Passive Ownership and Investment Efficiency

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Abstract

The paper examines and finds that passive ownership significantly decreases investment price sensitivity in firms by reducing managerially relevant information in prices. The result is robust to identification through the Russell 1000/2000 index switching and an alternate instrument. As passive ownership increases lendable supply and short selling, negative news is more likely to be reflected in prices making the effect of passive ownership on investments asymmetric. Firms impacted by passive ownership are more likely to underinvest, less likely to overinvest, and have lower future sales growth. Further, these firms are more likely to provide voluntary capex guidance to supplement lower informativeness of stock prices. The results are seen in non-industry focused passive ownership and are robust to using portfolio turnover based measures to classify passive ownership.

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Introduction

There has been rapid growth of passive investment over the past years. Passive ownership has increased from a median value of 0.38% in 1992 to 8% by 2021 (See Figure 1). Passive ownership also exhibits substantial cross-sectional variation among firms, ranging from 2% at the 25th percentile to 15% at the 75th percentile in 2021. This rapid growth in passive ownership has sparked a discussion on its effect on capital markets and on the informativeness of stock prices with mixed results.[2] As passive owners have fewer incentives to acquire firm specific information, several papers find that this results in less informative stock prices (See Sammon (2024), Broggard et al. (2019) among others). Other papers argue that passive owners reduced incentives for information acquisition increases the incentive of active traders to engage in informed trading resulting in more informative prices (See Buss and Sundaresan (2023)). [3] In this paper, we approach this discussion from a different perspective, that is to examine if passive ownership impacts firm decisions through its effect on managerial learning from stock prices.

Stock prices aggregate information from a variety of market participants and provide information to managers that is relevant to their decision making (Dow and Gorton (1997), Subrahmanyam & Titman (1999)). Though no single market participant may know more than the manager, they collectively may be more informed. Further, stock prices also convey the impact of external factors, like the economy and competitors, on the firm's prospects that is potentially informative for the managers (Bond, Edmans and Goldstein (2012)). The managerial learning hypothesis posits that managers learn private information from stock prices that facilitate more efficient decision making. Bond, Edmans and Goldstein (2012) emphasize the role of "revelatory price efficiency" (RPE) that is new information in market prices that is relevant for managerial learning. Chen, Goldstein and Jiang (2007) study managerial learning and find that higher RPE is associated with more efficient capital allocation decisions by firms

[2] There is a large literature that examines the impact of passive ownership on corporate governance that has also found mixed results. Appel et al. (2016) find that passive funds improve firm governance while Schmidt & Fahlenbrach (2017) and Heath et al. (2021) find a negative effect of passive ownership on governance.

[3] There is a large and growing literature that examines the effect of passive ownership on stock price informativeness. Coles, Heath and Ringgenberg (2022) find that though passive ownership reduces overall information production, it changes the composition of active investors such that price efficiency does not change.

(See also Bakke and Whited (2010) and Wurgler (2010)). In this paper, we examine if passive ownership impacts managerial learning by changing the investment-price sensitivity of firms.

Specifically, we examine the effect of passive ownership on the sensitivity of investment to prices (Tobin's Q) over the period 1992 to 2021. We use Thompson S12 mutual fund holding database to identify passive owners and construct the share of passive ownership for all firms that were in the Russell 1000 or Russell 2000 index. We find that investment Q sensitivity is decreasing in passive ownership. This result is robust to controlling for firm characteristics, to other definitions of investment, and to the inclusion of firm and year fixed effects. The estimated coefficients implies that if the passive ownership increases from the 25th percentile to the 75th percentile, the investment-price sensitivity decreases by 20.27%.

As passive ownership in a firm is endogenous, we follow the literature and use Russell index reconstitution to address endogeneity. We also use an alternate instrument that is based on heuristics followed by passive funds. As passive fund investment is a function of the firm's relative market capitalization we use the increase in passive ownership in other firms with similar market capitalization as an alternate instrument. We continue to find that investment Q sensitivity is declining in passive ownership.

A decline in managerial learning is our proposed underlying mechanism for why an increase in passive ownership reduces investment price sensitivity. As mentioned earlier, Bond, Edmans and Goldstein (2012) emphasize the role of "revelatory price efficiency" (RPE) that is new information in market prices as driving managerial learning. We use three measures of RPE proposed by Chen, Goldstein and Jiang (2007) and da silva (2021). These measures are price non-synchronicity, Gamma a measure of return correlation during high volume trading, and the overnight volatility ratio. We find that all three measures are decreasing in passive ownership. These results imply that increase in passive ownership is associated with a reduction in managerially relevant information in market prices providing support for our underlying mechanism.

Further, the reduction in managerially relevant information in the presence of passive ownership is likely to be asymmetric. Presence of passive owners increases supply of lendable shares and facilitates short selling activities resulting in the incorporation of negative news in

stock prices (See von Beschwitz, Honkanen and Schmidt (2022) and Palia and Sokolinski (2024)). This suggests that the effect of passive ownership on market prices is asymmetric with market prices incorporating negative news more effectively than positive news. Managers looking to learn from market prices are more likely to respond to the negative signals rather than positive signals in market prices making them underinvest on average. We next examine capital allocation decision of firms to study the effect of lower managerial learning on capital outlays and if there is any evidence of asymmetric investment.

Using the approach of Foucault and Fresard (2012) we estimate loss in managerial learning, at the firm year level, arising from the presence of passive owners. Consistent with our hypothesis we find that firm years associated with lower managerial learning, due to the presence of passive ownership, are more likely to underinvest and less likely to overinvest relative to industry benchmarks. We examine if this inefficient capital allocation reduces operating performance and find significantly lower sales growth one year and three year forward though there is no change in future operating income.

If stock prices are less informative in the presence of passive owners, then managers may use other mechanisms to seek feedback from the market on its proposed investments. Langberg and Sivaramakrishnan (2010) propose that one reason for managers to provide voluntary disclosure is that it triggers a response from the market and facilitates learning. Jayaraman and Wu (2021) document managerial learning from capex guidance. In particular, Jayaraman and Wu (2021) find that when the stock price reaction to voluntary capex guidance is positive, managers adjust their capital expenditures upwards. Less informative market prices due to the presence of passive owners can be supplemented by providing forecasts of planned expenditures that reduce information asymmetry and increase the informativeness of market prices post guidance. We examine and find that firm years with reduced learning from market prices are associated with a higher likelihood of providing capex guidance. Learning from post guidance prices, as captured by the sensitivity of capital expenditure adjustments to announcement CARs, is similar or higher for firms with passive ownership relative to others.

We have so far examined the effect of all passive owners. Bhojraj et al. (2020) and Antoniou et al (2022) find that industry focused passive owners are associated with information acquisition and increased price efficiency. In line with this we find that ownership by industry

focused passive funds is not associated with a reduction in investment price sensitivity. Chinco and Sammon (2024) document that many institutional investors that are not classified as passive investors follow passive strategies. Taking into account these "closet" passive funds substantially increases the estimate of passive ownership. We use a portfolio turnover based measure to capture "passive by action" funds and find that ownership by these is also associated with lower investment price sensitivity. The results highlight the importance of accounting more generally for passive investment strategies and further increases the relevance of our findings.

The literature has also examined the role of ETF with Glosten et al. (2021) documenting that ETFs facilitate timely incorporation of earnings information into stock prices and increase the information efficiency of firms. Antoniou et a. (2022) find that firms with sector focused ETF ownership have higher investment price sensitivity. Easley et al. (2021) show that ETFs have high portfolio turnover and can be characterized as active investment vehicles. Our results are robust to excluding ETF ownership for sample firms.

Our paper contributes to the growing literature that examines the impact of passive ownership on financial markets. Sammon (2024) argues that the mixed results in the literature regarding the effect of passive ownership on stock price informativeness arise due to the difficulty in capturing information in stock prices with different papers following different models for information. Our results find reduced investment price sensitivity with passive ownership. By showing reduced managerial learning from stock prices our evidence supports the literature that finds reduced price informativeness with passive ownership.

The study also contributes to the managerial learning literature. Chen, Goldstein and Jiang (2007) show that managerial learning is higher for firms with higher stock price informativeness. Foucault and Fresard (2012) show that managerial learning is higher for firms that are cross-listed in the US. Our study shows lower managerial learning in the presence of passive owners. We are among a few that examine the effect of passive ownership on real decision making. Broggard, Ringgenberg and Sovich (2019) find that an increase in commodity index investing distorts the price signal and impedes production decisions of firms. Billet, Diep-Nguyen and Garfinkel (2020) document that firms reduce learning from peer firm stock prices after their inclusion in the S&P 500 index. Bennett, Stulz and Wang (2020) document changes in firm policies after inclusion in the S&P 500 index. Our study documents the effect of passive

ownership on firm's investment patterns. Further, the study provides new insights by documenting that the effect on investment is asymmetric, with firm more likely to underinvest rather than overinvest relative to industry standards. The results have bearing on the "Investment-less Growth" documented by Gutierrez and Philippon (2016)

The remainder of the article is organized as follows: Section 2 describes the data and the construction of the main variables. Section 3 presents the main empirical results on the relation between the passive ownership and the sensitivity of investment to price. Section 4 studies the effect of passive ownership on revelatory price informativeness, Section 5 examines the effect on managerial capital allocation decision, Section 6 examines the nature of passive ownership and finally Section 7 concludes.

