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École affiliée à l'Université de Montréal

Three Essays on Institutional Investors and Firms' Characteristics

par
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Résumé

Dans le premier chapitre, en utilisant les données de Thomson Reuters 13F, nous trouvons des preuves empiriques significatives pour la plupart des prédictions de (Rajan, 2006) démontrant l'effet de différentes caractéristiques des taux d'intérêt sur les préférences des investisseurs institutionnels en matière de risque. Les investisseurs institutionnels détiennent des actions plus risquées lorsque les taux d'intérêt sont bas. Ils détiennent des actions moins risquées quand ces taux sont élevés. Cela s'explique principalement par leurs préférences pour les actions présentant un risque systématique plus élevé, et non idiosyncrasique, lorsque les taux d'intérêt sont bas. Ils ajoutent un risque systématique à leurs portefeuilles dans des environnements à taux d'intérêt bas, détenant des actions avec des betas de marché et de taille élevés. Cependant, contrairement aux prévisions de Rajan, nous trouvons peu de preuves significatives de l'effet d'un contexte dans lequel les taux d'intérêt sont constamment bas et moins volatiles sur les préférences des investisseurs institutionnels en matière de risque ou de ses composantes.

Dans le deuxième chapitre, nous analysons l'effet causal des investisseurs institutionnels sur le niveau de volatilité des actions et ses composants (volatilités idiosyncrasiques et systématiques). Nous démontrons tout d'abord l'effet de causalité en utilisant l'adhésion à l'indice Russell 2000 comme mesure de l'actionnariat institutionnel, et ce, basé sur (Crane et al., 2016). Nous documentons que, pour une entreprise médiane Russell 1000, une augmentation de l'écart-type de l'actionnariat institutionnel au cours d'un trimestre résulte en une diminution de la volatilité idiosyncrasique de 13,3% en termes annualisés. Cela entraîne une diminution de la volatilité totale de 12,8%. Les investis-

seurs institutionnels atteignent cet effet sur les caractéristiques de risque d'une entreprise en partie grâce à leur incidence sur la performance financière de cette entreprise, mesurée par ses revenus inattendus. Plus précisément, une augmentation de l'actionnariat institutionnelle augmente la performance financière de l'entreprise, ce qui se traduit par une diminution de sa volatilité totale et idiosyncrasique.

Dans le troisième chapitre, nous analysons les préférences et les effets des investisseurs institutionnels sur la valorisation des entreprises, laquelle est représentée par le ratio ajusté de la valeur au livre sur la valeur marchande. En premier lieu, nous étudions si les investisseurs institutionnels ont une préférence pour les entreprises de valeur. Nous documentons qu'après avoir pris en compte d'autres caractéristiques propres aux entreprises, les investisseurs institutionnels ont une préférence marquée pour les entreprises sous-évaluées. Ensuite, pour analyser l'effet de l'actionnariat institutionnel sur la valorisation des entreprises, nous avons établi l'effet de causalité et montré que les investisseurs institutionnels augmentent considérablement la valorisation des entreprises. En outre, une étude détaillée révèle que les investisseurs institutionnels augmentent considérablement la valorisation des entreprises sous-évaluées, mais que cet effet est plus marqué pour les entreprises surévaluées. Enfin, nous concluons que non seulement les investisseurs institutionnels recherchent activement des entreprises sous-évaluées, mais qu'ils augmentent également la valeur de celles-ci après leur détention.

Mots-clés

Investisseurs institutionnels, Caractéristiques de risque, Taux d'intérêt bas, Comportement de prise de risque, Valorisation des entreprises

Méthodes de recherche

Économétrie, Finance Empirique.

Abstract

In the first chapter, using Thomson Reuters 13F data, we find strong empirical evidence for most of (Rajan, 2006) predictions on the effect of different interest rate characteristics on institutional investors' preferences for risk. Institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high. This is mostly due to their preferences for stocks with higher systematic, rather than idiosyncratic, risk when interest rates are low. They add systematic risk to their portfolios in low-interest rate environments by holding stocks with high market and size betas. However, in contrast to Rajan's predictions, we do not find much significant evidence on the effect of persistently low and less volatile interest rate environment on institutional investors' preferences for risk or its components.

In the second chapter, we analyze the causal effect of institutional investors on stock level volatility and its components (Idiosyncratic and Systematic volatilities). We first establish the causal effect by employing Russell 2000 index membership as an instrument for institutional ownership following (Crane et al., 2016). We document that for a median Russell 1000 firm, a one standard deviation increase in institutional ownership in a given quarter causes a decrease in idiosyncratic volatility of 13.3% in annualized terms, which results in a decrease in total volatility of 12.8%. Institutional investors achieve this effect on a firm's risk characteristics partially through their effect on its financial performance, as measured by unexpected earnings. More precisely, an increase in institutional ownership increases a firm's financial performance, which turns to a decrease in its total and idiosyncratic volatility.

In the third chapter, we analyze institutional investors preferences for and effects on the firms' valuation, which is proxied by the firms' industry adjusted book to market ratio. In the first place, we study whether institutional investors have any preference for value firms. We document that after controlling for other firm-level characteristics, institutional investors have significant preferences toward undervalued firms. Then, to analyze the effect of institutional ownership on firms' valuation we established the causal effect and showed that institutional investors significantly increase firms' valuation. Furthermore, in a detailed study, it is revealed that institutional investors significantly increase undervalued firms valuation, but this effect is stronger for overvalued firms. Finally, we conclude that not only institutional investors actively are seeking undervalued firms, but they also increase firms' valuation after holding them.

Keywords

Institutional investors, Risk characteristics, Low interest rate, Risk taking Behavior, Firm valuation

Research methods

Econometrics, Empirical Finance.

Contents

List of Tables

List of Figures

General Introduction

This thesis is mainly about institutional investors' preferences and effects in the equity market. In the first chapter, we study institutional investors' preferences for equity market risk characteristics and analyze how different interest rate environment would alter these preferences. In the second chapter, we investigate how and through which mechanisms institutional investors influence firm-level risk measures and its components. Finally, in the third chapter, we analyze institutional investors' preferences and effect on the firm's valuation measures.

Policymakers and academics agree that the risk-taking behavior of institutional investors might have significantly contributed to the recent financial crisis. For example, (Yellen, 2011) argues that the excessive risk taken by investment managers prior to the crisis lead to the emergence of financial imbalances that in turn threatened the financial stability. In the first chapter titled "Interest Rates and Institutional Investors' Preferences for Risk", based on the discussion in (Rajan, 2006), we develop and test several hypotheses on the effects of interest rate environment on institutional investors' preferences for risk. Using Thomson Reuters 13F data, we find strong empirical evidence for most of (Rajan, 2006) predictions on the effect of different interest rate characteristics on institutional investors' preferences for risk. Institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high. This is mostly due to their preferences for stocks with higher systematic, rather than idiosyncratic risk when interest rates are low. By studying the change in T-bill rate, we document that institutional investors search for yield by holding more stocks with high total risk when

interest rate decreases. In this transition, they particularly prefer holding stocks with high systematic risk, especially those with the high market and SMB betas. We also distinguish between increases and decreases in the interest rate level and find that their effects are statistically different from each other. Decreases in the interest rate level have economically more important effects on institutional investors' preferences for total risk than increases. By studying categories of institutional investors suggested by (Bushee, 1998, 2001), we document that categories of institutional investors react similarly to the low-interest rate environment by holding stocks with higher total volatility. However, this effect is more pronounced for investors categorized as Quasi-Indexers and Dedicated investors compared to Transient institutional investors. These differences are mainly due to their investment horizon and the fact that Quasi-Indexer and Dedicated investors are more long-term investors compared to Transient investors. Nevertheless, in contrast to Rajan's predictions, we do not find any significant evidence on the effect of persistently low and less volatile interest rate environment on institutional investors' preferences for risk.

In the second chapter, "The Causal Effect of Institutional Ownership on Firm Level Risk Characteristics." we analyze the effect of institutional investors' on firm-level risk characteristics. Specifically, as we document in our above-mentioned chapter, institutional investors have preferences for certain firm-level characteristics. Hence, it is relatively difficult to distinguish between their effects on and preferences for firm-level risk characteristics. In this paper, we fill this gap by establishing a causal effect of institutional ownership on risk characteristics. We achieve identification using the inclusion in the Russell 2000 index as an instrumental variable for institutional ownership following (Crane et al., 2016). Specifically, we show that inclusion in the Russell 2000 index near the threshold is exogenous to risk, except through its effect on institutional ownership, and use discontinuity in index weights around the threshold as our instrumental variable for institutional ownership. We show that an increase in institutional ownership of a given stock decreases its total and idiosyncratic volatility a quarter later but does not affect its systematic risk. Furthermore, we find this effect to be more pronounced for institutional investors categorized as Transient investors. We also contribute to the literature by ana-

lyzing the sources of this causal effect, which the previous literature mostly ignores. We do this using mediation analysis to investigate the mechanism through which institutional investors affect the risk characteristics of firms in their holdings. Using different proxies as mediators, we conclude that institutional investors mainly reduce a firm 's volatility by increasing its performance proxied by its earnings per share.

Furthermore, in the third chapter "Institutional Investors' Preferences for and Effects on the Value / Growth Firms", we analyze whether institutional investors have preferences for undervalued stocks. Then, we investigate how institutional investors affect the relative valuation of these stocks. We measure undervaluation of a stock based on its industry adjusted book to market ratio which gives a relative measure of firms' value/growth standing in its industry. We document that on average, institutional investors do indeed have preferences for undervalued stocks. In the categories of institutional investors, we show that Quasi-Indexers and Dedicated investors prefer undervalued firms. However, Transient investors hold more overvalued stocks. After determining the preference of institutional investors, on the second part of the paper, we study the effect of institutional investors on firms' valuation measure using the suggested methodology by (Crane et al., 2016; Wurgler, 2010). Results show that institutional investors increase significantly firm's valuation after holding them. In the categories of institutional investors, our results show that Quasi-Indexers and Transient investors increase firms' valuation, and this effect is stronger for Transient investors. Finally, we link the preference and effect of institutional investors by analyzing the effect of institutional ownership on undervalued/overvalued firms. Our results show that institutional investors significantly increase the valuation of undervalued firms and this effect is stronger for overvalued ones. We can conclude that institutional investors prefer undervalued firms and they increase the valuation of these firms after owning them.

Chapter 1

Interest Rates and Institutional Investors' Preferences for Risk

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Abstract

Using Thomson Reuters 13F data, we find strong empirical evidence for most of Rajan's (Rajan, 2006) predictions on the effect of different interest rate characteristics on institutional investors' preferences for risk. Institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high. This is mostly due to their preferences for stocks with higher systematic, rather than idiosyncratic risk when interest rates are low. They add systematic risk to their portfolios in low interest rate environments by holding stocks with high market and size betas. However, in contrast to Rajan's predictions, we do not find much significant evidence on the effect of persistently low and less volatile interest rate environment on institutional investors' preferences for risk or its components.

1.1 Introduction

Policymakers and academics agree that the risk-taking behavior of institutional investors might have significantly contributed to the recent financial crisis. For example, (Yellen, 2011) argues that the excessive risk taken by investment managers prior to the crisis lead to the emergence of financial imbalances that in turn threatened the financial stability. Following the crisis, many have suggested interest rates play an important role in investment managers' risk taking behavior ((Rajan and Lines, 2010), (Yellen, 2011) and (Stein, 2013)). Even before the financial crisis, (Rajan, 2006) among only a few others points to the importance of the interest rate environment on institutional investors' attitudes towards risk and return. What separates (Rajan, 2006) from the discussion following the financial crisis is that he makes ex-ante predictions rather than providing ex-post explanations.

In this paper, based on the discussion in (Rajan, 2006), we develop and test several hypotheses on the effects of interest rate environment on institutional investors' preferences for risk. Our first hypothesis is about the effects of interest rate level. (Rajan, 2006) predicts that institutional investors shift their investments to riskier options when interest rates are low and become more conservative and hold less risky stocks when interest rates are high. This risk taking behavior has been termed "reaching for yield" during low interest rate environments, such as the one leading up to the financial crisis, and policymakers argue that it has been an important contributing factor to the financial crisis. ((Rajan and Lines, 2010), (Yellen, 2011) and (Stein, 2013)). Our second hypothesis is about the effects of changes in interest rate level. (Rajan, 2006) argues that a shift from high to low-interest rate environment might put upward pressure on stock prices in the market and might also leave institutions with high fixed rate commitments. A shift in interest rates in the other direction might put downward pressure on stock prices and might induce flight-to-quality and force institutions to search for liquid and less risky stocks. Thus, we expect institutional investors to hold riskier stocks when interest rates decrease and to hold less risky stocks when they increase. Our third hypothesis is about the asymmetric effects of increases and decreases in interest rate level. Although (Rajan, 2006)

does not explicitly discuss any asymmetries, we expect decreases in interest rate level to have a more important effect on institutional investors' preferences for risk than increases since most policymakers agree that low-interest rate environments play a more important role in institutional investors' incentives. Our fourth hypothesis is on the effect of the persistence of the interest rate environment. (Rajan, 2006) argues that compensation of institutions like hedge funds, which are based on nominal returns, might be persistently low in persistently low-interest rate environments if they do not search aggressively for higher returns by taking higher risk. Thus, we hypothesize that investors take on additional degree of risk when the level of interest rates have been low for several periods and eliminate an additional degree of risk from their portfolios when the level of interest rates have been high for several periods. Our fifth and final hypothesis is on the effect of interest rate volatility. (Rajan, 2006) alludes to the possibility that risk appetites of institutional investors might increase as interest rates fall and also become less volatile. We thus expect institutional investors to take on additional degree of risk when interest rates have low volatility and to eliminate additional risk from their holdings when interest rates are volatile.

We test these hypotheses using ownership data from Thomson Reuters 13F data, which reports the equity ownership of all institutional investors with more than $100 million filed with the SEC each quarter. We match this data to CRSP and COMPUSTAT and compute institutional ownership of each stock in each quarter between 1980 and 2014 as the percentage of its outstanding shares owned by all institutions in the 13F data. We proxy the risk of stock in a given quarter by its realized variance computed as the standard deviation of excess returns in that quarter. As the previous literature has shown (see (Falkenstein, 1996), (Dahlquist and Robertsson, 2001) , (Gompers and Metrick, 2001), (Bennett et al., 2003)), institutional investors preferences for a given stock might depend on other factors such as its size, book-to-market ratio, liquidity of the stock, in addition to its risk. We control for the effect of other factors on institutional investors' preferences by estimating cross-sectional regressions of the institutional ownership on the market value of equity, book-to-market ratio, 3 and 12 month cumulative returns including the current

quarter and illiquidity measure of (Amihud, 2002) in each quarter. We use the residuals from these cross-sectional regressions, i.e., residual institutional ownership unexplained by these factors, as our main variable of interest. This approach also allows us to remove the upward trend in institutional ownership in our sample period. We then sort stocks into terciles in each quarter based on their risk and test our hypotheses by running time series regressions of the equally-weighted average of residual ownership in each tercile on different interest rate variables while controlling for other stock and bond market and macroeconomic variables. For example, we test our first hypothesis by separately regressing the equally-weighted average of residual ownership in each tercile on the contemporaneous interest rate level and control variables. Given that we use residual ownership, which sums up to zero across stocks in a given quarter, as our dependent variables, the coefficient estimates on interest rate variables sum up to zero and can be interpreted as migration of institutional investors from one part of the risk spectrum to another part.

We start our analysis with the effect of interest rate level, which we proxy by the daily average of 3-month T-bill rate in a given quarter, on institutional investors' preferences for risk. Our results provide strong empirical evidence in support of our first hypothesis that institutional investors hold riskier stocks when the level of interest rates are low and fewer risky stocks when they are high. To be more precise, institutional investors hold relatively more stocks with low volatility in their portfolios when the interest rates are high. On the other hand, institutional investors hold fewer stocks with medium and high total volatility in their portfolios. Comparing the economic importance of the T-bill rate and the control variables show that interest rate level is also the economically most important variable in determining the ownership, especially for low-risk stocks. Furthermore, the T-bill rate by itself explains above 35% of the variation in the ownership in low and medium volatility stocks while it is about only 12% for high volatility stocks.

We then decompose the total risk into systematic and idiosyncratic risks and analyze the effect of interest rate level on institutional investors' preferences for these components. Although (Rajan, 2006) and others do not distinguish between the components of total risk, this allows us to understand better how interest rate level affects institutional

investors' preferences for total risk. To do this, we regress the daily excess returns of the stock in each quarter on the excess return on the market portfolio and the size, the book-to-market and momentum factors from Ken French's website. The idiosyncratic risk is then defined as the standard deviation of the residuals from this regression, and the systematic risk is defined as the square root of the difference between squared total risk (realized variance) and squared idiosyncratic risk (residual variance). We sort firms into terciles first based on their systematic risks and then sort the firms in each tercile into further terciles based on their idiosyncratic. We run separate time-series regressions of the equally-weighted average of residual ownership in each of the nine categories on the contemporaneous T-bill rate and control variables. Institutional investors preference for stocks with low risk when interest rates are high is mostly due to their preferences for stocks with lower systematic, rather than idiosyncratic, risk. To be more precise, when the T-bill rate is high, institutional investors prefer to hold more stocks with low systematic risk regardless of their idiosyncratic risk. They also tend to hold fewer stocks with medium to high systematic and medium idiosyncratic risk when the risk-free rate is high.

We then take a closer look at the effect of interest rate level on institutional investors' preferences for the components of systematic risk. To this end, we sort stocks into terciles based on their betas on one of the four risk factors, market, size, book-to-market, and momentum factors, which are employed to decompose their total risk into systematic and idiosyncratic risks. Then, we run separate time series regressions of the equally-weighted average of residual ownership in each tercile on the contemporaneous T-bill rate and control variables. Our results suggest that institutional investors' preference for stocks with low systematic risk in high-interest rate environments is mostly due to their preferences for stocks with low market and size risks but high momentum risk. In other words, when interest rates are high, institutional investors switch from stocks with medium to high market and SMB betas and low UMD betas to those with low market and SMB betas and high UMD betas. Interest rate level does not seem to affect their preferences for stocks with different HML betas.

To test our second hypothesis on the effect of changes in interest rate level, we de-

compose the current level of the T-bill rate into its previous level and change. We then run time series regressions of average residual ownership in different risk categories on these two components and control variables. Our results provide strong empirical support for our second hypothesis that institutional investors search for yield by holding more stocks with high total risk when interest rate decrease. In such decreasing interest rate environments, institutional investors search for yield in stocks with medium to high systematic and idiosyncratic risks, especially those with high systematic but medium idiosyncratic risks. Furthermore, they look for systematic risk in decreasing interest rate environments by holding more stocks with high market and SMB betas.

We then analyze the empirical evidence for the third hypothesis by decomposing changes in interest rate level into increases and decreases. In line with our third hypothesis, the effects of increases and decreases in the interest rate level are statistically different from each other and decreases in the interest rate level have economically more important effects on institutional investors' preferences for total risk than increases. To be more precise, institutional investors switch from medium to low-risk stocks when the T-bill rate increases. They do this by eliminating mostly systematic risks from their portfolios, but at the same time they tend to increase the idiosyncratic risk of their portfolios. On the other hand, they search for yield by switching from low to medium and high-risk stocks when the T-bill rate decreases. They do this by investing mostly in stocks with medium to high systematic risk but medium idiosyncratic risk. Furthermore, an increase in the T-bill rate increases the institutional ownership in stocks with the low market and SMB betas and decreases the institutional ownership in stocks with the high market and SMB betas, while a decrease in the T-bill rate has exactly the opposite effect. The main asymmetry is observed in institutional investors' preferences for stocks with different UMD betas. A decrease in the T-bill rate makes institutional investors hold more stocks with low UMD betas and fewer stocks with medium to high UMD betas, while an increase in the T-bill rate does not significantly affect their preferences for stocks with different UMD betas.

The empirical evidence for fourth and fifth hypotheses are weaker. Regarding our fourth hypothesis, we do not find any significant effect of persistently low-interest rates

on institutional investors' preferences for total risk or its components. However, when interest rates have been persistently high, institutional investors decrease the risk of their portfolio by switching from stocks with medium and high volatility to stocks with low volatility. They achieve this derisking in persistently high-interest rate environments by mostly switching from stocks with medium and high idiosyncratic risk to stocks with low idiosyncratic risk. Regarding our fifth hypothesis, although we find some evidence that institutional investors switch from stocks with medium and high volatility to stocks with low volatility stocks following periods of high-interest rate volatility, this effect of lagged interest rate volatility becomes statistically insignificant when we control for the contemporaneous interest rate level. In line with this finding, we do not find any strong empirical evidence on the effect of interest rate volatility on institutional investors' preferences for idiosyncratic and systematic risks.

Moreover, we extend our analysis to the categories of institutional investors. We utilize the classification suggested by (Bushee, 2001, 1998) in which he classified institutional investors based on their holdings turn over and diversification, and we found that different categories of institutional investors have similar tendency to expose to higher levels of risk and avoid lower levels of risks when the interest rate is low or decreases. However, there are some differences in the categories. More precisely, the effect of T-bill rate level is more pronounced for investors categorized as Quasi-Indexers and Dedicated as they tend to have longer investment horizons compared to Transient institutional investors. On the other hand, Transient and Quasi-Indexer investors' holdings show a spontaneous reaction to the contemporaneous change in T-bill rate since they are short-term investors compared to Dedicated investors.

Our paper is related to prior empirical literature on the effect of low-interest rate environment leading up to the financial crisis on money fund managers' risk-taking behavior (see (Di Maggio, 2016) , (Kacperczyk and Schnabl, 2013), (Strahan and Tanyeri, 2014), and (Di Maggio and Kacperczyk, 2017)). In line with our results for our first hypothesis, these studies find empirical evidence that the low-interest rate environment before the crisis might have induced money fund managers to reach for yield by taking risk. Our

paper contributes to this literature in several dimensions. First and foremost, to the best of our knowledge, we are the first to analyze the effect of different interest rate characteristics, and not only its level, on institutional investors' preferences for risk in different interest rate environments, including but not limited to the low-interest rate environments. Second, we are also the first to analyze the effects of interest rate characteristics on institutional investors' preferences for idiosyncratic and systematic risk as well as the components of systematic risk. Our results suggest that institutional investors search for yield in low-interest rate environments by holding fewer stocks with low systematic risk and more stocks with medium to high systematic risk but only medium idiosyncratic risk. Finally, we also analyze the effect of investors' expectations about future interest rates on institutional investors' preferences for risk.

The rest of the paper is organized as follows. Section 1.2 summarizes the existing theoretical and empirical literature. Section 1.3 discusses our hypotheses and the intuition behind them. Section 1.4 presents our data and some preliminary results. Section 1.5 presents our main set of results on the effects of different interest rate characteristics on institutional investors' preferences for total risk. Section 1.6 analyzes the effect of investors' expectations about future interest rates on institutional investors' preferences for risk. Finally, Section 1.8 concludes.

1.2 Literature review

The interest rate environment surrounding the financial crisis has led to an intense debate on its effect on investors' risk-taking behavior and has been the subject of intense coverage in the business publications and online outlets. As mentioned in the introduction, there is now a growing empirical literature on this issue (see (Di Maggio, 2016) , (Kacperczyk and Schnabl, 2013), (Strahan and Tanyeri, 2014), and (Di Maggio and Kacperczyk, 2017), among others). However, the theoretical literature on this issue is relatively limited and revolves mostly around speeches and opinion pieces by policymakers and academics. In addition to the those mentioned in the introduction, (Antolin et al., 2011) discuss the

effect of low-interest rates on insurance companies and pension funds. They argue that the solvency status of insurers and pension funds – which was badly damaged during the crisis - could fail to improve or even show some deterioration. (Belke, 2013) argues that if low-interest environment lasts, a very low nominal short-term rate can disrupt financial markets by encouraging investors to increase risk-taking and promoting the emergence of asset price bubbles. (Charles, 2017) in his speech mentions that US economy is on track to experience stable economic growth in the coming years and there is not much room left to decrease policy rates when the need emerges again. So he suggests a gradual path to adjust funds rate back to its long-run rate by adjusting risk management policies which lower the chance that policymakers experience zero-lower-Bound outcomes in future. Also (Mersch, 2016) warns about economic, legal and social impacts of current low-interest environment and he believes the longer the period, the stronger the effects will be, and he encourages policymakers to act to leave this situation.

Our paper is also related and contributes to the literature on institutional investors' preferences. (Falkenstein, 1996) documents that U.S. mutual funds tilt their portfolios towards large firms, and showed that mutual funds have a significant preference towards stocks with high visibility and low transaction costs, and are averse to stocks with low idiosyncratic volatility. (Del Guercio, 1996) examines the holdings of mutual funds and banks in 1988. She finds that banks tilt their portfolios more heavily toward "prudent" stocks and that the institutional preferences for prudence characteristics are relatively stable from 1988 to 1991. (Gompers and Metrick, 2001) find that American institutions invest in firms that are larger, more liquid, and have had relatively low returns during the previous year. (Dahlquist and Robertsson, 2001) shows that foreign institutional investors show a preference for large firms, firms paying low dividends, and firms with large cash positions on their balance sheets and a preference against firms with large dominant owners. When they further analyze the preference of foreign institutional investors for large firms, they find that market liquidity and presence in international markets, measured through export sales or listings on other exchanges, seem to characterize foreign holdings better than firm size alone. However, most of this literature does not consider any time

variation in institutional investors' preferences. The only exception to this is (Bennett et al., 2003), which also considers about time variability of institutional investors' preferences. Their findings suggest that institutional investors shifted their preferences toward smaller and riskier stocks over time. They argue that this shift in aggregate preferences is mainly because of changes in the preferences of each group of institutional investors rather than the change of relative importance of different types of institutional investors.

1.3 Hypotheses Development

In this section, we develop our testable hypotheses on the effect of different interest rate characteristics on institutional investors' preferences for risk. Although the theoretical literature on this issue is relatively limited, the financial crisis lead to a very active discussion on this issue. For example, several policy makers since the financial crisis discuss the effects of interest rates on the risk taking behavior of investment managers (see (Rajan and Lines, 2010), (Yellen, 2011) and (Stein, 2013)). However, this discussion following the financial crisis provides ex-post explanations, rather than ex-ante predictions, for the observed risk taking behavior of institutional investors in the low interest rate environment leading up to the financial crisis. On the other hand, (Rajan, 2006) among only few others makes several ex-ante predictions on the effects of different interest rate characteristics on institutional investors' preferences for risk, which we can test during and after the financial crisis as well as before it. For these reasons, our discussion here mostly focuses on the predictions of (Rajan, 2006), which have been also proposed by others following the financial crisis.

The most prominent hypothesis in this literature is on the effect of interest rate level on institutional investors' preferences for risk. To be more precise, (Rajan, 2006) predicts that institutional investors shift their investments to riskier options when interest rates are low and become more conservative and hold less risky stocks when interest rates are high. This risk taking behavior has been termed "reaching for yield" during low interest rate environments, such as the one leading up to the financial crisis. To illustrate his

point, (Rajan, 2006) provides several examples on how low interest rates would induce managers to look for riskier investment options. The first example he provides is based on insurance companies and their commitments. He argues that insurance companies might not have another alternative but to shift to riskier investments given that they might have fixed rate commitments. To be more precise, they might need to default on their commitments based on previously higher interest rate if they keep their safe investments which now offer lower rates of return due to decreasing interest rates. In the opposite scenario when the interest rates increase, he argues that insurance companies can meet their commitments without having to take additional risk. The second example he provides is based on hedge funds and their compensation structure. He argues that, when interest rates are high, hedge fund managers do not need to take additional risk since their returns, and thus their compensation, would be high due to high interest rates. On the other hand, when interest rates are low, the returns in financial markets would also be low on average and thus hedge fund managers need to search for additional risk to maximize their return and compensation. Although through different channels, Rajan (2006) predicts that institutional investors shift their investments to riskier options when interest rates are low and become more conservative when they are high. Thus, our first hypothesis can be summarized as:

H1: Institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high.

(Rajan, 2006) also argues that switching from high to low interest rate environment might have different effects on the risk characteristics of institutional investors's holdings. Specifically, he argues that a shift from high to low interest rate environment might put upward pressure on stock prices in the market and might also leave institutions with high fixed rate commitments, as discussed above. On the other hand, a shift in interest rates in the other direction might put downward pressure on stock prices and might induce flight-to-quality and force institutions to search for liquid and less risky stocks. Based on this discussion, our second hypothesis is

H2: Institutional investors hold riskier stocks when interest rates decrease and hold less risky stocks when they increase.

Although (Rajan, 2006) does not explicitly discuss any asymmetries in the effects of increases and decreases in the interest rate level. However, as suggested in 1.2 many authors have discussed the importance and consequences of low interest rate environment rather than high interest rate environment (e.g. (Antolin et al., 2011; Belke et al., 2013; Charles, 2017; Mersch, 2016)). Hence, we expect decreases in interest rate level to have a more important effect on institutional investors' preferences for risk than increases since, as discussed above, most policy makers agree that low interest rate environments play a more important role in institutional investors' incentives. Hence, our third hypothesis can be expressed as follows:

H3: Increases and decreases in the interest rate have asymmetric effects on the institutional investors' preferences towards risky stocks.

(Rajan, 2006) also argues that the persistence of the interest rate environment might have an effect on investors' preferences towards risk. In a persistently low interest rate environment, he argues that the compensation of institutions like hedge funds, which are based on nominal returns, might also be persistently low if they do not search aggressively for higher returns by taking higher risk. (Yellen, 2011) argues a similar point in her speech at the 2011 International Conference: Real and Financial Linkage and Monetary Policy. Thus, our fourth hypothesis is on the relation between the persistence of the interest rate environment and institutional investors' holdings and can be summarized as follows:

H4: Institutional investors take on additional degree of risk when the level of interest rates have been low for several periods and eliminate an additional degree of risk from their portfolios when the level of interest rates have been high for several periods.

Finally, (Rajan, 2006) alludes to the possibility that interest rate volatility might also play role in institutional investors' attitudes towards risk. Although he does not explicitly discuss this issue in detail, he argues that risk appetites might increase as interest rates fall and also become less volatile. (Yellen, 2011) also points to a shift to riskier assets by institutional investors when the volatility of interest rates is low. Our fifth hypothesis can then be summarized as:

H5: Institutional investors take on additional degree of risk when interest rates have

low volatility and eliminate additional risk from their holdings when interest rates are volatile.

(Rajan, 2006) and others are relatively vague about the exact definition of risk in their discussions. In the context of institutional investors' stock holdings, this opens the possibility to test these predictions for different dimensions of risk associated with stocks. Specifically, we start our analysis with total risk as measured by a stock's total variance. We then decompose total risk into systematic and idiosyncratic risk and analyze their attitudes towards these two types of risks as a function of interest rates. We then further decompose systematic risk into its components and analyze the effect of interest rates on institutional investors' preferences for different types of systematic risk.

1.4 Data

1.4.1 Institutional Ownership

Our main dataset is the 13F filings, where all institutional investors with more than $100 million in equity ownership report their holdings to the SEC each quarter. We access this data via Thomson Reuters between 1980 and 2014. We aggregate each institutional investor m's holdings in stock i in quarter t (own_{imt}) and divide it by the total number of shares outstanding of stock i in quarter t ($share_{it}$) to obtain our main variable of interest, namely the percentage of stock i by institutional investors:

$$Own_{it} = \sum_{m=1}^{M} \frac{own_{imt}}{shares_{it}} \tag{1.1}$$

We merge this dataset with CRSP and COMPUSTAT using CUSIPs and company names as discussed in the appendix, to obtain stock and firm-level characteristics.

In this paper, we are mainly interested in the institutional investors' preferences for risk and its components. We use the realized variance defined as standard deviation of daily excess returns on a stock in a given quarter as our measure of total risk. We then decompose total risk into systematic and idiosyncratic risks based on the Fama-French

four factor model. More precisely, we regress the daily excess returns of a stock in a given quarter on the excess return on the market portfolio (MKT) and the size (SMB), the book-to-market (HML) and momentum (UMD) factors. The idiosyncratic risk is then defined as the standard deviation of the residuals from this regression, and the systematic risk is defined as the square root of the difference between squared total risk (realized variance) and squared idiosyncratic risk (residual variance). In order to limit the effect of outliers, in regression setups we use log transformation ($log(1+Own_{it})$) for ownership measure, and logarithm of risk measures.

To understand institutional investors' preferences for total risk and its variation over time, we sort stocks into terciles in each quarter based on their total risk and present the equally weighted average of percentage ownership by institutional investors (Own_{it}) in each tercile in Figure 1.1. First of all, there is a clear time trend in institutional ownership in stocks regardless of their total risk. Institutional ownership in stocks with low and medium total risk increases from about 20% in 1980 to above 50% in 2014 while institutional ownership in stocks with high risk increases from about 10% in 1980 to above 30% in 2014. Second, institutional investors preferences for stocks with different risks exhibit significant variation around this time trend, which we will discuss in further detail below. Third, institutional investors always allocate more of their portfolio to stocks with low and medium risk, suggesting that they have a clear preference for these stocks over stocks with high risk. Finally, although they also prefer low-risk stocks over medium risk stocks in the earlier part of our sample, this preference disappears in the second part of our sample.

