Regional Accounting Performance, Local Real Estate Markets, and Stock Prices*

Scott Joslin†  Yaniv Konchitchki‡

June 16, 2018

Abstract

This paper posits that profitability changes of firms headquartered within a geographic region can manifest in regional real estate valuation implications. Indeed, regional profitability indices constructed from real-time quarterly financial reports provide timely information about future real estate values. However, this profitability-housing link is not fully processed in prices of real estate investment trusts exposed to regional real estate values. The paper also provides evidence that the profitability-housing link is stronger in tight local real estate markets. Overall, this paper shows that firms’ accounting performance analyzed at the geographic level has substantial economic implications for real estate valuations. It also identifies regional accounting profitability as relevant for timely understanding of local real estate markets and their consequences and, thus, as a primitive factor affecting the macroeconomy.

*The paper has benefited from comments and suggestions from Andrew Ang, Mary Barth, Eli Bartov, Nittai Bergman, Jacob Boudoukh, Larry Harris, Ross Levine, Gustavo Manso, Roni Michaely, Andy Rose, Nancy Wallace, Beverly Walther, Janet Yellen, and workshop participants at BlackRock, IDC, LBS, MIT, Northwestern, SF’s Fed, UC Berkeley, UCSD, UNC, USC, Toronto, and U. Penn. We also thank Chief Economists Mark Zandi (Moody’s Analytics) and Anne Picker (Econoday) for detailed institutional housing market explanations, the Real Estate and Financial Markets Lab of UC Berkeley’s Fisher Center for access to the detailed U.S. establishment dataset, and Victor Couture for help with the detailed establishment dataset. We acknowledge help from the helpdesks of the Bureau of Economic Analysis, Bureau of Labor Statistics, Econoday, Federal Reserve Bank of Philadelphia, Standard & Poor’s Capital IQ, and Zillow.

†University of Southern California, Marshall School of Business, sjoslin@usc.edu.

‡University of California at Berkeley, Haas School of Business, yaniv@haas.berkeley.edu.
1 Introduction

While decades of accounting research have examined the role of accounting amounts at the individual firm level for a wide array of questions—such as understanding stock returns, bankruptcy prediction, auditing, contracting, and corporate governance—this paper examines the role of accounting amounts at the regional level for understanding real estate markets and associated capital market implications. Indeed, recent fluctuations in U.S. real estate prices have demonstrated the fundamental effects of real estate on the financial sector and the macroeconomy, bringing the topic to the forefront in recent years and attracting attempts to better understand real estate markets and their implications for other markets. Calls for academic help have also emphasized the understanding of financial sector fluctuations and their underlying factors, especially the valuation of real estate, as a major challenge facing our time (e.g., Yellen, 2008a,b; Storch, 2011; Tirole, 2014). Responding to these calls and attempts to better understand real estate price fluctuations and their implications, this paper proposes that geographic information obtained from analyzing quarterly financial reports of U.S. corporations at the geographic level can be useful for understanding fluctuations across regional real estate markets and their equity valuation implications.

The first stage of analysis in this paper examines whether changes to regional accounting profitability constructed using firms headquartered within a geographic region manifest in changes to future real estate values in that region. To extract timely information about regional profitability, the paper develops real-time regional indices of accounting performance based on firms headquartered within each region. Specifically, using the regional classification of the Standard & Poor’s (S&P)/Case-Shiller Home Price Indices (Case-Shiller, hereafter) – the primary and widely used measure of U.S. residential real estate that tracks changes in real estate prices nationally and across regions – firms are sorted into regions based on their headquarters. Next, the second stage of analysis examines whether the implications of regional accounting performance for real estate values are incorporated in the prices of real estate investment trusts (REITs) through their exposure to regional changes in real estate values.

The main hypothesis is that profitability changes of firms headquartered in a region are linked to future real estate valuation. The economic basis for this hypothesis builds on economic theory of principal-agent, wage-effort, and implicit and incentive contracts suggesting that profit sharing is an important part of the employment relationship (e.g., Akerlof and Yellen, 1990). Further, regions with profitable firms often attract new firms to move or get more established in these regions; and vice versa. Empirically, studies provide evidence of (a) performance-related profit sharing with employees and especially with headquarters employees who tend to be more senior, (b) increased/decreased hiring in response to firms’ profit changes, and (c) firms’ geographic movements/establishments in search of profitable opportunities (e.g., Denny and Machin, 1991; Blanchflower, Oswald, and Sanfey, 1996; Bronars and Famulari, 2001; Hennessy, Levy, and Whited, 2007). In particular,

1Prior research also establishes that households’ expenditures including on housing depend on overall wealth are dictated by permanent income rather than by the periodic income only (e.g., Friedman, 1956;
given that housing supply of properties available for sale is not perfectly elastic (there are
not infinite real estate properties available for sale), future real estate values will be affected
because regional profitability changes can manifest in regional housing demand by firms’
current and/or new employees in the region.

The paper addresses whether regional accounting performance manifests in housing market
implications using two sets of analyses. The first set of analyses investigates the premise of a
regional-profitability-housing link by examining economic paths between regional profitability
and local real estate markets. It includes examining real estate demand versus supply and
probing the link between firms’ profits and future estimated employee wages. The second
set of analyses employs regression models of future real estate price changes on regional
accounting profitability changes. It also uses an impulse response test to probe how regional
profitability innovations relate to regional housing price changes over the subsequent 12
months.

Several findings emerge. Regarding the first set of analyses, the demand-supply exami-
nation indicates that local corporate employees constitute a considerable marginal demand
power relative to the regional supply of available real estate properties. The results show
that changes to firms’ current profits are intertemporally linked with subsequent changes in
estimated employee wages and salaries, especially over the short-run (the two subsequent
quarters), providing a mechanism through which firms’ profits can result in real estate
demand in local markets. The paper also forms an additional prediction regarding how the
intertemporal link between regional accounting profits and future real estate valuation is tied
to the tightness of local real estate markets in terms of the potential demand from corporate
employees relative to the supply of local real estate properties. The findings provide support
to the hypothesis that there is stronger regional profitability-housing link in regions with
tighter real estate markets.

Regarding the second set of analyses, the results show that accounting profitability changes
embed timely information about future real estate price changes at the national composite
level. There is also a strong positive link between accounting profitability changes in a
region and future real estate price changes in that region, indicating that firms’ accounting
profitability across different regions can help explain cross-sectional variation in local housing
markets. In addition, the profitability-housing link is incremental to variables possibly
associated with future real estate prices or economic activity. The impulse response analysis
shows that in response to an innovation in firms’ accounting profitability, a large part of the
associated future regional real estate price change manifests over the subsequent four months.

The analyses thus far have additional implications – for investment strategies involving
real estate. In particular, REITs invest in real estate and their shares are listed on major
stock exchanges. To the extent that regional accounting profitability has implications for
future real estate valuations, REIT managers are likely to incorporate such implications.
Nevertheless, obtaining real-time regional profitability information is not trivial. This is
because regional accounting profitability indices are not reported, and processing such data

Bernanke, 1984), indicating that regional profitability can also manifest in housing demand through employees
who anticipate a share in their firms’ profits.
is more involved than processing salient data readily presented in financial statements. Since information that is nontrivial to obtain may diffuse slowly into asset prices (e.g., Hong and Stein, 1999), REIT prices may not incorporate the implications of geographic accounting information for future real estate valuation on a timely basis, leading to predictable returns.

This paper’s mechanism dictates an ex ante prediction: a positive shock to regional accounting profitability is a positive event for REITs relying on real estate in that region (because such a shock manifests in higher future real estate values in the region). To test this prediction, the analysis forms portfolios investing in REITs each quarter, based on quarterly changes to regional accounting profitability, and then examines the future performance of these portfolios (that are conditioned on current information). Findings from these return analyses reveal significant abnormal returns, in the direction predicted. The zero-cost hedge strategy, which is available to investors in real time, has statistically and economically significant returns after adjusting for common risk factors. These findings shed light on how geographic accounting information is processed by investors, indicating that REIT investors do not incorporate such information in a timely manner. Two notes that should be clarified. First, is there merit for using accounting information rather than alternative data sources? The answer is yes. Timeliness of accounting data is important, theoretically and empirically. The evidence above suggests that the timely flow of quarterly accounting information enables real-time assessment of future real estate markets. This aspect of accounting timelines is also critical for the REIT investment analyses, as these investments are based on assessing future real estate markets based on current accounting profits available in real time.\textsuperscript{2} Second, the objective in the REIT analyses is testing how geographic accounting information is processed in prices rather than maximizing returns.

