Passive Ownership and Investment Efficiency

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Abstract

Current literature provides competing evidence on the impact of passive ownership on price efficiency. This paper empirically assesses whether passive owners hinder or enhance managers in learning private information from stock prices when making investment decisions. The results show that passive owners negatively affect corporate investment decisions, such that firms with higher passive ownership have lower investment-price sensitivity. Passive owners are negatively associated with the revelatory efficiency of stock prices and are negatively related to capex adjustments through feedback channels. Further analysis provides evidence of the effect of passive owners' characteristics, such as their industry exposure and portfolio turnover ratio (PTR), on managerial learning. This weaker managerial learning due to increased passive ownership increases the likelihood of under-investment but lowers the chances of over-investment and has a mixed effect on the firm's operating performance. Also, the results suggest that a nonlinear relationship exists between passive ownership and investment-price sensitivity. The paper addresses identification through Russell 1000/2000 index switching and instrumental variables. (JEL G14, G23, G31)

Keywords: Passive ownership, investment-price sensitivity, price informativeness.

Word count: 7992

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1 Introduction

Financial markets play an important role in the production and aggregation of information from a variety of market participants. Traders acquire fundamental information about stocks and impound their private information into stock prices through their speculative trading (Grossman & Stiglitz (1980), L. R. Glosten & Milgrom (1985), Kyle (1985)). The previous literature on corporate finance argues that firm managers learn from the information in stock prices about the prospects of their own firms (Dow & Gorton (1997), Subrahmanyam & Titman (1999)). The rationale behind this managerial learning hypothesis is that, though the managers are the firm's insiders, they will not always have complete and perfect information about the value-maximizing decisions. On the other hand, the stock price accumulates information from a wide range of market participants through their trading, which could be their primary way of engaging with firms. The accumulated information reflected in stock prices may contain new information for managers. Traditionally, investors and shareholders of firms influence managerial decision-making through this information channel and provide feedback to managers (Bond et al. (2012)). Managers learn this private information from stock prices and make economically efficient capital allocation decisions (Tobin (1984)). For instance, higher stock price informativeness is associated with more efficient capital allocation (Wurgler (2000)) and greater sensitivity of investments to stock prices (Chen et al. (2007), Bakke et al. (2010)).

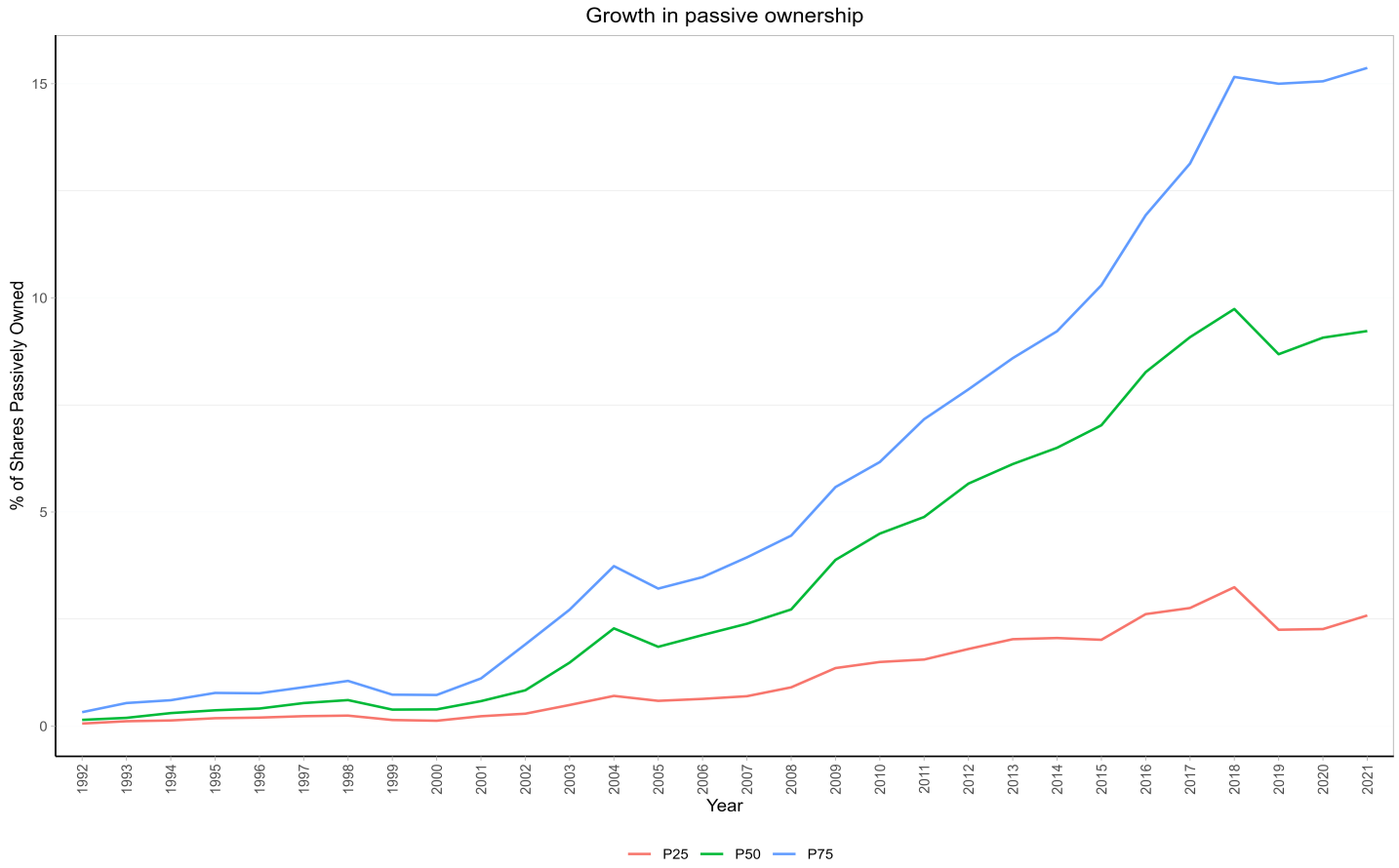
But, in the recent decade, financial markets have seen a massive rise in passive ownership. Passive ownership refers to ownership of firms by index funds and exchange-traded funds (ETFs). Index funds constitute more than 95% of total passive ownership. Figure 1 shows the growth in passive ownership from 1992 to 2021. The median and 75th percentile of passive ownership were less than 1% (0.38% and 0.72%, respectively) in 2000. But, over the last two decades, they have grown approximately 2000% and, as of 2021, they are approximately 8% and 15%, respectively. Also, passive ownership exhibits a high cross-sectional variation among firms, where a 25th percentile firm has around 2%, while the 75th percentile firm has around 15% of passive ownership as of 2021.

This massive growth in passive ownership has tremendous implications for financial markets and managerial decision-making. Compared to other owners, passive owners have greater restrictions and limitations about their investment choices and trading decisions, such as whether or when to exit or enter positions. This is because they have to replicate an index and thus have limited incentive in active stock picking and portfolio formation. This mechanical way of trading stocks based on an index makes it apparent that passive owners are restricted from trading based on information. However, in classic economic and finance theory, a fundamental hypothesis is that market participants make trading decisions based on some information (Modigliani & Miller (1959)). This fixed trading behavior of passive owners is a key feature that differentiates them from all other types of traditional firm owners and has potential implications for the investment efficiency of firms through the information channel.

In this article, I empirically assess whether passive owners hinder or enhance managers from learning private information from stock prices when they make investment decisions. I do so by examining the relationship between passive ownership of firms and the sensitivity of corporate investment to price. However, the current empirical evidence does not provide a precise prediction on the directionality of the effect of passive ownership on price informativeness and, through that, managerial learning and investment sensitivity. For instance, Buss & Sundaresan (2020) postulates that passive owners' inelastic demand lowers firms' capital cost, making them riskier and thus providing an opportunity for active investors to acquire more information and improve price informativeness. Thus, the inelastic demand hypothesis predicts that passive owners enhance managerial learning from stock price, making their investments more sensitive to stock price. On the other hand, Sammon (2022) shows that passive owners acquire less firm-specific information ahead of the earnings announcement, and limits to arbitrage hampers non-passive owners to offset the effect of passive owners. This trading constraint hypothesis predicts that passive owners hinder managerial learning from stock prices as passive owners have less incentive to acquire and trade on firm-specific information, making stock prices less informative for managers to glean signals from prices. In sum, whether managers learn more

or less from stock prices and how their investment sensitivity varies in the presence of passive ownership is, therefore, an open empirical question.

Figure 1: This figure shows the growth in passive ownership over the sample period from 1992 to 2021. P25, P50, and P75 represent each year's 25th percentile, median, and 75th percentile of passive ownership, respectively.



I address the above question as follows. Given the competing prediction on the directionality, I first examine the relationship between passive ownership and the sensitivity of investment to stock price. If passive owners hinder (enhance) managerial learning from stock price, investment-price sensitivity should be lower (higher) for firms with high passive ownership. Next, I provide evidence on the price informativeness and feedback channel through which passive owners affect managerial learning. Then, I further deep dive into the characteristics of the passive owners in terms of their industry exposure and portfolio turnover ratio (PTR) and their effect on managerial learning. Finally, I examine whether the impact of passive owners on managerial learning affects the firm's operating performance.

My findings support the trading constraint hypothesis that passive owners hinder managerial learning from stock price, such that firms with higher passive ownership have their investments less sensitive to stock prices. Moreover, the negative effect of passive owners on investment-price sensitivity is higher among firms in industries with higher investment-price sensitivity in general. I address endogeneity, establish causality using the instrumental variable approach in the context of Russell 1000/2000 index switching as an exogenous shock to passive ownership, and show that firms with higher passive ownership have lower investment-to-price sensitivity. Regarding the mechanism, passive owners are negatively associated with revelatory price efficiency of stock price informativeness. I also provide new evidence on the feedback channel that passive owners are associated with providing less feedback on managerial capex guidance. So, passive owners are

negatively associated with lower capex adjustments. Further evidence on the characteristics of passive owners shows that the negative effect of passive owners on managerial learning arrives from non-industry passive funds and from funds that are passive by action (lower PTR).