We then decompose their preferences for risk into their preferences for systematic and idiosyncratic risks separately. We do this in a similar fashion by sorting stocks into terciles in each quarter depending on their systematic or idiosyncratic risk independently and present the equally weighted average of percentage ownership by institutional investors (Own_{it}) in each tercile of systematic risk in panel (a) and idiosyncratic risk in panel (b) of Figure 1.2. First of all, institutional investors do not seem to have a clear preference for systematic risk in the early part of our sample up until the late 1980s. They exhibit

a clear preference for stocks with low and medium systematic risk over stocks with high systematic risk between the late 1980s and late 1990s. This preference changes significantly in the early 2000s when they hold more stocks with medium and high systematic risk compared to stocks with low systematic risk until the end of our sample in 2014. On the other hand, their preferences for idiosyncratic risk mimic their preferences for total risk. In other words, they apparently prefer to hold more stocks with low and medium idiosyncratic risks over stocks with high idiosyncratic risks, although these preferences still exhibit significant variation over time.

Finally, we present the institutional investors' preferences for the components of systematic risk in Figure 1.3. We follow a similar approach of sorting stocks into terciles based on their market, SMB, HML, and UMD betas independently and present the equally weighted average of percentage ownership by institutional investors (Own_{it}) in each tercile. Although there are some interesting patterns in institutional investors' preferences for stocks with different SMB, HML and UMD betas, such as their preferences for stocks with medium HML and UMD betas in the earlier part of our sample, institutional investors have clear preferences only for market risk. They prefer to hold fewer stocks with low market risk compared to stocks with medium and high market risk. This difference in institutional ownership in stocks with low and high market risk is less pronounced in the earlier part of our sample but becomes more evident after the late 1990s.

In addition to volatility and its components, institutional investors' preferences might depend on other factors, such as size, book-to-market ratio, liquidity of the stock. We control for the effect of other factors on institutional investors' preferences by estimating cross-sectional regressions of institutional ownership (own_{it}) on size measured as the market value of equity at the end of the quarter, book-to-market ratio measured as the book value of equity divided by the market value of equity at the end of the quarter, 3 and 12 month cumulative returns including the current quarter and the illiquidity measure of (Amihud, 2002) computed as the sum of absolute daily returns divided by the daily dollar trading volume (multiplied by the number of trading days in that quarter). We then use the residuals from these cross-sectional regressions, i.e., institutional ownership un-

explained by these factors, as residual ownership variable. Given that our cross-sectional regressions in each quarter include a constant, the residual ownership across stocks in each quarter sum up to zero and, thus, also removes the trend in institutional ownership discussed above.

1.4.2 Interest Rate Variables

We are interested in the effect of different variables related to interest rates on the institutional investors' preferences for different dimensions of risk. We start our analysis on the effect of interest rate levels where we use the daily average of 3-month T-bill rate in a given quarter as our main proxy for the level of interest rates. We then focus on the effect of the term structure of interest rates. We do this by extracting the term structure factors based on the (Nelson and Siegel, 1987) approach. Specifically, the three factor Nelson-Siegel yield curve can be written as follows:

$$y_t(\tau) = f_{1,t}\alpha_{\tau,1} + f_{2,t}\alpha_{\tau,2} + f_{3,t}\alpha_{\tau,3}, \tag{1.2}$$

where $y_t(\tau)$ is the yield on a zero-coupon government bond with a maturity of τ periods. We use the Fama-Bliss discount bond yields for $\tau = 1, 3, 12, 24, 36, 48$, and 60 months as our proxies for $y_t(\tau)$. Following (Diebold and Li, 2006), we define the factor loadings as $\alpha_{\tau,1} = 1$, $\alpha_{\tau,2} = \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau}\right)$, and $\alpha_{\tau,3} = \left(\frac{1-e^{-\lambda\tau}}{\lambda\tau} - e^{-\lambda\tau}\right)$, where λ governs the exponential decay rate and is set to 0.0609.[1] In this context, the factor $f_{1,t}$ captures the level of the yield curve: an increase in $f_{1,t}$ raises equally the yields of all maturities. The factor $f_{2,t}$ corresponds to the negative of the slope of yield curve. For ease of interpretation, we multiply $f_{2,t}$ by -1 so that an increase in $-f_{2,t}$ raises long yields more than the short ones. The factor $f_{3,t}$ is related to the curvature of the yield curve: an increase in $f_{3,t}$ has little effects on very short and very long yields, but raises medium-term yields. We estimate

[1] Setting λ to 0.0609 is appropriate for two reasons. First, (Diebold and Li, 2006) show that λ determines the maturity at which the loading on the medium-term, or curvature, factor achieves it maximum, and that $\lambda = 0.0609$ when the maturity is 30 months — i.e. the average of the maturities of two or three years that are commonly used for this purpose. Second, (Gilli et al., 2010) show that $\lambda = 0.0609$ offers the empirical advantage that the resulting factor loadings are not highly correlated.

these factors via Ordinary Least Squares (OLS) on the Nelson-Siegel yield curve (1.2) for each quarter.

1.4.3 Control Variables

In addition to interest rates, institutional investors' preferences towards different characteristics might depend on other macroeconomic and business factors. We categorize these variables into three groups and control for them in our analysis. The first group is stock market variables and include the quarterly return and realized volatility (computed as the sum of square daily returns) of the S&P 500 index and an aggregate illiquidity measure (computed as the equally-weighted average of stock-level Amihud illiquidity measures). The second group is the bond market variables and includes the term spread (computed as the yield difference between the ten-year treasury bond and three-month Treasury bill), the default spread (computed as the yield difference between Moody's BAA and AAA-rated corporate bond indices) and credit spread (computed as the yield difference between Moody's AAA-rated corporate bond index and three month treasury bill). The third group is macroeconomic variables and include the growth rate of GDP, inflation rate and the real-time probability of recession. Stock and bond market variables, except for aggregate illiquidity measure, as well as the inflation rate are from Amit Goyal's website, while the growth rate of GDP and the real-time probability of recession are from the Federal Reserve Bank of St. Louis. In our robustness checks, we also include the TED spread, which is only available starting 1986.

1.5 The Effect of Interest Rate Environment on Institutional Investors' Preferences for Total Risk

1.5.1 Interest Rate Level

In this section, we examine the effect of interest rate levels on institutional investors' preferences for risk. We start our analysis with total risk as measured by total volatility, where we regress the demeaned average ownership in total volatility terciles on the T-bill rate. Given the demeaned nature of our ownership measures, the coefficient estimates on the T-bill rate across regressions sum up to zero. Thus, they can be interpreted as the migration of institutional investors from one part of the total risk spectrum to another part. More precisely, a positive coefficient on the T-bill rate for a given volatility category would imply that institutional investors migrate into that category while a negative sign is suggesting migration from that category when the T-bill rate is high.

Table 1.1 presents these coefficient estimates on the T-bill rate in regressions with and without control variables in panel (a) and their economic importance in panel (b). These results provide strong empirical evidence in support of our first hypothesis that institutional investors hold riskier stocks when the level of interest rates are low and fewer risky stocks when they are high. To be more precise, institutional investors hold relatively more stocks with low volatility in their portfolios when the interest rates are high. On the other hand, institutional investors hold fewer stocks with medium and high total volatility in their portfolios. These results remain unchanged whether or not we include control variables. Comparing the economic importances of the T-bill rate and the control variables show that interest rate level is also the economically most important variable in determining the ownership, especially for low volatility stocks. Furthermore, the T-bill rate by itself explains above 35% of the variation in the ownership in low and medium volatility stocks while it is about only 12% for high volatility stocks.

Among the control variables, stock market variables seem to have significant effects

on the institutional ownership in stocks with different volatilities.[2] Institutional investors hold more low volatility stocks and fewer high volatility stocks in their portfolios when the stock market return is high, and stock market liquidity is low. These results are broadly in line with our discussion in Section 1.3. To be more precise, the institutional investors do not need to search for yield and, thus, choose to invest more in low volatility stocks when returns are already high. On the other hand, when markets are illiquid and, thus, riskier, they prefer to hold less risky investment, such as low volatility stocks.

We then turn our attention to the effect of interest rate level on institutional investors' preferences for the components of total risk, i.e., systematic and idiosyncratic risks. We first sort firms into terciles based on their systematic (idiosyncratic) risks and then sort the firms in each tercile into further terciles based on their idiosyncratic (systematic) risks. We then regress the demeaned average ownership in each of the nine categories on the T-bill rate and control variables. Table 1.2 presents the coefficient estimates on the T-bill rate. As mentioned before, the coefficient estimates in each panel sum to zero since our dependent variables are demeaned. Thus, each panel can be interpreted as the migration matrix of institutional investors' from one part of the systematic/idiosyncratic spectrum to another part. These results suggest that institutional investors preference for lower volatility stocks when interest rates are high is mostly due to their preferences for lower systematic, rather than idiosyncratic risk. To be more precise, when the T-bill rate is high, institutional investors prefer to hold more stocks with low systematic risk regardless of their idiosyncratic risk. They also tend to hold fewer stocks with medium to high systematic and medium idiosyncratic risk when the risk-free rate is high. In other words, these results suggest that institutional investors search for yield in low interest rate environments by holding fewer stocks with low systematic risk and more stocks with medium to high systematic risk but only medium idiosyncratic risk.

We now take a closer look at the effect of interest rate level on institutional investors' preferences for the components of systematic risk. To this end, we sort stocks into terciles based on their betas on one of the four risk factors, market, size, book-to-market, and

[2]GDP growth also has a significant coefficient estimate but only for medium total volatility stocks.

momentum factors, which are employed to decompose their total risk into systematic and idiosyncratic risks. Table 1.3 presents the coefficient estimates on the T-bill rate from regressions of the demeaned average ownership in each tercile from the sort based on a given risk factor on the T-bill rate and control variables. Our results from Table 1.2 suggest that institutional investors prefer to hold more stocks with low systematic risk when interest rates are high. Results in Table 1.3 suggest that this is mostly due to their preferences for stocks with low market and size risks but high momentum risk. In other words, when interest rates are high, institutional investors switch from stocks with medium/high market and SMB betas and low UMD betas to those with low market and SMB betas and high UMD betas. Interest rate level does not seem to affect their preferences for stocks with different HML betas.

1.5.2 Changes in Interest Rate Level

In this section, we decompose the current level of the T-bill rate into two components, its previous level and change, and test our second hypothesis by considering the effects of these components on the institutional investors' preferences for risk jointly. The coefficient estimates on the lagged T-bill rate and change in the T-bill rate from regressions with and without control variables and their economic significance are presented in Table 1.4. These results provide strong empirical support for our second hypothesis that institutional investors hold fewer risky stocks when interest rates increase. More precisely, the change in the T-bill rate has a significantly positive effect on the institutional ownership in low volatility stocks and significantly negative effects on the institutional ownership in medium and high volatility stocks. These results also suggest that the T-bill rate has significant lagged effects on the institutional ownership in stocks with different volatilities similar to its contemporaneous effects. Furthermore, the effect of the lagged T-bill rate is at least three times more economically important than the effect of the change in the T-bill rate. In an unreported analysis, we include the current and lagged levels and find that the current level continues have effects similar to those reported in Table 1.4 while

the lagged effect changes and becomes mostly insignificant. In other unreported analysis, we also include further lags of the T-bill rate in our empirical specification and find that they are neither statistically significant nor affect the significance of the contemporaneous effect. These results suggest that institutional investors pay attention mostly to the current level of the interest rates, rather than its previous levels or change when allocating their portfolios between stocks with different volatilities.

As in the previous section, we examine the effects of the change in and lagged values of the T-bill rate on institutional investors' preferences for systematic and idiosyncratic risks. First of all, we find that the lagged effect of T-bill rate on institutional investors' preferences for systematic and idiosyncratic risks are similar to its contemporaneous effects. To be more precise, institutional investors prefer to hold more stocks with low systematic risk regardless of their idiosyncratic risk following an increase in interest rates. Furthermore, in line with our results in panel (a), the lagged effect becomes insignificant when we include the contemporaneous level of the T-bill rate instead of the change in the T-bill rate in our regressions. Hence, we do not present the coefficient estimates on lagged T-bill rate but only those on change in the T-bill rate in Table 1.4 panel (b). These results suggest that, when the T-bill rate decreases from its previous level, institutional investors search for yield in stocks with medium to high systematic and idiosyncratic risks, especially those with high systematic but medium idiosyncratic risks. On the other hand, when the T-bill rate increases, they prefer to hold more of the stocks with low to medium systematic or idiosyncratic risks.

Once again, we then examine the effect of change in and lagged values of the T-bill rate on institutional investors' preferences for components of the systematic risk. The lagged effects of the T-bill rate are very similar to its contemporaneous effects and, thus, are omitted from Table 1.4, which presents the coefficient estimates on the change in the T-bill rate. These results suggest that institutional investors search for yield in stocks with high market and SMB betas but low UMD betas when interest rates are decreasing. To be more precise, when the T-bill rate increases, institutional investors hold more stocks with low market and SMB betas and fewer stocks with medium to high market betas, high

SMB betas, and low UMD betas. However, the change in the T-bill rate does not affect their preferences for stocks with different HML betas.

1.5.3 Increases vs Decreases in Interest Rate Level

We now take a closer look at the effect of change in the T-bill rate by distinguishing between increases and decreases in the T-bill rate and considering them as separate variables in our empirical specifications. Table 1.5 presents the effects of increases and decreases in the T-bill rate on institutional investors' preferences for total risk in panel (a), for systematic and idiosyncratic risks in panel (b) and components of systematic risk in panel (c).

We start our discussion with institutional investors' preferences for total risk. These results point to certain asymmetries between the effects of increases and decreases in the T-bill rate on institutional investors' preferences for total risk and, thus, provide empirical support for our third hypothesis. To be more precise, when we do not include control variables in our empirical specification, only decreases in the risk-free rate affect institutional investors' preferences for total risk, with institutional investors holding significantly more stocks with high volatility and significantly fewer stocks with low volatility in their portfolios. When we control for other variables, institutional investors switch from medium to low volatility stocks when the T-bill rate increases and they switch from low to medium and high volatility stocks when the T-bill rate decreases. In an unreported analysis, we find that the effects of decreases and increases in the T-bill rate on the institutional ownership in a given volatility category are significantly different from each other. However, this is not the case when we compare the magnitudes (the absolute value of the coefficient estimates) of their effects. We also find that the economic significance of the decrease in the risk-free rate is much higher than that of increases.

Results in panel (b) suggest that when the T-bill rate increases, institutional investors hold more stocks with low systematic risk regardless of idiosyncratic risk and fewer stocks with medium to high systematic risk and medium idiosyncratic risk. In other words, when

T-bill rate increases, institutional investors tend to eliminate mostly systematic risks from their portfolios but might sometimes increase the idiosyncratic risk of their portfolios. On the other hand, when the T-bill rate decreases, they search for yield in mostly stocks with medium to high systematic risk but medium idiosyncratic risk. These results are robust to sorting stocks based on their idiosyncratic risk first and systematic risk after.

We now turn our attention results in panel (c). An increase in the T-bill rate increases institutional investors' ownership in stocks with low market and SMB betas and decreases that in stocks with high market and SMB betas, while a decrease in the T-bill rate has exactly the opposite effect. The main asymmetry is observed in institutional investors' preferences for stocks with different UMD betas. A decrease in the T-bill rate makes institutional investors hold more stocks with low UMD betas and fewer stocks with medium to high UMD betas, while an increase in the T-bill rate does not significantly affect their preferences for stocks with different UMD betas.

1.5.4 Persistence of Interest Rate Level

In this section, we examine the effect of persistently low and high interest rates on the institutional investors' preferences for risk. We do this by considering dummy variables capturing periods of low and high interest rates in our empirical specifications. We capture persistently low interest rate periods if the T-bill rate is lower than 2% for two consecutive quarters and, similarly, persistently high interest rate periods if the T-bill rate is higher than 5% for two consecutive quarters. In our sample period between 1980 and 2014, there are 37 quarters when the T-bill rate is lower than 2% for two consecutive quarters and 59 quarters when it is higher than 5% for two consecutive quarters.

Panel (a) of Table 1.6 presents the coefficient estimates on these two dummy variables in our empirical specifications with and without the T-bill rate and control variables. First of all, we do not find any evidence for the first part of our fourth hypothesis, suggesting that institutional investors do not seem to take on additional degree of risk when interest rates have been persistently low. On the other hand, there is strong empirical evidence

for the second part of our fourth hypothesis. To be more precise, when interest rates have been persistently high, institutional investors decrease the risk of their portfolio by switching from stocks with medium and high volatility to stocks with low volatility. Although not presented, this effect is economically important (more than half of the T-bill rate's economic importance) and explains, by itself, about 40% of the variation in the institutional ownership in stocks with low and medium volatility. Although these results are robust to changing the number of periods to three and four instead of two in our dummy variable definitions, they are not robust to using different cutoff values for low and high interest rate environments.

Panel (b) of Table 1.6 presents the effect of these dummy variables on institutional investors' preferences for systematic and idiosyncratic risks when we control for interest rate level and other variables. Persistently low interest rate environments do not seem to have any significant effect on institutional investors' preferences for systematic and idiosyncratic risks in line with our results for their preferences for total risk. On the other hand, when interest rates have been persistently high, they eliminate risk from their portfolios by mostly switching from stocks with medium and high idiosyncratic risk to stocks with low idiosyncratic risk. These results are robust to sorting based on first idiosyncratic and then systematic risk.

Finally, panel (c) presents the effect of these dummy variables on institutional investors' preferences for the components of systematic risk. We do not find any significant effect of persistently high or low interest rate environments on institutional investors' preferences for components of systematic risk. This is not surprising and in line with the lack of any consistent pattern in the effects of these variables on institutional investors preferences for systematic risk.

Overall, these results suggest that there is some but weak evidence for our fourth hypothesis. More precisely, we do not find any significant effect of persistently low interest rates on institutional investors' preferences for total risk or its components. On the other hand, when interest rates have been persistently high, institutional investors decrease the risk of their portfolio by switching from stocks with medium and high volatility to stocks

with low volatility. They seem to achieve this derisking in persistently high interest rate environments by mostly switching from stocks with medium and high idiosyncratic risk to stocks with low idiosyncratic risk.

1.5.5 Interest Rate Volatility

In this section, we analyze the effects of interest rate volatility on institutional investors' preferences towards risk. We compute the interest rate volatility in a given quarter as the standard deviation of daily changes in the T-bill rate in that quarter. In addition to the contemporaneous interest rate volatility, we also consider its first lag in our empirical specifications to analyze any lagged effects of interest rate volatility. We start with institutional investors' preferences for volatility, which are presented in panel (a) of Table 1.7. When we do not control for the current level of the T-bill rate, contemporaneous and lagged interest rate volatility has similar effects, but the results are statistically and economically more important for lagged interest rate volatility. These results suggest that institutional investors switch from stocks with medium and high volatility to stocks with low volatility stocks following a period with high interest rate volatility, in line with our fifth hypothesis. In addition to this lagged effect, a higher contemporaneous interest rate volatility (or equivalently an increase in interest rate volatility[3]) significantly decreases the ownership in stocks with medium volatility. These effects become mostly insignificant when we include the current value of the T-bill rate, suggesting that interest rate volatility does not play an important role in institutional investors' preferences towards total risk when one takes the current level of interest rates into account. We nevertheless analyze the effects of contemporaneous and lagged interest rate volatility on institutional investors' preferences for systematic and idiosyncratic volatility (panel (b)) as well as for the components of systematic risk (panel (c)), for completeness. As expected, the empirical evidence for any effect of interest rate volatility on institutional investors' preferences

[3]In a linear model which also includes the first lag of a variable, the coefficient estimate on the contemporaneous value of or the change in the variable would be identical regardless of whether we consider one or the other in the empirical specification.

for systematic and idiosyncratic volatility is weak at best. To be more precise, institutional investors hold significantly fewer stocks with low systematic and idiosyncratic risks and more stocks with low systematic but high idiosyncratic risks following periods of high interest rate volatility, while interest rate volatility does not have any significant contemporaneous effects on institutional investors' preferences for systematic and idiosyncratic volatility. Furthermore, these results do not seem to be robust to sorting stocks based on first idiosyncratic risk and then systematic risk. On the other hand, results in panel (c) suggest that interest volatility affects institutional investors' preferences for stocks with different momentum risk both contemporaneously and with a lag. In or following periods of low interest rate volatility, institutional investors search for yield in stocks with medium to high momentum risk.

1.5.6 Categories of Institutional investors

In this section, we analyze the effect of interest rate on the preferences of institutional investors with the focus on their different categories. Since institutional investors classification is not reliable after 1998, we utilize the classification suggested by (Bushee, 2001, 1998) in which he classified institutional investors based on their holdings turn over and diversification into main three categories: Quasi-Indexers, Transient and Dedicated investors. Quasi-Indexers, have low turnover and highly diversified portfolio holdings. Transient institutions tend to have high portfolio turnover and highly diversified portfolios. Dedicated investors have less diversified portfolios also low portfolio turnover. Figure 1.4 exhibits equally weighted average of ownership in terciles of stocks sorted based on total volatility each quarter. Panel (a) shows the graph for Quasi-Indexers, there is a clear pattern that this category of institutional investors has preferences toward low-risk stocks. Panel (b) shows average ownership of Dedicated investors, and we can see that there are time variations in preferences toward different risk levels. However, there is no observable preference. Panel (c) depicts Transient investors; general time trend shows that average ownership for this category of institutions is growing and we can detect a slight

preference toward firms with low and medium volatility especially during the period from 2000 to 2008.

In Figure 1.5 we depict the equally weighted average ownership of investors in terciles of stocks sorted based on their systematic and idiosyncratic volatility. For systematic risk, for Quasi-Indexers in panel (a) we can observe that their preference toward systematic risk changes over time. Before 2000 they prefer firms with low systematic risk, but after 2000 they tilt their portfolios toward firms with high systematic risk. In panel (c) for Dedicated investors, it shows some variation in their preferences, but we cannot detect a clear pattern from the graph. In panel (e) for Transient investors, we can see a clear preference toward firms with higher systematic risk through our sample. For the case of idiosyncratic volatility panel (b) shows the graph for Quasi-Indexers, it reveals that they prefer firms with low or medium idiosyncratic volatility. In panel (d) for Dedicated investors we observe some variation, In the late 2000s, there is a slight preference toward firms with high and medium idiosyncratic volatility. In panel (f) for Transient investors, we can see a preference for firms with medium idiosyncratic volatility.

In this part, we test our main two hypothesis (one and two) on categories of institutional investors. Similar to previous sections, we regress demeaned average ownership in total volatility terciles on the T-bill rate. Table 1.8 presents coefficient estimates on the T-bill rate in regressions with and without control variables for three categories of institutional investors. Panel (a) shows the result for Quasi-Indexers. Coefficient estimates indicate that Quasi-Indexers hold medium level volatility stocks and avoid low volatility stocks when interest rates levels are low. In panel (b), results for Dedicated investors show that in the low level of interest rate this category of institutional investors significantly prefer high volatility stocks. Panel (c) finally shows results for Transient investors which own diversified portfolios with high turnover. Results for this group with control variable does not show significant preferences toward risk levels as a function of interest rate environment. In summary, results for this section confirms Hypothesis 1 for Quasi-Indexers and Dedicated investors which increase exposure of their portfolio to higher risk stocks when T-bill rates are low.

To examine hypothesis two, similar to the previous parts we decompose the level of T-bill rate into two components: its previous level and contemporaneous change. We consider the effect of these components on the institutional investors' ownership at each category. Table 1.9 summarizes results for this test. Panel (a) reports results for Quasi-Indexers, the coefficient estimates for lagged T-bill rate and contemporaneous change in T-bill rate confirms that this group of institutional investors hold riskier stocks when interest rate decreases and also shows that lagged T-bill rate has a similar effect on their portfolio. In panel (b) for Dedicated investors, the coefficients of change of T-bill rate show that institutional investors avoid stocks with low volatility and they prefer medium volatility when interest rate decreases, moreover the coefficients for the lagged T-bill rate is also similar to the change of T-bill. Finally, In panel (c) for Transient institutional investors, regressions with control variables show that lagged T-bill rate and contemporaneous change of T-bill rate have a significant effect on this category's holdings, coefficient estimates suggest that Transient investors strongly prefer firms with high or medium volatility when T-bill rate decreases or lagged T-bill rate is low.

In summary, results above confirms hypothesis one and two by showing that different categories of institutional investors have similar tendency to expose to higher levels of risk and avoid lower levels of risks when the interest rate is low or decreases. However, there are some differences in the categories, More precisely, the effect of T-bill rate level is more pronounced for investors categorized as Quasi-Indexers and Dedicated as they tend to have longer investment horizons compared to Transient institutional investors. On the other hand, Transient and Quasi-Indexer investors' holdings show a spontaneous reaction to the contemporaneous change in T-bill rate since they are short-term investors compared to Dedicated investors. Hence, these differences are in line with investors portfolio allocation classes and their investment time horizon.

1.6 The Effect of Expectations about Interest Rate Characteristics on Institutional Investors' Preferences for Total Risk

So far, we have focused on the effect of observed interest rate characteristics on institutional investors' preferences for risk. In this section, we analyze the effect of expected interest rate characteristics on institutional investors' preferences for risk.

We start our analysis with the effect of the term structure of interest rates as it might reflect investors' expectations about future interest rates. To this end, as before, we regress the equally-weighted average residual ownership in each tercile of stocks sorted by total risk on the contemporaneous values of the level, slope and curvature factors extracted from a three-factor Nelson-Siegel approach as discussed in Section 1.4.2. Panel (a) of Table 1.10 presents the results from these regressions. First of all, given that the T-bill rate and the level factor have a correlation of 85% in our sample, it is not surprising to find that institutional investors hold more stocks with low volatility and fewer stocks with medium and high volatility when interest rate levels are high. This also suggests that our results are robust using alternative definitions for the interest rate level. More interestingly, institutional investors hold fewer stocks with low volatility and more stock with high volatility when the slope of the term structure is higher and its curvature is lower. In other words, institutional investors search for yield in stocks with high volatility as the difference between long term and short term yields decrease and mid-term yields decrease relative to the yields of other maturities. However, the effects of slope and curvature are statistically insignificant when we do not include any control variables. The most important control variable in this context is the term spread, which is defined as the difference between the ten-year T-bill and three-month T-bill rates and is commonly used as a proxy for the slope of the term structure. The effects of slope and curvature are only marginally significant at the 10% level when we exclude the term spread from our control variable (unreported). These additional results suggest that the effects of

slope and curvature are sensitive to the set of control variables in our regressions. We nevertheless examine their effects on institutional investors' preferences for idiosyncratic and systematic risks (panel (b)) as well as the components of systematic risk (panel (c)). When the slope is high, investors tend to switch from stocks with low idiosyncratic and medium systematic risks to those with medium to high idiosyncratic risk and significantly so to those also with low systematic risks (panel (b)). They do this by decreasing their holdings of stock with high SMB and low HML betas (panel (c)). On the other hand, when the curvature is high, investors switch mostly from stocks with high systematic risk to those with low systematic risk and significantly so to those also with high idiosyncratic risks (panel (b)). They do this by holding fewer stocks with high SMB and HML betas (panel (c)).

These results might be hard to interpret without guidance on what high slope and curvature imply for investors' expectations about future interest rates. There are different theories on the relation between the slope and curvature of the term structure and future interest rates. Rather than taking a stand on this issues, we directly examine the effects of expectations about future interest rates on institutional investors' preferences for risk. To do this, we use the median forecast for the quarterly averages of daily T-bill rate, which is our main measure of the interest rate level, from the Survey of Professional Forecasters of the Federal Reserve Bank of Philadelphia, which publishes quarterly forecasts of several macroeconomic variables made by about 50 professional forecasters. In a given quarter, the forecasters are asked to provide their forecasts for that given quarter, called the nowcast and for the following four quarters. These forecasts are generally released by the Federal Reserve Bank of Philadelphia towards the middle of the quarter. We then compute the differences between these forecasts and the last observed quarterly level of the T-bill rate, i.e., the lagged T-bill rate defined as the average of daily T-bill rates in the previous quarter, which we refer to as the expected change in the T-bill rate.

In an unreported analysis, we find that the expected changes in the T-bill rate in the current and following quarter are negatively correlated with the slope factor while expected changes two to four quarters ahead are increasingly more positively correlated.

On the other hand, the curvature factor is positively correlated only with the expected change in the current quarter and is increasingly more negatively correlated with expected changes one to four quarters ahead. These correlations suggest that the slope and curvature factors are indeed related to expectations about future interest rates, but these relations are not easy to interpret. However, the interpretation of expected change in the T-bill rate itself is straightforward. For example, if the expected change in the T-bill rate four quarters ahead is positive, then the forecasters expect the T-bill rate to increase in four quarters.

To understand the effect of interest rate expectations on investors' preferences for risk, we regress the equally-weighted average residual ownership in each tercile of stocks sorted based on different risk characteristics on these measures. These results are presented in Table 1.11. Panel (a) shows that only expected changes in the T-bill rate in the current quarter has a statistically significant effect on institutional investors' preferences for total risk, and this is true only when we include control variables in our regressions. Institutional investors switch from stocks with medium and high volatility to stock with low volatility when they expected interest rates to increase, in line with our second hypothesis replacing the actual change with the expected change. Surprisingly, expected changes in the T-bill rate one to four quarters ahead do not have statistically significant effects on institutional investors' preferences for total risk regardless of whether or not we include control variables. These results suggest that institutional investors might be forward looking when it comes to changing their portfolios with changing interest rates. Panel (b) suggests that institutional investors decrease the total risk of their portfolios in times of high expected interest rates by switching from stocks with high systematic risk to those with low systematic risk regardless of the idiosyncratic risks of these stocks. Panel (c) shows that they achieve this by holding more stocks with low market and SMB betas and fewer stocks with low UMD betas.

1.7 Robustness Check

In this section we performed few robustness checks on the results regarding our 5 main hypothesis, first we divide our sample in to two sub-samples 1980-1997 and 1998-2014 then also we utilized real interest rate as an alternative measure of interest rate which is bill rate divided by the CPI index (consumer Price Index).

1.7.1 Hypothesis 1

Results in Table 1.12 panel (a) shows that before 1998 period without control variables in low interest rate environment, institutional investors prefer medium volatility stocks and avoid low volatility stocks, however, we loose significance with control variables. In panel (b) for results after 1998, the sign of coefficients are comparable to main results, but coefficients are insignificant. In panel (c) results with real interest rate shows that in low interest rate environment institutional investors hold medium and high volatility stocks and this is entirely in line with the primary results. In unreported results, we introduced TED Spread as the control variable and show that in low interest rate environment institutional investors hold more stocks with medium volatility and fewer stocks with low volatility. More precisely, results show that our findings are robust with introducing TED spread as control variable.

In some unreported results, decomposition of systematic/idiosyncratic volatility shows that before 1998 period in high interest rate environment, institutional investors prefer low and medium systematic risk without any particular preference for idiosyncratic risk. After 1998 in high interest rate environment, institutional investors significantly prefer low systematic and high idiosyncratic risk. In other words, in low interest rate environment, they search for yield with high systematic risk regardless of idiosyncratic risk. These results show that institutional investors' preferences for components of total risk are reasonably robust in different time periods. Moreover, using real interest rate and TED Spread as extra control variables, we found that results are in line with our main findings. Specifically, in high interest rate environment institutional investors prefer low systematic risk

regardless of idiosyncratic risk level, and when they search for yield in low interest rate environment they mainly prefer high systematic risk but more tilted toward medium level idiosyncratic risk.

1.7.2 Hypothesis 2

For Hypothesis 2 we report our robustness checks in Table 1.13. Panel (a) reports coefficient estimates for the period of 1980-1997. In specification 1 without control variables, we observe that results are comparable to our main findings. However, with including control variables in specification 2, results are not statistically significant, but the sign of coefficients are still in line with our findings. For the period after 1998 (panel (b)) regression coefficients demonstrate the same results as our main findings. Additionally, Including TED spread (not reported) as control variables does not effect coefficient estimates. Finally, in panel (c) we change the interest rate measure to real interest rate and coefficient estimates for real interest rate show similar findings to those with the T-bill rate.

Furthermore, decomposition of systematic/idiosyncratic volatility (unreported result) shows that with the increase of interest rate, institutional investors prefer low to medium systematic risk regardless of idiosyncratic risk for both periods before and after 1998. For this part as well, results with real interest rate are entirely in line with the main findings, and we can conclude that our findings for hypothesis 2 are reasonably robust with different sub-samples, interest rate measures, and control variables.

1.7.3 Hypothesis 3

Table 1.14 reports robustness checks for Hypothesis 3. For the period before 1998 (panel(a)) we observe that increase in T-bill rate increases ownership in low volatility stocks and decreases ownership in medium volatility stocks, however, we lose some significance with control variables. Results for the 1998-2014 period (panel (b)), demonstrate that with the decrease of T-bill rate, institutional investors prefer to hold riskier stocks, but there is no

significant effect with the increase of T-bill rate. Moreover, Results with the real interest rate in panel (c) exhibits the very same conclusion and confirms the asymmetric effect of increase/decrease of the interest rate on institutional investors' preferences for total risk.

1.7.4 Hypothesis 4

Table 1.15 reports robustness checks for Hypothesis 4. In panel (a) for the period after 1998 we do not find any evidence that institutional investors take additional risk in persistent low interest rate environment. However, for persistent high interest rate environment, we observe significant result in specification 1 which shows that institutional investors reduce total risk in persistent high interest rate environment. However, we lose significance by introducing control variables in specification 2. Hence, results in period 1998-2014 are somewhat comparable to the main findings.

1.7.5 Hypothesis 5

Based on Table 1.16 panel (a), for the period 1980-1997 we do not have any significant results for the relation between interest rate volatility and institutional ownership in different categories of risk. For sub-sample after 1998 (panel (b)) in specification 2, after controlling for current T-bill rate, coefficient estimates show a positive relation between contemporaneous interest rate volatility and ownership in high volatility stocks while lagged interest rate volatility is insignificant. These results are not consistent with our Hypothesis 5.

