CEO Compensation and Real Estate Prices: Pay for Luck or Pay for Action?

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Abstract

This paper uses real estate price shocks to study the sensitivity of CEO pay to luck. Evidence that CEOs are paid for lucky events that are outside of their control is commonly interpreted as inefficient contracting. However, compensating CEOs for luck can be part of efficient contracting if boards want to provide CEOs with incentives to act or respond to the lucky event. We use real estate price shocks to test whether CEOs are paid for luck, or paid to act or respond to luck. We distinguish between pay for luck and pay for action by exploiting GAAP accounting rules. In the US real estate used in the firm's operations is not market-to-market, thus a change in the value of real estate is only accounted for when the CEO reacts to the change in property value by, for instance, selling the real estate asset. We show that CEO compensation is associated with responses to real estate luck, which mostly explains the pay for luck. Our results challenge the inefficient contracting interpretation of pay for luck.

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1 Introduction

Agency theory suggests that boards design efficient compensation schemes to provide Chief Executive Officers (CEOs) with incentives to maximize shareholder value (Murphy, 1999; Core et al., 2002), and in a traditional optimal contracting framework, shareholders should not compensate CEOs for firm performance that is driven by exogenous shocks ("luck") (Holmström, 1979). However, several papers show evidence of "pay for luck", that is, pay that is due to observable lucky events, such as industry or market performance, not under the CEO's control (Bertrand and Mullainathan, 1998, 2001; Bebchuk and Fried, 2003; Garvey and Milbourn, 2006; Bizjak et al., 2008). More recent agency models suggest that pay for luck can actually be optimal if the principal wants to incentivize the agent to forecast or respond to lucky events (Axelson and Baliga, 2008; Göx, 2008; Noe and Rebello, 2011), or to reinforce effort incentives (Chaigneau et al., 2014). In these models, pay for luck can be interpreted as the CEO being rewarded for responding to an unpredicted lucky event (i.e., pay for action). In this paper, we propose a new setting to empirically disentangle pay for luck from pay for action.[1]

We use shocks to real estate prices to distinguish between CEO pay for luck and pay for action, where action consists of an optimal response to unanticipated luck. We exploit the fact that under US accounting principles (GAAP), real estate asset values are not marked-to-market (see Balakrishnan et al., 2014) to distinguish between pay for luck (increase in real estate prices incorporated in stock returns, but not in accounting returns) and pay for actions (increase in real estate prices incorporated both in stock returns and in accounting returns). This feature allows us to identify when the CEO responds to unexpected changes in the value of the firm's real estate holdings. As a first approach, we look at specific actions taken by the CEO: selling of real estate property, and debt issues that take advantage of the colateral value increase. As a second approach, we explore changes in accounting returns to comprehensively capture any action the CEO might have taken as a response to changes in real estate prices, without having to individually identify such actions. The fact that real estate assets are not marked-to-market to real estate price shocks provides some assurance that a change in accounting returns associated with a change in the value of real estate only occurs if there is an action taken by the manager. We find evidence that pay for luck is mostly explained by CEO actions or responses

[1] Recent work on relative performance evaluation (RPE) (Albuquerque (2009); Gong et al. (2011); Bettis et al. (2010, 2018); Lobo et al. (2018); De Angelis and Grinstein (2011)) states that the firm performance measures used to structure CEO pay contracts should exclude the component driven by exogenous shocks ("luck") and be more informative of CEO actions.

to lucky events.[2]

It is optimal for shareholders to reward a CEO for responding to a lucky event when that action increases shareholder value (Murphy, 1999; Core et al., 2002). For example, selling real estate as a response to a positive shock is an optimal action if real estate stock prices exhibit reversal as shown by Capozza et al. (2002).[3] A common response to real estate luck are sale-and-leaseback transactions, as they can relax financial constraints should they exist. As anecdotal evidence, Sotheby's announced in a press release in 2002 that it had engaged in a sale-and-leaseback deal regarding its New York headquarters. Their CEO, Bill Ruprecht, was clear in the motivation for the deal: "This is an outstanding opportunity for Sotheby's. (...) The attractive price of $175 million reflects the high asset quality, desirable location and Sotheby's bright future prospects. Sotheby's ... decided to enter into a sale-leaseback transaction as a means of financing to provide long-term liquidity for our business. It will also allow Sotheby's to pay down $100 million in short-term debt ..." Mr. Ruprecht added: "Sotheby's expects to report a gain on the sale of the building in the range of $25 million...". At the same time, an increase in the collateral value of assets due to the appreciation of real estate values enables firms to issue more debt (e.g., Chaney et al. (2012) and Cvijanović (2014)). Past studies show that corporate real estate sale-and-leaseback transactions add value to shareholders (see for instance Slovin et al. (1990), and Rutherford (1990), and for more recent evidence Ben-David (2005) and Whitby (2013)). In addition, shareholder activists often push firms to "monetize" the increase in value of their real estate by engaging in sale and leaseback transactions, which allows firms to generate cash for stock buybacks, paying dividends, investing in valuable projects or decreasing debt.[4]

Given that the empirical and anecdotal evidence suggests that, on average, CEOs react to real estate shocks by taking actions that increase shareholder value, we proceed by estimating the sensitivity of CEO pay to luck and to responses to lucky events. We start by estimating pay for luck in reduced form using changes in real estate prices as a lucky shock. Building on the identification strategy used in the collateral channel literature (Balakrishnan et al., 2014;

[2]Bertrand and Mullainathan (2001) points out that finding evidence of pay for luck does not necessarily provide support for a skimming model. Garvey and Milbourn (2006) argue that pay for luck, specifically rewarding CEOs for market or industry performance, can be optimal if it compensates managers for bearing systematic risk. Bizjak et al. (2008) argue that the documented asymmetry in CEO pay for luck is a result of competitive benchmarking, thus also optimal.

[3]If real estate prices exhibit momentum, selling is not the optimal response.

[4]For recent examples see https://www.wsj.com/articles/bob-evans-will-pursue-200-million-sale-leaseback-of-restaurant-properties-1441140056.

Chaney et al., 2012; Cvijanović, 2014), we compare how shocks to real estate prices impact CEO pay for firms that have different amounts of real estate assets on their balance sheet in 1992. We measure exposure to real estate shocks at the beginning of the sample period to alleviate concerns that exposure is endogenously chosen by the manager. Our empirical models include either firm or CEO-firm fixed effects to deal with the endogeneity of CEO-firm matching and omitted variables at the firm, CEO, and CEO-firm levels, which implies that time-invariant characteristics of the firm or the manager such as innate talent is unlikely to drive our results. Consistent with prior empirical literature, we find that CEOs are rewarded for luck. The magnitude of the effect is economically significant: the sensitivity of CEO pay to real estate luck suggests that a one standard deviation change in real estate prices for a firm with average exposure to real estate markets is associated with an increase in CEO compensation of approximately $158,900 evaluated at the mean.

We then estimate the sensitivity of CEO compensation to actions, by focusing on two specific responses to real estate luck: sales of real estate assets and debt issues. We also take advantage of the accounting treatment for shocks to the market value of real estate assets to distinguish between pay for lucky events and pay for responses to luck, i.e., for actions. Accounting returns only reflect shocks to real estate luck when the CEO acts on the luck by either selling the asset or engaging on a sale and lease back transaction, as examples.[5] Using this procedure, we capture the sensitivity of pay to action by testing the sensitivity of pay to changes in accounting returns that are associated with increases in real estate prices. To ensure that CEO's actions are not just common responses followed by firms in the same industry, in which case it would not be optimal to reward the CEO, we control for peer effects. Controlling for peer effects (Albuquerque et al. (2013); Bizjak et al. (2008)), we continue to find that the sensitivity of CEO compensation to responses to real estate price shocks is positive and significant, which suggests that CEOs are rewarded for their responses to real estate shocks.[6] After taking in consideration CEO's responses to real estate shocks, most of our estimates of pay for luck have either much smaller economic magnitudes or are not statistically significant, which suggest that

[5] "Real estate luck" might still be reflected in accounting returns in the following situations: extremely negative real estate shocks, when the firm can write off real estate assets; and the case of real estate rentals. We deal with the first case by excluding the extreme negative shocks from the analysis, and with the second by adjusting accounting returns for the effect of rental expenses. Further, since non-current real estate assets held for sale, or investment property, are marked-to-market, both accounting and market performance are expected to be affected by real estate shocks despite managerial actions. These assets typically represent a very small fraction of the firms' assets, and most of firms do not hold them.

[6] This result is broadly in line with Lewellen (2017), who decomposes firm performance into "luck" and "skill", and finds that CEOs are only compensated for skill.

pay for real estate luck is mostly explained by these responsive actions. Note that in cases when the optimal response of the manager to real estate shocks is "no action," say, not selling, there will be no changes in accounting performance and the "no action" response to luck is still embedded in the estimate of pay for luck. For this reason, our measure is conservative in capturing actions associated with real estate shocks.[7]

Next, we test whether the responses to luck are optimal from the point of view of shareholders. Even though it is arguably difficult to evaluate and directly test the optimality of these actions because we do not observe counterfactuals, we can still evaluate if, on average, common responses to real estate luck add value to shareholders. To do it, we run an event study on sale-and-leaseback (SLB) transactions. We find that real estate sale-and-leaseback transactions are associated with significant positive cumulative abnormal returns (CARs) on the announcement date, suggesting that these CEO actions are value increasing. We also explore cross sectional variation in the level of firms' financing constraints and in the quality of firms' corporate governance. The rationale is that most actions taken as a response to real estate luck, such as sale-and-leaseback transactions or debt issues using real estate as collateral, are more valuable for financially constrained firms. We find that rewarding CEOs for responses to real estate luck is more pronounced for financially constrained firms. We also find that pay for luck is mainly explained by these CEOs responses to luck, which suggests that in the case of real estate shocks, pay for luck is mostly pay for action. This is particularly true for well-governed firms, suggesting that these firms incentivize their CEOs to react to lucky real estate events, or just compensate their CEOs ex-post for these observable actions. Taken together, these results provide suggestive evidence that these actions create value to shareholders.

In order to address the concern that house prices might be correlated with some unobserved variable that is not under the CEO control but is also correlated with CEO compensation, for instance aggregate demand, we use the inelasticity of land supply as an exogenous regressor for real estate prices. To address the concern that a firm's real estate holdings may not be located in the same location as its headquarters, which we use to capture real estate shocks affecting the firm, we use data on a firm's location-specific real estate holdings from García and Norli (2012). We then test whether CEO compensation is linked to debt issues, assets sales and changes in ROA associated with real estate shocks. We again find that CEO pay is positively related to

[7]With our identification strategy we still cannot capture the ability of the CEO to forecast real estate shocks, and therefore compensating for this ability will still be part of the estimated pay for luck.

these actions suggesting that CEOs are paid for responses to luck.

By showing that CEOs are rewarded for taking actions in response to positive shocks, this paper adds to the general literature that examines CEO skill, incentives, and how the learning process about CEO ability and her actions can affect pay (Taylor, 2013), stock return volatility, and value creation, (Pan et al., 2015; Hermalin and Weisbach, 2017) as well as real investment decisions (Edmans et al., 2017). More specifically, we contribute to the literature on CEO compensation by providing evidence that most of the pay for luck effect documented in prior literature actually reflects pay for actions, when luck is driven by real estate shocks. We also contribute to the debate between the managerial power and competitive market views of CEO compensation (Murphy, 1999; Core et al., 2002). Pay for luck is typically used as an argument in favor of the managerial power hypothesis, as pay for luck occurs mostly in badly governed firms (Bertrand and Mullainathan, 2001; Chhaochharia and Grinstein, 2009; Garvey and Milbourn, 2006; Bebchuk et al., 2010). We provide evidence that most of the pay for luck is associated with managerial actions, which is more consistent with efficient contracting than rent extraction by CEOs.

Last, we offer insights on the implications of choosing accounting-based measures of performance versus market-based measures while writing optimal contracts (Lambert and Larcker, 1987; Bushman et al., 1996; Davila and Penalva, 2006). We show that accounting-based measures have the benefit of capturing actions in response to real estate price shocks. We also provide a new setting where accounting rules and practices, in this case using historical costs and not marking–to-market real estate assets, have real implications for CEO pay practices (Skantz, 2012; Göx, 2008).

The rest of the paper is organized as follows: in Section 2 we analyze the existing literature on pay for responses to luck and provide theoretical underpinning for our analysis. Institutional background is described in Section 3. In Section 4 we describe the data and methodology, and in Section 5 we discuss the main findings. Section 6 contains the discussion of the robustness tests, and in Section 7 we conclude.