Also, this weaker managerial learning due to increased passive owners increases the likelihood of underinvestment but reduces the likelihood of overinvestment, leading firms to invest less overall. Due to insufficient information from financial markets, managers could not decide what projects to invest in. Instead, firms with weaker managerial learning due to increased passive ownership pay more dividends and repurchases. I hypothesized that this weaker managerial learning due to increased passive ownership would lead to bad investments. However, my results show that managers ex-ante know that passive owners don't bring any information and don't care about the specifics of particular investments firms make. So, instead of investing, managers pay more to shareholders. Thus, instead of undertaking investments without complete information, managers proactively pay more to shareholders, leading to better operating performance in terms of return on assets and asset turnover. But, at the same time, the higher likelihood of under-investment due to increased passive ownership negatively affects the operating performance of firms in terms of lower sales growth.

My study contributes to three strands of literature. Firstly, this study provides new evidence on one of the negative implications of passive ownership and joins the current conversation on the consequences of growth in passive ownership for financial markets, corporate governance, and the real economy. Current literature has primarily examined the impact of passive ownership on the firms' corporate governance through agency channels. Appel et al. (2016) shows that passive funds influence the firm's governance through their voting blocs. However, subsequent research by Schmidt & Fahlenbrach (2017) shows that passive owners negatively affect a firm's governance, as they can only do low-cost monitoring, leading to increased agency costs. Then, Heath et al. (2021) provides direct evidence that passive owners are less effective monitors and shift control to managers. Next, Coles et al. (2022) shows that increased passive funds are associated with lower information production. Current empirical evidence shows that passive owners monitor less and do not engage with firms (Heath et al. (2021)), and negatively affect the corporate governance of the firms (Schmidt & Fahlenbrach (2017)), and are associated with lower information production (Coles et al. (2022)). While the effect of passive ownership of firms through the agency channel has been explored in multiple contexts, their effect on the investment efficiency of the firm through the information channel has not been explored thoroughly. Thus, my study addresses this gap and provide empirical evidence on the investment efficiency of the firms.

Regarding information efficiency, a separate stream of literature examined the role of ETFs separately. A main difference between index funds and ETFs is that ETFs trade in the secondary market. L. Glosten et al. (2021) shows that ETFs increase the information efficiency of firms with weak information environments by facilitating the timely incorporation of earnings information into stock prices. Antoniou et al. (2022) shows that firms with higher ETF ownership have higher investment-price sensitivity, and this efficiency comes through the non-market or sectoral ETFs. However, our general knowledge that ETFs are passive investment vehicles has been challenged by Easley et al. (2021), who shows that ETFs are characterized as highly active investment vehicles and have a high portfolio turnover. Thus, their positive impact on information efficiency should not be misinterpreted as the benefit of passive investing, as the ETFs are more active. My study differs from Antoniou et al. (2022) in multiple ways. First, my study mainly focuses on passive ownership by index funds, while their study focuses only on ETFs. My sample includes all the Russell 1000 and 2000 firms, while their sample includes only firms of small size. Finally, my sample period covers a large period from 1992 to 2021, while their period is only from 2003 to 2016.

Second, this study contributes to the managerial learning literature. Chen et al. (2007) shows that managerial learning is higher for firms with higher stock price informativeness. Foucault & Frésard (2012) shows that managerial learning is higher for firms that are cross-listed in the US have higher managerial learning through increased stock price informativeness. My study brings new insights that lower information production and less firm-specific information incorporation by passive owners actually make stock prices less useful to managers, and thus, their investments become less sensitive to stock prices.

Finally, I add another piece of evidence to the classic financial economic literature: the stock market is not a sideshow. Bond et al. (2012) argue that the stock market's price efficiency and feedback have real economic effects by affecting managerial decision-making. This study reveals new evidence that the exogenous growth in passive ownership in financial markets has real implications on the economy by affecting managerial investment decisions.

2 Data and Measurement

My analyses use data from the CRSP, Compustat, Thompson S12 Mutual fund holding database, Refinitiv Eikon, and Bloomberg, as discussed in detail below, for the years from 1992 to 2022.

I use the Thompson S12 mutual fund holding database to get fund-level holdings data. I classify a fund as a passive fund following the same method in Appel et al. (2016) and Hshieh et al. (2021). I categorize funds as passive funds if their names contain at least one of the following strings: 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. After classifying, I measure passive ownership for each firm as the percentage of shares held by passive mutual funds. Specifically, the passive ownership for each firm and year, $PO_{i,t}$, is calculated as,

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

where j is the set of passive funds holding stock i; $SHARES_{j,t}$ is the number of stock i's shares held by passive fund j at year t; and Total Shares Outstanding$_{i,t}$ is the total shares outstanding for stock i at year t. Similarly, I measure passive ownership by funds with the Russell 1000 or Russell 2000 Index as a benchmark. Also, I classify funds as ETFs if the fund name has particular strings and calculate Passive ownership by ETFs[2]

I use Russell Index historical members' data from Bloomberg and match these with CRSP and Compustat firm-level data. As my primary focus is on passive ownership by index funds, I do not impose any filters on firm and stock level characteristics, and my sample includes all firms that were either in the Russell 1000 or Russell 2000 index historically (Heath et al. (2021)). I use the Refinitv Eikon database for Managerial capex guidance data. My final sample consists of 60,770 firm-year observations over the sample period from 1992 to 2021.

The primary dependent variables are the measures of investment. I use capital expenditure (CAPX), R&D (RND), change in assets, and the sum of both CAPX and RND. A detailed description of the variables is provided in Section 3.1. To measure price informativeness, I use three measures of revelatory price efficiency: stock price nonsynchronicity, Gamma, and overnight volatility ratio. Detailed descriptions of the measurements are provided in Section 4.1.

Section 2 provides the summary statistics of all variables in my sample. The definitions of these variables are in Table A1. The mean (standard deviation) passive ownership of firms is 4.028 (25.324), which is close to the recent similar studies (Appel et al. (2016), Sammon (2022)). This high standard deviation of passive ownership reflects the higher cross-sectional variation among firms, which is an important motivation to examine the effect of passive owners on investment-price sensitivity. The mean (standard deviation) of investment measures, CAPX, CAPXRND, CHASSET, and RND, are 6.027% (6.578%), 11.189% (11.485%), 12.648% (34.211%) and 5.018% (9.605%) respectively. These numbers represent that, on average, a firm's investments represent 11% of the firm's total assets; in particular, CAPEX is 6% , and RND is 5% . The

[2]If the fund name contains strings such as ETF, Exchange-traded, and ETFs, I classify them as ETFs. As a robustness, I subtract ETF ownership from the total passive ownership, and all the results are similar.

average change in assets is about 12%. The mean Q is 2.186, and in terms of price informativeness measures, the mean NSYNC, Gamma, and OVR are 0.77, -0.01, and 0.683, respectively. These numbers align with previous literature (Chen et al. (2007)).

Table 1: Summary Statistics

Variables	N	Mean	SD	25%	50%	75%	90%
Passive ownership variables:							
PO^{ALL} (%)	60770	4.028	25.324	0.409	1.817	5.581	11.112
PO^{R1000} (%)	60770	0.060	0.152	0.000	0.000	0.000	0.272
PO^{R2000} (%)	60770	0.602	6.751	0.000	0.000	0.976	2.315
PO^{INDEX} (%)	60770	3.820	25.267	0.398	1.773	5.303	10.341
PO^{ACT} (%)	60345	9.299	56.590	1.779	5.767	14.275	22.689
PO^{NINDUS} (%)	60770	2.344	24.954	0.000	0.000	2.430	8.723
PO^{INDUS} (%)	60770	0.215	0.815	0.000	0.000	0.046	0.505
Investment variables:							
CAPX (%)	60770	6.027	6.578	1.948	3.972	7.601	13.218
CAPXRND (%)	60770	11.189	11.485	3.820	7.598	14.229	24.710
CHASSET (%)	60770	12.648	34.211	-2.318	5.923	17.671	40.834
RND (%)	60770	5.018	9.605	0.000	0.162	6.082	15.808
Firm-level control variables:							
Q	60770	2.159	1.759	1.179	1.587	2.430	3.949
ROA	60770	0.659	16.630	-0.338	4.029	8.076	12.806
CF	60770	0.063	0.169	0.036	0.088	0.141	0.206
SIZE	60770	6.596	2.003	5.148	6.468	7.924	9.346
LEV	60770	0.413	0.217	0.249	0.401	0.542	0.682
INVAST	60770	6.521	12.933	0.409	1.765	6.435	17.234
RET	60770	0.057	0.279	-0.088	0.066	0.204	0.367
SG	60770	16.422	48.019	-1.275	7.985	21.560	46.645
KZ Index	60770	-0.350	3.210	-0.730	-0.153	0.432	1.029
NUMEST	53455	2.522	0.192	2.565	2.565	2.565	2.565
Price informativeness variables:							
NSYNC	60770	0.775	0.200	0.646	0.829	0.949	0.987
GAMMA	60770	-0.001	0.128	-0.064	0.006	0.071	0.141
OVR	60770	0.682	0.319	0.587	0.783	0.895	0.978

This table presents the summary statistics (mean, 25th, median, 75th, 90th, and standard deviation of the variables for all stocks in my sample. The first column represents the variable abbreviations with corresponding units in parentheses, followed by the number of firm-year observations for each variable in the second column. For detailed definitions of each variable, refer to Table A1.

3 Empirical Results

In this section, I test the effect of passive ownership on the investment-price sensitivity of stocks and discuss the relevant results.

3.1 Passive ownership on investment-to-price sensitivity

To estimate whether passive ownership affects the sensitivity of a firm's investment to its stock price, I estimate the following regression:

$$INV_{i,t} = \alpha_t + \beta_1 \times Q_{i,t-1} + \beta_2 \times Q_{i,t-1} \times PO^{ALL}_{i,t-1} + \beta_3 \times PO^{ALL}_{i,t-1} + \psi \times \xi_{t-1} + \epsilon_t \tag{3.1}$$

Here, $INV_{i,t}$ refers to the investment of firm i in year t, measured by capital expenditure, the sum of capital expenditure and R&D expenses, change in assets and R&D expenses, all scaled by lagged total assets. $Q_{i,t-1}$ refers to firm i's Tobin's Q for year t, defined as the market value of equity plus the book value of assets minus the book value of equity, scaled by the book value of assets at the end of the previous year. The key variable of interest is the interaction term $Q_{i,t-1} \times PO^{ALL}_{i,t-1}$, which captures the incremental effect of passive ownership on investment-to-price sensitivity. This model includes a set of control variables of various firm characteristics that are known to affect investments, such as SIZE, Cash Flow, Leverage, Cash, ROA, inverse of assets, and Sales growth. All the variable definitions are in Table A1. I include firm-fixed effects to control for the time-invariant heterogeneity among firms and year-fixed effects to control for time-varying shocks.