However, in panel (c) utilizing real interest rate volatility instead of T-bill rate volatility, we find some significant results in line with our hypothesis. More precisely, institutional investors hold less risky stocks when lagged interest rate volatility increases, on the other hand, they prefer more risky stocks when interest rate volatility decreases. These results show that not the T-bill rate volatility but lagged real interest rate volatility plays an essential role in institutional investors' preferences for risk. However, results are dif-

ferent for two interest rate measures so we cannot drive a solid conclusion confirming the hypothesis.

1.8 Conclusion

In this paper, we develop and test several hypotheses on the effect of interest rate characteristics on institutional investors' preferences for risk based on (Rajan, 2006). Using Thomson Reuters 13F data, we find strong empirical evidence for most of Rajan's (Rajan, 2006) predictions. Institutional investors hold riskier stocks when the level of interest rates are low and fewer risky stocks when they are high. This is mostly due to their preferences for stocks with higher systematic, rather than idiosyncratic, risk when interest rates are low. To be more precise, institutional investors prefer to hold more stocks with high systematic risk regardless of their idiosyncratic risk when the T-bill rate is low. They add systematic risk to their portfolios in low interest rate environments by holding stocks with high market and size betas. We then decompose the current level of the T-bill rate into its previous level and current change and analyze their effects separately. Institutional investors search for yield by holding more stocks with high total risk when interest rate decrease. They do this by holding stocks with high systematic risk, especially those with high market and SMB betas, but medium idiosyncratic risk. Moreover, In the categories of institutional investors, we show that they qualitatively react similarly to the low interest rate environment by holding stocks with higher total volatility. However, this effect is more pronounced for investors categorized as "Quasi-Indexers" and "Dedicated" as they tend to have longer investment horizons.

We also distinguish between increases and decreases in the interest rate level and find that their effects are statistically different from each other. Decreases in the interest rate level have economically more important effects on institutional investors' preferences for total risk than increases. However, in contrast to Rajan's predictions, we do not find any much significant evidence on the effect of persistently low and less volatile interest rate environment on institutional investors' preferences for risk.

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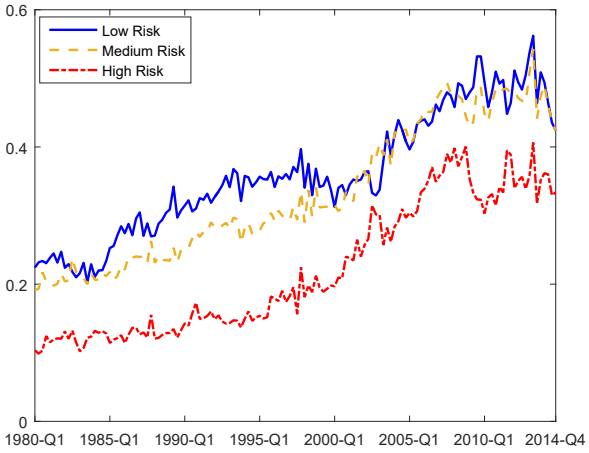
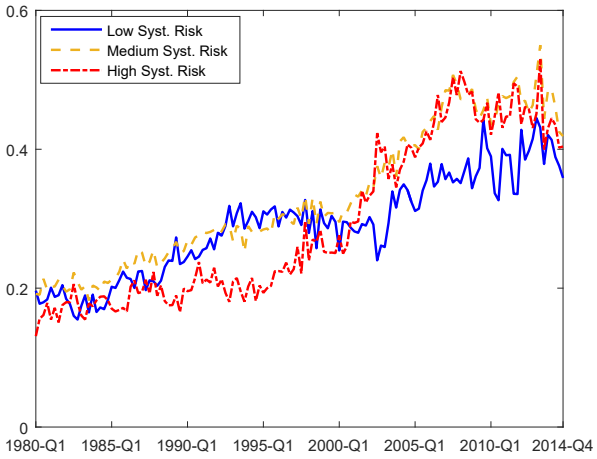
Figure 1.1 – Institutional Investors Preferences for Total Risk



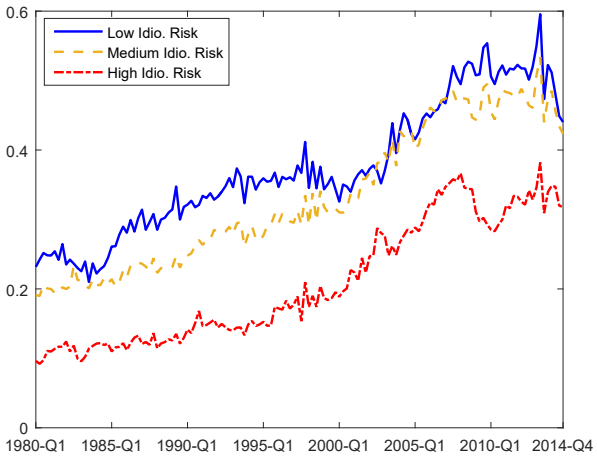
Note: This figure presents the equally weighted average of percentage ownership by institutional investors in each tercile of stocks sorted based on their total risk, i.e. realized variance.

Figure 1.2 – Institutional Investors Preferences for Components of Total Risk

(a) Systematic Risk



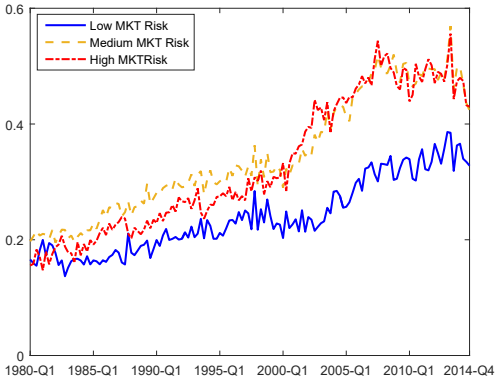
(b) Idiosyncratic Risk



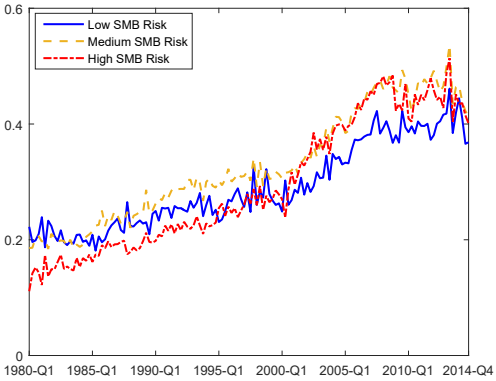
Note: This figure presents the equally weighted average of percentage ownership by institutional investors in each tercile of stocks sorted based on their systematic risk in panel (a) and idiosyncratic risk in panel (b).

Figure 1.3 – Institutional Investors Preferences for Components of Systematic Risk

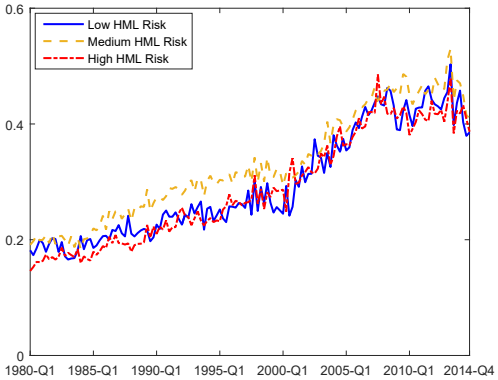
(a) Market Risk Factor



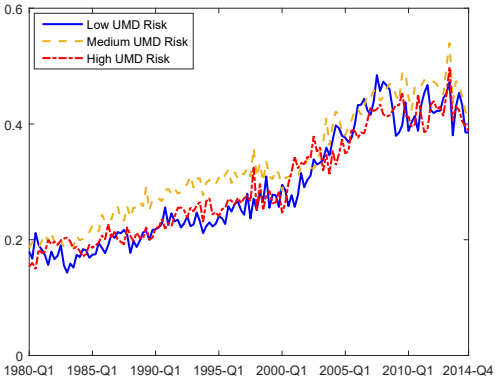
(b) Size Risk Factor



(c) Book-to-Market Risk Factor



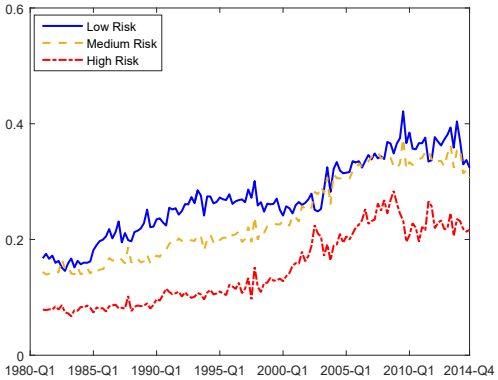
(d) Momentum Risk Factor



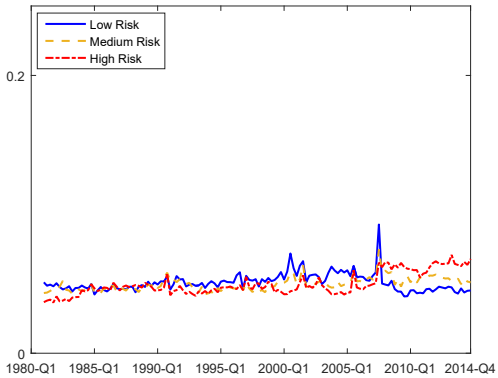
Note: This figure presents the equally weighted average of percentage ownership by institutional investors in each tercile of stocks sorted based on their market beta in panel (a), SMB beta in panel (b), HML beta in panel (c) and UMD beta in panel (d).

Figure 1.4 – Institutional Investors Preferences for Total Risk

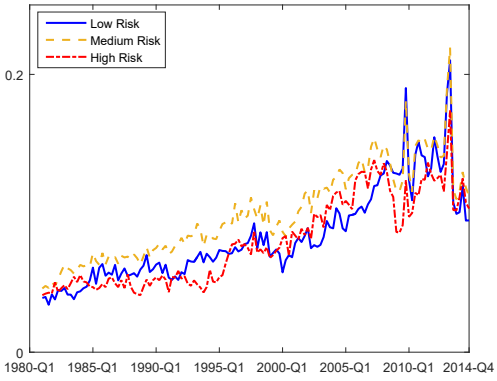
(a) Quasi Indexers



(b) Dedicated



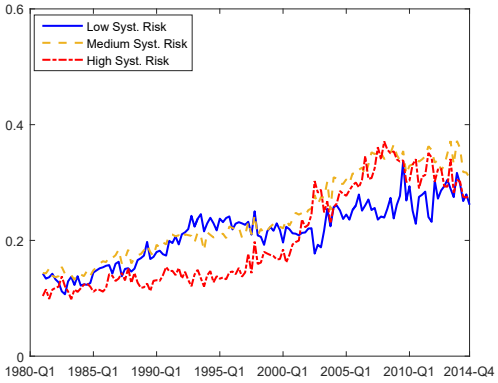
(c) Transient



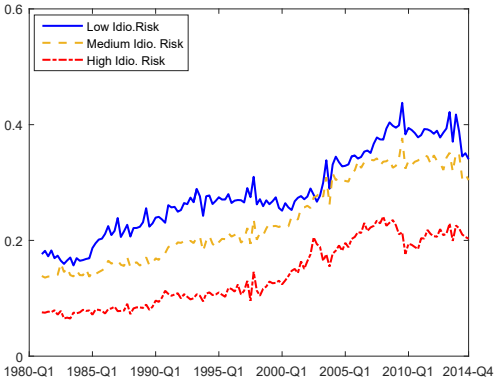
Note: This figure presents the equally weighted average of percentage ownership by institutional investors in each tercile of stocks sorted based on their total risk, i.e. realized variance.

Figure 1.5 – Institutional Investors Preferences for Components of Total Risk

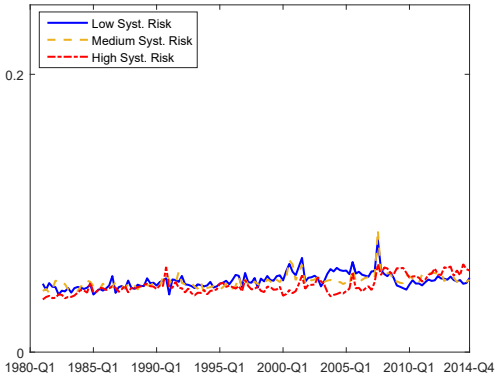
(a) Quasi Indexers - Systematic Risk



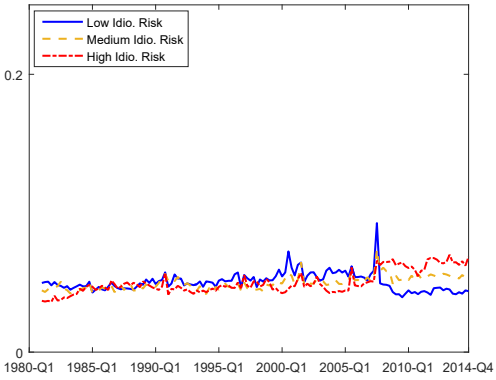
(b) Quasi Indexers - Idiosyncratic Risk



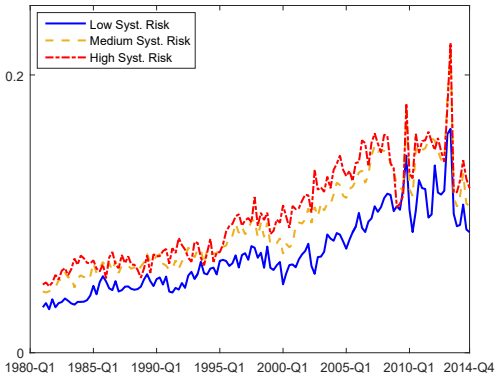
(c) Dedicated - Systematic Risk



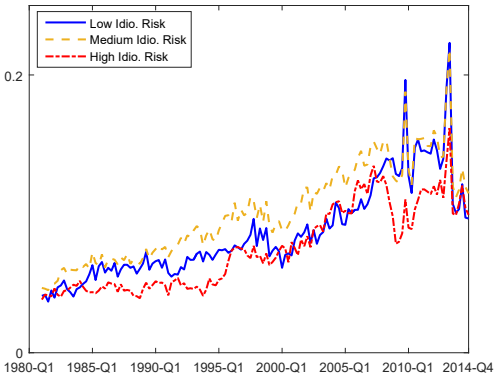
(d) Dedicated - Idiosyncratic Risk



(e) Transient - Systematic Risk



(f) Transient - Idiosyncratic Risk



Note: This figure presents the equally weighted average of percentage ownership by categories of institutional investors in each tercile of stocks sorted based on their risk measure(Systematic and Idiosyncratic).

Table 1.1 – The Effect of Interest Rate Level on Institutional Investors' Preferences for Total Risk

(a) Coefficient Estimates

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.2433***	-0.1477***	-0.0956***	0.4295***	-0.2270***	-0.2025**
Stock Market Variables						
Market Return	-	-	-	0.0236*	0.0007	-0.0243***
Market Volatility	-	-	-	0.0404	-0.0407*	0.0003
Market Liquidity	-	-	-	0.0002**	-0.0001	-0.0001**
Bond Market Variables						
Term Spread	-	-	-	0.3521	-0.0531	-0.2990
Default Spread	-	-	-	-0.6131	0.0573	0.5557
Credit Spread	-	-	-	0.6302	-0.3397	-0.2905
Macroeconomic Variables						
GDP Growth	-	-	-	-0.2739	0.2077**	0.0663
Inflation	-	-	-	0.0329	-0.0080	-0.0250
Recession Prob.	-	-	-	0.0066	-0.0007	-0.0059
Intercept	-0.0208***	0.0293***	-0.0086***	-0.0403**	0.0402***	0.0001
Adjusted R^2	34%	39%	12%	42%	53%	19%

(b) Economic Significance

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.0085	-0.0052	-0.0033	0.0150	-0.0079	-0.0071
Stock Market Variables						
Market Return	-	-	-	0.0020	0.0001	-0.0021
Market Volatility	-	-	-	0.0017	-0.0017	0.0000
Market Liquidity	-	-	-	0.0028	-0.0013	-0.0014
Bond Market Variables						
Term Spread	-	-	-	0.0032	-0.0005	-0.0027
Default Spread	-	-	-	-0.0029	0.0003	0.0027
Credit Spread	-	-	-	0.0033	-0.0018	-0.0015
Macroeconomic Variables						
GDP Growth	-	-	-	-0.0019	0.0015	0.0005
Inflation	-	-	-	0.0012	-0.0003	-0.0009
Recession Prob.	-	-	-	0.0015	-0.0002	-0.0014

Note: Panel (a) presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the T-bill rate in Specification 1 and on the T-bill rate and the control variables in Specification 2. Panel (b) presents the economic significance computed as the coefficient estimate multiplied by the standard deviation of each variable. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.2 – The Effect of Interest Rate Level on Institutional Investors' Preferences for Systematic and Idiosyncratic Risks

(a) Results for Stocks sorted by their Systematic and Idiosyncratic Risks

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	0.7489***	0.5281***	0.8007***
Medium Sys. Risk	0.2392***	-0.5725***	-0.0095
High Sys. Risk	-0.2877***	-1.3070***	-0.1402*

(b) Results for Stocks sorted by their Idiosyncratic and Systematic Risks

	Low Sys. Risk	Medium Sys. Risk	High Sys. Risk
Low Idio. Risk	0.8286***	0.0926	0.0716
Medium Idio. Risk	0.5151***	-0.6079***	-0.7673***
High Idio. Risk	0.5144***	-0.2039*	-0.4432***

Note: This table presents the coefficient estimates on the T-bill rate from the regressions of the equally weighted average residual ownership of stocks sorted by their systematic and idiosyncratic risks in panel (a) and idiosyncratic and systematic risk in panel (b) on the T-bill rate and control variables. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.3 – The Effects of T-bill Rate on Institutional Investors' Preferences for Systematic Risk Components

	Low	Medium	High
β_{MKT}	0.5555***	-0.2226***	-0.3329***
β_{SMB}	0.6883***	-0.0774**	-0.6109***
β_{HML}	-0.0537	0.0271	0.0266
β_{UMD}	-0.1448**	0.0056	0.1392**

Note: This table presents the coefficient estimates on the T-bill rate from the regressions of the equally weighted average residual ownership of stocks sorted by their betas on different factors. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.4 – The Effects of Change in the T-bill Rate on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	0.3215**	-0.1536**	-0.1679*
Lagged T-bill Rate	0.2427***	-0.1477***	-0.0950***
Intercept	-0.0206***	0.0293***	-0.0087***
Control Variables	NO	NO	NO
Adjusted R^2	34%	39%	12%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	0.8683***	-0.4217***	-0.4466***
Lagged T-bill Rate	0.4848***	-0.2515***	-0.2333***
Intercept	-0.0409**	0.0405***	0.0005
Control Variables	YES	YES	YES
Adjusted R^2	44%	54%	21%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	1.3405***	0.8537**	0.5422**
Medium Sys. Risk	0.4316**	-0.6687***	-0.3407**
High Sys. Risk	-0.3381	-1.5513***	-0.2694

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	0.6123***	-0.2682***	-0.3440**
β_{SMB}	0.5081**	0.0384	-0.5465***
β_{HML}	-0.0706	0.1316	-0.0610
β_{UMD}	-0.2690**	0.1124*	0.1566

Note: This table presents the effects of changes in the T-bill rate on institutional investors' preferences for total risk in panel (a), its components in panel (b) and the components of the systematic risk in panel (c). In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.5 – The Effects of Increases and Decreases in T-bill Rate on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Increase in T-bill Rate	0.0843	-0.1194	0.0350
Decrease in T-bill Rate	-0.4931**	0.1783	0.3148**
Lagged T-bill Rate	0.2608***	-0.1503***	-0.1105***
Intercept	-0.0207***	0.0293***	-0.0087***
Control Variables	NO	NO	NO
Adjusted R^2	34%	38%	12%

	Specification 2		
	Low	Medium	High
Increase in T-bill Rate	0.5335**	-0.3322**	-0.2013
Decrease in T-bill Rate	-1.1685***	0.5020***	0.6666***
Lagged T-bill Rate	0.5112***	-0.2586***	-0.2526***
Intercept	-0.0424**	0.0408***	0.0015
Control Variables	YES	YES	YES
Adjusted R^2	45%	54%	22%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	0.9525**/-1.6884**	0.5714*/-1.1068**	0.6811**/-0.4176
Medium Sys. Risk	-0.0040/-0.8222***	-0.5828***/0.7456**	-0.1311/0.5285**
High Sys. Risk	-0.0927/0.5580*	-1.0881**/1.9666***	-0.3063*/0.2363

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	0.5943***/-0.6284**	-0.3493***/0.1956	-0.2451*/0.4328*
β_{SMB}	0.4321**/-0.5763*	0.0662/-0.0134	-0.4983***/0.5897*
β_{HML}	0.1169/0.2387	0.1195/-0.1425	-0.2364*/-0.0962
β_{UMD}	0.0295/0.5365***	0.0112/-0.2031*	-0.0407/-0.3334***

Note: This table presents the effects of increases and decreases in the T-bill rate on institutional investors' preferences for total risk in panel (a), its components in panel (b) and the components of the systematic risk in panel (c). In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. In panels (b) and (c), the first number is the coefficient estimate on the increases in the T-bill rate while the second number is the coefficient estimate on the decreases in the T-bill rate. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.6 – The Effect of Interest Rate Persistence on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Persistenly Low	-0.0042	0.0020	0.0021
Persistently High	0.0166***	-0.0099***	-0.0067**
T-bill Rate	-	-	-
Intercept	-0.0155***	0.0262***	-0.0107***
Control Variables	NO	NO	NO
Adjusted R^2	41%	43%	16%

	Specification 2		
	Low	Medium	High
Persistenly Low	0.0015	-0.0007	-0.0007
Persistently High	0.0110**	-0.0059***	-0.0051*
T-bill Rate	0.2675*	-0.1392**	-0.1283
Intercept	-0.0353**	0.0375***	-0.0022
Control Variables	YES	YES	YES
Adjusted R^2	46%	57%	21%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	0.0089/0.0158**	-0.0021/0.0068	-0.0226***/-0.0037
Medium Sys. Risk	-0.0015/0.0086***	0.0038/-0.0066*	0.0023/-0.0050**
High Sys. Risk	0.0066/-0.0016	0.0110/-0.0151**	-0.0062/0.0008

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	0.0010/0.0014	-0.0017/0.0006	0.0006/-0.0020
β_{SMB}	-0.0102*/0.0054	0.0008/0.0004	0.0094/-0.0058*
β_{HML}	-0.0019/0.0012	0.0034*/0.0022	-0.0015/-0.0034
β_{UMD}	-0.0021/-0.0017	0.0021/0.0029**	0.0001/-0.0012

Note: This table presents the effect of persistently high and low interest rate environments on institutional investors' preferences for total risk in panel, its components in panel (b) and the components of the systematic risk in panel (c). We capture persistently low interest rate periods if the T-bill rate is lower than 2% for two consecutive quarters and, similarly, persistently high interest rate periods if the T-bill rate is higher than 5% for two consecutive quarters. In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. In panels (b) and (c), the first number is the coefficient estimate on the dummy variable for persistently high interest rate environment while the second number is the coefficient estimate on the dummy variable for persistently low interest rate environment . The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.7 – The Effect of Interest Rate Volatility on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Interest Rate Volatility	0.1384	-0.1152**	-0.0232
Lagged Interest Rate Volatility	0.2381***	-0.1331**	-0.1050*
T-bill Rate	-	-	-
Intercept	-0.0188***	0.0286***	-0.0098***
Control Variables	NO	NO	NO
Adjusted R^2	13%	18%	3%

	Specification 2		
	Low	Medium	High
Interest Rate Volatility	-0.1778	0.0829	0.0949
Lagged Interest Rate Volatility	-0.0634	0.0683**	-0.0049
T-bill Rate	0.5177***	-0.2810***	-0.2368**
Intercept	-0.0413**	0.0410***	0.0003
Control Variables	YES	YES	YES
Adjusted R^2	43%	54%	19%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys./Idio. Risk	-0.2309/-0.2357**	-0.1833/-0.0206	0.1610/0.1913**
Medium Sys./Idio. Risk	-0.1415/0.0704	0.1077/-0.0022	0.1137/0.0289
High Sys./Idio. Risk	-0.0115/0.0123	0.2325/-0.1081	-0.0476/0.0637

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	-0.0522/-0.1052*	0.0507/-0.0302	0.0015/0.1354**
β_{SMB}	0.0245/-0.0344	-0.0102/0.0063	-0.0143/0.0281
β_{HML}	0.1020*/-0.0289	-0.0342/-0.0255	-0.0678/0.0544
β_{UMD}	0.1902**/0.1442**	-0.0196/-0.0725**	-0.1706**/-0.0717

Note: This table presents the effect of interest rate volatility on institutional investors' preferences for total risk in panel, its components in panel (b) and the components of the systematic risk in panel (c). We capture the interest rate volatility in a given quarter as the standard deviation of daily changes in the T-bill rate in that quarter. In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. In panels (b) and (c), the first number is the coefficient estimate on the contemporaneous volatility while the second number is the coefficient estimate on the lagged volatility. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.8 – The Effect of Interest Rate Level on Institutional Investors' Preferences for Total Risk (Categories of Investors)

(a) Quasi Indexers

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.1628***	-0.1405***	-0.0224	0.4051**	-0.3780***	-0.0271
Stock Market Variables						
Market Return	-	-	-	0.0137	-0.0025	-0.0112
Market Volatility	-	-	-	-0.0105	-0.0085	0.0190
Market Liquidity	-	-	-	0.0001	-0.0001*	0.0000
Bond Market Variables						
Term Spread	-	-	-	0.4189	-0.3069*	-0.1120
Default Spread	-	-	-	-0.8078	-0.0716	0.8794***
Credit Spread	-	-	-	0.5641	-0.3080	-0.2561
Macroeconomic Variables						
GDP Growth	-	-	-	-0.4525***	0.2880***	0.1645
Inflation	-	-	-	0.0434	-0.0294	-0.0141
Recession Prob.	-	-	-	0.0102	-0.0064	-0.0038
Intercept	-0.0064***	0.0212***	-0.0149***	-0.0204	0.0384***	-0.0180**
Adjusted R^2	26%	35%	1%	35%	60%	10%

(b) Dedicated Investors

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.0332**	0.0106	-0.0437***	0.1253***	0.0320**	-0.1574***
Stock Market Variables						
Market Return	-	-	-	-0.0029	-0.0017	0.0047*
Market Volatility	-	-	-	0.0067	-0.0014	-0.0053
Market Liquidity	-	-	-	0.0000	0.0000	0.0000
Bond Market Variables						
Term Spread	-	-	-	0.0160	0.0911**	-0.1072**
Default Spread	-	-	-	-0.1794*	0.1316	0.0477
Credit Spread	-	-	-	0.2574***	-0.0180	-0.2394**
Macroeconomic Variables						
GDP Growth	-	-	-	-0.0868*	0.0803**	0.0066
Inflation	-	-	-	0.0418***	-0.0121	-0.0297***
Recession Prob.	-	-	-	0.0045*	-0.0017	-0.0028**
Intercept	0.0003	-0.0006	0.0003	-0.0047**	-0.0032*	0.0079***
Adjusted R^2	14%	2%	29%	41%	10%	52%

Table 1.8 – Continued

(c) Transient Investors

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.0696**	-0.0358**	-0.0337	0.0718	0.0105	-0.0824
Stock Market Variables						
Market Return	-	-	-	0.0062	0.0068**	-0.0130**
Market Volatility	-	-	-	-0.0388	0.0019	0.0369
Market Liquidity	-	-	-	0.0000	0.0000**	-0.0001**
Bond Market Variables						
Term Spread	-	-	-	0.3186**	0.0109	-0.3296***
Default Spread	-	-	-	0.6167**	-0.2754*	-0.3413
Credit Spread	-	-	-	0.3253	-0.1566	-0.1687
Macroeconomic Variables						
GDP Growth	-	-	-	0.0576	-0.0569	-0.0007
Inflation	-	-	-	-0.0196	0.0227	-0.0032
Recession Prob.	-	-	-	-0.0048	0.0037	0.0011
Intercept	-0.0195***	0.0123***	0.0072***	-0.0374***	0.0163***	0.0211***
Adjusted R^2	10%	8%	3%	43%	31%	37%

Note: Panel (a) presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership of Quasi Indexers on the T-bill rate in Specification 1 and on the T-bill rate and the control variables in Specification 2. Panel (b) presents results for Dedicated investors and Panel (c) shows results for Transient investors. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.9 – The Effects of Change in the T-bill Rate on Institutional Investors' Preferences for Risk (Categories of Investors)

(a) Quasi Indexers

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	0.3152*	-0.1286	-0.1865**
Lagged T-bill Rate	0.1635***	-0.1404***	-0.0231
Intercept	-0.0062***	0.0212***	-0.0150***
Control Variables	NO	NO	NO
Adjusted R^2	26%	34%	3%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	0.7926***	-0.4417***	-0.3509***
Lagged T-bill Rate	0.3797***	-0.2519***	-0.1278**
Intercept	-0.0176	0.0288***	-0.0112
Control Variables	YES	YES	YES
Adjusted R^2	41%	55%	10%

(b) Dedicated Investors

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	0.0948**	-0.0893***	-0.0056
Lagged T-bill Rate	0.0334**	0.0102*	-0.0436***
Intercept	0.0003	-0.0007*	0.0003
Control Variables	NO	NO	NO
Adjusted R^2	15%	11%	29%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	0.1008**	-0.0995***	-0.0014
Lagged T-bill Rate	0.0681***	0.0010	-0.0691***
Intercept	-0.0015	-0.0011	0.0026
Control Variables	YES	YES	YES
Adjusted R^2	32%	19%	37%

Table 1.9 – Continued

(c) Transient Investors

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	-0.0036	0.0267	-0.0231
Lagged T-bill Rate	0.0693**	-0.0356**	-0.0337
Intercept	-0.0196***	0.0124***	0.0072***
Control Variables	NO	NO	NO
Adjusted R^2	10%	8%	3%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	0.4082***	-0.0995*	-0.3086***
Lagged T-bill Rate	0.1419**	-0.0505**	-0.0914**
Intercept	-0.0360***	0.0182***	0.0178***
Control Variables	YES	YES	YES
Adjusted R^2	41%	41%	31%

Note: Panel (a) presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the T-bill rate in Specification 1 and on the T-bill rate and the control variables in Specification 2 for period 1980-1997. Panel (b) presents the coefficient estimates for period 1998-2014. Panel (c)presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the real interest rate in Specification 1 and on the real interest rate and the control variables in Specification 2 The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.10 – The Effects of the Term Structure Factors on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Level	0.2525***	-0.1499***	-0.1026***
Slope	-0.0326	0.0501	-0.0175
Curvature	0.0936	-0.0472	-0.0464
Intercept	-0.0252***	0.0312***	-0.0060*
Control Variables	NO	NO	NO
Adjusted R^2	37%	41%	14%

	Specification 2		
	Low	Medium	High
Level	0.4477***	-0.1962***	-0.2515***
Slope	-0.3919**	0.0116	0.3803***
Curvature	0.1757*	-0.0424	-0.1334**
Intercept	-0.0473***	0.0410***	0.0064
Control Variables	YES	YES	YES
Adjusted R^2	44%	55%	22%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	-0.5344/0.1826	0.0887/0.1663	0.7013***/0.1332***
Medium Sys. Risk	-0.3807***/0.2001***	-0.0455/-0.1531**	-0.0791/-0.0580
High Sys. Risk	-0.1666/-0.0058	0.2345/-0.3525**	0.1819/-0.1127*

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	-0.0684/0.0869	-0.0997/-0.0529*	0.1680/-0.0340
β_{SMB}	0.2942**/0.1390***	-0.0805/-0.0019	-0.2137*/-0.1371***
β_{HML}	-0.2648*/0.0394	-0.0302/0.0609*	0.2950*/-0.1003***
β_{UMD}	-0.1464/-0.0865*	-0.1132/0.0294	0.2596/0.0571

Note: This table presents the effect of term structure factors on institutional investors' preferences for total risk in panel (a), its components in panel (b) and the components of the systematic risk in panel (c). We capture the three term structure factors, i.e. the level, slope and curvature factors, based on a three factor Nelson-Siegel approach. In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. In panels (b) and (c), the first number is the coefficient estimate on the slope factor while the second number is the coefficient estimate on the curvature volatility. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.11 – The Effects of Expected Changes in T-bill Rate on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk

	Specification 1		
	Low	Medium	High
Exp. Change in Current Quarter	0.5014	-0.2244	-0.2770
Exp. Change in One Quarter	-0.3112	-0.0355	0.3467
Exp. Change in Two Quarters	-0.2370	0.0656	0.1714
Exp. Change in Three Quarters	-0.0145	0.0426	-0.0281
Exp. Change in Four Quarters	0.2363	-0.1637	-0.0726
Lagged T-bill Rate	0.2701***	-0.1833***	-0.0868**
Intercept	-0.0223***	0.0314***	-0.0090***
Control Variables	NO	NO	NO
Adjusted R^2	25%	35%	5%

