# The behavior of aggregate corporate investment

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**Abstract**

We study the behavior of aggregate corporate investment from 1952–2010. Investment grows rapidly following high profits and stock returns but, contrary to standard predictions, is largely unrelated to recent changes in market volatility, interest rates, or the default spread on corporate bonds. At the same time, high investment predicts negative profit growth going forward and is associated with low stock returns when investment data are publicly released, suggesting that a jump in investment coincides with bad news. Our analysis also shows that the investment decline following the financial crisis of 2008 was not unusual given the drop in GDP and profits at the end of 2008.

## 1. Introduction

Corporate investment is highly variable through time. From 1952–2010, the growth rate of aggregate fixed investment by U.S. corporations had a standard deviation of 7.6% annually, more than three times the volatility of GDP growth. As a consequence, corporate investment's share of GDP ranges from a low of 6.1% to a high of 9.4% during this period.

Corporate investment decisions have been linked theoretically to a variety of factors, but the importance of each remains poorly understood (Hubbard 1998; Caballero 1999; Stein 2003). For example, in the time-series literature on aggregate investment, there is conflicting evidence on the connection between investment and corporate profits, discount rates, and sentiment (Barro 1990; Morck, Shleifer, and Vishny 1990; Cochrane 1991; Blanchard, Rhee, and Summers 1993; Lamont 2000; Chen, Da, and Lorrain 2011; Arif 2012). In the cross-sectional literature, recent studies find a negative relation between investment and subsequent returns, leading to an active debate over whether the results are consistent with rational pricing or reflect a combination of wasteful investment, diminishing marginal returns, and stock mispricing (Fairfield, Whisenant, and Yohn 2003; Titman, Wei, and Xie 2004; Fama and French 2006; Cooper, Gulen, and Schill 2008; Lam and Wei 2011; Wu, Zhang, and Zhang 2010).

Our paper provides new evidence on the behavior of aggregate corporate investment. A key feature of our analysis is that we study how quarterly investment relates to both past and future changes in a variety of other variables, including profits, stock prices, volatility, and interest rates. The overall pattern of results—before, concurrent with, and after investment—is more informative about investment decisions than any of the relations would be in isolation. For example, many theories predict that profits and stock returns should lead investment, but the behavior of profits and stock returns following investment depends on whether changes in discount rates, profitability, or behavioral factors are most important. The lead-lag relations found in quarterly data are especially informative because investment turns out to have a much different relation to subsequent profits and stock returns than to prior profits and stock returns, effects that get washed out over longer horizons.

Our tests suggest three main findings that, to different degrees, challenge both conventional wisdom and many theoretical models. First, we show that investment growth is highly predictable based on recent profits and stock returns but, on the margin, has almost no connection to interest rates or market volatility. In terms of interest rates, an increase in the one-year Tbond rate and a decrease in the default spread predict higher investment growth going forward, consistent with the business-cycle properties of the variables, but neither effect is strong or lasts beyond one quarter. The positive relation between investment and the short-term Tbond rate—by itself or controlling for other macroeconomic variables—is hard to reconcile with the idea that Federal-Reserve-driven movements in interest rates have a first-order impact on corporate investment. The relation is perhaps most surprising because an increase in the short rate does predict slower profit, GDP, and noncorporate investment growth; the puzzle is why investment increases at the same time that interest rates rise and expected profit and GDP growth both decline.

The link between investment and market volatility is also interesting: an increase in volatility predicts below-average investment growth for a few quarters, but the effects are small and actually become positive once we control for profits and stock returns. The evidence contradicts standard models with irreversible investment, as well as recent empirical studies which suggest that high uncertainty dampens investment (Caballero 1999; Bloom 2009; Baker and Bloom 2013; Gilchrist, Sim, and Zakrajsek 2013).

Our second key result is that investment correlates *negatively* with future profit growth and market returns, the latter effect concentrated in the one to two quarters after investment (when expenditure data become public). The relation between investment and future profits is so strong that it almost fully reverses the profit growth leading up to investment, i.e., the profit growth observed prior to investment turns out to be largely transitory. The relation to stock returns is also strong, especially if investment growth is not explained by prior profits: Large spikes in 'abnormal' investment (the component that is uncorrelated with prior profit growth) are followed by excess market returns of -0.9% over six months, while large declines in abnormal investment are followed by excess returns of +8.8%. The evidence suggests that high investment growth coincides with bad news, contrary to traditional models of corporate investment. Our results also suggest that existing evidence in the literature that investment 'forecasts' market returns may capture the market's reaction to investment news rather than a true predictive relation.

It is important to note that a large increase in investment predicts a decline in actual *profits*, not just a decline in *profitability*. For example, aggregate corporate profits drop 3.1% in the five quarters following a large spike in investment (top quartile of its historical distribution) but grow 22.9% in the five quarters following a large investment decline (bottom quartile). Thus, our results cannot simply be attributed to diminishing marginal returns from investment.

While it is difficult to rule out all optimal investment stories for our results, the strong negative link between investment and future profits, along with the market's negative reaction to higher investment, suggests that large spikes in investment are bad news for corporate value. A possible explanation is that big changes in investment tend to be poorly timed: managers increase investment at the end of expansions just as profits peak and decrease investment at the end of recessions just as profits start to rebound. This suggests that investment is driven less by (rational) expectations of future profitability than suggested by traditional q-theoretic models of corporate investment.

Our third main result concerns the behavior of corporate investment during the recent financial crisis. Investment dropped 21% in 2009—the largest decline during our sample—and there seems to be a widely-held belief that a significant portion of the decline can be attributed to problems in the banking sector and credit markets (e.g., Campello et al. 2010). It seems interesting, then, to ask how much of the decline would be predicted by movement in real variables alone (profits, GDP, etc.) without appealing to anything special about the financial crisis. In fact, our regressions show the investment decline is fairly typical given the behavior of profits and GDP. For example, of the 23% total drop from 2008Q4–2009Q4, more than three-fourths (18.1%) would be predicted simply by the decline in GDP and corporate profits in the fourth quarter of 2008. Our results provide little evidence that unusual conditions in the credit markets led to a large drop in investment over and above what would be expected given changes in the real economy, consistent with Kahle and Stulz's (2013) evidence on the behavior of firm-level investment.

The remainder of the paper is organized as follows: Section 2 provides background for our tests; Section 3 describes the data; Sections 4 and 5 study how investment relates to past and future changes in profits, stock returns, interest rates, and market volatility; Section 6 explores the behavior of investment following the financial crisis of 2008; Section 7 concludes.

## 2. Background and predictions

Our tests focus on the joint dynamics of investment, profits, stock returns, market volatility, and interest rates. We argue that the overall pattern of lead-lag relations is informative about the relative importance of different factors that drive investment.

### *2.1. Discount rates*

Investment is often predicted to rise when discount rates fall (Cochrane 1991; Lamont 2000; Baker and Wurgler 2000; Chen, Da, and Larrain 2011). A common way to test this prediction is to ask whether aggregate investment forecasts market returns, but these tests tend to be inconclusive because realized returns are a very noisy measure of ex ante expected returns. Further, it is not always clear whether the tests really distinguish a predictive role for investment from a price response to news about investment, given the delay in the observability of aggregate expenditures.

An alternative is to ask whether investment is related to changes in observable discount-rate proxies, such as short-term interest rates, the yield spread between long-term and short-term Treasuries, and the yield spread between low-grade and high-grade corporate bonds. These variables track business conditions and have been used in prior research to capture time-varying expected returns (e.g., Fama and French 1989; Cochrane 1991). The impact of discount rates can also show up as an investment response to prior market returns, since stock prices move inversely with discount rates (Campbell 1991). However, a correlation with stock returns does not distinguish between rational and sentiment-driven variation in expected returns or between the role of cashflow news and discount-rate news.

*2.2. Profits*

Corporate profits might predict investment because they proxy for investment opportunities or the availability of 'cheap' internal financing. In fact, profits do explain significant variation in both firm-level and aggregate investment (Fazzari, Hubbard, and Petersen 1988; Barro 1990; Morck, Shleifer, and Vishny 1990; Blanchard, Rhee, and Summers 1993; Lewellen and Lewellen 2014).

A key feature of our tests is that we explore not only the link between investment and *prior* profits, but also the link between investment and *future* profits. We expect investment to be positively related to future profits if investment responds to changes in expected profitability or signals that firms have taken more positive NPV projects. (In principle, investment could be positively related to profits but negatively related to profitability; our tests focus on profits, not profitability.) On the other hand, higher investment might predict lower future profits if managers overreact to transitory changes in past profits.

*2.3. Stock returns*

Stock returns are likely to lead investment because they reflect changes in expected profits, discount rates, and investor sentiment, all factors that might influence investment decisions. But the behavior of returns *following* investment depends on which factor is most important. If discount rates are stable and investment is driven by expected profitability, returns should react positively to news about investment—assuming managers have private information about profits—but would not be predictable after investment is known. Stock prices might, however, react negatively to higher investment if it reflects managerial waste, but, again, returns would not be predictable after investment is known if prices adjust quickly. In contrast, investment could have long-term predictive power for returns if changes in discount rates or sentiment are important (subject to the caveats above about the power of the tests). Discount rate and sentiment effects could also reinforce a positive short-run reaction to investment if higher investment signals good news about investment opportunities or caters to the sentiment-driven demands of shareholders.

*2.4. Market volatility*

The traditional view from the real options and irreversible-investment literature is that higher uncertainty raises the value of delaying investment, leading to a short-run drop in expenditures (Pindyck 1991; Caballero 1999; Bloom 2009). The predictions are less clear cut if prices and interest rates are endogenous. For example, Kogan (2001) shows that higher uncertainty will not only affect the option-to-wait but can have an indirect and opposite impact on investment by lowering equilibrium interest rates. He shows that this indirect effect can, in principle, dominate the direct effect.

**3. Data and descriptive statistics**

Our primary data come from three sources. Aggregate corporate investment and profits come from the U.S. Flow of Funds accounts; stock returns and Treasury yields come from the University of Chicago's Center for Research in Security Prices (CRSP); and inflation, GDP, and corporate bond yields come from the FRED database compiled by the Federal Reserve Bank of St. Louis.

The Flow of Funds accounts track income, savings, and expenditures for broad sectors of the economy. Our tests focus on profits and fixed investment for nonfinancial corporations, available quarterly starting in 1952. The data are seasonally-adjusted and converted into real terms using the consumer price index (CPI). Most tests in the paper use changes in the variables scaled by lagged corporate assets valued at historical cost. In this calculation, we difference the raw series first and then divide by lagged assets, so changes in the variables are similar to growth rates (we scale by a common denominator in order to compare their magnitudes more easily; results using actual growth rates are similar and summarized in the text). Since at least the mid-1990s, the data have been released in the third month following each quarter. We generally interpret quarter t+1 as the 'announcement' quarter for investment and profits, though the information may not have been widely disseminated until quarter t+2 in early years of the sample.