Table 2 presents the regression results from estimating Equation (3.1). Columns 1,2, 3, and 4 represent the CAPX, CAPXRND, CHASSET, and RND investment measures. Firstly, the coefficient of Q is significantly positive for all investment measures. This result upholds prior knowledge that investments positively correlate with prices. In column 1, one standard deviation increase in Tobin's Q leads to an increase of about 1.15 standard deviation in the firm's investments, measured as CAPEX. Next, I focus on the main coefficient of interest $Q * PO^{ALL}$. As shown in Column 1, the coefficient is estimated as -0.034, negatively significant at 1% level. This shows that investment-price sensitivity is lower for firms with higher passive ownership. Given that the 25^{th} percentile value of PO^{ALL} is 0.424 and median value is 1.912 (Section 2), these estimates indicate that investment-price sensitivity for a firm with 25^{th} percentile value of PO^{ALL} is 0.823 [=0.774-(1.817-0.409)×(-0.034)]. The investment-price sensitivity will decrease by 0.176 (or about 21.4%) if a firm's passive ownership increases from a 25^{th} percentile value to a 75^{th} percentile value of 5.581. Figure 3 visually presents this decrease in investment-price sensitivity with respect to the increase in passive ownership from the one-standard deviation below the mean to one-standard deviation above the mean value. In terms of economic significance, one standard deviation increase in Tobin's q (1.759) is associated with an increase of 1.21% (0.93%) in corporate investment among firms in the bottom (top) quartile of passive ownership. This relative decrease in investment is economically significant, representing a change of 4.65% relative to average investments in my sample. Similarly, in terms of CAPXRND, a one-standard-deviation increase in Tobin's q (1.759) is associated with an increase of 3.13% (2.69%) in corporate investment among firms in the bottom (top) quartile of passive ownership. This relative decrease in investment in CAPXRND is much higher, representing a change of 11.3% relative to average investments in my sample. I also note that the overall effect of passive ownership on real investment (CAPX) is negative with a magnitude of -0.021 and, in terms of CAPXRND, the negative effect is -0.063 ($\beta_3 + \beta_2 * AverageQ_{i,t-1}$).

Next, in relation to other control variables, I find that firms with higher cash flow invest more in CAPEX but less in RND. Bigger firms have higher CAPEX but are negatively associated with other investment measures. I also find that firms with lower future returns invest more, pointing to a possible link between overvaluation and investing (Baker et al. (2003)). Firms with higher sales growth are positively associated with investments, indicating that worse operating performance could limit investments. Firms ' cash holdings are negatively associated with investments. One interpretation of this finding could be that since managers learn less from stock prices, they may pay to shareholders instead of making uncertain investments in the presence of high passive ownership. Highly leveraged firms invest less, as financial constraints may curb investments. The inverse of total assets has a positive effect on all measures of investments, indicating that firms with fewer assets have a greater ability to expand (Foucault & Frésard (2012)).

Table 2: Passive Ownership and investment-price sensitivity

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * PO^{ALL}	−0.034***	−0.054***	−0.197**	−0.023*
	(−5.715)	(−3.295)	(−2.090)	(−1.994)
Q	0.774***	1.922***	9.167***	1.118***
	(11.620)	(15.540)	(11.660)	(15.130)
PO	0.052**	0.054	0.330*	0.019
	(2.714)	(1.340)	(1.792)	(0.733)
CF	4.671***	−2.412**	59.940***	−6.933***
	(11.700)	(−2.624)	(8.559)	(−9.783)
SIZE	0.160*	−0.787***	−6.663***	−0.936***
	(1.732)	(−5.502)	(−11.730)	(−9.191)
RET	−1.025***	−1.920***	−18.070***	−0.721***
	(−4.465)	(−5.072)	(−7.961)	(−2.958)
SG	0.005***	0.006***	0.006	0.001
	(5.425)	(3.192)	(0.609)	(0.487)
CASH	−0.476***	−1.739***	−7.473***	−1.329***
	(−3.726)	(−6.743)	(−3.336)	(−4.820)
LEV	−3.193***	−3.722***	−23.000***	−0.314
	(−8.441)	(−5.690)	(−8.175)	(−0.814)
ROA	0.013***	−0.016*	0.016	−0.027***
	(3.991)	(−2.015)	(0.503)	(−4.427)
INVAST	0.055***	0.196***	0.726***	0.133***
	(4.987)	(7.220)	(8.283)	(8.200)
Adjusted R^2	0.619	0.736	0.354	0.878
Fixed effects	Yes	Yes	Yes	Yes
Observations	60,770	60,770	60,770	60,770

This table presents the results from the regression of firm investments (CAPX, CAPXRND, and CHASSET) on the interaction of Tobin's Q and passive ownership ($Q * PO^{ALL}$). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

3.2 Instrumental variable model - Russell 1000/2000 Index switching

In this section, I follow Appel et al. (2016), Heath et al. (2021) and Sammon (2022) and use the variation in passive ownership that occurs during the index reconstitution, making firms to switch from the Russell 2000 to the Russell 1000 index and vice versa. In terms of market capitalization, the Russell 1000 index includes the largest 1000 US stocks and, the Russell 2000 index constitutes the next largest 2000 stocks. The index assignment impacts the degree of passive ownership in that stock, as the portfolio weights allotted to each stock within an index are value-weighted.

Russel Investments reconstitutes their popular Russell 1000 (large-cap) and Russell 2000 (small-cap) indexes in June month of every year. 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.

During this index reconstitution, firms based on the above criteria will jump from Russell 1000 to 2000 and vice-versa. This index switching leads to a mechanical change in passive ownership. So, this setting provides a difference-in-difference setting to test out the exogenous change in passive ownership. The main reason is that the Russell 2000 index has higher weights and passive ownership compared to the Russell 1000 index (Pavlova & Sikorskaya (2020)). Thus moving from a higher (lower) weight index to a lower (higher) weight index reduces (increases) passive ownership. To carry out the analysis, I 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.[3] I pick 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), and examine their change in passive ownership, compared to the stocks that stayed in the same index (stayers).

My 2SLS instrumental variable approach is defined as follows:

$$PO^{All}_{i,t} = \alpha_0 + \beta_1\ I\{R2000 \rightarrow R1000\}_{i,t} \times POST + \beta_2\ I\{R1000 \rightarrow R2000\}_{i,t} \times POST + \epsilon_t \tag{3.2}$$

$$INV_{i,t} = \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 Q_{i,t-1} \times \widehat{PO^{ALL}_{i,t-1}} + \psi \xi_{t-1} + \epsilon_t \tag{3.3}$$

Panel A of Section 3.3 shows the results of the difference-in-difference estimates of Russell index switching on passive equity ownership, from Equation (3.2). $I\{R2000 \rightarrow R1000\}$ equals one if a firm switches the Russell 2000 to the Russell 1000 index and $I\{R1000 \rightarrow R2000\}$ equals one if a firm switches the Russell 1000 to the Russell 2000 index. Post is an indicator variable that equals one after index re-balancing. The coefficient of $R2000 \rightarrow R1000$ * POST shows that, when a firm switches from R2000 index to R1000 index, the overall passive ownership (PO^{All}) significantly decreases (-0.534), passive ownership by R2000 funds (PO^{R2000}) significantly decreases (-0.450) and passive ownership by R1000 funds (PO^{R1000}) significantly increases (0.065) post switching. Similarly, when a firm switches from R1000 index to R2000 index, the overall passive ownership (PO^{All}) increases (0.103), passive ownership by R2000 funds (PO^{R2000}) significantly increases (0.188) and passive ownership by R1000 funds (PO^{R1000}) significantly decreases (-0.039) post

[3] 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. To be consistent, I use 200 as the bandwidth. In Table A4, I show the number of switchers for different bandwidth sizes and, I find that 200 bandwidth includes the major proportion of switchers, enough to capture the index switching phenomenon. Nevertheless, my results hold for other bandwidths as well.

switching. 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. One particular reason 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).

Panel B of Section 3.3 shows the results of the second stage of the instrumental variable regression results, from the estimation of Equation (3.3). I estimate Equation (3.3) with the fitted values of passive ownership from Equation (3.2). The main coefficient of interest $Q \times \widehat{PO^{ALL}}$ is negative and significant for all measures of investment measures CAPX (-0.042), CAPXRND (-0.055), CHASSET (-0.236) and RND (-0.016). In particular, the IV estimate coefficient of CAPX is -0.044 is 1.2 times the baseline estimate of -0.034. This result is consistent with our baseline cross-sectional result, that firms with higher passive ownership have less investment-price sensitivity.

3.3 Instrumental variable model: Average passive ownership

In this section, I propose a new instrumental variable for passive ownership based on the herding behavior of growth in passive ownership. The instrumental variable for passive ownership of firm i in year t, is the average passive ownership of all firms in the same market capitalization quartile as the firm i, excluding firm i. The rationale is that the growth in passive ownership leads to herding behavior among index funds as they make trading decisions at their portfolio level. This leads to an increase in passive ownership among firms together. I exploit this condition and hypothesize that the increase in passive ownership in other firms in the same size quartile affects the passive ownership of firm i but will not affect the investment of firm i. The 2SLS regression setup is as follows:

$$PO_{i,t}^{All} = \alpha_0 + \beta_1 \ PO_{i,t}^{AVG} + \psi \xi_{t-1} + \epsilon_t \tag{3.4}$$

$$INV_{i,t} = \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 Q_{i,t-1} \times \widehat{PO_{i,t-1}^{ALL}} + \psi \xi_{t-1} + \epsilon_t \tag{3.5}$$

Table 4 shows the average passive ownership IV model results. Column 1 shows the first-stage results. The coefficient of PO^{AVG} is significantly positive (1.118), showing that average passive ownership of firms of the same size quartile, excluding firm i, positively affects the passive ownership of firm i. Columns 2 to 5 present the estimation of Equation (3.5) with fitted values from first-stage regression Equation (3.4). The interaction term of $Q \times \widehat{PO^{ALL}}$ is negatively significant for all investment measures. These results confirm that passive ownership negatively affects investment-price sensitivity.