	Specification 2		
	Low	Medium	High
Exp. Change in Current Quarter	1.5284***	-0.7970***	-0.7314***
Exp. Change in One Quarter	-0.3883	0.0706	0.3177
Exp. Change in Two Quarters	-0.0106	0.0053	0.0053
Exp. Change in Three Quarters	-0.0759	-0.0101	0.0859
Exp. Change in Four Quarters	0.0526	-0.0003	-0.0524
Lagged T-bill Rate	0.5507***	-0.3187***	-0.2320**
Intercept	-0.0475**	0.0466***	0.0009
Control Variables	YES	YES	YES
Adjusted R^2	36%	51%	15%

(b) Institutional Investors' Preferences for Systematic and Idiosyncratic Risk

	Low Idio. Risk	Medium Idio. Risk	High Idio. Risk
Low Sys. Risk	2.4749***	1.5378***	1.3400***
Medium Sys. Risk	0.7100**	-1.2539***	-0.6974***
High Sys. Risk	-1.2494***	-2.7440***	-0.1180

Table 1.11 – Continued

(c) Institutional Investors' Preferences for Components of Systematic Risk

	Low	Medium	High
β_{MKT}	0.9398***	-0.2052	-0.7347***
β_{SMB}	1.2332***	-0.0640	-1.1692***
β_{HML}	-0.3318	0.2766*	0.0552
β_{UMD}	-0.6863***	0.3490***	0.3374*

Note: This table presents the effect of expected changes in the T-bill rate on institutional investors' preferences for total risk in panel (a), its components in panel (b) and the components of the systematic risk in panel (c). We capture the three term structure factors, i.e. the level, slope and curvature factors, based on a three factor Nelson-Siegel approach. In panel (b), stocks are sorted into terciles based on their systematic risk and then sorted into further terciles in each tercile based on their idiosyncratic risk. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.12 – The Effect of Interest Rate Level on Institutional Investors' Preferences for Total Risk

(a) Institutional Investors' Preferences for Total Risk 1980 - 1997

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.0921**	-0.1014***	0.0093	-0.2469	0.3339***	-0.0870
Stock Market Variables						
Market Return	-	-	-	-0.0099	0.0117	-0.0018
Market Volatility	-	-	-	-0.0405	0.0227	0.0178
Market Liquidity	-	-	-	0.0001	-0.0001*	0.0000
Bond Market Variables						
Term Spread	-	-	-	-0.7749*	1.0244***	-0.2494
Default Spread	-	-	-	0.4370	-1.5201***	1.0831***
Credit Spread	-	-	-	0.0739	0.5308	-0.6047***
Macroeconomic Variables						
GDP Growth	-	-	-	-0.0775	-0.0614	0.1389
Inflation	-	-	-	-0.0498	0.0597*	-0.0099
Recession Prob.	-	-	-	-0.0201***	0.0146***	0.0054
Intercept	-0.0059**	0.0247***	-0.0188***	0.0151	-0.0011	-0.0141**
Adjusted R^2	20%	32%	-1%	36%	60%	36%

(b) Institutional Investors' Preferences for Total Risk 1998 - 2014

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	0.0408	-0.0759	0.0350	-0.0096	-0.0470	0.0566
Stock Market Variables						
Market Return	-	-	-	0.0279	0.0031	-0.0310*
Market Volatility	-	-	-	0.0101	-0.0434**	0.0332
Market Liquidity	-	-	-	0.0002	-0.0003**	0.0001
Bond Market Variables						
Term Spread	-	-	-	-0.3698	0.2098	0.1600
Default Spread	-	-	-	-0.7887	0.3736	0.4151
Credit Spread	-	-	-	1.4695**	-0.5186*	-0.9509*
Macroeconomic Variables						
GDP Growth	-	-	-	-0.2866	0.2387***	0.0478
Inflation	-	-	-	0.0572	-0.0517*	-0.0055
Recession Prob.	-	-	-	0.0121	-0.0079**	-0.0042
Intercept	-0.0209***	0.0293***	-0.0084***	-0.0375**	0.0375***	0.0000
Adjusted R^2	-1%	3%	-1%	16%	55%	-1%

(c) Institutional Investors' Preferences for Total Risk (Real interest rate)

	Specification 1			Specification 2		
	Low	Medium	High	Low	Medium	High
T-bill Rate	22.7749***	-13.4027***	-9.3722***	38.2791***	-17.8938***	-20.3853***
Control Variables	NO	NO	NO	YES	YES	YES
Intercept	-0.0181***	0.0276***	-0.0095***	-0.0247**	0.0313***	-0.0066
Adjusted R^2	35%	38%	13%	44%	52%	23%

Note: Panel (a) presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the T-bill rate in Specification 1 and on the T-bill rate and the control variables in Specification 2 for period 1980-1997. Panel (b) presents the coefficient estimates for period 1998-2014. Panel (c)presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the real interest rate in Specification 1 and on the real interest rate and the control variables in Specification 2 The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.13 – The Effects of Change in the T-bill Rate on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk 1980- 1997

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	0.2631***	-0.2045***	-0.0586
Lagged T-bill Rate	0.0868***	-0.0982***	0.0114
Intercept	-0.0053**	0.0244***	-0.0190***
Control Variables	NO	NO	NO
Adjusted R^2	28%	35%	0%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	0.1179	-0.0794	-0.0385
Lagged T-bill Rate	0.0363	-0.0284	-0.0079
Intercept	-0.0047	0.0179***	-0.0132**
Control Variables	YES	YES	YES
Adjusted R^2	37%	37%	5%

(b) Institutional Investors' Preferences for Total Risk 1998- 2014

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	-0.0592	0.3918	-0.3325
Lagged T-bill Rate	0.0423	-0.0825	0.0403
Intercept	-0.0210***	0.0297***	-0.0088***
Control Variables	NO	NO	NO
Adjusted R^2	-3%	8%	0%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	1.3437***	-0.3118	-1.0319**
Lagged T-bill Rate	0.1854	-0.0851	-0.1003
Intercept	-0.0464**	0.0398***	0.0066
Control Variables	YES	YES	YES
Adjusted R^2	24%	56%	7%

Table 1.13 – Continued

(c) Institutional Investors' Preferences for Total Risk (Real interest rate)

	Specification 1		
	Low	Medium	High
Change in T-bill Rate	31.6786***	-18.3949***	-13.2837*
Lagged T-bill Rate	22.9183***	-13.4831***	-9.4352***
Intercept	-0.0180***	0.0275***	-0.0095***
Control Variables	NO	NO	NO
Adjusted R^2	34%	37%	13%

	Specification 2		
	Low	Medium	High
Change in T-bill Rate	62.9887***	-30.0501***	-32.9386***
Lagged T-bill Rate	40.1935***	-18.8357***	-21.3579***
Intercept	-0.0230**	0.0305***	-0.0074
Control Variables	YES	YES	YES
Adjusted R^2	45%	52%	23%

Note: Panel (a) presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the T-bill rate in Specification 1 and on the T-bill rate and the control variables in Specification 2 for period 1980-1997. Panel (b) presents the coefficient estimates for period 1998-2014. Panel (c)presents the coefficient estimates from the regressions of the equally weighted average of the residual ownership on the real interest rate in Specification 1 and on the real interest rate and the control variables in Specification 2 The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.14 – The Effects of Increases and Decreases in T-bill Rate on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk 1980-1997

	Specification 1		
	Low	Medium	High
Increase in T-bill Rate	0.2801***	-0.2121***	-0.0679
Decrease in T-bill Rate	-0.2486	0.1979*	0.0507
Lagged T-bill Rate	0.0846***	-0.0972***	0.0126
Intercept	-0.0053**	0.0243***	-0.0191***
Control Variables	NO	NO	NO
Adjusted R^2	27%	34%	-1%

	Specification 2		
	Low	Medium	High
Increase in T-bill Rate	0.1921	-0.1665*	-0.0256
Decrease in T-bill Rate	-0.0337	-0.0194	0.0530
Lagged T-bill Rate	0.0363	-0.0284	-0.0079
Intercept	-0.0045	0.0176***	-0.0131**
Control Variables	YES	YES	YES
Adjusted R^2	37%	37%	4%

(b) Institutional Investors' Preferences for Total Risk 1998-2014

	Specification 1		
	Low	Medium	High
Increase in T-bill Rate	-1.8109	1.0659*	0.7451
Decrease in T-bill Rate	-0.5553	-0.1553	0.7105**
Lagged T-bill Rate	0.1106	-0.1088	-0.0018
Intercept	-0.0199***	0.0293***	-0.0094***
Control Variables	NO	NO	NO
Adjusted R^2	0%	9%	1%

	Specification 2		
	Low	Medium	High
Increase in T-bill Rate	-0.5967	0.3444	0.2522
Decrease in T-bill Rate	-1.9800***	0.5270*	1.4530***
Lagged T-bill Rate	0.2310	-0.1005	-0.1305
Intercept	-0.0440**	0.0390***	0.0050
Control Variables	YES	YES	YES
Adjusted R^2	28%	57%	10%

Table 1.14 – Continued

(c) Institutional Investors' Preferences for Total Risk (Real interest rate)

	Specification 1		
	Low	Medium	High
Increase in T-bill Rate	6.4279	-10.2920	3.8641
Decrease in T-bill Rate	-48.9015**	23.9216**	24.9799**
Lagged T-bill Rate	25.1123***	-14.1872***	-10.9251***
Intercept	-0.0182***	0.0276***	-0.0094***
Control Variables	NO	NO	NO
Adjusted R^2	35%	37%	13%

	Specification 2		
	Low	Medium	High]
Increase in T-bill Rate	34.2412**	-22.5685**	-11.6728
Decrease in T-bill Rate	-88.2703***	36.6297**	51.6406***
Lagged T-bill Rate	43.1516***	-19.6055***	-23.5461***
Intercept	-0.0243**	0.0308***	-0.0065
Control Variables	YES	YES	YES
Adjusted R^2	46%	52%	24%

Note: This table presents the effects of increases and decreases in the T-bill rate on institutional investors' preferences for total risk in period 1980-1997 in panel (a), ine period 1998-2014 in panel (b) and real interest rate instead of T-bill (c). The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.15 – The Effect of Interest Rate Persistence on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk 1998-2014

	Specification 1		
	Low	Medium	High
Persistenly Low	0.0040	-0.0002	-0.0038
Persistently High	0.0196***	-0.0091***	-0.0105***
T-bill Rate	-	-	-
Intercept	-0.0236***	0.0284***	-0.0048
Control Variables	NO	NO	NO
Adjusted R^2	11%	7%	5%

	Specification 2		
	Low	Medium	High
Persistenly Low	0.0114*	-0.0046*	-0.0068
Persistently High	0.0118	-0.0036	-0.0083
T-bill Rate	0.0608	-0.0849	0.0240
Intercept	-0.0335*	0.0375***	-0.0040
Control Variables	YES	YES	YES
Adjusted R^2	24%	58%	3%

Note: This table presents the effect of persistently high and low interest rate environments on institutional investors' preferences for total risk for period 1998-2014 in panel (a). We capture persistently low interest rate periods if the T-bill rate is lower than 2% for two consecutive quarters and, similarly, persistently high interest rate periods if the T-bill rate is higher than 5% for two consecutive quarters. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 1.16 – The Effect of Interest Rate Volatility on Institutional Investors' Preferences for Risk

(a) Institutional Investors' Preferences for Total Risk 1980-1997

	Specification 1		
	Low	Medium	High
Interest Rate Volatility	0.0637	-0.0789	0.0153
Lagged Interest Rate Volatility	0.0644	-0.0097	-0.0548
T-bill Rate	-	-	-
Intercept	-0.0034	0.0203***	-0.0169***
Control Variables	NO	NO	NO
Adjusted R^2	9%	5%	1%

	Specification 2		
	Low	Medium	High
Interest Rate Volatility	-0.0875	-0.1107	0.1982
Lagged Interest Rate Volatility	-0.0628	-0.0683	0.1311
T-bill Rate	2.0403**	1.1785	-3.2188**
Intercept	0.0024	0.0214***	-0.0238***
Control Variables	YES	YES	YES
Adjusted R^2	41%	36%	23%

(b) Institutional Investors' Preferences for Total Risk 1998-2014

	Specification 1		
	Low	Medium	High
Interest Rate Volatility	-0.1921	0.0474	0.1446
Lagged Interest Rate Volatility	0.1783	-0.2632**	0.0849
T-bill Rate	-	-	-
Intercept	-0.0198***	0.0315***	-0.0118***
Control Variables	NO	NO	NO
Adjusted R^2	-2%	7%	2%

	Specification 2		
	Low	Medium	High
Interest Rate Volatility	-0.7138**	0.1522	0.5616**
Lagged Interest Rate Volatility	0.2094	-0.1627*	-0.0467
T-bill Rate	3.2880	2.3256	-5.6136
Intercept	-0.0300*	0.0369***	-0.0069
Control Variables	YES	YES	YES
Adjusted R^2	28%	59%	7%

Table 1.16 – Continued

(c) Institutional Investors' Preferences for Total Risk (Real Interest rate)

	Specification 1		
	Low	Medium	High
Interest Rate Volatility	0.1384	-0.1152**	-0.0232
Lagged Interest Rate Volatility	0.2381***	-0.1331**	-0.1050*
T-bill Rate	-	-	-
Intercept	-0.0188***	0.0286***	-0.0098***
Control Variables	NO	NO	NO
Adjusted R^2	13%	18%	3%

	Specification 2		
	Low	Medium	High
Interest Rate Volatility	-0.2607	0.0477	0.2131**
Lagged Interest Rate Volatility	48.9602***	-27.3088***	-21.6514***
T-bill Rate	-30.6029	129.0052	-98.4023
Intercept	-0.0223*	0.0333***	-0.0110
Control Variables	YES	YES	YES
Adjusted R^2	47%	55%	25%

Note: This table presents the effect of interest rate volatility on institutional investors' preferences for total risk for period 1980-1997 in panel (a), for period 1998-2014 in panel (b) and the real interest rate instead of T-bill rate in panel (c). We capture the interest rate volatility in a given quarter as the standard deviation of daily changes in the T-bill rate in that quarter. The coefficients are estimated via OLS with HAC standard errors. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Chapter 2

The Causal Effect of Institutional Ownership on Firm Level Risk Characteristics

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Abstract

We establish the causal effect of institutional ownership on a firm's total risk and its systematic and idiosyncratic components using Russell 2000 index membership as an instrument for institutional ownership following (Crane et al., 2016). We find that for a median Russell 1000 firm, a one standard deviation increase in institutional ownership in a given quarter causes a decrease in idiosyncratic volatility of 13.3% in annualized terms, which results in a decrease in total volatility of 12.8%. Institutional investors achieve this effect on a firm's risk characteristics partially through their effect on its financial performance, as measured by unexpected earnings. More precisely, an increase in institutional ownership increases a firm's financial performance, which turns to a decrease in its total and idiosyncratic volatility.

2.1 Introduction

In today's financial markets, institutional investors play a central role. Their investment can reveal a lot about their preferences and/or private information. Thus, it is not surprising to find vast literature analyzing institutional investors' preferences for firm and stock-level characteristics. Of course, investment by institutional investors might also affect these characteristics. Documenting this effect is more challenging exactly for the reason that institutional investors have preferences for these characteristics. In other words, it is not easy to establish a causal link since it is challenging to distinguish between the institutional investors' effect on and preferences for these characteristics.

In this paper, we establish the causal effect of institutional ownership on a firm's total risk and its systematic and idiosyncratic components. This is an important topic since there is little consensus on the time-series evolution and the cross-sectional determinants of the total, and especially idiosyncratic risk in the literature. We contribute to this literature by showing that an increase in institutional ownership causes a decrease in a firm's total risk, which is mostly due to a decrease in its idiosyncratic volatility.

We establish this causal effect of institutional ownership on risk characteristics following (Crane et al., 2016), which show that the discontinuity in index weights of firms around the Russell 1000/2000 threshold provides a good instrument for institutional ownership. To be more specific, firms whose market values are just above the Russell 1000/2000 threshold become the smallest firms in the Russell 1000 and receive very small weights due to the value-weighted nature of these indices. On the other hand, firms whose market values are just below this threshold become the largest firms in the Russell 2000 and receive significant index weights. Hence, there is a big difference in index weights of these firms around the Russell 1000/2000 threshold. More importantly, whether a firm around this threshold finds itself in the Russell 1000 or 2000 is practically a random event since these firms cannot control small variations in their market value rankings. (Crane et al., 2016) show that this random assignment also leads to a big difference in the ownership of these firms by institutional investors. They would prefer to hold the largest stocks in

Russell 2000 with high index weights than the smallest stocks in the Russell 1000 with trivial index weights for different reasons such as benchmarking or reducing tracking error. Thus, the inclusion in the Russell 2000 index is a potential instrument which needs to provide a significant variation in the institutional ownership that is exogenous to firm-level risk characteristics.

Hence, we first show that the inclusion in the Russell 2000 index is indeed a good instrument. To do this, we consider the 400 firms around the Russell 1000 and 2000 index threshold in each year between 1980 and 2014. The Russell indices are reconstituted annually following a mechanical rule based on market values as of the last day of May. The index constituents are determined using firms' market value ranks each year at the end of May and index membership locks for an entire year. We obtain data on historical constituents of these indices from Russell and match them with Thomson Reuters 13F filings, CRSP and COMPUSTAT using CUSIPs and company names. We compute quarterly institutional ownership of a stock as the ratio of its shares held by institutional investors to its total number of shares outstanding. To proxy for a firm's total risk, we use its quarterly realized volatility computed as the standard deviation of its daily excess returns in a given quarter. We then decompose its total risk into systematic and idiosyncratic risks based on the Fama-French four-factor model. More precisely, we regress the daily excess returns of stock ($r_{i,t}$) in a given quarter on the excess return of the market portfolio as well the size, book-to-market, and momentum factors. The idiosyncratic risk is then defined as the standard deviation of the residuals from this regression, and the systematic risk is defined as the square root of the difference between squared total risk (realized standard deviation) and squared idiosyncratic risk (residual standard deviation).

In line with (Crane et al., 2016) findings, institutional ownership also exhibits a significant variation around the Russell 1000/2000 in our sample. The mean (median) institutional ownership in the largest 200 firms in the Russell 2000 is about 61% (63%) while it is about 54% (53%) for the smallest 200 firms in the Russell 1000. More importantly, this significant variation in institutional ownership due to the Russell 2000 inclusion is exogenous to the risk characteristics of these firms. More precisely, we find that firms

around the threshold are comparable in terms of their volatility as well as its systematic and idiosyncratic components. Having established the validity of our instrument based on the Russell 2000 index inclusion, we then use it to identify the exogenous variation in institutional ownership in a two-stage least squares framework. Specifically, we estimate the first stage regression of institutional ownership on a set of control variables as well as our instrument, a dummy variable that takes value one if a given firm is in the Russell 2000 and zero otherwise. In the second stage, we regress a given risk measure on the fitted values from the first stage, i.e., the exogenous variation in institutional ownership, as well as the same control variables from the first stage. The coefficient estimate on the instrumented institutional ownership can then be interpreted as the causal effect of institutional ownership on a given risk measure.

In this two-stage least squares framework, we first analyze the total effect of institutional ownership on total risk and its systematic and idiosyncratic components. We find that an increase in the institutional ownership significantly decreases a firm's total volatility. A one standard deviation increase in institutional ownership in a given quarter decreases total volatility by 46% in the following quarter. Given that the median annualized volatility of Russell 1000 firms is about 28% then this effect would be approximately 12.8% reduction in annualized volatility for a median Russell 1000 firm. Therefore, the effect of institutional ownership on total volatility is economically important. When we turn our attention to the components of total volatility, we observe a similar effect of institutional ownership on a firm's idiosyncratic volatility but not on its systematic volatility. More precisely, the coefficient estimate of instrumented institutional ownership is also negative and statistically significant for idiosyncratic volatility. This effect is also economically important since an increase in a firm's institutional ownership decreases its idiosyncratic volatility by 13.3% (in annualized terms) one quarter later, compared to the median annualized idiosyncratic volatility for Russell 1000 firms. The R^2s of the second stage regressions for total and idiosyncratic volatility are also quite high at 54% and 37%, respectively, suggesting that the second stage model can explain a significant part of the variation in risk measures. On the other hand, we do not find any significant effect of

institutional ownership on a firm's systematic risk since institutional ownership does not significantly affect the firms' betas on the four factors. These results are robust to using the 800, instead of 400, firms around the threshold.

In our main empirical results, we compute institutional ownership as well as risk measures at the end of the third quarter and, thus, analyze the contemporaneous effect of institutional ownership in risk measures. It is possible that the effect of institutional ownership on risk measures takes more than one quarter to be fully realized. In other words, institutional ownership might have a delayed effect on risk measures, in addition to its contemporaneous effect documented above. To analyze this potential delayed effect, we consider risk measures at the end of the fourth quarter each year while measuring institutional ownership still at the end of the third quarter, as in our main empirical analysis. We find that total institutional ownership continues to have a negative and significant effect on idiosyncratic volatility even after one quarter. However, it no longer has a significant effect on total volatility when we consider its delayed effect one quarter after. These findings suggest that the effect of total institutional ownership on total volatility takes one quarter to be fully realized while its effect on idiosyncratic volatility takes two quarters.

We then analyze how the effect of total institutional ownership on firm-level risk measures change with other firm-level characteristics. We do this by adding an interaction term of total institutional ownership with given firm-level characteristics in our second stage regressions from above. We consider eight firm-level characteristics that capture different dimensions of institutional investors' preferences. These characteristics are the market value, book-to-market ratio, illiquidity ratio, dividend yield, existing institutional ownership, earnings per share, total volatility and whether a firm pays dividend or not. We find that the effect of institutional ownership on total and idiosyncratic volatility is stronger for dividend-paying firms and firms with higher initial market values, earnings per share and liquidity but with lower initial volatility.

We also distinguish between different types of institutional investors based on their investment horizons using the classification suggested by (Bushee, 2001, 1998), which groups institutions into Dedicated, Quasi-Indexer, and Transient groups using factor and

cluster analysis. We find that the Russell 2000 index inclusion is a good instrument for Quasi-Indexer and Transient institutions but not for Dedicated institutions. Our results for Quasi-Indexer and Transient institutions suggest that an increase in ownership by Quasi-Indexer or Transient institutions significantly decreases both total and idiosyncratic volatility but not systematic volatility. More importantly, Quasi-Indexers seem to have a stronger economical effect on both total and idiosyncratic volatility than Transient institutions since Quasi-Indexers have larger stakes in the firms around the Russell 1000 threshold.

Having established the causal effect of institutional ownership on a firm's total and idiosyncratic volatility, we now turn our attention to the mechanism through which institutional investors achieve this effect. We consider two potential channels: First, institutional ownership affects a firm's volatility by its effect on the firm's actual financial or operational performance and/or its variation over time. Second, institutional ownership affects a firm's volatility through its effect on the market's perceptions. We analyze the causal effect of institutional ownership on a firm's risk characteristics through these channels based on mediation analysis. We consider several mediator variables to capture these two channels. Specifically, we focus on the earnings per share as our main proxy for a firm's financial performance, while distinguishing between its expected and unexpected components based on an autoregressive model. We use the volatility of the residuals from this regression, i.e. the unexpected EPS, as our proxy for the volatility of the firm's financial performance. We also consider the market-to-book ratio and dividend yield as other potential proxies for financial performance. To capture the market's expectations about the firm's financial performance, we use data from the Institutional Brokers Estimate System (IBES). We use the quarterly average of the monthly mean EPS estimates as our proxy for the market's expectations about a firm's financial performance. We also use the difference between the actual EPS and the mean estimate as another proxy for unexpected earnings, or earnings surprise. To capture the market's uncertainty about the firm's financial performance, we use the standard deviation of analysts' EPS forecasts.

We first regress each mediator variable on instrumented institutional ownership sepa-

rately. We find that an increase in the institutional ownership significantly increases the market-to-book ratio, unexpected earnings and analysts mean estimate but decreases the dividend yield. Given these results, we focus only on these four mediator variables and estimate their effects on the total and idiosyncratic volatilities in the next step of our mediation analysis. Of these four variables, the unexpected earnings are the only variable with a statistically significant effect on the total volatility, where an increase in the unexpected earnings decreases the total volatility. We then decompose the total effect of instrumented institutional ownership on a firm's total volatility into its direct effect and its indirect effect through its effect on the firm's unexpected earnings. The total effect of institutional ownership is -2.6307 which can be decomposed into its indirect or mediated effect of -0.2859 and direct effect of -2.3448. Although the indirect effect is statistically significant, it only explains 11% of the total effect of institutional ownership on a firm's total volatility and the remaining 89% is due to its direct effect or its indirect effect via other channels. We find that a firm's financial performance as measured by its unexpected earnings continues to have a statistically significant mediation effect, even when we control for all other potential mediator variables in a multivariate mediation analysis. Overall, these results suggest that institutional ownership increases a firm's financial performance, as measured by unexpected earnings, which in turn leads to a decrease in its total and idiosyncratic volatility.

The rest of the paper is organized as follows. Section 2.2 discusses the related literature and Section 2.3 presents our data. Section 2.4 discusses our empirical methodology and Section 2.5 presents our main empirical results. Section 2.6 presents the mediation analysis. 2.7 reports robustness of our findings. Finally, Section 2.8 concludes.

2.2 Related Literature

Our paper is related to a large literature analyzing institutional investors' preferences for firm-level characteristics. (Falkenstein, 1996) shows that institutional investors have a significant preference for large firms with high visibility and low transaction costs, and

are averse to firms with low idiosyncratic volatility. (Del Guercio, 1996) finds that banks tend to tilt their portfolios toward “prudent" stocks. (Gompers and Metrick, 2001) find that institutional investors in the US invest mostly in firms that are larger, more liquid, and have had relatively low returns during the previous year. (Dahlquist and Robertsson, 2001) analyzes the preferences of foreign institutional investors and finds that they prefer firms with high market capitalizations, large cash positions, and low dividends but without any large dominant owners. However, most of this literature does not consider any time variation in institutional investors' preferences. The only exception to this is (Bennett et al., 2003), which finds that institutional investors shifted their preferences towards smaller and riskier stocks over time. In an earlier study ((Cenesizoglu et al., 2017)), we also consider the time variation in institutional investors' preferences for firm-level characteristics and precisely study how they change their preferences with the underlying interest rate environment. We find that institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high, in line with predictions of (Rajan, 2006).

The other strand of the literature related to our research project analyzes the risk characteristics of stocks and their evolution over time. For example, (Campbell et al., 2001) documents a persistent increase in firm-level idiosyncratic volatility while the aggregate market and industry volatilities remain almost constant over the time. (Xu and Malkiel, 2003) studies the determinants of idiosyncratic volatilities of individual stocks and finds that idiosyncratic volatility of a stock is associated with the degree to which their shares are owned by institutional investors. However, (Brandt et al., 2009) show that the aggregate idiosyncratic volatility level in the early 2000s after an increase during 1990 is similar to its pre-1990 levels; and argue that this increase and reversal of idiosyncratic volatility is more pronounced for firms with lower price and high level of retail investors. (Rubin and Smith, 2009) show that the correlation between institutional ownership and idiosyncratic volatility depends on the firm's dividend policy. In particular, institutional ownership is negatively related to idiosyncratic volatility for non-dividend paying stocks while this relation is positive for dividend-paying stocks. (Chichernea et al., 2015) examines how

the aforementioned relation between institutional investor's ownership and idiosyncratic volatility changes based on the investment horizon of institutional investors and find that ownership by short-term (long-term) institutional investors is positively (negatively) related to idiosyncratic volatility. (Kang et al., 2014) studies the effect of hedge funds on idiosyncratic volatility and demonstrate that hedge funds and other institutional investors decrease idiosyncratic volatility, with the exception of firms with extremely high initial idiosyncratic volatility where this relation is reversed.

However, most of the studies in the latter strand cannot establish a causal effect of institutional ownership on risk characteristics mostly due to the findings of the former. To be more precise, it is not straightforward to obtain a causal effect since the former strand of the literature shows that institutional investors also have preferences for these risk characteristics. In other words, it is not easy to distinguish between the institutional investors' effect on and preferences for risk characteristics. This complication is also why there is no consensus in the literature on the sign of this effect. In this paper, we fill this gap by establishing causality and determining the sign of this relationship in a conclusive manner. Furthermore, we also contribute to the literature by analyzing the sources of this causal effect, which the previous literature mostly ignores.

2.3 Data

Our data consists of the 400 (or 800) firms around the Russell 1000 and 2000 index threshold in each year between 1980 and 2014. The Russell indices are reconstituted annually following a mechanical rule based on market values as of the last day of May. The index constituents are determined using firms' market value ranks each year at the end of May and index membership locks for an entire year. We obtain data on historical constituents of these indices from Russell and match them with Thomson Reuters 13F filings, CRSP and COMPUSTAT using CUSIPs and company names. One of our main variables of interest is the percentage of a given stock held by institutional investors. We obtain this variable using 13F filings, where all institutional investors with more than $100

million in equity ownership report their holdings to the SEC each quarter. We aggregate each institutional investor m's holdings in stock i in quarter t (own_{imt}) and divide it by the total number of shares outstanding of stock i at the end of quarter t ($share_{it}$) to obtain the percentage of stock i held by institutional investors:

$$Own_{it} = \sum_{m=1}^{M} \frac{own_{imt}}{shares_{it}} \tag{2.1}$$

Other main variables of interest are the total risk of a stock and its components, i.e., systematic and idiosyncratic risks. We use daily stock return data from CRSP and compute realized volatility, defined as the standard deviation of daily excess returns on a stock in a given quarter, as our measure of total risk. We then decompose total risk into systematic and idiosyncratic risks based on the Fama-French four-factor model. More precisely, we regress the daily excess returns of a stock ($r_{i,t}$) in a given quarter on the excess return on the market portfolio ($MKTRF_t$) and the size (SMB_t), book-to-market (HML_t) and momentum (UMD) factors.

$$r_{i,t} = \alpha + \beta_{MKT} MKTRF_t + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{MOM} MOM_t + \varepsilon_{i,t} \tag{2.2}$$

The idiosyncratic risk is then defined as the standard deviation of the residuals from this regression, and the systematic risk is defined as the square root of the difference between squared total risk (realized standard deviation) and squared idiosyncratic risk (residual standard deviation). We also consider a suite of variables computed using data from CRSP and COMPUSTAT based on standard definitions[1] as either control variables in our main analysis or mediator variables in our mediation analysis.

Finally, we are also interested in different types of institutional investors, such as pension and mutual funds. Although Thompson Reuters provides a classification of institutional investors, it is not reliable after 1998 as noted by several authors as well as on WRDS. Instead, we categorize institutional investors based on their investment horizons using the classification suggested by (Bushee, 2001, 1998). To be more precise, (Bushee,

[1] More specifically, we compute the variables based on the WRDS definitions.

2001, 1998) classify institutions into Dedicated, Quasi-Indexer, and Transient groups using factor and cluster analysis.

Transient institutions have high portfolio turnover and diversified portfolios. These investors with their small ownership in numerous firms and frequent trading activities are interested in short-term earnings or stock return. (Porter, 1992) argues that myopic investment behavior is mainly created by Transient investors. (Bushee, 1998) provides empirical evidence that managers in firms which are dominated by Transient investors are more likely to reduce R& D investment in order to meet investors' short-term earning targets. On the other hand, Dedicated institutions have low turnover and less diversified portfolio holdings. (Porter, 1992) argues that these type of investors are in exact contrast with Transient investors and tend to have large and long-term ownership concentrated in only a few firms. They do not exhibit myopic investment behavior and are interested more towards long-term dividend or capital appreciation. Finally, Quasi-indexers have low turnover and diversified portfolio holdings. (Porter, 1992) argue that these type of investors are mainly considered as passive investors following an indexing or buy-and-hold strategy. They tend to have small long-term ownership in a wide variety of stocks which reduces their incentive to monitor managers. On the other hand, (Carleton et al., 1998; Monks and Minow, 2015) discuss that indexing strategy restricts these type of institutions from selling and urges them to monitor and influence firms' governance.

For comparison purposes, we first present some summary statistics on all constituents of Russell 1000 and 2000 indices before focusing more on the firms around the thresholds in the next section. Table 2.1 presents these summary statistics for Russell 1000 firms in panel (a) and Russell 2000 firms in panel (b). Given that institutional investors have preferences towards larger stocks, it is not surprising to find that institutional ownership in Russell 1000 firms is higher than Russell 2000 firms. This difference is mainly driven by Quasi-Indexers which have about 10% more ownership in Russell 1000 stocks compared to Russell 2000 stocks. Turning our attention to risk measures reveals that Russell 2000 stocks have, on average, higher total risk than Russell 1000. This difference is mostly driven by the fact that Russell 2000 stocks have higher idiosyncratic volatilities compared

to Russell 1000 stocks, although they also have slightly higher systematic risk than Russell 1000. These results are expected since it is well known that small stocks tend to have higher total and idiosyncratic risks.

2.4 Methodology

In this section, we discuss our empirical approach to establish a causal effect of institutional ownership on different risk measures. Our approach closely follows the method of (Crane et al., 2016) based on the discontinuity in index weights of firms around the Russell 1000/2000 threshold. To this end, we first provide a brief background on the Russell indices and our identification assumption. We then discuss our two-stage least squares (TSLS) approach and present results based on the first stage estimation of institutional ownership on our instrument.

2.4.1 Identification Assumption

The Russell 1000 and 2000 are value-weighted indices of the largest 1000 and the subsequent largest 2000 U.S.-listed firms, respectively. The market value threshold between Russell 1000 and 2000 firms is determined based on the closing prices and the number of shares outstanding at the end of May each year. The exact index weights are determined only at the end of June. Hence, in our main empirical analysis, we consider data on institutional ownership as well as different risk measures from the third quarter of each year, which is the quarter immediately following the index construction at the end of June. Figure 2.1 depicts this timeline and the measurement of our variables.