2. Data

The data are obtained from multiple sources including CRSP, Compustat, Thompson S12 Mutual fund holding database, Refinitiv Eikon, and Bloomberg, as discussed in detail below, for the years from 1992 to 2021. We use the Thompson S12 mutual fund holding database to get the list of all U.S. domestic mutual funds' fund-level holdings data. We classify a fund as a passive fund following the same method as in Appel et al. (2016) and Hshieh et al. (2021). Funds are categorized as passive if their names contain at least one of the strings associated with passive investing.[4] We use Russell Index historical members' data from Bloomberg and match these with CRSP and Compustat firm-level data. The sample includes all firms that were either in the Russell 1000 or Russell 2000 index historically. The final sample consists of 61,144 firm-year observations from 7873 unique firms over the sample period from 1992 to 2021.

Passive ownership (PO) for each firm is the percentage of shares held by passive mutual funds. Specifically,

$$PO_{i,t} = \frac{\sum_{J=1}^{J} SHARES_{j,t}}{\text{Total Shares Outstanding}_{i,t}}$$

[4] Specifically, if the name contains at least one of the following: Index, Idx, Indx, Ind_ (where _ indicates a space), Russell, S & P, S and P, S&P, SandP, SP, DOW, Dow, DJ, MSCI, Bloomberg, KBW, NASDAQ, NYSE, STOXX, FTSE, Wilshire, Morningstar, 100, 400, 500, 600, 900, 1000, 1500, 2000, 5000, ETF, Exchange-traded, and ETFs.

where j is the set of passive funds holding stock i; $SHARES_{j,t}$ is the number of firm i's shares held by passive fund j at year t; and Total Shares Outstanding$_{i,t}$ is the total shares outstanding for firm i at year t. The mean passive ownership of firms in our sample is 3.88% which is in line with recent studies (See Appel et al. (2016), Sammon (2022)). We also identify ETFs, that is those where the fund name has ETF related strings and calculate passive ownership by ETFs. As seen in the Table 1 the ownership by ETFs is small at 0.21%.[5] Industry focussed funds are identified as funds whose holdings are focused in one of the Fama French 12 industry classifications with the remaining classified as non-industry funds. Mean ownership by industry focused passive funds is 0.215% and displays substantial variation across firms.

We follow Chen, Goldstein and Jiang (2007) and use three different measures of investment. The first is capital expenditures scaled by prior year value of total assets referred to as *CAPX*, the second is capital expenditure plus R&D expenses scaled by prior year value of total assets referred to as *CAPXRND* and the third is the percentage change in book assets, referred to as *Change in Assets*. *Change in Assets* also captures the acquisition and divestiture activities of firms. Tobin's Q is the market value of equity plus the book value of assets minus the book value of equity, scaled by the lagged book value of assets. A detailed description of the variables is provided in Appendix A. On average capital expenditures for sample firms was about 6.02% of assets and R&D is about 5% of assets. The percentage change in assets is on average 12.52%.

3. Empirical Results

In this section, we examine the effect of passive ownership on the investment-price sensitivity of stocks by estimating the following regression:

$$INV_{i,t} = \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 Q_{i,t-1} xPO_{i,t-1} + \beta_3 PO_{i,t-1} + Controls + \varepsilon_{i,t} \qquad (1)$$

Where $INV_{i,t}$ is firm i investment in year t. As discussed above, we use three measures of investment, that is *CAPX*, *CAPXRND* and *Change in Assets*. $Q_{i,t-1}$ is the lagged value of Tobin's

[5] As a robustness, we have subtracted ETF ownership from the total passive ownership and continue to find qualitatively similar results.

Q. The key variable of interest is the interaction of Tobin's Q and passive ownership which captures the incremental effect of passive ownership on investment-to-price sensitivity.

The model controls for firm characteristics that have been known to effect investments. Specifically, in line with Chen, Goldstein and Jiang (2007) we included the inverse of total assets as both investment and Q are scaled by total assets and including the inverse of total assets controls for correlation induced by the common scaling variable. We include Cash flow to control for the effect of cash flow on investment documented in prior literature. We also include future three year cumulative return, referred to as *Ret3*, in line with Chen, Goldstein and Jiang (2007) to control for higher investments when the stock is overvalued, that is when future returns are low.[6] We also include firm size, cash, sales growth, leverage and ROA. All the variable definitions are in Appendix A. We include firm-fixed effects to control for the time-invariant heterogeneity among firms and year-fixed effects to control for aggregate shocks.

As can be seen from Table 2, the coefficient of Q is significantly positive implying that firms increase their investments when Q is higher consistent with prior literature. The coefficient of interaction of Q with PO is negative and significant suggesting that the investment price sensitivity reduces as passive ownership in the firm increases. The estimated coefficients implies that if the passive ownership increases from the 25th percentile to the 75th percentile, the investment-price sensitivity decreases by 20.27%.[7] (See Figure 2)

In Model 2, we examine the effect of passive ownership on investment as captured by both CAPX and R&D. Missing values of R&D are assigned a value of zero. The coefficient of interaction of PO with Q continues to be negative and significant. In model 3, we estimate a model for change in total assets and continue to find a negative coefficient. Overall, the results show that an increase in passive ownership reduces the investment-price sensitivity.

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[6] Baker, Stein and Wurgler (2003) find that firms invest more when their stocks are overvalued. As overvalued stock is associated with lower future returns, we include future returns to control for the effect of overvaluation in line with prior literature.

[7] The investment-price sensitivity at the 25th percentile of passive ownership, which is 0.405 is estimated to be 0.865 (= 0.879 – 0.034 x 0.405). The investment price sensitivity at the 75th percentile of passive ownership which is 5.569 is estimated to be 0.6897 (= 0.879 - 0.034 x 5.569). This 0.1753 drop is 20.27% of the investment price sensitivity estimated at the 25th percentile.

The results with respect to control variables are consistent with prior literature. The inverse of total assets has a positive effect on all measures of investments. Firms with higher cash flows have higher investments. Firms with lower future returns also invest more implying higher investments when the stock is overvalued as argued by Baker, Stein and Wurgler (2003). Firms with higher sales growth are positively associated with investments and firms with cash holdings are negatively associated with investments.

Managers also have the potential to learn from analysts who have access to external and market information (Bakke et al. (2010)). We estimate a model including the number of analysts that follow the firm. Financial constraints may also impact the investment price sensitivity, and we also include KZ index of financial constraints proposed by Kaplan and Zingales (1997). Inclusion of these does not materially change the results (See Appendix Table 1).

3.1. Instrumental variable: Russell Index Reconstitution

Passive ownership in firms is endogenous and is a function of firm characteristics. In this section we estimate an instrumental variable model in line with Appel et al. (2016), Heath et al. (2021) and Sammon (2022). Specifically, we use the variation in passive ownership arising from the Rusell index reconstitution as an instrument.

The Russell 1000 index includes the largest 1000 US stocks and the Russell 2000 index constitutes the next largest 2000 stocks. Russel Investments reconstitutes their popular Russell 1000 (large-cap) and Russell 2000 (small-cap) indexes every year in the month of June. To decide the index constituents, Russell ranks all qualifying U.S. common stocks by their market capitalization as of the last business day in May. Before 2007, index assignment followed a simple rule: stocks ranked from 1 to 1000 were assigned to the Russell 1000 index, while stocks ranked from 1001 to 3000 were assigned to the Russell 2000 index. Starting in June 2007, Russell implemented a new assignment regime ("banding"). After sorting stocks by their market capitalization, Russell computes an upper and lower band around the rank-1000 cutoff; the bands are calculated as +/-2.5% of the total market capitalization of the Russell 3000E. Stocks within the bands do not switch indexes. That is, if a stock that was in the Russell 2000 last year is above the rank-1000 cutoff but below the upper band, it will stay in the Russell 2000 the following year, and vice versa. These criteria from Russell index providers are difficult to predict ex-ante

allowing us to treat the stock movements between indices as exogenous. The index assignment of stocks in the two indices impacts the degree of passive ownership in that stock. Stocks that move from the (top of) Russel 2000 to the (bottom of) Rusell 1000 go from a higher weight to a lower weight in the index resulting in a mechanical decline in passive ownership (Pavlova and Sikorskaya (2020)).

To carry out the analysis, we choose a bandwidth of 200 stocks, the bottom 200 stocks in the Russell 1000 index, and the top 200 stocks in the Russell 2000 index each year.[8] The switchers in each year, those stocks that switched the index from the last year (either from Russell 2000 to Russell 1000 or vice versa) serve as instruments to estimate the change in passive ownership. In the first stage, the indicator variable $I\{R2000 \rightarrow R1000\}$ equals one if a firm switches from Russell 2000 to the Russell 1000 index and $I\{R1000 \rightarrow R2000\}$ equals one if a firm switches from the Russell 1000 to the Russell 2000 index. Post is an indicator variable that equals one after index re-balancing.

