22,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{23,l} \text{diff}_{t-l} + \eta_{2,t} \\
\text{diff}_t &= \gamma_{30} + \sum_{l=1}^{2} \gamma_{31,l} \Delta r_{t-l}^{perm} + \sum_{l=1}^{2} \gamma_{32,l} \Delta r_{t-l}^{temp} + \sum_{l=1}^{2} \gamma_{33,l} \text{diff}_{t-l} + \eta_{3,t}
\end{aligned}$$

where r_t^{perm} represents a measure of repurchases that pay out permanent earnings, r^{temp} represents a measure of repurchases that pay out temporary earnings, and diff_t represents the difference in dividends predicted based on pre-1977 coefficients and dividends paid. Panel A presents coefficient estimates and Panel B presents Granger causality tests for the coefficients. Data cover the first quarter of 1985 through the fourth quarter of 1999.

Panel A: VAR Results

	Constant	$diff_{t-1}$	$diff_{t-2}$	Δrep_{t-1}^{perm}	Δrep_{t-2}^{perm}	Δrep_{t-1}^{temp}	Δrep_{t-2}^{temp}	$\bar{R}^2$
Coeff	0.005	2.114	0.675	0.641	-0.245	9.428	-0.737	0.403
p-value	(0.783)	(0.003)	(0.393)	(0.211)	(0.609)	(0.016)	(0.856)	

Panel B: Granger Causality Tests

	F-stat	p-value
$diff$	5.829	(0.005)
Δrep^{perm}	8.132	(0.001)
Δrep^{temp}	1.100	(0.341)

Figure 1: **Time Series of Dividends and Repurchases**

Figure 1 depicts the time series of real aggregate dividends and repurchases over the period 1985 through 2000. Dividends are the sum of Compustat Cash Dividends (Annual Data Item 127) for listed firms. Repurchases are the sum of Compustat Purchase of Common and Preferred Stock (Annual Data Item 115), less any change in preferred stock over the calendar year shown in the column marked "Year." Levels are depicted in millions of 1996 dollars.