2 Pay for luck and responses to luck

Empirical literature on pay for luck offers consistent evidence that CEOs are paid for good performance that is driven by exogenous lucky events, but mixed evidence with respect to the association between compensation and bad luck. The managerial power view argues that CEOs are paid for luck: CEOs are rewarded for lucky events not under their control and not penalized for unlucky ones. Bertrand and Mullainathan (2001) show that CEO pay in oil industries is equally sensitive to general firm performance as it is to performance driven by oil shocks that are not under the control of managers. Moreover, firms with weaker corporate governance mechanisms are the ones that tend to reward more their CEOs based on the exogenous shocks. Garvey and Milbourn (2006) argue that pay for luck, specifically rewarding CEOs for market or industry performance, can be optimal to compensate managers for bearing systematic risk. However they find that CEOs are indeed rewarded for good market conditions but not penalized when the market is doing poorly.

Given the extensive empirical evidence on pay for luck, a number of papers offer a rationale for this phenomenon. Several studies propose pay for luck as a mechanism to incentivize effort, for instance, effort to generate informative signals about the market. Axelson and Baliga (2008) question the standard point made by Holmström (1979) that CEO pay should be linked to the performance measure that is the most informative about managerial effort to avoid pay for luck. They argue that when managers receive private signals about industry or market performance it is optimal to pay them for exogenous performance. Gopalan et al. (2010a) make a similar argument that pay for industry performance is optimal when the principal wants to incentivize an optimal exposure to sector movements and this exposure is under the CEO control. Empirically, they find that pay for industry performance is mostly found in firms where the CEO has greater strategic flexibility with respect to sector exposure. Noe and Rebello (2011) argue that pay for luck can also work as an incentive mechanism to ensure continued survival of the firm after adverse shocks.[8]

Our paper offers support to Gopalan et al. (2010a) theory by showing that pay for luck might be optimal when the board wants to incentivize an ex-post optimal response to a lucky event that is not anticipated, but where the CEO has control of the exposure to the shock as evidenced, for instance, by sale and leaseback type of transactions. Evidence of pay for luck can also be rationalized by the CEO being compensated ex-post for responding optimally

[8]Other explanations for the pay for luck effect includeBizjak et al. (2008), Oyer (2004), and Chaigneau et al. (2014). Bizjak et al. (2008) argues that the documented asymmetry in CEO pay for luck is a result of competitive benchmarking. Oyer (2004) focuses on the participation constraint of managers and argues that pay for luck can be optimal when outside options of managers are positively correlated with industry performance and it is costly to re-write a new compensation contract. Chaigneau et al. (2014) propose a model where pay-for-luck interacts with the strength of the incentives managers have to start with.

to the anticipated lucky shock, this response being observable by the firm. Prior studies do not distinguish between these two possibilities. We identify these responses and test whether managers are paid for responding to exogenous changes in market conditions. Axelson and Baliga (2008) argue that in order to make long-term contracts renegotiation proof, managers must have private information in the short-term that make them optimistic about their long-term compensation prospects. In our setup, all managers observe a public signal (aggregate real estate shock); however, they have different private interpretations of that signal. Depending on the private interpretation, managers choose whether to respond to a (positive) exogenous (real estate) shock, in such a way to improve the firm's performance. This is consistent with their argument: contracts should tie compensation not only to measures that are related to pure effort, but also to measures about which the manager is likely to have better information than the market. This is precisely the case in our setting, because the manager can choose whether and how to respond to the exogenous events, contracts should incentivize these ex-post optimal responses.

Last, an alternative explanation draws on the argument by Axelson and Bond (2015), and DeMarzo et al. (2012), who predict that rewarding the manager for luck is optimal in good times, since the boards want to incentivize managers to seek positive NPV projects when the times are good, and to do so they may want to tie their compensation to measures that are beyond managers' control. In this paper, we show that CEOs are indeed compensated for positive NPV projects during good (real estate) times, such as engaging in sale and leaseback type of transaction.

3 Institutional background

3.1 Accounting treatment of long-lived assets under US GAAP

Real estate assets are typically recognized in the balance sheet as property plant and equipment, at acquisition cost, and depreciated on a systematic basis over time. Shocks to the value of firm real estate are reflected in its market and accounting performance in different ways. When the value of a firm's real estate changes as a result of a positive shock in real estate prices in the location of the firm's headquarters, this change in firm value should be reflected in its market capitalization (and therefore in its stock market performance) immediately assuming markets are efficient. However, according to US GAAP, the exact same shock should not be reflected in the firm's accounting performance. Based on the historical-cost principle, under GAAP, long-lived assets (such as real estate) are recorded on the balance sheet at historical cost even if their value have significantly increased over time. Historical-cost is a measure of value in which the price of an asset on the balance sheet is based on its nominal or original cost when acquired by the company. Given that the value of a firm's real estate assets is not marked-to-market, any changes to the firm's accounting performance we observe following a real estate shock must come from a firm (or its CEO) reacting to that shock in some way: for instance, when it decides to sell the real estate and then realizes a capital gain (or loss). The US GAAP historical-cost principle thus allows us to estimate the sensitivity of CEO pay to responses to luck because accounting performance is not affected by real estate shocks unless there is an action taken by the CEO.

Real estate assets can also be accounted for as investment property held for sale, when the firm holds the asset with the purpose of selling it in the future. In this case, the asset is measured at the lower of its carrying amount or fair value less costs to sell, and the assets are not depreciated. For those assets, because they are marked-to-market both accounting and market performance are affected by real estate shocks despite managerial actions. Non-current real estate assets held for sale, or investment property, typically represent a very small fraction of the firms' assets, and most of firms do not hold them (in our sample only 4 firm-year observations had such assets).

3.2 Reactions to events that are not under CEO control: example from sale and leaseback transactions

Following an increase in the value of the firm's real estate holdings, the CEO can respond in several different ways. As an example, the CEO can sell the real estate assets and relocate. In our sample, an average of 5.2% of companies changed headquarters location (see Table IA3). Alternatively, the CEO can sell the real estate assets and lease them back (to perform a sale and leaseback transaction or a SLB), or change the financing policy of the firm by issuing more debt while taking advantage of the increase in collateral value. In this section, we discuss the institutional details behind SLB transactions, as the process of issuing debt is well understood in the collateral channel literature (e.g., (Chaney et al., 2012) and (Cvijanović, 2014)).

As argued in Whitby (2013) the choice to enter into a SLB transaction is an example of an instance where the manager of a firm decides to change the way it finances the firm's assets.

In a SLB transaction, an asset is sold to a third party, usually a real estate investment trust (REIT), and then simultaneously leased back with little or no impact to the daily operations of the firm and the use of that asset.

The majority of corporate SLBs involve real estate. Whitby (2013) shows several examples of SLB transactions: the sale and subsequent leaseback of a distribution center to TriNet Corporate Realty Trust, Inc. by Nike, and the completed sale-and-leasebacks of three restaurant locations to Franchise Financial Corp. of America by Famous Dave's of America. A notable example of a SLB transaction is the Santander Bank sale of their Madrid headquarters (HQ) in January 2008 for a reported capital gain of $886 million. Santander pocketed 1.9 billion-euros at the time by entering a deal, which saw them lease the complex for 40 years with the option to purchase at the end of the lease.[9]

Ben-David (2005) reports that the most common assets involved in SLB transactions in his sample were the company's headquarters followed by retail locations. As he shows, the top two declared motives for entering into a SLB transaction are to use the cash proceeds to reduce debt and for expansionary purposes. As mentioned above, shareholder activists also pressure firms to engage in SLB transaction as a way to monitize real estate gains. An example is the restaurant chain Bob Evans Farms Inc. (BOBE) who, as a result of pressure from Sandell Asset Management, completed a total of $249 million in SLB transactions representing about 30% of the chain's overall real estate in 2016.[10] In addition to using the cash proceeds to reduce debt, increase investment or distributions to shareholders, under the accounting rules in place over the sample period, a SLB can also allow firms to take a large assets off the balance sheet (if the transaction is classified as operating lease) and record a gain. The accounting treatment for SLB transaction under ASC 840 states that the amount of the gain recorded by firms depends on the significance of the lease in comparison to the fair value of the property.[11]

[9] As reported in http://www.reuters.com/article/santander-property/update-1-santander-makes-605-mln-euros-on-hq-leaseback-deal-idUSL2573823720080125, Santander shares closed 0.7 percent higher on the SLB transaction announcement date.

[10] For details see https://www.wsj.com/articles/bob-evans-will-pursue-200-million-sale-leaseback-of-restaurant-properties-1441140056.

[11] Under ASC 840 if the future rental payments as a percentage of the fair value of the property is less than 10%, the full gain is recognized, if the percentage is between 10 and 90%, a partial gain is recognized, and if the percentage is above 90%, then recognition of the gain occurs through amortization over the lease term. For more details see https://asc.fasb.org.

4 Methodology

A large number of studies analyze whether CEOs are rewarded for lucky events. The standard approach by Bertrand and Mullainathan (2001) consists of estimating the sensitivity of CEO compensation to changes in firm performance driven by luck, using exogenous determinants of firm performance such as oil prices or exchange rates. However, when estimating the sensitivity of compensation to luck in this framework, one cannot disentangle the sensitivity of pay to luck from the sensitivity of pay to reactions to luck (actions).

The accounting treatment of real estate assets described in Section 3.1 allows us to do just that: given that any shocks to the value of a firm's real estate should only be reflected in the firm's financial statements if there was an action in response to the shock, we are able to disentangle the sensitivity of CEO pay to luck (measured by the market value of its real estate assets) from the sensitivity of pay to reactions to luck.

To confirm the results in the existing literature (Bertrand and Mullainathan, 2001; Garvey and Milbourn, 2006; Chhaochharia and Grinstein, 2009), we start by testing whether CEOs are compensated for lucky events, as proxied by changes in real estate values.[12] We estimate the following baseline specification:

$$\log(\text{TotalComp}_{i,t}) = \alpha + \beta_1 \text{HPI}_{m,t-1} + \beta_2 \text{Exp}_{i,t_0} + \beta_3 \text{Exp}_{i,t_0} \text{HPI}_{m,t-1} + \\ + \sum_x \beta_X X_{i,t} + \delta_{m,t} + \gamma_{i,c} + \mu_{j,t} + \varepsilon_{i,t} \quad (1)$$

Where $\text{TotalComp}_{i,t}$ is total CEO compensation in firm i at time t. Exp_{i,t_0} is defined as exposure to the value of real estate assets scaled by total assets in 1992. We measure the value of a firm's real estate assets in 1992 *prior* to the estimation sample to mitigate potential endogeneity between real estate value and firm investments. By using this approach, we do not incorporate the value of any real estate acquisitions or dispositions following 1992. This helps addressing a potential endogeneous association between real estate values and subsequent investments, however a downside to this approach is that it uses a relative noisy measure of a firm's real estate holdings. $\text{Exp}_{i,t_0}\text{HPI}_{m,t-1}$ represents the luck measure, in this case the level of the House Price Index (HPI) at the Metropolitan Statistical Area (MSA) m of firm i at time

[12] An alternative way of estimating the sensitivity of pay to lucky events is to run an instrumental variable regression, however, in the case of real estate luck the exclusion restriction is likely to be violated. Nonetheless, we run the IV regressions as a robustness check in Section 6.1.

$t-1$ interacted with the value of real estate assets for firm i at time t_0.[13] Because we include firm fixed effects in the model, this variable captures the change in real estate market values. $X_{i,t}$ are firm and CEO-specific controls such as ROA, total assets, market-to-book of assets ratio, stock return volatility, stock return, CEO age and CEO age squared. We also control for the real estate ownership decision by including the interaction of (log) total assets and $\text{HPI}_{m,t-1}$ ((Chaney et al., 2012)). $\delta_{m,t}$ are MSA-year fixed effects, $\gamma_{i,c}$ are firm or firm-CEO fixed effects, and $\mu_{j,t}$ are industry-year fixed effects. As an alternative to the baseline model, where firm fixed effects are included following the existing pay for luck studies (Bertrand and Mullainathan, 2001; Garvey and Milbourn, 2006; Chhaochharia and Grinstein, 2009), we also include firm-CEO fixed effects. While with firm-CEO fixed effects the coefficients are estimated using only within firm-CEO variation, with firm fixed effects variation might come from having different CEOs in the same firm. The firm-CEO fixed effects takes care of time-invariant unobservable characteristics of the CEO such as innate talent or risk preferences, that has been shown to explain much of the variation in CEO compensation (Graham et al., 2012).

As noted by Albuquerque et al. (2013), Bizjak et al. (2008) and Cadman and Carter (2013) among others, boards tend to structure CEO compensation contracts based on peer CEO (firm) compensation. The inclusion of industry-year fixed effects, $\mu_{j,t}$, serves as a control for peer effects: thus β_3 captures the general sensitivity of pay to (real estate) luck relative to other CEO-firm pairs that operate in the same industry.[14] To address a potential concern that there is matching between a firm's real estate exposure and CEO type, or between a firm's location and CEO type that might be driving our results, we include firm-CEO fixed effects, $\gamma_{i,c}$, as noted above. In this way, our main source of variation comes from tracking the same CEO-firm pair over time, which should also alleviate potential matching concerns.