At the time of the index construction, firms just above the threshold become the smallest firms in the Russell 1000 and receive very small weights due to the value-weighted nature of these indices. On the other hand, firms just below this threshold are the largest firms in the Russell 2000 and receive significant index weights. The assignment to the Russell 1000 or 2000 indices for firms around the threshold is practically a random event

since these firms cannot control small variations in their market value rankings. However, this random assignment leads to big differences in index weights for these firms, as shown in panel (a) of Figure 2.2 for 400 firms around the threshold.

More importantly, institutional investors would prefer to hold the largest stocks in Russell 2000 with high index weights than the smallest stocks in the Russell 1000 with trivial index weights for different reasons such as benchmarking or reducing tracking error. In other words, the institutional ownership of the largest firms in the Russell 2000 would be higher than that of the smallest firms in the Russell 1000. This is specifically what we observe in panel (b) of Figure 2.2 and Table 2.2. More precisely, the mean institutional ownership in the largest 200 firms in the Russell 2000 is about 61% while it is about 54% for the smallest 200 firms in the Russell 1000. The difference is even bigger at 10% when we consider the median ownership. Figure 2.2 also presents the ownership in these firms by Quasi-Indexer, Dedicated and Transient investors. As discussed above, it is not surprising to find that the difference in institutional ownership in these firms around the threshold is mostly driven by Quasi-Indexer institutions, which are generally passive investors following these indices. Transient institutions also own a slightly higher percentage of the largest 200 firms in the Russell 2000 index compared to the smallest 200 firms in the Russell 1000 while there is no difference in ownership of these firms by Dedicated institutions.

For our instrument based on the Russell index inclusion to be valid, firms around the threshold should be comparable, especially concerning their volatility and its components, which are our main variables of interest. Figure 2.3 presents the total volatility as well as its components, systematic and idiosyncratic volatility around the threshold. Unlike total institutional ownership, total volatility, as well as its components, do not exhibit a drastic discontinuity around the threshold. This is also confirmed based on summary statistics on these volatility measures for the 400 firms around the threshold. These findings show that total volatility and its components are very similar for firms around the threshold, suggesting the validity of our instrument based on the Russell index inclusion.

There are also other factors that might affect the validity of our instrument. (Crane

et al., 2016) discuss these factors and how to adjust for them in detail. Given that we follow their approach very closely, we refer the reader to their paper for further details.

2.4.2 Two Stage Least Squares

In this section, we discuss our estimation approach to establish a causal effect of institutional ownership on total volatility and its components. Following (Crane et al., 2016), we employ a two-stage least squares (TSLS), which can be summarized as follows: In the first stage of our TSLS approach, we regress the institutional ownership of 400 stocks around the threshold on a dummy variable of Russell 2000 index membership and market capitalization rankings as well as their interaction term:

$$\begin{aligned} Own_{i,t} = \alpha_t + \lambda_i + \kappa Russell2000_{i,t} + \delta_1 (MCAPRank_{i,t} - 1000) \\ + \delta_2 Russell2000_{i,t} (MCAPRank_{i,t} - 1000) + \delta_3 FloatAdj_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{2.3}$$

where $Russell2000_{i,t}$ is dummy variable which indicates Russell 2000 inclusion for firm i at year t measured May 31st of each year. In order to limit the effect of outliers in regression setups we use log transformation ($log(1+Own_{it})$) for ownership measure. We control for firm's distance to the threshold by including $MCAPRank_{i,t} - 1000$, which is firm i's distance to the threshold based on its market value at the end of May of year t, and its interaction with the Russell 2000 inclusion dummy variable, i.e., $Russell2000_{i,t}(MCAPRank_{i,t} - 1000)$. We also include $FloatAdj_{i,t}$ which is the $MCAPRank_{i,t}$ minus the actual Russell rank which is available in June. This variable controls for any characteristic other than market value, which might have been used to determine Russell index weight. We also include firm fixed effects captured by λ_i, in addition to the year fixed effects captured by α_t as considered by (Crane et al., 2016). Finally, $Own_{i,t}$ is the institutional ownership of firm i in year t which is measured at the third quarter of each year, i.e., the quarter immediately following Russell index disclosure.

In the second stage, we regress different measures of risk, $Risk_{i,t}$, on the instrumented institutional ownership and the same control variables from the first stage as well as the

year and firm fixed effects. Hence, our second stage regression is given by:

$$\begin{aligned} Risk_{i,t} = \theta_t + \mu_i + \beta \widehat{Own_{i,t}} + \gamma_1 (MCAPRank_{i,t} - 1000) \\ + \gamma_2 Russell2000_{i,t} (MCAPRank_{i,t} - 1000) + \gamma_3 FloatAdj_{i,t} + \eta_{i,t} \end{aligned} \tag{2.4}$$

where $Risk_{i,t}$ is the logarithm of one of the three risk measures – total, systematic or idiosyncratic – for firm i in the third quarter of year t. $\widehat{Own_{i,t}}$ is the fitted value of institutional ownership from the first stage, i.e., the instrumented institutional ownership.

Overall, the first stage allows us to identify the exogenous variation in institutional ownership based on the discontinuity of Russell index weights around the threshold. We then use this exogenous variation in our second stage to establish the causal effect of institutional ownership on different risk measures. We estimate both first and second stage regression via ordinary least squares with standard errors clustered at firm level.

2.5 Results

In this section, we first present the effect of Russell 2000 inclusion on institutional ownership based on the first stage estimation. We then direct our attention to our main empirical results on the causal effect of institutional ownership on different risk measures based on our second stage estimation. Finally, we analyze how different types of institutional investors and firm characteristics impact the effect of institutional ownership on different risk measures.

2.5.1 The Effect of Russell 2000 Inclusion on Institutional Ownership

As we have discussed in Section 2.4, inclusion in the Russell 2000 index for firms around the threshold affects the institutional ownership of these firms. However, we have not analyzed whether this effect is statistically significant. We do this based on the first stage estimation while controlling for other factors as discussed above. Table 2.3 presents these results.

We start our discussion with the effect of Russell 2000 inclusion on the total ownership. The dummy variable for inclusion in the Russell 2000 has a significant and positive effect on total institutional ownership in the 400 firms around the threshold. This is in line with our findings in Section 2.4 and shows that inclusion in the Russell 2000 index increases the total institutional ownership in the largest 200 firms in the Russell 2000 by about 1.9% compared to the smallest 200 firms in the Russell 1000. This effect is economically important when we consider that the mean and median institutional ownership in the Russell 2000 index are about 47% and 44%, respectively, as presented in Table 2.3. Furthermore, the market value rank has a negative effect, suggesting that the total institutional ownership decreases as the market value rank increases, or equivalently, market value decreases. This is in line with institutional investors' preferences for larger firms. $FloatAdj$ as mentioned previously controls for the difference between May end market cap ranking and Russell ranking and is calculated by firm's market cap rank minus Russell index rank. The positive and significant coefficient shows that smaller the firm's rank in Russell comparing to market cap rank, higher the ownership. This is in line with institutional investors' preference for firms with larger index weights in Russell. The adjusted R^2 of the first stage is also quite high at 88%, suggesting that our first stage regression can explain most of the variation in total institutional ownership. More importantly, the F-statistics of 16.48, which is significant at 1% level, suggests that the Russell inclusion dummy can be considered a good instrument for institutional ownership.

Table 2.3 also presents the results from the first stage regressions for different types of institutional investors. The Russell 2000 inclusion dummy has significantly positive coefficient estimates for Quasi-Indexer and Transient institutions while it has a coefficient estimate that is practically zero for Dedicated institutions. These results suggest that the Russell 2000 inclusion dummy is a good instrument for Quasi-Indexer and Transient institutions but not for Dedicated institutions, a conclusion also supported by the F-statistics. These results are not entirely unexpected. As discussed above, Quasi-Indexers and Transient investors are likely to track indices while Dedicated investors are long-term investors and their portfolio allocation do not depend on index inclusions or exclusions. Given these

results, we only present results from the second stage regressions for ownership by all institutions, Quasi-Indexers, and Transient investors.

2.5.2 The Effect of Institutional Ownership on Firm Level Risk Measures

The Effect of Total Institutional Ownership

Table 2.4 presents the results from the estimation of the second stage regressions. As discussed above, the coefficient estimate on the instrumented institutional ownership in the second stage regressions can be interpreted as the causal effect of institutional ownership on firm-level risk characteristics, the main interest of our paper.

We start our discussion with the effect of institutional ownership on the firm's total volatility. The instrumented institutional ownership has a significantly negative effect on total volatility, suggesting that an increase in the institutional ownership significantly decreases a firm's total volatility. To be more precise, a one standard deviation increase in institutional ownership in a given quarter decreases total volatility by 46% in the following quarter. Given that the median annualized volatility of Russell 1000 firms is about 28%, this effect of institutional ownership on a median firm in Russell 1000 would be approximately 12.8% reduction in annualized total volatility which is economically important.

When we turn our attention to the components of total volatility, we observe a similar effect of institutional ownership on a firm's idiosyncratic volatility but not on its systematic volatility. More precisely, the coefficient estimate of instrumented institutional ownership is also negative and statistically significant for idiosyncratic volatility. This effect is also economically important since an increase in a firm's institutional ownership increases its idiosyncratic volatility by 13.3% (in annualized terms) one quarter later, compared to the median annualized idiosyncratic volatility for Russell 1000 firms.

On the other hand, we do not find any significant effect of institutional ownership on a firm's systematic risk. To be more specific, although the coefficient of institutional own-

ership is negative, it is not significantly different from zero. There might be two potential explanations for this insignificant effect of institutional ownership on systematic risk: (1) Institutional investors cannot affect any component of a firm's systematic risk; (2) Institutional investors can affect the components of a firm's systematic risk, but these effects cancel each other. In an unreported analysis, we considered the effect of instrumented institutional ownership on the four components of systematic risk, i.e. the loadings on the four factors: $\beta_{mkt}, \beta_{hml}, \beta_{smb}$ and β_{mom}. The coefficient estimates on the instrumented ownership in all these second stage regressions are all statistically insignificant. This, in turn, suggests that institutional investors do not affect systematic risk because they do not affect any of its components and not because their effects on different components cancel each other out.

Furthermore, for all three risk measures, the market value rank has a positive coefficient, which means in general smaller firms (higher rank) are more volatile. However, in Russell 2000 we notice a decrease in total volatility. R^2 of the second stage is also quite high at 54%, 37%, and 65% for total volatility, idiosyncratic and systematic volatility respectively, suggesting that our second stage regression can explain a significant part of the variation in risk measures.

How does the Effect of Total Institutional Ownership Change with other Firm Level Characteristics?

Here, we analyze how the effect of total institutional ownership on firm-level risk measures change with other firm-level characteristics. We do this by adding an interaction term of total institutional ownership with given firm-level characteristics in our second stage regressions from above. We consider eight firm-level characteristics that capture different dimensions of institutional investors' preferences. These characteristics are the market value, book-to-market ratio, illiquidity ratio, dividend yield, existing institutional ownership, earnings per share, total volatility and whether a firm pays dividend or not. We measure these characteristics at the end of the first quarter of each year, i.e., one quarter before the Russell index construction at the end of May, to avoid any effect of institutional

ownership on these characteristics. Table 2.5 presents the results from the estimation of second stage regressions that include the interaction term in addition to all the variables in our main empirical specification described in Section 2.4.

Panel (a) reports results for total volatility as the dependent variable. The overall effect is negative as expected for different columns. However, the negative and significant interaction term for market cap reveals that for firms with the higher initial market cap the effect is stronger. Also, the negative and significant coefficient of interaction term with EPS explains that firms with higher Earnings per share before Russell1000 inclusion, tend to experience the stronger effect of Institutional ownership on their volatility. Further, the positive and significant coefficient for the interaction terms of illiquidity (ILR) and volatility $VOLAT$ reveals that the effect of ownership on volatility is more pronounced for firms with higher initial liquidity and lower volatility. Finally, the negative and significant coefficient of dividend dummy (dummy variable equal to 1 if the firm pays dividends) attests that the mentioned effect is stronger in dividend-paying firms.

Panel (b) shows results when idiosyncratic is the dependent variable. Similar to the panel (a), these results explain that the effect of institutional investors on firms' idiosyncratic volatility is negative and significant in general. However, this effect is stronger for firms with higher liquidity, higher earnings per share, lower volatility, and paying dividends.

Panel (c) also presents results where systematic risk is the dependent variable. As it is expected, the effect of institutional ownership on systematic risk is insignificant in most of the cases. However we can observe some significant effects in a few subcategories of firms. By introducing the interaction term of market size, the overall effect becomes positive and significant along with the negative coefficient of the interaction term. That means institutional investors affect positively firm systematic risk for small market cap stocks. Also, based on other interaction term coefficient estimates, we can say that it is possible to observe a negative effect on systematic risk in firms with high earnings per share and firms already held more by institutional investors. On the other hand, we can also observe positive effect for firms with extremely high initial volatility. These findings

are not in the main scope of our paper, but we provide them for completeness.

The Effect of Ownership by Different Types of Institutions on Firm Level Risk Measures

We now analyze the effect of ownership by different types of institutions on firm-level risk measures. As discussed above, the dummy variable for Russell 2000 inclusion is a good instrument for Quasi-Indexer and Transient institutions but not for Dedicated institutions. Hence, Table 2.6 presents the estimation results from the second stage regression for Quasi-Indexer institutions in panel (a) and Transient institutions in panel (b).

An increase in ownership by Quasi-Indexer or Transient institutions significantly decreases both total and idiosyncratic volatility but not systematic volatility. To be more precise, a one standard deviation increase in ownership by Quasi-Indexer institutions would decrease total and idiosyncratic volatilities by 14% and 14.3% (in annualized terms for a median Russell 1000 firm), respectively. Similarly, a one standard deviation increase in ownership by Transient institutions would decrease total and idiosyncratic volatility by 10.7% and 11.4% (in annualized terms for a median Russell 1000 firm), respectively. These values are economically important given that the median firm in the Russell 1000 index has total and idiosyncratic volatilities of 27.69% and 22.8%, respectively. Our findings for Quasi-Indexers are inline with Appel et al. (2016) that studied the effect of Quasi-Indexers on firm's corporate governance and documented that passive institutional investors actively affect firms corporate governance measures. In this vein, Our results suggest that Quasi-Indexers also significantly affect firm-level risk characteristics.

The Delayed Effect of Total Institutional Ownership on Risk Measures

In our main empirical results, we compute institutional ownership as well as risk measures at the end of the third quarter and, thus, analyze the contemporaneous effect of institutional ownership in risk measures. It is possible that the effect of institutional ownership on risk measures takes more than one quarter to be fully realized. In other words,

institutional ownership might have a delayed effect on risk measures, in addition to its contemporaneous effect documented above. To analyze this potential delayed effect, we consider risk measures at the end of the fourth quarter each year while measuring institutional ownership still at the end of the third quarter, as in our main empirical analysis. Figure 2.4 depicts this timeline of measurement for different variables. We then run the second stage regressions by replacing the contemporaneous risk measures (measured at the end of third quarter of each year) by their one-quarter ahead values (measured at the end of fourth quarter) as the left-hand side variable, while keeping all the right-hand side variables including the time and firm fixed effects the same.

Table 2.7 presents the results from these second stage regressions. Total institutional ownership continues to have a negative and significant effect on idiosyncratic volatility even after one quarter. It also continues to have an insignificant effect on systematic risk. However, it no longer has a significant effect on total volatility when we consider its delayed effect one quarter after. In an unreported analysis, we also considered risk measures three quarter after Russell index construction, i.e., the first quarter of the following calendar year, and found that the total institutional ownership does not have any statistically significant effect on total volatility or its components. These findings suggest that the effect of total institutional ownership on total volatility takes one quarter to be fully realized while its effect on idiosyncratic volatility takes two quarters. In other words, institutional investors continue to decrease a firm's idiosyncratic volatility even after their initial investments.

2.6 How do Institutional Investors Affect Firm Level Risk Measures?

In the previous section, we document that an increase in institutional ownership in a firm causes a decrease in the firm's total volatility. We also show that this is due to the fact that institutional ownership decreases the firm's idiosyncratic volatility but does not signifi-

cantly affect its systematic risk. In this section, we analyze the mechanism through which institutional investors achieve this effect on a firm's total and idiosyncratic volatilities. To this end, we first present our approach based on the mediation analysis. We then discuss potential mediator variables and present our empirical results.

2.6.1 Mediation Analysis

In mediation analysis, an independent variable hypothesized to affect a dependent variable through one or more intervening variables which are called mediators. Figure 2.5 depicts different steps in simple mediation analysis. Panel (a) presents the total effect of institutional ownership on a given risk measure, denoted by c. This total effect can then be decomposed into the direct effect of the independent variable on the dependent variable and its indirect effect through the mediator(s). One can achieve this decomposition by considering either a single mediator as depicted in panel (b) or multiple mediators as depicted in panel (c). The indirect effect of ownership on a given risk measure is given by $a \times b$ in the single mediator case and $\sum_{i=1}^{j} a_i \times b_i$ in the multiple mediator case where a (or a_i) denote the effect institutional ownership on the mediator variable and b (or b_i) denote the effect of the mediator variable on a given risk measure. The direct effect c' is then simply the difference between the total and indirect effects as $c' = c - a \times b$ in the single mediator case and $c' = c - \sum_{i=1}^{j} a_i \times b_i$ in the multiple mediator case. (Baron and Kenny, 1986) argue that the following conditions should hold to establish mediation in our framework: (1) The independent variable should have a significant effect on the dependent variable; (2) The independent variable should have a significant effect on the mediator; (3) The mediator should have a significant effect on the dependent variable.

In our main empirical analysis, we show that the first condition holds, i.e., the instrumented institutional ownership has a significant effect on a firm's total and idiosyncratic volatilities. To decompose this total effect via mediation analysis, we follow (Baron and Kenny, 1986) and first estimate the following regression for each mediator variable

$Mediator_{i,t}$ separately.

$$\begin{aligned} Mediator_{i,t} =& \theta_{2,t} + \lambda_{2,i} + a\widehat{Own_{i,t}} + \phi_{2,1}(MCAPRank_{i,t} - 1000) + \\ & \phi_{2,2} Russell2000_{i,t}(MCAPRank_{i,t} - 1000) + \phi_{2,3} FloatAdj_{i,t} + \eta_{i,t} \end{aligned} \tag{2.5}$$

This regression allows us to establish the second condition. If the instrumented institutional ownership does not have a significant effect on a given mediator variable, i.e., the estimate of a is statistically insignificant, it then does not make sense to analyze whether the mediator variable has a significant effect on a given risk measure. On the other hand, if the instrumented institutional ownership does have a significant effect on a given mediator variable, we then proceed to the estimation of the following regression to establish whether the mediator variable has a significant effect on a given risk measure:

$$\begin{aligned} Risk_{i,t} =& \theta_{3,t} + \lambda_{3,i} + bMediator_{i,t} + c'\widehat{Own_{i,t}} + \phi_{3,1}(MCAPRank_{i,t} - 1000) + \\ & \phi_{3,2} Russell2000_{i,t}(MCAPRank_{i,t} - 1000) + \phi_{3,3} FloatAdj_{i,t} + \zeta i,t \end{aligned} \tag{2.6}$$

This regression allows us to establish the third condition and, thus, the mediation effect of a given variable of interest. We run this regression for each mediator variable separately in order to understand their mediation role in the causal effect of institutional ownership on different risk measures. However, this regression does not allow us to understand the mediation role of a given variable when we control for other potential mediator variables. To this end, we also consider a multivariate mediation analysis by examining each potential mediator variable jointly in the following regression.

$$\begin{aligned} Risk_{i,t} =& \theta_{3,t} + \lambda_{3,i} + \sum_j b_j Mediator_{j,i,t} + c'\widehat{Own_{i,t}} + \phi_{3,1}(MCAPRank_{i,t} - 1000) + \\ & \phi_{3,2} Russell2000_{i,t}(MCAPRank_{i,t} - 1000) + \phi_{3,3} FloatAdj_{i,t} + \zeta i,t \end{aligned} \tag{2.7}$$

We estimate all the coefficients via OLS with firm-level clustered standard errors. Finally, In order to test the significance of Mediated effect, we use bootstrapped standard errors as suggested by (Preacher and Hayes, 2008). The bootstrapped standard errors are widely used in the literature using mediation analysis since it does not impose any assumption regarding the distribution of $a \times b$. We also consider the Sobel test statistic based on clustered standard error given by $\sqrt{a^2 s_b^2 + b^2 s_a^2 + s_a^2 s_b^2}$ which is assumed to have standard normal distribution ((Baron and Kenny, 1986)).

2.6.2 Mediator Variables

There are many potential channels through which institutional investors might be affecting the risk of a firm in which they invest. We consider two such channels. First, institutional ownership affects a firm's volatility by its effect on the firm's actual financial or operational performance and/or its variation over time. Second, institutional ownership affects a firm's volatility through its effect on the market's perceptions. To be more precise, investment by institutions might alter the market's expectations about the firm's performance and/or the market's uncertainty surrounding this performance.

These two channels have also been discussed in the literature, (McConnell and Servaes, 1990; Himmelberg et al., 1999) studied the effect of institutional investors on firms' performance. They find a significant positive relation between firm's Tobins' Q measure and the fraction of shares owned by institutional ownership. (Ackert and Athanassakos, 2003) examined the relationship between analysts' forecast and institutional investors' ownership for a firm's stock and documented that analysts increase their optimism about firm's earnings following institutional investors holding increase. (O'Brien and Bhushan, 1990) Also studied the relation between the number of institutional investors and analysts following the firms during 1981-1987 and they documented no significant relation in a simultaneous equations setup.

Consequently, we consider two sets of mediator variables to analyze the effect of institutional ownership on a firm's risk measures through these two channels. We focus on the earnings per share ($EPS_{i,t}$) as our main proxy for a firm's financial performance. We also distinguish between its expected and unexpected components based on the following AR(1) model:

$$EPS_{i,t} = c + QuarterDummies_t + \alpha EPS_{i,t-1} + \varepsilon_{i,t}$$

We estimate this model via OLS separately for each firm that has at least 30 quarterly EPS available through time. We consider both the actual ($EPS_{i,t}$) and unexpected ($\varepsilon_{i,t}$) EPS as proxies for financial performance. We use the square of the residuals from this regression, i.e. the unexpected EPS, as our proxy for the volatility of the firm's finan-

cial performance ($EPSSR$). Finally, we also consider market-to-book ratio ($MtoB$) and dividend yield ($DivY$) as other potential proxies for financial performance.

To capture the market's expectations about the firm's financial performance, we use data from the Institutional Brokers Estimate System (IBES), which provides monthly data on analysts' EPS estimates and other related statistics. We match the IBES database to our firms imposing three conditions: (1) The firm's fiscal year ends in December; (2) The firm has at least three estimates for a given quarter; (3) The firm has at least one month of data in a given quarter. We use the quarterly average of the monthly mean EPS estimates ($IBESMEANEST_{i,t}$) as our proxy for the market's expectations about a firm's financial performance. We also use the difference between the actual EPS, $EPS_{i,t}$, and the mean estimate ($IBESESTERR_{i,t}$) as another proxy for unexpected earnings, or earnings surprise. To capture the market's uncertainty about the firm's financial performance, we use the standard deviation of analysts' EPS forecasts ($IBESSTDEV_{i,t}$).

2.6.3 Empirical Results

Single Variable Mediation Analysis

Table 2.8 presents the effect of instrumented institutional ownership on the potential mediator variables. These results suggest that an increase in the institutional ownership significantly increases the market-to-book ratio, unexpected earnings, and Analysts mean estimate but decreases the dividend yield. On the other hand, institutional ownership does not have a statistically significant effect at the 10% level on any of the other mediator variables. As mentioned above, the independent variable of interest (instrumented institutional ownership) needs to have a statistically significant effect on a given variable to establish its mediation effect. Hence, we focus only on these four mediator variables – the market-to-book ratio, unexpected earnings, analysts' mean EPS estimate, and dividend yield – in the next step and estimate their effects on the total and idiosyncratic volatilities.

Panel (a) of Table 2.9 presents the effect of these variables on total volatility when

considered separately. Of these four variables, the unexpected earning is the only variable with a statistically significant effect on total volatility. To be more precise, an increase in the unexpected earnings decreases the total volatility, while controlling for all the other variables considered in the second stage estimation of our TSLS approach. These results, in turn, suggest that of all the potential mediator variables considered only the unexpected earnings satisfies all the conditions required of a mediator variable. We then decompose the total effect of instrumented institutional ownership on a firm's total volatility into its direct effect and its indirect effect through its effect on the firm's unexpected earnings. Panel (b) of Table 2.9 presents this decomposition. The total effect of institutional ownership is -2.6307 which can be decomposed into its indirect or mediated effect of -0.2859 and direct effect of -2.3448. Although the indirect effect is statistically significant, we can explain only 11% of the total effect of institutional ownership on a firm's total volatility by its effect via the firm's unexpected earnings. The remaining 89% is due to its direct effect or its indirect effect via other channels.

Table 2.10 presents similar results for the decomposition of the total effect of institutional ownership on a firm's idiosyncratic volatility. To be more precise, in Panel (a) the unexpected earnings is the only variable with a statistically significant effect on idiosyncratic volatility, in other words, an increase in the unexpected earnings decreases the idiosyncratic volatility. In panel (b) the total effect of ownership on the firm's idiosyncratic volatility is decomposed to direct and indirect effects. The indirect effect is statistically significant and shows that almost 8% of the total effect of institutional investors on firms' idiosyncratic volatility is mediated through unexpected earnings.

Overall, these results suggest that institutional ownership increases a firm's financial performance, as measured by unexpected earnings, which in turn leads to a decrease in both its total and idiosyncratic volatilities.

Multivariate Mediation Analysis

As discussed above, single variable mediation analysis allows us to analyze the mediation effect of potential variables when considered separately. However, it does not let us un-

derstand whether this mediation effect remains significant when we control for other potential channels. We turn to the multivariate mediation analysis to analyze the mediation effect of all potential variables jointly. Panel (a) of Table 2.11 presents the regression of total and idiosyncratic volatilities on all the mediator variables and instrumented institutional ownership as well as other control variables. These results show that four variables – unexpected earnings and its volatility, Market to book ratio, and dividend yield have statistically significant effect on a firm's total and idiosyncratic volatilities, making them potential channels through which institutional ownership might be affecting a firm's risk measures. In line with our previous results based on single mediator variables, an increase in unexpected earnings decreases a firm's total and idiosyncratic volatilities. On the other hand, an increase in the dividend yield, volatility of unexpected earnings, and market to book ratio increases a firm's total and idiosyncratic volatilities.

We now analyze the mediated effect of these variables while still controlling for all potential mediator variables. These results are presented in Panel (b) of Table 2.11. In line with our conclusions based on single mediator variables, we find that institutional ownership increases a firm's financial performance as measured by its unexpected earnings. This increase in unexpected earnings, in turn, decreases the firm's total and idiosyncratic volatilities. The multivariate mediation analysis reveals that in addition to unexpected earnings, institutional ownership affects a firm's risk measures through its effect on the firm's dividend yield and earnings volatility. More precisely, an increase in institutional ownership decreases a firm's dividend yield and earnings volatility, which themselves have positive effects on the firm's risk measures, for a negative mediated effect. Finally, when considered jointly, all the considered mediator variables have a significant mediated effect, which accounts for 18% to 13% of the total effect of institutional ownership on firm's total and idiosyncratic volatilities. The remaining 82% and 87% is either due to the direct effect of institutional ownership on the firm's total and idiosyncratic volatilities or its indirect effect through other unaccounted channels.

2.7 Robustness check

In this section to do robustness check, we expand the bandwidth from 400 to 800 firms around the Russell 1000/2000 threshold. In Table 2.12 we report second stage regression results for this setup. The coefficients of $\widehat{Own}_t$ demonstrates that the effect of institutional ownership on firm-level volatility and idiosyncratic risk is negative and statistically significant. Comparing these results with ones in Table 2.12 confirms that our findings in two different setups are qualitatively identical and the model is reasonably robust when tested in a different sample.

In another set of result, we only focused on the firms around Russell 1000 threshold ($\pm$200) which moved from Russell 1000 to Russell 2000 or vice versa. Since it was not possible to use IV setup[2] we studied change of ownership and change of risk characteristics which are measured one quarter after the Russell index inclusion. Table 2.13 presents the results for this study. Negative and significant coefficients of ΔOwn on $\Delta Volatility$ and $\Delta Idiosyncratic$ along with insignificant coefficient on $\Delta Systematic$ show qualitatively same result comparing to our main findings.

Due to the "banding" policy[3] which has been implemented on Russell index constituents starting year 2007, we implement our analysis on 1991-2006 sample similar to Crane et al. (2016) as robustness check. Results in Table 2.14 suggest that for idiosyncratic volatility results are qualitatively similar comparing to our main results. For total volatility we observe negative coefficient but it is not statistically significant. Since "banding" policy possibly effects firms close to threshold, we exclude $\pm$25 firms around the threshold to minimize this effect in our sample. Table 2.15 reports the result for this sub-sample and our findings in this table shows that the main results are robust excluding closest firms to the threshold.

Finally, as a matter of completeness we also test other institutional ownership measure

[2]Instrumental variable setup tested, but results from first stage regressions suggested that for this sample our IV is not a strong instrument.

[3]This policy means that stocks in the Russell 2000 are moved to Russell 1000 only if their end-of-May Russell market cap rank increased significantly during the year.

and for this purpose we utilize institutional ownership concentration measure (HHI- Index). Table 2.16 presents first stage regressions where dependent variable is institutional ownership concentration measure. As suggested by results, Russell 2000 index inclusion does not have a significant effect on ownership concentration and also first-stage F-statistics shows that Russell 2000 index inclusion is not a strong instrumental variable for ownership concentration measure.

2.8 Conclusion

In this paper, we established the causal effect of institutional investors on the firm-level risk measures including firms' total, idiosyncratic and systematic risk. To this goal, we utilized a two-stage regression model which used Russell2000 index inclusion as an instrumental variable for institutional investors following (Crane et al., 2016). We first show that the drastic change of Russell index weight at 1000/2000 threshold affects Institutional ownership but is exogenous to the firm-level risk measures. Utilizing this IV, we documented that an increase in institutional ownership significantly reduces the firm's total and idiosyncratic volatilities. However, there is no effect on the firm's systematic risk. We extend our analysis by studying the lagged effect of ownership and showed that institutional ownership measured at the end of the third quarter decreases firm's idiosyncratic volatility at the end of the fourth quarter each year. However, effects on total volatility do not persist till the end of the fourth quarter.

In another section, by adding the interaction term to our second stage regression models, we found that the effect of institutional ownership on firms' total and idiosyncratic volatility is stronger in firms with specific characteristics such as paying dividend, higher earnings per share and liquidity, but lower initial volatility. Moreover, we studied different categories of institutional investors and pointed out that Quasi-Indexers and Transient institutional investors reduce firms' risk. In comparison, this effect is more stronger for the Transient investors per one unit of increase in ownership.

In the second part of the paper, we studied the mechanism through which institutional

investors affect firms' risk measures. We consider two mechanisms for this effect. First, Institutional investors decrease firm risk by increasing its performance. Second, Institutional investors decrease firm risk by affecting market perceptions around the firm. We used mediation analysis and employed several variables (mediators) as proxies for each channel. Then, we reported that institutional investors reduce firms' volatility by increasing its financial performance measured by unexpected earnings per share. This indirect effect contributes to almost 11% of the total effect of institutional ownership on firms' volatility and is reasonably robust with including all of the mediators.

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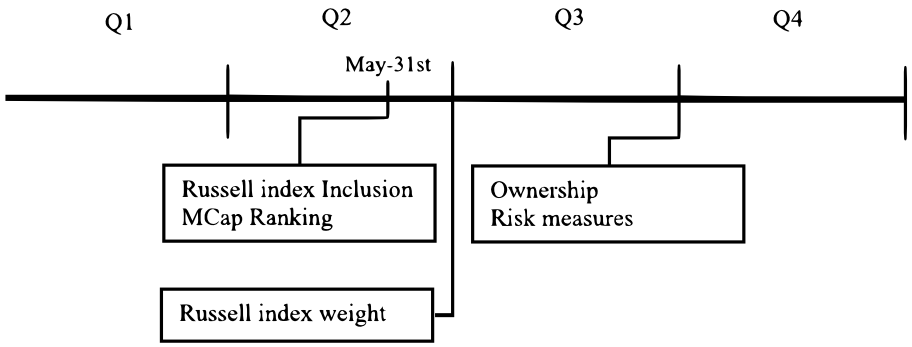
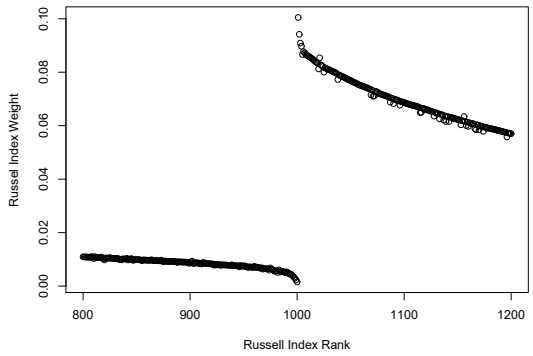
Figure 2.1 – Variable Measurement Timeline



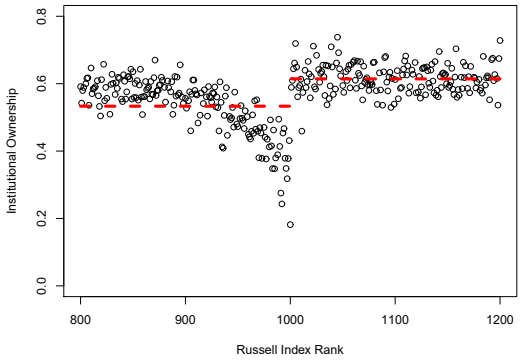
The Figure shows the variable measurement timeline in TSLS models. Each year, Russell inclusion index measured May-31st. CRSP unadjusted market cap end of May used as a proxy to identify firms around Russell index 1000/2000 threshold. Russell index weights disclose at the end of the second quarter each year. Institutional ownership and Risk characteristics are measured at the end of the third quarter.

