When Pay for Luck is Pay for Action:

CEO Compensation and Real Estate Prices

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ABSTRACT

We use changes in real estate prices to study the sensitivity of CEO compensation to luck and to responses to luck. Pay for luck might be optimal when CEOs are expected to react to luck. To identify responses to luck, we rely on the fact that accounting performance, unlike market performance, only reflects current real estate prices if the CEO responds to shocks. We show that CEO compensation is linked to responses to real estate luck, which explains pay for luck itself. Our results cast doubts on existing evidence of pay for luck as empirical support of the managerial power hypothesis.

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Introduction

Empirical evidence that CEOs are rewarded for luck (Bertrand and Mullainathan, 1998, Bertrand and Mullainathan, 2001, Garvey and Milbourn, 2006, and Chhaochharia & Grinstein, 2009) is often used to support the managerial power hypothesis of CEO compensation. Pay for luck is defined in this literature as the compensation driven by observable lucky events that are not under the control of the CEO. Indeed, under the simplest optimal contracting framework shareholders should not compensate CEOs for observable luck (Holmström, 1979). However, in more complex agency models pay for luck can be optimal. For instance, in case the board wants to incentivize the CEO to take action in response to the lucky event. A number of papers have rationalized pay-for-luck: Axelson and Baliga (2009), Gopalan, Milbourn and Song (2010), Noe and Rebello (2012) and Chaigneau and Edmans (2013). Edmans and Gabaix (2009), and Edmans and Gabaix (2015) provide a survey of optimal contracting theories that may explain the recent trends in CEO pay, such as pay for luck.

In this paper, we study the sensitivity of CEO compensation to luck using real estate prices to identify responses to lucky events. We rely on the fact that real estate price shocks are reflected in market performance and accounting performance in a different way. While the stock market value of the firm should reflect changes in its real estate market value (assuming efficient markets), under US accounting guidelines, accounting returns only reflect changes in real estate market values when there is some managerial action, such as selling property. We find that pay

for luck is explained mostly by CEO responses to lucky events. Our results cast doubt on existing evidence of pay for luck as empirical support of the managerial power hypothesis.

Regarding managerial action following a lucky event, it might be optimal for shareholders to reward a CEO for responding to a lucky event, to the extent that such an action improves firm performance. Therefore, as pointed out in Bertrand and Mullainathan (2001), finding evidence of pay for luck is not necessarily support for a skimming model. For example, it might make sense to reward a CEO that experiences a positive shock in real estate prices in the location of its headquarters to relocate to a less expensive area by selling its existing real estate.[1] Another example would be for a firm to perform a sale-and-leaseback transaction to relax financial constraints should they exist. There is an extensive literature which finds that corporate real estate sale-and-leasebacks generate positive cumulative abnormal stock returns around the announcement date, which suggest that these actions are value maximizing (see for instance Slovin, Sushka and Polonchek, 1990, Rutherford, 1990 and Whitby, 2013 for more recent evidence). We perform an event study around sale-and-leaseback transaction announcement dates and find significant positive abnormal returns, suggesting that indeed this CEO action adds value to shareholders. As anecdotal evidence, in 2007, the Spanish bank Santander raised more than €4.3bn through a series of sale-and-leaseback transactions that generated about €1.7bn of capital gains. This included the sale of the bank's Madrid headquarters, Boadilla del Monte,

[1] Selling real estate as a response to a positive shock is an optimal action if real estate stock prices exhibit reversal. If real estate prices exhibit momentum, this might not be the optimal action. Capozza, Hendershott, Mack and Mayer (2002) show that real estate prices exhibit reversal and that reversal is greater in large metro areas and faster-growing cities with lower construction costs.

which was worth €1.9 billion on its own. Given that the empirical evidence suggests that, on average, reactions to real estate shocks create shareholder value, we proceed by estimating the sensitivity of CEO pay to responses to lucky events.

Empirically, we start by estimating pay for luck using real estate prices as our luck variable. We follow Bertrand and Mullainathan (2001) and use a two stage procedure to estimate the sensitivity of CEO compensation to changes in stock market performance due to luck. In the first stage, we use real estate prices to explain firm stock market performance, and then use the predicted value of market performance from the first stage to estimate CEO pay driven solely by real estate luck. We find evidence, consistent with existing literature, that CEOs are rewarded for lucky events. Our estimated sensitivity of CEO pay to market performance suggests that a one percent increase in firm market performance leads to a 0.34 percent increase in CEO pay. The sensitivity of CEO pay to luck is larger: for a one percent increase in firm market performance due to luck, CEO pay increases by 0.50 percent. These results are in line with Bertrand and Mullainathan (2001) and show that the sensitivity of CEO pay to performance is similar in magnitude to the sensitivity of CEO pay to performance driven by luck.

Next, we estimate the portion of CEO compensation related to her responses to lucky events. Our strategy to identify responses to real estate luck (action) in a comprehensive way takes advantage of the accounting treatment of shocks to the market value of real estate assets. Assuming market efficiency, stock market performance reflects any change in the value of firm's real estate, irrespective of the CEO action. Contrarily, accounting performance only reflects changes in the

value of real estate when there is CEO action, because under US GAAP firms cannot mark-to-market these assets. Following a shock in real estate prices, net income and book values only change if the CEO decides to buy or sell existing assets.[2] Therefore, we re-estimate pay for luck, using real estate prices as an exogenous regressor for accounting performance instead of market performance. With this procedure, we capture the sensitivity of pay to responses to luck. We find that the sensitivity of CEO compensation to changes in accounting performance driven by real estate prices is positive and significant, which suggests that CEOs are rewarded for their responses to real estate shocks. The magnitude of the effect is economically relevant: for a 1 percent change in firm accounting performance that is driven solely by real estate shocks, and therefore by reactions to luck, there is a 6.9 percent change in CEO compensation.

We then make use of two specific actions that we can identify as being a response to real estate luck: debt issues and real estate assets sales. We test whether CEO compensation is linked to debt issues and assets sales driven by real estate shocks. We follow Cvijanović's (2014) two stage procedure, using real estate prices as an exogenous regressor for debt issues and real estate asset sales. We find that CEO pay is positively associated to these two actions, which suggests that CEOs are paid for responses to luck.

Next, we test for the presence of pay for luck, taking into account the possibility that CEOs react to the lucky event. To do so, we estimate pay for luck in the standard framework (using market

[2] This is always the case except for two 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 shocks from the analysis, and with the second by adjusting accounting returns for the effect of rental expenses.

performance of the firm) but control for responses to luck using different action variables: accounting performance, debt issues and real estate assets sales. Our estimates of pay for luck, where luck is the change in market value driven by real estate shocks, are not significantly different from zero. In other words, we find no evidence of CEO pay for pure luck when controlling for CEO reactions to luck.[3]

Finally, we use corporate governance to explore cross sectional variation of CEO pay for luck and responses to luck. We use the G-index, institutional ownership and industry concentration as proxies for the quality of corporate governance. Surprisingly, we do not find significant differences of pay for luck across firms with different levels of corporate governance. However, we do find that firms with good corporate governance have higher sensitivity of pay to responses to luck. In fact, for most specifications we find no sensitivity of pay for responses to luck in the subsample of poorly governed firms, which suggests that previous results are driven by the subsample of well governed firms.