The results of the first stage are reported in Table 3. Passive ownership significantly reduces for firms that switch from Russell 2000 to Russell 1000 (Model 3). This is a result of significant decline in ownership by funds linked to Russell 2000 (Model 1) that nets off the increase in ownership by funds linked to Russell 1000 (Model 2). When a firm switches from R1000 index to R2000 index, ownership by Russell 2000 linked funds increases while ownership by Russell 1000 index linked funds decreases. The coefficient for the net change in overall passive ownership (Model 3) is positive though not significant. In sum, the index switching from R2000 to R1000 significantly decreases the overall passive ownership, and its effect is comparatively stronger than the increase in passive ownership due to switching from R1000 to R2000 index.[9]

[8] Appel et al. (2016) use 250 stocks, Heath et al. (2021) use 100 stocks. In a similar setup, Ben-David et al. (2018) use different bandwidths such as 100, 200, 300, 400, and 500. We choose 200 as it includes the major proportion of switchers. However, the results are robust to other bandwidths.

[9] One reason for this is that the number of switchers from $R2000 \rightarrow R1000$ is higher (906 switchers) than the number of switchers from $R1000 \rightarrow R2000$ (697 switchers). The instrumental variables under this setup are not subject to the issues of weak instruments. The Cragg–Donald Wald F-test for weak instruments was above the Stock–Yogo critical F-statistic value of 18.37

The results of the second stage are tabulated in Table 4. The coefficient of the interaction between Q and instrumented value of PO is negative and significant for the three measures of investment *CAPX*, *CAPXRND*, and *Change in Assets*. These results suggest that our baseline results are unlikely to be entirely due to endogeneity and support the hypothesis that passive ownership reduces firm's investment-price sensitivity.

3.2 Alternate Instrument: Market Capitalization Peers

We also develop an alternate instrument for passive ownership. The instrument is based on heuristics followed by passive funds. Specifically, passive funds invest in firms based on the weight of the firm in the index which is a function of the firm's relative market capitalization. Consequently, increase in passive ownership in a firm is related to the increase in passive ownership in other firms with similar market capitalization. Therefore, our instrument for passive ownership in firm *i* in year *t*, is the average passive ownership of all firms in the same market capitalization quartile as firm *i*, excluding firm *i* , referred to as *Peer PO*. The logic is that the increase in passive ownership in other firms in the same size quartile, for example from increased fund inflows, is related to the increase in passive ownership of firm *i* and is likely to be exogenous to firm *i*.

The results are tabulated in Table 5. The first stage results, tabulated in Column 1 show that *Peer PO* is significantly related to passive ownership in a firm. In the second stage, we find that the interaction of Q and the instrumented PO is negative for all measures of investment though is not significant for *Change in Assets*.

4. Stock price informativeness

Our hypothesis is that passive owners have fewer incentives to gather and trade on firm specific information resulting in prices incorporating less information and consequently negatively impacting managerial learning from prices. In this section, we examine if passive ownership has an impact on managerially relevant price informativeness to provide evidence to support our channel.

Chen, Goldstein and Jiang (2007) argue that firm investments will be more sensitive to stock price when the price provides information that is new to managers, that is it captures more

private information of market participants. Bond, Edmans and Goldstein (2012) similarly argue that it is the new information produced in the market, referred to as revelatory price efficiency or RPE that impacts managerial learning as opposed to known information that is reflected in prices, referred to as forecasting price efficiency. da Silva (2021) examines different measures of price informativeness and also finds that only measures that capture private information or RPE influence managerial learning from stock prices.

In this section, we examine if higher passive ownership has an impact on the informativeness of stock prices, that is on revelatory price efficiency (RPE) that has been shown to influence managerial learning. We use three measures of RPE used in the prior literature which are stock price non-synchronicity, gamma, and the overnight volatility ratio.

The first of these measures, price non-synchronicity, referred to as *Nsync*, is based on the correlation of the stock with the market and the industry return. If the stock price is highly correlated with the market and the industry it is less likely to contain private firm specific information and hence less useful to the manager. This measure has been used Chen, Goldstein and Jiang (2007) and da Silva (2021) to capture private information and is defined as one minus the R^2 obtained from regressing daily return on market and industry returns over year t.

The second measure, referred to as *Gamma*, was developed by Llorente et. al. (2002) and is based on the notion that during period of high volume, stocks with a high degree of information-based trading exhibit positive return correlation. Following, Llorente et. al. (2002) and da Silva (2021) it is calculated as,

$$R_t = \alpha + \theta \times R_{t-1} + \gamma \times R_{t-1} \times V_{t-1} + \varepsilon_t$$

where R_t is the daily stock return; V_t is log turnover detrended by subtracting a 26-week moving average in t. γ reflects the amount of information-based trading. The higher the coefficient γ, the higher the information-based trading.

The third measure, overnight volatility ratio (OVR) is the ratio of overnight volatility to total volatility and is based on the notion that informed traders engage in information based trading during trading hours. In contrast, overnight returns are more likely to be driven by public information (French and Roll (1986), da silva (2021)). It is calculated as the ratio of the variance

of close-to-open returns to the variance of close-to-close returns. Higher volatility during trading hours in comparison to overnight volatility means more informative prices. We define *SOVR* as one minus the OVR so that higher *SOVR* indicate higher price informativeness.

As seen in Panel A of Table 6, the coefficient of *PO* is negative and significant for all three measures of RPE. We also use the instrumented value of PO. When using Russell reconstitution for identification we do not find any significant evidence that price informativeness is lower with passive ownership (See Panel B). However, when we use *Peer PO* as an instrument, we continue to find a significant negative effect of passive ownership on all three measures of RPE. These results provide some support to our underlying channel.

5. Impact on Investment Decisions

The results so far show that passive ownership reduces managerial reliance on stock prices to guide investment decisions. In this section, we examine how this reduced learning from stock prices effects firm's investment decisions. The managerial learning hypothesis does not have any implication for the level of investment as managers that learn from stock prices are likely to reduce investment when the information in market prices is negative and increase investment when the information in market prices is positive. Managers learning from market prices make better investment decisions, that could entail either increasing or decreasing investment, that result in better operating performance. In line with this, Foucault and Fresard (2012) find that cross listing and the associated increase in managerial learning results in improved operating performance (See also Chen, Goldstein and Jiang (2007)).

Though presence of passive ownership reduces managerially relevant information as seen above, this effect may not be symmetric. von Beschwitz, Honkanen and Schmidt (2022) find that passive ownership increases available supply of lendable shares and consequently the short interest in the firm. von Beschwitz et al. (2022) show that this increased ease of shorting increases price efficiency prior to negative earnings surprises. Palia and Sokolinski (2024) also document an increase in short interest arising from higher passive ownership and show that with passive ownership negative information is more likely to be incorporated in prices than positive information. If easier short selling with higher passive ownership allows for greater incorporation of negative news in stock prices, market prices are likely to be more informative

of negative news relative to positive news. Therefore, firms are more likely to respond to negative information in prices by reducing investment relative to the positive information in prices that imply increasing investment. This asymmetrical response implies that firms with high passive ownership will on average have lower investment relative to benchmarks.

We examine if increase in passive ownership is associated with this asymmetrical response, that is if managers of firms with high passive ownership are likely to underinvest. To examine firm capital allocation decisions in a given year we need a measure of the effect of passive ownership on managerial learning at the firm year level. The greater is the loss in managerial learning from passive ownership the greater will be impact on firm's capital allocation decision for that year. To obtain this measure of loss of managerial learning at the firm-year level, that is an estimate β_2 for each firm-year from equation 1, we follow the approach of Foucault and Fresard (2012). We re-estimate the baseline regression model in equation 1, without including the interaction term $Q \times$ PO. The residuals from this regression capture the impact of Q on investment in the presence of passive ownership. Firms with negative residuals experience a decrease in their investment-price sensitivity due to passive ownership. We create a dummy variable $Loss_{i,t}$, which takes the value of one for firm years where the residuals are negative and zero otherwise. We also create $High\ Loss_{i,t}$ which takes the value of one if the negative residuals are lower than the mean value of the negative residuals to capture a higher loss in managerial learning.

Next, to estimate whether the firm under-invested or over-invested in a year we need to know what the expected investment, in the absence of passive ownership, would have been. We develop two proxies of expected investment that are detailed below.

5.1 Industry Adjusted Investment

First, we use the average value of investment as captured by the CAPX for all firms in the industry, excluding the firm in question, to capture expected capital investment.[10] Industry adjusted investment is the firm's CAPX minus the industry average for that year. The variable

[10] We use the data for all firms in Compustat, and not just the sample firms, to estimate average capital expenditures over total assets for the industry, that is defined as Fama French 48.

Under Invest (*Over Invest*) takes the value of one if industry adjusted CAPX is in the bottom (top) quartile for the sample.

We then estimate a model for investment where the *Under Invest* dummy is the dependent variable and include control variables from before along with firm and year fixed effects. The main variable of interest is *Loss* that captures firm years with a loss in managerial learning from stock prices. As seen in Column 1of Panel A of Table 7, the coefficient of *Loss* is positive and significant suggesting that firms whose learning is impacted by passive ownership are more likely to invest below industry averages. In Column 2, we estimate a model of *Over Invest* and find that the coefficient of *Loss* is negative and significant showing that firm years associated with reduced managerial learning are less likely to invest over industry averages.[11] Results are similar when we include *High Loss* and find that the estimated coefficients are somewhat larger than those for *Loss* as expected.