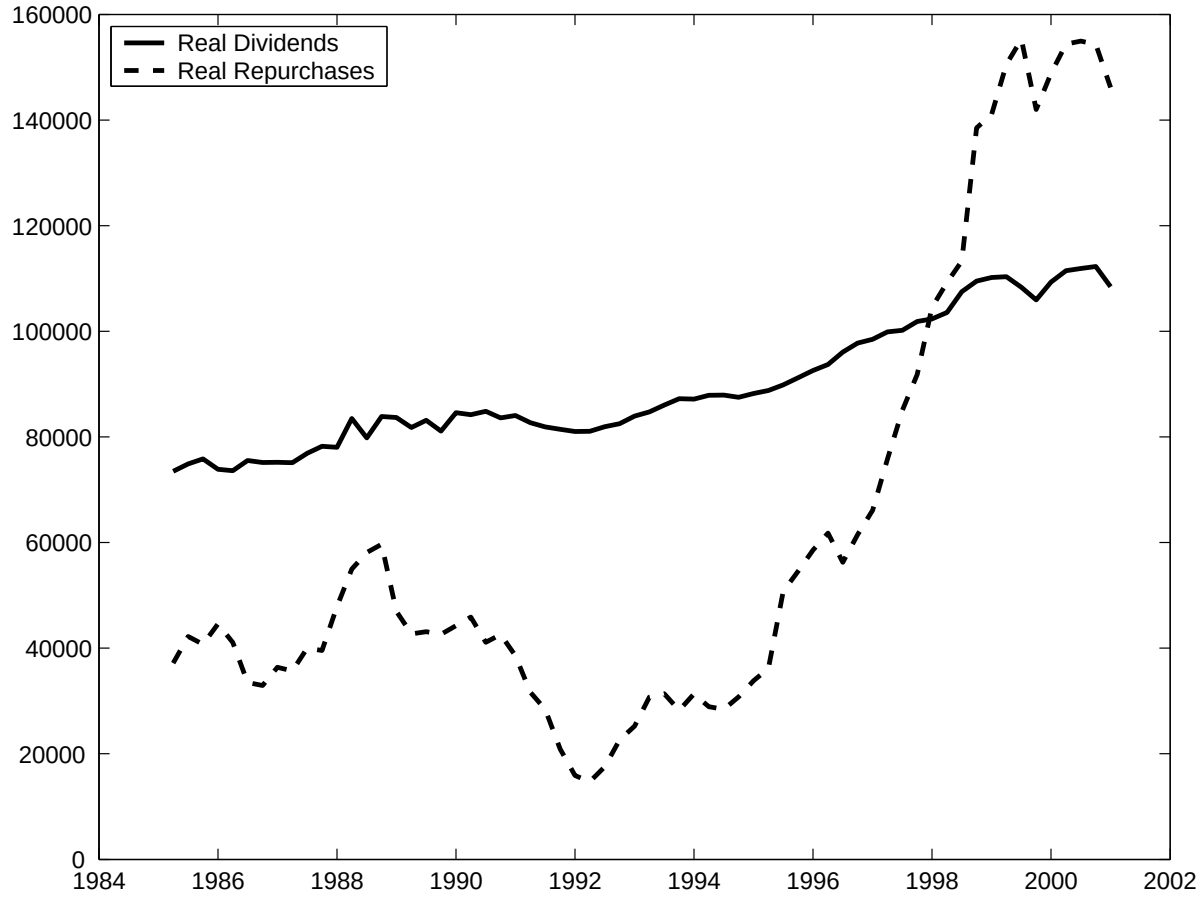
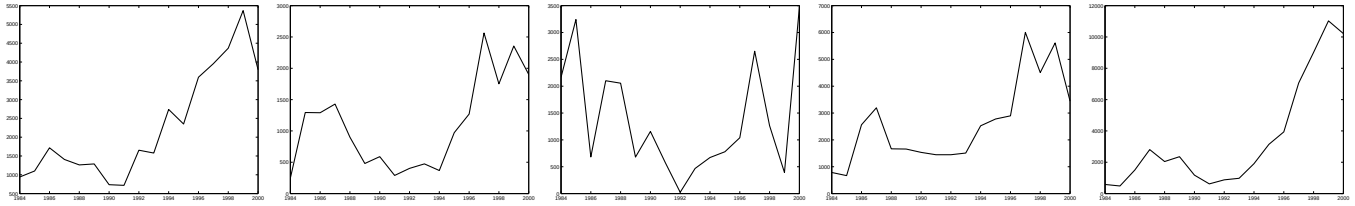
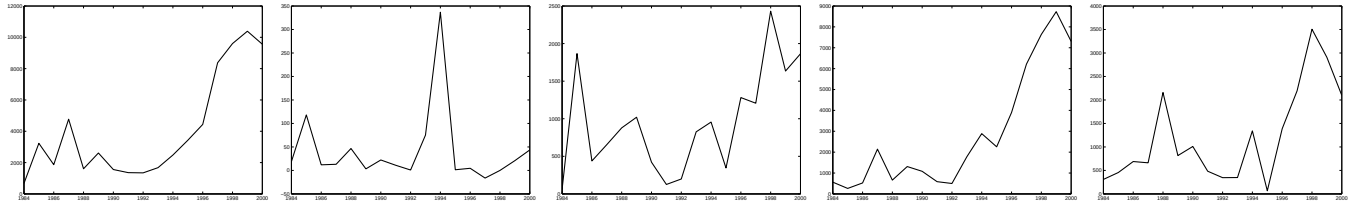


Figure 2: **Repurchases by Industry**

Figure 2 depicts the time series of real aggregate dividends and repurchases over the period 1984 through 2000 for each industry. Repurchases are the sum of Compustat Purchase of Common and Preferred Stock (Annual Data Item 115), less any change in preferred stock over the calendar year shown in the column marked "Year." Levels are depicted in millions of 1996 dollars.



(a) Cons. Non Dur. (b) Cons. Dur. (c) Energy (d) Chemicals (e) Whls and Ret.



(f) Manufacturing (g) Utilities (h) Telecom. (i) Financial (j) Other

Figure 3: **Repurchases by Market to Book Ratio**

Figure 3 depicts the time series of real aggregate dividends and repurchases over the period 1984 through 2000 for High and Low Market-to-Book Ratio firms. Repurchases are the sum of Compustat Purchase of Common and Preferred Stock (Annual Data Item 115), less any change in preferred stock over the calendar year shown in the column marked "Year." Levels are depicted in millions of 1996 dollars.