Table 3: IV Regression Results
Panel A: IV Regression using Russell 1000/2000 Index Switching: First-stage

	Dependent variable:		
	PO^{R2000}	PO^{R1000}	PO^{All}
	(1)	(2)	(3)
R2000 → R1000 * POST	−0.450***	0.065***	−0.534***
	(−4.255)	(3.930)	(−2.801)
R1000 → R2000 * POST	0.188**	−0.039**	0.103
	(2.122)	(−2.631)	(0.501)
$R2000 \rightarrow R1000$	−0.174*	0.035**	−0.043
	(−1.814)	(2.222)	(−0.257)
$R1000 \rightarrow R2000$	0.181*	−0.025*	−0.086
	(2.001)	(−1.853)	(−0.436)
Adjusted R^2	0.596	0.480	0.880
Fixed effects	F,Y	F,Y	F,Y
Observations	15,390	15,390	15,390

Panel B: IV Regression using Russell 1000/2000 Index Switching: Second-stage

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * $\widehat{PO^{ALL}}$	−0.042***	−0.055***	−0.236***	−0.016
	(−4.200)	(−3.173)	(−2.788)	(−1.159)
Q	0.718***	1.828***	8.507***	1.104***
	(5.270)	(8.122)	(10.620)	(8.198)
$\widehat{PO^{ALL}}$	−0.195	−0.291	−0.045	−0.080
	(−0.825)	(−0.894)	(−0.048)	(−0.439)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.652	0.705	0.284	0.847
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	14,312	14,312	14,312	14,312

Panel A presents the results on the effect of Russell 1000/2000 Index switching on passive ownership, estimated from Equation (3.2). Panel B presents the results from the regression of firm investments (CAPX, CAPXRND, and CHASSET) on the interaction of Tobin's Q and fitted passive ownership ($\widehat{PO^{ALL}}$), estimated from the second-stage of IV model Equation (3.3). All models include both firm and year fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Table 4: IV Regression: Average passive ownership approach

	Dependent variable:				
	PO^{ALL}	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)	(5)
$\boldsymbol{PO^{AVG}}$	1.118***				
	(13.700)				
Q * $\widehat{PO^{ALL}}$		−0.037***	−0.060***	−0.194*	−0.027**
		(−5.289)	(−3.468)	(−1.940)	(−2.299)
Q	−0.075***	0.740***	1.880***	8.949***	1.111***
	(−3.439)	(10.440)	(14.090)	(11.680)	(14.820)
$\widehat{PO^{ALL}}$		−0.132***	−0.204**	−0.644**	−0.040
		(−2.815)	(−2.432)	(−2.387)	(−0.856)
Controls	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.845	0.620	0.737	0.354	0.878
Fixed effects	F,Y	F,Y	F,Y	F,Y	F,Y
Observations	60,766	60,766	60,766	60,766	60,766

This table presents the results from the regression of firm investments (CAPX, CAPXRND, and CHASSET) on the interaction of Tobin's Q and fitted passive ownership ($\widehat{PO^{ALL}}$), estimated from the second-stage of IV model Equation (3.5). The first column represents the first stage regression, where the dependent variable is the passive ownership and the main independent variable is the PO^{AVG}, the average passive ownership of all firms in the same size quartile as firm i, excluding firm i. All models include both firm and year fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

3.4 Passive ownership and sub-optimal investments

So far, my findings show that passive ownership reduces the extent to which managers pay attention to stock prices and extract information from them. However, does this less use of stock prices while making investment decisions lead to sub-optimal investments? This section examines the relationship between the lower investment-price sensitivity due to passive ownership and the firm's investment efficiency.

To begin with, I need to figure out the actual loss in managerial learning due to increased passive ownership at the firm level. However, it is challenging to figure out the changes in investment-to-price sensitivity arising from passive ownership at the firm level. Methodologically, one needs to estimate β_3 for each firm-year from the baseline regression eq. (3.1) and link it with the firm's investment efficiency.

To overcome this challenge, I follow the approach of Foucault & Frésard (2012) and re-estimate the baseline regression model eq. (3.1) without controlling for the interaction term $Q \times PO^{ALL}$ and save the yearly residual regression for each firm i. The rationale is that in ceteris paribus, firms with negative residuals experience a decrease in their investment-price sensitivity due to passive ownership. Then, I create a dummy variable $NEG_{i,t}$, which takes one for negative residuals and zero otherwise.

Next, I need to measure the sub-optimal investment decisions of the firm in terms of whether firms under-

invest or over-invest due to weaker learning from stock price due to increased passive ownership. I follow Biddle et al. (2009) to measure the deviation from firms' expected level of investment to identify the sub-optimal investment decisions. First, I estimate the firm-specific investment model as a function of growth opportunities, measured by Tobins' Q and sales growth. I use the residuals as a proxy for firm-level diversion from expected investment. I estimate,

$$INV_{i,t} = \beta_0 + \beta_1 \times Q_{i,t-1} + \beta_2 \times SG_{i,t-1} + \epsilon_{i,t+1} \tag{3.6}$$

Here, INV is the investment, measured as CAPX, Q is Tobins' Q, and SG is sales growth. I estimate this equation for each industry year based on Fama French's 48 industries classification for all industries. I then classify firms based on the degree of residuals, i.e., deviation from predicted investment, and use this as a measure of sub-optimal investments. Mainly, I sort firm years based on these residuals from Equation (3.6) into quartiles. Firms in the bottom quartile (most negative residuals) are classified as under-investing, firms in the top quartile (most positive residual) are classified as over-investing, and the middle two quartiles are classified as benchmark groups.

To test the effect of lower managerial learning due to passive ownership on sub-optimal investment decisions, I examine the overinvestment and underinvestment firms separately compared to benchmark groups. I create a dummy variable, Underinvestment, which equals one if the firm is in the bottom quartile of residual from Equation (3.6) and 0 if it is a benchmark group. Similarly, I create a dummy variable, Overinvestment, which equals one if the firm is in the top quartile of residual from Equation (3.6) and 0 if it is a benchmark group. I use these two dummy variables as independent variables, and I regress it on NEG in year t, in a logistic regression setup, with the set of control variables, and I estimate the following regression,

$$INV\_Dummy_{i,t+1} = \alpha + \beta_1 \times NEG_{i,t} + \psi \times \xi_{t-1} + \theta_i + \theta_t + \epsilon_{i,t+1,t+3} \tag{3.7}$$

Here, $INV\_Dummy_{i,t+1}$ is either the underinvestment or over-investment dummy variable, and $NEG_{i,t}$ is the dummy variable for firms which has negative investment-price sensitivity due to passive ownership. ψ represents the control variables from the baseline regression: Tobins' Q, Size, Inverse of assets, cash flow, leverage, ROA, sales growth, and cash.

Table 5 shows the results of the estimation of Equation (3.7). Column 1 shows the results of the effect of passive ownership on the likelihood of firms' under-investment due to lower investment-price sensitivity. Column 2 shows the effect of passive ownership on the likelihood of firms' over-investment due to lower investment-price sensitivity. In column 1, the coefficient of NEG is significantly positive (0.207). This result indicates that firms with lower investment-price sensitivity due to passive ownership are more likely to under-invest. Similarly, in column 2, the coefficient of NEG is significantly negative (-0.468), indicating that firms with lower investment-price sensitivity have a lower likelihood of over-investment. These results suggest that firms with lower managerial learning due to high passive ownership have a high likelihood of sub-optimal investment decisions, significantly higher under-investment, and reduced over-investment. The lower information production and feedback from passive owners negatively affect the managerial learning from stock prices. This weaker learning and insufficient feedback from increased passive owners deprive managers of valuable information from stock prices, leaving them with incomplete information to make optimal investment decisions. Thus, managers without complete information, due to lower managerial learning from stock price, make sub-optimal investments, and therefore, firms with higher passive ownership are associated with lower investments overall.

Table 5: Passive ownership and sub-optimal investment decisions

	Dependent variable:	
	Under Investment	Over Investment
	(1)	(2)
NEG	0.207***	−0.468***
	(8.412)	(−20.430)
Q	0.194***	0.147***
	(20.780)	(15.380)
CF	−1.023***	2.401***
	(−9.361)	(20.560)
SIZE	−0.079***	−0.102***
	(−9.348)	(−12.190)
RET	−0.043	−0.304***
	(−0.926)	(−6.530)
CASH	0.571***	−0.242***
	(11.400)	(−4.368)
LEV	0.122**	−0.446***
	(1.984)	(−7.073)
ROA	0.001	−0.004***
	(1.292)	(−3.080)
SG	0.002***	0.002***
	(6.513)	(5.924)
INVAST	0.011***	−0.001
	(8.357)	(−0.357)
Firm Cluster	Yes	Yes
Fixed effects	Ind, Year	Ind, Year
Observations	39,537	39,679
Pseudo R^2 (%)	13.9	8.2

This table presents the likelihood of under-investment and over-investment by firms with lower investment-price sensitivity due to passive ownership, as estimated from the regression Equation (3.7). The dependent variables, Under Investment (Over Investment), are dummy variables that take one if the firm's residual from Equation (3.6) lies in the bottom (top) quartile and 0 if the residual lies in the benchmark quartiles. The main independent variable, NEG, is a dummy variable that takes 1. if the firm residual is negative from Equation (3.6). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

3.5 Impact of passive ownership on operating performance of firms

In this section, I examine the impact of passive ownership on the operating performance of firms. I connect the measurement of change in investment-price sensitivity due to increased passive ownership, NEG, calculated by following Foucault & Frésard (2012), from the previous section, with the operating performance of firms. I use three measures of operating performance: return on assets (ROA), sales growth (SG), and asset turnover ratio (AT). Then, I estimate the impact of passive ownership on the operating performance of firms as follows:

$$OP_{i,t+1,t+3} = \alpha + \beta_1 \times NEG_{i,t} + \beta_2 \times OP_{i,t} + \psi \times \xi_{t-1} + \theta_i + \theta_t + \epsilon_{i,t+1,t+3} \tag{3.8}$$

Table 6: Passive ownership and operating performance of firms

	Dependent variable:					
	ROA_{t+1}	ROA_{t+3}	SG_{t+1}	SG_{t+3}	AT_{t+1}	AT_{t+3}
	(1)	(2)	(3)	(4)	(5)	(6)
NEG_t	0.343***	0.097	−2.315***	−1.385***	0.396*	0.835***
	(7.298)	(1.143)	(−6.358)	(−5.426)	(1.713)	(3.168)
ROA_t	0.005	0.018*				
	(0.477)	(1.843)				
SG_t			−0.111**	−0.053***		
			(−2.053)	(−6.180)		
AT_t					0.616***	0.484***
					(34.850)	(24.410)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.894	0.819	0.414	0.612	0.928	0.939
Fixed effects	F,Y	F,Y	F,Y	F,Y	F,Y	F,Y
Observations	52,905	44,848	52,840	44,745	52,905	44,854

This table presents the results on the impact of passive ownership on the operating performance of firms. The dependent variables are the measures of operating performance: return on assets (ROA), sales growth (SG), and, asset turnover ratio (AT). The main independent variable, NEG, is a dummy variable that takes 1. if the firm residual is negative from Equation (3.6). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Table 6 shows the results on the impact of passive ownership on the operating performance of firms. The coefficient of NEG is positive and significant in columns 1, 2, 5, and 6. Firms with lower investment-price sensitivity due to increased passive ownership have better future operating performance in terms of ROA and AT. However, they have lower sales growth, as the coefficient of NEG is negative and significant in columns 3 and 4. These results suggest that firms with lower investment-price sensitivity due to increased passive ownership have better operating performance in terms of ROA and asset turnover ratio. In Table A5, I find that NEG is positively associated with the payout measures of the firm. The rationale is that, due to increased passive ownership, managers cannot glean useful signals from stock prices to make investments,

make fewer investments, and pay more to shareholders instead. This result aligns with previous findings by Crane et al. (2016), who show that firms with higher institutional owners pay more dividends. However, managers may also forego some good projects due to insufficient information from investors, which is reflected in negative sales growth.