The coefficient of interest is β_3, which captures the sensitivity of CEO pay to (real estate) luck for a given firm-CEO pair over time, controlling for location specific- and time-varying industry-specific characteristics that might be driving our results.

As described in Section 3.1, given that any shocks to the value of a firm's real estate should only be reflected in the firm's financial statements if there is an action in response to the shock, we are able to disentangle the sensitivity of CEO pay to luck (measured by the market value

[13]In Section 4.1, we describe in detail how we measure the market value of a firm's real estate assets, which is a key construct in our analysis, and how we obtain the HPI information.

[14]As a (untabulated) robustness test, we alternatively include industry-size-year fixed effects, which assumes that peers are firms in the same industry, size quartile (measured by the firm's market value of equity) and year, and obtain similar results.

of its real estate assets) from the sensitivity of pay to reactions to luck (measured by sale of real estate assets, increase in debt and change in accounting earnings). Given that the value of a firm's real estate assets is not marked-to-market in financial statements, any changes to the firm's accounting performance that is associated with a real estate shock must come from a firm (or its CEO) reacting to that shock in some way: for instance, when it decides to sell the real estate and then realizes a gain (or loss).

Our first measure of CEO action is *Real Estate Asset Sales*, calculated based on the difference in the balance sheet value of a firm's real estate assets between year t and year $t-1$: RESChange = $\text{REValue}_t - \text{REValue}_{t-1}$, where REValue = Buildings, Land and Improvement, and Construction in Progress / Total Assets, whereby we only look at the cases when this difference is negative, indicating real estate asset sales. In the tests, RESales assumes either a value of zero (when REChange > 0) or the assumed value of the real estate sale (absolute value of REChange if negative). We focus on real estate asset sales because it is more likely for the CEO to sell real estate as a response to a positive shock, or do a sale-and-leaseback transaction, than to buy real estate as a response to a negative shock. More precisely, we look at the cases when the difference in the book value of real estate assets is negative (net sales), which can also happen when firms sell and buy real estate elsewhere (at the lower price), or start to rent. For this reason our results can be interpreted as conservative or as a lower bound. In our baseline specification we use balance sheet values net of accumulated depreciation. Ideally, we would use gross values to determine these sales, however accumulated depreciation is only available in Compustat for a fraction of the sample period, which results in a smaller sample size.[15] This motivates the following specification:

$$\begin{aligned}\log(\text{TotalComp}_{i,t}) = \alpha + \beta_1\text{HPI}_{m,t-1} + \beta_2\text{Exp}_{i,t_0} + \beta_3\text{RESales}_{i,t} + \beta_4\text{Exp}_{i,t_0}\text{HPI}_{m,t-1} + \\ + \beta_5\text{RESales}_{i,t}\text{HPI}_{m,t-1} + \beta_6\text{RESales}_{i,t}\text{Exp}_{i,t_0} + \beta_7\text{RESales}_{i,t}\text{HPI}_{m,t-1}\text{Exp}_{i,t_0} + \\ + \sum_x \beta_X X_{i,t} + \delta_{m,t} + \gamma_{i,c} + \mu_{j,t} + \varepsilon_{i,t} \quad (2)\end{aligned}$$

The coefficient of interest is β_7, and it captures the sensitivity of CEO pay to reactions to luck, as proxied by the sale of real estate assets. Hence, in Equation 2, we are comparing the

[15] We run this alternative specification (untabulated) with gross values for a smaller sample size of about 5,000 observations and find similar results albeit with weaker statistical significance.

sensitivity of CEO pay to reactions to luck ($\text{RESales}_{i,t}$) for a given firm over time, controlling for time-varying location specific characteristics that might be driving our results. The inclusion of time-varying industry specific characteristics $\mu_{j,t}$ ensure that we are comparing the CEO pay sensitivity to RESales, *relative* to other CEO-firm pairs that operate in the same industry and year. We also use debt issues and ROA as alternative measures for CEO actions.

To address a potential concern that there is an omitted variable driving our results (for example, local demand shocks can be driving both local real estate prices and CEO compensation in that location), we also include MSA-year fixed effects $\delta_{m,t}$, which should absorb any time-varying MSA-specific factors, such as an increase in local growth opportunities, local demand shocks, or an increase in local investment.[16]

4.1 Data

This section describes data sources and presents summary statistics. Our initial sample consists of a panel of CEO-firm-years of Standard and Poor's (S&P) 1,500 firms drawn from the Execucomp database, from 1992-2016. We then match this sample to CRSP and Compustat databases to obtain stock returns and accounting data, and to the Federal Housing Finance Association's (FHFA) database of CBSA-level house price data. We exclude firms in the finance, insurance, real estate, construction, and mining industries, as well as firms involved in a major takeover operation, following existing literature (see for instance (Chaney et al., 2012) and (Cvijanović, 2014)). By excluding such firms we also make sure real estate assets are not market-to-market, which is key to our identification.

Similar to Chaney et al. (2012) and Balakrishnan et al. (2014), we measure the market value of a firm's real estate holdings at the beginning of the sample, in 1992, and then identify firm real estate asset value changes coming from variation in real estate prices across geographical locations and time. We choose to measure the value of a firm's real estate assets in 1992 and then inflate it with subsequent variations in local MSA-level real estate prices to arrive at the changes in the market value of a firm's real estate, since 1992 is the first year when the compensation data become available in Execucomp.[17]

There are three major categories of property, plant, and equipment that are included in

[16]Note that in specifications where both firm fixed effects and MSA-year fixed effects are included, the only source of variation to estimate the coefficient of interest is coming from firms that relocate, which in itself implies an action (because exposure is defined to be time-invariant at the firm level, and the real estate shock is MSA-year specific).

[17]Execucomp data for 1992 and 1993 are largely based on S&P 1500 firms.

the definition of real estate assets: Buildings, Land and Improvement, and Construction in Progress. These assets are not marked-to-market, but valued at historical cost. To arrive at the measure of a firm's real estate assets we follow two steps. First, we measure a firm's real estate assets in 1992 as the book value of Property, Plant, and Equipment Total (Net) (Compustat variable PPENT) less Property, Plant, and Equipment Leases (Net)(Compustat PPENLS), less Property, Plant, and Equipment Machinery and Equipment (Net) (Compustat PPENME)(REValue= (PPENT − PPENLS − PPENME)/AT)[18], thus yielding the total value of a firm's land and improvements, buildings, and construction in progress. Under the U.S. GAAP these items represent the respective capitalized values, less accumulated depreciation.[19] We replace missing observations with zeros. This variable is scaled by total assets to get the portion of the firm's assets related to its real estate holdings.

Second, and following Balakrishnan et al. (2014), we use real estate prices $\text{HPI}_{m,t-1}$ to estimate the market value of real estate assets in 1992 and then track the change in the market value of these assets over the sample period as a function of changes in real estate prices. We compute the market value of real estate assets held in 1992 as the book value at the time of the acquisition interacted with the cumulative price increase from the acquisition date to 1992. To compute the value of these assets after 1992, we use the market value of real estate assets at 1992 multiplied by the cumulative price increase from 1992 to a given year, as captured by $\text{Exp}_{i,t_0}\text{HPI}_{m,t-1}$, whereby Exp_{i,t_0} denotes the value of real estate asset in 1992, and $\text{HPI}_{m,t-1}$ indicates the cummulative price increase in (local) real estate prices. We obtain the house price data from the Federal Housing Finance Association's (FHFA). They are calculated at the level of a Core Based Statistical Area (CBSA). A CBSA is a geographic area defined by the Office of Management and Budget (OMB) based around an urban center of at least 10,000 people and adjacent areas. CBSAs largely overlap with Metropolitan Statistical Areas (MSA) also defined by the OMB, and we use the two acronyms interchangeably throughout the paper. The data contains a quarterly CBSA-level house-price index for 369 CBSAs from 1986 to 2016. The choice to use residential prices instead of commercial real estate prices is driven by the lack of availability of reliable commercial real estate data at MSA level for the period in question. Namely, most publicly available sources report state prices indexes for offices, excluding other

[18]Property, Plant and Equipment Total (Net) (PPENT) is defined in Compustat as Property, Plant and Equipment Total (Gross) (PPEGT) less Depreciation, Depletion, and Amortization (Accumulated) (DPACT).

[19]Note that Property, Plant and Equipment Total (Net) PPNT excludes land and property held for investment purposes or for development and resale.

types of commercial real estate.

The CEO-firm year data is merged to the house price data by linking each firm's headquarters zip code (from Compustat) with its particular CSBA using data from US Department of Housing and Urban Development (HUD) database. HUD provides HUD-USPS crosswalk files, which allocate zip codes to CBSAs. Ideally, we would use zip code data for each real estate asset owned by the firm, but that information is not readily available on Compustat. In Section 6.2, we perform a robustness test using a subsample of firms for which we are able to obtain information about their operation locations.

We use Execucomp to obtain, or calculate, the following variables used in our analysis: cash compensation, equity compensation, total compensation, tenure, and age. Our primary dependent variable is total pay, which consists of salary, bonus, non-equity incentive payout, value of restricted stock granted, value of options granted, and other compensation (Execucomp item TDC1). In our regressions we control for firm size using the logarithm of firm total assets, firm growth opportunities using Tobin's Q, accounting profitability using ROA and stock return, and stock price volatility. Following Bertrand and Mullainathan (2001), we also control for CEO age, CEO age squared, and firm fixed effects or CEO-firm fixed effects as alternative specifications.[20] Finally, we obtain blockholder data from Thomson Reuters.

The final dataset includes 14,310 CEO-firm year observations from 1992-2016. All variables are winsorized at the 1st and 99th percentile values. Appendix (Section 9) provides variable definitions and data sources.

[Insert Table 1]

Table 1 reports summary statistics of CEO compensation, firm characteristics, and real estate market variables. The average CEO in this sample has a total compensation of 4.8 million dollars. The average cash component is 1.3 million, while the average equity component corresponds to 3.5 million. These numbers are in line with the literature on CEO compensation using similar data (Chhaochharia and Grinstein, 2009; Fahlenbrach, 2008; Gopalan et al., 2010b). The average real estate holdings and real estate sales as a percentage of assets are 32% and 1.5%, respectively .

[20] We do not explore within CEO variation only, i.e., CEO fixed effects, because in this case variation in exposure and real estate prices would also be driven by CEO turnover across firms, which is not the type of variation we are after. We can still control for time-invariant CEO-specific characteristics in our CEO-firm fixed effects regressions while reducing the impact of variation due to CEO turnover.

5 Results

5.1 Pay for luck

[Insert Table 2]

This section presents the main results. Table 2 Panel A presents our initial test of the effect of real estate prices on CEO pay. We follow the methodology described in Section 4.1. The dependent variable in all regressions is the log of total compensation. The independent variable of interest is the interaction term between real estate assets and HPI, which captures the exposure of the firm to real estate and shocks to the price of these assets. The baseline specifications include firm fixed effects, or alternatively firm-CEO fixed effects, which means that we explore within firm, or within firm-CEO variation. Thus the variation in the variable of interest results from changes in the market value of the real estate assets over time for the same firm in the case of firm fixed effects, and for the same firm-CEO pair in the case of firm-CEO fixed effects. The estimated coefficient is 0.026 in column 1 and 0.043 in Column 3, both statistically significant at 5% and 1%, respectively. This means that for a one standard deviation change in the real estate prices index for a firm with average exposure to this market, CEO compensation increases by between approximately \$158,900 and \$262,796, evaluated at the mean.[21] The specification with firm-CEO fixed effects is relevant because the variation in the market value of firm's real estate cannot be explained by firm-CEO endogenous matching, or by CEO characteristics that are time invariant such as innate talent.

In columns 2 and 4, we add MSA-year fixed effects to the previous specifications with firm and firm-CEO fixed effects, respectively. In these specifications we are restricted to within firm/firm-CEO variation that is not driven by price changes at the MSA level because we include MSA-year fixed effects and HPI is defined exactly at the MSA-year level. Therefore, the only source of variation to estimate the coefficient of interest in these regressions is coming from firms changing their headquarters to a different MSA. Note that exposure is time invariant at the firm level, as it is measured in 1992, and therefore absorbed by the firm fixed effect. We are interpreting these changes as actions or responses to luck, since the firm is changing headquarters to a different MSA. The estimated coefficient ranges between 0.032 and 0.047, which suggests that a one standard deviation change in HPI associated with a new location, for a firm with average real estate exposure, increases average CEO compensation by between

[21] Using the estimated coefficient in column 1: (0.026)(5.071)(0.250) x \$4.82 million = \$158,900.