(a) High Market to Book

(b) Low Market to Book

Figure 4: **Repurchases by Market Capitalization**

Figure 4 depicts the time series of real aggregate dividends and repurchases over the period 1984 through 2000 for Large and Small Market Capitalization firms. Repurchases are the sum of Compustat Purchase of Common and Preferred Stock (Annual Data Item 115), less any change in preferred stock over the calendar year shown in the column marked "Year." Levels are depicted in millions of 1996 dollars.

(a) Big

(b) Small

Figure 5: **Earnings and GDP**

figure 5 depicts the time series of log real aggregate earnings and GDP. Data cover the period 1985-2000 and are sampled at the quarterly frequency. Nominal values are converted to real using the PCE deflator.

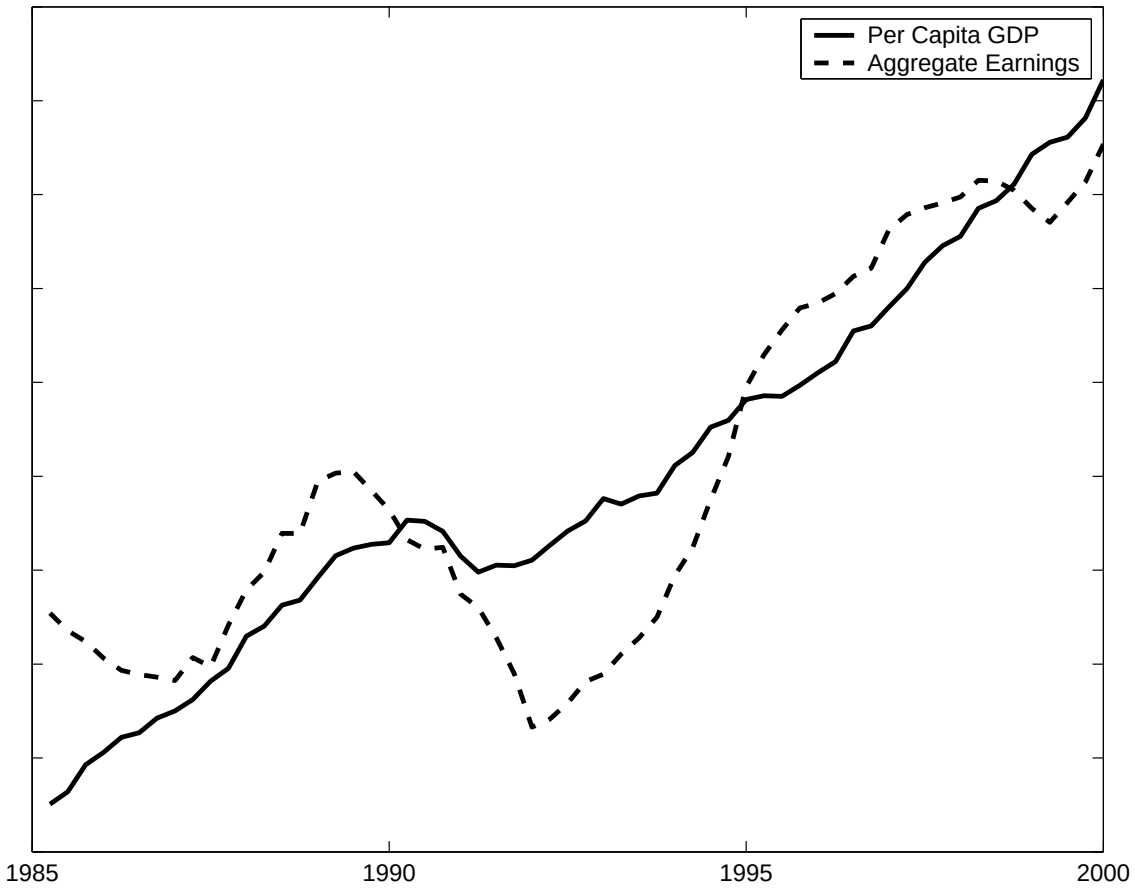


Figure 6: **Earnings and GDP**

figure 6 depicts the time series of permanent, e^{perm} and temporary, e^{temp} earnings. The series are calculated as in expression (8) and are normalized to zero at the first quarter of 1985. Data cover the period 1985-2000 and are sampled at the quarterly frequency.

