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

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Abstract

We use real estate prices shocks to study the sensitivity of CEO compensation to luck, and to responses to luck (action). Pay for luck can be optimal when CEOs are expected to react to unanticipated luck. Our identification of pay for action relies on real estate asset sales and debt issuance. We also rely on the fact that accounting performance, unlike market performance, only reflects real estate prices shocks if the CEO responds to them. We show that CEO compensation is associated with responses to real estate luck, which mostly explains 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, the evidence of pay for luck can be interpreted as the CEO being paid 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 responses to unanticipated luck. We take advantage of 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 not reflected in financial statements) and pay for actions (increase in real estate prices reflected in financial statements if an action is taken). This feature allows us to identify when the CEO responds to the unexpected changes in the value of the firm's real estate holdings. As a first step, we look at specific actions taken by the CEO, such as selling of real estate property and issuing debt. As a second step, we explore changes in accounting returns that are associated with changes in real estate prices as a way to comprehensively capture any action the CEO might have taken as a response to luck, without having to individually identifying such actions. The fact that real estate assets are not marked-to-market to real estate 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 to lucky events.[2]

[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.

[2]Bertrand and Mullainathan (2001) points out that finding evidence of pay for luck does not necessarily provide

It is optimal for shareholders to reward a CEO for responding to a lucky event when that action adds shareholder value (Murphy, 1999; Core et al., 2002). For example, it might make sense to reward a CEO that experiences a positive shock to real estate prices in the location of its headquarters to relocate to a less expensive area by selling its existing real estate. 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, J.C. Penney engaged in a sale-and-leaseback deal in 2017, selling their headquarters in Texas for $353 million. Their CEO was clear in the motivation for the deal: "With the tremendous growth and development currently taking place within Plano and North Texas, there's no better time to take advantage of this lucrative market by pursuing a sale of our Home Office real estate. (...) This presents an ideal opportunity to reduce outstanding debt and create long term savings." (Elsayed and Wahba, 2016). 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 Cvijanovic, 2014). Past studies show that corporate real estate sale-and-leaseback transactions add value to shareholders (see for instance Slovin et al., 1990, Rutherford, 1990, and for more recent evidence Ben-David, 2005 and Whitby, 2013). 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.

Empirically, 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 recent work in the collateral channel literature (Balakrishnan et al., 2014; 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. By measuring exposure to real estate shocks at the beginning of the sample period we alleviate the concern that exposure is endogenously chosen by the manager. To deal with the endogeneity of CEO-firm matching and omitted variables at the firm and CEO levels we run our empirical models with either firm or CEO-firm fixed effects. In these specifications we explore within firm (or CEO-firm) variation

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.

only, which implies that time-invariant characteristics of the firm or the manager such as innate talent cannot drive our results. Consistent with prior empirical literature, we find that CEOs are rewarded for luck. Moreover, 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 $40,000 evaluated at the mean.

We then estimate the sensitivity of CEO compensation to actions or responses to lucky events, by focusing on two specific responses to real estate luck: sales of real estate assets and debt issues associated with the collateral value increase. We take advantage of the accounting treatment for shocks to the market value of real estate assets to distinguish between lucky events and responses to luck, i.e., actions.[4] Using this procedure, we capture the sensitivity of pay to responses to luck. In cases when the optimal response of the manager 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. In this sense our measure is conservative in capturing actions associated with real estate shocks. To ensure that CEO's actions are not just common responses followed by all firms in the same industry, in which case it would not be optimal to reward the CEO, but they are associated with abnormal industry returns, 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. 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. After taking in consideration CEO's responses to real estate shock, we continue to find some evidence of pay for luck, however the economic magnitudes are significantly smaller.[5] In fact, most of our estimates of pay for luck are not statistically significant after controlling for responses to luck, which suggest that pay for luck is mostly explained by these responsive actions.

Next, we test whether the responses to luck are optimal from the point of view of sharehold-

[4] "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.

[5] 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.

ers. 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 address this issue, we explore cross sectional variation in the quality of corporate governance of the firms, and we run an event study on sale-and-leaseback (SLB) transactions. In addition, we explore cross sectional variation in the level of firms' financing constraints. 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 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 find that pay for luck is mainly explained by these CEO 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. We also find that rewarding CEOs for responses to real estate luck is more pronounced for financially constrained firms. Taken together, these results provide suggestive evidence that these actions create value to shareholders. They also echo the results from the large literature that tries to assess the impact of CEOs on firm outcomes (Adams et al., 2005).