Viewed as a whole, this paper posits possible spillovers from regional corporate performance to real estate markets through the propagation of regional accounting profitability in demand for local real estate properties, resulting in implications for real estate valuation. Analyzing how the regional profitability-housing link is processed in capital markets reveals that these links are not fully processed in REIT prices. This paper closely relates to extant research on: (a) the information content of accounting numbers at the firm level (e.g., Marsh and Merton, 1986; Kothari, 2001; Lee, 2001), (b) macro-accounting (e.g., Konchitchki, 2011; ), (c) cross-sectional stock returns and return predictability (e.g., Sloan, 1996; Hong and Stein, 1999), (d) cross-firm information spillovers (e.g., Foster, 1981; Romer, 1986; Grossman and Helpman, 1991,; Krugman, 1991; Audretsch and Feldman, 1996), and (e) the relationship between real estate markets and the macroeconomy (e.g. Quan and Titman, 1999). The approach in this paper differs by focusing on regional accounting performance (rather than

\textsuperscript{2}Indeed, this paper employs an uncommon approach in various types of real estate and other macroeconomic analyses, highlighting the value added of the accounting system. In particular, although this is the first study to examine accounting-housing-equity linkages, prior research often proxies for personal income or corporate profits by relying on decennial Census data or annual tabulations of income tax returns prepared by the Internal Revenue Service (IRS) with a significant lag (see, e.g., Bureau of Economic Analysis, 2002, 2004; U.S. Census Bureau, 2002; Mian and Sufi, 2012). As examples, corporate profits tabulations are available with a lag of two-three years and census data with a lag of up to ten years. Whereas these data lack timeliness, accounting financial statements are reported every quarter, providing important timely information.
on firm-level accounting performance as almost exclusively been done in prior work), on the
real estate market (rather than other macro constructs), on possible spillover effects from
firms to individuals’ investment decisions (rather than across firms), and on implications for
equity investments. In doing so, this paper sheds new light on the extent to which geographic
accounting amounts inform timely understanding of real estate price fluctuations and related
asset pricing implications.

This paper contributes to extant research in accounting and its related fields. First,
it provides evidence for accounting-housing links and for REIT-based investment analysis.
Second, it identifies regional accounting performance as relevant for timely understanding
of real estate price fluctuations and, thus, as a primitive source of performance and risk
assessment of the financial sector and the macroeconomy. In doing so, it takes a closer,
bottom-up look at the actual microeconomic behavior of corporations for understanding
the macroeconomy (instead of the almost exclusive top-down approach taken in economic
research that uses Dynamic Stochastic General Equilibrium, DSGE, modeling; see, e.g.,
Smith, 2016; Wolfers, 2016). Additionally, by offering fresh evidence on the role of regional
accounting performance in real estate and equity markets, this paper contributes to research

From an economic perspective, understanding what drives real estate values is not less
important than understanding pricing dynamics of other asset classes including stocks, bonds,
and commodities. Real estate is a major asset class, totaling $39.7 trillion in the United
States as of December 2017. To compare, as of December 2017 the total U.S. stock market
capitalization was about $26.8 trillion. The combined recent annual U.S. ($18.6 trillion) and
Chinese ($11.2 trillion) gross domestic product (GDP) was $29.8 trillion.\footnote{Sources: Fed’s Board of Governors, most recent Z.1 report published on September 21, 2017: Table B.101 (line 4, for residential), Table B.103 (line 3, for corporate); Dow Jones U.S. Total Stock Market Index Fact Sheet (for market cap, most recent calculation); and World Bank’s Data Section, Indicators, GDP at Market Prices (for GDP, where available data as of December 2017 is for 2016).} Yet although vast
research has overwhelmingly focused on how stock returns move in the cross-section and
relate to firm-level accounting data, little is known about cross-regional real estate valuation
and especially its link to regional profitability and associated stock prices. Section II discusses
data, variables, timeline, and sample statistics. Section III discusses the research design,
predictions, and evidence regarding the first part of the paper: the link between regional
accounting profitability and real estate valuation. Section IV discusses the impact of tightness
of local real estate markets on the profitability-housing link. Section V addresses the second
part of the paper: the processing of regional accounting information by investors. Section VI
concludes.
2 Data

Data and Variable Construction

Accounting and stock return data for U.S. firms are obtained from the Wharton Research Data Services (WRDS). Accounting variables are from the Compustat North America Fundamentals Quarterly File (WRDS: FUNDQ). Monthly raw stock returns are from the Center for Research in Security Prices (CRSP), Monthly Stock File (WRDS: MSF). CRSP/Compustat Merged Database Linking Table (WRDS: CCMLINKTABLE) is used to link Compustat observations with returns data from CRSP. In addition, risk-free rate and Fama-French-Carhart factors are from the Fama-French Factors Monthly Frequency File (WRDS: FACTORS_MONTHLY); Treasury bond and bill yields are from the Federal Reserve Board of Governors H.15 Report; stock market returns are from the CRSP Monthly Index File; and GDP, inflation, and corporate profits are from the Philadelphia’s Fed Real-Time Data Research Center (as explained on the Fed’s website, the Fed data are quarterly and stated in annual rates). Stocks are adjusted for possible delisting returns following Shumway and Warther (1999), as detailed in the appendix (available online).

The Case-Shiller Home Price Indices are obtained from the S&P Dow Jones Indices website. These indices have time varying coverage. For example, coverage starts in: January 1972 for Miami; January 1977 for San Diego and Denver; January 1980 for San Francisco, Los Angeles, and New York; and January 2000 for Dallas. This data is used to calculate monthly real estate price changes for each region, varying from 182 observations (Dallas) to 518 observations (Miami). Zip codes for firms’ headquarters are obtained from Compustat; ZIP Code longitude and latitude coordinates are from the Census Gazetteer Files of the U.S. Department of Commerce’s Census Bureau. To analyze housing supply and demand, each firm’s total number of employees is obtained from the Compustat North America Fundamentals Annual file (WRDS: FUNDA), as well as regional supply data for real estate properties available for sale from Zillow.5

To execute the analyses, the paper develops real-time measures of regional accounting profitability changes. Specifically, using longitude and latitude coordinates, the distances between each Compustat firm’s headquarter and all Case-Shiller regions is calculated. Each firm is assigned into a region based on the minimal distance. This process thus sorts all firms into regions based on the location of their headquarters. For brevity, the appendix includes detailed information on the construction of the indices. The mean (median) minimal distance is 88 (33) miles. The 5th and 95th quantiles are 1.4 miles and 281 miles, respectively. Using firms in each region, quarterly indices of regional accounting profitability changes are constructed based on earnings reports available prior to calculating future housing and REIT returns. Figure 1 uses Facebook Inc. as an example to illustrate the firm’s distances to Case-Shiller regions. The analysis focuses on how firms’ profits are spilled over to local employees regardless of where the profits are generated. One potential concern with this sorting mechanism is that it could assign firms to regions where only some of their employees

5Data from Zillow on supply of properties available for sale was obtained from http://www.zillow.com/research/data; this is a residential dataset detailed to the zip code level, called “For-Sale Inventory (Raw)”.


reside. However, to the extent that this is true, this would likely bias against finding a regional accounting-housing link. In addition, to assess the validity of the regional indices, external validity analysis is conducted employing the Fed’s data, as detailed in the appendix for brevity.

The analyses throughout employ varying samples, to allow for feasible information flows and following the Case-Shiller coverage of the housing data that vary by regions. Specifically, following the Case-Shiller coverage, real estate price changes include 182 to 518 observations depending on the region. In terms of alignment with accounting data, regional accounting profitability changes using quarterly accounting observations are calculated over the period from Q4:1972 (the most recent quarter before housing data begin for Miami) to Q4:2014. The analyses of stock investment strategies use: (a) quarterly accounting profitability changes over the quarters from Q4:1999 to Q2:2014, and (b) monthly stock returns on 303 unique REITs beginning in March 2000, one month after all regional accounting profitability quarterly changes are available. The REIT return analysis sample begins in Q4:1999 to allow REIT investors to have information on the accounting-housing link across all regions and given that the first month for which regional housing data are available for all regions is January 2000. This sample ends in Q2:2014.