Figure 2.2 – Russell Index and Categories of Institutional Investors Around the Cutoff

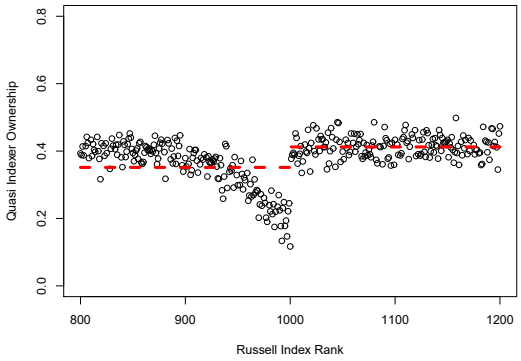
(a) Russell index weight close to 1000 cutoff



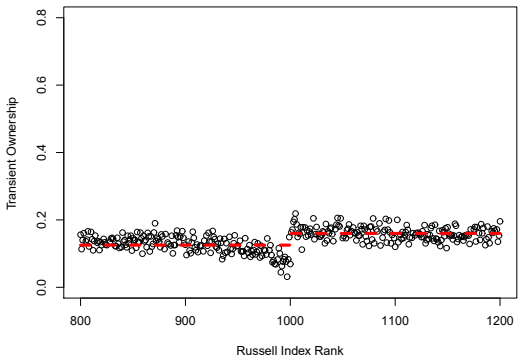
(b) Total Institutional ownership close to cutoff



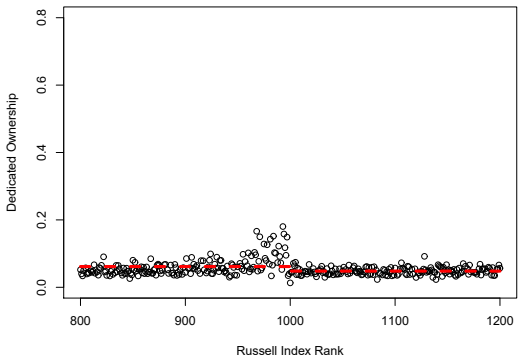
(c) Quasi-Indexers ownership close to cutoff



(d) Transient investor ownership close to cutoff



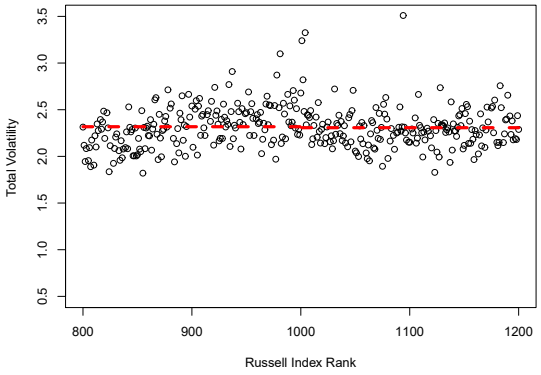
(e) Dedicated investor ownership close to cutoff



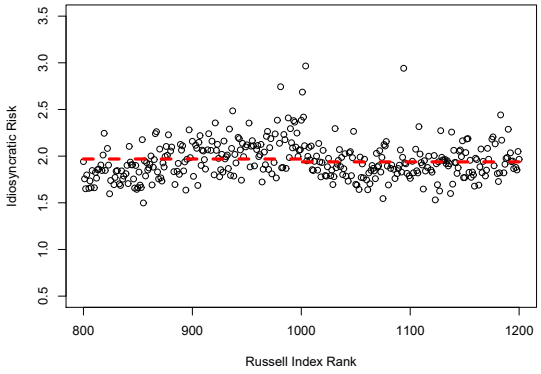
These figures present average index weight and Institutional ownership for firms around the Russell 1000/2000 threshold ($\pm$ 200 firms) based on their Russell index rank through 1980-2014. Panel (a) shows Russell index weight. Panel (b) shows average total institutional ownership for firms. Panel (c) depicts average Quasi-Indexer ownership for firms. Panel(d) shows average Transient ownership for firms. Panel (e) shows average Dedicated ownership for firms.

Figure 2.3 – Russell Index and Risk Measures Around the Cutoff

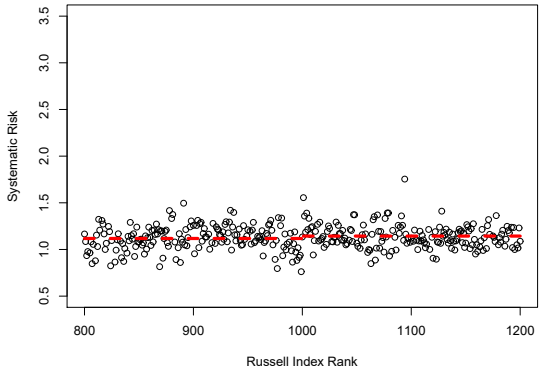
(a) Total Volatility around the cutoff



(b) Idiosyncratic Volatility around the cutoff

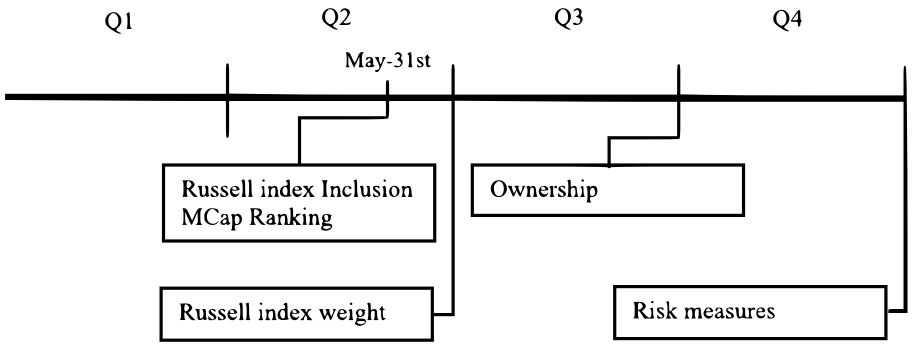


(c) Systematic Volatility around the cutoff



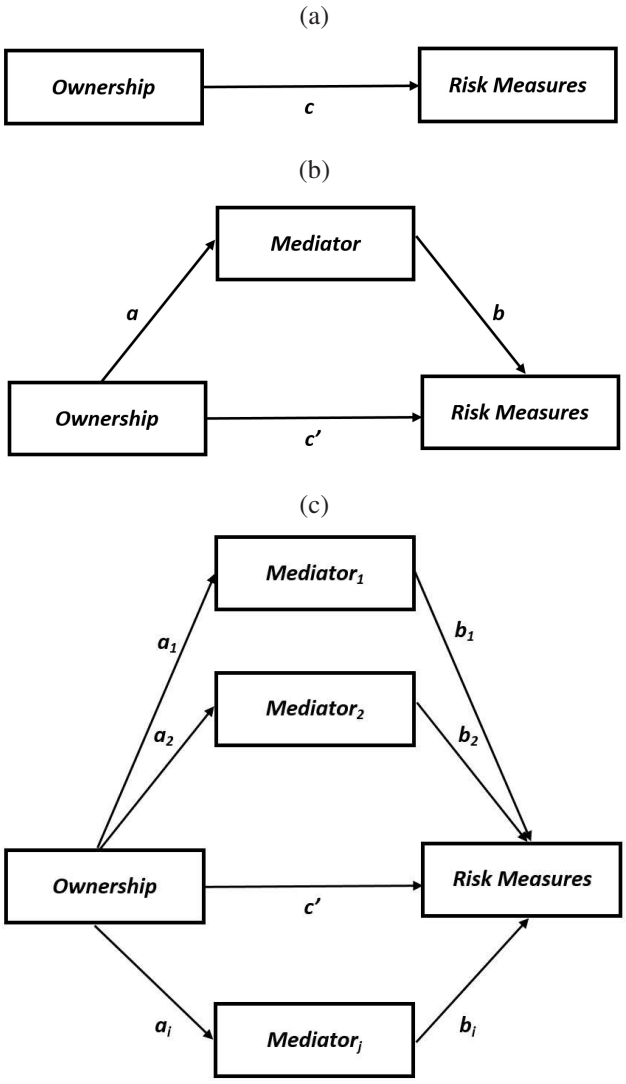
These figures present average risk measures for firms around the Russell index threshold based on their Russell index rank through 1980-2014. Panel (a) shows average total volatility of firms. Panel (b) shows average Idiosyncratic volatility of firms. Panel (c) depicts average systematic risk of firms.

Figure 2.4 – Variable Measurement Timeline for Delayed Effect



The Figure shows the variable measurement timeline in TSLS models. Each year, Russell inclusion index measured May-31st. CRSP unadjusted market cap end of May used as a proxy to identify firms around Russell index 1000/2000 threshold. Russell index weights disclose at the end of the second quarter each year. Institutional ownership are measured at the end of the third quarter, and Risk characteristics are measured at the end of the fourth quarter.

Figure 2.5 – Mediation Analysis



Panel (a) shows total effect of Ownership on Risk Measures. panel (b) simple mediation model, *Ownership* is hypothesized to conduct indirect effect on *Risk measures* through *Mediator*. panel(c) depicts multiple mediator model, *Ownership* is hypothesized to conduct indirect effect on *Risk measures* through $Mediator_1, Mediator_2, ..., Mediator_j$.

Table 2.1 – Summary Statistics

(a) Russell1000

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.4280	0.6190	0.6020	0.7850	0.2420
Dedicated Ownership	0.0110	0.0340	0.0540	0.0730	0.0691
Quasi indexer Ownership	0.2960	0.4270	0.4200	0.5460	0.1760
Transient Ownership	0.0570	0.1070	0.1300	0.1800	0.0976
Volatility	1.3300	1.7440	2.0150	2.3430	1.1260
Idiosyncratic Risk	1.0720	1.4360	1.6460	1.9550	0.8981
Systematic Risk	0.6120	0.8860	1.0770	1.2800	0.8063
Market Cap (in million $)	1034.9	2450.4	7952.8	5891.7	23070.0

(b) Russell2000

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.2200	0.4400	0.4720	0.7020	0.2971
Dedicated Ownership	0.0050	0.0260	0.0520	0.0710	0.0738
Quasi indexer Ownership	0.1440	0.2820	0.3140	0.4600	0.2069
Transient Ownership	0.0330	0.0910	0.1230	0.1830	0.1140
Volatility	1.8390	2.5210	2.8570	3.4580	1.5995
Idiosyncratic Risk	1.5690	2.2070	2.5100	3.0860	1.4556
Systematic Risk	0.6570	1.0290	1.2280	1.5250	0.8917
Market Cap (in million $)	110.90	257.01	427.90	555.80	497.39

Panel (a) presents the summary statistics for firms that listed in Russell 1000 index and panel(b) presents same information for firms assigned to Russell 2000 index. Note: p25 and p75 represent 25 and 75 percentiles of data respectively.

Table 2.2 – Summary Statistics for Firms Around the Cutoff (±200)

(a) Russell800-1000

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.3079	0.5319	0.5408	0.7716	0.2865
Dedicated Ownership	0.0049	0.0242	0.0594	0.0722	0.1046
Quasi indexer Ownership	0.1930	0.3381	0.3588	0.5026	0.2051
Transient Ownership	0.0397	0.0999	0.1274	0.1865	0.1100
Volatility	1.4630	1.9909	2.3179	2.7561	1.3639
Idiosyncratic Risk	1.2547	1.7076	1.9648	2.3573	1.0942
Systematic Risk	0.5689	0.8758	1.1266	1.3499	0.9517
Market Cap (in million $)	408.0	1066.9	1287.3	1851.4	1112.1

(b) Russell1001-1200

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.3688	0.6331	0.6143	0.8567	0.2990
Dedicated Ownership	0.0061	0.0260	0.0480	0.0675	0.0619
Quasi indexer Ownership	0.2471	0.4149	0.4130	0.5704	0.2066
Transient Ownership	0.0562	0.1330	0.1587	0.2333	0.1257
Volatility	1.5219	2.0398	2.3038	2.7727	1.2783
Idiosyncratic Risk	1.2400	1.7150	1.9360	2.3490	1.0919
Systematic Risk	0.6115	0.9615	1.1402	1.4166	0.8366
Market Cap (in million $)	294.85	971.34	1061.69	1558.43	870.32

Panel (a) presents the summary statistics for bottom 200 firms listed in Russell 1000 based on Russell Rank, panel (b) presents same information for top 200 firms assigned to Russell 2000 index. Note: p25 and p75 represent 25 and 75 percentiles of data respectively.

Table 2.3 – First Stage Regressions

	Total Own	Dedicated	Quasi Indexers	Transient
$MCAPRank_t - 1000$	-0.5912**	0.0161	-0.2810	-0.4691**
$FloatAdj_t$	0.9518***	-0.0474	0.6722***	0.5527***
$(MCAPRank_t - 1000)(Russell2000_t)$	0.0829	0.1228	-0.0695	0.1296
$RUIndex2000_t$	0.0186***	0.0002	0.0132***	0.0107***
Adjusted R^2	88%	58%	84%	68%
F-statistic(excl instr.)	16.4800***	0.0037	11.2200***	9.5770***

This table represents first stage regression in Equation 2.3 for $\pm$ 200 firms bandwidth around Russell 1000/2000 threshold. $Russell2000_{i,t}$ is a dummy variable which indicates Russell 2000 inclusion for firm i at the second quarter of year t, and its coefficient represents the discontinuity parameter in Ownership at the threshold $(Rank = 1000)$. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.4 – Second Stage Regressions

	Volatility	Idiosyncratic	Systematic
$MCAPRank_t - 1000$	3.3186***	3.3750***	2.4415**
$FloatAdj_t$	1.4672	2.3260*	0.1551
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.0785**	-4.7400**	-1.5998
$\widehat{Own}_t$	-2.8557**	-4.0440***	-0.4056
Adjusted R^2	54%	37%	65%

This table represents result for the second stage regression in Equation 2.4 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold. Dependent variables are firm-level risk measures: volatility, idiosyncratic and systematic risks respectively in three columns. Dependent variables are measured at the end of the third quarter each year. $\widehat{Own}_t$ is instrumented total institutional ownership. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available at each June. Coefficients estimates are based on OLS with firm and time fixed effects and standard errors are clustered at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.5 – Impact of Firm Characteristics on The Causal Effect

(a) Total Volatility

	Mcap	MToB	ILR	DIVY
$\widehat{Own}_t$	-0.5837	-2.7002***	-2.6616***	-2.6773***
$MCAPRank_t - 1000$	1.9168**	3.0908***	3.0267***	3.0979***
$FloatAd j_t$	0.2670	1.2139	1.2509	1.2032
$Char_t \times \widehat{Own}_t$	-0.1529***	0.0017	0.3099***	-0.0038
$(MCAPRank_t - 1000)(Russell2000_t)$	-3.7020***	-3.9194***	-3.9186***	-3.9448***
Adjusted R^2	66%	66%	66%	66%

	OWN	EPS	DIVdummy	VOLAT
$\widehat{Own}_t$	-2.4619**	-2.4276**	-2.6424***	-1.8529**
$MCAPRank_t - 1000$	3.0866***	2.9016***	3.1067***	2.1138***
$FloatAd j_t$	1.1756	0.9750	1.2076	0.1923
$Char_t \times \widehat{Own}_t$	-0.2475	-0.0512***	-0.0813*	0.7563***
$(MCAPRank_t - 1000)(Russell2000_t)$	-3.9744***	-3.7073***	-4.0040***	-2.6337**
Adjusted R^2	66%	66%	66%	70%

(b) Idiosyncratic Volatility

	Mcap	MToB	ILR	DIVY
$\widehat{Own}_t$	-2.9782***	-3.8632***	-3.8264***	-3.8441***
$MCAPRank_t - 1000$	2.7172***	3.1996***	3.1213***	3.2054***
$FloatAd j_t$	1.7047*	2.1011**	2.1492**	2.0921**
$Char_t \times \widehat{Own}_t$	-0.0632	0.0014	0.3664***	-0.0026
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.5704***	-4.6501***	-4.6403***	-4.6710***
Adjusted R^2	62%	62%	62%	62%

	OWN	EPS	DIVdummy	VOLAT
$\widehat{Own}_t$	-3.7270***	-3.6211***	-3.8008***	-3.0845***
$MCAPRank_t - 1000$	3.1993***	3.0299***	3.2167***	2.2982***
$FloatAd j_t$	2.0769**	1.8883**	2.0985**	1.1606
$Char_t \times \widehat{Own}_t$	-0.1342	-0.0458***	-0.1031**	0.6972***
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.6869***	-4.4586***	-4.7464***	-3.4625**
Adjusted R^2	62%	62%	62%	66%

Table 2.5 – Continued

(c) Systematic Volatility

	Mcap	MToB	ILR	DIVY
$\widehat{Own_t}$	5.2019***	-0.6134	-0.5729	-0.5771
$MCAPRank_t - 1000$	-1.2132	2.0375*	2.0356*	2.0485*
$FloatAdj_t$	-2.4772*	0.1233	0.1136	0.1060
$Char_t \times \widehat{Own_t}$	-0.4224***	0.0026*	0.0562	-0.0038
$(MCAPRank_t - 1000)(Russell2000_t)$	-0.5589	-1.1894	-1.2229	-1.2282
Adjusted R^2	66%	65%	65%	65%

	OWN	EPS	DIVdummy	VOLAT
$\widehat{Own_t}$	-0.0670	-0.3029	-0.5702	0.3362
$MCAPRank_t - 1000$	2.0216*	1.8328	2.0499*	0.9580
$FloatAdj_t$	0.0422	-0.1446	0.1056	-1.0140
$Char_t \times \widehat{Own_t}$	-0.5886***	-0.0563***	-0.0128	0.8380***
$(MCAPRank_t - 1000)(Russell2000_t)$	-1.2996	-0.9673	-1.2369	0.2245
Adjusted R^2	65%	65%	65%	68%

The table represents result for second stage regression with an added interaction term of firm characteristics and instrumented ownership. Panel (a) represents results where the dependent variable is total volatility. Panel (b) and (c) demonstrate results for idiosyncratic and systematic volatility respectively. Dependent variables are measured at the end of the third quarter each year t. $\widehat{Own_t}$ is instrumented total institutional ownership from the first stage regressions. Each column represents result for regression including the interaction term of instrumented ownership and characteristic mentioned at the top of the column $Char_t \times \widehat{Own_t}$; the firm characteristics $Char_t$ is measured at the end of the first quarter year t. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level for $\pm$ 200 firms around Russell 1000/2000 threshold. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.6 – Second Stage Regressions – Categories of Institutional Ownership

(a) Quasi-Indexers

	Volatility	Idiosyncratic	systematic
$MCAPRank_t - 1000$	4.1470***	4.4330***	2.8871**
$FloatAdj_t$	1.6540	2.5250*	0.3982
$(MCAPRank_t - 1000)(Russell2000_t)$	-5.0750***	-6.0040***	-2.1566
$\widehat{Own}_{QIX,t}$	-4.3530**	-6.0570***	-1.0316
Adjusted R^2	43%	16%	65%

(b) Transient

	Volatility	Idiosyncratic	systematic
$MCAPRank_t - 1000$	2.8210**	2.6030*	2.4882**
$FloatAdj_t$	1.5200	2.4340	0.0820
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.0710**	-4.6580*	-1.6024
$\widehat{Own}_{TRA,t}$	-5.2580**	-7.4130**	-0.8665
Adjusted R^2	33%	-3%	65%

The table presents result for the second stage regression in Equation 2.4 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold. Dependent variables are firm-level risk measures: volatility, idiosyncratic and systematic risks respectively in three columns. Dependent variables are measured at the end of the third quarter each year. Panel (a) represents results where the independent variable is Quasi-investors ownership, and panel (b) represents results for Transient institutional investors. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available at each June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.7 – Delayed Effect

	Volatility	Idiosyncratic	Systematic
$MCAPRank_t - 1000$	2.7549***	2.6470**	2.9880**
$FloatAdj_t$	0.7594	2.2560*	-1.8840
$(MCAPRank_t - 1000)(Russell2000_t)$	-3.0554**	-3.6770**	-2.0070
$\widehat{Own_t}$	-1.2988	-3.0680**	2.1650
Adjusted R^2	70%	55%	66%

The table presents result for the second stage regression in Equation 2.4 including $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold. Dependent variables are firm-level risk measures: volatility, idiosyncratic and systematic risks in three columns. Dependent variables are measured at the end fourth quarter year t. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.8 – Mediation Analysis – Effect of Institutional Ownership on Mediators

	MToB	EPS	EPSSR	EPSRES
$\widehat{Own_t}$	29.2610**	2.9420	-11.7926	10.7860***
$MCAPRank_t - 1000$	-10.7310	-13.9910***	0.4358	-4.6470*
$FloatAdj_t$	-27.7030**	-0.1780	8.2200	-6.2170**
$(MCAPRank_t - 1000)(Russell2000_{t_1})$	-9.5190	20.1830***	-11.1683	5.3040
	36%	94%	22%	5%

	DIVY	IBESMEANEST	IBESESTERR	IBESSDTEV
$\widehat{Own_t}$	-0.5741*	24.6140***	-10.2880	-1.3786
$MCAPRank_t - 1000$	0.4863	-31.1810***	4.0110	0.4857
$FloatAdj_t$	0.3038	-21.7470***	3.5230	0.5798
$(MCAPRank_t - 1000)(Russell2000_{t_1})$	-0.7884	18.8080	-13.7490	-3.9189
	37%	100%	5%	100%

The table represents results for the regression in Equation 2.5 which measures the effect of total institutional ownership on Mediator candidates for $\pm$ 200 firms around the Russell 1000/2000 threshold. Institutional ownership is instrumented by Russell index, and Mediators selected as a proxy for firm's financial performance (MToB, EPS, EPSSR, EPSRES, and DIVY) and information asymmetry (IBESMEANEST, IBESESTERR, IBESSDTEV). Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.9 – Mediation Analysis – Mediators effect on Total Volatility

(a) Mediators effect on Total Volatility

	Volatility	Volatility	Volatility	Volatility
$MToB_t$	0.0011			
$EPSRES_t$		-0.0265***		
$DIVY_t$			0.0496	
$IBESMEANEST$				-0.0039
$\widehat{Own_t}$	-2.8869***	-2.3448**	-2.8272***	-4.2504***
$MCAPRank_t - 1000$	3.3300***	3.1403***	3.2945***	3.6642***
$FloatAdj_t$	1.4967*	0.8480	1.4521*	1.9740*
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.0684***	-4.1238***	-4.0395***	-3.9617**
Adjusted R^2	66%	66%	66%	68%

(b) Mediated effect of Ownership on Total Volatility

Mediator	EPSRES
Mediated Effect	-0.2859***
Direct Effect	-2.3448**
Total Effect	-2.6307***
Prop. Mediated	11%

This table reports the indirect effect of ownership on total volatility through mediator candidates for $\pm$ 200 firms around the Russell 1000/2000 threshold. Panel (a) shows results for the indirect effect of ownership on total volatility while controlling for mediators happened to be significant in Table 2.8. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Mediators with significant coefficients in panel (a) are chosen for the panel(b). Panel (b) reports Bootstrapped (1000 Rep) point estimates and significance levels for the total and specific mediated effects of ownership on total volatility through Mediator. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.10 – Mediation Analysis – Mediators effect on Idiosyncratic Volatility

(a) Mediators effect on idiosyncratic volatility

	Idiosyncratic	Idiosyncratic	Idiosyncratic	Idiosyncratic
$MToB_t$	0.0007			
$EPSRES_t$		-0.0288***		
$DIVY_t$			0.0704	
$IBESMEANEST$				-0.0028
$\widehat{Own_t}$	-4.0658***	-3.6391***	-4.0041***	-5.9445***
$MCAPRank_t - 1000$	3.3832***	2.9997***	3.3412***	4.0175***
$FloatAdj_t$	2.3462***	1.8229*	2.3047**	3.2766***
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.7335***	-4.6433***	-4.6849***	-4.9666***
Adjusted R^2	62%	63%	63%	65%

(b) Mediated effect of ownership on idiosyncratic volatility

Mediator	EPSRES
Mediated Effect	-0.3110***
Direct Effect	-3.6391***
Total Effect	-3.9502***
Prop. Mediated	8%

This table reports the indirect effect of ownership on idiosyncratic volatility through mediator candidates for $\pm$ 200 firms around the Russell 1000/2000 threshold. Panel (a) shows results for the indirect effect of ownership on idiosyncratic volatility while controlling for mediators happened to be significant in Table 2.8. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Mediators with significant coefficients in panel (a) are chosen for the panel(b). Panel (b) reports Bootstrapped (1000 Rep) point estimates and significance levels for the total and specific mediated effects of ownership on idiosyncratic volatility through Mediator. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.11 – Multiple Mediation Analysis

(a) Mediators effect on risk measures

	Volatility	Idiosyncratic
EPS_t	-0.0036	-0.0043
$EPSRES_t$	-0.0228***	-0.0229***
$EPSSR_t$	0.0089***	0.0089***
$MToB_t$	0.0030*	0.0032**
$DIVY_t$	0.1694***	0.1721***
$IBEMEANEST_t$	-0.0085	-0.0086
$IBESSTDEV_t$	0.0092	0.0115
$IBESESTERR_t$	0.0010	0.0014
$\widehat{Own}_t$	-3.4449***	-5.2490***
$MCAPRank_t - 1000$	3.0535***	3.1128***
$FloatAdj_t$	0.8920	2.3597**
$(MCAPRank_t - 1000)(Russell2000_t)$	-2.9565*	-3.7413**
Adjusted R^2	68%	64%

(b) Mediated effect of ownership on risk measures

	Volatility	Idiosyncraitic
EPS_t	-0.0174	-0.0209
$EPSRES_t$	-0.3191**	-0.3207***
$EPSSR_t$	-0.1510**	-0.1519**
$MToB_t$	0.1181	0.1281
$DIVY_t$	-0.1677***	-0.1703***
$IBEMEANEST_t$	-0.1734	-0.1761
$IBESSTDEV_t$	-0.0351	-0.0438
$IBESESTERR_t$	-0.0123	-0.0166
Mediated Effect	-0.7579*	-0.7723*
Direct Effect	-3.4449***	-5.2490***
Total Effect	-4.2028***	-6.0213***
Prop. Mediated	18%	13%

This table reports indirect effect of ownership on total and idiosyncratic volatility through multiple mediator candidates for $\pm$ 200 firms around the Russell 1000/2000 threshold. Panel (a) shows results for indirect effect of ownership on risk measures while controlling for multiple mediators. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Panel(b) reports Bootstrapped (1000 Rep) Point Estimates and significance levels for the total and specific mediated effects of Ownership on total and idiosyncratic volatility through multiple mediators. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 2.12 – Second Stage Regressions – 800 Firm Bandwidth

	Volatility	Idiosyncratic	Systematic
$MCAPRank_t - 1000$	1.5711***	1.5457***	0.7754
$FloatAdj_t$	0.5525	1.7621**	-1.5507*
$(MCAPRank_t - 1000)(Russell2000_t)$	-1.8780***	-2.3449***	-0.0557
$\widehat{Own}_t$	-1.8768***	-3.3246***	1.3982
Adjusted R^2	59%	44%	62%

This table represents result for the second stage regression in Equation 2.4 for $\pm$ 400 firms bandwidth around the Russell 1000/2000 threshold. Dependent variables are firm-level risk measures: volatility, idiosyncratic and systematic risks respectively in three columns. Dependent variables are measured at the end of the third quarter each year. $\widehat{Own}_t$ is instrumented total institutional ownership. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available at each June. Coefficients estimates are based on OLS with firm and time fixed effects and standard errors are clustered at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 2.13 – Change of Ownership on Change of Volatility

	$\Delta Volatility$	$\Delta Idiosyncratic$	$\Delta Systematic$
ΔOwn_t	-0.2903**	-0.4216***	0.1144
$RUIndex2000_t$	0.0409*	0.0142	0.1293***
$MCAPRank_t - 1000$	-1.2891	-0.6970	-3.1063
$FloatAdj_t$	0.1288	-0.1114	1.3992
$(MCAPRank_t - 1000)(Russell2000_t)$	1.0083	0.9543	0.0956
Adjusted R^2	15%	8%	21%

In this setup we focus on the firms around the Russell 1000 threshold $\pm$ 200 which changed the index and analyze the effect change of ownership on change of risk measures after index inclusion. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 2.14 – Second Stage Regression Models (1991 - 2006)

	Volatility	Idiosyncratic	Systematic
$MCAPRank_t - 1000$	3.6622**	4.8554***	-1.8110
$FloatAdj_t$	-1.4241	1.2772	-8.9640***
$(MCAPRank_t - 1000)(Russell2000_t)$	-0.9160	-2.2373	6.0810*
$\widehat{Own_t}$	-0.3947	-1.5012*	2.8670***
Adjusted R^2	14%	-14%	17%

This table represents result for the second stage regression in Equation 2.4 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold for period of 1991-2006. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 2.15 – Second Stage Regression Models Excluding Closest 50 Firms Around the Threshold

	Volatility	Idiosyncratic	Systematic
$MCAPRank_t - 1000$	3.1140***	3.1480***	2.6038**
$FloatAdj_t$	1.0040	1.9960	-0.6458
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.1880**	-4.8980**	-2.2579
$\widehat{Own_t}$	-2.3490*	-3.5530**	0.4262
Adjusted R^2	58%	44%	65%

This table represents result for the second stage regression in Equation 2.4 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold excluding $\pm$ 25 closest firms to the threshold in order to minimize Russell index "banding" policy effect. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 2.16 – First Stage Regression - Institutional Ownership Concentration Measure

	HHI
$MCAPRank_t - 1000$	0.0278
$FloatAdj_t$	0.0018
$(MCAPRank_t - 1000)(Russell2000_t)$	-0.0690
$RUIndex2000_t$	0.0009
Adjusted R^2	72%
F-statistic(excl instr.)	0.2973

This table represents first stage regression in Equation 2.3 for $\pm$ 200 firms bandwidth around Russell 1000/2000 threshold. Dependent variable is institutional ownership Herfindahl-Hirschman Index (HHI). $Russell2000_{i,t}$ is a dummy variable which indicates Russell 2000 inclusion for firm i at the second quarter of year t, and its coefficient represents the discontinuity parameter in Ownership at the threshold $(Rank = 1000)$. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Chapter 3

Institutional Investors' Preferences for and Effects on the Value / Growth Firms

Farid Radmehr

Abstract

This paper aims at studying institutional investors preferences for and effects on the firm's valuation measure using the database of institutional investors holdings from 1980 through 2014. In the first part of the paper, we study their preference toward value firms. We illustrate time variation in this preference and verify a definite preference for undervalued firms relative to their industry. The preference for undervalued firms is especially significant for "Quasi-Indexer" institutional investors. In the second part of the paper, using two-stage least squares regression models, we show that institutional ownership significantly increases a firms' valuation after holding them. Results in this paper show that not only institutional investors actively are seeking undervalued firms, but they also increase firms' valuation after holding them.

3.1 Introduction

Over the two last decades, the number of institutional investors has increased substantially in developed economies such as Canada, the United States, and the United Kingdom, to the extent that they now hold more than half of the corporate properties (Aggarwal et al., 2011; Gompers and Metrick, 2001)

In this paper, we study institutional investors' preference for and effects on firm valuation measure. It has been widely discussed in the literature that institutional investors have specific preferences for firm-level characteristics in their equity holdings. After holding firms in their portfolio, institutional investors have the potential to affect firms characteristics or valuation either directly with using their votes or indirectly by their trading decisions.

In the first part of the paper, using quarterly data from 13F, CRSP and Compustat databases from 1980 till 2014. We study the preference of institutional investors to the firm valuation measure. For firm valuation measure, we employ value weighted industry-time adjusted book to market ratio. This measure provides a relative valuation measure of the firm comparing to its peers in the industry. Higher the adjusted book to market ratio means the firm is undervalued and lower the ratio implies that the firm is overvalued relative to its industry. By controlling for other firm characteristics, we show that institutional investors prefer firms with a higher adjusted book to market ratio (lower valuation in the industry). Based on (Bushee, 2001, 1998) we also studied categories of institutional investors (Quasi-Indexers, Transient and Dedicated) and found that different types of institutional investors have different preferences. Institutional investors categorized as Quasi Indexers and Dedicated long-term investors have preferences toward high adjusted book to market ratio (undervalued firms). However, Transient institutional investors who are mainly short-term investors prefer overvalued stocks in the industry (low adjusted book to market ratio).

After documenting the preferences of institutional investors, In the second part of the paper, we study the effect of institutional investors on the firms' valuation measure

(adjusted book to market ratio). In order to distinguish the effect of institutional investors from their preferences, we use the methodology suggested by (Crane et al., 2016; Wurgler, 2010). In their methodology, the inclusion of firms in Russell 2000 index is identified as an instrument for institutional ownership.