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, we use data on a firm's location-specific real estate holdings from García and Norli (2012). We test whether CEO compensation is linked to debt issues, assets sales and changes in ROA associated with real estate shocks. We find that CEO pay is positively related to these actions, which suggests 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 their 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 part of the pay for luck effect documented in prior literature actually reflects pay for actions. 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 part of the pay for luck is associated with managerial actions, which is not fully consistent with rent extraction by the CEO.

Last, we offer insights to the literature 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 preferential 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.[6]

Given the extensive empirical evidence on pay for luck, a number of papers offer a rationale for this phenomenon, which we broadly categorize in to two groups. In the first group of studies, the models 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.

In a second group of studies, Oyer (2004) focuses on the participation constraint of managers: he 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.

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 lease back type of transactions. Evidence of pay for luck can also be rationalized by the CEO being compensated ex-post for responding optimally 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

[6]Bizjak et al. (2008) argue that the documented asymmetry in CEO pay for luck is a result of competitive benchmarking.

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.

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. 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. However, according to US GAAP, the exact same shock should not be reflected in the firm's accounting performance.[7] Based on the historical-cost principle, under GAAP, long-lived assets (such as real estate) and most

[7] Minnis and Sutherland (2017) argue that financial statements are not very helpful as a monitoring mechanisms for firms with real estate loans because real estate assets are easily observable by those outside the firm, and the availability of public information, such as appraisals, comparable transactions, and real estate indices, all of which should be impounded in the firm's market capitalization.

other assets held on the balance sheet are recorded 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. For example, she can decide to sell the real estate assets, or to sell them and lease them back (to perform a sale and leaseback transaction or a SLB), or to change the financing policy of the firm by issuing more debt, just to name a few. 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 Cvijanovic, 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 changes her mind about the best way to finance the firm's assets. In a SLB transaction, an asset is sold to a third party 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 Head Quarters (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.[8]

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 reduce debt and for expansionary purposes. In our sample, on average 5.2%, of companies changed headquarters location (see Table IA3).

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.[9] We estimate the

[8]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.

[9]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.

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 (Plant, Property, & Equipment less Plant, Property, & Equipment Machinery, Equipment and Leases, divided by total assets) in 1992[10]; $\text{Exp}_{i,t_0}\text{HPI}_{m,t-1}$ represents the luck measure, in this case the level of the House Price Index (HPI) at the MSA m of firm i at time $t-1$ interacted with the value of real estate assets for firm i at time t_0[11], $X_{i,t}$ 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; $\delta_{m,t}$ are MSA-year fixed effects, $\gamma_{i,c}$ are firm-CEO fixed effects, and $\mu_{j,t}$ are industry-year fixed effects. As an alternative to the baseline model, where firm-CEO fixed effects are included, and following existing pay for luck studies (Bertrand and Mullainathan, 2001; Garvey and Milbourn, 2006; Chhaochharia and Grinstein, 2009), we include firm fixed effects only. While with CEO-firm fixed effects the coefficients are estimated using only within CEO-firm variation, with firm fixed effects variation might come from having different CEOs in the same firm. The CEO-firm 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 Sunder (2014) 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. 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.

[10] As we will discuss in detail in Section 4.1 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.

[11] The market value of a firm's real estate assets is a key construct in our analysis and we describe it in detail in Section 4.1.

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 of its real estate assets) from the sensitivity of pay to reactions to luck. Given that the value of a firm's real estate assets is not marked-to-market, 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 capital gain (or loss).

Our measure of CEO action is *Real Estate Asset Sales*, defined as the difference in the balance sheet value of a firm's real estate assets between year t and year $t-1$: $\text{RESales} = \text{REValue}_t - \text{REValue}_{t-1}$, where $\text{REValue} = (\text{PPENT} - \text{PPENLS} - \text{PPENME})/\text{AT}$, whereby we only look at the cases when this difference is negative, indicating real estate asset sales. 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. We run alternative specifications with gross values for a small sample and show the results in Panel B of Table 4. We also use debt issues and ROA as alternative measures for CEO actions.[12] This motivates the following specification:

[12] *ROA* is defined as *Net income* divided by *Total Assets*. 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.

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

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. 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).

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 sensitivity of CEO pay to reactions to luck for a given CEO-firm pair 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 reactions to luck, *relative* to other CEO-firm pairs that operate in the same industry.

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.[13]

Following Chaney et al. (2012) and Balakrishnan et al. (2014), there are three major categories of property, plant, and equipment that are included in the definition of real estate assets: Buildings, Land and Improvement, and Construction in Progress (FATB, FATC and FATP). These assets are not marked-to-market, but valued at historical cost. To arrive at the measure of a firm's real estate assets in 1992 we follow a procedure that yields equivalent values to the ones in Chaney et al. (2012). The real estate exposure variable is defined as Property, Plant, and Equipment Total (Net) less Property, Plant, and Equipment Leases (Net), less Property, Plant, and Equipment Machinery and Equipment (Net), (Compustat (PPENT-PPENME-PPLENLS)[14], 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.[15] In order to maintain a similar sample size to the most standard analysis we replace missing observations with zeros. That variable is scaled by total assets to get the portion of the firm's assets related to its real estate holdings.