Overall, we find significant evidence that firms compensate their managers for responses to lucky events. 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 especially true in well governed firms.

[3] With our identification strategy we still cannot capture the ability of the CEO to forecast, and that compensating for this ability will still be considered pay for luck.

In order to address the concern that house prices might be correlated with some unobserved variable, for instance aggregate demand, we use the inelasticity of land supply as an exogenous regressor for real estate prices. We also address the concern of reverse causality by restricting our analysis to small firms in large areas, where it is less likely that the firm performance can affect real estate prices. To address the concern that the majority of 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 Garcia and Norli (2012).

We contribute to the literature on CEO compensation by providing new insights on pay for luck. We also contribute to the open debate between the managerial power and competitive market views of CEO compensation. There is evidence supporting both views, but neither of the views is fully supported (Frydman and Jenter, 2010). 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, Harford and Li, 2007, Chhaochharia and Grinstein, 2009, Garvey and Milbourn, 2006, and Bebchuk, Grinstein and Peyer 2010). Jenter and Lewellen (2014) and Jenter and Kanaan (2015) document that CEOs are also penalized by bad luck, being fired due to poor firm performance that is not necessarily under their control. We provide a setting where pay for luck is associated with managerial actions and not rent extraction by the CEO. Our paper is also related to the recent literature that links real estate shocks to corporate outcomes (Chaney, Sraer and Thesmar, 2012, and Cvijanović, 2014), real estate prices and household borrowing (Mian and Sufi, 2011), and real estate prices and small business employment (Adelino, Schoar and Severino, 2015).

The remainder of the paper is organized as follows. Section I presents the identification and empirical methodology. Section II shows the data and sample description. Section III presents the main empirical results. Section IV shows additional cross sectional results and presents robustness tests, and section V concludes.

I. Identification and Empirical Methodology

The question whether CEOs are rewarded for lucky events has been addressed in the literature by a large number of studies. The standard approach by Bertrand 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 (action).

By using real estate market shocks we are able to make this distinction, and identify responses to luck. 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, the exact same shock should not be reflected in accounting performance according to US GAAP. Accounting performance is only affected by real estate shocks when the firm takes some action, for instance, when it decides to sell the real estate and then realizes a capital gain (or loss).

We are able 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. We proceed in three steps. In the first step, we follow Bertrand and Mullainathan (2001) and estimate pay for luck using market value of shareholder's equity as our performance measure and real estate prices as our luck variable. We start by estimating the general sensitivity of pay to performance using a standard Ordinary Least Squares (OLS) model to estimate the following equation:

$$y_{it} = \beta * mperf_{it} + \alpha_X * X_{it} + \gamma_i + \chi_t + \varepsilon_{it} \quad (1)$$

Where y_{it} is total CEO compensation in firm i at time t, $mperf_{it}$ is a market performance measure, X_{it} are firm and CEO-specific controls including the book value of real estate assets, γ_i are firm fixed effects, and χ_t are year fixed effects. The coefficient β captures the general sensitivity of pay to performance.

We then estimate the sensitivity of pay to luck using a two stages procedure where real estate prices are used to predict firm performance. In the first stage we estimate the following equation:

$$mperf_{it} = b * hpi_{mt-1} * re_{it-1} + d * hpi_{mt-1} + a_X * X_{it} + g_i + c_t + e_{it} \quad (2)$$

Where $hpi_{mt-1} * re_{it-1}$ represents the luck measure, in this case the level of the House Price Index (HPI)[4] at the MSA m of firm i at time $t-1$ interacted with the book value of real estate assets for firm i at time *t-1*; X_{it} are firm and CEO-specific controls, g_i are firm fixed effects, and

[4] Ideally we would use commercial property prices as a luck variable however this data is not available at the MSA/State level.

c_t are year fixed effects. Our measure of market performance is the change in market value of equity, following Bertrand and Mullainathan (2001). From the first stage estimation we obtain firm performance driven solely by real estate luck. In the second stage, we estimate the sensitivity of pay to changes in predicted firm market performance due to luck using the following equation:

$$y_{it} = \beta_{Luck} * \widehat{mperf}_{it} + \alpha_X * X_{it} + \gamma_i + \chi_t + \varepsilon_{it} \quad (3)$$

The coefficient β_{Luck} captures the sensitivity of pay to changes in performance due to luck, in this case to changes in real estate prices. When β_{Luck} is significantly different from zero it means that a CEO is rewarded for changes in performance driven by luck.

In the second step we follow the same two stages procedure, but we use accounting performance instead of market performance. The first stage is given by the following equation:

$$aperf_{it} = b * hpi_{mt-1} * re_{it-1} + d * hpi_{mt-1} + a_X * X_{it} + g_i + c_t + e_{it} \quad (4)$$

In the second stage we estimate the sensitivity of CEO compensation to the predicted accounting performance:

$$y_{it} = \beta_{Action} * \widehat{aperf}_{it} + \alpha_X * X_{it} + \gamma_i + \chi_t + \varepsilon_{it} \quad (5)$$

In this regression the coefficient β_{Action} measures the sensitivity of CEO pay to responses to luck associated with shocks in real estate prices. Note that changes in accounting performance driven

by real estate shocks can only be associated to action, since the firm cannot mark-to-market real estate assets.

Our measure of accounting performance is *ROA,* 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. We also use debt issues and real estate asset sales as alternative measures for CEO actions.

As a last step, we estimate the sensitivity of pay to luck using market performance while also controlling for accounting performance. To do this, we run two first stages, one to estimate predicted market performance, as in Equation 2, and another to estimate predicted accounting performance, as in Equation 4[5], where the role of *aperf* is to capture any action taken by the CEO in reaction to the real estate shocks. There are two exogenous regressors in the first stages: *hpi* and *hpi* interacted with the real estate of the firm. The first regressor aims to capture oveall changes in real estate prices in a given location, while the second captures these exogenous changes taking into account the exposure of the firm to the real estate market. In the second stage, we are able to disentangle the sensitivity of CEO *pay for luck* from the sensitivity to *reactions to luck*:

[5] Given that our first-stage regression contains two endogenous variables and two exogenous regressors: $b * hpi_{mt-1} * re_{it-1}$ for a firm specific real estate shock and $d * hpi_{mt-1}$ for a general location real estate shock, the estimated coefficients in the second stage will be consistent under a broad set of conditions (Murphy and Topel, 1985).

$$y_{it} = \beta_{Luck} * \widehat{mperf}_{it} + \beta_{Action} * \widehat{aperf}_{it} + \alpha_X * X_{it} + \gamma_i + \chi_t + \varepsilon_{it} \quad (6)$$

In this regression β_{Luck} measures pay for luck after controlling for CEO action, as captured by β_{Action}.

II. Data and Sample Description

This section describes data sources and presents summary statistics. Our initial sample consists of a panel of CEO-firm-years of firms Standard and Poor's (S&P) 1,500 firms drawn from the Execucomp database. 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 to obtained house price data. Following previous literature, we exclude firms in the financial and utilities industries.

We use Execucomp to obtain or calculate the following compensation variables used in our analysis: *cash* compensation, equity compensation, total compensation, tenure, and age.

The real estate exposure variable is defined using the variable real estate asset holdings from Compustat (Compustat items PPENT, PPENME, and PPENLS). 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.