Table 1 reports summary statistics for the variables and Figs. 1 and 2 plot their evolution through time. Average quarterly investment equals 1.56% of assets, roughly double average quarterly profits of 0.83%. Both variables are highly persistent and trend downward during the sample. Investment reaches a high of 2.07% at the end of 1978 and a low of 0.97% in the first quarter of 2010 after dropping dramatically during the recent

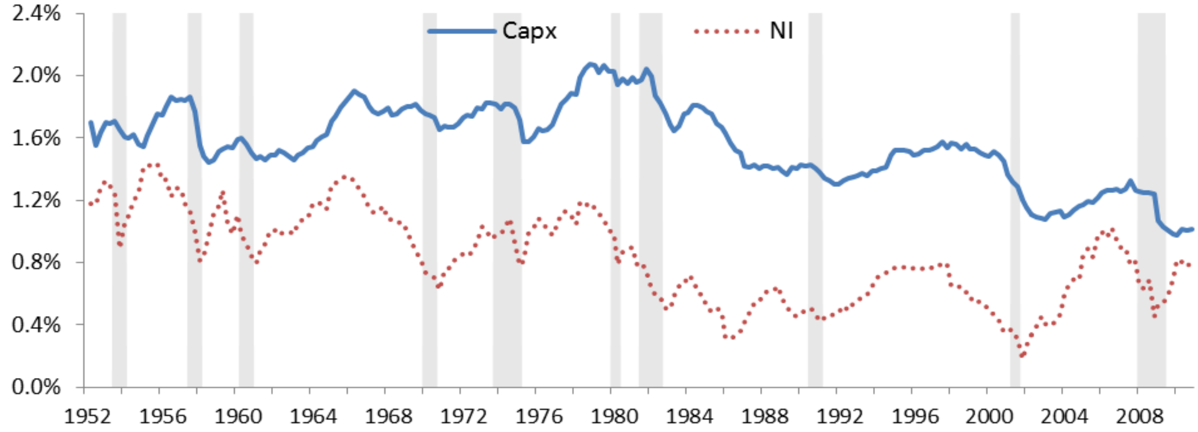


Fig. 1. Quarterly fixed investment (Capx) and after-tax profits (NI) scaled by lagged total assets for nonfinancial corporations from 1952–2010. Data come from the Federal Reserve's seasonally-adjusted Flow of Funds accounts. Shaded regions indicate NBER recessions.

financial crises. More generally, investment shows a clear business-cycle pattern, growing in expansions (except during the late-1980s) and dropping in recessions. One notable pattern is that the largest investment declines occur at the end of recessions, just as the economy starts to rebound.

Profits are always lower than investment and tend to be more variable, with a standard deviation of 0.29% in levels and 0.07% in changes (compared with 0.25% and 0.04%, respectively, for investment). Quarterly profitability reaches a high of 1.44% near the start of the sample and a low of 0.18% in the fourth quarter of 2001, reflecting in part the downward trend in profitability through time. Profits show a clear business-cycle pattern and a clear correlation with investment.

Table 1 also reports summary statistics for quarterly stock returns (the CRSP value-weighted index), GDP growth, inflation (CPI growth), quarterly stock volatility (the square root of the sum of squared daily returns on the CRSP value-weighted index), the interest rate on 1-year Treasury notes ('R'), the yield spread between 10-year and 1-year Treasury notes ('Term'), and the yield spread between Baa and Aaa corporate bonds ('Def'). The latter three variables serve as proxies for aggregate discount rates, based on the connection between the variables and expected stock and bond returns (e.g., Fama and French 1989; Ferson and Harvey 1999; Baker and Wurgler 2012). We use stock market volatility as a proxy for aggregate uncertainty,

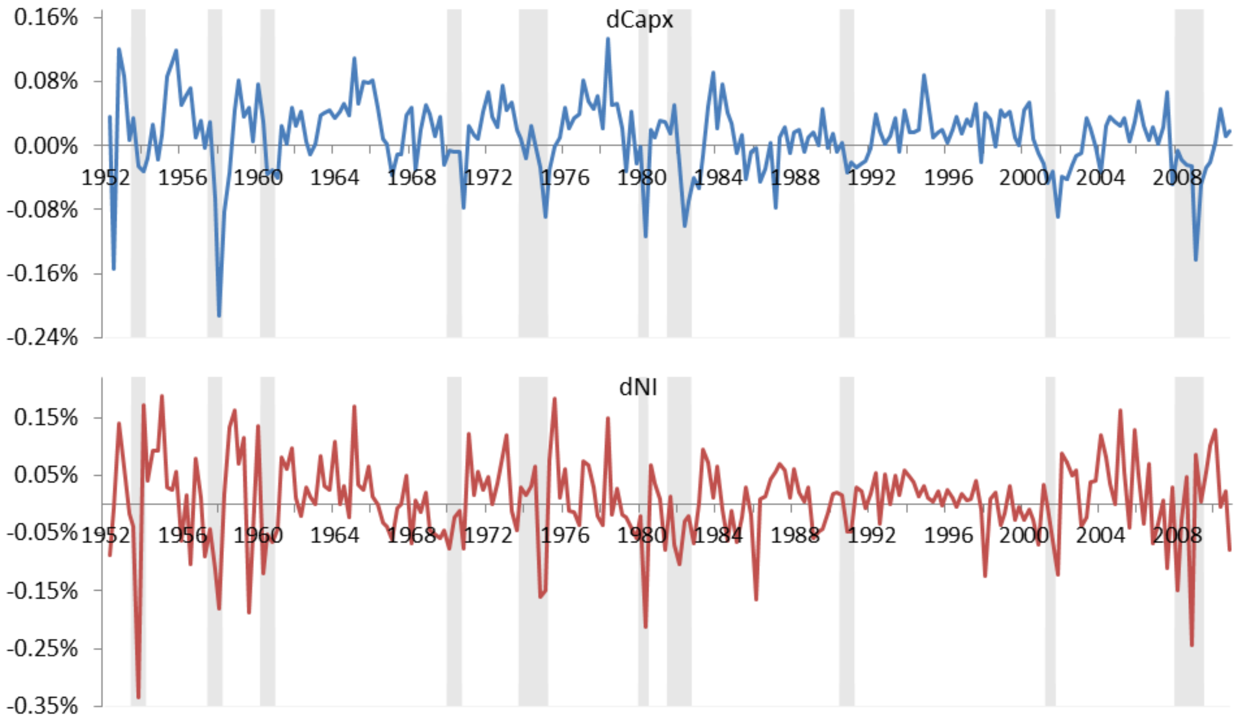


Fig. 2. Quarterly changes in fixed investment (dCapx) and after-tax profits (dNI), scaled by lagged total assets, for nonfinancial corporations from 1952–2010. Data come from the Federal Reserve's seasonally-adjusted Flow of Funds accounts. Shaded regions indicate NBER recessions.

following Bloom (2009) and others. The logic is that stock volatility should provide a timely and forward-looking measure of uncertainty.

Fig. 3 plots the discount-rate variables through time. Short-term interest rates typically fall in and around recessions, while the term and default spreads exhibit the opposite behavior. The default spread probably shows the clearest business-cycle behavior, spiking rapidly in recessions and then declining fairly steadily in expansions. The term spread tends to increase and remain high for many quarters after the official end of a recession and to decline only in the second half of an expansion. Thus, the three variables seem to pick up different aspects of the business cycle.

Stock volatility, in the bottom panel of Fig. 3, trends upward through time. Volatility jumps around the stock market crash in October 1987, increases steadily in the second half of the 1990s before dropping in the mid-2000s, and then spikes up again during the financial crisis in 2008. There is some evidence of an increase in

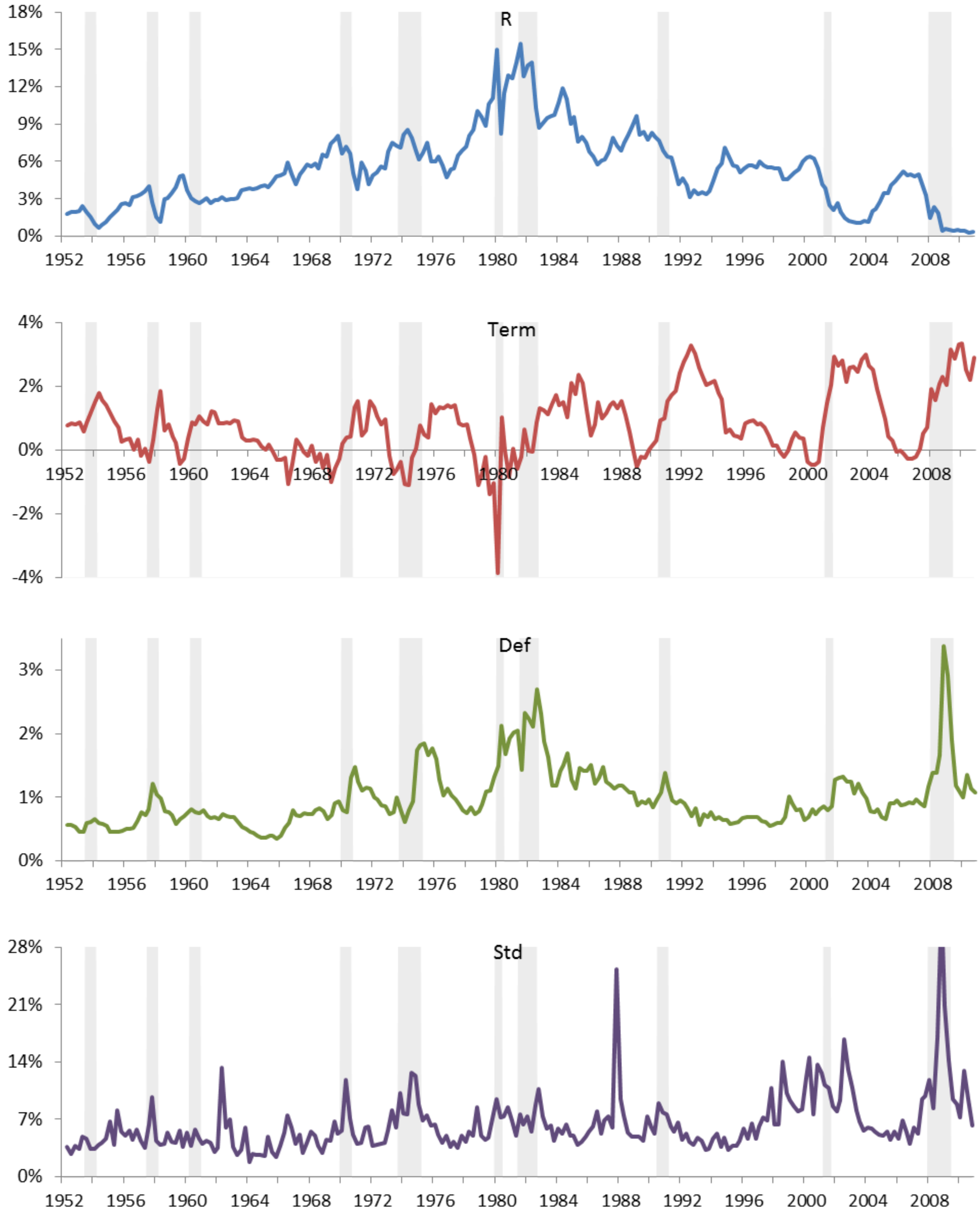


Fig. 3. Quarterly 1-year Tnote rate (R), term premium (Term; the yield spread between 10-year and 1-year Tnotes), default spread (Def; the yield spread between Baa- and Aaa-rated corporate bonds), and stock volatility (Std; the square root of the sum of squared daily market returns) from 1952–2010. Interest rates and stock returns come from CRSP and corporate bond yields come from the St. Louis Fed. Shaded regions indicate NBER recessions.

volatility during recessions but the cyclical behavior is modest.

Table 2 reports correlations between the variables. Given the high persistence of the variables, Table 2 and our subsequent tests focus on changes in investment, profits, interest rates, and stock volatility rather than levels (stock returns, GDP growth, and inflation are not differenced since they are already growth rates). As observed above, investment and profits are procyclical, exhibiting a positive correlation with GDP growth, inflation, and short-term interest rates and a negative correlation with changes in the term and default spreads. Investment and profits are also positively correlated with each other but weakly negatively correlated with contemporaneous stock returns.