Following Balakrishnan et al. (2014) we then 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 $\text{HPI}_{m,t-1}$

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

[14]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).

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

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 will 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 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.

We use Execucomp to obtain, or calculate, the following compensation 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 revenue, firm growth opportunities using Tobin's Q, accounting profitability, using ROA, stock return and stock price volatility. Following Bertrand and Mullainathan (2001), we also control for CEO age, CEO age squared, CEO tenure, CEO tenure squared, a trend, a quadratic trend, and firm fixed effects or CEO-firm fixed effects as alternative specifications.[16]

The final dataset includes 17,943 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

[16] 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.

estate market variables. The average CEO in this sample has a total compensation of 4.9 million dollars. The average cash component is 1.2 million, while the average equity component corresponds to 3.95 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 as a percentage of assets are 32%.

[Insert Table 2]

Table 2 breaks the data into 2 groups: firms with high and low real estate exposure. A firm is defined to have high (low) real estate exposure if *Real Estate Assets* is above (below) the yearly median *Real Estate Assets*. In this univariate setting, we find that total compensation is significantly higher for firms that have low real estate exposure. This is mainly driven by the higher equity pay of firms with low real estate exposure. This result, despite relying on parsimonious univariate analysis, contrasts with the common belief that pay for luck, in this case luck driven by real estate shocks, is associated with excessive pay.

5 Results

5.1 Pay for luck

[Insert Table 3]

This section presents the main results. Table 3 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 0.022 in column 1 and 0.034 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 $40,000 and $60,000. 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 this changes as action or responses to luck, since the firm is changing headquarters to a different MSA. The estimated coefficient ranges between 0.028 and 0.044, 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 \$50,000 and \$78,000. Overall, our results seem to be driven by within firm variation over time and related to shocks as opposed to cross sectional differences in exposure to real estate markets. In section 6.3 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. 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, we define real estate assets as buildings, land and improvement, and construction in progress (Compustat variables FATB, FATC, and FATP). These assets are not marked-to-market, but are valued at historical cost. To estimate their market value, we follow Balakrishnan et al. (2014): 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.[17]

By using this approach, we do not incorporate the value of any real estate acquisitions or dispositions following 1993. This helps us to address potential endogeneity between real estate values and subsequent investments, however a potential downside to this approach is that it creates a relatively noisy measure of a firm's real estate holdings. Additionally, 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 3 Panel A (14,0000 observations).

Table 3 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 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.

[17]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.

5.3 Pay for responses to luck

We proceed to test if CEO compensation is correlated with specific responses to real estate luck. Table 4 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 commonly taken by the whole industry.

[Insert Table 4]

In columns 1 and 3, we estimate the model with MSA, but not MSA-year, 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 between 0.002 and 0.003 (columns 1 and 3 in Table 4) 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 the following 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 is 0.002 and 0.003 respectively.

If we focus on the coefficient of the interaction term between real estate exposure and HPI, we find some evidence that CEO compensation correlates with real estate shocks irrespective of action. The magnitude of the estimated coefficient is smaller than in previous regressions shown in Table 3, and not statistically significant in most specifications. This result suggests that pay for luck is mostly explained by pay for responses to luck.

In Table 4 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 on changes in ROA associated to 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. Another possible reaction to real estate shocks 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. *ROA* is defined as *Net income* divided by *Total Assets*. 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.

[Insert Table 5]

Table 5 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 ou 1% level, and range from 0.023 to 0.055, 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 (except in Column 1) and around 0.001. 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 6, 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 6]

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 varies between 0.047 and 0.082 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).

In contrast, when we test for pay for actions (Panel B), we find that both cash and equity compensation are associated with responses to luck. The estimated coefficients on equity compensation and cash compensation are both statistically significant at the 1% level.

This table suggests that while pay for luck is mostly associated with equity pay, pay for actions comes through in both equity and 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 the 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 7, 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 7]

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 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 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, 2007), we use the following measures of corporate governance strength and product market competition: Herfindahl index (HHI) of industry concentration and board independence. In our first test, we analyze the role played by the relative role of 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, following Coles et al. (2008) we use board independence, defined as the number of independent directors scaled by total directors, as a measure of firm governance.