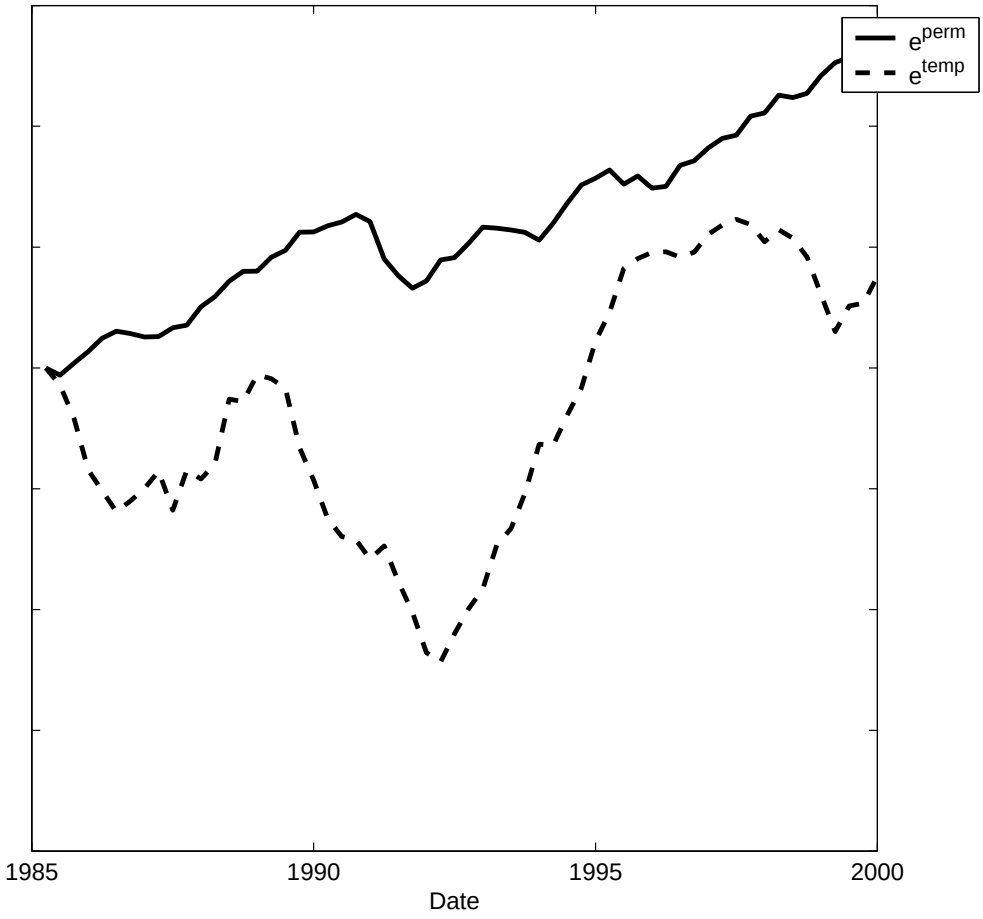
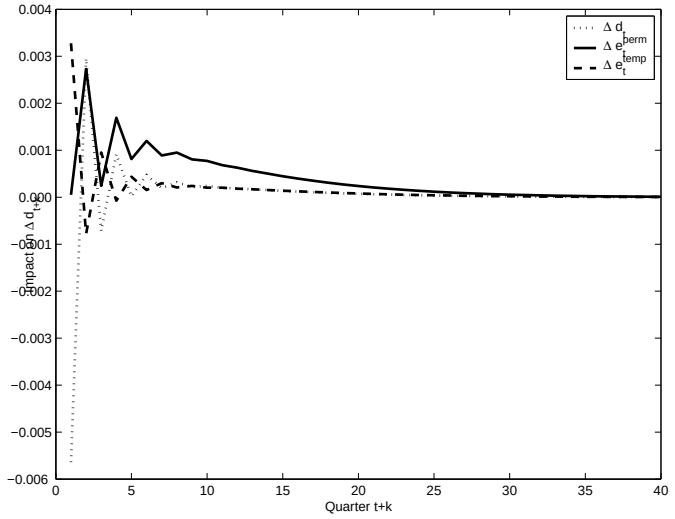
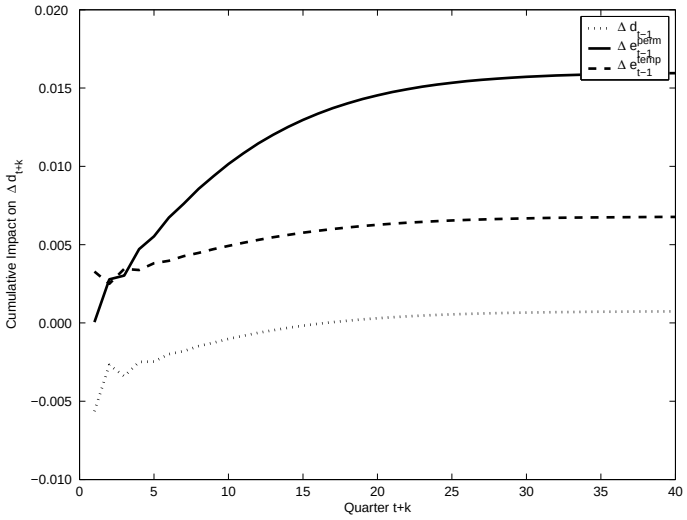