Following the suggested methodology we analyze the effect of institutional ownership on firms' adjusted book to market ratio using two-stage least square models. Our results show that an increase in institutional investors' ownership significantly increases firms valuation relative to their industry. For firms in 800-1000 Russell rank, one percent point increase in total ownership would decrease adjusted book to market ratio by 0.12 standard deviations, which shows the strong economic impact of institutional ownership on increasing firms' relative valuation. We also studied categories of institutional investors and document that an increase in Quasi-Indexer and Transient investors instrumented ownership increases significantly firm valuation afterward. Comparison of these two categories shows that Transient investors have stronger effect on increasing firms' valuation. This stronger effect can be explained by Transient investors' myopic investment behavior which lead them to impose stronger effect in a short period of time on firms' valuation.

As an alternative setup, we also examine the delayed effect of institutional ownership on firm valuation and show that the effect of ownership on the adjusted book to market ratio remains significant after a quarter. More precisely, we document that institutional ownership, instrumented at the end of the third quarter, significantly increases firm valuation, measured at the end of the fourth quarter. Finally, we establish a link between two main findings of the paper. In other words, we study how the institutional investors' effect will change based on the firms' valuation. To this purpose, we analyze the effect of institutional ownership on undervalued and overvalued firms. Our results show that for undervalued firms, institutional investors significantly increase their valuation. Moreover, this effect is stronger for over-valued firms. We can conclude that not only institutional investors actively seek for undervalued firms, they also tend to increase firms' valuation by owning them.

The paper proceeds as follows. Section 3.2 discusses the literature. Section 3.3 describes our institutional ownership data and firm-level valuation measures and control variables. Section 3.4 presents the preferences of institutional investors on firm valuation measure. Section 3.5 presents empirical results regarding the causal effect of institutional ownership on firms' valuation. 3.6 presents robustness checks and finally 3.7 concludes the paper. Section 3.7 concludes the paper.

3.2 Literature Review

Several studies have analyzed the institutional investors' preferences in the literature. (Del Guercio, 1996) documented that banks tend to tilt their portfolios toward "prudent" stocks. (Gompers and Metrick, 2001) find that institutional investors in the US invest mostly in firms that are larger, more liquid, and have had relatively low returns during the previous year. In that vein, (Ciochetti et al., 2002) also show that liquidity is a major characteristic in institutional investors portfolio and they prefer to take larger positions in more liquid assets like REIT stocks comparing to private real estate equities.

(Dahlquist and Robertsson, 2001) analyzes the preferences of foreign institutional investors in Swedish firms and finds that they prefer firms with high market capitalizations, large cash positions, and low dividends but without any large dominant owners. (Bennett et al., 2003) reveals that institutional investors shifted their preferences towards smaller and riskier stocks over time. In an earlier study, ((Cenesizoglu et al., 2017)) consider the time variation in institutional investors' preferences for firm-level characteristics and specifically how they change with the underlying interest rate environment. They find that institutional investors hold riskier stocks when the level of interest rates are low and less risky stocks when they are high, in line with predictions of (Rajan, 2006). On the other hand, the relation between firms performance and ownership structure has been discussed in the literature.(McConnell and Servaes, 1990) studied the effect of institutional investors on firms' Tobin's Q measure. They find a significant positive relation between Q measure and the fraction of shares owned by institutional investors. They also find

a positive curvilinear relation between firm's Q measure and shares held by corporate insiders in the firm. In another study (Himmelberg et al., 1999), investigated the relationship between ownership and firms performance measured by Tobin's Q. They discussed the endogenous relation between managerial ownership and firm performance and concluded with no significant relation between managerial ownership and firm performance. (Morck et al., 1988) studied fortune 500 firms in 1980 and exhibited a positive relation between firm's Q measure and management ownership, but also they showed that this positive relation is non-monotonic and capped. (Sahut and Gharbi, 2010) In their paper studied French firms and took into account the heterogeneity of institutional ownership. They showed that the effect of institutional ownership on firm's Q measure depends on their behavior (active or passive). Furthermore, they showed a bilateral relation between ownership and performance measures.

Most of the papers studying the relation between institutional ownership and firms valuation does not establish the causal effect due to the endogeneity problems. However, in this paper we address this issue by establishing the causal effect and determining the sign of the effect on firms valuation. Also in this paper, we link institutional investors preferences for and effects on firm valuation and study how institutional investors affect the firms which they potentially prefer to hold in terms of valuation.

3.3 Data

3.3.1 Institutional ownership

Our main dataset is the 13F filings, where all institutional investors with more than $100 million in equity ownership report their holdings to the SEC each quarter. We access this data via Thomson Reuters between 1980 and 2014. We aggregate each institutional investor m's holdings in stock i in quarter t (own_{imt}) and divide it by the total number of shares outstanding of stock i end of quarter t ($share_{it}$) to obtain our main variable of

interest, namely the percentage of stock i held by institutional investors:

$$Own_{it} = \sum_{m=1}^{M} \frac{own_{imt}}{shares_{it}} \tag{3.1}$$

In this paper, we are also interested in different types of institutional investors, such as pension and mutual funds. Although Thompson Reuters provides a classification of institutional investors, it is not reliable after 1998 as noted on the WRDS website of Thompson Reuters. Instead, we use the investor classifications provided by (Bushee, 2017) which covers 13F database institutional investors from 1981 to 2015. We distinguish between institutional investors based on their investment horizons. For this purpose, we adopt the classification suggested by (Bushee, 2001, 1998), which categorize institutions into Dedicated, Quasi-Indexer, and Transient groups using factor and cluster analysis. In summary, Transient institutions have high portfolio turnover and diversified portfolios, Dedicated institutions have low turnover, and less diversified portfolio holdings and Quasi-Indexer institutions have low turnover and diversified portfolio holdings.

3.3.2 Firm level valuation measure

We merge the Thomson Reuters 13F dataset with CRSP and COMPUSTAT using CUSIPs and company names to obtain stock and firm-level characteristics. We use industry-time adjusted book to market ratio ($BToM^{\star}$) as firm valuation measure relative to its industry. For this purpose at each quarter, we use the Fama French 12 industry classification and calculate market value adjusted book to market ratio for each firm in each industry. In order to limit the weight of firms with a large market cap in the industry, we use the logarithm of firm size in our weight calculation. We employ this measure as the firm's valuation metric relative to its peers in the industry. Higher the ratio indicates that the firm is undervalued and lower the ratio means the firm is overvalued relative to its industry. Additionally, this measure allows us to filter out any industry-specific effect on firms valuation. In an alternative measure, at each industry - quarter we sort firms based on their adjusted book to market measure ($BToM^{\star}$) and use 40 and 60 percentiles to cat-

egorize them into three Low, Medium and High categories of firm valuation. Table 3.1 demonstrates the summary statistics of our sample of firms during 1980 - 2014 years.

3.4 Institutional Investors' Preferences

In the first step, we present a graphical presentation of ownership for different categories of firm valuation through time. For this purpose, at each quarter we control institutional ownership for lagged firm-level variables in a regression model:

$$Own_{i,t} = c_i + c_t + \gamma\, Controlvariables_{i,t-1} + resid_{i,t} \tag{3.2}$$

where we use log transformation ($log(1+Own_{it})$) for ownership measure as dependent variable. Control variables are logarithm of firm size ($MCap_{i,t-1}$), last three month cumulative return $Ret3_{i,t}$, logarithm of quarter-end price ($Price_{i,t-1}$), Earnings per share ($EPS_{i,t-1}$), and standard deviation of daily returns over the quarter in logarithm ($VOLAT_{i,t-1}$). Moreover, we consider firm and time fixed effects(c_i& c_t). Then, residuals of above mentioned regression are utilized as our variable of interest (residual ownership).

We measure equally weighted average of residual ownership for firms with low, med, and high adjusted book to market ratio $BToM^{\star}_{k,i,t} \quad k = Low, Medium, High$. Figure 3.1 depicts the time series of residual ownership for these three categories of firms over time. There are some time variations in average ownership, However, it is clear that average residual ownership for under-valued firms (High book to market ratio) tend to be higher than the other two categories over time. Contrarily for overvalued firms (firms with the low adjusted book to market ratio), there is a clear pattern that average residual ownership is generally lower comparing to firms with medium and low valuations.

To quantify institutional investors preferences for firms' valuation measure, we regress institutional ownership of firms on lagged valuation measure and control variables in a regression model as follows:

$$Own_{i,t} = \alpha_i + \alpha_t + \beta\, ValuationMeasure_{i,t-1} + \gamma Controlvariables_{i,t-1} + \varepsilon_{i,t} \tag{3.3}$$

where, $Own_{i,t}$ is institutional ownership for firm i at quarter t. Lagged valuation measures include adjusted book to market ratio ($BToM^{\star}_{i,t}$); or dummy variables which indicate whether a firm is in a High, Medium or Low valuation categories ($BToM^{\star}_{k,i,t} \quad k = Low, Medium, High$). Lagged control variables include logarithm of firm size ($MCap_{i,t}$), last three month cumulative return ($Ret3_{i,t}$), quarter end logarithm of price ($Price_{i,t}$), Earnings per share ($EPS_{i,t}$), and standard deviation of daily excess returns in logarithm ($VOLAT_{i,t}$). Moreover, in this regression setup we consider firm and time fixed effects and standard errors are clustered at firm level.

Results in Table 3.2 presents two different setups for regression model in Equation 3.3. The dependent variable for each setup is total institutional ownership. The coefficient estimate for the low book to market dummy variable is negative and significant at 1% significance level. This coefficient indicates that institutional investors have weaker preference for firms in high valuation category in comparison to the firms in medium valuation category. Contrarily, the coefficient estimate for high book to market dummy variable is positive and significant at 1% level. This coefficient reveals that institutional investors have stronger preference toward firms with low valuation category compared to the firms in medium valuation category. In the second setup, we utilize adjusted book to market ratio $BToM^{\star}_{t-1}$ as our independent variable and coefficient for this variable is positive and significant at 1% level, which demonstrates that institutional investors on average have preferences to undervalued firms in industry.

By taking into account both parametric and non-parametric results, we can conclude that after controlling for other firm characteristics, institutional investors significantly prefer undervalued firms (high adjusted book to market ratio) relative to their peers in the industry. Turning our attention to the other coefficient estimate, we can infer that institutional investors prefer stocks that are larger, have lower price, had relatively low returns during the previous quarter, and have lower realized volatility. These results are also in line with what has been discussed in the literature. Also adjusted R^2 for both setups are around 85% which shows that these variables can explain a significant part of the institutional ownership variation.

3.4.1 Categories of institutional ownership

As mentioned in the data section we use categories of institutional investors to better understand the preferences of institutional investors with different portfolio specifications. Figure 3.2 depicts average institutional ownership for firms sorted into three terciles of adjusted book to market ratio. Panel a) presents Quasi-Indexers and we observe that average ownership for this category of institutional ownership is higher for firms with low valuation measure. Panel b) however shows that for Transient investors average ownership is higher for firms with higher valuation measure. In panel c) for Dedicated investors we do not observe a clear pattern of preference. Table 3.3 panel (a) presents results of regression 3.3 for Quasi-Indexers. In these sets of results, the coefficient for the low adjusted book to market dummy variable is negative and significant, and the coefficient for the high adjusted book to market dummy variable is positive and significant. Moreover, the coefficient for the adjusted book to market ratio is positive and significant. The reported R^2s indicate that these regressions are able to explain major part of the variation in dependent variable. All these results together indicate that Quasi-Indexer institutional investors on average prefer undervalued firms with the higher book to market ratio. Even though this category of institutional investors are considered to be passive investors, but results suggest that after controlling for other firm characteristics, they have strong preferences toward undervalued firms in industry.

Table 3.3 panel (b) presents results for Dedicated institutional investors. First, the coefficient estimate for the low adjusted book to market dummy variable is negative and significant and, the coefficient for the high adjusted book to market dummy variable is positive and significant. However, the coefficient for the adjusted book to market ratio is positive but statistically insignificant. Also, the reported R^2s are about 54% which show that the regression model can explain a significant part of the variation in dependent variable. In total, results for Dedicated institutional investors suggest that this group of institutional investors have a slight preference toward undervalued firms in the industry, but this preference is not as clear and significant as the preference of Quasi-Indexers.

Table 3.3 panel (c) presents results for Transient institutional investors. Coefficient estimate for the low adjusted book to market dummy variable is positive and significant. On the other hand, the coefficient for the high adjusted book to market dummy variable is negative and significant. Also, the coefficient estimate for the adjusted book to market ratio is positive but statistically insignificant. Finally adjusted R^2s are around 62% suggesting that our regression model can explain most of the variation in dependent variable. In summary, results for Transient institutional investors point that they have preferences toward overvalued firms with the lower book to market ratio in their industry. The finding is in contrast with other groups of institutional investors but could be explained by the nature of these institutional investors who tend to have higher turnovers in their portfolios and prefer shorter-term investments. So by definition, they are not value investors, and their holdings gravitate toward overvalued stocks.

3.5 Institutional Investors' Causal Effect

In the previous section, we have identified institutional investors' preferences toward firm-level valuation measures (adjusted book to market ratio). In this section, we expand our analysis and measure the causal effect of institutional investors on the valuation of firms which they hold. As it is documented in the previous section, institutional investors have preferences toward firms with particular valuation characteristics. Therefore, in this section in order to understand the effect of investors on firms valuation we utilize identification setup suggested by (Crane et al., 2016). They discuss that large discontinuity of the Russell index weights around 1000/2000 threshold induces an exogenous variation in institutional ownership. Hence, they adopt Russell 2000 index inclusion as an instrument for institutional ownership. Following their methodology, we match Russell index constituents with our database and discuss our findings in this section.

3.5.1 Russell index and institutional investors

Our database also consists of Russell 1000 and Russell 2000 constituents for the period of 1980-2014. We get these data from Russell and match it with 13F, CRSP, and COMPUSTAT databases. Russell 1000 is the value-weighted index of largest 1000 U.S. listed firms, and Russell 2000 is the value-weighted index of following 2000 firms. Table 3.4 demonstrates the summary statistics of our sample. Panel (a) presents the summary statistics for firms in Russell 1000 and panel (b) presents firms in Russell 2000. Comparing to firms in Russell 2000, firms in Russell 1000 are on average larger and held more by Institutional investors which confirms that institutional investors prefer larger stocks. Moreover, in the valuation measures, we notice that firms in Russell 2000 have a higher book to market and adjusted book to market ratios compared to Russell 1000 firms. The difference in valuation measures reveals that on average firms in Russell 2000 have lower valuation relative to the firms in Russell 1000.

As argued in (Crane et al., 2016; Wurgler, 2010), firms around the Russell 1000 threshold are comparable regarding their characteristics, and they cannot control small variations in their market value ranking. Accordingly, the assignment to the Russell 1000 or 2000 indices is practically a random event. However, this random assignment leads to big differences in index weights for these firms and, more importantly, their weights in institutional investors' portfolios benchmarking these indices. Therefore, drastic changes in firms index weight around the Russell 1000 cutoff is directly related with firms institutional ownership and could be assumed exogenous to other characteristics of the firms, i.e., their market valuation.

Figure 3.3 presents important characteristics of firms close to the Russell 1000 threshold. In panel (a) Y-axis is Russell index weight, and X-axis is Russell rank for firms close to the 1000 cutoff, smaller the rank is larger the firm. The plot exhibits the variation in the Russell index weight around the threshold ($\pm$200 firms), and clearly shows the index weight discontinuity around the 1000/2000 Russell index cutoff. In this figure firms are sorted based on their Russell rank and index weight for each rank is averaged through

years 1980-2014. In Figure 3.3 panel (b) X-axis is Russell index ranking, and the Y-axis is average total institutional ownership over time. This plot also shows the discontinuity of ownership around the 1000 cutoff. As expected, ownership has a decreasing trend over the Russell index ranking. However, at the 1000 threshold, an immediate increase in ownership is observed for smaller firms ($Rank \geq 1000$). The dotted lines on each side of threshold demonstrate average ownership of firms below/above the threshold. Finally, Panel (c) depicts the adjusted book to market ratio ($BToM^{\star}$) for firms around the cutoff. Although there is some variation around the cutoff, the difference is not as apparent as the observed discontinuity in panel (b). Hence, we can perceive that the effect of Russell index weights on institutional ownership is exogenous to firms' valuation measure.

3.5.2 Two stage least squares method

In this section, we perform parametric tests and two-stage least square (TSLS) method utilizing the Russell index as an instrumental variable. Russell indexes are formed based on market capitalization rankings on each May 31st. The largest thousand firms form the Russell 1000, and the next two thousand firms make up the Russell 2000. Russell index assignment is available at inclusion time May 31st which is utilized as an instrument variable, but the ranking is not announced till the end of June each year. Therefore, to identify firms around 1000 cutoff, we utilize the May 31st unadjusted market capitalization ranking from CRSP as a proxy for the May 31st Russell ranking.

In the first stage of our TSLS approach, we regress the institutional ownership of 400 stocks around the threshold on the dummy variable of Russell 2000 index inclusion, market capitalization ranking, their interaction term, and a control variable for Russell index weights. In the second stage, we regress the valuation measure on instrumented institutional ownership from the first stage.

$$\begin{aligned} Own_{i,t} = \alpha_t + \gamma_i + \tau Russell2000_{i,t} + \delta_1 (MCAPRank_{i,t} - 1000) \\ + \delta_2 Russell2000_{i,t} (MCAPRank_{i,t} - 1000) + \delta_3 FloatAdj_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{3.4}$$

$$Valuation_{i,t} = \theta_t + \lambda_i + \beta \widehat{Own_{i,t}} + \phi_1 (MCAPRank_{i,t} - 1000) + \phi_2 Russell2000_{i,t} (MCAPRank_{i,t} - 1000) + \phi_3 FloatAdj_{i,t} + \eta_{i,t} \tag{3.5}$$

In order to limit the effect of outliers in regression setups we use log transformation ($log(1 + Own_{it})$) for ownership measure. $Russell2000_{i,t}$ is a dummy variable which indicates Russell 2000 inclusion for firm i at year t measured at May 31st of each year. In the first stage, we identify the exogenous variation in institutional ownership caused by Russell index inclusion near the 1000/2000 cutoff. Control variables for firms distance to the threshold are also included in the model and are measured in the second quarter of year t. These control variables are $MCAPRank_{i,t} - 1000$ which is the distance to threshold for firms ranked based on their May 31st Market-cap and interaction term of $Russell2000_{i,t}(MCAPRank_{i,t} - 1000)$. Moreover, $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. This variable controls for the effects of Russell weights and any characteristic other than Market-cap which is used to determine Russell index weight that could affect the ownership. Dependent variable $Own_{i,t}$ is measured next available quarter after Russell inclusion each year. In other words, institutional ownership is measured at the end of the third quarter of each year and control variables are measured in the second quarter of the same year. With this setup, we can measure "average treatment effect" of Russell inclusion on institutional ownership τ around the cutoff point where $MCAPRank_{i,t} - 1000 = 0$.

In the second stage, the estimated ownership from the first stage is used to estimate the effect of ownership on firm-level valuation measure. For this goal, we regress adjusted book to market ratio $BToM^{\star}_{i,t}$ on the estimated institutional ownership $\widehat{Own_{i,t}}$ and control variables from previous stage. $BToM^{\star}_{i,t}$ indicates adjusted book to market ratio for the firm i in year t which is measured next available quarter after index assignment date each year (third quarter). Since $Russell2000_{i,t}$ is the instrument, we exclude it in second stage regression. Both regressions include the year and firm fixed effects. Figure 3.4 depicts the timeline for the measurement of the mentioned variables in the setup.

Table 3.5 reports first stage regressions for total and categories of institutional ownership. For total institutional ownership, discontinuity parameter estimate τ is significant

and positive. Its sign is in line with graphical representations and reveals that at the 1000 threshold, inclusion in Russell 2000 increases significantly total ownership almost by 1.9%. Relative to median ownership of Russell1000, inclusion in Russell2000 would increase total institutional ownership in the firm by 1.16 percentage point. First stage F-statistic, which is a measure to test the strength of our instrument, is included in the last row of the table. For total ownership, F statistic is 16.48 which is significant at 1% level. Results show that Russell 2000 inclusion have a strong and positive correlation with total ownership and also is a strong IV for total institutional ownership.

In other setups in Table 3.5, sub-categories of institutional investors are used as dependent variables. The coefficients of $Russell2000_{i,t}$ are positive and significant for Quasi-Indexers and Transient investors. However, the coefficient for Dedicated investors is insignificant. Results are in line with investors categories definitions, Quasi-indexers are by definition index trackers and have incentives to track Russell 2000 index. Transient investors also likely track indexes in their highly volatile portfolio and reduce tracking errors especially relative to the small-cap indexes. On the other hand, the coefficient for Dedicated investors does not show any sign of index tracking behavior in their holdings since they are long-term investors and their portfolio allocation will not be affected by index inclusions. First stage F-statistics reveal that Russell index inclusion is a strong IV for Quasi-Indexers and Transient Investors, but this variable cannot be utilized as an IV for Dedicated investors.

3.5.3 Causal effect of institutional investors

In this section, we establish and study the causal effect of institutional investors on the firm-level valuation measure using the second stage regression as mentioned in Equation 3.5. Table 3.6 presents the results for second stage regression where total institutional ownership is the dependent variable. The end of May market-cap rank is used to identify ± 200 firms around the Russell1000/2000 threshold. Regression coefficients are calculated based on OLS regression with clustered standard error at the firm level. The coef-

ficient estimate of instrumented ownership ($\widehat{Own_{i,t}}$) is negative (-0.0735) and significant at 1% level which indicates a positive and significant effect on firms relative valuation in industry. In Russell 1000, total institutional ownership median and standard deviation are 0.6190, and 0.2420 respectively. Moreover, the adjusted book to market ratio has 0.4553 standard deviation. Based on our estimate, one percentage point increase in total ownership would decrease adjusted book to market ratio by 0.12 standard deviations which shows the significant impact of ownership on increasing firms' relative valuation in industry.

All the results mentioned above in first place confirm the causal effect of institutional investors on firm-level valuation measure and strongly indicate that exogenous increase in total institutional investor ownership increases the value of the firm. Also, the positive and significant coefficient of market-cap rank indicates that smaller firms have higher adjusted book-to-market ratio. Positive and significant coefficient estimate of $FloatAdj_t$ also suggests that the difference between Russell index rank and market-cap rank is significantly related to firm valuation. Finally, adjusted R^2 of 37% indicates that our second stage regression model can explain a significant part of the variation in firms valuation measure.

3.5.4 Categories of institutional ownership

In Table 3.5 it has been tested that Russell 2000 dummy variable is a valid instrument for Quasi-Indexers and Transient investors' ownership. In this part, we explore the effect of Quasi-indexers and Transient institutional investors on the firm's valuation. Table 3.7 in panel (a) and panel (b) reports the effect of Quasi-Indexer and Transient institutional investors respectively.

In Table 3.7 For Quasi-indexers in panel (a), the coefficient estimate of instrumented ownership is -0.1094 and significant at 1% level in regression with the adjusted book to market ratio ($BToM^{\star}$) as the dependent variable. The coefficient indicates that Quasi-indexers significantly increase firm's value relative to its industry. To better understand

the effect of Quasi-Indexers' ownership on firm valuation in 800-1000 Russell rank, one standard deviation increase in total ownership would decrease adjusted book to market by 0.17 standard deviations which shows the significant impact of ownership in increasing the firm's valuation.

In panel (b) for Transient investors results are qualitatively similar. The coefficient of instrumented Transient ownership on the adjusted book to market ratio is -0.1356 and significant at 1% level. However, relative to firms in 800-1000 Russell rank, one percentage point increase in transient ownership would decrease adjusted book to market by 0.22 standard deviations which shows the significant economic impact of ownership on firms' valuation.

Those results attest that the increase of Quasi-Indexer and Transient investors' ownership significantly increase firms' valuation. Comparing these two categories, it could be inferred that Transient investors have a stronger effect on increasing firms' valuation after holding them. The stronger effect could be explained by Transient investors' myopic investment activity with which they tend to increase the firm's valuation in a short period of time. Although Quasi-Indexers are considered passive investors but our result suggest that they are not passive owners and could actively influence firms' characteristics and valuations as discussed in (Appel et al., 2016; Carleton et al., 1998; Monks and Minow, 2015).

3.5.5 Delayed effect of institutional investors

In previous parts we studied the contemporaneous effect of institutional ownership on firms' valuation, however, in this part we study the delayed effect of institutional investors on firms' valuation. More specifically, we employ the second stage model with year-end firm valuation measure to quantify the impact of institutional ownership at the firm's valuation at the end of the fourth quarter. Figure 3.5 shows graphically the timeline used for this model. In this setup, valuation measures are included at the end fourth quarter each year t. Table 3.8 shows the result for our second stage regression in Equation 3.5. The

coefficient of estimated ownership $\widehat{Own_{i,t}}$ is similar to our previous findings and is negative and significant at 5% level. This result shows that the institutional investors' effect on firms' valuation remains statistically and economically significant after a quarter even though we lose significance at other variables' coefficient estimates. We can conclude that institutional ownership plays an important role in determining the value of the firm.

3.5.6 The effect of other firm characteristics

To examine how the effect of institutional ownership on firm valuation changes for firms with different characteristics, we introduce interaction term of ownership and firm characteristics to our second stage regressions. Since Russell index inclusion discloses May end of each year, we measure different characteristics of firms one quarter ahead of Russell index inclusion to avoid any possible effect of ownership on firm characteristics. In other words, we are measuring firms characteristics at the end of the first quarter each year t and include the interaction term $Char_t \times \widehat{Own_t}$ in the model.

$$\begin{aligned} Valuation_{i,t} =& \theta_t + \lambda_i + \beta \widehat{Own_{i,t}} \\ &+ \phi_1 (MCAPRank_{i,t} - 1000) + \phi_2 Russell2000_{i,t-1} (MCAPRank_{i,t} - 1000) \\ &+ \phi_3 FloatAdj_{i,t} + \phi_4 Char_{i,t} \times \widehat{Own}_{i,t} + \eta_{i,t} \end{aligned} \tag{3.6}$$

Table 3.9 shows results for the second stage regression with the $Char_t \times \widehat{Own_t}$ interaction term. Results are for total institutional ownership and the depended variable in these regressions is firm valuation measure ($BToM_t^{\star}$). Each column represents results for regression with an interaction term of the characteristic which is specified at the top of the column.

Selected characteristics are: logarithm of market size of the firm ($Mcap$), (Amihud, 2002) illiquidity measure based on daily returns in quarter (ILR), dividend yield of the firm during last four quarters ($DIVY$), dummy variable whether firm pays dividend during the last four quarters ($Divdummy$), fraction of firm's stock held by institutional investors

(*Own*), earnings per share of the firm (*EPS*), EPS volatility of the firm (*EPSSR*). [1] The standard deviation of firms' daily return in the quarter ($VOLAT$).

The positive and significant coefficient for the interaction terms with the dividend yield, earnings volatility, and total volatility indicates that institutional investors have stronger impact on a firm's value with the lower dividend yield, earnings volatility, and total volatility. These findings provide some intuition that firms with less volatility in their earnings and price are those that institutional investors could boost their valuation more effectively by owning them.

3.5.7 The effect of institutional ownership on undervalued / overvalued firms

The causal effect of institutional investors on firms' adjusted book to market ratio has been established and discussed in previous sections. Also, in the first part of the paper, we showed that institutional investors have preferences toward undervalued firms. In this section, we link these two results and analyze the effect of the institutional investors on initially undervalued and overvalued firms with the high and low adjusted book to market ratio respectively. To this purpose, similar to the previous part we add the interaction terms of $BToM^{\star}_{t} \times \widehat{Own}_t$ and $BToM^{\star}_{k,t} \times \widehat{Own}_t \quad k = Low, Medium, High$ to the second stage regressions in two different setups. Similar to the previous stage, $BToM^{\star}_{t}$ and $BToM^{\star}_{j,t}$ are measured at the end of the first quarter each year t.

Regressions in Table 3.10 show results of these setups. In the first setup we add the interaction terms with valuation dummy variables. The coefficient estimate of $\widehat{Own}_t$ is negative (-0.0414) and significant which indicates that institutional ownership increases the value of the undervalued firms significantly. Also, the coefficient estimates for the interaction terms of $BToM^{\star}_{Medium,t} \times \widehat{Own}_t$ and $BToM^{\star}_{Low,t} \times \widehat{Own}_t$ are both negative and

[1] EPS volatility for each firm (*EPSSR*) calculated as squared residuals of EPS AR(1) process. we require each firm at least has 30 quarterly EPS available through time

$$EPS_{i,t} = c + QuarterDummies_t + \alpha EPS_{i,t-1} + \varepsilon_{i,t} \quad for\ each\ i$$

significant (-0.0055 & - 0.0095). These coefficients also reveal that the effect of institutional ownership is stronger when firms are already in medium or overvalued categories. In the second setup, the coefficient estimate of $BToM_t^{\star} \times \widehat{Own_t}$ is positive and significant (0.0083) while the coefficient estimate of instrumented ownership is still negative and significant. By taking into account both of the coefficients estimates we can infer that the effect of institutional investors on firms' valuation is stronger in the firms with higher valuation (lower book to market).

So we can conclude that institutional investors prefer undervalued firms with a high book to market ratio. Then it is attested that those investors increase the firm's valuation significantly for undervalued firms. Still, this effect is even stronger for medium and overvalued firms. In unreported results, we also get qualitatively similar results for Quasi-Indexers and Transient institutional investors. In sum, these results establish a link between institutional investors' preferences and effects on firm valuation. Hence, institutional investors not only seek undervalued firms in each industry but they also actively influence firms' valuation after holding them.

3.6 Robustness Checks

Due to the "banding" policy[2] which has been implemented on Russell index constituents starting year 2007, we implement our analysis on 1991-2006 sample similar to Crane et al. (2016) as robustness check. Results in Table 3.11 shows that the coefficient for instrumented ownership is negative and significant and results are qualitatively similar to our main findings in Table 3.6. Since "banding" policy possibly effects firms close to threshold we exclude ± 25 firms around the threshold to minimize this effect in our sample. Table 3.12 reports the result for this sub-sample and our findings in this table shows that the main results are robust excluding closest firms to the threshold.

Moreover, we test other institutional ownership measure and for this purpose we uti-

[2]This policy means that stocks in the Russell 2000 are moved to Russell 1000 only if their end-of-May Russell market cap rank increased significantly during the year.

lize institutional ownership concentration measure (HHI- Index). Table 3.13 presents institutional investors preferences where dependent variable is institutional ownership concentration measure. Coefficient estimates on dummy variables shows that institutional ownership concentration is higher for undervalued stocks, however coefficient estimates of valuation measure does not show any significant preferences. In total, we conclude that institutional ownership concentration is slightly higher for undervalued firms. On the other hand, Table 3.14 shows first stage regressions where dependent variable is institutional ownership concentration measure. As suggested by results, Russell 2000 index inclusion does not have a significant effect on ownership concentration and also first-stage F-statistics shows that Russell 2000 index inclusion is not a strong instrumental variable for this alternative measure of institutional ownership.

3.7 Conclusion

Using institutional holdings data from 1980 through 2014, we exhibit time-varying institutional investors preferences for firms valuation measure. It is shown that during this period institutional investors own more of undervalued firms in their industry. Our parametric results also suggest that institutional investors have a significant preference for undervalued firms. Results for categories of institutional investors revealed that Quasi-Indexer and Dedicated investors prefer undervalued firms. However, Transient institutional investors have a slight preference for overvalued firms.

In the second part of the paper, we use the discontinuity of Russell index weight around Russell 1000/2000 threshold as an instrument for institutional ownership to analyze the effect of institutional ownership on the firms' valuation. Our results in this part explain that institutional investors significantly (economically and statistically) increase firm valuation after holding them. Our results also revealed that the effect of institutional ownership is stronger in firms who pay lower dividends and have less operational and financial volatilities. We also studied the effect of institutional ownership on overvalued and undervalued firms and found that institutional investors significantly increase under-

valued firms valuation. However, this effect is stronger for already overvalued firms.

Our findings support the view that not only institutional investors pick undervalued stocks but also they increase firms valuation in the equity market. The results are in line with the strand of literature that shows a positive effect of institutional investors on firms performance. However, in this paper, we expand that view to the firms' equity market valuation.