## 4. Predicting investment

Our analysis proceeds in two steps. This section studies how investment behaves following changes in profits, stock returns, volatility, and interest rates, while the next section studies how profits and stock returns behave following changes in investment. The tests focus on correlations, not causation, but the patterns shed light on the underlying factors that drive investment.

### *4.1. Univariate relations*

Table 3 looks at how quarterly investment (dCapx) relates to current and past changes in profits (dNI), stock prices (Mkt), market volatility (dStd), short-term interest rates (dR), the term spread (dTerm), and the default spread (dDef). All variables represent changes or growth rates and should approximate shocks to the variables given their high persistence in levels (see Table 1).

Panel A reports slopes from simple regressions that consider each variable separately:

$$dCapx_{t+k} = a_k + b_k X_t + e_{t+k}, \quad (1)$$

where $dCapx_{t+k}$ is the quarterly change in investment (scaled by lagged assets), $X_t$ is the predictor variable shown in the left-most column, and k takes values of zero to five as indicated at the top of each column. Since $dCapx_t$ is a single-quarter change, the cumulative change in investment can be inferred by summing the slopes in a given row. We report Newey-West t-statistics below the slopes, incorporating two lags of autocorrelation (doubling the number of lags produces very similar results).

Panel A shows that profits, stock returns, and the default spread are the strongest predictors of investment. Higher profits are associated with a contemporaneous increase in investment (t-statistic of 3.30) and growth in each of the subsequent five quarters (t-statistics of 2.80 to 5.32). The strongest effect shows up in quarter t+1, for which a $1 increase in profits predicts a $0.25 increase in quarterly investment (investment and profits are scaled by the same variable, so the slopes show how investment grows following a $1 increase in profits). Summing the slopes for all quarters, an extra dollar of profits is associated with just under $1.00 of additional investment in quarter t+5. (Slopes for quarters t+6 and t+7 are also positive but insignificant.) Thus, investment is strongly correlated either with the information reflected in profits or with the additional supply of internal financing brought by higher profits.

Stock returns also predict investment growth for up to six quarters, consistent with a lag between a shock to investment opportunities or sentiment and changes in actual expenditures. The predictive power of stock returns is strongest in quarter t+4, but the slopes for quarters t+2 through t+6 are all highly significant, with t-statistics of 2.85–4.10. The slopes indicate that a 10% increase in stock prices forecasts a 0.007–0.014% increase in investment as a percentage of total assets in every quarter t+1 to t+6. To put these numbers in perspective, if we instead use investment growth as the dependent variable (scaling by lagged investment rather than lagged assets), a 10% increase in stock prices predicts 0.5–0.9% of additional investment growth in each quarter t+1 to t+6, cumulating to 4.3% of additional investment in quarter t+6. We discuss the magnitudes further below.

Short-term interest rates (dR) are positively correlated with investment growth in quarters t and t+2, while changes in the default spread (dDef) are negatively correlated with investment growth in quarters t+1 through t+4. The first result is puzzling viewed from the perspective that higher interest rates should dampen investment. However, the results are consistent with the procyclical behavior of short-term interest rates and the countercyclical behavior of the default spread (see Fig. 3). Thus, dR and dDef seem to capture information about changes in either profitability or the equity premium over the business cycle. At the same time, the predictive power of both variables is weaker than that of profits and stock returns and, as we discuss next, largely disappears in multiple regressions.

Finally, Panel A shows that market volatility is weakly correlated with subsequent investment growth. The slopes are negative for all quarters t+1 through t+5 but marginally significant, at best, in only two quarters (the strongest t-statistic is -1.79). The evidence suggests that shocks to aggregate uncertainty have little impact on investment even before we control for movement in the other variables.[1]

*4.2. Multiple regressions*

Panel B of Table 3 studies the joint explanatory power of profits, stock returns, volatility, and interest rates. The format is similar to Panel A, with $dCapx_{t+k}$ regressed on lagged variables, except that each column reports a regression using all of the variables together. Lagged dCapx is included in the regressions to control for persistence in investment growth.

The regressions in Panel B confirm many of the univariate results discussed above: Profits and stock returns predict investment growth for up to six quarters, while short-term interest rates, the default spread, and market volatility contribute a small amount of additional predictive power.

There are three notable differences between Panels A and B. First, stock returns now predict a stronger and more rapid increase in investment beginning as soon as quarter t+1 (the slopes for quarters t+1 to t+4 all increase compared with Panel A, while the slopes for t+5 and t+6 stay the same). The rapid increase following high stock returns suggests that firms either have substantial flexibility to react to changes in investment opportunities or sentiment, or have private information about investment opportunities and make the decision to investment before the market learns about the shock to, say, profitability, thereby decreasing the time lag between returns and the actual change in expenditures.

[1] Fig. 4 shows that market volatility is punctuated by two large spikes in 1987Q4 and 2008Q4. The predictive power of dStd in Panel A becomes marginally stronger if we reduce the impact of those spikes by setting the minimum value of dStd to -8% and the maximum value of dStd to 10% (roughly equivalent to winsorizing it at the 1st and 99th percentiles). In this case, the slope for quarter t+2 has a t-statistic of -2.26, though the slopes for all other quarters remain insignificant (the t-statistics range from -0.53 to -1.55).

A second notable difference is that interest-rate shocks are less significant in Panel B than in Panel A. Changes in short-term interest rates continue to be positively related to investment in quarters t and t+1, but changes in the default spread lose much of their predictive power (the slopes drop roughly in half and only the t-statistic for quarter t+1 is less than -2.0). The results suggest that much of the explanatory power of dR and dDef in Panel A can be attributed to their correlations with profits (0.32 and -0.34, respectively). Further, to the extent that profits and lagged investment do a good job controlling for variation in the business cycle, the positive slope on short-term interest rates in the multiple regressions is hard to reconcile with the hypothesis that Federal-Reserve-driven movements in interest rates have a first-order impact on corporate investment. The slope is never significantly negative, out to quarter t+8, and remains positive in quarters t+0 through t+2 even if we add GDP growth to the regressions.[2] In short, interest-rate changes unrelated to profits have little predictive power for investment.

The third notable difference is that market volatility actually becomes positively related to investment growth once we control for profits, stock returns, and the other variables. The predictive slope on dStd is positive at all horizons and significant for quarters t+1, t+3, and t+4. Thus, the negative slopes in Panel A are largely attributable to the correlation between volatility and stock returns (-0.50) rather than a direct link between volatility and investment. The results provide no evidence that corporations cut investment in response to an increase in aggregate uncertainty, contrary to the predictions of many theoretical papers (e.g., Pindyck 1991; Caballero 1999; Bloom 2009).

The joint explanatory power of the variables in Panel B is substantial, predicting 33% of the variation in investment growth in quarter t+1 and an average of 16% in the three subsequent quarters. To illustrate the relative importance of profits and stock returns, Fig. 4 plots the growth in investment predicted by a one-standard-deviation increase in each variable, starting with the predicted effect in quarter t+1 and cumulating out to quarter t+5. The estimates come from multiple regressions like those in Table 3—using investment

[2] GDP growth is highly correlated with changes in corporate profits (dNI) and has similar predictive power for investment. If GDP growth is added to the regressions in Panel B, it and dNI are both significant but their t-statistics are much smaller than when the variables are used separately. We omit GDP from Table 3 to avoid problems with multicollinearity, but it is useful to note that GDP does have incremental predictive power.

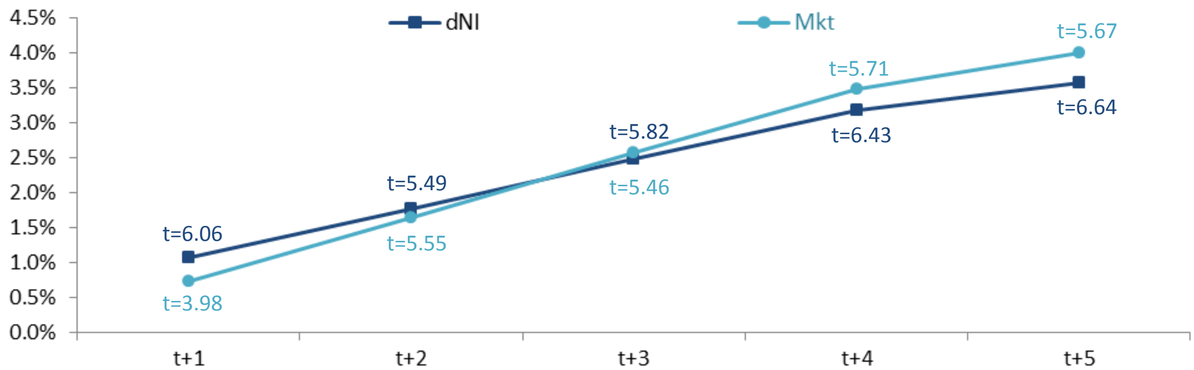


Fig. 4. Cumulative growth in quarterly investment following a one-standard-deviation increase in corporate profits ($dNI_t$) or stock returns ($Mkt_t$), controlling for the other predictors in Table 3. Investment and profits come from the seasonally-adjusted Flow of Funds accounts for nonfinancial corporations; stock returns come from CRSP. Newey-West t-statistics are reported next to each point.

growth rates instead of investment changes scaled by assets—and the t-statistics adjust for correlation between slopes at different horizons.

The graph shows that a one-standard-deviation increase in profits predicts 1.1% of additional investment in quarter t+1, growing to 3.6% of additional investment in quarter t+5 (with a t-statistic of 6.64); a one-standard-deviation increase in stock returns predicts 0.7% of additional investment in quarter t+1, growing to 4.0% of additional investment in quarter t+5 (with a t-statistic of 5.67). These effects are large relative to average investment growth of 3.2% annually from 1952–2010.

The other predictors in Table 3 have less predictive power, but the cumulative effects of dDef and dStd are statistically significant (not shown in the graph). A one-standard-deviation increase in dDef predicts 1.6% less investment in quarter t+5 (t-statistic of -3.01), while a one-standard-deviation increase in dStd leads to 1.3% more investment (t-statistic of 3.48).

*4.3. Discussion*

Table 3 suggests three main conclusions. First, investment grows rapidly following high profits and stock returns—consistent with virtually any theory of corporate investment—but can take up to a year and a half to fully adjust. These results update, and somewhat revise, the findings of Barro (1990), Morck, Shleifer, and

Vishny (1990) and Blanchard, Rhee, and Summers (1993), who disagree about whether profits or stock prices are more important for investment. Our evidence suggests that both variables are significant, with very similar predictive power for investment.

Second, investment growth shows little connection to changes in either short- or long-term interest rates. In some ways, the (weak) positive correlation between investment growth and the short rate is expected since both variables are procyclical. It seems more surprising that the relation remains positive after controlling for profit and GDP growth, i.e., we find no evidence that, conditional on current profit and GDP growth, higher interest rates dampen investment growth going forward. A potential explanation could be that interest rates and investment are both driven by expectations of future economic activity, but we find little support for that hypothesis in the data: higher interest rates are actually *negatively* associated with subsequent GDP growth. For example, if we forecast GDP growth using the variables in Table 3 (keeping the same specification as Panel B), the slopes on $dR_t$ are marginally negative in quarters t+2 through t+5 (t-statistics of -1.44 to -1.93) and, together, those slopes are jointly significant (their sum has a t-statistic of -2.11; a 1% increase in $dR_t$ predicts 0.7% lower GDP growth). The puzzle is why higher interest rates are not associated with as strong, or even stronger, slowdown in investment.