5.2 Model for Expected Investment

In this section, instead of using industry averages to capture firm's expected investment we model expected investment for the firm and take deviations from the expected investment to identify over and under investment by the firm.

Specifically, we follow Biddle et. al. (2009) and estimate the following model for firm investment

$$INV_{i,t} = \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 SG_{i,t-1} + \varepsilon_{i,t}$$

Where $INV_{i,t}$ is CAPX, and $SG_{i,t-1}$ is lagged sales growth. We estimate this equation for each Fama French's 48 industry classification. The residual from the estimation captures firm year - level deviation from expected investment. The residuals are sorted into quartiles and like before *Under Invest* (*Over Invest*) dummy takes the value of one if they are in the bottom (top) quartile. Using this method to capture under and over investment yields similar results as seen in Panel B of Table 7. The coefficient of *Loss* dummy is positive and significant in the model for *Under*

[11] Due to inclusion of firm and year fixed effects we have estimated and tabulated a linear OLS model. For robustness we have also estimated a logit model and find qualitatively similar results as seen in Appendix Table 2.

Invest and negative and significant in the model for *Over Invest*. The estimated coefficient for *High Loss* is consistent with prior results and somewhat larger in magnitude.

Overall, these results show that passive ownership is associated with asymmetrical managerial learning that results in a higher likelihood of underinvestment and a lower likelihood of overinvestment relative to others in the industry. These results might explain the investment less growth documented by Guiterrezz and Philippon (2016).

5.3 Effect on Operating Performance

If the capital allocation decisions of firms are not optimal on account of reduced managerial learning from market prices, then this should be reflected in lower operating performance. We follow Foucault and Fresard (2012) and examine if firm years associated with a loss of managerial learning are more likely to be associated with lower future performance. Like before, we include *Loss* and *High Loss* to capture firm years with lower managerial learning from market prices. We use two measures of operating performance in line with Foucault and Fresard (2012) that is Operating Income which is the ratio of earnings before interest, taxes and depreciation (Ebitda) to sales. We calculate one year as well as three year forward operating income. We also calculate one year and three year forward sales growth.

We estimate a model of future operating performance and control for current operating performance along with control variables included in prior estimations. As seen in Panel A of Table 8, the coefficient of *Loss* is not significant for operating income but is negative and significant for sales growth. This is the case for both one year as well as three year forward performance. Firm years associated with a loss of managerial learning due to passive ownership are associated with lower future sales growth. We see no evidence of lower operating earnings. Panel B reports the results for *High Loss* with qualitatively similar results – there is no significant evidence of decline in future operating income though there is a significant reduction in future sales growth. Asymmetric investment distortions that entail firms underinvesting but not overinvesting might result in firms foregoing value enhancing projects that result in lower sales growth. However, as firms do not overinvest (in value destroying projects) there is less of an impact on operating earnings.

5.4 Providing Guidance on Capital Expenditures

If stock prices are less informative in the presence of passive owners, then managers may use other mechanisms to seek feedback from the market on its proposed investments. Langberg and Sivaramakrishnan (2010) propose that one reason for managers to provide voluntary disclosure is that it triggers a response from the market and facilitates learning.

Boone and White (2015) show that firms increase voluntary disclosure, via earnings forecast and 8-K reports, with an increase in institutional ownership to cater to passive investors. Passive investors demand firm disclosures as these reduce information asymmetry and impact their trading and monitoring costs.[12] In contrast to general voluntary disclosure, Jayaraman and Wu (2021) examine capital expenditure guidance provided by managers and find evidence of managerial learning from the market reaction to their guidance. Specifically, Jayaraman and Wu (2021) find that when the stock price reaction to capex guidance is positive, managers adjust their capital expenditures upwards.

Given the potential for managers to learn from the market's response to capex guidance as documented by Jayaraman and Wu (2021) we examine if firms where managerial learning is reduced due to the presence of passive owners are more likely to provide capex guidance and conditional on providing a capex guidance to take into account the market's feedback to their forecasts when making their decisions. Less informative market prices due to the presence of passive owners can be supplemented by providing forecasts of planned expenditures that reduce information asymmetry and increase the informativeness of market prices post guidance.

To examine this, we obtain annual capex forecasts from IBES that begin in 2003. The *Guidance* dummy takes the value of one if the firm issued a capex guidance in that year and zero otherwise. Conditional on providing a guidance, we follow Jayaraman and Wu (2021) to capture the firm's response by calculating *CAPX Adj* which is the percentage difference between the actual capital expenditure and the capital expenditure forecast scaled by the forecast.[13] *CAPX Adj* captures how much the firm changes its capital outlays from its initial forecast. The

[12] However, Ge, Bilinski and Kraft (2021) find that firms may reduce costly voluntary disclosure with an increase in passive ownership due to passive investors lower demand for firm specific information.

[13] We take the first capital expenditure forecast issued by the firm.We include both point and range capital expenditure guidance. In this case of a range if the actual Capex is less than the lower range or higher than the higher range, then CAPX adjustment is (Capex Actual - Guidance)/Guidance x 100. If the actual Capex is between the range, the CAPX adjustment is 0.

market reaction to the forecast is measured by the five day cumulative abnormal return around the forecast date and is referred to as CAR. [14]

As we want to estimate the likelihood of providing guidance and estimating the firm's response conditional on having provided the guidance, we estimate a Heckman's model. In the first stage we estimate the likelihood of a firm providing a capex guidance and in the second stage we examine how much the firm adjusts its capital outlays in response to the market feedback to its guidance. The first stage is a probit model where the dependent variable is *Guidance*. We use two instruments to capture the likelihood of providing guidance. The first is the lagged fraction of the industry, not including the firm, that provided a capex guidance, referred to as *Industry Guidance*. Firms are more likely to provide guidance if other firms in their industry also provide guidance. The industry propensity to provide capex guidance should not impact how firms adjust their final capital expenditures. The second instrument is *Prior Guidance*, that is a dummy if the firm provided a capital expenditure guidance in the prior year as firms are more likely to provide guidance if they have been doing it in the past. Past policy of providing guidance should not impact management's capex adjustment in the current year. We also include the control variables included before and year fixed effects along with prior CAPX as firms with larger capital expenditures are more likely to provide guidance.[15]

As seen in first stage of Panel A in Table 9, the coefficients of both *Industry Guidance* and *Prior Guidance* are positive and increase the likelihood of providing guidance in the current year. The coefficient of *Loss* is positive and significant implying that firm years associated with lower managerial learning from stock prices are more likely to be associated with a capex guidance. The results for the first stage are similar when we include *High Loss* (See first stage in Panel B).

The dependent variable for the second stage is *CAPX Adj* with the main explanatory variable being *CAR*. We include the control variables included so far along with prior CAPX

[14] CAR is the firm return over that of the S&P500 index over five days around the forecast date, that is from day -2 to day + 2 where day 0 is the forecast date. We remove days where the firm also releases an earnings forecast.
[15] We do not include firm fixed effects in this estimation. Within firm variation in guidance is low and firm fixed effects in the non-linear probit estimation leads to substantial data attrition. The inclusion of *Lag Guidance* controls for the firm's prior policy and potentially for the effect of time invariant firm characteristics that might impact guidance.

and two new variables in line Jayaraman and Wu (2021). The new variables are earnings surprise (ES) and Earning Change.[16] The estimation includes firm and year fixed effects. The coefficient of *CAR* is positive and significant and consistent with the results of Jayaraman and Wu (2021). The positive coefficient for *CAR* implies that firms increase their capex outlays if the market response to capex forecasts are positive (See Panel A, column 2). In column 3, we also include the interaction of *Loss* and *CAR* and find that is not significant. Firm years with a loss in prior managerial learning are associated with similar learning from market prices post guidance as control firms. In Panel B, we find that the coefficient of interaction of *High Loss* and *CAR* is positive and significant suggesting that firms that have lower managerial learning due to passive ownership put a larger weight on the market feedback to their capex guidance.

Overall, the results show that in years where managerial learning from stock prices is reduced firms are more likely to provide capex guidance. Firm's voluntary capex guidance is likely to reduce the information asymmetry in stock prices. Response to post guidance market prices, by firms impacted by passive ownership is similar to or higher than other firms. The results support the hypothesis that firms provide voluntary capex guidance to reduce information asymmetry and learn more effectively from market prices.

6. Nature of Passive Ownership

In this section, we explore further what constitutes passive ownership. We have used fund names to classify funds as passive. However, classified passive owners may differ in their investment strategies and many ostensibly active funds follow passive investment strategies. In this section, we explore different ways to identify passive ownership and its potential impact on the results.

6.1 Industry vs Non-Industry Passive Funds

We first examine the role of industry focused funds. Prior literature that has examined ownership by sector-focused ETFs finds that they improve price efficiency and investment-

[16] In line with Jayaraman and Wu (2021), earnings surprise (ES) is the mean analyst forecast minus the actual earnings. Earning Change is EPS-lag (EPS) from Compustat.

price sensitivity. In contrast, ownership by broad-market-based ETFs negatively affects price efficiency and does not have any effect on investment-price sensitivity (See Bhojraj et al. (2020), Antoniou et al. (2022)). This suggests that the presence of industry focused passive funds is less likely to be associated with uninformative stock prices and effect investment price sensitivity.