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.[18]

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. We find much larger coefficients on pay for responses to luck in the subsample with low industry concentration (low HHI). Confirming our initial intuition, the estimated coefficients on pay for responses to luck are highly significant for low HHI firms (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 our sample based on the level of board independence. We find some evidence (albeit weak), that the firms with higher board independence have significantly larger estimated coefficients of pay for responses to luck (0.004). 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.

5.6.3 Pay for responses to luck and financing constraints

Table 9 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 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

[18] 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.

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 financially constrained firms[19], irrespective of the measure of financing constraints used. [20] On the other hand, in the non-financially constrained groups, we find that the pay for responses to luck coefficient is 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 9 about here]

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 10]

In Table 10 (Panel A) we find evidence that *High Real Estate Exposure* firms are more likely to tie their CEO compensation ex-ante to accounting measures of performance (as proxied by the firm's ROA). The estimated coefficients on ROA are highly significant for both *High and Low Real Estate Exposure firms*, however, they are two times larger in the case of *High Real Estate Exposure* firms. At the same time, for both *High and Low Real Estate Exposure* firms we see similar loadings of CEO compensation on contemporaneous and lagged measures of firm stock market performance. These results suggest that boards of *High Real Estate Exposure* firms tend to anticipate real estate market swings that are outside of CEOs control and link their compensation to their accounting performance.

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

[20]Results uzing firm size as the measure of financing constraints are shown in Appendix. They remain unchanged.

Additionally, as shown in Panel B, the "pay for luck" coefficient on $\text{Exp}_{i,t_0}\text{HPI}_{m,t-1}$ (HPI(t-1) x RE(92), is negative and insignificant for *High Real Estate Exposure* firms. This further 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 in a position to extract smaller 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 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 Table 3 and Table 4), and the dependent variable is total compensation. We estimate the following first-stage regression for house prices at the MSA level:

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

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.[21] 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. Overall, we find significant pay for responses to luck (columns 2-5). The estimates found using this setting (between 0.002 and 0.003) are qualitatively similar to those in Table 4.

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. To address this concern, we follow the standard procedure in the literature (Chaney et al., 2012) by including the 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. The results of these regressions are shown in Table IA1, and they remain unchanged.

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

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

[21] 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.

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 of 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. 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 marginally significant 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, we focus only on real estate property accounted for as 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 (PPE) 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 coefficient is 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, and using shocks to real estate values as a measure of luck, we find that CEOs are paid for actions or for responding to lucky events. We also show that pay for luck, as typically measured, can be partially explained by these responses to luck. 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 action. 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 being rewarded for their response to luck, such as by selling real estate, and not purely for lucky events.

CEOs are paid for action in both equity and cash pay, whereas we find that pay for luck only occurs through equity pay. We also find positive and significant abnormal returns associated with announcements of sale-and-leasebacks by firms in our sample, suggesting that shareholders view those responses to luck as optimal.

This paper brings a new perspective on the topic of pay for luck, and contributes to the active debate on CEO compensation. We provide empirical evidence that pay for luck might not necessarily be consistent with rent extraction by the CEO.

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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 * CSHO).
Log Debt	Log of debt in thousands of $ (Compustat DLC+DLTT).
RE Sales	Scaled RE Assets less previous year's scaled RE assets $ (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))].
Real Estate 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 = RE total (HPI 1993/HPI 1975)(CPI 1975/HPI purchase year), where Book Value of Real Estate = Buildings at Cost + Construction in Progress at Cost + Land Improvements at Cost 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 Statistical Area (Federal Housing Finance Association), obtained from the Federal Housing Finance Association's (FHFA).
Board Independence	The number of independent directors for a firm in a given year scaled by the total number of directors.

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.

	Mean	Median	St. dev	Min	Max	Obs.
Total Comp	4,927.594	2,927.068	5,650.176	170.717	32,501.71	17,943
Cash Comp	1,242.579	913.346	1,624.041	0.000	77,926	17,943
Equity Comp	3,950.642	1,752.067	9,482.613	0.000	650,848	17,943
Delta	634.794	190.311	1,512.707	2.293	11,723.89	15,937
Vega	132.483	49.06	216.736	0.000	1,203.938	16,018
Percent Equity	0.575	0.646	0.284	0.000	0.985	17,919
MVE	8,301.728	1,678.739	19,486.8	25.036	115,239.3	17,943
Tobin's Q	1.900	1.522	1.180	0.739	8.336	17,943
ROA	0.053	0.061	0.108	-0.551	0.327	17,943
Volatility	0.406	0.353	0.215	0.069	2.188	17,943
Return	0.144	0.088	0.523	-0.922	4.634	17,368
EBIT	747.951	149.399	1793.09	-331.114	11,658	17,822
RE Assets (1992)	0.246	0.156	0.243	0.000	0.944	17,943
RE Assets	0.317	0.246	0.236	0.000	0.967	17,943
HPI	16.504	15.704	5.406	9.805	32.166	17,943
RE Sales	0.076	0.035	0.221	-0.314	0.889	16,308
CEO Age	56.453	56	7.226	30	96	17,939
CEO Age Squared	3,239.16	3136	837.107	900	9,216	17,939
Firm Age	25.97	25.46	13.403	0.06	54.03	17,215