Interestingly, higher interest rates do predict a slowdown in household and nonprofit investment (HI), the second most important component of gross private domestic investment. Using the predictive model in Panel B, $dR_t$ is significantly negatively related to HI in all quarters t+1 through t+5, with t-statistics of -2.00 to -4.47. The predicted decline in HI more than offsets the predicted increase in corporate investment, leading to a weak negative relation between interest rates and total U.S. fixed investment.

The third main conclusion from Table 3 is that market volatility is only weakly related to investment growth, with a somewhat negative predictive slope when used alone and a somewhat positive predictive slope controlling for the other variables. The latter result contradicts conventional wisdom, formal models with irreversible investment or fixed adjustment costs, and, to some extent, prior evidence, though we do not know of a directly comparable test in the literature. For example, Bloom (2009) argues that an increase in uncertainty reduces investment and output in the short run but leads to a rebound over longer horizons, as uncertainty subsides and 'firms address their pent-up demand for labor and capital' (p. 625). However, we find no evidence for this pattern in aggregate corporate investment.

*4.4. Robustness*

Our conclusions survive a number of robustness checks:

*Market volatility*. Unlike the other predictors, market volatility has a relatively low autocorrelation of 0.61, so changes in volatility are somewhat predictable. We find similar results if volatility shocks from an AR1 model are used in place of volatility changes, though the negative relation between volatility and investment in Panel A becomes stronger (t-statistics of -2.34 to -3.29 in quarters t+1 through t+4 ) and the positive relation between volatility and investment in Panel B becomes weaker (t-statistics of -0.47 to 1.40). The robust conclusion seems to be that volatility has little predictive power for investment growth after controlling for profits, stock returns, and the other variables.

*Idiosyncratic volatility*. Philippon (2009) and Gilchrist, Sim, and Zakrajsek (2013) show that idiosyncratic volatility predicts aggregate investment, but neither paper controls for profits or stock returns. Our own tests suggest that idiosyncratic volatility predicts about as well as market volatility. We measure idiosyncratic volatility in the same way as Philippon, based on the cross-sectional dispersion of firm-level stock returns (estimated quarterly). Changes in idiosyncratic volatility are weakly negatively related to investment growth in both simple regressions (t-statistics of -0.59 to -1.57 in quarters t+1 through t+4) and multiple regressions controlling for the other predictors in Table 3 (t-statistics of -0.85 to -1.94).

*Federal funds rate*. The federal funds rate is often used as a proxy for short-term interest rates, in part because it may reflect monetary policy more directly than the one-year Tbond rate. Our results are similar using either variable. The federal funds rate is positively related to subsequent investment growth in simple regressions but has little predictive power controlling for the other predictors.

*Bond market q*. Philippon (2009) shows that an estimate of Tobin's q derived from corporate bond prices

($q_{bond}$) has stronger predictive power for private nonresidential fixed investment than a traditional stock-based measure. His variable, available on his website from 1953Q2–2007Q2, also predicts corporate investment in our data: By itself, changes in $q_{bond}$ are significantly positively related to dCapx in quarters t+1 through t+4, with t-statistics greater than four in quarters t+1 and t+2. The relation between $q_{bond}$ and next-quarter dCapx remains significant controlling for the other variables in Table 3, but $q_{bond}$ does not predict investment reliably after quarter t+1 and has little impact on our other results (profits and stock returns continue to have strong predictive power in quarters t+1 through t+5).

*Credit spreads*. Gilchrist and Zakrajsek (2012) show that a credit spread measure (GZ) derived from matching individual corporate bonds to a portfolio of zero-coupon Tbonds with the same cash flows has strong predictive power for GDP and other macro variables. A component of this spread, the 'excess bond premium' (EBP), is especially significant. Both series are available on the *American Economic Review* website from 1973Q1–2010Q3. We find mixed evidence that GZ and EBP predict investment in our data. Used alone, levels and changes in the variables are negatively related to subsequent investment growth, with t-statistics as high as -7.64 (using $EBP_t$ to predict $dCapx_{t+1}$). However, when GZ and EBP are added to our multiple regressions, only the level of the variables has reliable predictive power, and much of that comes from the fact that the levels of GZ and EBP are highly correlated with prior profits and stock returns. In our preferred specification, using changes in the variables, GZ is not significant at any horizon (t-statistics of -1.73 to 1.13) and EBP is significant only in quarters t+4 and t+5 (t-statistics of -2.10 and -2.63). The conclusions regarding our other variables do not change.

**5. Investment and future performance**

We reverse the timing in this section, focusing on the link between investment and *future* profits and returns. The main questions we ask are: (1) How does investment relate to subsequent profit growth? (2) How do stock prices behave when investment becomes publicly known? (3) Does the relation between investment and future stock returns provide evidence that either discount rates or sentiment explain significant variability in investment growth?

*5.1. Investment and future profits*

Table 4 looks at the connection between investment and future profits, either using investment by itself or controlling for lagged profits, stock returns, volatility, and interest rates. The table is organized along the lines of Table 3, with simple regressions of $dNI_{t+k}$ on each variable in Panel A and multiple regressions using all of the predictors together in Panel B.

The two panels tell the same basic story: investment is strongly negatively related to future profit growth. Higher investment predicts lower profit growth in every quarter t+1 to t+4, highly significant in both simple regressions (t-statistics of -1.40 to -5.06) and multiple regressions controlling for stock returns, volatility, and interest rates (t-statistics of -1.78 to -4.83). The relation is strongest in quarters t+2 and t+3, in which a dollar of $dCapx_t$ predicts roughly $0.70 lower profits (recall that changes in profits and investment are both scaled by assets, so the slopes can be interpreted as the change in profits predicted by a $1 increase in investment). The slopes are also negative in quarters t+5 and t+6, but the estimates are not significant in either simple or multiple regressions.

The strength and speed of the effects suggest that the relation between investment and future profits is not causal. Higher investment could, in principle, reduce profits if growth pushes up costs faster than revenues. However, it seems unlikely that a $1 increase in investment would *cause* a $0.21 drop in profits in the subsequent quarter or, summing the slopes across quarters in Panel B, a $1.36 drop in profits in quarter t+5. Additional support for this view comes from the fact that, in supplemental tests, we find that higher investment predicts not just lower profits but also lower GDP growth. Specifically, while $dCapx_t$ is positively related to GDP growth in quarters t and t+1, it is negatively related to GDP growth in quarters t+2 through t+5. The relation is not as strong as it is for profit growth, but the slope is significant in quarter t+3 with a t-statistic of -2.96 (or -3.48 in multiple regressions like those in Panel B). We can think of no reason that higher investment would *cause* a drop in subsequent GDP growth.

The negative relation between investment and future profits presents a challenge for traditional models of

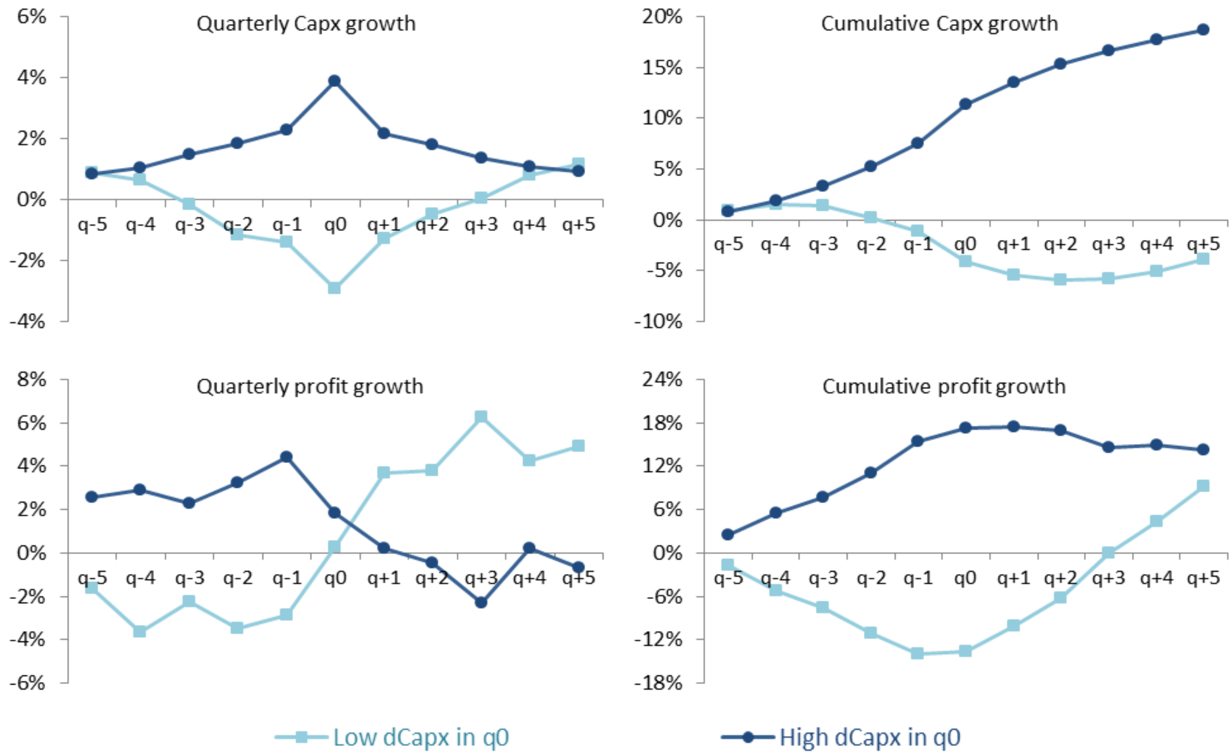


Fig. 5. Investment and profit growth in quarters leading up to and following a large increase (dark line) or decrease (light line) in quarterly investment (dCapx in q0). The top panels show the quarterly and cumulative growth rate of investment; the bottom panels show the quarterly and cumulative growth rate of profits. Investment and profits come from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations.

corporate investment, which universally imply (as far as we know) that high investment signals good news and higher profits. The fact that a spike in investment predicts slower GDP growth and a drop in profits suggests that some component of investment coincides with bad news. This interpretation is consistent with the low stock returns in quarters t+1 and t+2 that we document in the next section.

One possibility is that spikes in investment are simply poorly timed: Managers raise investment following high profits and stock returns but, by the time investment growth peaks, subsequent profit growth turns out to be low. Fig. 5 depicts these effects graphically. In particular, the figure shows how investment and profits evolve in the quarters leading up and following large changes in investment, defined as the top and bottom quartiles of dCapx historically (quarterly investment growth averages 3.9% in the top quartile and -2.9% in the bottom quartile, with persistently high or low growth in the surrounding quarters). Remarkably, the negative relation between investment and future profits is nearly as strong as the positive relation between investment and prior profits. Profits grow 5.2% slower per quarter in the five quarters after a large increase in investment than after a large decrease, almost completely reversing the 5.9% quarterly profit differential leading up to investment. As a consequence, profit growth over the full 11-quarter window is nearly the same around big increases and big decreases in investment. Investment seems to grow strongly following what turns out to be a largely transitory shock to profits.

A few other results in Table 4 are noteworthy. First, stock returns have strong but short-lived predictive power for profit growth. The slope on $Mkt_t$ is highly significant in quarters t+1 and t+2 but close to zero thereafter, consistent with prior evidence that aggregate returns contain little information about long-run profit or dividend growth (e.g., Cochrane 2008). Second, profits follow something close to a random walk, but profit growth becomes weakly positively autocorrelated once we control for the other variables in Panel B (the most important of which is dCapx): The slope on $dNI_{t-1}$ is positive at all horizons and marginally significant in quarters t+1 and t+2 (the sum of the two slopes is 21%, with a t-statistic of 2.18). Finally, changes in interest rates and the default spread are weakly negatively related to future profit growth. The point estimates in Panel B are not significant individually, but the cumulative slope on $dR_t$ for quarters t+2 through t+5 and the cumulative slope on dDef for quarters t+1 through t+3 are both marginally significantly negative (t-statistics of -2.03 and -2.09, respectively).