We classify a passive fund as industry focused if the fund has more than 50% of its holdings from one Fama French 12 industry groups. Based on this criterion about 10% of all passive funds are classified as industry focused. These industry focused funds are smaller in size and hold on average stocks in 2.11 industries. In contrast, funds classified as non industry specific are larger and are exposed to 8.47 industries. *PO (Ind)* and *PO (Non Ind*) is the ownership of passive funds classified as industry focused and not industry focused respectively. We include ownership by both industry and non industry focused passive owners and their interaction with Q in our estimation.[17] As seen in Table 10, ownership by industry focused passive funds does not significantly effect investment price sensitivity in line with prior work. It is non industry specific passive ownership that negatively effects investment price sensitivity.

6.2 Portfolio Turnover

Chinco and Sammon (2024) document that many institutional investors that are not classified as passive follow passive strategies. This could arise due to "internal indexing" whereby they manage index tracking portfolios or due to "closet indexing" where they are evaluated relative to an index. Taking into account these "passive by action" funds substantially increases the estimates of passive ownership.

We use frequency of trading and portfolio turnover as an alternate way to classify funds as passive. This way to identifying passive investors is likely to identify active funds that follow passive investment strategies. Specifically, we calculate portfolio turnover ratio (PTR) that captures portfolio churn and is calculated as follows:

[17] Some funds could not be classified as industry focused or not due to missing data.

$$PTR_{i,t} = \frac{min(\text{Buy}_{i,t}, \text{Sell}_{i,t})}{AUM_{i,t}}$$

Where Buy and Sell refers to the value of stocks fund *i* bought or sold in time *t* and AUM is the assets under management at time *t*. The mean value of PTR is 1.47 for passive funds and 19.8 for other funds. We use 0.24 the median value of PTR for passive funds as a cutoff to identify funds that are likely to follow passive investment strategies. *PO (PTR)* is the ownership by funds with PTR below 0.24 and captures ownership by funds that are passive by action.

The mean value of *PO (PTR)* is 9.23% and more than double the mean value of PO of 3.88% estimated based on fund names. Estimates of the base model with PO (PTR) are reported in Panel B of Table 10 and continue to show a significantly lower investment price sensitivity with higher passive ownership for all three measures of investment. [18]

7. Conclusion

In this paper, we provide evidence on the impact of passive ownership on managerial learning and investment decisions. We show that firms with high passive ownership have weaker investment-price sensitivity. This result is robust to different measure of passive ownership, firm and year fixed effects and to controls for endogeneity of passive ownership.

As passive ownership facilitates short selling negative news is more effectively incorporated in stock prices relative to positive news. This asymmetric effect on the informativeness of stock prices implies that managers are more likely to respond to the negative news in prices relative to positive news. In novel results, we show that firms where managerial learning is impacted by passive ownership are more likely to underinvest and less likely to overinvest relative to industry benchmarks. This asymmetric inefficiency in investment patterns results in lower future sales growth though has no impact on future operating income. We also find that firms where managerial learning is impacted by passive ownership are more

[18] This definition of passive captures funds with low turnover. Higher ownership by these funds may result in lower liquidity and thereby reduce informativeness of prices as shown by Kerr et. al. (2020). In untabulated tests, we examine and find that high ownership by passive by action funds is associated with less informative prices as captured by NSYNC, Gamma and SOVR measures.

likely to provide capex guidance to reduce information asymmetry and subsequently increase learning from post guidance prices.

Passive ownership has been increasing over the years and this growth is expected to continue in the future. Understanding the effect of passive ownership on firm decision is important. The paper is among a few that examine the real effect of passive ownership on managerial learning and capital investments. We not only document significantly lower learning but also provide new insights that link passive ownership to underinvestment, lower sales growth and increased capex guidance.

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Appendix A: Variable Definitions

Variable	Definition
PO	Passive Ownership: the percentage of shares held in September of year t by passive mutual funds
*PO R*2000	The percentage of shares held in September of year t by index funds whose name contains "2000"
*PO R*1000	The percentage of shares held in September of year t by index funds whose name contains "1000"
CAPX	Capital expenditures (Compustat variable capx) at fiscal year-end divided by lagged total assets (Compustat variable at). Expressed as %.
CAPXRND	Capital expenditures (Compustat variable capx) plus R&D (Compustat variable xrd) divided by lagged total assets (Compustat at). Expressed as %.
Change in Assets	Change in total assets (Compustat variable at) computed as the change in total assets from year $t-1$ to year t divided by initial value. Expressed as %.
RND (%)	R&D expenses at the end of the fiscal year divided by lagged total assets. Missing values are set to zero.
NSYNC	Stock price nonsynchronicity is defined as one minus R^2 from regressing daily return on market and industry index over year t.
Q	Tobin's Q is defined as the market value of the equity (Price * Common share outstanding) (Compustat variables prcc_f * csho) plus the book value of the assets minus the book value of the equity (Compustat variable ceq) divided by the book value of the assets (compustat variable at).
ROA	Earnings before interest, taxes and depreciation (Compustat variable Ebitda) scaled by total assets
Cash Flow	Cash flow is defined as net income before extraordinary items (Compustat variable ib) plus depreciation and amortization expenses (Compustat variable dp) plus R&D expenses (Compust variable xrd) divided by lagged assets.
Cash	The ratio of cash and cash equivalent (Compustat variable che) to total assets.
Firm Size	The natural logarithm of the firm's market capitalization at the fiscal year-end.
RET3	The annualized stock return of firm *i* for the following three years starting at the beginning of fiscal year t+1. For creating this variable, a stock must have future returns of at least one year. So it is three years or less depending on data.
Leverage	The sum of long-term and current liabilities (Compustat variable dltt) scaled by total assets.
Inverse of Asset	The inverse of the total assets.
Sales Growth	Annual growth rate in sales (Compustat variable Sale) at the firm level. It is the change in sales from year $t-1$ to year t divided by initial value
KZ Index	This is an index of financial constraints, from Kaplan & Zingales (1997) and Baker et al. (2003).
NUMEST	Log of one plus the number of unique analysts who issued earnings forecasts for a firm within a fiscal year. Data have been obtained from I/B/E/S Summary files.

Figure 1: Growth of Passive Ownership

The figure illustrates the level of passive ownership over the years.

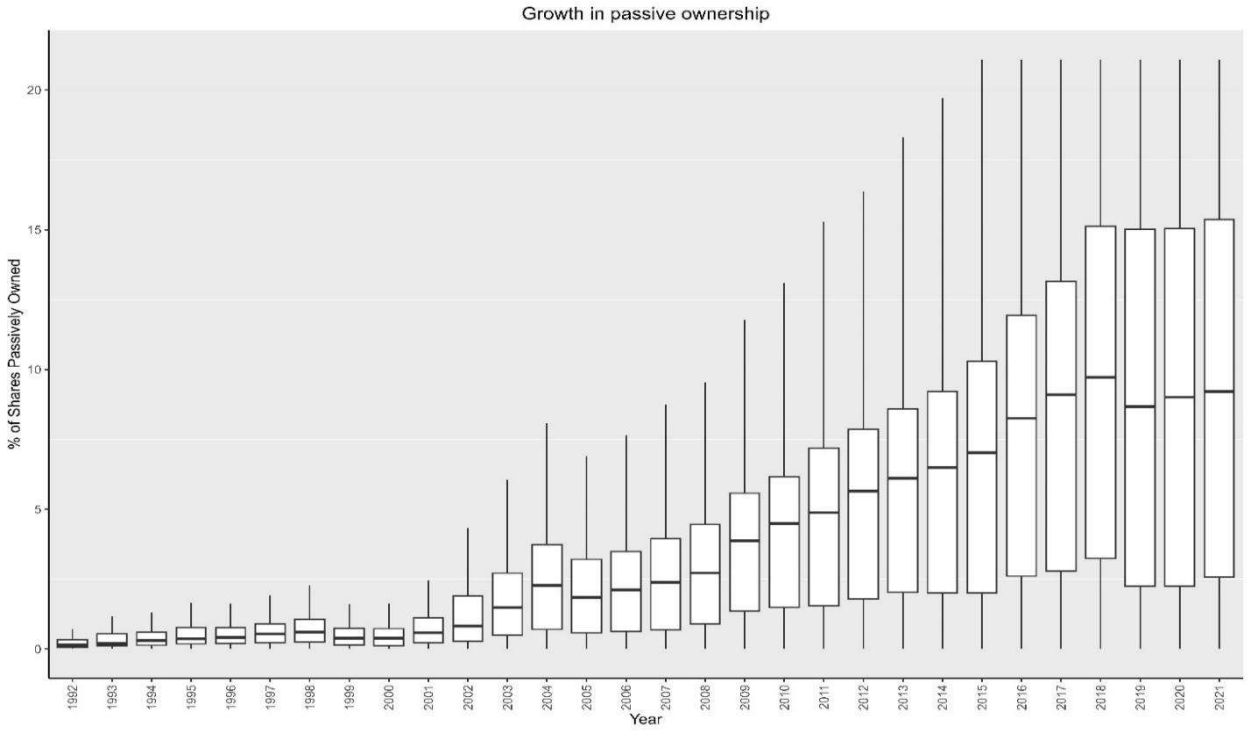

Figure 2: Impact of Q on Investment for different Levels of Passive Ownership

The figure illustrates the impact of firm's Q on its investment level for different levels of passive ownership. The linear relation is calculated using the coefficient from base regression given in Equation 1 and the results from Table 2 by allowing levels of Q to vary.