House price data is obtained 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. The data contains a quarterly CBSA-level house-price index for 369 CBSAs from 1986 to 2012. 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.

Our primary dependent variable is total pay, which consists of salary, bonus, value of restricted stock granted, value of options granted, long-term incentive payout, 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.

The final dataset includes 17,041 CEO-firm year observations from 1992-2011. All variables are winsorized at the 1st and 99th percentile values. Table A.I in the Appendix provides variable definitions and data sources.

Table I reports summary statistics of CEO compensation, firm characteristics, and real estate market variables. The average CEO in this sample has a total compensation of 4.5 million dollars. The average cash component is 1.2 million, while the average equity component

corresponds to 3.2 million. These numbers are in line with the literature on CEO compensation using similar data (Chhaochharia and Grinstein, 2009, Fahlenbrach, 2009, and Gopalan, Milbourn, Song, and Thakor, 2014). The average real estate holdings as a percentage of assets is 32%.

[Insert Table 1 Here]

Table II breaks the data into 2 groups: 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 result is mainly driven by higher equity pay.

[Insert Table II Here]

III. Results

This section presents the main results.

A. Pay for Luck

Table III presents our initial test of the effect of real estate prices on CEO pay. We follow the methodology described in Section 2. Column 1 shows the first stage of the two stage procedure, as in Equation 2, where real estate prices hpi_{mt-1} and their interaction with the exposure to real estate markets $hpi_{mt-1} * re_{it-1}$ are the exogenous regressors for market performance (*Log MVE*).

The dependent variable in Columns 2 and 3 is the logarithm of total compensation. Following Bertrand and Mullainathan (2001), all regressions include firm fixed effects, trend and trend quadratics to allow for the positive and non-linear trends in CEO pay over the sample period. We also include age and tenure quadratic terms and control for Tobin's *q*, stock volatility and firm past performance. All standard errors are adjusted for heteroscedasticity and within-firm correlation, using clustered standard errors at the MSA level.

Column 2 shows the results of the OLS estimation of the sensitivity of total CEO pay to general change in the market performance, as measured by *log(MVE)*. The estimated coefficient is 0.34, which suggests that a one percentage point increase in the firm market performance leads to a 0.34 percent increase in CEO pay. Examination of other commonly used firm- and CEO-level characteristics affecting CEO pay indicates that pay is positively associated with stock return volatility and with CEO age. The coefficient on the age quadratic is negative indicating a concave age profile of the CEO pay. Firm tangibility, as measured by *Real Estate Assets* is negatively associated with CEO pay, suggesting that firms with greater exposure to real estate markets pay their CEOs less.

Column 3 shows the pay for luck IV estimation found in Equation 3. As discussed in the previous section, we use MSA-level real estate prices and their interaction with a measure of a firm's real estate holdings (*Real Estate Assets*) as exogenous regressors for performance (measured by *log(MVE)*). The coefficient in Column 4 is 0.50, suggesting that for a one percentage point increase in firm market performance due to luck, pay increases by 0.50 percent.

These results are in line with Bertrand and Mullainathan (2001), who show that pay is as sensitive for general performance as it is for lucky performance, with the economic magnitudes being very similar.

Columns 4 and 5 show the estimates of similar regression using the log of cash compensation as dependent variable. The coefficient in Column 4 is 0.16, suggesting that CEO cash compensation positively reacts to increases in general market performance. As shown in Column 5, there seems to be no sensitivity of cash compensation to luck, as measured by real estate prices. This result is consistent with the idea that pay for luck should come through equity pay. Changes in the market value of a firm's real estate assets affect the firm's stock market value. Similarly, changes in a firm's stock market value affect CEO equity pay. This is not necessarily the case for cash compensation as it might not be directly linked to market performance.

Columns 6 and 7 repeat the same exercises for *log (equity compensation)*. The performance coefficient of 0.49 in Column 6 suggests that for a one percent increase in firm market performance, equity compensation increases by 0.49 percent. The point estimate in Column 7 of 1.43 suggests that for a one percent increase in firm market performance due to luck, CEO equity compensation increases by 1.43 percent. As expected, pay for luck mainly affects equity compensation. In fact, equity pay seems to be even more sensitive to lucky performance than to general performance.

[Insert Table III Here]

B. Pay for Action: Responses to Luck

Table IV tests the sensitivity of CEO pay to reactions to luck. We perform the same tests as in Table III, using accounting performance instead of stock market performance. Column 1 shows the results of the first stage of the two stage procedure, as in Equation 4. In the first stage, the dependent variable is accounting performance *(ROA)*, and the exogenous regressors are lagged *HPI,* hpi_{mt-1}, and the interaction of lagged *HPI* with *Real Estate Assets,* $hpi_{mt-1} * re_{it-1}$. The sensitivity of accounting performance to real estate prices is positive and significant, which points towards CEOs responding to real estate shocks. The associated F-statistic is 79.84, suggesting that our instrument is not weak. Column 2 shows the estimates of an OLS regression of the log of *Total compensation* on accounting performance. The point estimate suggests that for a one percent increase in accounting performance CEO pay increases by 0.60percent. Column 3 shows the second stage of the two stage procedure, as in Equation 5, and suggests that CEO pay responds to changes in accounting performance that are driven by real estate prices. The coefficient is 6.9, which is larger than the OLS estimate. For a one percent change in accounting performance driven by real estate shocks, CEO compensation increases by 6.9%. This result suggests that pay is more sensitive to CEO responses to luck than to general accounting performance. But in fact, once we consider the distribution of predicted ROA, for a one standard deviation change in predicted ROA (0.046) the effect in compensation is 0.31. This magnitude is very similar to the one using predicted value of market performance: for a one standard deviation change in predicted market performance (0.56) the effect in compensation is

0.28. The results are very similar when using cash compensation (columns 4 and 5) and equity compensation (columns 6 and 7), both are positively and significantly correlated with accounting performance predicted by real estate shocks. This was not the case with market performance where only equity compensation was significant. This result is consistent with the fact that stock market performance reacts to real estate shocks irrespective of action, and therefore the link between stock market performance and equity compensation is mechanical. Overall, the results in Table IV point towards CEOs being rewarded for action.

[Insert Table IV Here]

We use ROA predicted by real estate prices in our aim to be comprehensive and capture all actions the CEO might take as a response to a luck event. However, because there might be omitted variation correlated with both ROA and real estate shocks, we also study alternative CEO responses to luck. Specifically, we focus on debt issues and real estate assets sales.

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 debt capacity of the firm. 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 or doing a sale-and-lease back transaction. 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. Table V shows the results.

Column 1 shows the first stage of the two stage procedure, as in Equation 4, where *log(debt)* uses hpi_{mt-1} and $hpi_{mt-1} * re_{it-1}$, as its exogenous regressors. The interaction term is positively correlated with debt issues, which is consistent with Cvijanović (2014), who finds that firms react to a positive shock to the value of their collateral by increasing their debt holdings. The associated F-statistic in the first stage is 26.75, suggesting that our instrument is not weak. The dependent variable in Columns 2 and 3 is total compensation. Column 2 shows the OLS estimate (0.05) and column 3 shows the two stage estimate (0.97), as in Equation 5, with both coefficients being statistically significant.