Table 2: **CEO Compensation and Exposure to Real Estate Shocks**

This table presents mean differences for CEO compensation variables between CEOs whose firms have above median Real Estate Assets' holdings and those who have below median Real Estate Assets' holdings. All variables are winsorized at the 1st and 99th percentile values. Variables are defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	Low RE Exposure	High RE Exposure	Difference	t-stat
Total Comp	5,151	4,705	446	5.28***
Cash Comp	1,275	1,211	64	2.65***
Equity Comp	4,266	3,636	630	4.45***
Percent Equity	0.584	0.567	0.017	3.91***
Obs	8,965	8,965		

Table 3: **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. 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 normalized by lagged total assets (see Section 6.3 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. 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: Total Compensation

	(1)	(2)	(3)	(4)
RE(92) x HPI(t-1)	0.022**	0.028***	0.034***	0.044***
	[2.151]	[2.671]	[2.628]	[2.688]
HPI(t-1)	-0.006		-0.014	
	[-0.552]		[-0.995]	
ROA(t)	0.336***	0.364***	0.383***	0.375***
	[3.528]	[3.137]	[5.205]	[3.967]
Stock Return(t)	0.053***	0.056***	0.051***	0.052**
	[3.184]	[2.660]	[2.821]	[2.147]
Log(Assets)	0.382***	0.384***	0.335***	0.332***
	[13.553]	[9.884]	[9.767]	[7.394]
Log(Assets) x HPI(t-1)	-0.001	-0.001	0.000	0.000
	[-0.574]	[-0.906]	[-0.196]	[-0.126]
Tobin's Q	0.109***	0.097***	0.118***	0.108***
	[8.528]	[6.186]	[6.743]	[4.640]
Volatility	-0.082	-0.334	0.071	-0.085
	[-0.457]	[-1.568]	[0.332]	[-0.377]
ROA(t-1)	0.103	0.097	0.207**	0.184*
	[1.315]	[1.108]	[2.355]	[1.728]
Stock Return(t-1)	0.091***	0.081***	0.089***	0.080***
	[7.868]	[6.247]	[8.475]	[6.735]
CEO Age	0.028	0.027	0.005	-0.005
	[1.395]	[1.135]	[0.186]	[-0.159]
CEO Age Squared	0.000	0.000	0.000	0.000
	[-1.618]	[-1.293]	[0.054]	[-0.294]
Observations	14,509	14,509	14,509	14,509
R-squared	0.754	0.778	0.827	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: 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 4: **Pay for Action - Total Compensation & Pay for reactions to luck**

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 normalized 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 - Total Compensation

	(1)	(2)	(3)	(4)
RE Sales x HPI(t-1) x RE(92)	0.002***	0.002**	0.003***	0.003***
	[3.110]	[2.319]	[3.246]	[2.905]
RE Sales x HPI(t-1)	-0.000	-0.001	-0.001**	-0.002***
	[-1.300]	[-1.234]	[-2.369]	[-3.490]
RE Sales x RE(92)	-0.006	-0.007	-0.010*	-0.015***
	[-1.413]	[-1.220]	[-1.922]	[-2.859]
RE(92) x HPI(t-1)	0.002	0.001	0.004*	0.004
	[1.155]	[0.789]	[1.947]	[1.435]
RE Sales	0.007	0.009	0.015**	0.024***
	[1.541]	[1.379]	[2.430]	[3.677]
HPI(t-1)	-0.001***		-0.002***	
	[-2.877]		[-3.453]	
ROA(t)	0.044***	0.044***	0.044***	0.047***
	[3.781]	[3.473]	[4.741]	[4.381]
Stock Return(t)	0.008***	0.009***	0.008***	0.009***
	[3.847]	[4.176]	[4.299]	[4.279]
Log(Assets)	0.048***	0.052***	0.041***	0.043***
	[12.678]	[12.683]	[9.455]	[9.336]
Log(Assets) x HPI(t-1)	-0.001	-0.001	0.000	-0.000
	[-0.871]	[-0.987]	[0.130]	[-0.050]
Tobin's Q	0.013***	0.011***	0.013***	0.012***
	[8.294]	[6.660]	[6.910]	[5.517]
Volatility	-0.156	-0.332*	0.092	-0.231
	[-1.091]	[-1.919]	[-0.678]	[-1.443]
ROA(t-1)	0.038***	0.030***	0.036***	0.028***
	[3.868]	[2.829]	[3.969]	[3.005]
Stock Return(t-1)	0.013***	0.013***	0.013***	0.013***
	[7.011]	[7.131]	[8.601]	[8.259]
CEO Age	0.006**	0.005*	0.006*	0.004
	[2.289]	[1.925]	[1.880]	[1.046]
CEO Age Squared	-0.001***	-0.001**	-0.001*	-0.001
	[-2.707]	[-2.311]	[-1.958]	[-1.345]
Observations	15,625	15,625	9,224	9,224
R-squared	0.755	0.779	0.827	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: Measuring 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 5: **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: Log(debt) or ROA 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 3 and 4, 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: ROA