$195,569 and $287,242, evaluated at the mean. Overall, the results seem to be driven by within firm variation over time that are related to real estate shocks. In section 6.4 we further discuss these events and the frequency with which firms change headquarters.

5.2 Measurement: value of real estate holdings

We re-estimate our baseline results using an alternative and more precise definition of a firm's real estate holdings. We follow Balakrishnan et al. (2014) and Chaney et al. (2012) and start with the sample of US-based Compustat firms in 1993 with non-missing total assets. The year of 1993 was the last year in which the Securities and Exchange Commission (SEC) required that firms report the accumulated depreciation of buildings; this is also the year in which the CEO compensation information become available in Execucomp for a larger number of firms. To compute the market value of a firm's real estate holdings (buildings, land and improvement, and construction in progress), we measure the ratio of the accumulated depreciation of buildings (in 1993) to the historic cost of buildings, which gives us the relative proportion of the original value of a building that has been depreciated. Based on a depreciable life of 40 years, we compute the average age of buildings for each firm. We infer the market value of a firm's real estate assets for each year in the sample period (1993 to 2016) by inflating their historical cost with MSA-level residential real estate inflation after 1975, and CPI inflation before 1975.[22] Using this approach gives us a relatively smaller sample resulting in a data set of around 5,000 observations (when we combine the firms active in 1993 with the Execucomp data), relative to our main approach described in Table 1 (around 14,500 observations).

Table 2 Panel B presents the results of re-estimating the baseline regressions using the Chaney et al. (2012) measure of a firm's real estate holdings. The results are similar to the ones presented in Panel A: using various fixed-effects structures we confirm our finding that there is a positive association between CEO pay and the value of a firm's real estate holdings, further suggesting the presence of pay for (real estate) luck. This association is typically interpreted as pay for luck, because changes in real estate prices are not under the control of the CEO. However, this association can also be driven by responses of the CEO to these real estate shocks: responses to luck. Similarly to the results in Panel A, the results in columns 2 and 4 are suggestive of this possibility. In specifications 2 and 4, the fixed effects structure (firm

[22]For firms with missing book value of real estate assets in 1993, we assign a book value of 0 in 1993 if they have a 0 book value of real estate assets in 1994.

plus MSA-year, or CEO-firm plus MSA-year) restricts the sources of variation to estimate the coefficients to within firm or within CEO-firm changes that are not MSA-year specific. The estimated coefficient, between 0.028 and 0.058, is positive and significant at 5% and 1% level respectively, suggesting that firms relocate to a different MSA and managers are rewarded for such action. Note that unless there is variation over time for specific firms (CEO-firm pair), because MSA-year specific shocks are absorbed by the respective fixed effect, we would not be able to estimate this effect. In sum, the results in this section suggest that CEOs are rewarded for (real estate) luck, and suggestively for responses to luck, irrespective how the value of the firm's real estate holdings are computed.

5.3 Pay for responses to luck

We proceed to test if CEO compensation is correlated with specific responses to real estate luck. Table 3 Panel A shows the results. In this table, the main variable of interest is the triple interaction term between real estate exposure, HPI and RE Sales. This term captures real estate asset sales associated with shocks to the market value of the firm's real estate assets. Since real estate asset are not marked-to-market but held at book values, negative changes in a firm's real estate assets only occur if there is some managerial response to real estate prices (sale of real estate assets) and therefore we interpret the coefficient of this variable as the sensitivity of pay to responses to real estate luck. Because we run all regressions with industry-year fixed effects, we filter out the common yearly industry component of RE Sales, which means that we only capture responses to real estate shocks that are not common to the whole industry.

[Insert Table 3]

In columns 1 and 3, we estimate the model with MSA fixed effects and with firm or firm-CEO fixed effects, respectively. When looking only at within firm variation, and when we restrict this variation to the tenure of the CEO we find a point estimate for the variable of interest of 0.003 (columns 1 and 3 in Table 3) that is statistically significant at 1% level.

In columns 2 and 4, we further saturate the regressions with MSA-year fixed effects. In this case identification is achieved in one of two ways: one, by comparing firms in the same MSA-year and same industry that respond in different ways to the same real estate shock. Because HPI is varying at the MSA-year level, the coefficient is estimated based on different RE Sales across firms. The other possibility is that a given firm changes MSA by relocating. In each of these two cases, this coefficient captures the sensitivity of CEO compensation to some action (sale of real estate assets) taken as a response to luck in real estate prices. Our estimated coefficients in columns 2 and 4 are 0.002 and 0.002 respectively.

If we focus on the coefficient of the interaction term between real estate exposure (RE(92) and HPI, we find that the magnitude of the estimated coefficient is smaller than in the previous regressions shown in Table 2, and not statistically significant. This result suggests that pay for luck is mostly explained by pay for responses to luck.

In Table 3 Panel B, we test if CEO compensation is associated with responses to luck, while measuring the value of the firm's real estate holdings following Chaney et al. (2012) and Balakrishnan et al. (2014) (as described above). We find similar results to the ones presented in Panel A: our results indicate that CEOs are indeed compensated for their reactions to lucky events, as proxied by the sales of real estate assets. In column 4 the estimated coefficient of interest is positive but not statistically significant. However, this is our most saturated specification with respect to fixed effects, as we include CEO-firm plus MSA-year fixed effects. Because in this panel we are restricted to a smaller sample, there might be little variation left to estimate this coefficient. Overall our results suggest that our main findings are robust to alternative measurement of the value of firms' real estate holdings.

5.4 Other responses to real estate luck: debt issues and ROA changes

We also study alternative CEO responses to luck. Specifically, we focus on debt issues and changes in ROA associated with real estate shocks, as a "catch-all" variable for CEO actions.

Cvijanović (2014) shows that there is a spillover effect of real estate markets on firm investment through the value of its collateral, which influences the firm's debt capacity. Therefore, a possible response of the CEO to a positive real estate shock is to issue new debt. Other possible reactions to real estate shock is buying/selling real estate assets, doing a sale-and-lease back transaction, and eventually paying down debt as a result of the cash inflow. While in the previous sections we test for real estate asset sales as an explicit action, here we perform an additional test that looks into changes into accounting performance of the firm, as measured by its ROA, in a "catch all" actions approach that can include gains from sales of real estate or a decrease in interest expense.[23] ROA is defined as *Net income* divided by *Total Assets*.

[23]If instead the CEO takes advantage of the increase in collateral to issue more debt, then ROA could decrease due to the higher interest expense. The conflicting predictions regarding the impact of the real estate shock on ROA makes it hard to detect any association between CEO pay and changes in ROA that are related to the real

We use net income to make sure we capture any type of action that the manager might have taken as response to real estate shocks. We adjust ROA for *rental expenses* because these might not be associated to CEO action. Since changes in value of a firm's real estate assets are not marked-to-market, we should only observe changes in its ROA that are associated with real estate shocks if a CEO acts in response to the real estate luck. A possible concern here is that ROA may change because of other (omitted) variables. To address this issue, we use a comprehensive fixed-effects structure, that enables us to isolate the variation that comes from looking at two otherwise identical firms, that operate in the same MSA, at the same point in time and that belong to the same industry, while controlling for the time-varying industry- and MSA fixed effects. In addition, we are only interested in the coefficient that captures changes in ROA that are associated with real estate shocks.

[Insert Table 4]

Table 4 presents the results. Panel A shows that the estimated coefficients on the triple interaction term, ROA x HPI(t-1) x RE(92), are statistically significant at 5% level or 1% level, and range from 0.211 to 0.279, suggesting that CEOs are indeed rewarded for their responses to lucky events, as proxied by ROA. Panel B shows similar results: estimated coefficients on the triple interaction term when debt issues are used (as proxied by log debt) are significant, and range between 0.005 in column 1 and 0.010 in column 4. The results of this section provide further support that CEOs seem to be rewarded for their responses to real estate luck, irrespective of which measure of CEO action we consider: asset sales, debt issues or a "catch-all" variable ROA.

5.5 Cash and equity pay

In Table 5, we run our analysis differentiating between cash and equity compensation. We expect most of pay for luck to occur through equity compensation, as the stock price of the company, assuming some level of market efficiency, should reflect the market value of the real estate assets of the firm.

[Insert Table 5]

When we run the pay for luck test (Panel A), we find a positive and significant correlation between the market value of real estate assets and CEO equity compensation. The coefficient

estate shock.

varies between 0.070 and 0.109 and is significant at the 1% level. We do not find that cash compensation is significantly associated with real estate shocks. These results suggest that boards of directors reward CEOs in equity, but not in cash, for real estate shocks (or luck).[24]

In contrast, when we test for pay for actions (Panel B), we find that cash compensation is associated with responses to luck, whereas equity compensation is not, suggesting that rewarding responses to luck operates through discretionary bonus. The estimated coefficients on RE Sales x HPI(t-1) x RE(92) in cash compensation are both statistically significant at the 1% and 5% levels. We continue to find that boards of directors reward CEOs in equity, but not in cash, for luck.

This table suggests that while pay for luck is mostly associated with equity pay, pay for actions occurs through cash compensation.

5.6 Is pay for responses to luck optimal?

So far we have not discussed the optimality of incentivizing and paying CEOs to respond to real estate luck. It only makes sense for the board to pay, or incentivize the CEO to respond to luck if such responses are optimal from the point of view of the shareholders. Even though it is arguably difficult to evaluate and directly test the optimality of such actions because we do not observe a counterfactual, we can still evaluate if, on average, responses to real estate luck add value to shareholders, and which companies pay for responses to luck. To address this we run an event study on SLB transactions and explore cross sectional variation in corporate governance.

5.6.1 Event study: sale and leaseback transactions

In Table 6, we perform an event study around SLB transaction announcement dates and find significant positive abnormal returns, suggesting that this specific CEO action, on average, creates value for shareholders. For these tests we use the sample of SLB transaction in Whitby (2013).

[Insert Table 6]

We find that SLB transactions in general generate significant cumulative abnormal returns (CAR) between 1.3% and 1.4%. When restricting the sample to SLB of real estate assets only

[24]While in Table 5, Table 7, Table 8, Table 9 and Table IA4 we ran all four specifications as in Table 2, we only report the two most saturated ones for brevity.

CAR are between 2.1% and 2.3%. As for SLB that occur as response to increases in real estate prices, we find CAR between 1.9% and 2%. These results are consistent with the idea that incentivizing managers to respond to real estate luck, or paying them ex-post if the action is observable, might be optimal.

5.6.2 Pay for responses to luck and financing constraints

Table 7 shows the results for firms with different levels of financial constraints. Following the existing literature (Almeida et al. (2011); Campello and Hackbarth (2012); Hadlock and Pierce (2010)), we use the Hadlock-Pierce Size-Age index (SAI), firms' previous year's payout ratio and firm size as proxies for the level of financial constraints. In Panel A, we follow Hadlock and Pierce (2010) and calculate the beginning-of-year SA index value for every sample firm. Each firm with an index value above (below) the median within the year is then assumed to be the constrained (unconstrained) and put in the high (low) SAI group. In Panel B, we follow Almeida et al. (2011) and for each year in our sample, we rank firms based on their payout ratio and assign to the financially constrained (unconstrained) group those firms below (above) the median of the annual payout distribution. We calculate the payout ratio as the ratio of total distributions (dividends plus stock repurchases) to operating income. We find that pay for responses to luck is significant in all specifications for the financially constrained firms,[25] irrespective of the measure of financing constraints used.[26] On the other hand, in the non-financially constrained groups, we find that the pay for responses to luck coefficient is mostly not significant. These results are consistent with the notion that responses to luck are more valuable for financially constrained (young and small) firms, as they might relax such constraints. Taken together these results provide suggestive evidence that responses to luck are valuable actions from a shareholder's point of view.

[Insert Table 7 about here]

5.6.3 Pay for responses to luck and corporate governance

In this section, we explore cross sectional variation in the level of corporate governance. Following the existing literature (Bertrand and Mullainathan, 2001; Dittmar and Mahrt-Smith,

[25] For brevity, we report two fixed-effects specifications, however, our results remain unchaged in all four specifications.

[26] Results using firm size as the measure of financing constraints are shown in Appendix, Table IA4. The results remain unchanged.