Columns 4-6 repeat the same exercise with real estate asset sales. Column 4 shows the results of the first stage regression, as in Equation 4, where the dependent variable is negative changes in real estate assets (asset sales). As expected, we find a positive and significant correlation between real estate asset sales and prices. The associated F-statistic is 51.57, suggesting that our instrument is not weak. The dependent variable in Columns 5 and 6 is total compensation. We find that compensation is positively associated with real estate asset sales in general (with a point estimate of 0.21), but also to the ones driven by prices as in Equation 5 (with a point estimate of 0.83).

[Insert Table V Here]

The results with specific actions confirm our previous results with ROA: CEO compensation is associated with responses to lucky events, specifically to debt issues and sale of real estate property.

C. Can "Pay for Action" Explain "Pay for Luck"?

Table VI examines the effect of luck on CEO pay while controlling for CEO reactions to luck using ROA, debt issues, and real estate asset sales as described in the previous section.

Columns 1 and 2 show the first stage of the two stage procedure, where we use MSA-level real estate prices hpi_{mt-1} and their interaction with a measure of a firm's real estate holdings, $hpi_{mt-1} * re_{it-1}$, as exogenous regressors for both market and accounting performance (measured by ROA). Columns 3 and 4 show the first stage for debt issues and asset sales. There is a positive correlation between the market value of real estate and both accounting and market performance, debt issue and asset sales. The second stages, as in Equation 6, are shown in columns 5-7. CEO pay for luck (i.e., the sensitivity of pay to market performance driven by real estate prices) is insignificant when controlling for observable CEO reactions to luck: ROA (column 5), debt issues (column 6), and real estate property sales (column 7). All common firm- and CEO-level characteristics (unreported) enter the specification with expected signs.

The coefficients on predicted ROA and asset sales are statistically significant, unlike the coefficient for debt issues. When we restrict the sample to positive shocks (see Table IA II in the internet appendix) the results are similar in signs and magnitudes, but all of the "action" variable's coefficients, including debt issues become statistically significant. This suggests that CEOs tend to react more to positive real estate shocks, which is in line with the literature on the collateral channel (Chaney, Sraer and Thesmar, 2012, and Cvijanović, 2014).

[Insert Table VI Here]

The results in Table VI indicate that when taking into account CEO actions in response to lucky events, there is no pay for pure luck, as measured by increases in the market value of firms' real estate holdings.

D. Corporate Governance and Pay for Luck

In this subsection we explore the heterogeneity of CEO pay for luck with respect to firm corporate governance characteristics. In particular, we want to see if there is a different sensitivity of CEO pay to real estate related luck with respect to firm governance.

Table VII displays real estate related pay for luck with respect to three measures of corporate governance: the G-index, and institutional ownership, and industry concentration. Gompers, Ishii and Metrick (2003) constructed the G-Index from data compiled by the Investor Responsibility Research Center ("IRRC"). A firm's score is based on the number of shareholder rights-decreasing provisions a firm has, such as poison pills, golden parachutes, supermajority rules to approve mergers, staggered boards, and limitations of shareholders' ability to call special meeting. The index ranges from a feasible low of 0 to a high of 24. A high G-Score is associated with weak shareholder rights, that is, poor corporate governance while a low G-Score is related to good corporate governance.

Panel A and B of Table VII show the results for *Low G* and *High G* firms. The results in Columns 1 and 3 show a slightly lower sensitivity of pay for market performance in the *Low G*

subsample (0.295) when compared to *High G* (0.357). The second stage estimate of pay for luck in Columns 2 and 4 suggest that only *Low G* firms pay their CEOs for real estate luck.

The results on pay for luck are very similar when using our other governance measures. We find significant pay for luck in firms with high institutional ownership and in firms with low industry concentration, but not in firms with low institutional ownership or high industry concentration.

[Insert Table VII Here]

These results are surprising because well governed firms are the ones rewarding their CEOs for real estate luck. We further investigate this issue to test whether these results can be explained by responses to luck. The results are shown in Table VIII.

We replicate the tests in Tables IV and V, where we test if firms pay their CEOs for responses to luck. We use ROA, debt issues and real estate assets sales to identify "pay for action". Panel A and B of Table VIII show the results for *Low G* and *High G* firms. We find significant evidence of pay for action in both subsamples, but the point estimates are larger for subsample of *Low G* firms.

Panels C and D show the results for the subsamples of *High IO* and *Low IO*. We find evidence of pay for action in the subsample of high institutional ownership firms. When using ROA, the coefficient is significant in both samples, but the point estimate is larger in the well governed firms. The results using industry concentration are in Panels E and F. We only find significant evidence of pay for responses to luck in the subsample of low industry concentration.

[Insert Table VIII Here]

To summarize, we find evidence of pay for luck in the subsamples of well governed firms. However, this seems to be explained by pay for responses to luck.

IV. Discussion and Robustness

In this section we present several robustness tests to our main results and discuss some of the concerns with the previous analysis.

A. Using Land Supply Elasticity as an Exogenous Regressor for Real Estate Prices

A major concern with the previous analysis is the validity of real estate prices as an exogenous regressor for firm performance. For real estate prices to be a valid exogenous independent variable they must be correlated with CEO compensation only through the value of the firm's real estate and not through other channels, for instance, an aggregate demand shock. To account for this possibility, we use the lagged value of hpi_{mt} predicted by land supply elasticity (Saiz, 2010) of the MSA *m* interacted with the national Case-Shiller House Price Index at time *t*; and the lag of predicted hpi_{mt} interacted with firm specific Real Estate Assets to estimate Log(MVE), ROA and Log(Debt). Our results of estimating Equation 6 in this way are shown in Table IX.

Columns 1- 4 present our estimates from the first stages. The dependent variable in Columns 5-8 is the log of total compensation. The independent variable of interest in Column 5 is market performance, and the coefficient is 1.06. This suggests that previous results on pay for real estate luck are robust to using land supply elasticity as a source of exogenous variation in real estate prices. The results in Columns 6-8 show the results on pay for responses to luck using ROA, debt issues, and asset sales. All point estimates are positive and statistically significant, consistent with the notion that CEOs are rewarded for responding to real estate shocks, for instance, by issuing debt or by selling real estate assets.

[Insert Table IX Here]

These results alleviate the concern that previous results were driven by an aggregate demand shock, affecting both real estate prices and market performance of the firm.

B. Other Robustness Tests

We test for asymmetric effects of real estate shocks on CEO compensation. We run our baseline regressions where we allow for different sensitivities of firm performance and compensation to positive and negative real estate shocks. Tables IAI and IAII, in the internet appendix, show the results.

In Table IAI we run our tests on pay for responses to luck using ROA for two subsamples taking into account positive and negative real estate shocks. We find that pay for responses to luck is mainly associated with positive shocks. This is consistent with the notion that it is easier and

more common for the CEO to respond by issuing debt or doing a sale-and-leaseback transaction than to buy real estate.

We also try to disentangle pay for luck from pay for action in the samples of positive and negative real estate shocks. In Table IAII, we do not find pay for luck in either subsample once we control for action. Moreover, the only significant evidence of pay for responses to luck occurs in the subsample of positive real estate shocks.

One concern with our identification strategy is that ROA might be affected by real estate price changes, even when the CEO takes no action. This could be the case when extreme negative changes in real estate prices occur and the firm recognizes asset impairment.[6] However, the fact that our results are robust to using only the sample of positive real estate socks suggests that previous results are not driven by real estate assets impairment due to extremely negative shocks of real estate prices.