Accounting profit for firm $i$ in quarter $q$ ($Prof_{i,q}$) is measured as scaled quarterly operating income before depreciation, and accounting profitability change ($\Delta Prof_{i,q}$) is measured as the year-over-year change in $Prof_{i,q}$: $\Delta Prof_{i,q} = Prof_{i,q} - Prof_{i,q-4}$. Accounting information is taken from fiscal quarters ending in March, June, September, or December. These observations account for the majority of firm fiscal year ends and this approach eliminates the need for observations where there are few (or even no) firms in a region with financial reports in a given time period. To mitigate the effects of outlier, firm’s profits and profit changes are trimmed based on the top and bottom one percentile of each quarterly cross-section. To avoid negative denominator problems, profits are scaled by sales. Regional quarterly time series of profits ($Prof_{region,q}$) and profit changes ($\Delta Prof_{region,q}$) are based on value-weighted cross-sectional averages, with weights based on market value of equity as of the beginning of each quarter. Profit is operationalized as operating income before depreciation because this measure assesses operating performance while abstracting from line items below operating income. Inferences are not sensitive to alternatively using net income or income before extraordinary items. For a firm-quarter to be included in the sample it must not have missing values for market value of equity, $\Delta Prof_{i,q}$, and earnings reported by the time that future real estate and stock returns are accumulated. To avoid drawing inferences based on illiquid or very small firms, the analyses include only firms if it has a stock prices higher than $5 and has sales, book value of equity, total assets, and market value of equity higher than $10 million.

For the firm-level cross-sectional analysis (following Equations (1–2) and reported in Table 5, below), accounting data are obtained from Compustat North America Fundamentals.

---

6 In Compustat Quarterly population, 83.2 percent of the observations correspond to fiscal years ending in March, June, September, or December. In other months, only nine out of the 20 regions have an average of more than 10 reports per quarter across the sample. Only four out of the 20 regions have more than 10 reports for at least 75 percent of the months.
Figure 1: Corporate Headquarters and U.S. Regions: An Example Using Facebook Inc.
Notes: The figure illustrates the distances of a firm to U.S. regions (Case-Shiller) using Facebook Inc. as an example.

Annual and Quarterly datasets. The cross-sectional analysis employs a sample of 359,749 quarterly observations over the period from Q1:1970 until Q4:2015 with data available for this analysis.

Timeline
Figure 2 provides the timeline of the analysis. Attention is limited to quarterly accounting reports that are available for predicting future real estate price changes and for making investment decisions without look-ahead bias. Thus firms’ earnings announcement dates are used to retain accounting data only for firms that announce their quarterly profits within two months after their fiscal quarter-ends so that it can be used in making investment decisions at that time. Future housing price changes and REIT returns are then computed beginning the two months following quarter end so that all information is available.

Sample Statistics
Table 2 provides sample statistics of key variables. The mean monthly regional real estate price changes, $\Delta RealEstateRegion$, vary across regions (from 0.2 to 0.5 percent); and the median shows about the same magnitude. The standard deviation of the monthly real estate
price changes show substantial variation, varying between 0.6 and 1.4 percent across regions. Regarding the quarterly accounting profitability data, the table shows that the mean and median profitability changes aggregated across all regions ($\Delta \text{Prof}$) are 0.000 and 0.001 with a standard deviation of 0.020. These findings indicate high variation in accounting profitability changes, and they also show how focusing on the national housing market masks notable heterogeneity in accounting profitability across regions, as positive and negative profitability shocks to different regions are aggregated together. Indeed, the mean regional accounting profitability changes varies considerably across regions (between -0.7 and 1.1 percent). Regarding the other variables, the statistics are similar to those in prior research. For example, mean and median inflation rates are 4.3 and 3.5 percent, respectively (note that the Fed’s data are quarterly and stated in annual rates).

3 Regional Accounting Performance and Future Real Estate Valuation

This section examines how changes in regional accounting profitability relate to future real estate price changes in that region. The main hypothesis is that changes to regional profitability manifest in future changes to real estate prices in that region. The analyses that follow investigate paths between regional accounting profitability and local real estate markets.\footnote{It is possible to empirically examine several alternative measures of firms’ performance, such as revenues, cash flows, or revenue growth. However, this study focuses on firms’ profitability because of the vast prior theoretical and empirical literature that establishes firms’ profit sharing as an important part of the employment relationship.}
Analyses of Economic Paths through which Regional Accounting Profitability Can Manifest in Real Estate Valuation

Several analyses were conducted in order to identify economic paths through which geographic accounting profits can manifest in future housing and equity market implications. First, as always in any cross-sectional study, one needs heterogeneity in profitability and real estate dynamics. That is, regional accounting profitability and regional real estate prices should not move in lockstep across regions. Such heterogeneity is essential to identify geographic variation for the analyses that follow. To examine heterogeneity, correlations across U.S. regions are calculated using changes in regional real estate prices and in regional profitability.

Table 3 reports information about the correlations across regions of monthly and annual real estate price changes as well as correlations of regional profitability. The minimum, maximum, and standard deviation of the pairwise correlations of these quantities are presented in the table. Panel A (B) summarizes Spearman and Pearson correlations in month-over-month (year-over-year) real estate price changes. Panel C summarizes these correlations among regional profitability changes. Panel A shows that the minimum correlation among monthly real estate price changes across U.S. regions varies between 0.211 and 0.392, and the corresponding maximum correlation varies between 0.712 and 0.859. Panel B shows that the minimum correlation among annual real estate price changes across U.S. regions varies between -0.025 and 0.500, and the corresponding maximum correlation varies between 0.793 and 0.970. The appendix includes detailed results on all the pairwise correlations used to construct this table. For example, Portland’s housing market is only marginally and negatively correlated (-2.5 percent) with that of Boston in terms of annual real estate price changes. Turning to regional profitability, Panel C shows that the minimum correlation among quarterly accounting profitability changes across U.S. regions varies between -0.239 and -0.042, and the corresponding maximum correlation varies between 0.199 and 0.438, indicating high variation in regional profits across regions. These findings together reveal that both regional real estate markets and regional accounting profits do not move in lockstep across regions. Hence focusing on the national housing market or the overall profitability of the U.S. corporate sector masks substantial heterogeneity in how real estate values and firms’ profitability vary across regions.

The second analysis focuses on the following question: if the fraction of employees residing near their firms’ headquarters (i.e., local employees) to total firms’ employees or to the regional supply of real estate properties available for sale is immaterial, regional firms’ profitability may have an immaterial effect on the corresponding-region real estate demand. Suggestive evidence on the demand-supply relationship is obtained by calculating the ratio of corporate employees relative to the supply of real estate properties available for sale. Briefly, this analysis shows that corporate employees constitute a considerable marginal demand power for the supply of real estate properties available for sale. The appendix provides detailed information about this examination.

Table 4 reports the ratio of corporate employees for firms headquartered in each Case-Shiller region to the regional supply of properties available for sale (the appendix provides more detailed information related to this table). The table refers to the period beginning
in 2010 because supply data of properties available for sale is available only beginning in that year. The table shows that, considering all regions together, the number of corporate employees is about 19 to 32 times the supply of real estate properties available for sale. When broken down by Case-Shiller regions, this ratio ranges between 4 (Miami, in 2012) and 174 (San Francisco, in 2014), with high variation across regions. These magnitudes show that corporate employees constitute a considerable marginal demand power for the supply of real estate properties available for sale. The impact of tightness in regional real estate markets and its implications for the regional accounting-housing link is considered further in Section 4.