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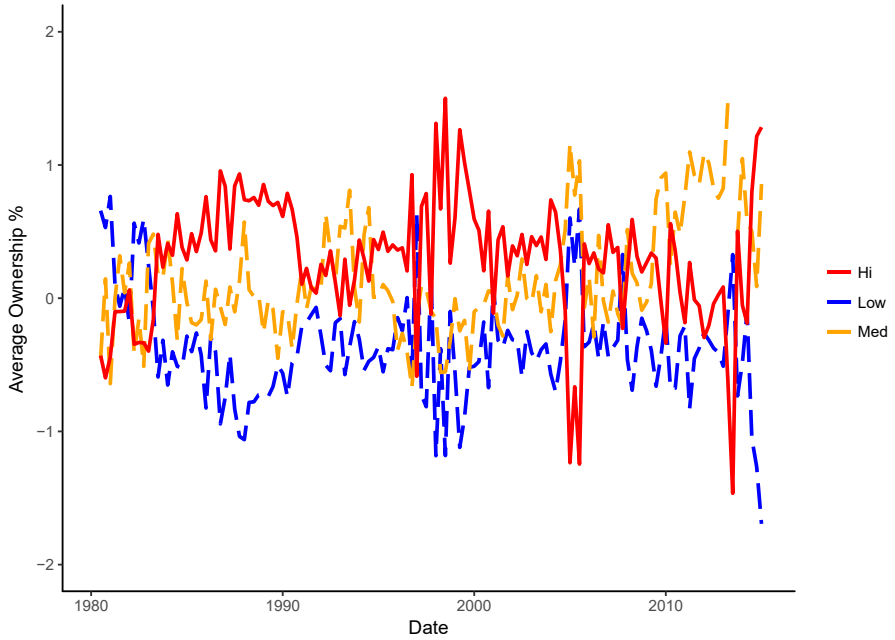
Figure 3.1 – Average Residual Institutional Ownership in Book to Market Terciles

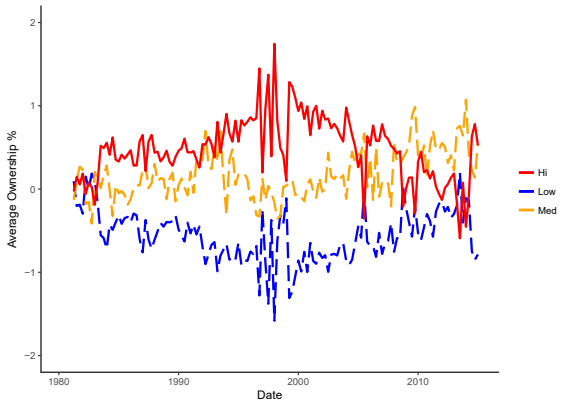
(a) Total Ownership



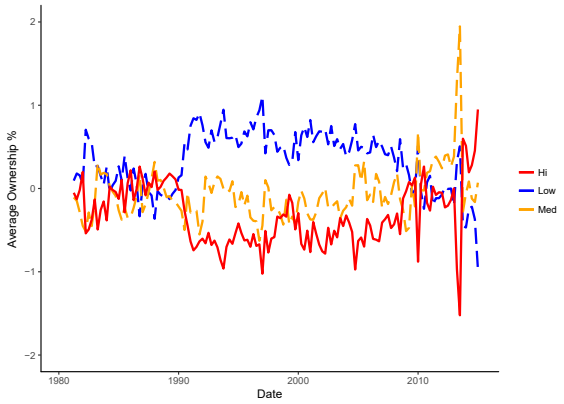
The figure presents average residual institutional ownership from Equation 3.2 for firms sorted in the Low, Medium and High adjusted book to market ratio relative to their industry.

Figure 3.2 – Average Residual Institutional Ownership in Book to Market Terciles (Categories of Institutional Investors)

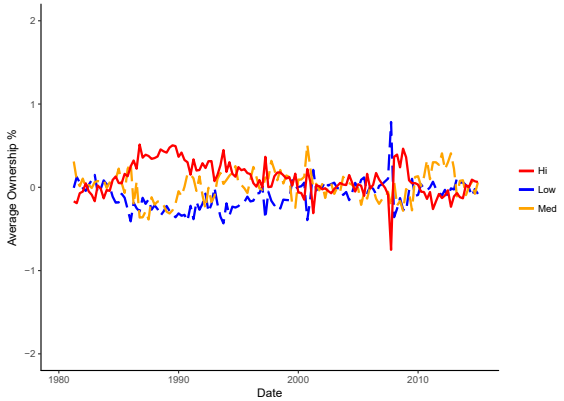
(a) Quasi Indexer



(b) Transient Ownership



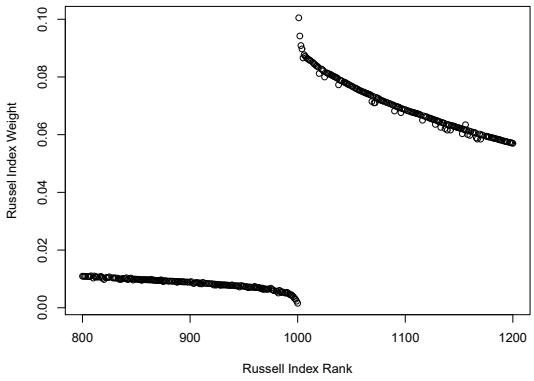
(c) Dedicated



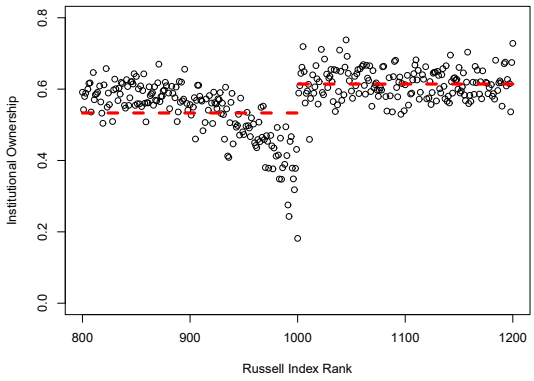
The figure presents average residual institutional ownership from Equation 3.2 for firms sorted in the Low, Medium and High adjusted book to market ratio relative to their industry. Panel a) shows for Quasi-indexers and panel b) and c) exhibits average residual ownership for Transient and Dedicated investors respectively.

Figure 3.3 – Russell Index Threshold and Firms Characteristics

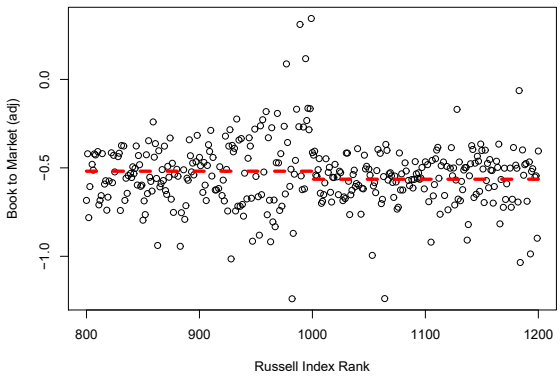
(a) Russell index weight close to 1000 cutoff



(b) Institutional investor ownership close to cutoff

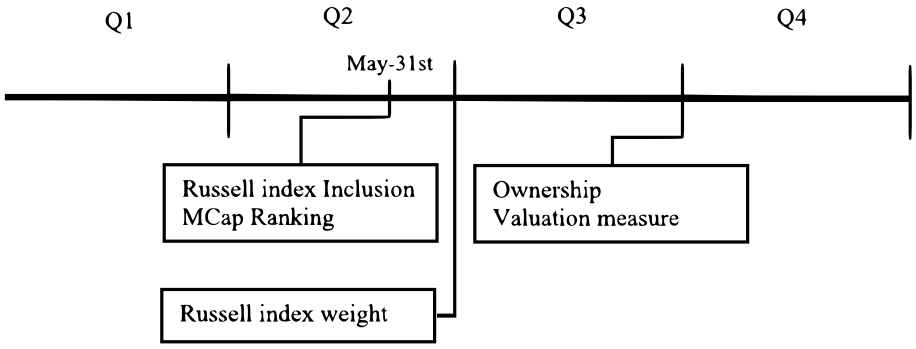


(c) Book to market ratio close to cutoff



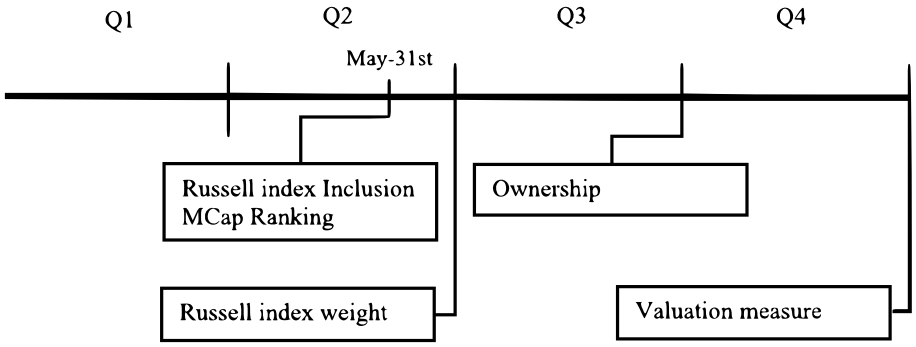
This figure presents average index weight, institutional ownership, and valuation for firms based on Russell index weight. Panel (a) shows Russell index weight around 1000 threshold ($\pm$ 200 firms). Panel (b) shows average institutional ownership for firms around Russell 1000 threshold ($\pm$ 200 firms). Panel (c) depicts average adjusted book to market ratio for firms around the Russell 1000 threshold ($\pm$ 200 firms) based on their Index weight. Firms are sorted based on their Russell rank each year, and characteristics on Y-axis are averaged for each rank through 1980-2014.

Figure 3.4 – Variable Measurement Timeline



The Figure shows the variable measurement timeline in TSLS models. Each year, Russell inclusion index measured May-31st. CRSP unadjusted market cap end of May used as a proxy to identify firms around Russell index 1000/2000 threshold. Russell index weights disclose at the end of the second quarter each year. Institutional ownership and valuation ratio measured at the end of the third quarter.

Figure 3.5 – Variable Measurement Timeline - year end effect



The Figure shows the variable measurement timeline in TSLS models. Each year, Russell inclusion index measured May-31st. CRSP unadjusted market cap end of May used as a proxy to identify firms around Russell index 1000/2000 threshold. Russell index weights disclose at the end of the second quarter each year. Institutional ownership and valuation ratio measured at the end of the fourth quarter.

Table 3.1 – Summary Statistics

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.1000	0.3000	0.4000	0.6000	0.2976
Dedicated Ownership	0.0000	0.0000	0.1000	0.1000	0.0755
Quasi indexer Ownership	0.1000	0.2000	0.3000	0.4000	0.2112
Transient Ownership	0.0000	0.1000	0.1000	0.1000	0.1029
Book to Market	0.4000	0.6000	1.5000	1.0000	19.5900
adj Book to Market	-0.2000	0.1000	0.9000	0.4000	19.5800
Market Cap (in million $)	49	189	2078	844	11360

Table presents the summary statistics for our sample of firms during 1980-2014. Note: p25 and p75 represent 25 and 75 percentiles of data respectively.

Table 3.2 – Total Institutional Investors Preferences

	Own	Own
$BToM_{Low,t-1}$	-1.2957***	
$BToM_{High,t-1}$	0.8311***	
$BToM^{\star}_{t-1}$		0.0320***
$MCAP_{t-1}$	5.6211***	5.4429***
$Ret3_{t-1}$	-0.0078***	-0.0107***
$Price_{t-1}$	-0.1908	-0.4422**
EPS_{t-1}	-0.0045*	-0.0056**
$VOLAT_{t-1}$	-1.2587***	-1.3110***
Adjusted R^2	85%	85%

Table presents two different setups for regression models Equation 3.3. $Own_{i,t}$ is institutional ownership for firm i at quarter t. Lagged valuation measures include adjusted Book to market ratio $BToM^{\star}_{i,t}$. In another setup, we use $BToM^{\star}_{k,i,t-1}$ $k = Low, Medium, High$ dummy variables which indicates whether a firm at each industry-quarter has Low, Medium or High adjusted book to market ratio comparing to its peers. Lagged Control variables include firm size $MCap_{i,t-1}$, last three month cumulative return $Ret3_{i,t-1}$, quarter end logarithm of price $Price_{i,t-1}$, Earnings per share $EPS_{i,t-1}$, and standard deviation of daily returns over the quarter $VOLAT_{i,t-1}$. Coefficients estimates are based on OLS with firm and time fixed effects with clustered standard errors at firm level.***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.3 – Categories of Institutional Investors' preferences

(a) Quasi Indexers

	Own_{QIX}	Own_{QIX}
$BToM^{\star}_{Low,t-1}$	-1.6771***	
$BToM^{\star}_{High,t-1}$	1.2057***	
$BToM^{\star}_{t-1}$		0.0228***
$MCAP_{t-1}$	3.5807***	3.3078***
$Ret3_{t-1}$	-0.0160***	-0.0199***
$Price_{t-1}$	0.6015***	0.2765*
EPS_{t-1}	-0.0080***	-0.0095***
$VOLAT_{t-1}$	-1.1729***	-1.2416***
Adjusted R^2	83%	82%

(b) Dedicated Investors

	Own_{DED}	Own_{DED}
$BToM^{\star}_{Low,t-1}$	-0.2168***	
$BToM^{\star}_{High,t-1}$	0.1486**	
$BToM^{\star}_{t-1}$		0.0063
$MCAP_{t-1}$	0.3502***	0.3196***
$Ret3_{t-1}$	-0.0017***	-0.0023***
$Price_{t-1}$	-0.8209***	-0.8700***
EPS_{t-1}	-0.0017	-0.0019
$VOLAT_{t-1}$	-0.4630***	-0.4729***
Adjusted R^2	54%	54%

Table 3.3 – Continued

(c) Transient Investors

	Own_{TRA}	Own_{TRA}
$BToM_{Low,t-1}$	0.7652***	
$BToM_{High,t-1}$	-0.5918***	
$BToM^{\star}_{t-1}$		0.0082
$MCAP_{t-1}$	1.9327***	2.0918***
$Ret3_{t-1}$	0.0113***	0.0133***
$Price_{t-1}$	-0.0130	0.1236
EPS_{t-1}	0.0083***	0.0093***
$VOLAT_{t-1}$	0.3261***	0.3567***
Adjusted R^2	62%	62%

Tables present results for regression models Equation 3.3 for each subcategory of institutional investors. In panel a) dependent variable is Ownership of Quasi Indexer investors Own_{QIX}, In panel b) dependent variable is Dedicated ownership Own_{DED} and in panel c) dependent variable is Transient ownership Own_{TRA}.Lagged valuation measures include adjusted Book to market ratio $BToM^{\star}_{i,t-1}$. In another setup, we use $BToM^{\star}_{k,i,t-1} \quad k = Low, Medium, High$ dummy variables which indicates whether a firm at each industry-quarter has Low, Medium or High adjusted book to market ratio comparing to its peers. Lagged Control variables include firm size $MCap_{i,t-1}$, last three month cumulative return $Ret3_{i,t-1}$, quarter end logarithm of price $Price_{i,t-1}$, Earnings per share $EPS_{i,t-1}$, and standard deviation of daily returns over the quarter $VOLAT_{i,t-1}$. Coefficients estimates are based on OLS with firm and time fixed effects with clustered standard errors at firm level.***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.4 – Summary Statistics - Russell 1000 and Russell 2000

(a) Russell1000

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.4280	0.6190	0.6020	0.7850	0.2420
Dedicated Ownership	0.0110	0.0340	0.0540	0.0730	0.0691
Quasi indexer Ownership	0.2960	0.4270	0.4200	0.5460	0.1760
Transient Ownership	0.0570	0.1070	0.1300	0.1800	0.0976
Book to Market	0.3030	0.5030	0.6250	0.8190	0.5084
Adjusted Book to Market	-0.2360	-0.0660	-0.0250	0.1300	0.4553
Market Cap (in million $)	1035	2450	7953	5892	23070

(b) Russell2000

	p25	Median	Mean	p75	SD
Total Institutional Ownership	0.2200	0.4400	0.4720	0.7020	0.2971
Dedicated Ownership	0.0050	0.0260	0.0520	0.0710	0.0738
Quasi indexer Ownership	0.1440	0.2820	0.3140	0.4600	0.2069
Transient Ownership	0.0330	0.0910	0.1230	0.1830	0.1140
Book to Market	0.3510	0.5770	0.6990	0.8810	0.6096
Adjusted Book to Market	-0.1850	0.0190	0.0990	0.2800	0.5909
Market Cap (in million $)	111	257	428	556	497

Panel (a) presents the summary statistics for firms that listed in Russell 1000 index and panel(b) presents same information for firms assigned to Russell 2000 index. Note: p25 and p75 represent 25 and 75 percentiles of data respectively.

Table 3.5 – First Stage Regression ($\pm$200 firms around Russell 1000 Threshold)

	Total Own	Dedicated	Quasi Indexers	Transient
$MCAPRank_t - 1000$	-59.1196**	0.0161	-0.2810	-0.4691**
$FloatAdj_t$	95.1796***	-0.0474	0.6722***	0.5527***
$(MCAPRank_t - 1000)(Russell2000_t)$	8.2890	0.1228	-0.0695	0.1296
$RUIndex2000_t$	1.8633***	0.0002	0.0132***	0.0107***
Adjusted R^2	88%	58%	84%	68%
F-statistic(excl instr.)	16.4800***	0.0037	11.2200***	9.5770***

This table represents first stage regression in Equation 3.4 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. $Russell2000_{i,t}$ is a dummy variable which indicates Russell 2000 inclusion for firm i at year t measured May 31st of each year and its coefficient represents the discontinuity parameter in Ownership at the threshold ($Rank = 1000$). $MCAPRank_{i,t-1} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t-1}$ is the difference between the $MCAPRank_{i,t-1}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects, and clustered standard errors at firm level. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.6 – Second Stage Regression Models for Total Institutional Ownership.($\pm$200 firms around Russell 1000 Threshold)

	$BToM^{\star}$
$MCAPRank_t - 1000$	4.4266*
$FloatAdj_t$	5.6279**
$(MCAPRank_t - 1000)(Russell2000_t)$	-5.2606
$\widehat{Own_t}$	-0.0735***
Adjusted R^2	37%

This table represents result for second stage regression in Equation 3.5 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. Dependent variables are firm-level valuation measure (adjusted book to market) $BToM_t^{\star}$ measured at the end of the third quarter each year. $\widehat{Own_t}$ is instrumented total institutional ownership from the first stage regressions. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects, and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.7 – Second Stage Regression Models for Categories of Institutional investors. ($\pm$200 firms around Russell 1000 Threshold)

(a) Quasi Indexers

	$BToM^{\star}$
$MCAPRank_t - 1000$	5.8682**
$FloatAdj_t$	5.9358**
$(MCAPRank_t - 1000)(Russell2000_t)$	-6.6990
$\widehat{Own}_{QIX,t}$	-0.1094***
Adjusted R^2	9%

(b) Transient

	$BToM^{\star}$
$MCAPRank_t - 1000$	2.4636
$FloatAdj_t$	5.9654**
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.1336
$\widehat{Own}_{TRA,t}$	-0.1356***
Adjusted R^2	12%

This table represents result for second stage regression in Equation 3.5 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. Panel(a) presents results with Quasi indexers $\widehat{Own}_{QIX,t}$ as independent variable and Panel(b) represents results for Transient ownership $\widehat{Own}_{TRA,t}$ as independent variable. Dependent variables are firm-level valuation measure (adjusted book to market) $BToM_t^{\star}$ measured at the end third quarter each year. $\widehat{Own}_t$ is instrumented total institutional ownership from the first stage regressions. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.8 – Second Stage Regression - year end effect ($\pm$200 firms around Russell 1000 Threshold)

(a) Total Ownership

	$BToM_t^\star$
$MCAPRank_t - 1000$	2.2136
$FloatAdj_t$	3.6949
$(MCAPRank_t - 1000)(Russell2000_t)$	-1.3452
$\widehat{Own_t}$	-0.0582**
Adjusted R^2	52%

This table represents result for second stage regression in Equation 3.5 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. Dependent variables are firm-level valuation (adjusted book to market) $BToM_t^\star$ measured at the end fourth quarter each year. $\widehat{Own_t}$ is instrumented total institutional ownership from the first stage regressions. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31st Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.9 – Second Stage Regression with Interaction terms ($\pm$200 firms around Russell 1000 Threshold)

	Mcap	ILR	DivY	DIVdummy
$\hat{Own}_t$	-0.0686***	-0.0764***	-0.0754***	-0.0761***
$MCAPRank_t - 1000$	3.5669*	4.0386**	4.0018**	4.0061**
$FloatAdj_t$	5.3503***	5.6696***	5.6280***	5.6974***
$Char_t \times \widehat{Own}_t$	-0.0006	-0.0016	0.0019**	-0.0004
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.6396*	-4.7419*	-4.6912*	-4.7556*
Adjusted R^2	67%	67%	67%	67%

	OWN	EPS	EPSSR	VOLAT
$\hat{Own}_t$	-0.0791***	-0.0754***	-0.0801***	-0.0748***
$MCAPRank_t - 1000$	4.0170**	3.9326**	3.6730**	3.8262**
$FloatAdj_t$	5.7290***	5.6145***	6.4980***	5.5143***
$Char_t \times \widehat{Own}_t$	0.0000	-0.0002	0.0002***	0.0014**
$(MCAPRank_t - 1000)(Russell2000_t)$	-4.6890*	-4.6450*	-4.4860*	-4.4946*
Adjusted R^2	67%	67%	67%	67%

This table represents result for second stage regression in Equation 3.6 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. Dependent variables are firm-level valuation measure (adjusted book to market) $BToM_t^{\star}$ measured at the end third quarter each year. $\widehat{Own}_t$ is instrumented total institutional ownership from the first stage regressions. Each column represents result for regression including the interaction term of instrumented ownership and characteristic mentioned at the top of the column $Char_t : \widehat{Own}_t$; the firm characteristics $Char_t$ is measured at the end of the first quarter each year. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.10 – Effect of institutional ownership on BToM in interaction with firms' initial valuation measure ($\pm$200 firms around Russell 1000 Threshold)

	$BToM^{\star}$	$BToM^{\star}$
$\widehat{Own_t}$	-0.0414***	-0.0283**
$MCAPRank_t - 1000$	1.8164	2.8235**
$FloatAdj_t$	3.0647**	2.0455*
$BToM^{\star}_{Medium,t} \times \widehat{Own_t}$	-0.0055***	
$BToM^{\star}_{Low,t} \times \widehat{Own_t}$	-0.0095***	
$BToM^{\star}_t \times \widehat{Own_t}$		0.0083***
$(MCAPRank_t - 1000)(Russell2000_t)$	-3.5848	-3.1905*
Adjusted R^2	68%	77%

This table represents result for second stage regression in Equation 3.6 for $\pm$ 200 firms bandwidth around the Russell 1000 threshold. Dependent variables are firm-level valuation measure (adjusted book to market) $BToM^{\star}_t$ measured at the end third quarter each year. $\widehat{Own_t}$ is instrumented total institutional ownership from the first stage regressions. $BToM^{\star}_t \times \widehat{Own_t}$ is the interaction term of instrumented ownership and valuation measure which included at the end of the first quarter. $BToM^{\star}_{k,t} \times \widehat{Own_t} \quad k = Low, Medium, High$ is the interaction term of instrumented ownership and firm valuation dummy variable which is measured at the end of the first quarter. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects, and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.11 – Second Stage Regression Models 1991-2006

	$BToM^{\star}$
$MCAPRank_{t-1} - 1000$	4.8088*
$FloatAdj_{t-1}$	3.8291*
$(MCAPRank_{t-1} - 1000)(Russell2000_{t-1})$	-4.4523
$\widehat{Own_t}$	-0.0585***
Adjusted R^2	60%

This table represents result for the second stage regression in Equation 3.5 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold for period of 1991-2006. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 3.12 – Second Stage Regression Models Excluding 50 Closest Firms Around the Threshold

	$BToM^{\star}$
$MCAPRank_t - 1000$	3.6164
$FloatAdj_t$	4.8873*
$(MCAPRank_t - 1000)(Russell2000_{t-1})$	-4.1260
$\widehat{Own_t}$	-0.0591**
Adjusted R^2	46%

This table represents result for the second stage regression in Equation 3.5 for $\pm$ 200 firms bandwidth around the Russell 1000/2000 threshold excluding $\pm$ 25 closest firms to the threshold in order to minimize Russell index "banding" policy effect. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5% and 10% levels.

Table 3.13 – Institutional Investors perferences - Concentration Measure

	HHI	HHI
$BToM_{L,t_1}$	-0.1027***	
$BToM_{H,t_1}$	0.0766***	
$MadjBToM_{t-1}$		-0.0005
$MCAP_{t-1}$	0.2133***	0.1933***
$Ret3_{t-1}$	-0.0003**	-0.0005***
$Price_{t-1}$	-0.1879***	-0.2063***
EPS_{t-1}	-0.0009	-0.0010
$VOLAT_{t-1}$	-0.1762***	-0.1802***
Adjusted R^2	64%	64%

Table presents two different setups for regression models Equation 3.3. Dependent variable $HHI_{i,t}$ is institutional ownership concentration for firm i at quarter t. Lagged valuation measures include adjusted Book to market ratio $BToM^{\star}_{i,t}$. In another setup, we use $BToM^{\star}_{k,i,t-1} \quad k = Low, Medium, High$ dummy variables which indicates whether a firm at each industry-quarter has Low, Medium or High adjusted book to market ratio comparing to its peers. Lagged Control variables include firm size $MCap_{i,t-1}$, last three month cumulative return $Ret3_{i,t-1}$, quarter end logarithm of price $Price_{i,t-1}$, Earnings per share $EPS_{i,t-1}$, and standard deviation of daily returns over the quarter $VOLAT_{i,t-1}$. Coefficients estimates are based on OLS with firm and time fixed effects with clustered standard errors at firm level. HHI index multiplied by 100 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

Table 3.14 – First Stage Regression - Institutional Ownership Concentration Measure

	HHI
$MCAPRank_t - 1000$	0.0278
$FloatAdj_t$	0.0018
$(MCAPRank_t - 1000)(Russell2000_t)$	-0.0690
$RUIndex2000_t$	0.0009
Adjusted R^2	72%
F-statistic(excl instr.)	0.2973

This table represents first stage regression in Equation 3.4 for $\pm$ 200 firms bandwidth around Russell 1000/2000 threshold. Dependent variable is institutional ownership Herfindahl-Hirschman Index (HHI). $Russell2000_{i,t}$ is a dummy variable which indicates Russell 2000 inclusion for firm i at the second quarter of year t, and its coefficient represents the discontinuity parameter in Ownership at the threshold $(Rank = 1000)$. $MCAPRank_{i,t} - 1000$ is the distance to threshold for firms ranked based on their May 31th Market-cap. $FloatAdj_{i,t}$ is the difference between the $MCAPRank_{i,t}$ and the actual Russell rank which is available in June. Coefficients estimates are based on OLS with firm and time fixed effects and clustered standard errors at firm level. Market cap and Russell index rankings are divided by 10000 to avoid nominal coefficients in the table. ***, **, * denote statistically significant coefficient estimates at the 1%, 5%, and 10% levels.

General Conclusion

In the First chapter, we studied institutional investors' preferences for firm-level risk characteristics. We formed several hypotheses based on (Rajan, 2006) about the effect of the interest rate environment on institutional investors' preferences. Using Thomson Reuters 13F data, we find strong empirical evidence for most of (Rajan, 2006) predictions and our hypothesis. Institutional investors hold riskier stocks when the level of interest rates are low and fewer risky stocks when they are high. When we decompose the total volatility of the firms, we find that this preference toward riskier stocks in low-interest rate environment is mostly due to their preferences for stocks with higher systematic, rather than idiosyncratic risk. To be more precise, institutional investors in low-interest rate environment, prefer to increase their exposure to systematic risk rather than idiosyncratic risk. By further decomposition of systematic risk, we document that they mostly increase their portfolio exposure to systematic risk by holding firms with higher market and size betas.

We then decompose the current level of the T-bill rate into its previous level and current change and analyze their effects separately. Our results show that institutional investors' reaction to current change of interest rate is similar to the lagged level of interest rate, and they search for yield by holding more stocks with high total risk when interest rate decreases. In the categories of institutional investors, we show that they similarly react to the low-interest rate environment by holding stocks with higher total volatility. However, this effect is more pronounced for investors categorized as Quasi-Indexers and Dedicated as they tend to have longer investment horizons compared to Transient institutional investors. We also document that the decrease in interest rate has a more significant

impact on institutional investors' holding rather than the increase of interest rate. That means interest rate does not have a symmetric effect on institutional investors' portfolio. However, in contrast to Rajan's predictions, we do not find any much significant evidence on the effect of persistently low and less volatile interest rate environment on institutional investors' preferences for risk.

In the second chapter, we studied the causal effect of institutional investors on the firm-level risk measures including firms' total, idiosyncratic and systematic risk. We employed a two-stage regression model suggested by (Crane et al., 2016) in which Russell 2000 index inclusion is used as an instrumental variable for institutional investors. We first show that the drastic change of Russell index weight at 1000/2000 threshold affects institutional ownership but is exogenous to the firm-level risk measures. By focusing on the firms around the Russell 1000/2000 threshold and utilizing this IV, we document that an increase in institutional ownership significantly reduces the firm's total and idiosyncratic volatilities. However, there is no effect on the firm's systematic risk.

Furthermore, we studied different categories of institutional investors, and document that Quasi-Indexers and Transient institutional investors reduce firms' risk. Moreover, this effect is stronger for the Transient investors per one unit of increase in ownership. In the second part of the paper, we studied the mechanism through which institutional investors affect firms' risk measures. We hypothesized two channels for this effect. First, Institutional investors decrease firm risk by affecting its performance. Second, Institutional investors decrease firm risk by affecting market perceptions around the firm. We utilized mediation analysis and picked several variables (mediators) as proxies for each of the above mentioned two channels. Finally, we reported that institutional investors reduce firms' volatility by increasing its financial performance measured by unexpected earnings per share. This indirect effect contributes to almost 11% of the total effect of institutional ownership on firms' volatility and is reasonably robust with including all of the mediators.

In the third chapter, we studied institutional investors' preferences for and effects on firms' valuation measure which is measured by the firm's industry adjusted book to market ratio. First, we exhibit time-varying preference of institutional investors for firms'

valuation measure and show that institutional investors tend to own more of undervalued firms in industries. Our parametric results also suggest that institutional investors have a significant preference for undervalued firms. Results for categories of institutional investors reveals that Quasi-indexer and Dedicated investors prefer undervalued firms. Contrarily, Transient institutional investors slightly prefer overvalued firms. Second, similar to the second chapter, in order to study the causal effect of institutional investors on firms' valuation, we use the Russell 2000 index inclusion as an instrument for institutional ownership of firms around the Russell 1000/2000 threshold. Our results in this part explain that institutional investors significantly (economically and statistically) increase firm valuation after holding them. Our results also reveal that the effect of institutional ownership is stronger in firms who pay lower dividends and have less operational and financial volatilities. To link two parts of the paper, we studied the effect of institutional ownership on overvalued/undervalued firms and found that institutional investors significantly increase undervalued firms valuation. Moreover, this effect is stronger for already overvalued firms.

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Appendix A – Forming the Database

We base our main DATABASE by matching Ownership data from Thomson Reuters 13F data, which reports the equity ownership of all institutional investors with more than $100 million filed with the SEC each quarter, with CRSP and Compustat databases. To match 13F filings and CRSP, we mainly utilized Cusips under 13F filings and matched through time with historical CUSIPs in the CRSP database. As a second check, we also reviewed matching firms' tickers to confirm the correct match. We mainly used the CRSP database for the price, outstanding shares, dividend information and daily and monthly return as well as calculating firms different risk measures. To have other financial ratios, we merge Compustat with our database for this purpose we utilized CCM table which links gvkey from Compustat to permnos from CRSP. Since CRSP and 13F databases are based on calendar quarters, we merged Compustat fiscal quarter to the nearest calendar quarter to have all data in calendar quarters. After merging all databases, we apply some filters to reduce the effect of outliers.

- Winsorize top 1% of ownership data at each quarter.
- Filter shares with less than 1 dollar price.
- Windsorize firms at each Quarter at lowest 1% percentile of market-Cap.

Finally, we keep the data which we have all necessary clean information which formed our main DATABASE. For some specific analysis, To capture the market's expectations about the firm's financial performance, we use data from the Institutional Brokers Estimate System (IBES), which provides monthly data on analysts' EPS estimates and other related

statistics. To this purpose we merge the IBES database into our main DATABASE. We used summary history database from 1980/01/01-2014/12/31 to match with the quarterly database. We combined monthly data to build quarterly mean and standard deviation for each firm. We also considered some conditions to meet while building the database.

- The company's fiscal year ends in December.
- At least three estimates at each quarter for a firm.
- At least one month of data in a quarter.

Finally, for some of our analysis, we also merged Russell annual constitutes for Russell 1000 and 2000 indexes from 1980 till 2014. The match between Russell index and our database happened through firms' CUSIPs. Table 1 summarizes the matching process, each row shows the number of unique identification codes (CUSIP, permno, ...) for each database and number of the unique identification code for matched databases. Panel (a) reports matching for the main DATABASE which is a merged database of 13F, Compustat and CRSP, covers more than 23000 unique firms through the time. Panel (b) reports the pairing of DATABASE and IBES database, which shows that out of 17338 unique CUSIPs 14920 CUSIPS are matched with the DATABASE and matching ratio is about 86%. Panel(c) reports the matching outcome of DATABASE and Russell indexes which indicates that the matching ratio is about 99% for Russell1000 and Russell2000 with DATABASE.

Table 1 – Merging Database

(a) Principal DATABASE

	CRSP	13F	CRSP-13F	Compustat	DATABASE
CUSIP	37456	58770	33459	34101	32132
permno	27514		25018		23848
gvkey				34120	

(b) DATABASE - IBES match

	IBES	DATABASE-IBES
CUSIP	17338	14920
permno		11046
gvkey		

(c) DATABASE and Russell Match

	Russell1000	DATABASE - Rusell1000
CUSIP	4566	4517
permno		3757
gvkey		

	Russell2000	DATABASE - Rusell2000
CUSIP	13188	13016
permno		11261
gvkey		

Table shows the merging process to build necessary databases. CUSIP, gvkey and permnos are unique identification numbers used in each database. Panel (a) shows the main DATABASE which is matched database of CRSP, COMPUSTAT, and 13F. Panel (b) shows the match of DATABASE and IBES database. Panel (c) reports the pairing of DATABASE and Russell indexes.