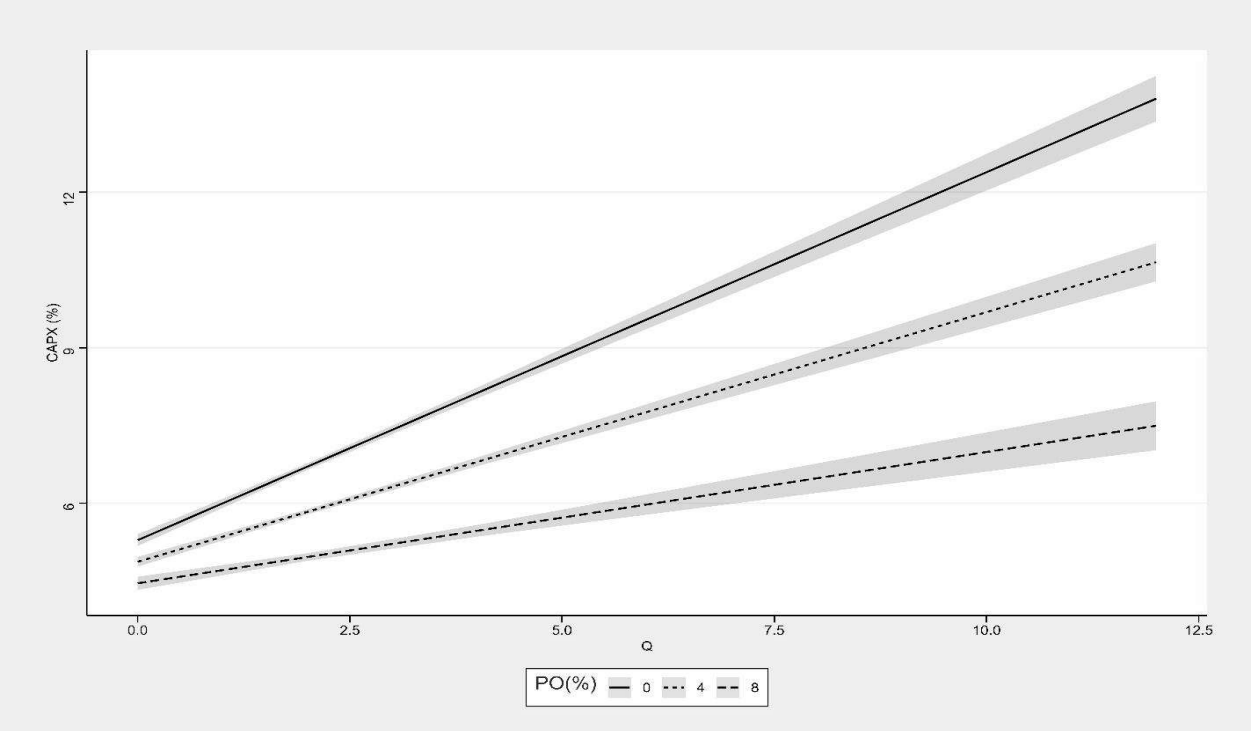

Table 1: Summary Statistics

PO is the percentage shares held by passive owners. Other ownership is the percentage shares by all other institutions not classified as passive. ETF Own is the ownership of funds classified as ETFs. PO (Ind) and PO (Non Ind) is the ownership by funds classified as industry focused and not industry focused respectively. PO (Ptr) is the ownership of funds classified as passive based on portfolio turnover ratio. The number of observations are 61,144.

Variables	Mean	25th Percentile	Median	75th Percentile	SD
Passive Ownership					
Passive Ownership (PO)	3.881	0.405	1.809	5.569	4.868
Other Ownership	20.2	8.339	18.831	29.318	108.512
ETF Own	0.207	0	0	0.004	0.734
PO (Ind)	0.215	0	0	0.045	0.815
PO (Non Ind)	2.337	0	0	2.413	24.879
IndOwn_R1000	0.057	0	0	0	0.136
IndOwn_R2000	0.57	0	0	0.971	1.033
PO (Ptr)	9.277	1.766	5.734	14.239	56.421
Investment					
CAPX	6.017	1.946	3.975	7.607	6.452
RND	4.992	0	0.159	6.074	9.429
CAPXRND	11.172	3.821	7.599	14.236	11.343
Change in Assets	12.519	-2.341	5.92	17.677	32.515
Q	2.147	1.178	1.586	2.43	1.659
Control Variables					
ROA	9.621	6.584	11.773	17.225	15.675
Cash Flow (CF)	0.064	0.039	0.09	0.145	0.181
Firm Size	6.6	5.15	6.471	7.929	2.002
Leverage	0.413	0.249	0.401	0.542	0.216
Inverse of Assets	6.477	0.407	1.759	6.423	12.593
RET3	0.056	-0.088	0.066	0.204	0.275
Sales Growth	15.971	-1.29	7.985	21.574	42.786
KZ Index	-0.35	-0.73	-0.153	0.432	3.207
NSYNC	0.775	0.646	0.829	0.949	0.2
GAMMA	-0.001	-0.064	0.006	0.071	0.123
OVR	0.681	0.586	0.783	0.895	0.319
NUMEST	2.523	2.565	2.565	2.565	0.186

Table 2: Passive Ownership and Investment Price Sensitivity

This table presents the results from an OLS estimation where the sample consists of firms belonging to the Russell 1000 and Rusell 2000 over 1992 to 2021. The dependent variables are listed in the top row. CAPX (CAPXRND) is the ratio of capital expenditures (and R&D expenses) to prior total assets. Change in assets is the change in total assets from last year. PO is passive ownership, Q is Tobin's Q and firm size is log of market capitalization. All variables are lagged and winsorized at 1% and defined in Appendix A. Fixed effects are included and specified at the end of the table. T statistics with standard errors clustered at the firm level are reported in parenthesis below.. *, **, and *** denote significance at10%, 5%, and 1% respectively

	CAPX	**CAPXRND**	**Change in Assets**
Q x PO	-0.034***	-0.055***	-0.088**
	(-6.872)	(-5.782)	(-2.374)
Q	0.879***	2.083***	9.747***
	(19.600)	(26.580)	(30.020)
PO	0.046***	0.067**	0.096
	(2.598)	(2.466)	(0.949)
Cash Flow	1.267***	1.825***	10.970***
	(4.260)	(3.029)	(4.342)
Firm Size	0.058	-0.895***	-7.021***
	(0.811)	(-7.852)	(-18.160)
RET3	-1.229***	-1.788***	-19.770***
	(-10.210)	(-9.256)	(-26.420)
Sales Growth	0.005***	0.006***	0.003
	(6.070)	(4.627)	(0.583)
Cash	-0.295**	-1.990***	-8.010***
	(-2.040)	(-7.707)	(-7.586)
Leverage	-2.878***	-3.637***	-21.070***
	(-10.050)	(-7.393)	(-11.370)
ROA	0.034***	-0.043***	0.164***
	(7.863)	(-4.720)	(5.012)
Inverse of Assets	0.052***	0.186***	0.755***
	(6.903)	(10.890)	(11.930)
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,144	61,144	61,144
Adjusted R^2	0.616	0.735	0.327

Table 3: First Stage of the 2SLS

The table reports results for the first stage of the 2SLS. In Model 1 (2) the dependent variable is ownership by funds that are linked to Russell 2000 (1000) index. In Model 3 the dependent variable is all passive ownership. R1000_2000 (R2000_1000) is a dummy variable that takes the value of 1 if the firm moved from Russell 1000 (2000) to Russell 2000 (1000) index. Post is a dummy variable that takes the value of 1 after the index switch. The sample consists of the 200 firms at the bottom (top) of the Rusell 1000 (2000) index every year. Control variables are lagged and winsorized at 1%. See Appendix A for variable definition. Fixed effects are included and specified at the end of the table. T statistics with errors clustered at the firm level are reported in parenthesis below. *, **, and *** denote significance at10%, 5%, and 1% respectively

	Ownership by Russel 2000 linked funds	**Ownership by Russel 1000 linked funds**	**All Passive Ownership**
	Model 1	**Model 2**	**Model 3**
R2000_R1000 x Post	-0.386***	0.051***	-0.441***
	(-6.279)	(5.388)	(-2.826)
R1000_R2000 x Post	0.123*	-0.022**	0.161
	(1.844)	(-2.313)	(0.894)
R2000_R1000	-0.087	0.016	-0.029
	(-1.363)	(1.574)	(-0.210)
Post	0.102***	-0.008*	0.096
	(3.433)	(-1.928)	(1.293)
R1000_R2000	0.199***	-0.025***	-0.113
	(3.003)	(-2.725)	(-0.620)
Q	0.045***	-0.009***	-0.038
	(-3.619)	(-4.621)	(-1.048)
Cash Flow	-0.017	0.004	-0.364
	(-0.169)	(-0.296)	(-1.520)
Firm Size	-0.400***	0.072***	-0.083
	(-14.300)	(-18.12)	(-0.983)
RET3	0.066	-0.012**	-0.181
	(-1.518)	(-1.999)	(-1.505)
Sales Growth	0.0005**	-0.0001**	0.0001
	(-2.196)	(-2.345)	(-0.271)
Cash	0.017	-0.003	-0.122
	(-0.342)	(-0.510)	(-1.021)
Leverage	-0.112	0.007	-0.648**
	(-1.169)	(-0.455)	(-2.105)
ROA	-0.002*	0.0004*	-0.007*
	(-1.647)	(-1.814)	(-1.716)
Inverse of Assets	-0.047***	0.007***	-0.049***
	(-5.913)	(-5.726)	(-4.299)
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	15,476	15,476	15,476
Adjusted R^2	0.643	0.67	0.903

Table 4: Second Stage of the 2SLS Estimation

This table presents the results from the second stage of a 2SLS estimation. The dependent variables are listed on top rows. CAPX (CAPXRND) is the ratio of capital expenditures (and R&D expenses) to total assets. Change in assets is the change in total assets from last year. PO (IV) is the instrumented passive ownership, Q is Tobin's Q and Firm size is market capitalization. All variables are lagged (except RET3) and winsorized at 1% and defined in Appendix A. Fixed effects are included and specified at the end of the table. T statistics with standard errors clustered at the firm level are reported in parenthesis below. *, **, and *** denote significance at10%, 5%, and 1% respectively..