The third analysis examines intertemporal linkages between firms’ profits and future employee wages and salaries. Specifically, consider the cross-sectional (firm-level) regression models of future changes in estimated employee wages and salaries on current-period profit changes, as follows:

\[
\Delta W_{i,q}^{t \rightarrow q+} = \alpha + \rho \Delta Prof_{i,q} + \sum (\text{control})_{i,q} + \epsilon_{i,q+t} \quad t \in \{1, 2, 3, 4\} \quad (1)
\]

\[
\Delta W_{i,q+t-1 \rightarrow q+} = \chi + \delta \Delta Prof_{i,q} + \sum (\text{control})_{i,q} + \xi_{i,q+t} \quad t \in \{1, 2, 3, 4\} \quad (2)
\]

The dependent variable in Equation (1) (Equation (2)) is the accumulated (quarter-over-quarter) change in estimated wages and salaries over the subsequent quarters relative to the current quarter. Because Compustat Fundamentals Quarterly does not provide quarterly wages and salaries of employees, this paper develops a procedure to estimate this variable. Specifically, using Compustat Fundamentals Annual, possible proxies for annual wages and salaries are calculated by subtracting from sales, general, and administrative expense (Compustat: XSGA) seven possible combinations of variables that capture annual expenses unrelated to wages and salaries (i.e., research and development, rental, advertising, pension and retirement, and staff; in Compustat: XRD, XRENT, XAD, XPR, and XLR, respectively). Given that a firm’s employee wages and salaries should relate to the firm’s number of employees, the analysis uses the variable combination with the highest correlation between the annual number of employees (Compustat: EMP) among each of the seven alternatives. The combination with the highest correlation is XSGA-XRD. This proxy is used at the quarterly frequency using Compustat Fundamentals Quarterly to approximate each firm’s estimated quarterly employee wages and salaries. Regarding the independent variables for a firm i at a quarter q: \(\Delta Prof_{i,q}\) is the change in profits, where gross profits are used to prevent any possible mechanical relation between operating profits and contemporaneous/subsequent wages and salaries; \(LEV_{i,q}\) is leverage, calculated as a firm’s total shareholders’ equity divided by total assets; \(BTM_{i,q}\) is book-to-market ratio, calculated as a firm’s total shareholders’ equity divided by total market value of equity; \(MVE_{i,q}\) is total market value of equity; \(HighTech_{i,q}\) is an indicator variable that is equal to one if a firm is in high tech industry, and zero otherwise.\(^8\) Equations (1–2) are estimated using both pooled and Fama-MacBeth

\(^8\)Following prior literature (e.g., Kasznik and Lev, 1995), HighTech is equal to one if a firm’s four-digit SIC code falls within the following ranges: 2833 to 2836 (drugs), 3570 to 3577 (computers), 3600 to 3674 (electronics), 7371 to 7379 (computer programming and data processing), or 8731 to 8734 (research, development, and testing services).
specifications. The pooled regressions are estimated using double clustering by firm and quarter. The Fama-MacBeth regressions are estimated each quarter, with industry fixed effects (based on two-digit SIC code, omitted for brevity) following the Fama and MacBeth (1973) procedure.

Table 5 reports results from cross-sectional (firm-level) regression models of future changes in estimated employee wages and salaries on current-period profit changes, following Equation (1) (Equation (2)). Panel A shows that a current-quarter change in firms’ profits is significantly positively tied to future employee wages and salaries accumulated from the current quarter through each of the four-quarters ahead. Panel B focuses on the marginal quarterly effect in each of the subsequent quarters. It shows that the profits-to-future-wages linkages stem from effects during the subsequent two quarters, with significantly positive estimated coefficients on current profit changes for these horizons (for the one-quarter-ahead horizon, the t-statistic is 3.440 (3.690) in the pooled (Fama-MacBeth) specification; for the two-quarters-ahead horizon, the t-statistic is 3.880 (3.210) in the pooled (Fama-MacBeth) specification). These findings establish an intertemporal linkage between current firms’ profit changes and changes in employee wages and salaries over the subsequent two quarters, thereby further identifying a mechanism through which firms’ profits can manifest in real estate valuation implications.

The fourth analysis relating to the economic mechanism focuses on assessing REIT geographic concentration and specialization. Specifically, the REIT return analyses examine whether prices of REITs incorporate the regional profitability-housing link, focusing on real estate markets where REITs are located. Indeed, prior research and anecdotal evidence suggest high regional concentration and specialization in REITs and that REIT managers prefer to hold regionally focused asset bases (e.g., Capozza and Seguin, 1999; Ling, Naranjo, and Scheick, 2015). To further examine this institutional feature in the sample, 100 REITs in the sample were randomly selected and their 10-Ks were examined for geographic-related investment strategies. Of these 100 REITs, 84 REITs were found to invest in their local markets, either as their main investment focus or as part of their investment strategy, corroborating prior evidence of regional concentration and specialization in REITs.

An important issue also with REITs is that they often engage in both residential and commercial real estate activities. However, the analysis uses real estate indices that focus on the residential market. Theoretically, prior research from urban economics suggests that the same basic forces affect demand for both residential and commercial real estate (e.g., Rosen, 1979; Roback, 1982). Indeed, prior empirical research suggests that the two assets classes exhibit strong correlation (e.g., Gyourko, 2009; Calanog, 2011). Studies also provide evidence of strong correlations among business activities within each asset class, such as between rental fees and acquisition values of residential real estate as well as between condominium and single-family house prices over the 1996-2012 period and across U.S. regions (e.g., Hughes, 2013). Further, several REIT observations in the sample directly relate to residential businesses, from developing single-family houses and lots to renting single-family and various other types of residential real estate (e.g., American Homes 4 Rent; American Residential Properties; Silver Bay Realty Trust; Starwood Waypoint Residential Trust). Together, the theory and evidence suggest that to a first approximation fluctuations in Case-Shiller indices relate to
fluctuations across different types of housing activities and thus capture an assessment of the housing market. Note that here also to the extent that regional residential real estate prices are not related to REIT returns, this would bias the analysis against finding significant results.

Overall, the first set of analyses and discussions above identify a possible economic mechanism through which regional accounting profitability can manifest in real estate valuation implications. Given that the supply of real estate properties available for sale is not perfectly elastic, even a slight increase in firms’ profits shared with employees has the potential to increase marginal demand for real estate. The results also show that changes to firms’ current profits are linked with future changes in employee wages and salaries, especially over the two subsequent quarters.

Regression and Impulse Response Analyses

To directly examine the link between regional accounting profitability information and future real estate valuation, ordinary least squares regression analyses are conducted to relate future real estate price changes to accounting profitability changes in the corresponding region. The first regression analysis focuses on the overall national housing market, operationalized by returns on the two Case-Shiller composite real estate indices. The second regression analysis focuses on models probing cross-sectional variation across regional housing markets using returns on the Case-Shiller metropolitan indices. Examining real estate valuation across U.S. regions is more insightful in this setting than examining the overall composite housing index, because it analyzes whether variation in profitability changes across regions is tied to variation in the housing market across the corresponding markets.

In particular, consider first the following time-series equation:

\[
\Delta \text{RealEstate}_{\text{region},m+t} = \lambda + \beta \Delta \text{Prof}_{\text{region},q|\Omega_m} + \mu_{\text{region},m+t},
\]

where \(\Delta \text{RealEstate}_{\text{region},m+t}\) is the change in the regional monthly real estate price from month \(m\) to month \(m+1\), scaled by the price in month \(m\); region refers to one of the Case-Shiller regions, either composite or metropolitan; \(\Delta \text{Prof}_{\text{region},q|\Omega_m}\) is the quarterly regional real-time index of accounting profitability change in that region, where \(\Omega_m\) reflects the conditioning on information available as of \(m\); and future months are \(m+t\).

This baseline regression is extended sequentially to include conditioning control variables:

\[
\Delta \text{RealEstate}_{\text{region},m+t} = \lambda + \beta \Delta \text{Prof}_{\text{region},q|\Omega_m} + \text{(controls)},
\]

where all independent variables are calculated strictly conditioned on \(\Omega_m\), that is on month \(m\) information set. A variety of controls are used in different specifications. First is \(\text{RETURN}\), the quarterly buy-and-hold return on the stock market index (i.e., the S&P Stock Composite Index). Second is \(\text{lagCS}\), the lagged change on the Case-Shiller Index. Additionally, time and region fixed effects are applied as controls in different specifications. Note that a number of other aggregate macro-variables are relevant to regional real estate prices such as GDP, the term spread, the risk-free rate, the aggregate market return, corporate profits, and inflation.
Indeed, including these shows no change in inferences. The inclusion of time fixed effects in several of the specifications suppresses the need to control for aggregate variables that do not vary across regions.