*5.2. Investment and future stock returns*

The results above show that investment predicts profit growth but do not provide any indication of when the market learns about the effects. In this section, we study the link between investment and future stock returns, both in the short run when expenditures become public and in the long run after expenditures are known. Prior studies have looked at whether investment predicts returns, but the evidence is mixed and often does not distinguish between short-run ‘announcement’ effects and true predictability, given the delay in the observability of aggregate expenditures.

Because stock returns should correlate differently with expected and unexpected investment—in an efficient market, only the latter reflects new information—we explore the predictive power of both the total change in investment and estimates of the expected and unexpected change. Our analysis in Section 4 shows that investment growth is highly predictable based on recent changes in investment, profits, and stock prices. Therefore, to forecast investment, we estimate a model that includes two lags of each of those variables (adding another lag or including the other predictors from Section 4 has little impact on the results). As shown in Table 5, the predictors are highly significant (t-statistics of 1.87–5.37) and together predict 38% of the variation in dCapx. We use the fitted values and residuals from this regression as our measures of expected and unexpected investment.

Table 6 documents the link between investment and subsequent stock returns. Again, the basic format is the same as our earlier tables, with stock returns for quarters t through t+5 ($Mkt_{t+k}$) regressed on either the total change in investment in quarter t ($dCapx_t$) or the expected and unexpected changes in investment ($E[dCapx_t]$ and $U[dCapx_t]$). Panels C and D add a variety of control variables to the regression, including the change in profits ($dNI_t$), the change in market volatility ($dStd_t$), and either the level or change in short-term interest rates (R), the term spread (Term), and the default spread (Def), supplemented with lagged market returns and dividend yield ($DY_t$). For this table, market returns are measured net of the three-month Tbill rate in order to test for predictability in excess returns.

The table shows that stock returns, like profits, are negatively related to prior investment growth, concentrated in quarters t+1 and t+2 when the market likely learns about investment. The slopes for those two quarters are highly significant, with t-statistics of -3.18 and -2.45 using the total change in investment in Panel A and -3.22 and -3.21 using the unexpected change in investment in Panel B. The slopes in subsequent quarters, as well as the slopes on expected investment, are also predominantly negative but their statistical significance is weaker. The results suggest that high investment is associated with bad news but provide little evidence that investment predicts subsequent returns once expenditures become known.

Economically, the point estimates in Table 6 are large. A one-standard-deviation increase in $dCapx_t$ predicts that market returns will be 1.6% lower in quarter t+1 and a combined 2.9% lower in quarters t+1 and t+2 (the latter has a t-statistic of -3.29). Similarly, a one-standard-deviation increase in $U[dCapx_t]$ implies that market

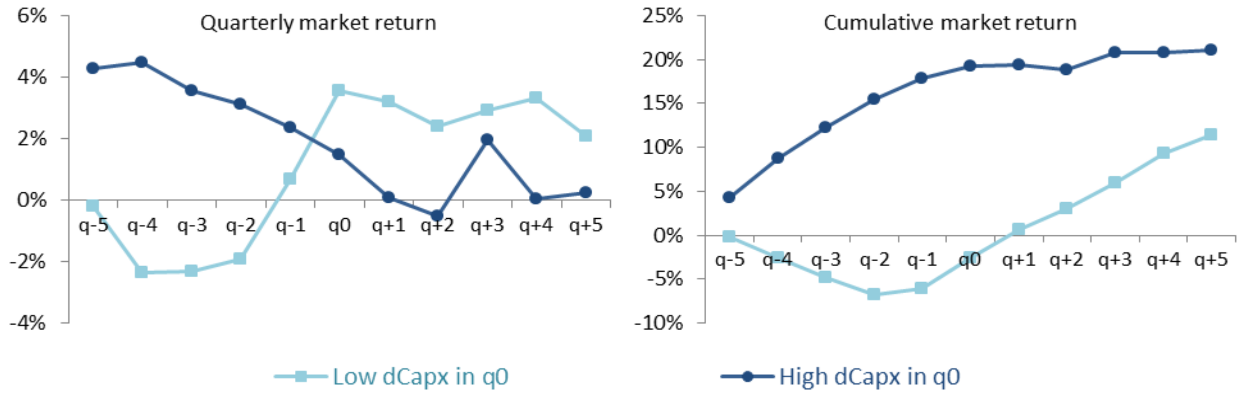


Fig. 6. Excess stock market returns in quarters leading up to and following a large increase (dark line) or decrease (light line) in quarterly investment (dCapx in q0). Investment comes from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; stock market returns and three-month Tbill rates come from CRSP.

returns will be 1.4% lower in quarter t+1 and a combined 2.8% lower in quarters t+1 and t+2 (the latter has a t-statistic of -4.51).

For additional perspective, Fig. 6 plots stocks returns in the quarters leading up to and following a big increase or decrease in investment (top and bottom quartiles of the historical distribution of dCapx). Returns are nearly 25% higher in the five quarters before a jump in investment than before a big investment decline, but, as we saw with profits, the pattern flips after investment: excess returns are -0.4% in the six months after a spike in investment and 5.6% in the six months after a big decline. The graph provides some evidence that the pattern continues after quarter t+2 but the return spread narrows. In the five-quarter post-investment window, excess returns are just 1.8% after a big increase but 13.9% after a big decline. The numbers become 3.3% and 17.5%, respectively, if returns for quarter t are included.

The behavior of stock prices mimics the behavior of profits in Fig. 5 but seems to be shifted forward one quarter in event time. Again, a remarkable fact is that the return spread in quarters t+1 to t+5 offsets a large fraction of the pre-investment return spread, so cumulative returns over the full 11-quarter window differ by less than 10% around big spikes versus big declines in investment (returns of 21.1% and 11.4%, respectively). In principle, the basic pattern—a positive return spread before and a negative return spread after—could be explained by discount-rate effects, but the size and speed of the reversal seems more consistent with the view

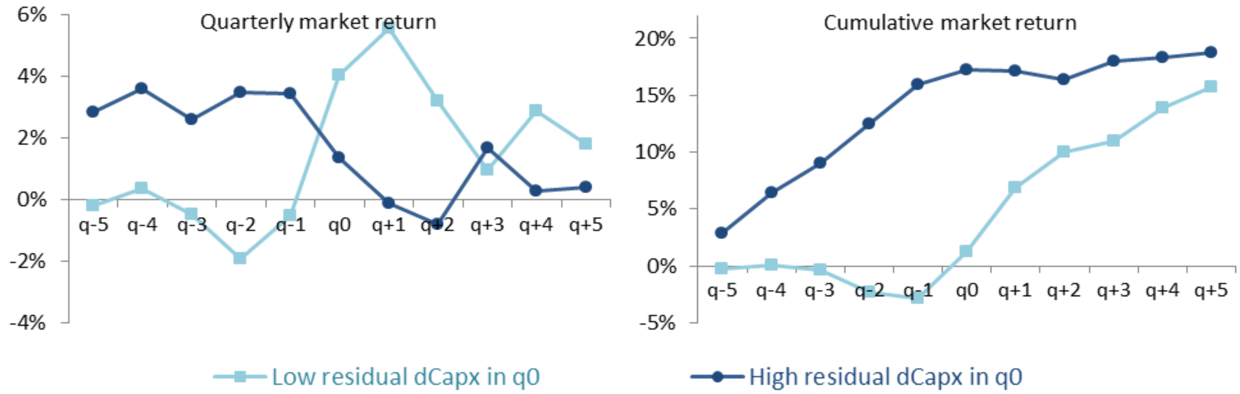


Fig. 7. Excess stock market returns in quarters leading up to and following a large increase (dark line) or decrease (light line) in the component of investment that is uncorrelated with prior profit growth. Investment comes from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; stock returns come from CRSP.

that a spike in investment is associated with bad news (concentrated in quarters t+1 and t+2). In addition, the fact that cumulative profit growth is a bit higher around spikes in investment likely explains part of the return spread observed in Fig. 6, implying that any discount-rate effects imbedded in stock prices that persist beyond the end of the window must be small.

It is important to note that, while the patterns in profits and returns are similar, they seem to be distinct effects. To illustrate, Fig. 7 replicates Fig. 6 but, rather than focus on quarters with high or low dCapx, we look at quarters in which investment changes a lot controlling for prior profits, i.e., we focus on quarters that have a big positive or negative residual when $dCapx_t$ is regressed on profit growth from quarter t-5 to t-1. Like the total change in investment, this component is strongly negatively related to market returns in quarters t+1 and t+2. In fact, market returns are more extreme when investment changes unexpectedly given prior profit growth: excess returns are -0.9% in the six months after an unexpected jump in investment and 8.8% after an unexpected decline, for a spread of 9.7% (compared with 6.0% in Fig. 6). The spreads in quarters t+1 and t+2 are both significant, with t-statistics of -4.31 and -2.85, respectively.

### *5.3. Discussion*

Our results suggest that a spike in investment is associated with bad news. The evidence is hard to reconcile with traditional models of corporate investment, which suggest that higher investment should be positively associated with stock returns and predict higher profits.

We can think of only two reasons that high investment might be bad news if investment responds optimally to fundamentals. First, an increase in labor costs could simultaneously lead to low profits but high investment as firms shift away from labor. Second, if there is a difference between 'old' and 'new' capital, a negative shock to existing capital could also hurt profits yet induce higher investment as firms shift to new capital. The problem for both stories is that, if either has a first-order impact on investment growth in general, we would expect investment growth to be negatively related to both prior and subsequent profits as firms respond to wage and productivity shocks. Neither story predicts a dramatic difference in the way that investment relates to recent past and future profit growth.

The evidence seems more consistent with the view that large changes in investment are, on average, poorly timed. Managers may overreact to prior profits and stock returns, expanding investment excessively in the late-stages of expansions and cutting investment excessively at the end of recessions. This interpretation does not mean that higher investment is, in general, wasteful or inefficient. Indeed, when investment growth is commensurate with prior profit growth—$dCapx_t$ is high or low but matches the growth expected given the typical relation between investment and profits—market returns in quarters t+1 and t+2 are not unusual.[3] Our evidence suggests, instead, that it is an *abnormal* spike in investment, given prior profit growth, that is associated with low market returns.

Our findings are consistent with agency-based theories of investment, although those theories are typically applied to acquisition decisions rather than capital expenditures (Stein 2003). The limited evidence that does exist on the market's reaction to capital expenditures suggests that announcements of high future investment are actually viewed as good news for the small sample of firms with identifiable announcements (McConnell and Muscarella 1985; Chung, Wright, and Charoenwong 1998). However, we do not know of any study that

[3] We have repeated the excerise in Fig. 8 focusing on quarters that have high or low expected investment growth, defined as the fitted value from the regression of $dCapx_t$ on prior profits. The return spread in the six months after a spike in expected investment is actually slightly positive, equal to 0.07% in quarter t+1 and 0.17% in quarter t+2. Neither estimate is significantly different from zero.

looks at the market's reaction to unexpected capital expenditures for a broad cross section of firms. (The closest might be Titman, Wei, and Xie 2004, who find that investment growth predicts low returns in the years after investment is known.)