In Table IAIII we run our baseline specification using a state weighted *HPI* for each firm based on its real estate holdings instead of only 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). To measure the degree of firm geographic concentration, García and Norli (2012) extract state name counts from annual reports filed with the SEC on

[6] See SFAS 121 on the impairment of real estate assets.

Form 10 K. The 10 K statement gives information on the firm's real estate holdings, such as factories, warehouses, and sales offices. For example, firms may include sales at stores in different states, and/or list the manufacturing facilities they operate together with the city and state where they are located. The authors parsed of all 10 Ks filed with the SEC during the period 1994 through 2008, yielding 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. These relative exposures (or weights) are then interacted with corresponding state level land prices and summed at the firm-year level, to give a weighted firm real estate exposure to each state where it operates. Results from replicating the tests of Table IV with this revised measure of real estate market values are shown in Table IAIII. The results are consistent with our previous analysis, with ROA predicted by real estate shocks being positively and significantly correlated with CEO compensation.

A possible concern with the previous analysis is a reverse causality argument, where large firms are able to affect real estate prices in given geographical areas. In this case, real estate prices would not be a valid exogenous regressor for firm performance. To account for this possibility we exclude large firms operating in small geographical areas and run the same tests as in Table IV. More precisely, we restrict our sample to firms belonging to the bottom three quartiles of the size distribution, whose headquarters are located in one of the top 30 MSAs based on the MSA rank by population as of July 1, 2012, as estimated by the United States Census Bureau. Results are shown in Table IAIV, and are similar in nature to the ones in Table IV.

C. Do responses to luck create value to shareholders?

It only makes sense for the board to incentive 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 the optimality of such actions because we do not observe the counterfactual, we can still evaluate if on average responses to real estate luck add value to shareholders. We perform an event study around sale-and-leaseback (SLB) transaction announcement dates and find significant positive abnormal returns, suggesting that indeed this CEO action creates value. Table X shows the results. We find that SLB transactions in general generate significant cumulative abnormal returns (CAR) between 1.3 and 1.4 percent. When restricting the sample to SLB of real estate assets only CAR are between 2.1 and 2.3 percent. As for SLB that occur as response to increases in real estate prices we find CAR between 1.9 and 2 percent. These results are consistent with the idea that incentivizing managers to respond to real estate luck might be optimal.

[Insert Table X Here]

VI. Conclusion

In this paper we show evidence that CEOs are rewarded for responding to lucky events. We also show that pay for luck, as typically measured, can be explained by these responses to luck. We propose a novel identification 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. 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 reactions to luck and not purely for lucky events, at least when it comes to luck associated with the real estate market.

This paper brings a new perspective on the topic of *pay for luck*, and contributes to the active debate on CEO compensation. We show how pay for luck might not necessarily be consistent with the hypothesis of rent extraction by the CEO. In fact, well governed firms seem to be the ones that rewarding their CEOs for responses to luck.

Appendix A.

Table AI
Variables Definition

CEO Level Variables	
Total Compensation	Total CEO pay in thousand $, which consists of salary, bonus, value of restricted stock granted, value of options granted, longterm incentive payout, and other compensation (Execucomp TDC1).
Cash Compensation	Salary plus bonus in thousand $ (Execucomp TOTAL_CURR).
Equity Compensation	Value of restricted stock granted plus value of options granted in thousand $ (Execucomp RSTKGRNT + OPTION_AWARDS_BLK_VALUE).
Equity Percentage	Equity compensation divided by total compensation.
CEO Age	Age of CEO in years (RiskMetrics).
CEO Tenure	Number of years as CEO in the current position (RiskMetrics).
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).
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	Plant, Property, & Equipment less Plant, Property, & Equipment Machinery, Equipment and Leases, divided by total assets (Compustat (PPENT-PPENME-PPLENLS) / AT).
HPI	Level of the House Price Index for a particular Core Based Statistical Area (Federal Housing Finance Association).

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TABLES

Table I
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 – 2011 inclusive. All variables are winsorized at the 1st and 99th percentile values. Variable definitions are as defined in the Appendix.

	Mean	Median	St. Dev.	Min	Max	N
Total compensation	4,488.86	2,510.24	5,498.17	168.41	33,228.69	17,041
Cash compensation	1,210.62	910.00	1,049.41	3.00	7,000.00	17,041
Equity compensation	3,246.33	1,380.12	4,866.58	0.00	29,424.73	17,041
Equity percentage	0.54	0.59	0.28	0.00	0.98	17,018
Size	4,068.20	1,564.18	5,252.93	237.30	16,502.00	17,041
Market value of equity	6,743.72	1,477.46	15,769.93	22.98	96,326.57	17,041
Tobin's q	1.91	1.51	1.22	0.75	8.35	17,041
ROA	0.05	0.06	0.11	-0.55	0.31	17,041
Volatility	0.11	0.10	0.06	0.03	0.39	17,041
Stock return	0.13	0.08	0.48	-0.83	2.37	17,041
Ebit	623.11	134.65	1,491.18	-286.00	10,375.00	16,873
Real Estate Assets	0.32	0.26	0.23	0.00	0.97	17,041
Hpi	15.72	14.59	5.17	8.53	36.34	17,041
CEO age	56.16	56.00	7.25	30.00	95.00	16,331
CEO tenure	2,746.27	1,887.00	2,868.74	-5,723.00	22,187.00	16,503

Table II
CEO Compensation and Real Estate Assets Intensity: Mean Differences

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. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	Low Real Estate Assets	High Real Estate Assets	Difference	t-stat	
Total compensation	4,766.28	4,271.52	494.75	5.84	***
Cash compensation	1,214.98	1,207.19	7.79	0.48	
Equity compensation	3,497.87	3,049.27	448.60	5.98	***
Equity percentage	0.55	0.53	0.03	6.21	***
N	7,486	9,555			

Table III
Pay for Luck

This table presents estimates of OLS and two stage regressions of the logarithm of CEO total, cash, and equity compensation on the logarithm of the market value of firm equity (MVE) and other CEO and firm level control variables. The two stage regressions use the lag of Hpi and the lag of Hpi multiplied by Real Estate (R.E.) Assets to estimate the logarithm of MVE, following Bertrand and Mullainathan (2001). 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 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. All regressions include firm fixed effects, a trend, and a quadratic trend variable. 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.