The objective in Equation (4) is to examine whether regional profits propagate in real estate markets, rather than finding the best predictive model for future real estate valuation. Several additional regressors are included in Equation (4) to assess the incremental effect of regional profitability, including Fed’s data for local economic activity – state coincident and leading indicators – that focus on purging “normal” economic activity during each region-period over the sample period. More specifically, the paper includes the Philadelphia’s Fed State Coincident Indexes, which summarize in a single statistic current economic conditions using four state-level measures from the Bureau of Labor Statistics, BLS, and the BEA. It also includes the Philadelphia’s Fed State Leading Indexes, which predict the six-month growth rate of the state’s coincident index. In addition to the coincident index, the Fed’s leading models include state-level variables that lead the economy. Every month, the growth rate on the state coincident indices is calculated using the past month or three months, aligned on the recently available state coincident and leading variables on the regions based on the state in which the Case-Shiller region is located.

In estimating Equations (3–4), real estate price changes are aligned with the most recently available accounting profitability quarterly changes for the corresponding region. Figure 2 and Section 2 provide more details on the timeline used to align future monthly real estate price changes with regional accounting profitability information.

Table 6 reports results from the regression models of subsequent composite real estate price changes on the corresponding regions’ accounting profitability changes, following Equation (3). The results show that the estimated coefficients on the regional accounting profitability changes are significant in both models, with t-statistics of 5.88 and 3.74 for the 20-city and 10-city composite regions, respectively. These findings indicate that regional accounting profitability changes are linked to future real estate price changes at the overall composite level.

Table 7 reports results from the regression model focusing on the cross-section of real estate prices following Equation (4), which examines whether regions with higher accounting profitability are linked to higher future real estate prices. The first column reports estimates from a baseline model, and the next columns report results from estimating models with additional variables as controls. The first column shows that the estimated coefficient on the regional accounting profitability change is significant, with a t-statistic of 2.36. This finding shows a positive cross-sectional linkage between accounting profitability change in a region and future real estate price changes in that region.

The next columns show that the estimated coefficients are significant across all models, with t-statistics varying between 2.18 and 3.96. These findings indicate that the cross-sectional linkage between future regional real estate price changes and the corresponding region accounting profitability change is incremental to several variables that can be associated with future real estate prices or economic activity.

Together, findings from Tables 5-7 show that future real estate price changes are predicted
by the real-time regional accounting profitability indices, at the overall composite and the cross-sectional levels. The evidence indicates that regional accounting profitability across different regions helps explain cross-sectional variation in overall and regional housing markets, and it demonstrates that processing geographic accounting information is nontrivial because regional profitability effects vary across regions.

Next, the examination proceeds to impulse response analysis that probes how a change (innovation) in regional accounting profitability affects subsequent real estate price changes in the region. This analysis focuses on accumulated impulse response functions, for a response in \( \text{RealEstateRegion} \) over the 12 months subsequent to an innovation in \( \text{Prof}_{\text{region}} \), at the Case-Shiller composite regional levels. An impulse response function shows how one variable reacts to a perturbation in another variable in the system. Such analysis is common in macroeconomics modeling, where response functions are often used to describe how a macroeconomic variable reacts over time to impulses often modeled as a vector autoregression. The model is implemented as a VARX with one lag, with the endogenous variable \( \text{RealEstateRegion} \) and the exogenous variable \( \text{Prof}_{\text{region}} \).

Table 8 reports results from the impulse response analysis, providing the accumulated impulse response functions from accounting profitability impulses. The table shows that, in response to an impulse to firms’ accounting profitability, more than half of the future real estate price changes manifest over the three-four months subsequent to the impulse, on average across U.S. regions, and the effect dissipates almost entirely after seven months. Plots of standard errors surrounding the responses, untabulated for brevity, indicate that these impulse response results are significant. Overall, the table provides evidence of the dynamics of future housing market returns in response to innovations in regional accounting profitability.

4 Tightness in Regional Real Estate Markets

Key in the proposed mechanism driving the regional accounting-housing link is the impact that greater wages will have on housing demand. That is, the main hypothesis is predicated on an increase in local housing demand associated with local profitability. In general equilibrium, a shift in demand is typically accompanied by an increase in supply. However, real estate is an illiquid asset class, as well as requires a significant time for supply to adjust (either in the form of new construction or in the form of existing homeowners placing their properties for sale). These features can result in greater price reactions to shifts in the demand curve.

The analysis in this section investigates the implications of this mechanism to form an additional important hypothesis. Specifically, Table 4 shows that there is substantial cross-sectional variation in the tightness of regional markets. Here tightness is defined as the ratio of the total number of corporate employees for firms in a given region to the supply of residential real estate properties available for sale. For example, in 2015 there was a ratio of 158 employees to each property for sale in San Francisco; at the same time, there was a ratio of 9 employees to each property for sale in Phoenix.

Should the relevant tightness be measured relative to the real estate available for sale or
relative to the total number of homes (possibly plus a measure of potential home construction)?
To answer this question, consider a potential home buyer in San Francisco in 2015. To the extent that there are frictions preventing the housing supply from adjusting to an increased demand in a timely manner, this potential buyer is faced with a decision to either buy now in a tight market or wait and potentially buy later. The first option – of buying in a tight market – is likely to result in greater price impact of the buying transaction. Further, the second option forgoes the consumption value of homeownership that the potential buyer may highly value and even be willing to pay an above-market price to capture her personal consumption surplus. Moreover, when considering the second option the potential buyer is also likely to have extrapolative beliefs based on well-known short term momentum in real estate markets (e.g., Glaeser and Nathanson, 2017). Under extrapolative beliefs, the homeowner may believe that waiting will result both in forgone consumption surplus and an even higher price later. Together, this economic intuition suggests that the regional profitability-housing link is likely to be stronger in regions with tighter housing markets.

To investigate this mechanism, consider the following regression:

$$\Delta RealEstate_{region,m,t} = \lambda + \beta \Delta Prof_{region,q|\Omega_m} + \gamma \Delta Prof_{region,q|\Omega_m} \times T_{region}$$

where $T_{region}$ is the regional measure of tightness. Due to limited data availability from Zillow (available since 2010) and for simplicity, the tightness measure for each region is fixed at the average value using data available since 2010 and is equal to the log of the ratio of total number of corporate employees in a region to the supply of the corresponding-region residential real estate properties available for sale. To ease coefficient interpretation, $T_{region}$ uses the de-meaned regional employees-to-available-real-estate ratio. The mechanism discussed above forms a prediction: that the coefficient on the interaction term should be positive. That is, in a tighter regional real estate market, there is a stronger response to increased local profitability. The results from estimating the regression with the same controls used in estimating Equation (3) are given in Table 9. In all of the specifications the interaction term is positive and statistically significant. This finding confirms the hypothesis that there is stronger regional profitability-housing link in regions with tighter real estate markets.

5 The Processing of Regional Accounting Profitability Information by Equity Investors

If equity investors do not incorporate regional accounting profitability information on a timely basis, future abnormal returns may result. The main hypothesis dictates an ex ante empirical prediction: to the extent that regional accounting profitability changes are linked with future regional house price fluctuations, the diffusion of spikes (drops) in regional profitability will lead to positive (negative) future returns for REITs exposed to the regional real estate market.

This analysis employs portfolio-level tests focusing on future REIT returns to investment strategies based on regional accounting profitability, controlling for common risk factors. The investment strategies are ex ante, based on REITs’ locations and the regional profitability
The basic logic underlying the investment analysis is as follows. Each quarter all U.S. regions are sorted into five groups based on the regional quarterly accounting profitability changes available in real time before making any investments. The lowest (highest) group composes Portfolio 1 (5) and includes regions with the most extreme negative (positive) shock to firms’ profits in these regions. Note that, to allow for dissemination of regional accounting profitability information, the sorting into groups is based on quarterly accounting data fully known by the second month after each fiscal quarter-end, before REITs’ monthly returns are examined over the months beginning three months after each fiscal quarter-end. For example, in Q2:2010 the most negative and positive shocks to regional profitability were in Minneapolis and Boston, respectively. The analysis then examines REIT returns over the quarter subsequent to the month in which all accounting profitability information becomes available. If regional accounting profitability changes affect future regional real estate price changes, the strategy buys (sells) REITs likely to be mostly affected by extreme high (low) regional profitability changes.