2007), we use the following measures of corporate governance strength and product market competition: Herfindahl index (HHI) of industry concentration and presence of blockholders. In our first test, we analyze the role played by the product market competition of the industry the firm operates in: we construct the HHI index for each firm in our sample following Giroud and Mueller (2011). We expect to see stronger responses to luck in industries with low industry concentration. In less concentrated industries, managers have greater competitive pressure to take actions that maximize firm value, or, in other words, they have less slack to behave sub optimally. Therefore, we should expect managers in more competitive industries to more actively respond to real estate luck. In our second test, in the spirit of Core et al. (1999) we use outside blockholder ownership, defined as the ownership of external blockholders that own at least 5% of the outstanding shares, as a further measure of firm governance. Holderness (2003) among others argues that blokholders have incentives to improve corporate management, and as such, their presence will be indicative of sound corporate governance practices. While we recognize that there are other aspects of corporate governance that may have a significant role in our setting, we focus on these measures because they are well founded in the existing literature and they offer clear predictions for what constitutes "good" governance.[27]

Table 8 shows the results of pay for responses to luck in subsamples of strong and weak governance.

[Insert Table 8]

We proceed by splitting our sample into high and low HHI firms (Panel A), based on the time-varying median value of HHI. Confirming our initial intuition, the estimated coefficients on pay for responses to luck are positive and significant in the subsample with low industry concentration (low HHI) (0.003 and 0.004). On the other hand, for more concentrated industries (as proxied by high HHI), we do not seem to find these effects.

In Panel B, we split the sample into high and low block ownership firms if their aggregate block ownership is above or below the mean block ownership in that year (20%). We find that the firms with high blockholder ownership have positive and significant responses to luck (coefficients between 0.026 and 0.021), whereas firms with low blockholder ownership do not. Overall, the results presented in Table 8 suggest that better governed firms seem to be more likely to reward their CEOs for responding to (real estate) luck.

[27] We also run our analysis using alternative governance proxies: the G-index by Gompers et al. (2003), and the E-index by Bebchuk et al. (2008). Our results remain unchanged.

5.6.4 Ex-ante real estate exposure and pay for luck

Better governed firms seem to reward managers for responding to luck, but can corporate boards of firms with high real estate holdings anticipate potential windfalls on behalf of CEOs coming from their exposure to real estate luck? If so, do they structure the compensation contracts ex-ante in such a way to limit pay for luck while at the same incentivizing pay for *responses* to luck? To try to answer this question, we run our analysis by splitting the sample of the firms based on the level of their real estate holdings prior to the estimation period (in 1992). We classify firms as ex-ante *High (Low) Real Estate Exposure* firms if they are in the top (bottom) quintile of real estate holdings in 1992.

[Insert Table 9]

In Table 9 the "pay for luck" coefficient on HPI(t-1) x RE(92), is negative and insignificant for *High Real Estate Exposure* firms. This suggests that corporate boards can anticipate the sensitivity of CEO pay to lucky events and structure their compensation contracts in such a way that CEOs are not in a position to extract rents from such lucky events. On the other hand, the "response to luck" coefficient on $\text{RESales}_{i,t}\text{HPI}_{m,t-1}\text{Exp}_{i,t_0}$ (RESales x HPI(t-1) x RE(92)) is positive and highly significant for *High Real Estate Exposure* firms (columns 3 and 4), suggesting that firms with high real estate holdings tend to incentivize their CEOs ex-ante for responding to lucky events ex-post.

6 Robustness tests and discussion

6.1 Endogeneity of real estate prices

There are two potential sources of endogeneity in our analysis. The first concern is that real estate prices might not be exogenous to the performance of firms, and hence CEO compensation. That is, there might be an unobservable variable (e.g., increase in demand or influx of new firms to the region) that is driving both location specific real estate prices and CEO compensation, which would then in turn affect our results. The second concern relates to the real estate ownership decision: firms that are more likely to own their real estate can also be more likely to compensate their CEOs for responses to luck.

To address the first concern, the omitted variable bias, we follow the instrumental variable approach of Chaney et al. (2012) and use land supply elasticity (Saiz, 2010) at the MSA level, interacted with changes in national real estate prices (as proxied by the S&P Case-Shiller U.S. House Price index) to predict real estate prices at the MSA level (HPI). We then use the predicted MSA real estate prices (HPI) in our tests with compensation as the dependent variable. More precisely, we estimate a series of two-stage OLS (2SLS) specifications, where the second stage is as in Equation (1) and Equation (2) (and with fixed effects structures as shown in tables 2 and 3), and the dependent variable is total compensation. We estimate the following first-stage regression for house prices at the MSA level:

$$\text{HPI}_t^m = \beta_1 P_t^{\text{US}} e_0^m + \delta_t + \mu_m + \varepsilon_t^i \quad (3)$$

Where P_t^{US} denotes the value of the S&P Case-Shiller U.S. House Price index at time t, e_0^m denotes land supply elasticity in MSA m, HPI_t^m denotes the value of the house price index in MSA m at time t. δ_t and μ_m capture year and MSA fixed effects, thus abstracting from location specific and time specific trends. To account for using the predicted HPI values from the first-stage as the regressor in the second stage regression, we bootstrap our standard errors.

[Insert Table IA1]

The results of the first stage regression are shown in column 1 in Table IA1.[28] As expected, the interaction of housing supply elasticity and U.S. Case-Schiller House Price Index has a positive and statistically significant coefficient at the 99% confidence level. The associated F-statistic for the weak instruments is 38.43, suggesting that the chosen IV does not suffer from the weak instrument problem.

The second potential source of endogeneity is that firms that are more likely to own real estate are also more sensitive to local demand shocks. Thus finding that CEOs are compensated for real estate shocks could reflect the board's attempt to compensate the CEO for responses to demand shocks. To address this concern, we follow the standard procedure in the literature (Chaney et al., 2012) and further include interactions between firms' initial characteristics and the HPI: in particular, we include five quintiles of firm age, firm size, ROA, as well as two-digit SIC industry dummies and MSA dummies.

In a recent critique, Davidoff (2016) argues that land supply elasticity is not a good instru-

[28] All of our appendix tables and specifications include all controls and the fixed-effects structure used in Tables 3 and 4, but for brevity we suppress their coefficients. We run a separate first stage for all the second stages, but only present the output for the first stage. All t-statistics on inelasticity variables in the four first stages are above 5.90.

ment for house prices, as they are not useful for comparisons across MSAs. However, he notes that the interactions with firm characteristics such as those included here "obviate the need for a price instrument conditional on different assumptions from those evaluated in this paper." Furthermore, his critique does not apply to comparisons between real estate owning and non-real estate owning firms that operate within the same MSA, as we do here and throughout the paper.

The results of these regressions are shown in Table IA1. Overall, we find marginally significant evidence of pay for luck and significant pay for responses to luck (columns 2-5), except in Column 3 when MSA-year fixed effects are included. The estimates found using this setting (between 0.002 and 0.003) are qualitatively similar to those in Table 3.

6.2 Measurement: geographical location of firms' real estate holdings

[Insert Table IA2]

In Table IA2 we run our baseline specification using a state-weighted HPI for each firm based on its real estate holdings across the U.S. instead of only using the real estate holdings in the state of its headquarters, as defined by Compustat. Since Compustat does not contain data on the location of each piece of firm's real estate holdings, we test the validity of previous results by using state-level data on firms' operations obtained from García and Norli (2012), who extract state name counts from annual reports filed with the SEC on Form 10-K. The authors parse out all 10-Ks filed with the SEC during the period 1994 through 2008, which gives them information on the firm's real estate holdings, such as factories, warehouses, and sales offices. This procedure yields a count of the number of times each 10-K mentions a U.S. state name. Based on the state name counts, we construct a relative exposure of each firm to local, state level real estate market, as captured by state level house price indices HPI.

In this test, we follow the empirical strategy in (Cuñat et al., 2018), wherby HPI is not measured at the MSA level where the company's headquarters are located, but it is now calculated as a weighted average of the state-level HPIs in which the firm operates and then multiplied by RE(92). In this procedure, we construct measures of time-varying firm-level real estate "shocks" that take into account the different weights that each location represents in the firm's overall business and construct firm-specific real estate price indices that aggregate prices across all the locations in which a firm operates.

Results from replicating the tests of Tables 3 and 4 with this revised measure of real estate market values are shown in Table IA2. The results using this state-level measure are consistent in both significance and magnitude with our previous analysis. We find significant pay for responses to luck and depending on the specification some evidence of pay for luck.

6.3 Measuring responses to luck

Our identification strategy relies on the fact that, under US GAAP, accounting performance of companies is unrelated to real estate markets performance unless there is a responsive action of the CEO. In our "additional actions" regression model, the interaction term of ROA with firm exposure to real estate markets and real estate prices captures the sensitivity of CEO compensation to accounting performance that is related to real estate shocks. This identification can be compromised in two ways that we discuss in this section.

First, the idea that the optimal response of the manager to a real estate price change can be no action at all. For instance the optimal response to an increase in prices might not be to sell and cash in the capital gain but instead hold the property, if prices are expected to increase even more in the future. In such cases this "no action" response is captured by market performance but not in accounting performance and the observed sensitivity of compensation to responses to luck is underestimated.

Second, although unlikely, there may be instances where accounting performance is linked to real estate prices irrespective of responses. This is the case when real estate property is accounted for as investment property, or as available for sale asset. In such cases real estate assets can be marked to market. We address this concern in two ways. First, in all our tests we focus only on real estate property that is used in the firm's operations and accounted for in property plant and equipment to estimate the sensitivity of compensation to responses to luck. These assets are not marked to market and therefore the interaction term of ROA with exposure (RE(92)) will be non-zero only if there is managerial response to real estate prices.

By excluding investment property from our analysis, again we are providing a lower bound for the coefficient of responses to luck. Note that CEOs can also respond to real estate prices by buying or selling property that is not for the use of the company but for investment purposes instead. However, it is also not clear whether investing in real estate assets in an activity that is beyond the scope of the firm is an optimal action to take. These cases are extremely rare, only 4 firm-year observations in our entire sample have such assets on their balance sheet.

Overall, our estimated coefficients represent a lower bound for the true sensitivity of compensation to responses to luck. Both issues discussed above suggest that our coefficient is underestimated due to "no actions" not being captured and actions over investment property also being ignored.

6.4 Headquarter location changes and sale-and-leaseback transactions

As evidence that firms relocate and take part in sale-and-leaseback (SLB) transactions on a regular basis, we present a time series of both the number of firm HQ location changes and firm HQ sale-and-leaseback transactions in Figures IA1 – IA2.

[Insert Figure IA1]

[Insert Figure IA2]

We also present the percentage of firms in our sample that change HQ locations in Table IA3.

[Insert Table IA3]

To identify changes in firm HQ location, one cannot use the HQ state variable found in Compustat as the variable is a firm's "historical" HQ state and is constant across all years for a given firm. We obtain firm HQ location data from Scott Dyreng's website who captured annual HQ location data from firm filings on the SEC.gov website. The number of firms changing HQ states is significant; for the years the data is available (1997-2011), on average 5.2% of firms in our sample change their HQ state. The percentage of firms changing their HQs varies from 2.5% in 2000 to 8% in 2004.

7 Conclusion

In this paper, we use shocks to real estate values as a measure of luck to test whether CEOs are paid for exogeneous shocks outside of the CEO's control (luck), or paid for responding to the lucky event (action) in a way that maximizes shareholder value. We propose a novel empirical strategy that relies on the different exposure of firms to real estate shocks and on the fact that market and accounting performance do not reflect the changes in the value of real estate in the same way to identify CEO actions. While stock market returns should promptly reflect any changes in the value of real estate assets of the firm, accounting returns should not, unless some action is taken by the manager. When we explore this difference we find that CEOs are rewarded for their response to luck, such as by selling real estate or issuing debt, and not purely for lucky events.

We then test whether the responses to luck are optimal from the point of view of shareholders and find a positive and significant abnormal returns associated with announcements of sale-and-leasebacks transactions by firms in our sample, suggesting that shareholders view those responses to luck as optimal. We also find that firms that are more financially constrained and well-governed are the ones that reward CEOs for action rather than for luck, suggesting that CEO's response to the luck is most valuable for these firms. Whereas the evidence of pay for luck only occurs through equity pay, CEOs seem to be compensated for action mostly using cash pay.

Our results provide consistent evidence of pay for action or response to luck. Nonetheless, they are subject to common caveats in the literature that studies real estate shocks. First, our sample is subject to a survivorship bias since we measure exposure to real estate shocks at the beginning of the sample period to alleviate concerns that exposure is endogenous. Second, although the firm's headquarters accounts for one of the largest real estate holdings of firms, it does not account for all of the firm's real estate holdings. We perform a robustness test using a small sample size for which we can identify the location of the firm's real estate assets and obtain similar results. However, to the extent that firms have significant amounts of their real estate property in states other than of its headquarters, the change in the value of those real estate assets can be an omitted variable introducing noise in our results. Third, following Chaney et al. (2012) we rely on the residential price index to proxy for changes in commercial real estate property values as that information is not readily available. Both are highly correlated.