	(1)	(2)	(3)	(4)
ROA x HPI(t-1) x RE(92)	0.024**	0.023**	0.055***	0.055***
	[2.600]	[2.486]	[3.149]	[2.809]
ROA x HPI(t-1)	-0.004**	-0.003*	-0.005*	-0.005**
	[-2.439]	[-1.900]	[-1.957]	[-2.057]
ROA x RE(92)	-0.330**	-0.299*	-0.489*	-0.413
	[-1.981]	[-1.756]	[-1.913]	[-1.412]
HPI(t-1) x RE(92)	0.002	0.002	0.001	0.000
	[1.088]	[0.942]	[0.290]	[0.107]
Observations	15,451	14,545	14,996	14,033
R-squared	0.778	0.798	0.819	0.836

Panel B: Debt Issues

	(1)	(2)	(3)	(4)
Log(Debt) x HPI(t-1) x RE(92)	0.001	0.001**	0.001*	0.001**
	[1.457]	[2.045]	[1.813]	[2.269]
Log(Debt) x HPI(t-1)	0.000	0.000	0.000	0.000
	[-0.612]	[-0.556]	[0.027]	[-0.244]
Log(Debt) x RE(92)	-0.005	-0.01	-0.017*	-0.024**
	[-0.633]	[-1.353]	[-1.951]	[-2.262]
HPI(t-1) x RE(92)	-0.001	-0.003	-0.002	-0.006
	[-0.339]	[-0.907]	[-0.466]	[-1.179]
Observations	15,451	14,545	14,996	14,033
R-squared	0.778	0.798	0.819	0.835
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: **Pay for Luck & Action - Cash and Equity Compensation**

This table presents estimates of OLS regressions of the logarithm 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 Table 3, but for brevity, their coefficients are suppressed (other controls include: RE92, ROA(t), Stock Return (t), Log(Assets), 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 RE(92)	-0.002	-0.003	0.047**	0.082**
	[-0.168]	[-0.249]	[2.274]	[2.600]
HPI(t-1)		-0.007		-0.026*
		[-0.976]		[-1.714]
Observations	14,524	8,784	14,524	8,784
R-squared	0.777	0.843	0.553	0.599

Panel B: Pay for Action

	(1)	(2)	(3)	(4)
RE Sales x HPI(t-1) x RE(92)	0.019**	0.024***	0.037**	0.053***
	[2.017]	[3.301]	[2.055]	[2.949]
RE Sales x HPI(t-1)	-0.002	0.000	0.002	-0.006
	[-0.786]	[-0.182]	[0.323]	[-0.855]
RE Sales x RE(92)	-0.077*	-0.069*	-0.1	-0.084
	[-1.691]	[-1.804]	[-0.874]	[-0.898]
HPI(t-1) x RE(92)	-0.027	-0.011	0.02	0.052
	[-1.552]	[-0.646]	[0.627]	[1.416]
RE Sales	0.062	0.042	0.019	0.099
	[1.372]	[1.065]	[0.152]	[0.941]
HPI(t-1)		-0.005		-0.022
		[-0.687]		[-1.456]
Observations	15,643	9,234	15,643	9,234
R-squared	0.778	0.843	0.553	0.600
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 7: **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 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 3, 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 board independence (Panel B). Board independence is the number of independent directors scaled by the number of total directors. 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

Group	(1) Low HHI	(2) Low HHI	(3) High HHI	(4) 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: Board Independence