	1st:	Log(*Total comp*)		Log(*Cash comp*)		Log(*Equity comp*)	
	Log(*MVE*)	OLS	2S	OLS	2S	OLS	2S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Hpi_{(t-1)}$	-0.000						
	[-0.097]						
*R.E. Assets*Hpi*$_{(t-1)}$	0.024**						
	[2.240]						
Log(MVE)		0.338***	0.502**	0.155***	-0.141	0.493***	1.430*
		[23.142]	[2.322]	[10.316]	[-0.551]	[13.933]	[1.815]
Real Estate Assets	-0.855***	-0.402***	-0.305*	-0.338***	-0.511***	-0.342	0.205
	[-5.375]	[-3.792]	[-1.934]	[-4.568]	[-2.635]	[-1.331]	[0.364]
Tobin's q	0.323***	0.007	-0.047	0.014	0.110	-0.010	-0.314
	[17.841]	[0.562]	[-0.680]	[1.328]	[1.403]	[-0.340]	[-1.301]
Volatility	-2.778***	0.850***	1.309**	-0.431***	-1.255*	1.745***	4.365*
	[-14.170]	[4.707]	[2.069]	[-4.863]	[-1.743]	[4.766]	[1.945]
Stock return$_{(t-1)}$	-0.000***	-0.000***	-0.000***	0.000**	0.000	-0.001***	-0.001***
	[-7.945]	[-7.624]	[-4.936]	[2.173]	[0.784]	[-19.913]	[-6.196]
$ROA_{(t-1)}$	1.184***	0.220***	0.027	-0.204**	0.143	0.525***	-0.577
	[10.949]	[2.642]	[0.102]	[-2.571]	[0.464]	[2.843]	[-0.594]
CEO age	0.030	0.031	0.026	0.033**	0.042***	0.096**	0.065
	[1.570]	[1.383]	[1.133]	[2.402]	[2.580]	[2.137]	[1.215]
CEO age squared	-0.000	-0.000	-0.000	-0.000**	-0.000**	-0.001**	-0.001
	[-1.568]	[-1.585]	[-1.352]	[-2.172]	[-2.368]	[-2.490]	[-1.565]
CEO tenure	0.000	0.000	0.000	0.000***	0.000***	-0.000	-0.000
	[1.484]	[1.171]	[0.889]	[3.182]	[3.347]	[-0.455]	[-0.789]
CEO tenure squared	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	[0.190]	[-0.778]	[-0.804]	[-1.293]	[-1.135]	[-0.675]	[-0.674]
F-test	102.70						
Observations	14,78	14,078	14,078	14,042	14,042	14,091	14,091
R-squared	0.398	0.292	0.233	0.158	0.128	0.187	0.164

Table IV
Pay for Action: Responses to Luck

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total, cash, and equity compensation on ROA and other CEO and firm level control variables. The two stage regressions use the lag of Hpi and the lag of Hpi multiplied by Real Estate (R.E.) Assets to estimate ROA, following Bertrand and Mullainathan (2001). 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 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. All regressions include firm fixed effects, a trend, and a quadratic trend variable. 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.

	1st:	Log(*Total comp*)		Log(*Cash comp*)		Log(*Equity comp*)	
	ROA	OLS	2S	OLS	2S	OLS	2S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Hpi_{(t-1)}$	-0.002***						
	[-2.733]						
*R.E. Assets*Hpi*$_{(t-1)}$	0.004***						
	[4.519]						
ROA		0.594***	6.924***	0.642***	6.098***	0.630***	8.478***
		[5.631]	[3.723]	[9.356]	[2.909]	[2.606]	[2.648]
R. E. Assets	-0.112***	-0.563***	-0.153	-0.388***	-0.039	-0.591**	-0.077
	[-5.057]	[-4.559]	[-0.799]	[-5.248]	[-0.265]	[-2.168]	[-0.205]
q	0.024***	0.102***	-0.057	0.048***	-0.088*	0.134***	-0.063
	[15.050]	[9.985]	[-1.142]	[5.260]	[-1.767]	[6.181]	[-0.754]
Volatility	-0.286***	0.066	1.778***	-0.688***	0.792*	0.529	2.662***
	[-8.621]	[0.284]	[3.476]	[-6.830]	[1.704]	[1.276]	[2.942]
Stock return$_{(t-1)}$	-0.000*	-0.000***	-0.000	0.000*	0.000	-0.001***	-0.001***
	[-1.916]	[-7.877]	[-0.825]	[1.741]	[1.637]	[-21.295]	[-7.577]
$ROA_{(t-1)}$	0.174***	0.513***	-0.584	-0.132*	-1.061**	0.993***	-0.367
	[9.481]	[6.577]	[-1.593]	[-1.917]	[-2.356]	[5.119]	[-0.599]
CEO age	0.002	0.041*	0.029	0.037**	0.026	0.111**	0.096**
	[1.090]	[1.678]	[1.141]	[2.496]	[1.397]	[2.347]	[1.970]
CEO age squared	-0.000	-0.000*	-0.000	-0.000**	-0.000	-0.001***	-0.001**
	[-1.221]	[-1.835]	[-1.267]	[-2.259]	[-1.191]	[-2.651]	[-2.262]
CEO tenure	0.000	0.000	0.000	0.000***	0.000***	-0.000	-0.000
	[0.930]	[1.537]	[0.929]	[3.380]	[2.762]	[-0.197]	[-0.442]
CEO tenure squared	0.000	-0.000	-0.000	-0.000	-0.000*	-0.000	-0.000
	[0.549]	[-0.709]	[-1.005]	[-1.294]	[-1.690]	[-0.667]	[-0.823]
F-test	79.84						
Observations	14,078	14,078	14,078	14,042	14,042	14,091	14,091
R-squared	0.148	0.238	0.237	0.141	0.134	0.165	0.165

Table V
Pay for Action: Debt Issues and Real Estate Assets Sales

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total, compensation on Log(Debt), Real Estate (R.E.) Sales and R.E. Purchases. All specifications include CEO and firm level control variables: R.E. Assets, Tobin's q, Volatility, Stock Return, Lagged ROA, CEO age, CEO age squared, CEO tenure and CEO tenure squared. The two stage regressions use the lag of Hpi and the lag of Hpi multiplied by R.E. Assets to estimate Log(Debt), R.E. Sales and R.E. Purchases. The sample consists of all firms in Execucomp and Compustat for which R.E. Assets data and Hpi data is available for the years 1992 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. All regressions include firm fixed effects, a trend, and a quadratic trend variable. 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.

	1st:	Log(*Total comp*)		1st:	Log(*Total comp*)	
	Log(*Debt*)	OLS	2S	*R.E. Assets Sales*	OLS	2S
	(1)	(2)	(3)	(4)	(5)	(6)
Hpi (t-1)	-0.009			-0.007***		
	[-1.053]			[-10.763]		
*R. E. Assets*Hpi (t-1)*	0.029*			0.028***		
	[1.974]			[13.523]		
Log(Debt)		0.049***	0.965**			
		[8.173]	[1.982]			
R.E.Assets Sales					0.207**	0.838***
					[2.289]	[2.717]
F-test	26.75			51.57		
Observations	14,078	14,078	14,078	7,802	7,802	7,802
R-squared	0.132	0.239	0.236	0.276	0.242	0.245

Table VI
Pay for Luck Controlling for Responses to Luck

The table presents estimates of two stage panel regressions of the logarithm of CEO total, compensation on Log(MVE) and ROA, Log(Debt), and Real Estate (R.E.) Sales. All specifications include CEO and firm level control variables: R.E. Assets, q, Volatility, Stock Return, Lagged ROA, CEO age, CEO age squared, CEO tenure and CEO tenure squared. The two stage regressions use the lag of Hpi and the lag of Hpi multiplied by R.E. Assets to estimate Log(Debt), and R.E. Sales. The sample consists of all firms in Execucomp and Compustat for which R.E. Assets data and Hpi data is available for the years 1992 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. All regressions include firm fixed effects, a trend, and a quadratic trend variable. 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.