	CAPX	CAPXRND	Change in Assets
Q x PO (IV)	-0.044***	-0.059***	-0.173***
	(-4.662)	(-3.728)	(-2.694)
Q	0.931***	2.075***	10.020***
	(8.968)	(10.550)	(13.350)
PO (IV)	-0.041	-0.092	0.722
	(-0.155)	(-0.192)	(0.483)
Cash Flow	3.222***	2.820**	15.480**
	(4.120)	(1.997)	(2.381)
Firm Size	0.186	-0.635***	-6.714***
	(1.346)	(-2.905)	(-8.442)
RET3	-1.085***	-1.439***	-14.140***
	(-3.820)	(-3.737)	(-10.220)
Sales Growth	0.003	0.005	-0.017
	(1.211)	(1.407)	(-1.352)
Cash	-0.998***	-2.363***	-7.196***
	(-2.628)	(-3.529)	(-2.864)
Leverage	-3.297***	-3.917***	-24.340***
	(-5.580)	(-4.570)	(-7.982)
ROA	0.047***	-0.01	0.173**
	(4.137)	(-0.423)	(2.137)
Inverse of Assets	0.084*	0.385***	0.775**
	(1.868)	(3.091)	(2.284)
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	14,398	14,398	14,398
Adjusted R^2	0.654	0.706	0.232

Table 5: Alternate Instrument and 2SLS Estimation

This table presents the first and second stage results of a 2SLS estimation. The dependent variable in the first stage is passive ownership in a firm. Peer PO is the average passive ownership for all firms in the same market capitalization quartile as the firm, excluding the firm. The dependent variables for the second stage are specified on top row. CAPX (CAPXRND) is the ratio of capital expenditures (and R&D expenses) to total assets. Change in assets is the change in total assets from last year. PO (IV) is the instrumented passive ownership and Q is Tobin's Q. All control variables are lagged, except RET#3, and defined in Appendix A. All variables are winsorized at 1%. Fixed effects are included and specified at the end of the table. T statistics with standard errors clustered at the firm level are reported in parenthesis below. . *, **, and *** denote significance at10%, 5%, and 1% respectively..

	First stage	Second Stage		
	PO	**CAPX**	**CAPXRND**	**Change in Assets**
Peer PO	0.733***			
	(31.670)			
Q x PO (IV)		-0.037***	-0.063***	-0.041
		(-6.428)	(-5.645)	(-0.918)
Q	-0.131***	0.874***	2.086***	9.682***
	(-6.796)	(18.900)	(25.740)	(28.850)
PO (IV)		0.01	0.046	0.416*
		(0.264)	(0.733)	(1.690)
Cash Flow	-0.044	1.234***	1.778***	10.970***
	(-0.405)	(4.158)	(2.958)	(4.343)
Firm Size	0.316***	0.103	-0.849***	-7.426***
	(6.965)	(1.329)	(-6.753)	(-17.440)
RET3	0.098*	-1.219***	-1.776***	-19.820***
	(1.736)	(-10.120)	(-9.179)	(-26.470)
Sales Growth	-0.001**	0.005***	0.006***	0.004
	(-2.298)	(5.921)	(4.498)	(0.705)
Cash	-0.350***	-0.310**	-2.010***	-7.734***
	(-6.383)	(-2.125)	(-7.710)	(-7.281)
Leverage	0.195	-2.832***	-3.569***	-21.380***
	(1.336)	(-9.865)	(-7.216)	(-11.540)
ROA	-0.007***	0.034***	-0.043***	0.164***
	(-3.932)	(7.875)	(-4.691)	(5.008)
Inverse of Assets	0.001	0.052***	0.186***	0.755***
	(0.352)	(6.925)	(10.900)	(11.830)
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,144	61,144	61,144	61,144
Adjusted R^2	0.849	0.622	0.738	0.299

Table 6: Passive Ownership and Price Informativeness

This tables reports OLS estimates where the dependent variables are different proxies of price informativeness that are specified in columns heading. NSYNC is price non-synchronicity and is one minus the R2 from regressing daily returns on the market and industry returns. Gamma is the return autocorrelation during high volume. SOVR is one minus the overnight volatility ratio. Panel A (B) [C] reports results using average passive ownership (instrumented PO using Russell reconstitution)[instrumented using peer market capitalization]. Control variables included but not tabulated are Cash flow, Size, RET3, sales growth, cash holding, leverage, ROA, and inverse of assets. All control variables other than Return3 are lagged and defined in Appendix A. The estimation included firm and year fixed effects. T statistics with standard errors clustered at the firm level are in parenthesis below. . *, **, and *** denote significance at10%, 5%, and 1% respectively

	NSYNC	Gamma	SOVR
Panel A: Passive Ownership			
PO	-0.004***	-0.002**	-0.008***
	(-3.629)	(-2.240)	(-5.353)
Q	-0.001	-0.003***	0.003
	(-1.194)	(-3.252)	-1.657
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,144	61,144	61,144
Adjusted R^2	0.779	0.043	0.456
Panel B: Instrumented PO using Russel Reconstitution			
PO	0.012**	-0.0005	0.002
	(2.406)	(-0.088)	(0.179)
Q	-0.002	-0.002*	0.001
	(-1.461)	(-1.937)	(0.180)
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	14,398	14,398	14,398
Adjusted R^2	0.712	0.075	0.147
Panel C: Instrumented PO using Peer Passive Ownership			
PO	-0.007***	-0.002***	-0.032***
	(-8.725)	(-2.987)	(-13.250)
Q	-0.001	-0.003***	-0.0005
	(-1.092)	(-5.481)	(-0.264)
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,144	61,144	61,144
Adjusted R^2	0.778	0.046	0.459

Table 7. Investment with Passive Ownership

The table reports results from an OLS estimation where the dependent variable is Underinvest (Overinvest) dummy and is specified on the top row. (*High*) *Loss* dummy takes the value of one if the firm investment Q sensitivity is (highly) impacted by passive ownership. Control variables included but not tabulated are Cash flow, Size, RET3, sales growth, cash holding, leverage, ROA, and inverse of assets. All variables other than RET3 are lagged and defined in Appendix A. Variables are winsorized at 1%. The estimation includes firm and year fixed effects. T statistics with standard errors clustered at the firm leave are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

Panel A: Industry Adjusted

Under Invest (Over invest) dummy takes the value of one if the firm's industry adjusted capital expenditure in that year is in the bottom (top) quartile. The industry adjusted capital expenditure is firm's CAPX/ TA minus the industry average. We use the Fama French 48 to classify industry.

	Under Invest	**Over Invest**	**Under Invest**	**Over Invest**
Loss Dummy	0.033***	-0.118***		
	(9.594)	(-28.750)		
High Loss Dummy			0.040***	-0.151***
			(8.327)	(-26.120)
Q	-0.011**	0.042***	-0.011**	0.044***
	(-4.662)	(15.63)	(-4.841)	(16.160)
Controls	Yes	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes	Yes, Yes
Observations	53,271	53,271	53,271	53,271
Adjusted R^2	0.283	0.355	0.283	0.354

Panel B: Model for Capital Expenditures

Underinvest (Overinvest) dummy takes the value of one if the residuals from a model of firm's investment are in the bottom (top) quartile.