Abnormal returns are determined from the intercepts (i.e., alphas) from monthly time-series regressions of future excess returns for the portfolios conditioned on past accounting information (e.g., Fama and French 1993). In particular, the following time-series equation is estimated at the portfolio level to obtain portfolio intercepts:

$$R_{p,m} - R_{f,m} = \alpha_p + \beta_{p,MKTRF} MKTRF + \beta_{p,SMB} SMB_m + \beta_{p,HML} HML_m + \beta_{p,UMD} UMD_m + \Psi_{p,m}$$ (6)

where $R_{p,m}$ is the return for portfolio $p$ in month $m$.

This test examines whether the intercepts for portfolios based on the sharpest decrease/increase in regional accounting profitability are significant and in the predicted direction, where each portfolio intercept can be interpreted as the monthly abnormal return from buying the specific portfolio and selling short a risk-free asset. Indeed, these estimated portfolio intercepts permit testing the ability of regional accounting information to explain systematic differences in the cross-section of (risk-adjusted) REIT returns.

In addition, to test for abnormal hedge returns, the analysis constructs a zero-cost investment portfolio that buys the portfolio with the sharpest regional accounting profitability increase (highest portfolio) and sells short the portfolio with the sharpest regional accounting profitability decrease (lowest portfolio). The zero-cost portfolio’s return is then regressed on the same-period factor returns. The intercept from this regression can be interpreted as a monthly abnormal return on the zero-cost hedge portfolio. Here the coefficient of interest is the portfolio alpha, $\alpha_p$. To the extent that REIT prices incorporate regional accounting information on a timely basis, there will be no future abnormal returns (insignificant $\alpha_p$). However, if current-period REIT prices only gradually incorporate the favorable (adverse) effect of regional accounting profitability increases (decreases) on future housing prices, there will be a delayed positive (negative) return adjustment as future real estate price changes are realized, which will lead to positive (negative) future abnormal returns, as reflected in significant $\alpha_p$.

Table 10 reports results from the portfolio-level REIT return investment analysis. The results reveal that the estimated intercepts for the lowest and highest portfolios are in the
expected direction: the intercept on the highest portfolio (i.e., investing in REITs mostly exposed to regions with the sharpest increase in regional accounting profitability) is 0.0068 (t-statistic = 2.81), whereas the intercept on the lowest portfolio (i.e., investing in REITs mostly exposed to regions with the sharpest decrease in regional accounting profitability) is -0.0004 and significant (t-statistic = -1.80). The table also shows that a trend regression across the portfolios is significantly positive, indicating a general increase in abnormal returns across the portfolios. These results provide portfolio-level evidence that forming portfolios based on current-period regional accounting profitability information generates significant future abnormal returns, in a manner consistent with predictions. In addition, the difference between the highest and lowest portfolios is 0.0072, with a t-statistic of 6.04 for testing the difference between these portfolios. This finding reflects an economically significant risk-adjusted return of 0.72 percent per month (note that this asset pricing test employs monthly returns), or 9.03 percent annualized. The table also reveals a statistically and economically significant return from a hedge portfolio strategy constructed by buying/selling short the lowest/highest portfolios, with a zero-cost risk-adjusted return of 0.0072 per month (annualized hedge return = 9.03 percent; t-statistic = 3.08). Thus, the findings show significant zero-cost annualized hedge returns, controlling for the corresponding-period returns on common risk factors.9

Overall, the abnormal return findings reveal significant abnormal returns and intercepts for the highest and lowest portfolios, with zero-cost hedge investment strategies in REITs that result in statistically and economically significant risk-adjusted returns. Notably, the abnormal returns are obtained over the period subsequent to the availability of all regional accounting profitability information required for the investments in REITs. The return predictability findings reveal consistent evidence of regional accounting information being only gradually incorporated in REIT prices. Also, note that the strategies’ objective is testing how geographic accounting information is processed in REIT prices rather than maximizing strategy profits. For the latter objective, the strategies can be refined, e.g., using REITs mostly specialized in each region or mostly affected by residential real estate.10

9The F-statistic for a multiple comparison that the risk loadings are the same for Portfolios 1 and 5 is 3.75, corresponding to a p-value is 0.6 percent. This indicates a rejection of the null of same risk loadings on the two portfolios.

10Additional analyses, untabulated for brevity and detailed in the appendix, further probe the regional-profitability-equity link and the mechanism of how geographic accounting information is processed in stocks. The main findings are as follows. First, an analysis that invests in REITs only after the regional profitability effects are largely incorporated in real estate values yields lower to no predictable stock returns. Second, building on the permanent income theory (e.g., Friedman, 1956; Bernanke, 1984), a possible reason for the stock return patterns is that REIT investors do not adequately internalize permanent wealth implications embedded in geographic profitability changes. Indeed, the abnormal return patterns are consistent with investors not calibrating for the differential persistence of regional profitability changes, which vary across regions. In addition, two additional tests provide same conclusions about the regional-profitability-stocks mechanism. Third, a two-step Fama and MacBeth (1973) analysis reveals that a regional-profitability-based factor is not a significant priced risk factor, suggesting that the return patterns do not appear to be due to an omitted risk factor. Fourth, using real estate price forecasts to test how real estate forecasters process past regional profitability information shows that future real estate forecast errors are correlated with current regional accounting information, which indicates that real estate forecasters do not adequately process available information in regional profitability. This finding is consistent with the stock return evidence
6 Conclusion

Across the United States, housing supply is not perfectly elastic and corporate employees constitute a considerable marginal demand power for real estate properties available for sale. This paper posits and documents that (a) regional accounting performance manifests in regional real estate markets and embeds timely information about future real estate valuation, (b) the profitability-housing link is stronger in tight local real estate markets, and (c) the implications of regional accounting information for future real estate valuation are not fully processed in REIT prices. By identifying regional accounting information as relevant for timely understanding of local real estate market fluctuations and, thus, as a source of performance and risk assessment of the financial sector and the macroeconomy, this study responds to recent calls for academic help in understanding the housing markets and their implications. This paper also brings to the forefront the value added of the accounting system for macroeconomic analyses that have traditionally ignored the flow of data from firms’ financial statements.

This paper makes a first step towards understanding whether and how regional accounting information is tied to local markets. This paper can serve as a starting point for a wide array of related works. For example, in addition to identifying a new role for the accounting system in better understanding housing and equity markets, this paper identifies a major macro-level consequence of corporate governance. Specifically, it suggests that employee compensation and corporate governance in general – which have evolved at the firm level in response to principal-agent dynamics and traditionally been researched at the firm level (e.g., Armstrong and Vashishtha, 2012) – can be a source of macro-level consequences such as real estate prices and economic growth. Similar to Bernanke (1983), which suggests that firm-level information asymmetries between banks and borrowers are aggregated into the macro-level effect of the 1930s’ financial crisis through changes in bank runs’ probabilities prior to the Great Depression, this paper suggests that firm-level agency dynamics between firms and employees through profit sharing are aggregated into a macro-level effect on real estate markets through changes in profits and demand for real estate.