	1st:						
	Log(*MVE*)	*ROA*	Log(*Debt*)	*R.E. Assets Sales*	Log(T*otal comp*)		
	(1)	(2)	(3)	(4)	(6)	(7)	(8)
ROA					9.149***		
					[2.835]		
Log(Debt)						1.970	
						[1.058]	
R.E. Assets Sales							2.854*
							[1.697]
Hpi (t-1)	-0.000	-0.002***	-0.009	-0.007***			
	[-0.097]	[-2.733]	[-1.053]	[-10.763]			
*R.E. Assets*Hpi (t-1)*	0.024**	0.004***	0.029*	0.028***			
	[2.240]	[4.519]	[1.974]	[13.523]			
Log(MVE)					-0.653	-1.436	-2.297
					[-1.246]	[-0.755]	[-1.411]
F-test	102.70	79.84	26.75	51.57			
Observations	14,078	14,078	14,078	14,059	14,078	14,078	14,074
R-squared	0.398	0.148	0.292	0.276	0.237	0.237	0.237

Table VII
Pay for Luck and Firm Governance

The table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total compensation on PPE and other CEO and firm level control variables. The two stage regressions use the lag of HPI and the lag of HPI multiplied by PPE as the exogenous regressors to estimate the logarithm of MVE. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PPE) data is available for the years 1992 – 2011 inclusive. Panels are differentiated by whether firms have below/above median Gompers, Ishii, and Metrick (2003) Governance Index (G-Index) or below/above median institutional ownership. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroskedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	(1)	(2)	(3)	(4)
	Panel A: Low g		*Panel B: High g*	
Log(MVE)	0.295***	0.455*	0.357***	0.204
	[12.222]	[1.916]	[21.289]	[0.526]
Observations	6,319	6,319	7,636	7,636
R-squared	0.215	0.177	0.324	0.261
	Panel C: High IO		*Panel D: Low IO*	
Log(MVE)	0.299***	0.538*	0.293***	0.547
	[13.068]	[1.943]	[7.646]	[1.261]
Observations	5,673	5,673	5,151	5,151
R-squared	0.188	0.153	0.185	0.141
	Panel F: Low hhi		*Panel E: High hhi*	
Log(MVE)	0.319***	0.479*	0.319***	0.068
	[11.106]	[1.739]	[19.461]	[0.178]
Observations	7,389	7,389	6,581	6,581
R-squared	0.302	0.263	0.260	0.205

Table VIII
Pay for Responses to Luck and Firm Governance

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total compensation on PPE and other CEO and firm level control variables. The two stage regressions use the lag of HPI and the lag of HPI multiplied by PPE as the exogenous regressors to estimate the logarithm of MVE. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PPE) data is available for the years 1992 – 2011 inclusive. Panels are differentiated by whether firms have below/above median Gompers, Ishii, and Metrick (2003) Governance Index (G-Index) or below/above median institutional ownership. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroskedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Low g			Panel B: High g		
ROA	6.812**			5.329***		
	[2.480]			[2.830]		
Log(Debt)		0.809			0.552*	
		[1.401]			[1.915]	
R.E. Sales			1.062***			0.593**
			[3.276]			[2.296]
Observations	6,319	6,319	6,319	7,636	7,636	7,636
R-squared	0.174	0.171	0.172	0.262	0.262	0.262
	Panel C: High IO			Panel D: Low IO		
ROA	8.417***			3.414*		
	[2.774]			[1.727]		
Log(Debt)		0.161			-0.967	
		[0.804]			[-0.779]	
R.E. Sales			0.875**			0.510
			[2.402]			[1.553]
Observations	5,673	5,673	5,673	5,151	5,151	5,151
R-squared	0.152	0.148	0.076	0.142	0.143	0.142
	Panel E: Low hhi			Panel F: High hhi		
ROA	10.242*			2.008		
	[1.917]			[1.178]		
Log(Debt)		1.268**			0.218	
		[2.003]			[0.688]	
R.E. Sales			1.005***			0.371
			[4.113]			[1.101]
Observations	7,389	7,389	7,389	6,581	6,581	6,581
R-squared	0.264	0.264	0.032	0.206	0.206	0.206

Table IX
Inelasticity of Land Supply

This table presents estimates of two stage panel regressions of the Log(Total Compensation) on Log(MVE), ROA, Log(Debt) and Real Estate (R.E.) Assets Sales. All specifications include CEO and firm level control variables: R.E. Assets, q, Volatility, Stock Return, Lagged ROA, CEO age, CEO age squared, CEO tenure and CEO tenure squared. The two stage regressions use the lag of HPI predicted by land supply elasticity and the Case-Shiller House Price Index and the lag of predicted HPI multiplied by Real Estate Assets to estimate Log(MVE), ROA and Log(Debt). It then includes the predicted Log MVE and ROA as independent variables. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PP&E) data is available for the years 1992 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. All regressions include firm fixed effects, a trend, and a quadratic trend variable. 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.

	1st:							
	Log(MVE)	ROA	Log(Debt)	R.E. Assets Sales	Log (Total comp)			
	(1)	(3)	(5)	(7)	(2)	(4)	(6)	(8)
Log(MVE)					1.064***			
					[3.405]			
ROA						7.538***		
						[3.925]		
Log(Debt)							0.653***	
							[2.833]	
R.E. Assets Sales								1.199***
								[4.159]
Predicted Hpi(t-1)	-0.012***	-0.002***	-0.011	-0.009***				
	[-3.261]	[-2.920]	[-1.210]	[-17.426]				
R.E. Assets Predicted Hpi (t-1)*	0.033***	0.005***	0.048***	0.029***				
	[2.791]	[4.871]	[3.186]	[15.687]				
F-test	107.23	63.37	28.43	107.02				
Observations	13,129	13,129	13,129	13,129	13,129	13,129	13,129	13,129
R-squared	0.398	0.150	0.137	0.250	0.237	0.237	0.236	0.237

Table X
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)	1.27%	194/164	4.183***
CAR (-2,2)	1.34%	192/166	3.583***
CAR (-3,3)	1.37%	192/166	3.382***
Sale-Leasebacks of Real Estate only (N = 206)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	2.05%	115/91	4.349***
CAR (-2,2)	2.29%	117/89	3.744***
CAR (-3,3)	2.16%	111/95	3.153***
Sale-Leasebacks of Headquarters only (N = 69)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	0.94%	39/30	1.895**
CAR (-2,2)	1.12%	44/25	2.019**
CAR (-3,3)	0.19%	40/29	1.272
Sale-Leasebacks following positive real estate shocks (N = 240)			
	Mean	Pos/Neg	Patell Z
CAR (-1,1)	1.85%	127/113	3.525***
CAR (-2,2)	2.04%	126/114	2.777***
CAR (-3,3)	1.87%	122/118	2.519***

Internet Appendix for
"When Pay for Luck is Pay for Action: CEO Compensation and Real Estate Prices"

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Table IA I
Pay for Responses to Luck: Positive and Negative Real Estate Shocks