While a detailed cross-sectional study is beyond the scope of this paper, supplemental tests suggest that our results carry over to firm-level investment. Specifically, we repeat our tests using firm-level capital expenditure data from Compustat (available quarterly from 1984–2012), measuring unexpected investment as the residual when seasonally-differenced Capx is regressed, cross sectionally, on a firm's lagged market-to-book ratio of assets, four-quarter lagged Capx, and four lags of stock returns, seasonally-differenced Capx, and seasonally-differenced earnings. In Fama-MacBeth regressions that control for contemporaneous changes in earnings and sales, abnormal investment in quarter t is associated with a drop in stock returns in quarter t+1 similar to that found in aggregate data. The slope on $dCapx_t$ is significantly negative in the full sample of firms (-0.20 with a t-statistic of -2.28) but is especially strong among firms larger than the 10th percentile of NYSE-listed companies (-0.34 with a t-statistic of -3.20).[4] The main difference at the firm level is that Capx's predictive power persists for several quarters after expenditures are disclosed, rather than being concentrated in quarters t+1 and t+2.

## 6. Investment growth, 2008–2009

The behavior of investment during the recent financial crisis has received wide attention in both the academic literature and popular press. Many observers have suggested that, due to the dramatic decline of short-term debt markets and losses in the banking sector, firms' ability to finance investment was severely restricted. For example, in a survey of chief financial officers in December 2008, Campello et al. (2010) report that 57% of U.S. respondents said their firms were 'somewhat affected' or 'very affected' by difficulties in accessing the credit markets, and a majority of respondents said their firms had to forego attractive investments because of an inability to obtain external funds. Given this narrative—that an unprecedented credit crisis induced a severe

[4] The results are based on 107 quarterly cross-sectional regressions from 1986–2012 (the first two years of quarterly Capx data on Compustat are needed to get four lags of seasonally-differenced Capx). The average cross section has 3,379 firms with necessary data, dropping to 1,617 firms when the smallest companies based on lagged total assets are excluded from the sample. Capx and earnings are deflated by total assets. All variables other than stock returns in quarter t+1 are winsorized at their 1st and 99th percentiles. Additonal details are available on request.

drop in investment—it seems useful to study this period in some detail.

On a basic level, the decline in investment at the end of 2008 and in 2009 was indeed unprecedented during our sample. Corporate investment dropped 21% in 2009 and declined a total of 27% from its quarterly high in 2007Q3 to its (local) minimum in 2009Q4. The decline in 2009 and the drop from 2007Q3 through 2009Q4 represent the largest annual decline and largest cumulative drawdown, respectively, observed in our data (the second largest annual decline is 17% in 1958 and the second largest cumulative drawdown is 24% from 2000Q3 to 2003Q1).

The more interesting issue, however, is whether the behavior of investment during the financial crisis was 'special,' that is, whether a significant portion of the decline represents an unusual response to the credit crisis rather than a normal reaction to changing macroeconomic conditions. Put differently, it seems clear that some portion of the investment drop in 2008 and 2009 can be tied to a decline in investment opportunities, not just an inability of firms to finance good projects. Understanding the role of each factor is important for policy makers yet remains the subject of much debate (e.g., Kahle and Stulz 2013).

Of course, unambiguously isolating the two factors is impossible. Our approach is simply to ask whether the investment decline can be explained by movements in profits, GDP, and stock prices during the crisis, without appealing to anything special going on in the credit markets. The question is: How much would investment drop if it simply maintained its historical link to profits, GDP, and stock prices? Interpreted differently, if managers update investment plans based on macroeconomic signals, how much would they reduce investment if nothing incremental was happening in the credit markets?

We approach this question in a couple of ways. Fig. 8 compares the actual investment decline from 2008Q4–2009Q4 to the decline predicted given macroeconomic conditions in 2008Q4, estimated from three regression models: Model 1 predicts investment using profits ($dNI_t$) and lagged investment ($dCapx_{t-1}$); Model 2 adds $GDP_t$ as a third predictor; and Model 3 adds stock returns ($Mkt_t$) as a fourth predictor. The one-quarter change predicted for 2008Q4 comes from a regression of $dCapx_t$ on each set of variables; the two-quarter change

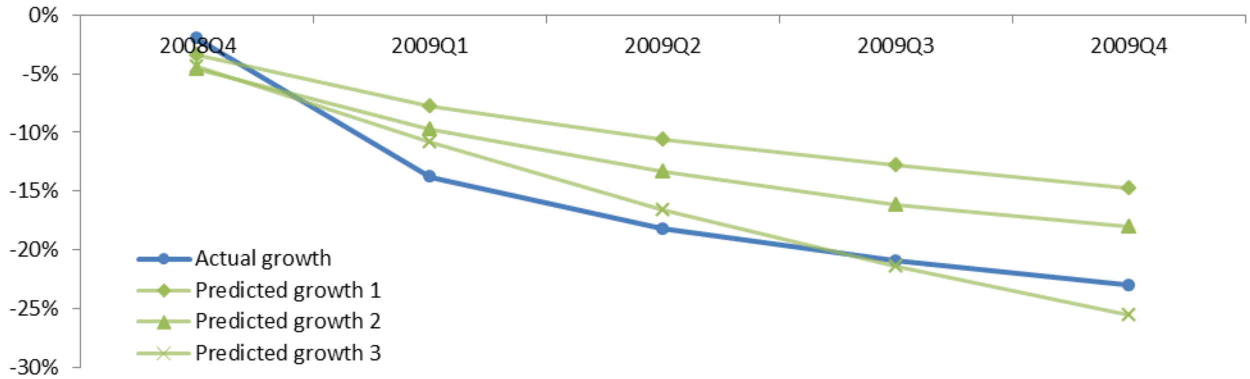


Fig. 8. Predicted vs. actual cumulative investment growth from 2008Q4 through 2009Q4. The predicted growth rate is the fitted value (given the predictors in 2008Q4) from a regression of $dCapx_t + dCapx_{t+1} + \ldots + dCapx_{t+k}$ on various predictors known in quarter t, where k equals zero for predicted growth in 2008Q4 and increases by one as the forecast horizon is lengthened (k equals five for predicted cumulative growth from 2008Q4–2009Q4). Three sets of predictors are used. Predicted growth 1 is based on lagged quarterly investment growth ($dCapx_{t-1}$) and the change in profits ($dNI_t$); Predicted growth 2 is based on lagged quarterly investment growth, change in profits, and GDP growth ($GDP_t$); Predicted growth 3 is based on lagged quarterly investment growth, change in profits, GDP growth, and stock returns ($Mkt_t$). Investment and profits come from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; investment is scaled by lagged investment and profits are scaled by lagged total assets. GDP comes from the St. Louis Fed's FRED database. Value-weighted stock returns come from CRSP.

predicted for 2008Q4–2009Q1 comes from a regression of $dCapx_t + dCapx_{t+1}$ on each set of variables; and so forth. Thus, the graph compares the actual decline in investment to the decline predicted based on the behavior of profits, GDP, and stock returns at the end of 2008.[5]

The graph shows that macroeconomic conditions at the end of 2008 would, by themselves, predict a substantial decline in investment from 2008Q4–2009Q4. If investment maintained its historical connection to profit growth, investment was predicted to drop by 14.7%, roughly two-thirds the actual decline of 23.0%. The difference between the two is due primarily to a greater-than-predicted drop in 2009Q1. If we add GDP growth to the model, the predicted decline grows to 18.1%, nearly four-fifths of the actual decline. Finally, if we add stock returns to the model, the predicted decline becomes larger (25.5%) than the actual decline. Thus, the vast majority, if not all, of the investment decline could be described as 'normal' given the behavior of profits, GDP, and stock returns at the end of 2008.

[5] The predictions simply equal the fitted values from the regressions, estimated in the full sample using investment growth as the dependent variable. The results are similar if we omit the financial crisis itself from the regressions (the predictions in Fig. 8 change by less than 1.4 percentage points).

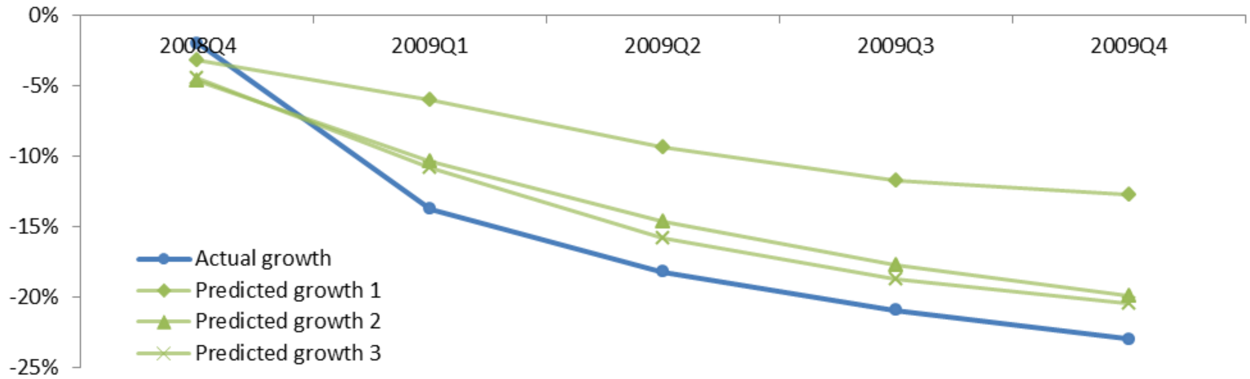


Fig. 9. Predicted vs. actual cumulative investment growth from 2008Q4 through 2009Q4. The predicted growth rate each quarter is the fitted value from a regression of $dCapx_t$ on various predictors known in quarter t. Three sets of predictors are used. Predicted growth 1 is based on the current change in profits and three lags of investment growth and profit changes; Predicted growth 2 is based on the current change in profits, current GDP growth, and three lags of investment growth, profit changes, and GDP growth; Predicted growth 3 is based on the current change in profits, current GDP growth, current market returns, and three lags of investment growth, profit changes, GDP growth, and market returns. Investment and profits come from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; investment is scaled by lagged investment and profits are scaled by lagged total assets. GDP comes from the St. Louis Fed's FRED database. Value-weighted stock returns come from CRSP.

The forecasts in Fig. 8 are based solely on profits, GDP growth, and stock returns in 2008Q4. Predicted growth from 2008Q4–2009Q4 takes into account the long-run forecasting ability of the quarterly variables but does not reflect in any way the evolution of profits, stock returns, etc., after 2008Q4. An alternative approach, shown in Fig. 9, is to update forecasts of investment growth every quarter, based on the most recent behavior of the predictors. The main complication is that quarterly changes in the predictors have a long-lasting impact on investment growth, persisting for at least several quarters (see Table 3). To capture these effects, our prediction models in Fig. 10 include current profits, GDP, and stock returns, as well as three lags of those variables and prior investment growth.

Fig. 9 has a similar message as Fig. 8: The behavior of profits, GDP, and stock returns in 2008 and 2009 can explain much of the decline in investment following the financial crisis. Cumulating the predicted quarterly growth rates, investment would be predicted to decline 12.8% from 2008Q4–2009Q4 given observed changes in profits, 20.0% given observed changes in profits and GDP, and 20.5% given observed changes in profits, GDP, and stock returns. The actual decline of 23.0% is greater, but the bulk of the decline again looks like a historically typical response to macroeconomic conditions, even without any unusual behavior in the banking sector and credit markets. These results are generally consistent with the firm-level evidence of Kahle and Stulz (2013) that a reduction in the availability of external financing may have played a small role relative to changes in firms' investment opportunities.

## 7. Conclusions

Our paper provides new evidence on the behavior of aggregate corporate investment from 1952–2010. The variability of corporate investment has important macroeconomic and policy implications and helps us to understand better how firms make investment decisions.