However, I rerun the above analysis, with CHASSET, as a measure of investment, Table A6, the reduction in investment price sensitivity due to increased passive ownership hurts the operating performance of firms, in terms of all three measures of operating performance. Similarly, I follow the ranking approach by Chen et al. (2007) to examine the impact of passive ownership on a firm's operating performance. Table A7 shows that firms with higher passive ownership percentile have worse operating performance. Overall, the effect of passive ownership on operating performance is mixed, and the effect varies for different investment measures. In sum, firms with weaker investment-price sensitivity due to increased passive ownership have worse operating performance, and this can be mitigated by paying out more to shareholders, which could improve firms' operating performance.

4 Evidence on the Mechanisms

In this section, I examine the mechanisms through which passive ownership negatively affects investment-price sensitivity and potential mechanisms through which passive owners hinder managerial learning from stock prices.

4.1 Test of price informativeness

The first mechanism through which passive ownership affects managerial learning is stock price informativeness. Chen et al. (2007) shows that the amount of private information in stock prices positively investment-price sensitivity. Better informative prices help managers extract private information from stock prices that may guide them in making investment decisions. Prior literature emphasizes the difference in the price informativeness in terms of new information produced in the market (i.e., revelatory price efficiency - RPE) and that of already known merely reflected in prices (forecasting price efficiency - FPE). In particular, Bond et al. (2012) highlights that only RPE is useful for managerial learning and is competent to influence managerial decisions. Thus, I examine the impact of passive ownership on RPE. I use a set of price informativeness measures, which are proxies of RPE (Pereira da Silva (2021)). These measures include Stock price nonsynchronicity, gamma (a measure of private information), and overnight volatility ratio. The detailed description of these measures are as follows:

Stock price nonsynchronicity (NSYNC): NSYNC is defined as one minus R^2 from regressing daily return on market and industry index over year t. The intuition is that if a firm's stock return is strongly correlated with the market and the industry return, then the stock price is less likely to contain firm-specific information. Following Chen et al. (2007), NSYNC is 1-R^2.

Private information (GAMMA): Gamma is a measure of informed trading, developed by Llorente et al. (2002). It is calculated as,

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

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 rationale is that during periods of high volume, stocks with a high degree of information-based trading exhibit positive return auto-correlation.

Overnight Volatility Ratio (OVR): The ratio of overnight volatility is calculated as the ratio of the variance of close-to-open returns to the variance of close-to-close returns. French & Roll (1986) claim that

private information, not public information, is the primary source for volatility. Trading gradually reveals private information, generating higher volatility during trading hours. Higher volatility during trading hours in comparison to overnight volatility means more informative prices. Thus higher OVR figures indicate higher price informativeness.

Table 7 shows the results on the impact of passive ownership on price informativeness. The dependent variables in columns 1,2, and 3 are NSYNC, GAMMA, and OVR, respectively. Our main coefficient of interest, PO^{ALL}, is negative and significant in all three columns. This shows that higher passive ownership reduces the stock price informativeness of firms. This is one main mechanism through which passive ownership negatively affects managerial learning and, thus, investment-price sensitivity. Since passive owners are negatively associated with stock price informativeness, higher passive ownership makes stock prices less informative and less useful for managers to glean valuable signals to make investment decisions. Thus, managers give less weightage to stock prices while making investment decisions, and thus their investments are becoming less sensitive to stock prices.

Table 7: Passive ownership and price informativeness

	Dependent variable:		
	NSYNC	Gamma	OVR
	(1)	(2)	(3)
$\boldsymbol{PO^{ALL}}$	-0.004^{***}	-0.002^{**}	-0.008^{***}
	(-3.615)	(-2.147)	(-5.400)
Q	-0.001	-0.003^{***}	0.003
	(-0.581)	(-3.074)	(1.543)
CF	-0.050^{***}	-0.020^{**}	0.003
	(-4.127)	(-2.467)	(0.214)
SIZE	-0.047^{***}	-0.002	0.011^{*}
	(-15.020)	(-0.906)	(1.919)
RET	0.017^{**}	0.0003	-0.018
	(2.504)	(0.059)	(-1.603)
SG	-0.00000	-0.00001	0.0001^{***}
	(-0.130)	(-0.867)	(3.164)
CASH	-0.009^{***}	-0.001	0.009^{*}
	(-3.844)	(-0.260)	(1.780)
LEV	0.016^{**}	0.003	-0.043^{**}
	(2.258)	(0.353)	(-2.756)
ROA	0.0002^{*}	0.00002	-0.0003^{*}
	(1.742)	(0.386)	(-1.918)
INVAST	-0.001^{***}	-0.00001	-0.004^{***}
	(-4.688)	(-0.039)	(-6.565)
Fixed effects	F,Y	F,Y	F,Y
Observations	60,770	60,770	60,770
Adjusted R^2	0.780	0.043	0.455

This table presents the results from the regression of firm price informativeness on passive ownership (PO^{ALL}). The dependent variables are the three measures of RPE: stock price nonsynchronicity (NSYNC), Gamma (a measure of private information), and overnight volatility ratio (OVR). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

4.2 Effect of passive ownership on managerial learning

One particular way through which managers learn from the market is by providing disclosures and getting feedback from the market. Managers adjust their beliefs based on the market feedback. Jayaraman & Wu (2021) shows that managers adjust their capital expenditure based on the market reaction to their capex guidance. This feedback mechanism is an important channel through which managers learn from investors and make decisions accordingly. In this section, I examine the impact of passive ownership on managerial learning through this feedback mechanism. In particular, I analyze whether passive owners provide feedback to managers on capex guidance and how managers adjust their capex based on the feedback from passive owners. To examine the above relationship, I estimate the following regression:

$$CAPX\_ADJ_{i,t} = \beta_0 + \beta_1 \times PO^{ALL}_{i,t-1} + \beta_2 \times CAR_{i,a} + \psi \times \eta_{t-1} + \epsilon_{i,t} \tag{4.1}$$

In the above equation, capex adjustment (CAPEX_ADJ) is defined as the percentage difference between capital expenditures made by the firm in a year and the amount forecasted by the firm for the same year (scaled by the latter). The market reaction to the capex forecast is measured by the cumulative abnormal return (CAR: firm return minus S&P500 index return) over five days around the forecast date (+-2 days corresponding to the forecast date). CAPX_FORE is the capex forecast by firms, and CAPX_ACT is the actual capex made by firms in the forecast year. I include a set of control variables, such as size, lag CAPEX, Earnings surprise, market return, and EPS dummy. I augment Equation (4.1) with firm and Year fixed effects, and in terms of clustering, I tabulate results on both the firm and year levels.

Table 8: Summary Statistics

Variables	N	Mean	SD	25%	50%	75%
CAPX_ADJ	10471	10.516	105.850	-15.093	0.000	12.300
CAR	10471	0.621	9.243	-3.686	0.565	4.866
SIZE	10471	8.116	1.686	6.984	8.090	9.258
CAPX_ACT	10471	921.938	2603.555	42.551	155.069	692.233
CAPX_FORE	10471	945.311	2856.018	50.000	160.000	700.000
ES	10471	0.011	0.927	-0.123	-0.014	0.119
SURP	10437	0.247	4.628	-0.510	0.170	0.890

Table 9 shows the impact of passive ownership on managerial capex adjustments. I follow Jayaraman & Wu (2021) empirical setup for examining the effect of passive ownership on managerial through feedback channel. For my sample, in column 1, the CAR is positive and significant (1.605). In column 2, the coefficient of PO^{ALL} is significantly negative (-0.789). In column 4, the coefficient of CAR becomes insignificant, but the coefficient of PO^{ALL} is significantly negative. This shows that in firms with higher passive ownership, capex adjustments are lower, as managers do less revision on their actual capital expenditures from their guidance. Also, the effect of CAR has less effect in the presence of passive ownership. These results indicate that firms with higher passive ownership receive less feedback on their guidance, and the market reaction to the guidance is less valuable to managers. So, managers do not learn any information from the feedback and do less revision to their capital expenditures. This is in line with prior evidence that passive owners are associated with less information production and have constraints on making trading decisions based on any information. Thus, passive owners provide less feedback to managers on their capex guidance, leading to less revision of their beliefs, reflected by the lower capex adjustments of firms with high passive ownership. This feedback channel is another mechanism through which passive owners negatively affect managerial learning and investment-price sensitivity.

Table 9: Passive ownership and Managerial Learning

	Dependent variable:			
	CAPX_ADJ			
	(1)	(2)	(3)	(4)
$\boldsymbol{PO^{ALL}}$		-0.789^{***}		-1.228^{*}
		(-2.658)		(-1.992)
CAR	1.605^{**}	1.470^{**}	1.281^{*}	1.243
	(2.199)	(1.984)	(1.799)	(1.730)
CAPX	-0.0001	-0.0003	-0.001	-0.001
	(-0.110)	(-0.316)	(-0.683)	(-0.686)
SIZE	2.204^{*}	2.703^{**}	8.896^{**}	8.843^{***}
	(1.865)	(2.211)	(2.874)	(2.904)
ES	-1.902	-2.197	-1.705	-1.885
	(-1.164)	(-1.369)	(-0.830)	(-0.947)
EPS Dummy	-10.130^{***}	-9.990^{***}	-4.812^{**}	-4.806^{**}
	(-3.672)	(-3.664)	(-2.624)	(-2.581)
MKTRET	0.970	0.910	0.662	0.632
	(1.007)	(0.950)	(0.675)	(0.651)
SURP	-0.591	-0.599	-0.676	-0.698
	(-0.850)	(-0.866)	(-0.835)	(-0.875)
Clustering	F	F	F,Y	F,Y
Fixed effects	None	None	F,Y	F,Y
Observations	10,437	10,437	10,437	10,437
Adjusted R^2	0.003	0.004	0.093	0.094

This table presents the results on the impact of passive ownership (PO^{ALL}) on the capex adjustments. The dependent variables *, **, and *** denote the significance at 10%, 5%, and 1%, respectively.