This paper brings a new perspective on the topic of pay for luck, and contributes to the active debate on CEO compensation. Using our setting, we are able to identify CEO's responses to an exogeneous shock and show that CEOs are rewarded for responding to the lucky event by taking actions that are presumably in the best interest of the shareholders. Thus, our results challenge the inefficient contracting view that CEOs are mostly paid for luck.

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9 Appendix

Variable Definitions

CEO Level Variables	
Total Compensation	Total CEO pay in thousand $, which consists of salary, bonus, value of restricted stock granted, value of options granted, long-term incentive payout, and other compensation (Execucomp TDC1).
Cash Compensation	Salary plus bonus plus long-term incentive payout (before 2006) and salary plus bonus plus non equity incentive pay (after 2006) in thousand $ (Execucomp SALARY + BONUS + NONEQ_INCENT).
Equity Compensation	Value of restricted stock granted plus value of options granted in thousand $ (Execucomp RSTK-GRNT + OPTION_AWARDS_BLK_VALUE (pre adoption of FAS 123R) and post FAS 123 adoption: Execucomp STOCK_AWARDS_FV + OPTION_AWARDS_BLK_VALUE after 2006.)
Equity Percentage	Equity compensation divided by total compensation.
CEO Age	Age of CEO in years (ExecuComp).
CEO Tenure	Number of years as CEO in the current position (ExecuComp).
Firm Level Variables	
Log Sales	Log of sales in thousands of $ (Compustat SALE).
Log MVE	Log of market capitalization in thousands of $ (Compustat PRCC_F x CSHO).
Log Debt	Log of debt in thousands of $ (Compustat DLC+DLTT).
RE Sales	The absolute value of RE assets less previous year's RE assets scaled by total assets if negative, otherwise zero. $ (Compustat (PPENT - PPENLS - PPENME) / AT).

Tobin's Q	Sum of total assets plus market value of equity minus book value of equity divided by total assets [Compustat (AT + CSHO x PRCC_F - CEQ) / AT].
ROA	Net income plus rental expenses multiplied by one minus income taxes scaled by pretax income divided by total assets (Compustat (NI+XRENT*(1-TXT/PI))/AT).
Volatility	Annualized standard deviation of monthly stock returns (CRSP).
Stock Return	Annual stock return [Compustat (PRCC_F(t) / AJEX(t) + DVPSX_F(t) / AJEX(t)) / (PRCC_F(t-1) / AJEX_F(t-1))].
RE(92)	RE Assets of the firm at the start of our sample, in 1992. For definition of RE Assets, see below.
RE Assets	Property, Plant, and Equipment Total (Net) less Property, Plant, and Equipment Leases (Net), less Property, Plant, and Equipment Machinery and Equipment (Net), divided by total assets (Compustat (PPENT-PPENME-PPLENLS) / AT).
RE Assets (Chaney et al., 2012)	Market Value of Real Estate in 1993 = Book Value of Real Estate in 1993 (HPI 1993/HPI 1975)(CPI 1975/HPI purchase year), where Book Value of Real Estate = Buildings at Cost (Compustat FATB)+ Construction in Progress at Cost (Compustat FATC)+ Land Improvements at Cost (Compustat FATP). Purchase year = 1993 – building age. Building age = 40 * (Accumulated depreciation/Property, Plant, and Equipment for Buildings at Cost)
HHI	Herfindahl Hirschman Index computed as the sum of the squared market shares within an SIC2 digit industry
HPI	Level of the House Price Index for a particular Core Based or Metropolitan Statistical Area (Federal Housing Finance Association), obtained from the Federal Housing Finance Association's (FHFA).

Blockholder Ownership	Total ownership of blockholders, where a blockholder is defined as an outside owner of 5% or more of the total shares outstanding).

10 Tables and Figures

Table 1: **Summary Statistics**

This table presents summary statistics for CEO compensation and firm characteristics. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All variables are winsorized at the 1st and 99th percentile values. Variables are defined in the Appendix.

Variable	Mean	P25	P50	P75	SD	N
Total Comp	4,820.768	1,317.205	2,804.967	5,931.761	5,674.892	14,310
Cash Comp	1,263.698	628.750	950.000	1,488.077	1,074.674	14,310
Equity Comp	3,522.720	468.160	1,610.834	4,388.759	5,027.625	14,310
Delta	0.004	0.001	0.002	0.005	0.006	10,639
Vega	0.080	0.018	0.040	0.096	0.106	10,639
Percent Equity	0.556	0.366	0.613	0.792	0.279	14,310
Assets	7,992.812	620.546	1,731.958	5,640.000	28,557.960	14,310
Log(Assets)	7.570	6.431	7.457	8.638	1.577	14,310
Tobin's Q	1.891	1.186	1.509	2.137	1.162	14,310
Log(Revenue)	7.472	6.424	7.386	8.527	1.549	14,310
MVE	7,376.903	581.763	1,681.075	5,533.326	16,561.560	14,310
Debt	2,349.712	70.288	381.834	1,445.000	13,649.010	14,310
Log(Net Debt)	5.464	4.267	5.948	7.277	2.642	14,310
ROA	0.056	0.028	0.062	0.105	0.103	14,310
EBIT	679.015	45.996	151.125	534.967	1,564.841	14,228
Volatility	0.111	0.067	0.095	0.136	0.063	14,310
Return	0.146	-0.138	0.089	0.329	0.524	14,310
RE(92)	0.250	0.101	0.160	0.259	0.242	14,310
RE Assets	0.324	0.138	0.258	0.481	0.233	14,310
HPI	16.231	11.832	15.253	19.263	5.071	14,310
RE Sales	0.015	0.000	0.003	0.019	0.026	14,310
CEO Age	56.180	52.000	56.000	61.000	7.149	14,310
Firm Age	25.785	14.808	25.477	36.400	12.628	14,281
SAI	-4.070	-4.594	-4.196	-3.655	0.538	11,700
Block Ownership	0.205	0.112	0.184	0.275	0.143	10,184
Payout Ratio	0.015	0.000	0.008	0.022	0.043	14,310

Table 2: **Pay for Luck - Total Compensation**

Panel A presents estimates of OLS regressions of the logarithm of CEO total compensation on the lag of HPI and the lag of HPI interacted with Real Estate (R.E.) Assets (in 1992) and other CEO and firm level control variables. Panel B presents estimates of OLS regressions of the logarithm of CEO total compensation on the lag of HPI and the market value of a firm's real estate holdings calculate using the Chaney et al. (2012) method. RE Value is the ratio of the market value of real estate assets normalized by lagged total assets (see Section 5.2 for details on the construction of this variable). HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1993 – 2016 inclusive. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Pay for Luck

	(1)	(2)	(3)	(4)
HPI(t-1) * RE(92)	0.026**	0.032***	0.043***	0.047***
	[2.124]	[2.631]	[2.742]	[2.812]
HPI(t-1)	-0.005		-0.010	
	[-0.412]		[-0.477]	
Log(Assets)	0.384***	0.382***	0.344***	0.339***
	[13.950]	[11.000]	[8.977]	[8.036]
Log(Assets) x HPI(t-1)	-0.001	-0.001	-0.001	-0.001
	[-0.479]	[-0.676]	[-0.301]	[-0.210]
Tobins Q	0.116***	0.103***	0.124***	0.115***
	[8.576]	[6.843]	[6.677]	[5.007]
ROA(t)	0.331***	0.359***	0.381***	0.373***
	[3.469]	[3.359]	[5.123]	[4.211]
Stock Return(t)	0.052***	0.054***	0.050***	0.051**
	[3.158]	[2.882]	[2.785]	[2.274]
Volatility	-0.082	-0.333*	0.070	-0.084
	[-0.458]	[-1.712]	[0.330]	[-0.410]
ROA(t-1)	0.099	0.093	0.206**	0.181*
	[1.238]	[1.141]	[2.297]	[1.825]
Stock Return(t-1)	0.091***	0.081***	0.089***	0.080***
	[7.915]	[6.854]	[8.526]	[7.381]
CEO Age	0.028	0.027	0.005	-0.005
	[1.390]	[1.231]	[0.163]	[-0.169]
CEO Age Squared	-0.000	-0.000	0.000	-0.000
	[-1.613]	[-1.402]	[0.075]	[-0.316]
Observations	14,310	13,370	13,838	12,876
R-squared	0.774	0.794	0.828	0.847
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-year FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-year FE		Y		Y

Panel B: Pay for Luck while measuring RE assets using ownership data from 1993

	(1)	(2)	(3)	(4)
RE Value	0.033***	0.028**	0.049***	0.058***
	[3.668]	[2.266]	[5.320]	[3.954]
HPI(t-1)	-0.014		0.010	
	[-0.445]		[0.274]	
ROA(t)	0.079***	0.083***	0.059***	0.078***
	[3.808]	[3.018]	[2.809]	[2.832]
Stock Return(t)	0.011***	0.011***	0.007**	0.011***
	[3.594]	[2.729]	[2.328]	[2.641]
Log(Assets)	0.018**	0.014	-0.002	-0.006
	[2.478]	[1.498]	[-0.227]	[-0.542]
Log(Assets) x HPI(t-1)	-0.000	0.001**	0.000*	0.000
	[-0.002]	[2.189]	[1.731]	[0.676]
Tobin's Q	0.018***	0.020***	0.015***	0.016***
	[7.215]	[6.218]	[5.035]	[3.802]
Volatility	-0.260	-0.315	0.013	-0.143
	[-1.238]	[-1.153]	[0.057]	[-0.463]
ROA(t-1)	0.037*	0.006	0.027	0.010
	[1.746]	[0.231]	[1.258]	[0.362]
Stock Return(t-1)	0.012***	0.014***	0.013***	0.014***
	[4.019]	[3.419]	[4.243]	[3.804]
CEO Age	0.009***	0.013***	0.007	0.012
	[2.613]	[3.065]	[1.105]	[1.337]
CEO Age Squared	-0.000***	-0.000***	-0.000**	-0.000**
	[-2.909]	[-3.260]	[-2.202]	[-1.965]
Observations	5,551	5,050	5,364	4,855
R-squared	0.780	0.841	0.854	0.900
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-Yr FE		Y		Y

Table 3: **Pay for Action - Total Compensation**

Panel A presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) & Real Estate Sales and other CEO and firm level control variables. Panel B presents estimates of OLS regressions of the logarithm of CEO total compensation on the interaction between RE Sales and RE Value, where the market value of a firm's real estate holdings (RE Value) is calculated using the Chaney et al. (2012) method. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1993 — 2016 inclusive. RE Value is the ratio of the market value of real estate assets scaled by lagged total assets. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Pay for Action (RE Sales)

	(1)	(2)	(3)	(4)
RE Sales x HPI(t-1) x RE(92)	0.003***	0.002***	0.003***	0.002***
	[3.609]	[2.799]	[3.916]	[3.186]
RE Sales x HPI(t-1)	-0.000	-0.000	-0.000***	-0.000***
	[-1.497]	[-0.807]	[-5.624]	[-3.251]
RE Sales x RE(92)	-0.000	-0.000	0.000**	0.000
	[-0.583]	[-0.905]	[2.071]	[1.368]
RE(92) x HPI(t-1)	0.007	-0.002	0.009	0.011
	[0.464]	[-0.123]	[0.555]	[0.635]
HPI(t-1)	0.000		-0.002	
	[0.044]		[-0.868]	
RE Sales	0.012	0.016	0.034	0.033
	[0.460]	[0.549]	[1.412]	[1.275]
Log(Assets)	0.049***	0.051***	0.038***	0.039***
	[15.096]	[15.339]	[10.966]	[10.910]
Log(Assets) x HPI(t-1)	-0.000	-0.000	0.000	0.000
	[-0.801]	[-0.787]	[0.149]	[0.142]
Tobin's Q	0.014***	0.012***	0.013***	0.013***
	[9.397]	[6.839]	[8.089]	[5.789]
ROA(t)	0.023***	0.020**	0.029***	0.030***
	[3.057]	[2.248]	[4.116]	[4.262]
Stock Return(t)	0.008***	0.009***	0.008***	0.009***
	[3.379]	[3.544]	[4.383]	[4.098]
Volatility	-0.094	-0.255*	-0.062	-0.205
	[-0.739]	[-1.822]	[-0.457]	[-1.478]
ROA(t-1)	0.016**	0.020*	0.020***	0.016**
	[2.136]	[1.914]	[4.013]	[2.153]
Stock Return(t-1)	0.013***	0.013***	0.013***	0.013***
	[7.330]	[7.063]	[10.336]	[9.721]
CEO Age	0.003	0.002	0.003	0.000
	[1.238]	[0.645]	[0.767]	[0.069]
CEO Age Squared	-0.000	-0.000	-0.000	-0.000
	[-1.481]	[-0.856]	[-0.739]	[-0.355]
Observations	14,310	13,370	13,838	12,876
R-squared	0.790	0.813	0.849	0.867
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-Yr FE		Y		Y