Our tests show that expected investment growth is linked tightly to changes in profits and stock prices but only weakly to changes in interest rates, stock volatility, and the default spread. We find no evidence that investment declines following a spike in aggregate uncertainty, contrary to the predictions of many models with irreversible investment. We also find no evidence that investment growth slows after a rise in short-term or long-term interest rates, contrary to the idea that Federal-Reserve-driven movements in interest rates have a first-order impact on corporate investment.

The link between investment and prior profits and stock returns undoubtedly reflects the impact of fundamentals on investment. But the link between investment and *future* profits and returns suggests that fundamentals may not be the whole story: investment growth is negatively related to future profits and to quarterly stock returns when expenditures become publicly known. Investment grows rapidly following what appear to be largely transitory shocks to profits, and spikes in investment seem to coincide with bad news.

Our final tests show that the decline in investment following the 2008 financial crisis, while unprecedented in our sample, would have been predicted largely by the behavior of profits and GDP in 2008 and 2009, without needing to ascribe a special role to the banking sector and short-term debt markets. Our estimates suggest that at least three-quarters of the investment decline can be thought of as a historically typical drop given the behavior of profits and GDP at the end of 2008. Problems in the credit markets may have played a role, but the impact on corporate investment is arguably small relative to a decline in investment opportunities following the 2008 recession and financial crisis.

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**Table 1**
**Descriptive statistics, 1952–2010**
This table summarizes the time-series properties (average, median, standard deviation, minimum, maximum, and autocorrelation) of the key variables used in the empirical tests. Data are quarterly, in percent, 1952Q2–2010Q4 (235 quarters). Aggregate corporate investment and profits come from the Federal Reserve's seasonally adjusted Flow of Funds accounts for nonfinancial corporations (table F102); levels and changes in these variables are scaled by beginning-of-quarter book value of total assets (table B102). Value-weighted stock returns and Treasury (Tnote) yields come from CRSP. Inflation, GDP growth, and the yield spread between Baa and Aaa bonds come from the St. Louis Fed's FRED database. The standard deviation of stock returns (Std) is calculate as the square root of the sum of squared daily returns during the quarter. Investment, profits, stock returns, and GDP are inflation-adjusted using the CPI.

| Variable | Description | Avg | Med | Std | Min | Max | Auto |
|---|---|---|---|---|---|---|---|
| Capx | Corporate fixed investment | 1.56 | 1.55 | 0.25 | 0.97 | 2.07 | 0.99 |
| NI | After-tax corporate profits | 0.83 | 0.81 | 0.29 | 0.18 | 1.44 | 0.97 |
| dCapx | Change in Capx | 0.01 | 0.02 | 0.04 | -0.21 | 0.13 | 0.44 |
| dNI | Change in NI | 0.01 | 0.01 | 0.07 | -0.34 | 0.19 | 0.11 |
| Mkt | Value-weighted stock returns | 1.97 | 2.96 | 8.43 | -26.93 | 22.35 | 0.10 |
| GDP | GDP growth | 0.77 | 0.77 | 0.96 | -2.71 | 3.93 | 0.37 |
| CPI | Inflation | 0.91 | 0.74 | 0.83 | -3.44 | 4.16 | 0.62 |
| Std | Std deviation of Mkt | 6.45 | 5.53 | 3.60 | 1.84 | 33.72 | 0.61 |
| R | 1-year Tnote yield | 5.28 | 5.13 | 3.00 | 0.30 | 15.44 | 0.95 |
| Term | 10-year – 1-year Tnote yield | 0.79 | 0.76 | 1.05 | -3.86 | 3.33 | 0.85 |
| Def | Baa – Aaa yield | 0.97 | 0.84 | 0.46 | 0.34 | 3.38 | 0.88 |
| dStd | Change in Std | 0.01 | -0.19 | 3.15 | -15.78 | 19.27 | -0.28 |
| dR | Change in R | -0.01 | 0.09 | 0.93 | -6.77 | 3.86 | -0.17 |
| dTerm | Change in Term | 0.01 | 0.00 | 0.58 | -2.81 | 4.88 | -0.24 |
| dDef | Change in Def | 0.00 | 0.00 | 0.23 | -1.03 | 1.72 | 0.02 |

**Table 2**
**Correlations, 1952–2010**

This table reports the correlation between quarterly changes in aggregate corporate investment, profits, stock prices (i.e., returns), GDP, consumer prices, stock volatility, and interest rates. Data are quarterly, in percent, from 1952Q2–2010Q4. Aggregate investment (Capx) and after-tax profits (NI) come from the Federal Reserve's seasonally adjusted Flow of Funds accounts for nonfinancial corporations; changes in the two variables are scaled by beginning-of-quarter total assets. Value-weighted stock returns (Mkt), 1-year Tnote yields (R), and the yield spread between 10-year and 1-year Tnotes (Term) come from CRSP. GDP growth (GDP), inflation (CPI), and the yield spread between Baa and Aaa bonds (Def) come from the St. Louis Fed's FRED database. Stock volatility (Std) is defined as the square root of the sum of squared daily returns during the quarter. d(·) indicates a quarterly change.

| Variable | dCapx | dNI | Mkt | GDP | CPI | dStd | dR | dTerm | dDef |
|---|---|---|---|---|---|---|---|---|---|
| dCapx | 1 | 0.28 | -0.07 | 0.55 | -0.06 | 0.12 | 0.30 | -0.31 | -0.02 |
| dNI | 0.28 | 1 | 0.00 | 0.60 | -0.04 | -0.06 | 0.32 | -0.26 | -0.34 |
| Mkt | -0.07 | 0.00 | 1 | 0.09 | -0.19 | -0.50 | -0.12 | 0.10 | -0.15 |
| GDP | 0.55 | 0.60 | 0.09 | 1 | -0.09 | 0.05 | 0.33 | -0.30 | -0.25 |
| CPI | -0.06 | -0.04 | -0.19 | -0.09 | 1 | -0.10 | 0.16 | 0.00 | -0.09 |
| dStd | 0.12 | -0.06 | -0.50 | 0.05 | -0.10 | 1 | -0.03 | -0.10 | 0.32 |
| dR | 0.30 | 0.32 | -0.12 | 0.33 | 0.16 | -0.03 | 1 | -0.79 | -0.35 |
| dTerm | -0.31 | -0.26 | 0.10 | -0.30 | 0.00 | -0.10 | -0.79 | 1 | 0.16 |
| dDef | -0.02 | -0.34 | -0.15 | -0.25 | -0.09 | 0.32 | -0.35 | 0.16 | 1 |

**Table 3**
**Predicting corporate investment, 1952–2010**

This table reports simple-regression (Panel A) and multiple-regression (Panel B) slopes when changes in corporate fixed investment from zero to five quarters in the future are regressed on prior changes in fixed investment, changes in corporate profits, changes in stock volatility, changes in interest rates, and stock returns. Slopes are multiplied by 100, with Newey-West t-statistics reported in the subsequent row. Corporate investment (Capx) and profits (NI) come from the Federal Reserve's seasonally adjusted Flow of Funds accounts for nonfinancial corporations; changes in the variables are scaled by beginning-of-quarter book value of total assets. Value-weighted stock returns (Mkt), 1-year Tnote yields (R), and the yield spread between 10-year and 1-year Tnotes (Term) come from CRSP. The yield spread between Baa and Aaa bonds (Def) comes from the St. Louis Fed's FRED database. Stock volatility (Std) is defined as the square root of the sum of squared daily returns during the quarter. d(·) indicates a quarterly change. Boldface indicates slopes that are more than 1.96 standard errors from zero.

| | Dependent variable | | | | | |
|---|---|---|---|---|---|---|
| Predictor | $dCapx_t$ | $dCapx_{t+1}$ | $dCapx_{t+2}$ | $dCapx_{t+3}$ | $dCapx_{t+4}$ | $dCapx_{t+5}$ |
| *Panel A: Simple regressions (predictors used individually)* | | | | | | |
| $dCapx_{t-1}$ | **43.54** | **30.63** | **17.35** | 2.93 | -3.50 | **-14.19** |
| | 5.07 | 4.27 | 2.41 | 0.39 | -0.55 | -2.17 |
| $dNI_t$ | **17.39** | **24.97** | **17.06** | **15.53** | **14.89** | **9.97** |
| | 3.30 | 5.32 | 4.04 | 3.50 | 3.33 | 2.80 |
| $Mkt_t$ | -0.04 | 0.07 | **0.13** | **0.12** | **0.14** | **0.09** |
| | -1.03 | 1.73 | 3.44 | 3.89 | 4.10 | 2.91 |
| $dStd_t$ | 0.17 | -0.08 | -0.19 | -0.07 | -0.09 | -0.05 |
| | 1.49 | -0.72 | -1.79 | -1.37 | -1.63 | -0.86 |
| $dR_t$ | **1.47** | 0.96 | **1.09** | 0.44 | 0.08 | 0.03 |
| | 5.09 | 1.55 | 2.85 | 1.45 | 0.28 | 0.12 |
| $dTerm_t$ | **-2.40** | -0.89 | **-1.55** | -0.77 | -0.03 | -0.37 |
| | -4.74 | -0.98 | -2.43 | -1.35 | -0.07 | -1.05 |
| $dDef_t$ | -0.32 | **-5.12** | **-4.29** | **-3.14** | **-3.46** | -2.02 |
| | -0.20 | -2.98 | -3.22 | -2.86 | -3.29 | -1.84 |
| *Panel B: Multiple regressions (predictors used together)* | | | | | | |
| $dCapx_{t-1}$ | **43.83** | **39.49** | **24.34** | 10.31 | 5.51 | -10.08 |
| | 5.90 | 6.15 | 3.86 | 1.45 | 0.92 | -1.55 |
| $dNI_t$ | **18.19** | **22.94** | **15.13** | **15.31** | **14.64** | **9.25** |
| | 3.64 | 5.93 | 3.43 | 3.07 | 3.00 | 2.39 |
| $Mkt_t$ | 0.07 | **0.13** | **0.17** | **0.16** | **0.17** | **0.09** |
| | 1.39 | 4.20 | 5.18 | 4.39 | 4.33 | 2.39 |
| $dStd_t$ | 0.19 | **0.18** | 0.06 | **0.18** | **0.20** | 0.10 |
| | 1.35 | 2.69 | 0.75 | 2.20 | 2.59 | 1.23 |
| $dR_t$ | **0.84** | **0.74** | 0.52 | -0.05 | -0.10 | -0.63 |
| | 2.03 | 2.22 | 1.09 | -0.11 | -0.20 | -1.17 |
| $dTerm_t$ | -0.35 | 1.29 | -0.20 | -0.21 | 0.41 | -0.96 |
| | -0.56 | 1.86 | -0.26 | -0.30 | 0.53 | -1.11 |
| $dDef_t$ | 1.74 | **-2.84** | -1.61 | -1.56 | -2.29 | -1.26 |
| | 1.43 | -2.26 | -1.33 | -1.19 | -1.86 | -0.98 |
| $R^2$ | 0.33 | 0.33 | 0.22 | 0.13 | 0.13 | 0.05 |

**Table 4**
**Investment and future profits, quarterly, 1952–2010**
This table reports simple-regression (Panel A) and multiple-regression (Panel B) slopes when changes in corporate profits from zero to five quarters in the future are regressed on lagged changes in corporate profits, changes in fixed investment, changes in stock volatility, changes in interest rates, and stock returns. Slopes are multiplied by 100, with Newey-West t-statistics reported in the subsequent row. Corporate investment (Capx) and profits (NI) come from the Federal Reserve's seasonally adjusted Flow of Funds accounts for nonfinancial corporations; changes in the variables are scaled by the beginning-of-quarter book value of total assets. Value-weighted stock returns (Mkt), 1-year Tnote yields (R), and the yield spread between 10-year and 1-year Tnotes (Term) come from CRSP. The yield spread between Baa and Aaa bonds (Def) comes from the St. Louis Fed's FRED database. Stock volatility (Std) is defined as the square root of the sum of squared daily returns during the quarter. d(·) indicates a quarterly change. Boldface indicates slopes that are more than 1.96 standard errors from zero.