An interesting avenue for future research would be to use this study’s framework to probe how regional accounting profitability manifests in other local markets and shapes society, for example in terms of affecting price levels, educational attainments, and possible population inequalities across different regions. In addition, this study focuses on Case-Shiller real estate indices as they are readily available and have attracted high attention from researchers, professionals, and the media. Building on the corporate governance literature suggesting that senior managers enjoy a large fraction of firms’ profits, another avenue would be to investigate documenting that REIT investors do not adequately process regional accounting information.

\[11\] Indeed, financial risk is driven by real estate fluctuations and it is the major high-dimensional distinct risk underlying economic growth (e.g., Glaeser, 2013 and Joslin, Priebsch, and Singleton, 2014). The substantial impact of real estate on the financial sector and the economy stems from leverage and the fact that real estate is the easiest asset to borrow against, especially for households. For example, $9.9 trillion of outstanding debt for home mortgages had been issued against the value of residential real estate (Fed’s most recent Z.1 report available as of December 2017, Table B.101, line 33).
how the accounting-housing linkages differ when considering luxury real estate properties and across varying degrees of executive compensations. Another research direction would be to assess how different factors – such as supply elasticity or labor-versus-capital-intensive regions – affect the propagation of firms’ profits in local housing markets. For example, it is likely that regional profitability has stronger housing effects in regions with less efficient zoning laws (that slowly respond to housing demand changes) or with local firms that are more labor than capital intensive (such as service firms versus manufacturing firms that respond differently to changes in profitability in terms of changes in marginal number of employees).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta$RealEstateRegion$\text{region}$</td>
<td>Month-over-month real estate price change on the real estate region index $\text{region}$. Case-Shiller Home Price Indices are from the S&amp;P Dow Jones Indices.</td>
</tr>
<tr>
<td>Prof$\text{region}$</td>
<td>Real-time indices of quarterly accounting profitability change for region $\text{region}$. Developed by sorting all firms into regions based on the location of their headquarters. Then, using firms in each region, the quarterly indices of regional accounting profitability changes are based on earnings reports available in real time, where accounting profit for firm $i$ in quarter $q$ ($\text{Prof}<em>{i,q}$) is measured as scaled quarterly operating income before depreciation. Accounting profitability change ($\Delta \text{Prof}</em>{i,q}$) is the year-over-year change in $\text{Prof}<em>{i,q}$. To mitigate the effects of outliers, a firm’s profits and profit changes based on the top and bottom one percentile of each quarterly cross-section are deleted. To avoid negative denominator problems, profits are scaled by sales. Regional quarterly time series of profits (Prof) and profit changes ($\Delta \text{Prof}$) are based on value-weighted cross-sectional averages, with weights based on market value of equity as of the beginning of each quarter. For a firm-quarter to be included in the sample it must have nonmissing values for market value of equity, $\Delta \text{Prof}</em>{i,q}$, and the quarterly earnings announcement date.</td>
</tr>
<tr>
<td>Region</td>
<td>The $\text{region}$ regional classification is as follows: region 1 = DC-Washington; region 2 = MI-Detroit; region 3 = MN-Minneapolis; region 4 = OH-Cleveland; region 5 = CA-San Diego; region 6 = CA-San Francisco; region 7 = CO-Denver; region 8 = IL-Chicago; region 9 = MA-Boston; region 10 = NC-Charlotte; region 11 = OR-Portland; region 12 = WA-Seattle; region 13 = AZ-Phoenix; region 14 = CA-Los Angeles; region 15 = TX-Dallas; region 16 = FL-Miami; region 17 = FL-Tampa; region 18 = GA-Atlanta; region 19 = NV-Las Vegas; region 20 = NY-New York; region 21 = 20-city composite; region 22 = 10-city composite.</td>
</tr>
<tr>
<td>$\Delta$Prof</td>
<td>Quarterly accounting profitability change over all firms in the economy.</td>
</tr>
<tr>
<td>RETURN</td>
<td>Quarterly buy-and-hold return on the stock market index (i.e., the S&amp;P Stock Composite Index).</td>
</tr>
<tr>
<td>$W_{i,q}$</td>
<td>Estimated quarterly figure for employee wages and salaries for each firm $i$ in quarter $q$. Because Compustat Fundamentals Quarterly does not provide quarterly wages and salaries of employees, this variable is estimated using the following procedure. First, using Compustat Fundamentals Annual, possible proxies for annual wages and salaries are calculated by subtracting from sales, general, and administrative expense (Compustat: XSGA) seven possible combinations of variables that capture annual expenses unrelated to wages and salaries (i.e., research and development, rental, advertising, pension and retirement, and staff; in Compustat: XRD, XRENT, XAD, XPR, and XLR, respectively). Second, given that a firm’s employee wages and salaries should relate to the firm’s number of employees, the analysis uses the variable combination with the highest correlation between the annual number of employees (Compustat: EMP) and each of the seven alternatives. Overall, implementing this proxy at the quarterly frequency using Compustat Fundamentals Quarterly results in each firm’s estimated quarterly employee wages and salaries.</td>
</tr>
<tr>
<td>$\Delta W_{i,q-q+t}$ (or $\Delta W_{i,q+t}$)</td>
<td>Accumulated (or quarter-over-quarter) change in estimated wages and salaries over each of the subsequent four quarters relative to the current quarter, where $t = {1, \ldots, 4}$. Change in profits for firm $i$ in quarter $q$, for the firm-level cross-sectional regressions of current profit changes and future changes in estimated employee wages and salaries, where gross profits are used in this analysis to refrain from any possible mechanical relation between operating profits and contemporaneous/subsequent wages and salaries.</td>
</tr>
<tr>
<td>$\Delta$Profg$g_{i,q}$</td>
<td>Leverage for firm $i$ in quarter $q$, calculated as a firm’s total shareholders’ equity divided by total assets.</td>
</tr>
<tr>
<td>$BTM_{i,q}$</td>
<td>Book-to-market ratio for firm $i$ in quarter $q$, calculated as a firm’s total shareholders’ equity divided by total market value of equity.</td>
</tr>
<tr>
<td>$MVE_{i,q}$</td>
<td>Total market value of equity for firm $i$ in quarter $q$.</td>
</tr>
<tr>
<td>$\text{HighTech}_{i,q}$</td>
<td>An indicator variable that is equal to one if a firm’s four-digit SIC code falls within the following ranges: 2833 to 2836 (drugs), 3570 to 3577 (computers), 3600 to 3674 (electronics), 7371 to 7379 (computer programming and data processing), or 8731 to 8734 (research, development, and testing services). Following prior literature (e.g., Kasznik and Lev, 1995), HighTech is equal to one if a firm’s four-digit SIC code falls within the following ranges: 2833 to 2836 (drugs), 3570 to 3577 (computers), 3600 to 3674 (electronics), 7371 to 7379 (computer programming and data processing), or 8731 to 8734 (research, development, and testing services).</td>
</tr>
<tr>
<td>$\text{LEV}_{i,q}$</td>
<td>Regional measure of tightness. Due to limited data availability from Zillow (available since 2010) and for simplicity, the tightness measure for each region is fixed at the average value using data available since 2010 and is equal to the log of the ratio of total number of corporate employees in a region to the supply of the corresponding-region residential real estate properties available for sale (de-meaned, to ease coefficient interpretation).</td>
</tr>
</tbody>
</table>