Figure 7: Impulse Response Function: Dividends

Figure 7 depicts the response of dividend growth to a one standard deviation shock to lagged dividend, permanent, and temporary earnings growth. The second panel depicts the cumulative impact of this shock.



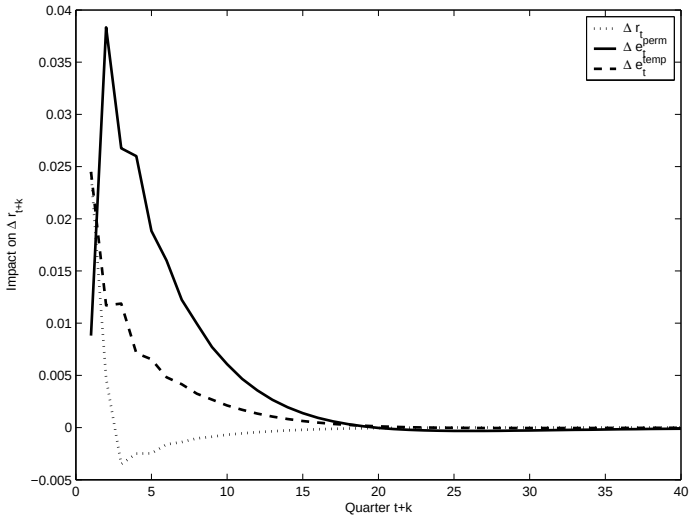
(a) Impact of One σ Shock



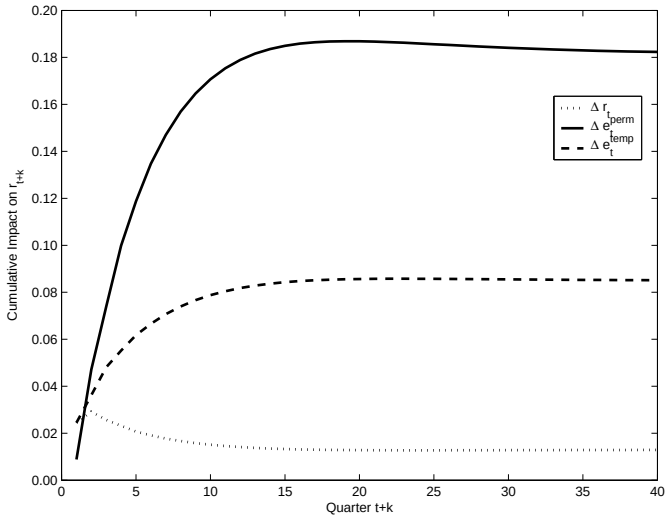
(b) Cumulative Impact of One σ Shock

Figure 8: Impulse Response Function: Repurchases

Figure 8 depicts the response of repurchase growth to a one standard deviation shock to lagged repurchase, permanent, and temporary earnings growth. The second panel depicts the cumulative impact of this shock.



(a) Impact of One σ Shock



(b) Cumulative Impact of One σ Shock