5 Robustness Tests

In this section, I examine the robustness of passive ownership's impact on the firms' investment-price sensitivity. To do so, I reclassify passive funds in terms of their characteristics and run the baseline regression. In particular, I examine the two characteristics of the funds, industry exposure, and trading behavior, measured through the portfolio turnover ratio. I also examine the robustness of the results by controlling for the manager's information to account for any substituting effect and financial constraints of the firm as a control, which may affect investments.

5.1 Industry vs Non-Industry Passive Funds

Our main results show that passive owners negatively affect managerial learning in terms of weaker investment-price sensitivity, making managers give less weightage to stock prices while making investment decisions. Passive owners affect managerial learning through price informativeness and feedback channel mechanisms. To examine the robustness of the negative impact of passive ownership, I examine the source of the lack of information production among passive funds. Prior literature shows that ownership by sector-focused ETFs improves price efficiency and investment-price sensitivity, while broad-market-based ETF ownership negatively affects price efficiency and does not have any effect on investment-price sensitivity (Bhojraj et al. (2020), Antoniou et al. (2022)). I follow a similar rationale and examine what type of passive owners negatively affect managerial learning based on the industry exposure of passive ownership.

I examine the impact of passive ownership on investment-price sensitivity based on the fund's industry exposure. I classify a passive fund as an industry passive fund if the fund has more than 50% of its holding stocks from the same industry, based on Fama French 12 industry classification. Otherwise, it is classified as a non-industry passive fund. Table 10 shows that, on average, the number of industries an industry fund is exposed to is only 2, while non-industry funds are exposed to about eight industries. Among passive ownership, more than 90% of the funds are non-industry funds (Section 2). Also, industry funds are smaller in size ($233 Million) in terms of AUM compared to non-industry funds ($739 Million).

Table 10: Fund Statistics

Fund Type	Avg(#Ind)	Avg.AUM(max.Ind)	Avg.AUM(Total)
Industry fund	2.11	98833612	233027128
Non-Industry fund	8.47	139728004	739097549

Table 12 shows the results on the impact of passive ownership on investment-price sensitivity based on their industry exposure type. I interact passive ownership by industry and non-industry funds separately on Q. The coefficient for $Q \times PO^{IND}$ is only significant and positive for CHASSET. In contrast, the $Q \times PO^{NIND}$ coefficient is significantly negative for CAPX, CAPXRND, and CHASSET and only negative for RND. This shows that the negative effect of passive ownership on investment-to-price sensitivity comes from non-industry passive funds. The effect of industry-specific passive funds is insignificant because, even if they bring any new information that could be already captured in Q, their effect on investment-price sensitivity is insignificant.

5.2 Passive by Action

In this section, I examine the impact of ownership by funds, which are passive in terms of their action, on the investment efficiency of firms. I classify funds into passive based on their portfolio turnover ratio (PTR), which reflects how much the funds churn their portfolio. I measure PTR as follows:

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

Here, Buy and Sell refers to the value of stocks the fund i bought or sold in time t and, AUM refers to the total asset value of the fund holdings at time t.

Table 11: Summary of PTR by fund type

Fund Type by Name	Mean	P10	P25	Median	P75
Active	19.83	0.04	0.15	0.42	1.00
Passive	1.47	0.02	0.07	0.24	0.73

Table 12: Passive ownership by industry exposure and investment-price sensitivity

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * PO^{NINDUS}	−0.037***	−0.052***	−0.273***	−0.018
	(−6.426)	(−3.766)	(−3.297)	(−1.623)
Q * PO^{INDUS}	−0.004	−0.039	0.763**	−0.047
	(−0.139)	(−0.495)	(2.217)	(−0.748)
Q	0.748***	1.873***	8.956***	1.093***
	(12.150)	(16.500)	(11.820)	(15.750)
PO^{NINDUS}	0.069***	0.086**	0.615***	0.024
	(4.291)	(2.563)	(3.813)	(0.994)
PO^{INDUS}	−0.172	−0.561***	−3.383***	−0.288**
	(−1.503)	(−2.971)	(−3.714)	(−2.231)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.619	0.737	0.355	0.879
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	60,689	60,689	60,689	60,689

This table presents the results on the impact of passive ownership, based on their industry exposure (PO^{NIND} and PO^{IND}) on the investment-price sensitivity. The dependent variables *, **, and *** denote the significance at 10%, 5%, and 1%, respectively.

The mechanical trading behavior of passive funds is reflected in their lower trading frequency, and their lower trading frequency is an essential means through which they negatively affect the investment-price sensitivity of firms. This raises the question of whether ownership by funds with a lower trading frequency impacts firms' managerial learning from stock prices. So, I classify a fund as a passive fund if the fund has less than 24% PTR, which is the median PTR of actual passive funds (PO^{ALL}). Some passive funds have multiple reasons for higher churning in their portfolio; for example, a Russell 3000 fund has to adjust its portfolio of 3000 stocks compared to a fund replicating an index with a lower number of stocks. But, if a fund that claims to be active has a trading frequency less than a median passive fund, it creates an apprehension about whether these funds are active and whether they really bring any valuable information for managers to learn from the stock price. Thus, classifying the funds based on their churning behavior brings a new perspective for examining the real impact of passive ownership. As mentioned earlier, I classify funds with less PTR than a median passive fund by claim as passive funds by action. The mean passive ownership, in terms of action (PO^{ACT}), is 9.55%, more than double the actual passive ownership. This shows that most funds that claim to be active are passive in their action, meaning they trade less than a passive fund. So, it is essential to understand the effect of these passive (in terms of action) funds on firms' managerial learning and investment-price sensitivity. Thus, I run my baseline analysis based on this classification, and the results are shown in Table 13.

Table 13 shows the results of the impact of passive ownership, in terms of their action (PO^{ACT}) on the investment-price sensitivity of firms. The main coefficient of interest, $Q * PO^{ACT}$ is negative and significant

for all investment measures, except RND. This result indicates that, as expected, firm ownership by passive funds in terms of their action (low PTR) negatively affects firms' investment-price sensitivity. One particular interpretation of this result is that the ownership by passive funds, in terms of their action, does less portfolio churning. Through this, they bring less liquidity into markets. It is evident from prior literature that liquidity is an essential factor that positively affects the price informativeness of stocks (Kerr et al. (2020)). Thus, the firms with higher ownership by passive funds, in terms of their action, have lower investment- price sensitivity, as these passive funds trade less and so, managers give less weightage to stock prices when making investment decisions. In Table A3, I show that passive ownership negatively affects stock price informativeness, such that firms with higher passive ownership, in terms of action, are associated with lower stock price informativeness.

Table 13: Passive ownership by action and investment-price sensitivity

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * PO^{ACT}	−0.018***	−0.026***	−0.102**	−0.010
	(−4.952)	(−2.898)	(−2.075)	(−1.675)
Q	0.791***	1.942***	9.200***	1.119***
	(11.890)	(15.730)	(11.730)	(14.590)
PO^{ACT}	0.019*	0.017	0.233**	0.004
	(1.857)	(0.852)	(2.058)	(0.315)
Controls	Yes	Yes	Yes	Yes
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	60,154	60,154	60,154	60,154
Adjusted R^2	0.620	0.738	0.353	0.879

This table presents the results from the regression of firm investments (CAPX, CAPXRND, and CHASSET) on the interaction of Tobin's Q and passive ownership by action ($Q * PO^{ACT}$). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

5.3 Controlling for manager's information and financial constraints

Next, I examine the effect of passive ownership on investment-price sensitivity by controlling for the manager's information and the firm's financial constraints. Our main results show that passive owners negatively affect managerial learning from stock prices as they bring less firm-specific information. Does this lead to a substitution effect where managers substitute their learning from investors for another alternative avenue? To examine this effect, I control the number of analysts following the firm, as analysts are an essential source of outside information for managers (Bakke et al. (2010)). I also control for the firm's financial constraints, as financially constrained firms give more weight to market information, as they may have to raise funds for investments.

Table 14 shows the impact of passive ownership on investment-to-price sensitivity by controlling for managerial information and financial constraints. I control for managerial information using the proxy, the number of analysts following the firm, and financial constraint by using the KS index (Kaplan & Zingales (1997)). The main results still hold that the coefficient of interaction between Q and PO^{ALL} is negative and signif-

icant for all CAPX and CAPXRND. At the same time, it is only negative for CHASSET and RND, after controlling for the manager's alternative source of information, proxied by the number of analysts and the financial constraint of the firm. The coefficient of NUMEST is positive for all investment measures, pointing out that outside information from analysts guides managers in making investments. However, for CHASSET and RND, the interaction coefficient of NUMEST and PO^{ALL} is negatively significant, showing that the effect of analyst information is lower for investments in CHASSET and RND.