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total, cash, and equity compensation on Return on Assets (ROA) and other CEO and firm level control variables. The two stage regressions use the lag of HPI and the lag of HPI multiplied by PP&E to estimate ROA following Bertrand and Mullainathan (2001). The table is broken out into two panels: positive RE shocks and negative RE shocks. Positive/Negative RE shock is defined as one if HPI has increases/decreases year-over-year and zero otherwise. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PP&E) data and HPI data is available for the years 1992 – 2011 inclusive. The control variables included can be seen in Table 4. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	Total	1st:	Log (Total Comp)		Log (Cash Comp)		Log (Equity Comp)	
	Comp	ROA	OLS	2S	OLS	2S	OLS	2S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Positive shocks							
Hpi(t-1)	-0.001***	-0.000*						
	[-3.815]	[-1.694]						
*R.E. Assets*Hpi(t-1)*	0.002**	0.000***						
	[2.314]	[2.616]						
ROA	0.644***		0.662***	8.847**	0.849***	5.637*	0.694*	13.508*
	[4.094]		[4.264]	[2.045]	[8.936]	[1.739]	[1.948]	[1.935]
Observations	10,334	10,334	10,334	10,334	10,304	10,304	10,340	10,340
R-squared	0.213	0.147	0.211	0.208	0.173	0.155	0.114	0.114
	Panel B: Negative shocks							
Hpi(t-1)	-0.000	-0.002**						
	[-0.030]	[-2.019]						
*R.E. Assets*Hpi(t-1)*	0.005	0.007***						
	[0.413]	[3.693]						
ROA	0.496***		0.502***	1.223	0.174**	0.367	0.715**	3.028
	[3.756]		[3.842]	[0.646]	[2.575]	[0.262]	[2.451]	[0.741]
F-test		70.57						
Observations	3,520	3,520	3,520	3,520	3,516	3,516	3,525	3,525
R-squared	0.265	0.102	0.265	0.259	0.030	0.027	0.245	0.242

Table IA II
Pay for Luck Controlling for Responses to Luck: Positive and Negative Real Estate Shocks

This table presents estimates of two stage panel regressions of the logarithm of CEO total, compensation on Log(MVE) and ROA, Log(Debt), and Real Estate (R.E.) Sales. All specifications include CEO and firm level control variables: R.E. Assets, q, Volatility, Stock Return, Lagged ROA, CEO age, CEO age squared, CEO tenure and CEO tenure squared. The two stage regressions use the lag of Hpi and the lag of Hpi multiplied by R.E. Assets to estimate Log(Debt), and R.E. Sales. The table is broken out into two panels: positive RE shocks and negative RE shocks. Positive/Negative RE shock is defined as one if HPI has increases/decreases year-over-year and zero otherwise. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PP&E) data and HPI data is available for the years 1992 – 2011 inclusive. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	1st:						
	Log (MVE)	ROA	Log (Debt)	R.E. Asset Sales	Log(Total Comp)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: positive shocks						
ROA					8.982*		
					[1.856]		
Log(Debt)						0.552**	
						[2.094]	
R.E. Asset Sales							1.075*
							[1.823]
Hpi(t-1)	0.010*	-0.001*	-0.023*	-0.007***			
	[1.851]	[-1.694]	[-1.843]	[-8.107]			
*R.E. Assets*Hpi(t-1)*	0.020*	0.003***	0.048***	0.034***			
	[1.670]	[2.616]	[2.706]	[14.619]			
Log(MVE)					-0.217	-0.278	-0.790*
					[-0.519]	[-0.966]	[-1.805]
F-test	93.59	70.57	24.64	238.00			
Observations	10,334	10,334	10,334	10,334	10,334	10,334	10,334
R-squared	0.439	0.147	0.119	0.279	0.208	0.208	0.208
	Panel B: negative shocks						
ROA					0.918		
					[0.430]		
Log(Debt)						-0.606	
						[-0.199]	
R.E. Asset Sales							0.234
							[0.450]
Hpi(t-1)	0.003	-0.002**	0.004	-0.008***			
	[0.496]	[-2.019]	[0.229]	[-7.422]			
*R.E. Assets*Hpi(t-1)*	0.011	0.007***	-0.006	0.025***			
	[0.841]	[3.693]	[-0.264]	[8.388]			
Log(MVE)					0.203	-0.278	0.241
					[0.257]	[-0.966]	[0.333]
F-test	57.29	10.67	17.37	16.70			
Observations	3,520	3,520	3,520	3,520	3,520	3,520	3,520
R-squared	0.380	0.102	0.127	0.227	0.259	0.259	0.259

Table IA III
State Home Price Index

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total, cash, and equity compensation on logarithm of the market value of firm equity (MVE), Return on Assets (ROA) and other CEO and firm level control variables. The two stage regressions use the lag of State HPI and the lag of State HPI multiplied by PP&E to estimate Log of MVE and ROA following Bertrand and Mullainathan (2001). The State HPI is calculated using state-level data on firms' operations within each state, obtained from García and Norli (2012), multiplied by each state's HPI obtained from the Lincoln Institute of Land policy. The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PP&E) data and HPI data is available for the years 1992 – 2011 inclusive. All regressions include year quadratic and firm fixed effects. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	1st:	Log(Total Comp)		Log(Cash Comp)		Log(Equity Comp)	
	ROA	OLS	2S	OLS	2S	OLS	2S
	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Hpi(t-1)	-0.012						
	[-1.497]						
R.E. Assets							
**State Hpi(t-1)*	0.075***						
	[4.794]						
ROA		0.594***	3.386**	0.642***	1.570	0.630***	5.082*
		[5.631]	[2.401]	[9.356]	[1.589]	[2.606]	[1.710]
F-test	83.31						
Observations	10,337	14,078	10,337	14,042	10,307	14,091	10,343
R-squared	0.148	0.238	0.182	0.141	0.130	0.165	0.115

Table IA IV
Small Firms in Large MSAs

This table presents estimates of OLS and two stage panel regressions of the logarithm of CEO total, cash, and equity compensation on logarithm of the market value of firm equity (MVE), Return on Assets (ROA) and other CEO and firm level control variables. The two stage regressions use the lag of HPI and the lag of HPI multiplied by PP&E to estimate Log of MVE and ROA following Bertrand and Mullainathan (2001). The sample consists of all firms in Execucomp and Compustat for which Plant, Property & Equipment (PP&E) data and HPI data is available for the years 1992 – 2011 inclusive and belonging to the bottom three quartiles of the size distribution whose headquarters are located in one of the top 30 MSAs based on the MSA rank by population. All regressions include year quadratic and firm fixed effects. All variables are winsorized at the 1th and 99th percentile values. The standard errors are robust to heteroscedasticity and clustered at the firm level. Variable definitions are as defined in the Appendix. Asterisks indicate statistical significance at the 1% (***), 5% (**), or 10% (*) level.

	Total	1st:	Log (Total Comp)		Log (Cash Comp)		Log (Equity Comp)	
	Comp	ROA	OLS	2S	OLS	2S	OLS	2S
	(1)	(2)	(3)	(4)		(6)	(7)	(8)
Hpi(t-1)	-0.002***	-0.000***						
	[-4.758]	[-2.856]						
*R.E. Assets *Hpi(t-1)*	0.002**	0.000***						
	[2.516]	[3.645]						
ROA	0.540***		0.571***	5.647***	0.609***	5.278**	0.702**	6.961*
	[4.404]		[4.686]	[2.683]	[8.378]	[2.488]	[2.549]	[1.726]
F-test		33.05						
Observ.	9,032	9,032	9,032	9,032	9,013	9,013	9,045	9,045
R-squared	0.211	0.145	0.208	0.205	0.140	0.132	0.149	0.149