| | Dependent variable | | | | | |
|---|---|---|---|---|---|---|
| Predictor | $dNI_t$ | $dNI_{t+1}$ | $dNI_{t+2}$ | $dNI_{t+3}$ | $dNI_{t+4}$ | $dNI_{t+5}$ |
| *Panel A: Simple regressions (predictors used individually)* | | | | | | |
| $dCapx_t$ | **45.23** | -13.56 | **-23.91** | **-47.90** | **-23.39** | -9.96 |
| | 4.16 | -1.40 | -2.35 | -5.06 | -2.21 | -0.56 |
| $dNI_{t-1}$ | 10.93 | 3.93 | 2.75 | -10.21 | -4.38 | 5.80 |
| | 1.44 | 0.60 | 0.35 | -1.44 | -0.55 | 0.84 |
| $Mkt_t$ | 0.00 | **0.21** | **0.24** | 0.05 | -0.01 | -0.05 |
| | -0.03 | 3.46 | 4.35 | 0.97 | -0.17 | -1.04 |
| $dStd_t$ | -0.13 | -0.21 | -0.31 | -0.05 | 0.01 | 0.19 |
| | -0.67 | -1.38 | -1.87 | -0.43 | 0.05 | 1.27 |
| $dR_t$ | **2.49** | 0.33 | -0.64 | -0.63 | -0.78 | **-0.81** |
| | 5.29 | 0.44 | -1.77 | -1.19 | -1.20 | -2.17 |
| $dTerm_t$ | **-3.22** | 0.34 | 0.45 | 0.73 | 0.82 | 0.63 |
| | -4.35 | 0.30 | 0.68 | 0.90 | 0.78 | 1.11 |
| $dDef_t$ | **-11.06** | **-5.54** | -2.97 | -0.18 | 0.20 | **3.30** |
| | -5.85 | -1.97 | -1.51 | -0.09 | 0.10 | 2.21 |
| *Panel B: Multiple regressions (predictors used together)* | | | | | | |
| $dCapx_t$ | **35.81** | -21.08 | **-29.04** | **-51.20** | -21.50 | -13.44 |
| | 3.06 | -1.85 | -2.52 | -4.83 | -1.78 | -0.62 |
| $dNI_{t-1}$ | 1.87 | 10.26 | 11.04 | 1.99 | 1.04 | 8.46 |
| | 0.23 | 1.72 | 1.52 | 0.30 | 0.12 | 1.20 |
| $Mkt_t$ | -0.01 | **0.24** | **0.23** | 0.05 | -0.03 | -0.04 |
| | -0.20 | 3.90 | 3.89 | 0.78 | -0.46 | -0.71 |
| $dStd_t$ | 0.00 | 0.26 | 0.04 | 0.10 | 0.00 | 0.08 |
| | -0.03 | 1.68 | 0.28 | 0.71 | 0.01 | 0.45 |
| $dR_t$ | 0.71 | 1.49 | -1.01 | -0.29 | -1.11 | -1.04 |
| | 0.90 | 1.89 | -1.33 | -0.41 | -1.81 | -1.27 |
| $dTerm_t$ | -0.84 | 1.92 | -1.47 | -0.82 | -1.00 | -0.97 |
| | -0.74 | 1.36 | -1.12 | -0.75 | -0.81 | -1.01 |
| $dDef_t$ | **-9.64** | -4.18 | -2.98 | -0.65 | -1.25 | 1.54 |
| | -5.24 | -1.41 | -1.66 | -0.37 | -0.57 | 0.72 |
| $R^2$ | 0.19 | 0.08 | 0.09 | 0.07 | 0.00 | 0.00 |

**Table 5**
**Expected investment, quarterly, 1952–2010**

This table reports slopes and t-statistics when changes in corporate investment are regressed on lagged investment, lagged profits, and lagged stock returns:

$dCapx_t = a + b_1\, dCapx_{t-1} + b_2\, dCapx_{t-2} + b_3\, dNI_{t-1} + b_4\, dNI_{t-2} + b_5\, Mkt_{t-1} + b_6\, Mkt_{t-2} + e_t$.

The slopes are multiplied by 100. Aggregate fixed investment (Capx) and profits (NI) come from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; changes in the variables are scaled by the beginning-of-quarter book value of assets. Value-weighted stock returns (Mkt) come from CRSP. d(·) indicates a quarterly change. Boldface indicates slopes that are more than 1.96 standard errors from zero.

| | $b_1$ | $b_2$ | $b_3$ | $b_4$ | $b_5$ | $b_6$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Slope | **20.05** | **26.44** | **18.56** | 5.78 | **0.10** | **0.08** | 0.38 |
| t-statistic | 2.70 | 4.25 | 5.37 | 1.87 | 3.44 | 2.91 | |

**Table 6**
**Corporate investment and stock returns, quarterly, 1952–2010**
This table reports slopes and t-statistics when excess stock returns from zero to five quarters in the future are regressed on investment, profits, stock volatility, interest rates, dividend yield, and lagged stock returns. Corporate investment (Capx) and profits (NI) come from the seasonally adjusted Flow of Funds accounts for nonfinancial corporations; changes in the variables are scaled by lagged assets. Expected and unexpected changes in investment (E[dCapx] and U[dCapx]) are the fitted values and residuals from the regression shown in Table 5. Value-weighted stock returns in excess of the three-month Tbill rate (Mkt), 1-year Tnote yields (R), the yield spread between 10-year and 1-year Tnotes (Term), and annual dividend yield (DY) come from CRSP. The yield spread between Baa and Aaa bonds (Def) comes from the St. Louis Fed's FRED database. Stock volatility (Std) is the square root of the sum of squared daily returns during the quarter. d(·) indicates a quarterly change. Boldface indicates slopes that are more than 1.96 standard errors from zero.

| | Dependent variable | | | | | |
|---|---|---|---|---|---|---|
| Predictor | $Mkt_t$ | $Mkt_{t+1}$ | $Mkt_{t+2}$ | $Mkt_{t+3}$ | $Mkt_{t+4}$ | $Mkt_{t+5}$ |
| *Panel A: dCapx* | | | | | | |
| $dCapx_t$ | -13.57 | **-35.61** | **-29.40** | -2.19 | -16.33 | -3.92 |
| | -1.08 | -3.18 | -2.45 | -0.17 | -1.56 | -0.34 |
| $R^2$ | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 |
| *Panel B: Expected vs. unexpected dCapx* | | | | | | |
| $U[dCapx_t]$ | 2.73 | **-39.57** | **-40.95** | 6.94 | -21.41 | 7.24 |
| | 0.19 | -3.22 | -3.21 | 0.41 | -1.38 | 0.51 |
| $E[dCapx_t]$ | -44.19 | -28.59 | -20.77 | -21.70 | -13.98 | -15.74 |
| | -1.95 | -1.22 | -0.92 | -1.22 | -0.71 | -0.78 |
| $R^2$ | 0.01 | 0.03 | 0.02 | 0.00 | 0.00 | -0.01 |
| *Panel C: dCapx, lagged market returns, changes in volatility, and changes in discount-rate variables* | | | | | | |
| $U[dCapx_t]$ | 13.90 | **-34.70** | **-45.49** | 2.97 | -23.56 | 5.50 |
| | 0.82 | -2.68 | -3.08 | 0.17 | -1.44 | 0.33 |
| $E[dCapx_t]$ | -22.44 | -22.26 | -27.66 | -24.90 | -15.59 | -21.26 |
| | -1.18 | -0.96 | -1.18 | -1.32 | -0.77 | -1.02 |
| $dNI_t$ | -4.89 | -0.77 | 12.06 | 2.19 | 2.95 | -4.81 |
| | -0.59 | -0.10 | 1.46 | 0.24 | 0.33 | -0.58 |
| $Mkt_{t-1}$ | **0.26** | -0.07 | -0.06 | 0.00 | -0.01 | -0.06 |
| | 3.69 | -0.96 | -0.70 | 0.06 | -0.14 | -0.71 |
| $dStd_t$ | **-1.57** | -0.04 | 0.31 | -0.08 | 0.07 | 0.12 |
| | -7.09 | -0.23 | 1.69 | -0.35 | 0.40 | 0.66 |
| $dR_t$ | **-2.44** | **-2.59** | -1.72 | 0.06 | 0.35 | -0.62 |
| | -2.47 | -2.37 | -1.57 | 0.06 | 0.33 | -0.58 |
| $dTerm_t$ | -2.33 | **-3.33** | -2.41 | -0.73 | 0.46 | -2.44 |
| | -1.49 | -2.22 | -1.41 | -0.48 | 0.26 | -1.42 |
| $dDef_t$ | 0.79 | -5.99 | 1.29 | 3.10 | 2.43 | -2.51 |
| | 0.31 | -1.92 | 0.42 | 1.01 | 0.94 | -0.78 |
| $R^2$ | 0.32 | 0.04 | 0.04 | -0.02 | -0.02 | -0.01 |
| *Panel D: dCapx, lagged market returns, changes in volatility, and levels of discount-rate variables* | | | | | | |
| $U[dCapx_t]$ | 12.74 | **-35.30** | **-41.08** | 11.12 | -20.61 | 8.21 |
| | 0.85 | -2.43 | -2.72 | 0.60 | -1.21 | 0.52 |
| $E[dCapx_t]$ | -26.73 | -16.21 | -12.50 | -11.07 | -17.31 | -21.73 |
| | -1.33 | -0.68 | -0.54 | -0.52 | -0.76 | -0.91 |
| $dNI_t$ | -12.23 | -0.83 | 8.52 | -0.91 | -1.71 | -4.21 |
| | -1.37 | -0.12 | 1.16 | -0.10 | -0.22 | -0.51 |

| | | | | | | |
|---|---|---|---|---|---|---|
| $Mkt_{t-1}$ | **0.22** | -0.02 | -0.06 | -0.01 | -0.03 | -0.03 |
| | 3.43 | -0.32 | -0.87 | -0.09 | -0.37 | -0.41 |
| $dStd_t$ | **-1.44** | -0.13 | **0.37** | 0.00 | 0.15 | 0.12 |
| | -7.42 | -0.51 | 2.39 | 0.01 | 0.83 | 0.76 |
| $R_t$ | -0.19 | -0.50 | -0.48 | -0.29 | -0.09 | -0.02 |
| | -0.60 | -1.79 | -1.82 | -1.06 | -0.38 | -0.08 |
| $Term_t$ | 0.44 | 0.32 | 0.21 | 0.61 | 1.03 | 1.09 |
| | 0.71 | 0.53 | 0.35 | 0.98 | 1.63 | 1.88 |
| $Def_t$ | -0.38 | -0.34 | 0.46 | -0.35 | -2.13 | -2.60 |
| | -0.17 | -0.17 | 0.28 | -0.17 | -1.25 | -1.88 |
| $DY_t$ | -0.27 | **1.80** | **1.92** | **1.71** | **1.56** | **1.44** |
| | -0.51 | 2.96 | 3.28 | 3.14 | 2.72 | 2.51 |
| $R^2$ | 0.31 | 0.05 | 0.07 | 0.01 | 0.01 | 0.00 |