Panel B: Pay for Action (RE Sales): RE assets using ownership data from 1993

	(1)	(2)	(3)	(4)
RE Sales x RE Value	0.010***	0.006*	0.008**	0.001
	[2.787]	[1.899]	[2.419]	[0.255]
RE Value	-0.002**	-0.004**	0.003	-0.003
	[-2.083]	[-2.533]	[1.458]	[-1.006]
HPI(t-1)	-0.054*		-0.047	
	[-1.725]		[-1.246]	
RE Sales	-0.000	-0.000	-0.000**	-0.000
	[-0.742]	[-0.987]	[-2.226]	[-0.720]
ROA(t)	0.058***	0.059***	0.047***	0.057***
	[3.426]	[2.872]	[2.718]	[2.608]
Stock Return(t)	0.008***	0.007*	0.004	0.004
	[2.803]	[1.920]	[1.441]	[1.082]
Log(Assets)	0.042***	0.035***	0.027***	0.021***
	[10.478]	[6.354]	[4.799]	[2.654]
Log(Assets) x HPI(t-1)	0.000	0.000	0.000	0.001**
	[0.317]	[1.540]	[1.514]	[2.514]
Tobin's Q	0.013***	0.013***	0.011***	0.011***
	[6.188]	[4.964]	[4.881]	[3.687]
Volatility	-0.240	-0.372	0.078	-0.200
	[-1.192]	[-1.432]	[0.360]	[-0.669]
ROA(t-1)	0.051***	0.040*	0.057***	0.057***
	[2.917]	[1.928]	[3.116]	[2.581]
Stock Return(t-1)	0.014***	0.014***	0.014***	0.013***
	[5.245]	[4.083]	[5.304]	[3.797]
CEO Age	0.002	-0.001	-0.000	-0.004
	[0.556]	[-0.348]	[-0.058]	[-0.442]
CEO Age Squared	-0.000	0.000	-0.000	0.000
	[-1.031]	[0.017]	[-0.430]	[0.214]
Observations	5,551	5,050	5,364	4,855
R-squared	0.753	0.811	0.829	0.873
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-Yr FE		Y		Y

Table 4: **Other actions: Debt issues and the ROA channel**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) and one of: ROA (Panel A) or Log(debt) (Panel B) and other CEO and firm level control variables. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Tables 2 and 3, but for brevity, their coefficients are suppressed (*Other controls*). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Pay for Action (ROA)

	(1)	(2)	(3)	(4)
ROA x HPI(t-1) x RE(92)	0.279***	0.257***	0.227***	0.211**
	[3.326]	[3.271]	[2.919]	[2.366]
ROA x HPI(t-1)	-0.049***	-0.040**	-0.038**	-0.036**
	[-3.193]	[-2.505]	[-2.374]	[-2.159]
ROA x RE(92)	-3.028**	-2.637*	-2.410*	-1.926
	[-2.228]	[-1.953]	[-1.813]	[-1.229]
HPI(t-1) x RE(92)	0.010	0.018	0.029*	0.034*
	[0.902]	[1.612]	[1.868]	[1.932]
HPI(t-1)	-0.005		-0.013	
	[-0.467]		[-0.922]	
Observations	14,310	13,370	13,838	12,876
R-squared	0.774	0.795	0.828	0.847
Other Controls	Y	Y	Y	Y
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-Yr FE		Y		Y

Panel B: Pay for Action (Debt Issuances)

	(1)	(2)	(3)	(4)
Log(Debt) x HPI(t-1) x RE(92)	0.005**	0.006**	0.007***	0.010***
	[2.065]	[2.113]	[3.479]	[4.921]
Log(Debt) x HPI(t-1)	0.000	0.000	0.000	0.000
	[0.255]	[0.672]	[0.425]	[0.335]
Log(Debt) x RE(92)	-0.093*	-0.130**	-0.106**	-0.169***
	[-1.787]	[-2.242]	[-2.304]	[-3.109]
HPI(t-1) x RE(92)	-0.008	-0.010	-0.006	-0.030
	[-0.346]	[-0.349]	[-0.317]	[-1.372]
HPI(t-1)	0.001		-0.005	
	[0.088]		[-0.362]	
Observations	14,310	13,370	13,838	12,876
R-squared	0.774	0.795	0.828	0.848
Other Controls	Y	Y	Y	Y
Firm FE	Y	Y		
Firm-CEO FE			Y	Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE	Y		Y	
MSA-Yr FE		Y		Y

Table 5: **Pay for Luck & Action - Cash and Equity Compensation**

Panel A presents our baseline pay for luck regressions for relative shares of cash and equity compensation (as percentage of total compensation). Panel B presents estimates of OLS regressions of the percentage of CEO cash and equity compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) & Real Estate Sales and other CEO and firm level control variables. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 — 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Tables 2 and 3, but for brevity, their coefficients are suppressed (*Other controls* include: RE(92), ROA(t), Stock Return (t), Log(Assets), Log(Assets) x HPI(t-1), Tobin's Q, Volatility, ROA(t-1), Stock Return (t-1), CEO Age, CEO Age Squared). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Pay for Luck

	Cash		Equity	
	(1)	(2)	(3)	(4)
HPI(t-1) x RE92	0.005	0.012	0.070***	0.109***
	[0.355]	[0.608]	[3.018]	[3.761]
HPI(t-1)		0.066***		0.005
		[3.823]		[0.122]
Observations	13,333	13,803	13,388	13,854
R-squared	0.663	0.741	0.666	0.715
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Panel B: Pay for Action

	Cash		Equity	
	(1)	(2)	(3)	(4)
RE Sales x HPI(t-1) x RE(92)	0.023***	0.016**	0.020	0.013
	[3.348]	[2.292]	[1.121]	[0.890]
RE Sales x HPI(t-1)	-0.001	0.001	0.002	0.003**
	[-1.293]	[1.194]	[1.075]	[2.422]
RE Sales x RE92	0.028	-0.014	-0.053	-0.066***
	[1.477]	[-0.930]	[-1.382]	[-2.779]
HPI(t-1) x RE 92	0.004	0.010	0.066***	0.108***
	[0.258]	[0.516]	[2.920]	[3.745]
HPI(t-1)		0.625**		-0.224
		[2.570]		[-0.385]
Observations	13,319	13,792	13,374	13,843
R-squared	0.663	0.741	0.667	0.716
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Table 6: **Cumulative Abnormal Returns at the Announcement of Sale-and-Leasebacks**

The table presents the wealth effects associated with the announcement of a sale and leaseback transaction. The cumulative abnormal return (CAR) is calculated using the market model, which is estimated using the CRSP equally-weighted stock returns over 252 days. Day 0 is the announcement date of the sale and leaseback (SLB). The sample consists of SLB transactions from 1980 – 2011 and is from Whitby (2013). Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Full Sample of Sale-Leasebacks (N = 358)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	0.0127	194/164	4.183***
CAR (-2,2)	0.0134	192/166	3.583***
CAR (-3,3)	0.0137	192/166	3.382***
Sale-Leasebacks of Real Estate only (N = 206)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	0.0205	115/91	4.349***
CAR (-2,2)	0.0229	117/89	3.744***
CAR (-3,3)	0.0216	111/95	3.153***
Sale-Leasebacks of Headquarters only (N = 69)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	0.0094	39/30	1.895**
CAR (-2,2)	0.0112	44/25	2.019**
CAR (-3,3)	0.0019	40/29	1.272
Sale-Leasebacks following Positive Real Estate Shocks (N = 240)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	0.0185	127/113	3.525***
CAR (-2,2)	0.0204	126/114	2.777***
CAR (-3,3)	0.0187	122/118	2.519***

Table 7: **Pay for Action – Financial Constraints**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) and RE Sales, and other CEO and firm level control variables broken into subsets based on proxies for financial constraints. Panels are differentiated by whether firms have below/above median Hadlock-Pierce Size-Age Index of financing constraints (SAI) (Panel A) or previous year's payout ratio (Panel B). We compute the payout ratio as the ratio of total distributions (dividends plus stock repurchases) to operating income. In Panel A, we follow Hadlock and Pierce (2010) and calculate the beginning-of-year SA index value for every sample firm and place firms with index value above (below) the median within the year cohort in the constrained (unconstrained) category. In Panel B, following Almeida et al. (2011) for each year in our sample, we rank firms based on their payout ratio and assign to the financially constrained (unconstrained) group those firms below (above) the median of the annual payout distribution. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (*Other controls*). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Hadlock-Pierce Size-Age Index (SAI)

	(1) Low SAI	(2) Low SAI	(3) High SAI	(4) High SAI
RE Sales x HPI(t-1) x RE(92)	-0.007	-0.006*	0.005**	0.002*
	[-1.173]	[-1.769]	[2.284]	[1.683]
RE Sales x HPI(t-1)	0.001	-0.001	0.000***	0.000
	[0.419]	[-0.510]	[3.847]	[0.259]
RE Sales x RE(92)	0.059	0.053	-0.000***	
	[1.172]	[1.571]	[-2.886]	
HPI(t-1) x RE(92)	0.004	0.004	-0.008	0.003
	[1.053]	[1.475]	[-1.414]	[0.852]
RE Sales	0.002	0.019	-0.000***	-0.000
	[0.093]	[1.462]	[-3.836]	[-0.291]
HPI(t-1)		-0.002		-0.000
		[-1.500]		[-0.107]
Observations	3,318	3,909	4,372	4,630
R-squared	0.845	0.851	0.836	0.850
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Panel B: Dividend Payout

Dividend payout	(1) High	(2) High	(3) Low	(4) Low
RE Sales x HPI(t-1) x RE(92)	0.014	0.008	0.031**	0.025*
	[1.602]	[1.074]	[2.075]	[1.849]
RE Sales x HPI(t-1)	0.004*	0.002	0.000**	0.000*
	[1.939]	[1.146]	[2.056]	[1.823]
RE Sales x RE(92)	-0.020**	-0.029***	0.000	0.000
	[-2.256]	[-4.377]	[0.230]	[0.211]
HPI(t-1) x RE(92)	0.008	0.014	0.001	0.055**
	[0.423]	[0.652]	[0.018]	[2.157]
RE Sales	-0.036*	-0.012	-0.000**	-0.000*
	[-1.674]	[-0.608]	[-2.066]	[-1.876]
HPI(t-1)		-0.001		-0.008
		[-0.077]		[-1.015]
Observations	8,347	8,990	4,922	5,446
R-squared	0.846	0.873	0.740	0.765
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Table 8: **Pay for Action – Governance**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) & Real Estate Sales and other CEO and firm level control variables. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (*Other controls*). Panels are differentiated by whether firms have below/above median Herfindahl Index (HHI) (Panel A) or high/low blockholder ownership (Panel B). High (Low) blockholder ownership firms are those above (below) the mean blockownership, that is they have more (less) than 20 percent of their outstanding equity owned by blockholders. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Panel A: Herfindahl Index

	(1)	(2)	(3)	(4)
Group	Low HHI	Low HHI	High HHI	High HHI
RE Sales x HPI(t-1)*RE(92)	0.003*	0.004***	0.001	0.000
	[1.930]	[2.663]	[0.435]	[0.125]
RE Sales x HPI(t-1)	0.000	-0.002	0.000	-0.001***
	[0.039]	[-1.605]	[-1.363]	[-2.689]
RE Sales x RE(92)	-0.007	-0.015	0.040***	0.040**
	[-0.801]	[-1.187]	[2.882]	[2.374]
HPI(t-1) x RE(92)	0.003	0.007	-0.005	0.004
	[0.779]	[1.079]	[-0.916]	[0.739]
RE Sales	0.003	0.025	0.008	0.018***
	[0.290]	[1.619]	[1.245]	[2.948]
HPI(t-1)		0.005		-0.008
		[1.571]		[-0.798]
Observations	7,046	4,495	6,468	4,130
R-squared	0.811	0.819	0.836	0.837
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Panel B: Blockholder Ownership

Subset	(1) Low	(2) Low	(3) High	(4) High
RE Sales x HPI(t-1) x RE(92)	-0.060	-0.010	0.026**	0.021*
	[-1.479]	[-0.333]	[2.060]	[1.901]
RE Sales x HPI(t-1)	0.001	0.002	0.003	0.003**
	[0.794]	[1.237]	[1.449]	[2.216]
RE Sales x RE(92)	0.583**	0.135	-0.065*	-0.084**
	[2.165]	[0.531]	[-1.712]	[-2.531]
HPI(t-1) x RE(92)	0.037	0.036	0.014	0.037
	[1.083]	[1.432]	[0.399]	[1.563]
RE Sales	-0.505	-0.031	0.977	0.482
	[-1.080]	[-0.079]	[1.510]	[1.368]
HPI(t-1)		0.006		-0.044***
		[0.250]		[-3.378]
Observations	4,129	4,568	5,253	5,565
R-squared	0.855	0.866	0.840	0.854
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Table 9: **Real Estate Exposure and Pay for Luck**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) & Real Estate Sales and other CEO and firm level control variables. The sample is split based on above/below median Real Estate Exposure of firms in 1992. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (*Other controls*). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Pay for Action