Table 14: Controlling for manager's information and financial constraints

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * PO^{ALL}	−0.033***	−0.043**	−0.134	−0.014
	(−5.402)	(−2.631)	(−1.336)	(−1.233)
Q	0.765***	1.853***	8.921***	1.070***
	(11.160)	(14.390)	(11.550)	(14.650)
NUMEST * PO^{ALL}	−0.008	−0.041	−1.022**	−0.052**
	(−0.272)	(−1.005)	(−2.234)	(−2.360)
NUMEST	0.461***	1.201***	6.479***	0.746***
	(2.872)	(5.929)	(5.701)	(6.255)
KZ INDEX * PO^{ALL}	−0.003	−0.004	0.074	0.001
	(−0.606)	(−0.597)	(1.556)	(0.219)
KZ INDEX	0.098***	−0.036	−0.447	−0.161***
	(3.215)	(−0.670)	(−0.845)	(−3.576)
PO	0.081	0.151	2.874**	0.137**
	(1.015)	(1.529)	(2.429)	(2.527)
Controls	Yes	Yes	Yes	Yes
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	53,455	53,455	53,455	53,455
R^2	0.679	0.779	0.445	0.898
Adjusted R^2	0.630	0.745	0.359	0.883

5.4 Testing Nonlinearity

Conventionally, the impact of passive ownership on price informativeness is negative, as passive owners have a lower incentive to acquire firm-specific information. However, empirical research has documented that price informativeness tends to be higher for firms with large shares of passive owners. Buss & Sundaresan (2020) shows that an increase in the aggregate size of passive owners positively affects price informativeness, and the effect is amplified cross-sectionally. Thus, at a higher level, the passive owners' effect is more sophisticated than the conventional view. Therefore, this section examines the impact of passive owners on investment-

price sensitivity at higher levels of passive owners. To study the effect, I estimate the following nonlinear regression model:

$$INV_{i,t} = \alpha_t + \beta_1 Q_{i,t-1} + \beta_2 Q_{i,t-1} \times PO^{ALL}_{i,t-1} + \beta_3 PO^{ALL}_{i,t-1} + \beta_4 Q_{i,t-1} \times PO^{ALL2}_{i,t-1} + \beta_5 PO^{ALL2}_{i,t-1} + \psi \xi_{t-1} + \epsilon_t \quad (5.1)$$

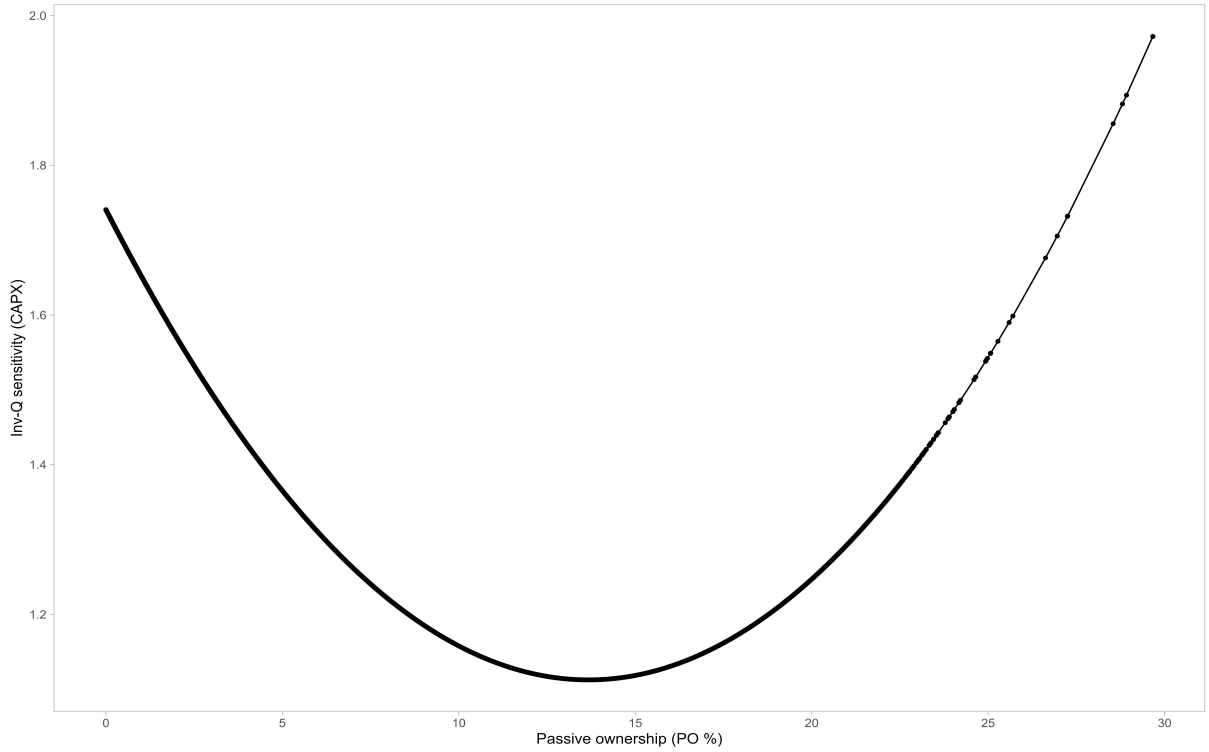
Table 15: Passive Ownership and investment-price sensitivity

	Dependent variable:			
	CAPX	CAPXRND	CHASSET	RND
	(1)	(2)	(3)	(4)
Q * PO^{ALL}	−0.072***	−0.105**	−0.415*	−0.047
	(−4.017)	(−2.377)	(−1.756)	(−1.627)
Q * PO^{ALL2}	0.002***	0.003*	0.014	0.002
	(2.938)	(1.718)	(1.431)	(1.233)
Q	0.806***	1.964***	9.352***	1.139***
	(10.800)	(14.250)	(10.570)	(13.770)
PO^{ALL}	0.063	0.021	0.330	0.017
	(1.316)	(0.212)	(0.801)	(0.264)
PO^{ALL2}	−0.002	−0.0003	−0.008	−0.001
	(−0.929)	(−0.079)	(−0.455)	(−0.304)
Controls	Yes	Yes	Yes	Yes
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	60,770	60,770	60,770	60,770
Adjusted R^2	0.619	0.736	0.354	0.878

This table presents the results from the regression of firm investments (CAPX, CAPXRND, and CHASSET) on the interaction of Tobin's Q and passive ownership ($Q * PO^{ALL}$). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Equation (5.1) includes the squared term of passive ownership ($PO^{ALL2}_{i,t-1}$) and the product of $Q_{i,t-1} \times PO^{ALL2}_{i,t-1}$ in addition to the terms included in Equation (3.1). The results of this estimation are reported in Table 15, and our focus is on the coefficient estimate of $Q_{i,t-1} \times PO^{ALL2}_{i,t-1}$. Overall, the results show that the impact of passive owners on the sensitivity of investment-to-prices follows a nonlinear pattern. The magnitude of the coefficient β_4 is 0.002 for CAPX, and it is also statistically significant at the 1% level. Figure 2 plots the impact of passive ownership on investment-price sensitivity for different levels of PO^{ALL}. I find a tipping point around 15%, beyond which passive ownership enhances a firm's investment-price sensitivity measure by CAPX.

Figure 2: The Impact of Passive Ownership on Investment-to-Price Sensitivity Measured by CAPEX.
This figure illustrates the nonlinear impact of the firm's normalized stock price ($Q_{i,t}$) on the investment-price sensitivity for different levels of passive ownership. The nonlinear relation is calculated using the coefficient estimates from the regression Equation (5.1), and results reported in Table 15, by allowing the level of passive ownership to vary from low to high.



6 Conclusion

In this paper, I provide new evidence on the negative impact of growth in passive ownership on manager's investment decisions. I show that firms with high passive ownership negatively affect managerial learning, leading to weaker investment-price sensitivity. Firms with high passive ownership are associated with lower stock price informativeness. Managers also receive less feedback from passive owners on their guidance, leading to lower capex adjustments based on feedback from passive owners.

This weaker managerial learning due to increased passive ownership has a higher likelihood of under-investment and a lower likelihood of over-investment, and overall, firms with higher passive ownership invest less. This less investing could be substituted by paying out more when there isn't enough information to guide investments. I find evidence supporting this managerial action that firms with lower investment-price sensitivity have higher payouts to shareholders in terms of dividends and share repurchases. This substitution effect is actually associated with better operating performance in terms of ROA and asset turnover ratio. However, lower investments due to increased passive ownership lead to lower sales growth. Overall, it turns out that passive owners do not provide enough information to guide investments of firms, leading to less investment and more payout to shareholders. And, such firms have better operating performance of firms.

This negative effect of passive ownership on managerial learning from stock price is robust to classifying passive ownership based on the industry exposure of funds, their portfolio turnover ratio, and controlling for managers' alternative information environment. Also, I find a nonlinear effect of passive ownership on investment-price sensitivity. Investment-price sensitivity decreases with an increase in passive ownership till 15%, and after that level, the investment-price sensitivity increases with an increase in passive ownership.

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7 Appendix

Table A1: Variables Definitions

Variable	Definition
PO^{All}	Passive Ownership: the percentage of shares held in September of year t by passive mutual funds
PO^{R2000}	The percentage of shares held in September of year t by index funds whose name contains "2000"
PO^{R1000}	The percentage of shares held in September of year t by index funds whose name contains "1000"
CAPX (%)	Capital expenditures at fiscal year-end divided by lagged total assets.
CAPXRND(%)	Investment is defined as capital expenditures (Compustat capx) plus R&D (Compust xrd) divided by lagged total assets (Compustat at).
CHASSET (%)	Change in total assets computed as the percentage change in total assets from year $t-1$ to year t.
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 prcc_f * csho) plus the book value of the assets minus the book value of the equity (Compustat ceq) divided by the book value of the assets.
ROA	Income before extraordinary items (Compustat item IB) scaled by total assets
CF	Cash flow is defined as net income before extraordinary items (Compustat ib) plus depreciation and amortization expenses (Compustat dp) plus R&D expenses (Compust xrd) divided by lagged assets.
CASH	The ratio of cash and cash equivalent to total assets.
SIZE	The natural logarithm of the firm's market capitalization at the fiscal year-end.
RET	The annualized stock return of firm i for the following three years starting at the start of fiscal year t+1. For creating this variable, a stock must have future returns of at least one year.
LEV	The sum of long-term and current liabilities scaled by total assets.
INVAST	The inverse of the total assets.
SG	Annual growth rate in sales revenue at the firm level.
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.

Table A2: Sample Construction

	Firm-Year observation
CRSP data over the sample period	195104
Intersection of Thompson S12 data and CRSP	83341
Merging this with COMPUSTAT data and removing missing observations:	
CAPX	(7057)
Q	(191)
CF	(1775)
Size	(15)
SG	(1142)
CASH	(5)
LEV	(12129)
Total Dividends	(169)
Total Long term debt	(88)
Final Intersection of Thompson S12 data, CRSP and COMPUSTAT	60,770

Figure 3: Impact of Q on Investment for different levels of Passive Ownership.