Subset	(1) High Bd Ind	(2) High Bd Ind	(3) Low Bd Ind	(4) Low Bd Ind
RE Sales x HPI(t-1) x RE(92)	0.004**	0.001	-0.003	0.001
	[2.191]	[0.593]	[-1.283]	[0.279]
RE Sales x HPI(t-1)	-0.001	-0.001	0.000	-0.003***
	[-0.637]	[-0.766]	[-0.383]	[-2.850]
RE Sales x RE(92)	-0.012	0.000	0.051*	0.025
	[-0.584]	[-0.006]	[1.961]	[0.890]
HPI(t-1) x RE(92)	0.001	0.004	-0.001	0.001
	[0.367]	[1.141]	[-0.230]	[0.329]
RE Sales	0.012	0.011	0.007	0.045**
	[0.594]	[0.420]	[0.448]	[2.335]
HPI(t-1)		-0.003**		0.000
		[-2.005]		[-0.290]
Observations	4,602	2,986	4,499	2,840
R-squared	0.859	0.859	0.839	0.833
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: **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 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. 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) Yes	(2) Yes	(3) No	(4) No
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	
	[-2.256]	[-4.377]	[0.230]	
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 10: **Real Estate Exposure and Pay for Luck**

Panel A presents estimates of OLS regressions of the logarithm of CEO total compensation on CEO and firm level control variables. Panel B 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 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-Sensitivity to Accounting and Market Performance

	(1)	(2)	(3)	(4)
RE92	Low	Low	Hi	Hi
ROA(t)	0.040**	0.049***	0.085*	0.070***
	[2.399]	[2.675]	[1.970]	[3.620]
Stock Return(t)	0.005**	0.008***	0.011***	0.007***
	[2.233]	[3.484]	[3.181]	[2.581]
Log(Assets)	0.045***	0.035***	0.044***	0.035***
	[4.739]	[5.520]	[8.409]	[6.234]
Tobin's Q	0.012***	0.012***	0.011***	0.012***
	[3.396]	[3.648]	[3.182]	[3.698]
Volatility	-0.025	0.447	-0.523	-0.249
	[-0.095]	[1.442]	[-1.534]	[-0.974]
ROA(t-1)	0.049**	0.106***	0.007	0.005
	[2.523]	[3.491]	[0.297]	[0.253]
Stock Return(t-1)	0.009***	0.012***	0.015***	0.011***
	[3.692]	[4.022]	[4.728]	[3.220]
CEO Age	0.001	0.001	0.007*	0.009**
	[0.262]	[0.157]	[1.679]	[2.075]
CEO Age Squared	0.000	0.000	-0.000*	0.000
	[-0.456]	[0.229]	[-1.795]	[-1.461]
Observations	6,836	7,254	6,682	7,493
R-squared	0.795	0.831	0.824	0.844
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

RE92	(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]
ROA(t)	0.038**	0.044***	0.044*	0.039***
	[2.369]	[2.867]	[2.610]	[2.779]
Stock Return(t)	0.006	0.006*	0.010***	0.010***
	[1.637]	[1.963]	[3.322]	[3.295]
Log(Assets)	0.049***	0.041***	0.054***	0.043***
	[5.861]	[7.503]	[11.093]	[9.115]
Tobin's Q	0.013***	0.014***	0.014***	0.014***
	[4.581]	[5.485]	[5.717]	[5.224]
Volatility	-0.076	0.101	-0.544***	-0.239
	[-0.308]	[0.573]	[-2.512]	[-1.108]
ROA(t-1)	0.040**	0.038**	0.025	0.040**
	[2.490]	[2.555]	[1.091]	[2.355]
Stock Return(t-1)	0.012***	0.013***	0.012***	0.012***
	[5.072]	[5.695]	[4.194]	[4.863]
CEO Age	-0.001	0.006	0.007*	0.007
	[-0.079]	[1.230]	[1.676]	[1.627]
CEO Age Squared	-0.001	-0.001	-0.001*	-0.001*
	[-0.135]	[-1.201]	[-1.886]	[-1.808]
Observations	6,772	7,193	6,682	7,493
R-squared	0.795	0.832	0.825	0.844
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 3, 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	Y	Y	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 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.

	(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 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. 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.