Table 1: Variable Definitions.
Table 2: Descriptive Statistics

<table>
<thead>
<tr>
<th>Region</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>25th Pctl</th>
<th>75th Pctl</th>
</tr>
</thead>
<tbody>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.003</td>
<td>0.010</td>
<td>-0.003</td>
<td>0.010</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.003</td>
<td>0.013</td>
<td>-0.002</td>
<td>0.008</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.003</td>
<td>0.003</td>
<td>0.012</td>
<td>-0.001</td>
<td>0.009</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.003</td>
<td>0.009</td>
<td>-0.002</td>
<td>0.007</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.005</td>
<td>0.005</td>
<td>0.011</td>
<td>-0.002</td>
<td>0.012</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.004</td>
<td>0.008</td>
<td>0.000</td>
<td>0.009</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.003</td>
<td>0.004</td>
<td>0.011</td>
<td>-0.001</td>
<td>0.009</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.003</td>
<td>0.010</td>
<td>-0.003</td>
<td>0.011</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.003</td>
<td>0.006</td>
<td>-0.001</td>
<td>0.006</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.004</td>
<td>0.009</td>
<td>0.000</td>
<td>0.009</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.004</td>
<td>0.010</td>
<td>-0.001</td>
<td>0.009</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.003</td>
<td>0.004</td>
<td>0.013</td>
<td>0.000</td>
<td>0.007</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.005</td>
<td>0.011</td>
<td>-0.002</td>
<td>0.011</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.002</td>
<td>0.009</td>
<td>-0.002</td>
<td>0.007</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.004</td>
<td>0.010</td>
<td>0.000</td>
<td>0.010</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.002</td>
<td>0.009</td>
<td>0.000</td>
<td>0.007</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.002</td>
<td>0.010</td>
<td>-0.002</td>
<td>0.007</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.003</td>
<td>0.011</td>
<td>0.000</td>
<td>0.006</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.002</td>
<td>0.003</td>
<td>0.014</td>
<td>-0.002</td>
<td>0.008</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.004</td>
<td>0.004</td>
<td>0.012</td>
<td>-0.002</td>
<td>0.011</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.003</td>
<td>0.006</td>
<td>0.011</td>
<td>-0.002</td>
<td>0.010</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.003</td>
<td>0.004</td>
<td>0.009</td>
<td>-0.002</td>
<td>0.010</td>
</tr>
<tr>
<td>RealEstate</td>
<td>0.000</td>
<td>0.001</td>
<td>0.020</td>
<td>-0.006</td>
<td>0.008</td>
</tr>
<tr>
<td>RETURN</td>
<td>0.020</td>
<td>0.022</td>
<td>0.071</td>
<td>-0.019</td>
<td>0.065</td>
</tr>
<tr>
<td>Prof</td>
<td>0.002</td>
<td>0.003</td>
<td>0.028</td>
<td>-0.008</td>
<td>0.014</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.001</td>
<td>0.000</td>
<td>0.030</td>
<td>-0.013</td>
<td>0.014</td>
</tr>
<tr>
<td>Prof</td>
<td>0.001</td>
<td>0.002</td>
<td>0.042</td>
<td>-0.009</td>
<td>0.014</td>
</tr>
<tr>
<td>Prof</td>
<td>0.000</td>
<td>0.001</td>
<td>0.021</td>
<td>-0.008</td>
<td>0.011</td>
</tr>
<tr>
<td>Prof</td>
<td>0.011</td>
<td>0.007</td>
<td>0.066</td>
<td>-0.014</td>
<td>0.043</td>
</tr>
<tr>
<td>Prof</td>
<td>0.009</td>
<td>0.006</td>
<td>0.035</td>
<td>-0.009</td>
<td>0.027</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.001</td>
<td>0.001</td>
<td>0.066</td>
<td>-0.028</td>
<td>0.026</td>
</tr>
<tr>
<td>Prof</td>
<td>0.002</td>
<td>0.000</td>
<td>0.027</td>
<td>-0.008</td>
<td>0.007</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.001</td>
<td>0.001</td>
<td>0.035</td>
<td>-0.011</td>
<td>0.013</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.002</td>
<td>0.000</td>
<td>0.043</td>
<td>-0.010</td>
<td>0.015</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.002</td>
<td>0.000</td>
<td>0.030</td>
<td>-0.017</td>
<td>0.015</td>
</tr>
<tr>
<td>Prof</td>
<td>0.006</td>
<td>0.007</td>
<td>0.052</td>
<td>-0.022</td>
<td>0.029</td>
</tr>
<tr>
<td>Prof</td>
<td>0.004</td>
<td>0.000</td>
<td>0.291</td>
<td>-0.020</td>
<td>0.020</td>
</tr>
<tr>
<td>Prof</td>
<td>0.002</td>
<td>0.004</td>
<td>0.021</td>
<td>-0.010</td>
<td>0.015</td>
</tr>
<tr>
<td>Prof</td>
<td>0.003</td>
<td>0.001</td>
<td>0.039</td>
<td>-0.014</td>
<td>0.012</td>
</tr>
<tr>
<td>Prof</td>
<td>0.000</td>
<td>0.000</td>
<td>0.026</td>
<td>-0.013</td>
<td>0.016</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.003</td>
<td>0.001</td>
<td>0.040</td>
<td>-0.008</td>
<td>0.012</td>
</tr>
<tr>
<td>Prof</td>
<td>-0.007</td>
<td>-0.002</td>
<td>0.046</td>
<td>-0.010</td>
<td>0.006</td>
</tr>
<tr>
<td>Prof</td>
<td>0.010</td>
<td>0.008</td>
<td>0.083</td>
<td>-0.015</td>
<td>0.028</td>
</tr>
<tr>
<td>Prof</td>
<td>0.000</td>
<td>0.002</td>
<td>0.029</td>
<td>-0.009</td>
<td>0.012</td>
</tr>
<tr>
<td>Prof</td>
<td>0.002</td>
<td>0.003</td>
<td>0.028</td>
<td>-0.008</td>
<td>0.014</td>
</tr>
<tr>
<td>Prof</td>
<td>0.002</td>
<td>0.003</td>
<td>0.021</td>
<td>-0.007</td>
<td>0.011</td>
</tr>
</tbody>
</table>
Notes: The table provides descriptive statistics for key variables. $\Delta \text{RealEstate}_{\text{region}} = x$ is month-over-month real estate price change on the real estate region x index. $\Delta \text{Prof}_{\text{region}} = x$ is quarterly accounting profitability change for region x, and $\Delta \text{Prof}$ is the quarterly accounting profitability change over all firms in the economy. The regional classification is as follows: region 1 = DC-Washington; region 2 = MI-Detroit; region 3 = MN-Minneapolis; region 4 = OH-Cleveland; region 5 = CA-San Diego; region 6 = CA-San Francisco; region 7 = CO-Denver; region 8 = IL-Chicago; region 9 = MA-Boston; region 10 = NC-Charlotte; region 11 = OR-Portland; region 12 = WA-Seattle; region 13 = AZ-Phoenix; region 14 = CA-Los Angeles; region 15 = TX-Dallas; region 16 = FL-Miami; region 17 = FL-Tampa; region 18 = GA-Atlanta; region 19 = NV-Las Vegas; region 20 = NY-New York; region 21 = 20-city composite; region 22 = 10-city composite. $\text{RETURN}$ is the quarterly buy-and-hold return on the stock market index (i.e., the S&P Stock Composite Index); $\text{GDP}$ is the quarterly realization of GDP growth in real terms; $\text{TBILL}$ is the yield on the one-year constant maturity Treasury bill; $\text{INFLATION}$ is based on the realization of the consumer price index for the quarter; $\text{CORP}$ is quarterly growth in corporate profits calculated by the Bureau of Economic Analysis; $\text{TERM}$ is the yield on the ten-year constant maturity Treasury bond minus the yield on the one-year constant maturity Treasury bill. To develop measures of regional accounting profitability changes, I sort firms into regions based on the location of their headquarters. Using firms in each region, I construct quarterly indices of regional accounting profitability changes based on earnings reports available in real time. I measure accounting profit for firm $i$ in quarter $q$ ($\text{Prof}_{i,q}$) as scaled quarterly operating income before depreciation. I measure accounting profitability change ($\Delta \text{Prof}_{i,q}$) as the year-over-year change in $\text{Prof}_{i,q}$. To mitigate the effects of outliers, I trim a firm’s profits and profit changes based on the top and bottom one percentile of each quarterly cross-section. To avoid negative denominator problems, I scale profits by sales. Regional quarterly time series of profits ($\text{Prof}$) and profit changes ($\Delta \text{Prof}$) are based on value-weighted cross-sectional averages, with weights based on market value of equity as of the beginning of each quarter. For a firm-quarter to be included in the sample it must have nonmissing values for market value of equity, $\Delta \text{Prof}_{i,q}$, and the quarterly earnings announcement date. Accounting variables are from the Compustat North America Fundamentals Quarterly File (WRDS: FUNDQ) available from WRDS. Treasury bond and bill yields from the Federal Reserve Board of Governors H15 Report; and GDP, inflation, and corporate profits from the Philadelphia’s Fed Real-Time Data Research Center, where these Fed’s data are quarterly and stated in annual rates. Case-Shiller Home Price Indices are from the S&P Dow Jones Indices website. The analyses throughout employ varying samples, to allow for feasible information flows and following the Case-Shiller coverage of the housing data that vary by regions. Specifically, following the Case-Shiller coverage, real estate price changes include 182 to 518 observations depending on the region. In terms of alignment with accounting data, analyses of stock investment strategies use observations as reported in the related table. For analyses predicting future real estate price changes I calculate regional accounting profitability changes using quarterly accounting observations over the period from Q4:1972 to Q4:2014 (n = 168 quarters).
References


Hughes, J. D., 2013, “What Drives Condo Prices: the Rental or Single Family Housing Market?,” Massachusetts Institute of Technology Center for Real Estate, Program in Real Estate Development.


Storch, M., 2011, “Opening Address Speech by Chairman of the Board of the Nobel Foundation,” the Nobel Foundation.