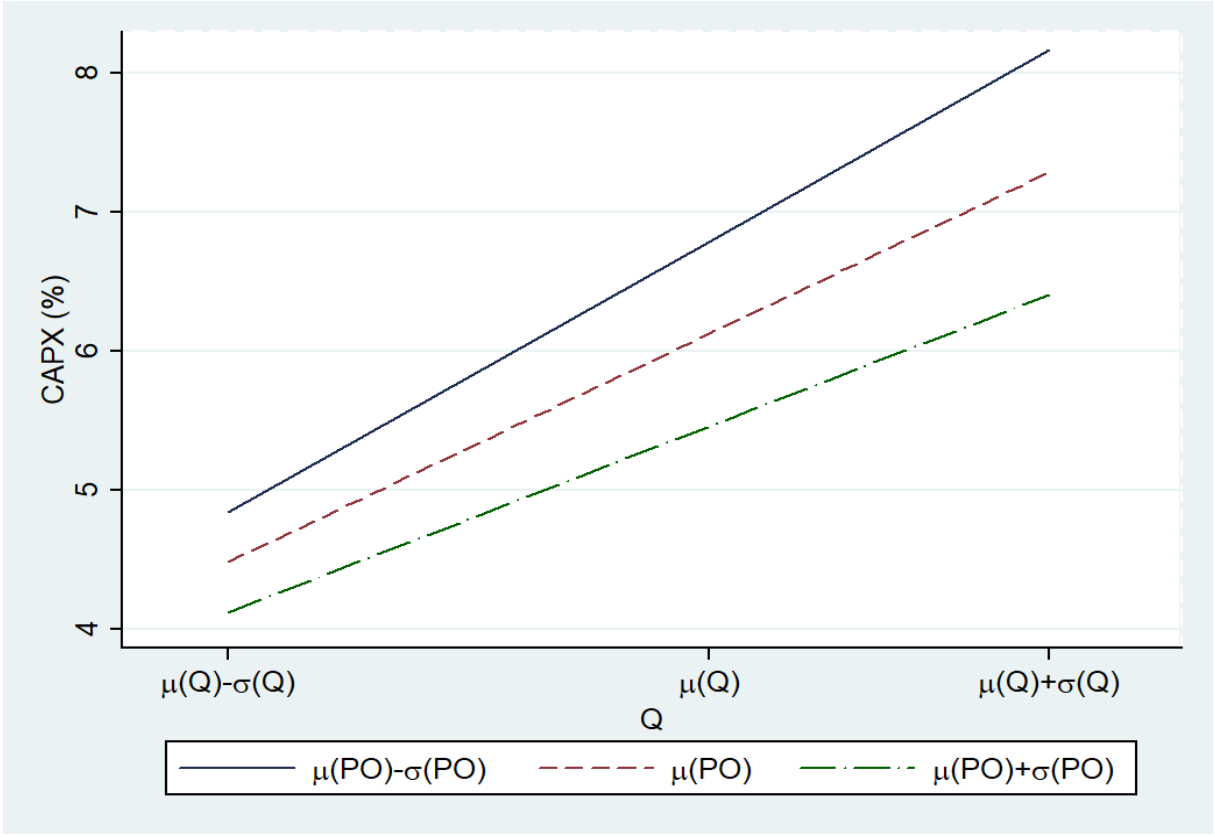

Table A3: Passive ownership by action and price informativeness

	Dependent variable:		
	NSYNC	Gamma	OVR
	(1)	(2)	(3)
PO^{ACT}	−0.001***	−0.0004*	−0.002***
	(−4.317)	(−1.842)	(−3.728)
Q	−0.001	−0.003***	0.003*
	(−0.490)	(−3.046)	(1.887)
CF	−0.051***	−0.020**	0.004
	(−4.176)	(−2.446)	(0.315)
SIZE	−0.048***	−0.002	0.007
	(−15.010)	(−0.967)	(1.343)
RET	0.017**	0.001	−0.017
	(2.489)	(0.160)	(−1.507)
SG	−0.00000	−0.00001	0.0001***
	(−0.163)	(−0.904)	(3.062)
CASH	−0.009***	−0.001	0.009
	(−3.710)	(−0.350)	(1.585)
LEV	0.016**	0.003	−0.046***
	(2.245)	(0.364)	(−2.969)
ROA	0.0002	0.00002	−0.0003*
	(1.666)	(0.395)	(−1.856)
INVAST	−0.001***	−0.00000	−0.004***
	(−4.431)	(−0.019)	(−6.395)
Adjusted R^2	0.779	0.043	0.451
Fixed effects	Yes	Yes	Yes
Observations	60,154	60,154	60,154

This table presents the results on the impact of passive ownership on the operating performance of firms. The dependent variables are the measures of operating performance: return on assets (ROA), sales growth (SG), and asset turnover ratio (AT). The main independent variable, NEG, is a dummy variable that takes 1. if the firm residual is negative from Equation (3.6). All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Table A4: Number of Switchers in different bandwidth Size

Bandwidth	$R2000 \rightarrow R1000$	$R1000 \rightarrow R2000$
100	412	328
150	660	544
200	906	697
250	1085	838
300	1240	960
350	1352	1041
400	1413	1120
450	1475	1185
500	1526	1240

Table A5: Passive ownership and firm payout

	Dependent variable:			
	DIV	DIV_YIELD	PAYOUT	REPURCH
	(1)	(2)	(3)	(4)
NEG	0.050***	0.0002***	0.142***	0.186***
	(3.203)	(4.654)	(9.507)	(9.899)
Controls	Yes	Yes	Yes	Yes
Adjusted R^2	0.853	0.610	0.809	0.617
Fixed effects	F,Y	F,Y	F,Y	F,Y
Observations	52,898	52,898	49,577	49,581

This table presents the results on the effect of lower investment-price sensitivity due to increased passive ownership on firms' payout policies. The dependent variable includes payout measures, such as dividend, dividend yield, payout (sum of dividend and repurchases), and repurchases. All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Table A6: Passive ownership and operating performance of firms - CHASSET

	Dependent variable:					
	ROA_{t+1}	ROA_{t+3}	SG_{t+1}	SG_{t+3}	AT_{t+1}	AT_{t+3}
	(1)	(2)	(3)	(4)	(5)	(6)
NEG	−0.430***	−0.208**	−8.081***	−3.604***	−1.526***	−0.595*
	(−5.832)	(−2.290)	(−15.130)	(−12.700)	(−5.067)	(−1.756)
Q	0.060	0.143	4.025***	3.140***	0.237	0.295
	(0.554)	(0.667)	(9.239)	(8.032)	(1.054)	(1.015)
CF	92.780***	46.840***	75.460***	10.670***	3.801	−15.370***
	(28.570)	(49.570)	(9.659)	(3.399)	(0.902)	(−5.583)
SIZE	0.216	0.309	−3.760***	−5.261***	−1.863***	−2.916***
	(1.164)	(1.653)	(−6.136)	(−12.520)	(−5.219)	(−6.013)
RET	−1.361***	4.437***	−8.354***	0.891	5.062***	7.266***
	(−4.331)	(12.820)	(−5.377)	(0.871)	(7.968)	(8.030)
CASH	−0.166	−0.372	10.020*	5.168**	−1.777*	−1.235
	(−0.164)	(−1.081)	(2.044)	(2.329)	(−1.851)	(−1.368)
LEV	2.233***	4.133***	−0.351	−12.080***	20.730***	18.000***
	(4.195)	(6.893)	(−0.137)	(−7.237)	(9.848)	(8.969)
INVAST	0.054**	0.045*	0.226**	0.204***	−0.019	−0.114**
	(2.105)	(1.722)	(2.640)	(2.895)	(−0.433)	(−2.051)
ROA	0.007	0.018*				
	(0.586)	(1.882)				
SG			−0.127**	−0.061***		
			(−2.401)	(−7.140)		
AT					0.621***	0.485***
					(34.930)	(23.770)
Adjusted R^2	0.894	0.819	0.422	0.615	0.928	0.939
Fixed effects	F,Y	F,Y	F,Y	F,Y	F,Y	F,Y
Observations	52,905	44,848	52,840	44,745	52,905	44,854

This table presents the results on the impact of passive ownership on the operating performance of firms. The dependent variables are the measures of operating performance: return on assets (ROA), sales growth (SG), and asset turnover ratio (AT). The main independent variable, $Ranking_{i,t}$ All models include both firm and year fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.

Table A7: Passive ownership and operating performance of firms - Ranking Approach

	Dependent variable:					
	ROA_{t+1}	ROA_{t+3}	SG_{t+1}	SG_{t+3}	AT_{t+1}	AT_{t+3}
	(1)	(2)	(3)	(4)	(5)	(6)
$Ranking_{i,t}$	−0.001	−0.010***	−0.057***	−0.038***	−0.028***	−0.009
	(0.002)	(0.003)	(0.011)	(0.008)	(0.008)	(0.010)
Q	0.023	0.113	3.232***	2.758***	0.103	0.244
	(0.106)	(0.206)	(0.429)	(0.340)	(0.216)	(0.286)
CF	92.680***	46.720***	73.160***	9.412***	3.611	−15.460***
	(3.261)	(0.953)	(7.703)	(3.099)	(4.205)	(2.753)
SIZE	0.296	0.400**	−2.140***	−4.472***	−1.492***	−2.779***
	(0.184)	(0.183)	(0.611)	(0.398)	(0.370)	(0.488)
RET	−1.286***	4.454***	−7.035***	1.475	5.301***	7.364***
	(0.310)	(0.348)	(1.486)	(1.027)	(0.621)	(0.908)
CASH	0.094	−0.282	14.280***	7.119***	−1.060	−0.935
	(0.987)	(0.354)	(5.005)	(2.464)	(0.901)	(0.880)
LEV	2.590***	4.295***	6.156**	−9.079***	22.050***	18.530***
	(0.537)	(0.566)	(2.526)	(1.608)	(2.073)	(1.927)
INVAST	0.049*	0.039	0.120	0.152**	−0.041	−0.122**
	(0.025)	(0.026)	(0.084)	(0.069)	(0.042)	(0.055)
ROA	0.007	0.018*				
	(0.011)	(0.010)				
SG			−0.109**	−0.052***		
			(0.054)	(0.009)		
AT					0.615***	0.483***
					(0.018)	(0.020)
Adjusted R^2	0.894	0.819	0.413	0.611	0.928	0.939
Fixed effects	Yes	Yes	Yes			
Observations	52,905	44,848	52,840	44,745	52,905	44,854

This table presents the results on the impact of passive ownership on the operating performance of firms. The dependent variables are the measures of operating performance: return on assets (ROA), sales growth (SG), and asset turnover ratio (AT). The main independent variable, $Ranking_{i,t}$, is the percentile rank of passive ownership at the firm-year level. All models include both firm and year-fixed effects. t-statistics (in brackets) are computed based on standard errors that are double clustered by firm and year. *, **, and *** denote the significance at 10%, 5%, and 1% respectively. For detailed definitions of each variable, refer to Table A1.