RE(92)	(1) Low	(2) Low	(3) Hi	(4) Hi
RE Sales x HPI(t-1) x RE(92)	0.001	0.003	0.002***	0.002***
	[0.318]	[0.704]	[2.440]	[2.380]
RE Sales x HPI(t-1)	0.000	-0.001	-0.001	-0.001
	[0.142]	[-0.672]	[-0.607]	[-1.219]
RE Sales x RE(92)	-0.001	-0.001**	0.009	0.009
	[-0.452]	[2.315]	[0.809]	[0.953]
HPI(t-1) x RE(92)	-0.004	0.018	-0.001	-0.001
	[-0.273]	[2.522]	[-0.130]	[-0.054]
RE Sales	0.001	0.008	-0.003	-0.002
	[0.074]	[0.883]	[-0.337]	[-0.339]
HPI(t-1)		-0.002*		0.000
		[-1.448]		[0.201]
Observations	6,772	7,193	6,682	7,493
R-squared	0.795	0.832	0.825	0.844
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Table IA 1: **Inelasticity**

This table presents estimates of two stage panel regressions of the Log(Total Compensation) on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) & ROA and other CEO and firm level control variables. The first stage regressions use the lag of HPI predicted by land supply elasticity and the Case-Shiller House Price Index to predict HPI. The second stage regressions includes the predicted HPI and its interaction terms as independent variables. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 − 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (*Other controls*). We also control for interactions between firms' inital characteristics and the HPI: we include five quintiles of: firm age, firm size, ROA, as well as two-digit SIC industry dummies and MSA dummies. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

Variables	(1) HPI	(2) Total Comp	(3) Total Comp	(4) Total Comp	(5) Total Comp
Stage	1st	2nd	2nd	2nd	2nd
Case-Shiller Inelasticity	0.009***				
	[7.415]				
HPI Predicted x RE Sales x RE(92)		0.002**	0.002	0.002***	0.003***
		[2.168]	[1.650]	[2.775]	[3.404]
HPI Predicted x RE Sales		-0.001	-0.001	-0.001***	-0.002***
		[-1.559]	[-1.510]	[-3.602]	[-3.931]
HPI Predicted x RE(92)		0.002	0.004*	0.004*	0.006*
		[1.502]	[1.746]	[1.821]	[1.714]
Observations	11,490	11,446	10,820	8,247	7,739
R-squared	0.998	0.768	0.787	0.818	0.834
Initial Controls x HPI	Y	Y	Y	Y	Y
Other Controls	Y	Y	Y	Y	Y
Firm FE	Y	Y			
Firm-CEO FE			Y	Y	Y
Ind-Yr FE	Y	Y	Y	Y	Y
MSA FE				Y	
MSA-Yr FE	Y	Y	Y		Y

Table IA 2: **State Level HPI – Pay for Luck/Action**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of State-level HPI, Real Estate (R.E.) Assets (in 1992) & Real Estate Sales and other CEO and firm level control variables. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. State-weighted HPI for each firm is based on its real estate holdings across the U.S. instead of only using the real estate holdings in the state of its headquarters. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (*Other controls*). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	(1)	(2)	(3)	(4)
RE Sales x HPI(t-1) x RE(92)			0.017*	0.031***
			[1.913]	[2.793]
RE Sales x HPI(t-1)			-0.016	-0.015*
			[-1.642]	[-1.867]
RE Sales x RE(92)			-0.022	-0.040
			[-0.833]	[-1.642]
HPI(t-1) x RE(92)	0.033	0.080***	0.029	0.075***
	[1.315]	[3.047]	[1.183]	[2.893]
RE Sales	-0.001**	0.000	0.017	0.020
	[-2.414]	[-1.101]	[1.268]	[1.641]
HPI(t-1)		-0.066***		-0.063***
		[-3.397]		[-3.302]
Observations	8,007	7,409	8,007	7,409
R-squared	0.797	0.826	0.797	0.826
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Table IA 3: **Percent of Firms Changing Headquarter Location**

This panel presents the number and percentage of firms in our sample that change their HQ location and the total number of firms in our sample between 1997 and 2011. The state headquarter data is from Scott Dyreng's website. The headquarter data in Compustat is historical data and does not change over time even if the firm changes locations.

Year	% Change HQ	No of Firms Change HQ	Total No of firms
1997	7.30%	77	1052
1998	6.70%	70	1038
1999	4.50%	45	1002
2000	2.50%	24	975
2001	4.40%	42	953
2002	3.60%	34	932
2003	5.80%	53	921
2004	8.00%	73	912
2005	5.20%	46	880
2006	5.40%	46	859
2007	4.10%	35	859
2008	6.50%	58	886
2009	7.40%	64	863
2010	4.00%	34	848
2011	2.70%	22	818

Table IA 4: **Alternative Measure of Financing Constraints: Size**

This table presents estimates of OLS regressions of the logarithm of CEO total compensation on all possible two and three way interactions of the lag of HPI, Real Estate (R.E.) Assets (in 1992) and RE Sales, and other CEO and firm level control variables broken into subsets based on proxies for financial constraints. Small/Big firms are those on the top (bottom) quartile of the size-year distribution based on firms' total assets. The sample consists of all firms in Execucomp and Compustat for which Real Estate Assets data and HPI data is available for the years 1992 – 2016 inclusive. HPI denotes CBSA-level house prices, as obtained from the Federal Housing Finance Association's (FHFA) database. All specifications include all control variables used in Table 2, but for brevity, their coefficients are suppressed (Other controls). All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the MSA level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	(1)	(2)	(3)	(4)
	Small	Small	Large	Large
RE Sales x HPI(t-1) x RE(92)	0.006***	0.003***	0.001	0.001
	[3.553]	[3.091]	[0.654]	[0.520]
RE Sales x HPI(t-1)	-0.000	0.000	0.000***	0.000***
	[-0.700]	[0.870]	[7.578]	[3.066]
RE Sales x RE(92)	-0.021	-0.009	0.000	
	[-0.945]	[-0.610]	[0.069]	
HPI(t-1) x RE(92)	0.001	0.002	0.009	0.006
	[0.339]	[0.612]	[0.794]	[0.763]
RE Sales	0.015	0.001	-0.000***	-0.000***
	[1.042]	[0.154]	[-7.606]	[-3.114]
HPI(t-1)		-0.000		0.001
		[-0.328]		[0.632]
Observations	3,081	3,575	2,367	3,074
R-squared	0.759	0.768	0.763	0.744
Other Controls	Y	Y	Y	Y
Firm FE	Y		Y	
Firm-CEO FE		Y		Y
Ind-Yr FE	Y	Y	Y	Y
MSA FE		Y		Y
MSA-Yr FE	Y		Y	

Figure IA 1: Sale-and-Leaseback Transactions

This figure presents the annual number of Real Estate/Headquarter Sale-and-Leaseback transactions by US firms between 1990 and 2012. The data is from Whitby (2013) and limited to Firm HQ SLBs.

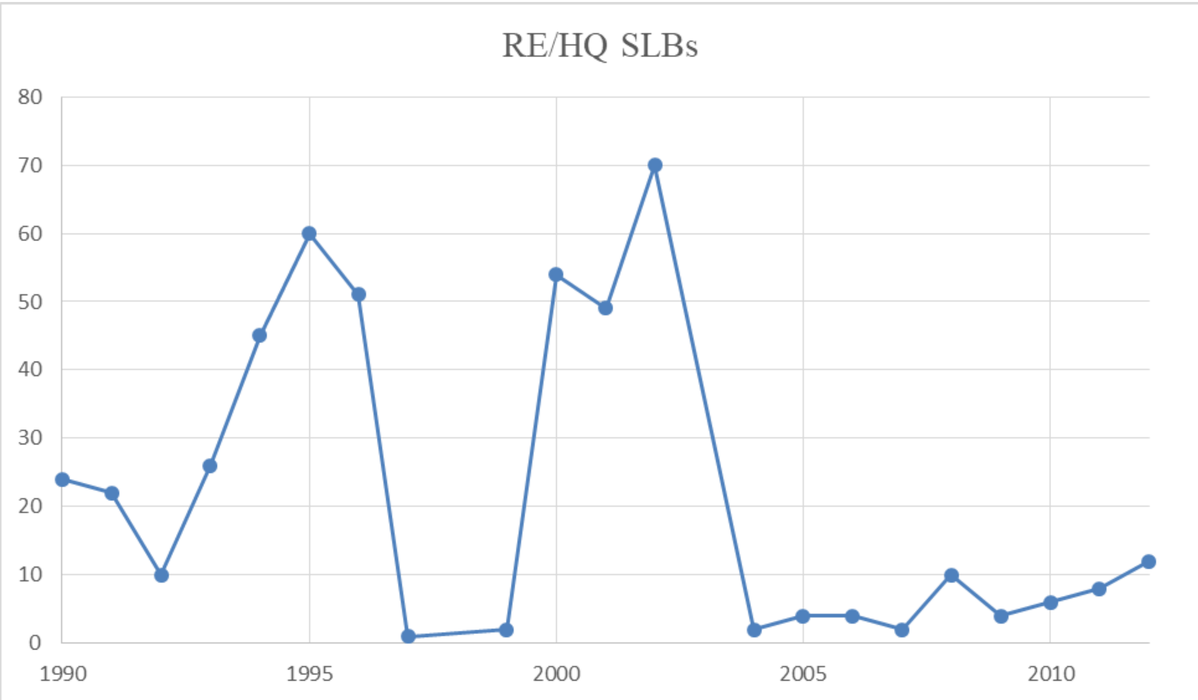
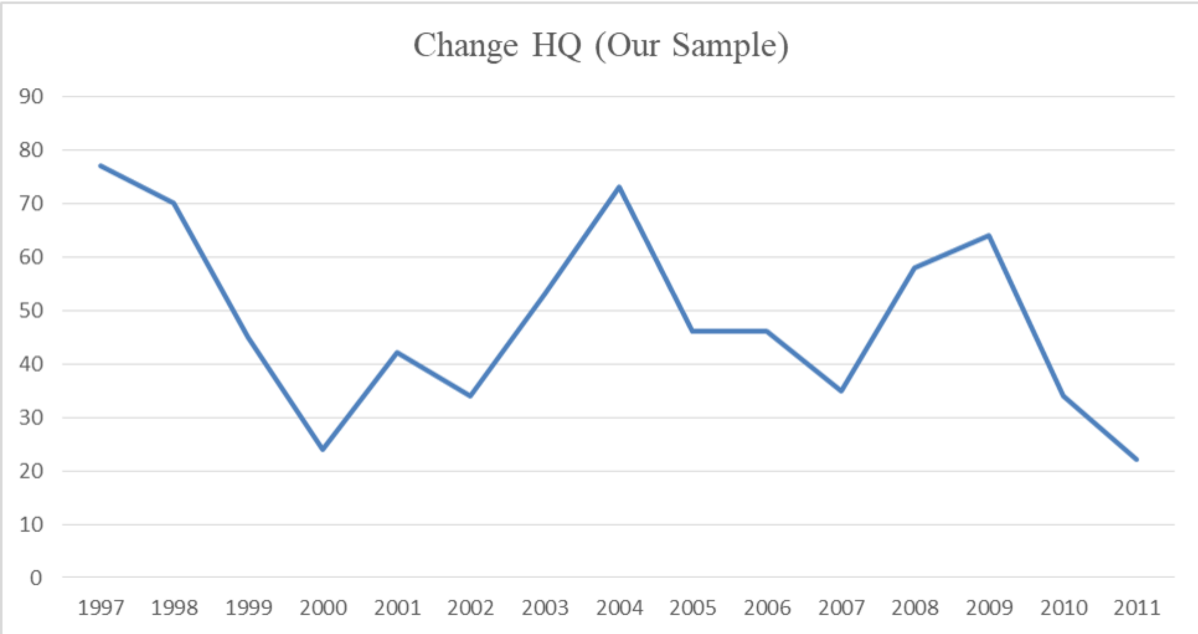


Figure IA 2: Headquarter Changes

The below figures present the number of firms in our sample (Panel A) and in the entire Compustat universe (Panel B) which change headquarter states between 1997 and 2011. The state headquarter data is from Scott Dyreng's website. The headquarter data in Compustat is historical data and does not change over time even if the firm changes locations.

Panel A



Panel B