	Under invest	**Over Invest**	**Under Invest**	**Over Invest**
Loss Dummy	0.081***	-0.127***		
	(20.83)	(-29.870)		
High Loss Dummy			0.106***	-0.163***
			(19.040)	(-27.840)
Q	0.012***	0.024***	0.011***	0.026***
	(4.298)	(9.071)	(3.846)	(9.657)
Controls	Yes	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes	Yes, Yes
Observations	52,868	52,868	52,868	52,868
Adjusted R^2	0.366	0.381	0.365	0.378

Table 8: Impact on Operating performance

Operating Income is the ratio of Ebitda to Sales. (*High*) *Loss* dummy takes the value of one if the firm investment Q sensitivity is (highly) impacted by passive ownership in prior year. A firm year is classified as being (*High*) *Loss* by passive ownership if the residuals from equation 2 are negative (in the bottom half of negative residuals). Control variables included but not tabulated are cash flow, Size, RET3, sales growth, cash holding, leverage, ROA, and inverse of assets. For the ROA (Sales growth) model lagged sales growth (lagged ROA) was not included as control. All variables other than RET3 are lagged and defined in Appendix A. Variables are winsorized at 1%. The estimation includes firm and year fixed effects. T statistics with standard errors clustered at the firm leave are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

	Panel A				**Panel B**			
	Operating Income		Sales Growth		Operating Income		Sales Growth	
	One Year Forward	Three Year Forward	One Year Forward	Three Year Forward	One Year Forward	Three Year Forward	One Year Forward	Three Year Forward
Loss Dummy	0.440	0.04	-2.082***	-1.572***				
	(0.970)	(0.144)	(-7.587)	(-7.622)				
High Loss					-0.019	-0.37	-3.275***	-2.415***
					(-0.027)	(-0.927)	(-8.063)	(-8.417)
Q	2.680**	1.348***	5.062***	3.508***	2.683***	1.355***	5.103***	3.543***
	(4.684)	(3.554)	(19.580)	(18.690)	(4.683)	(3.567)	(19.760)	(18.950)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm, Year FE	Y, Y	Y, Y	Y, Y	Y, Y	Y, Y	Y, Y	Y, Y	Y, Y
Observations	53,127	43,591	53,204	45,039	53,127	43,591	53,204	45,039
Adjusted R^2	0.790	0.844	0.257	0.490	0.79	0.844	0.258	0.491

Table 9: Learning from Capex Guidance

The table displays results of a Heckman Model where the dependent variable in the first stage is Guidance and in the second stage is CAPX Adj. Guidance is a dummy that takes the value of one if the firm provides a capex guidance in the year. CAPX Adj is the difference between the actual capital expenditure and the initial forecast scaled by the forecast. Industry Guidance is the fraction of firm in the industry that provide capex guidance, Prior Guidance is a dummy that takes the value of one if the firm provided capex guidance in the prior year. (*High*) *Loss* dummy takes the value of one if the firm investment Q sensitivity is (highly) impacted by passive ownership in prior year. A firm year is classified as being (*High*) *Loss* by passive ownership if the residuals from equation 2 are negative (in the bottom half of negative residuals). CAR is the five day market adjusted cumulative abnormal return. IMR is the Inverse Mills Ratio. The first stage included the control variables used before that is Cash flow, Size, RET3, sales growth, cash holding, leverage, ROA, and inverse of assets, along with prior CAPX. The second stage included additional control variables of ES and Earning Change. The control variables are lagged, except RET3, and not tabulated for brevity. All variables are winsorized at 1%, fixed effects included and specified below. T statistics with standard errors clustered at the firm level are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

	Panel A			**Panel B**		
	First Stage	Second Stage		First Stage	Second Stage	
	Guidance	CAPX_Adj		Guidance	CAPX_Adj	
Loss	0.220***	1.712	1.716			
	(11.380)	(1.273)	(1.276)			
High Loss				0.340***	1.595	1.508
				(14.300)	(0.826)	(0.779)
Industry Guidance	0.005***			0.006***		
	(5.308)			(5.842)		
Prior Guidance	1.163***			1.154***		
	(31.750)			(31.500)		
Loss x CAR			1.590			
			(1.456)			
High Loss x Car						2.888*
						(1.902)
CAR		2.001***	1.093		1.991***	1.306**
		(3.557)	(1.361)		(3.538)	(2.171)
IMR		-1.957	-1.932		-1.782	-1.712
		(-0.978)	(-0.965)		(-0.895)	(-0.860)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Year	F,Y	F,Y	Year	F,Y	F,Y
Observations	47,457	7,664	7,664	47,457	7,664	7,664
Adjusted R^2		0.324	0.324		0.324	0.324

Tables 10: Nature of Passive Ownership and Investment-Price Sensitivity

This table presents the results from an OLS estimation where the sample consists of firms belonging to the Russell 1000 and Rusell 2000 over 1992 to 2021. The dependent variables are listed on top row. CAPX (CAPXRND) is the ratio of capital expenditures (and R&D expenses) to prior total assets. Change in assets is the change in total assets from last year. Q is Tobin's Q and firm size is log of market capitalization. Control variables included but not tabulated are Cash flow, Size, RET3, sales growth, cash holding, leverage, ROA, and inverse of assets. All variables other than RET3 are lagged and defined in Appendix A. Variables are winsorized at 1%. The estimation includes firm and year fixed effects. T statistics with standard errors clustered at the firm leave are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

Panel A: Industry focused Funds

PO (Ind) and PO (Non Ind) is ownership by passive funds classified as industry and not industry focused respectively. A fund is classified as (not) industry focused if 50% or more of its holdings are (not) in one Fama French 12 industry group.

	CAPX	CAPXRND	Change in Assets
Q x PO (Non Ind)	-0.036***	-0.057***	-0.193***
	(-6.732)	(-6.412)	(-5.289)
Q x PO (Ind)	-0.015	0.033	1.099***
	(-0.386)	(0.285)	(3.360)
Q	0.853***	2.014***	9.585***
	(19.840)	(27.250)	(30.290)
PO (Non Ind)	0.067***	0.104***	0.457***
	(4.126)	(4.638)	(4.907)
PO (Ind)	-0.116	-0.805***	-4.330***
	(-0.825)	(-3.156)	(-4.999)
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,063	61,063	61,063
Adjusted R^2	0.622	0.738	0.301

Panel B: Passive by Action

PO (PTR) is the ownership by funds that have been classified as passive based on their portfolio turnover ratio.

	CAPX	CAPXRND	Change in Assets
Q x PO (PTR)	-0.017***	-0.026***	-0.044**
	(-6.314)	(-4.799)	(-2.306)
Q	0.887***	2.093***	9.743***
	(19.050)	(26.100)	(29.270)
PO (PTR)	0.017**	0.022*	0.095**
	(2.055)	(1.677)	(1.988)
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	60,525	60,525	60,525
Adjusted R^2	0.622	0.739	0.299

Appendix Table 1: Robustness with Analyst Coverage and Financial Constraints

This table presents the results from an OLS estimation where the sample consists of firms belonging to the Russell 1000 and Rusell 2000 over 1992 to 2021. The dependent variables are listed on top row. CAPX (CAPXRND) is the ratio of capital expenditures (and R&D expenses) to prior total assets. Change in assets is the change in total assets from last year. PO is passive ownership, Q is Tobin's Q and firm size is log of market capitalization. Number of Analysts is the number of analysts that follow the firm. KZ index is a measure of financial constraints in accordance with Kaplan and Zingales (1997). Control variables included but not tabulated are Cash flow, Size, Return3, sales growth, cash holding, leverage, ROA, and inverse of assets. All variables other than Return3 are lagged and defined in Appendix A. Variables are winsorized at 1%. The estimation includes firm and year fixed effects. T statistics with standard errors clustered at the firm leave are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

	CAPX	**CAPXRND**	**Change in Assets**
Q x PO	-0.032***	-0.045***	-0.055
	(-6.455)	(-4.725)	(-1.532)
Q	0.854***	2.027***	9.647***
	(18.320)	(24.890)	(29.200)
PO	0.049***	0.052*	0.091
	(2.649)	(1.840)	(0.878)
Number of Analysts	0.441***	1.217***	4.475***
	(3.594)	(6.626)	(5.016)
KZ Index	0.179***	0.04	-3.587***
	(3.955)	(0.582)	(-8.768)
Controls	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes
Observations	61,144	61,144	61,144
Adjusted R^2	0.616	0.735	0.327

Appendix Table 2: Logit estimation of underinvestment

The table reports results from a logit estimation where the dependent variable is Underinvest (Overinvest) dummy and is specified on the top row. Underinvest (Overinvest) dummy takes the value of one if the firm's industry adjusted capital expenditure in that year is in the bottom (top) quartile. The industry adjusted capital expenditure is firm's CAPX/ TA minus the industry average. We use the Fama French 48 to classify industry. *Loss* dummy takes the value of one if the firm investment Q sensitivity is (highly) impacted by passive ownership in prior year. Control variables included but not tabulated are Cash flow, Size, Return3, sales growth, cash holding, leverage, ROA, and inverse of assets. All variables other than Return3 are lagged and defined in Appendix 1. Variables are winsorized at 1%. The estimation includes firm and year fixed effects. T Statistics with standard errors clustered at the firm leave are in parenthesis below. . *, **, and *** denote significance at 10%, 5%, and1% respectively.

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	Panel A: Industry Adjusted		**Panel B: Model for CAPX**	
	Under Invest	Over Invest	Under Invest	Over Invest
Loss Dummy	0.286***	-1.011***	0.778***	-01.172***
	(9.407)	(-28.572)	(21.136)	(-31.861)
Q	-0.085***	0.357***	0.085***	0.218***
	(-4.699)	(14.397)	(3.636)	(8.877)
Controls	Yes	Yes	Yes	Yes
Firm FE, Year FE	Yes, Yes	Yes, Yes	Yes, Yes	Yes, Yes
Observations	41,892	41,892	34,167	34,346
Psuedo R^2	0.113	0.152	0.102	0.143