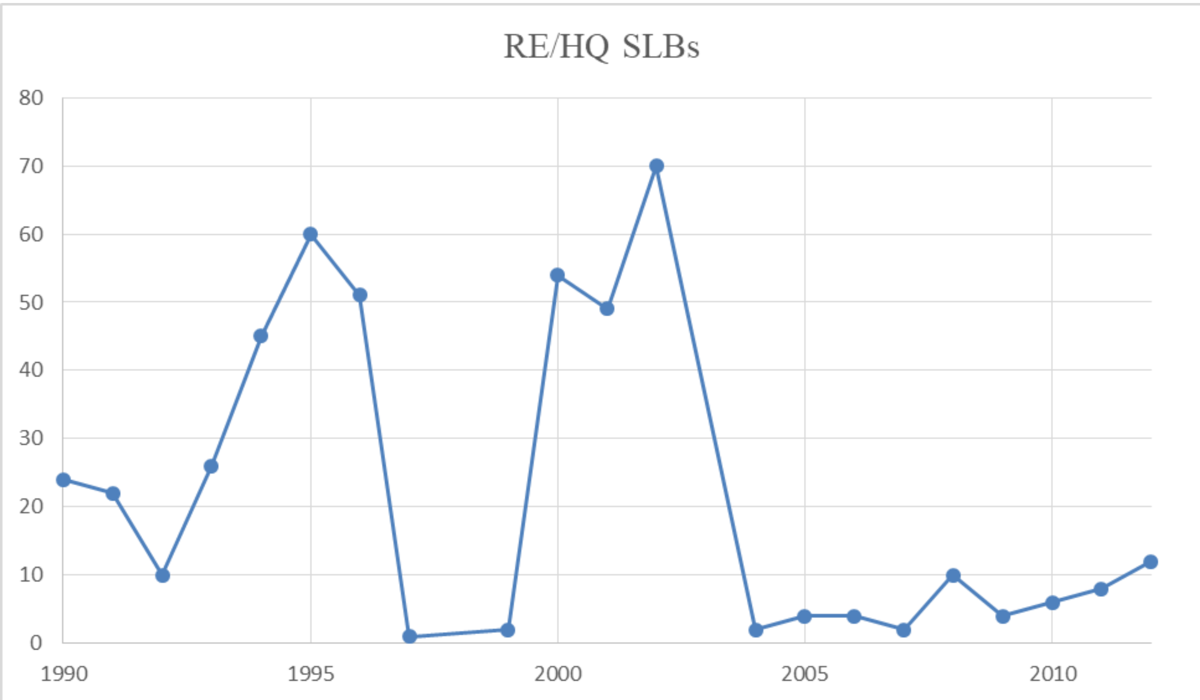
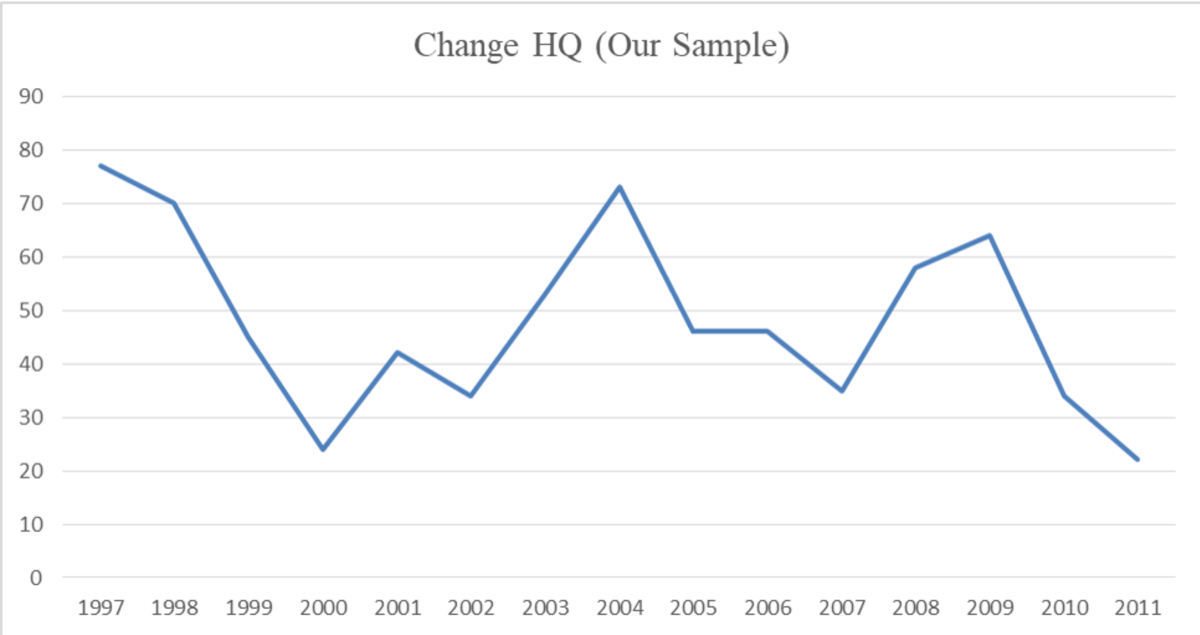


Figure IA 2: Headquarter Changes

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