ONLINE APPENDIX FOR:

Geographic financial performance: Implications for local real estate prices and REIT stock returns

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ABSTRACT

This appendix provides additional information on the paper titled "Geographic financial performance: Implications for local real estate prices and REIT stock returns." Whereas the paper focuses on likely readers, this appendix focuses on potential replicators and providing interested readers with additional information.

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Overall, the paper addresses the following questions: How do local real estate markets move in the cross-section of geographic regions? Are such movements linked to the regional performance of the corporate sector, and what is the role of financial information in understanding such linkages? How are possible regional-financial-real-estate linkages processed in capital markets such as stocks, and how is this processing affected by information in corporate financial reports? This appendix provides replication guidance and additional information, as follows:

1. The paper develops real-time measures of regional profitability changes. This appendix provides detailed information on this process. Specifically, the following information is used in this process: (a) a zip-code-coordinates mapping from the Census Gazetteer File of U.S. Department of Commerce's Census Bureau, (b) longitude and latitude coordinates for Case-Shiller regions,[1] (c) zip codes of Compustat's corporate headquarters, and (d) the distance of a firm's headquarters to its closest Case-Shiller region using a spherical distance calculation that accounts for the curvature of earth.[2]

[1] Google search extracts coordinates for the Case-Shiller regions, that are then converted to be stated in decimal terms for the spherical distance formula. For example, to extract the longitude and latitude of Washington, DC, we search for the following term: "coordinates of Washington DC," which provides "38.9047° N, 77.0164° W." We convert these coordinates to be stated in decimal terms for the spherical distance formula. Latitude measures a location's distance relative to north or south of the equator (where the equator is situated at 0°, the North Pole at 90° north, the South Pole at 90° south (or -90°), and its measurements range from 0° to (+/-)90°). Longitude measures a location's distance relative to east or west of the prime meridian (where the prime meridian runs through Greenwich, England, and its measurements range from 0° to (+/-)180°). Therefore, we precede the latitude by a minus sign (-) if it is south of the equator (a positive latitude implies north), and we precede the longitude by a minus sign if it is west of the prime meridian (a positive longitude implies east).

[2] For long distances that span large countries, measures based on two dimensions are not appropriate because they fail to account for the earth's near-spherical shape of an oblate spheroid; consequently, distance measures need to use the graticule, the coordinate system along with a specific formula (e.g., Ivis 2006). Lines of latitude run in an east to west direction either above or below the equator. Lines of longitude run north and south through the poles, often with the Prime Meridian (running through Greenwich, England) measured at 0°. Accordingly, for each firm we first obtain the longitude and latitude coordinates (measured in degrees of decimal) of its headquarters from the U.S. Census Bureau's Gazetteer File and convert coordinates from decimal degrees to radians by multiplying the latitude and longitude values by $\pi/180$. We then use the great circle distance Haversine formula to calculate mileage between two pairs of latitudes and longitudes, as follows: distance = 3959 * (2 * Arcsin(min(1,sqrt(Sin(((Lat2 - Lat1) * CT) / 2)2 + Cos(Lat1 * CT) * Cos(Lat2 * CT) * Sin(((Long2 - Long1) * CT) / 2)2)))), where CT refers to $\pi/180$; Lat1 and Lat2 (Long1 and Long2) refer to the latitudes (longitudes) of two points; 3959 refers to the radius of the earth that is assumed to be 3,959 miles; sqrt (min) refers to the square root (minimum) functions; and Sin, Cos, and Arcsin respectively refer to the sine, cosine, and arcsine circular trigonometric functions.

Then, using the longitude and latitude coordinates, this paper calculates distances between each Compustat firm's headquarter and all Case-Shiller regions and then assigns each firm into a region based on the minimal distance. This process thus sorts all firms into regions based on the location of their headquarters.

Regarding the construction of the reginal profitability indices, note that the analysis focuses on profitability changes and not on the difference between actual and analysts' forecast of profitability because the hypothesis directly relates to how profits manifest in real estate demand through profit sharing rather than how profits deviate from analysts' expectations. Firms can beat analysts' expectations and still be unprofitable or have their profits decrease. Also note that the paper's real-time indices of regional profitability performance can also be used for future research, for instance to obtain real-time financial-statement-based profitability indices at the zip code, county, state, or any other desirable geographic level.

2. To assess the validity of the regional profitability indices, for the paper and future research, the paper conducts external validity analysis employing Fed's data. In particular, for each quarterly change in a regional profitability index, the corresponding quarterly change in the Philadelphia's Fed State Coincident Index (which combines four state-level indicators from the BEA and BLS about current economic conditions) is calculated, matching each Case-Shiller region with the state in which the region is located. The analysis then calculates correlations, for each region, between changes in the regional profitability index and changes in the Fed's Coincident Index for the state in which the Case-Shiller region is located. The findings show correlations of up to 0.474 across U.S. regions, all significant at the 1 percent level, which indicates that the regional profitability indices reflect a material portion of local economies. Note that the finding of non-perfect correlations for the Case-Shiller regions are expected, as Fed's coincident data reflect economic

performance (a) at the state level (which is the same across Case-Shiller regions within a state) and (b) for dimensions that are different from firms' financial statement profits. Overall, this analysis provides some external validity on the regional profitability indices. A further assessment firms' accounting profits versus Fed's state coincident data is as follows. First, conceptually accounting profits are closely tied to the paper's hypothesis, given the long line of prior theoretical and empirical works on firms' profit sharing with employees. Second, Fed's local economic data are at the state level, and thus data are the same for all Case-Shiller regions within each state. Third, Fed's data do not focus on firms' profits but rather reflect several other economic activities. Fourth, Fed's state data are subject to substantial revisions, every month, triggered by BEA and BLS benchmark revisions. Specifically, revisions to Fed's indicators reflect, among other reasons, the impact of the revisions to employment figures, the annual benchmark revisions to employment and income, the re-estimation of models each year following the release of the benchmark revisions and the model specification, and the smoothing procedure incorporating each new observation that causes a slight revision to the entire series each month. However, as an empirical matter the analysis examines information in firms' accounting profits relative to Fed's state-level data as well as to several additional variables such as term spread, interest rate, GDP, stock returns, inflation, and BEA corporate profits. Regional profitability changes are incremental to the variables considered.

3. The paper explains that stocks are adjusted for possible delisting returns following Shumway and Warther (1999). More detailed information is as follows. In the first step: (1) If a security delists during a particular period and the delisting return is coded as missing by CRSP, the observation's treatment is based on the reason for the delisting. If the delisting results from a performance-related reason (delisting code higher than 499, excluding delisting codes equal to 501 or 502, e.g., price too low, insufficient shareholders, bankruptcy or insolvency, failure to meet equity

requirements, or forced delisting by the SEC or the exchange), then a single replacement value of -55 percent is used as the delisting return. Otherwise, the analysis employs as the missing delisting return the average delisting return of similar delisting categories. (2) Alternatively, if a security delists and the delisting return is coded as available by CRSP (note that in this case the monthly delisting returns contain partial-month returns), then the compounded delisting return and a single replacement value of -55 percent are used as the delisting return if the delisting is as a result of a performance-related reason; otherwise, the compounded delisting return and the average delisting return of similar delisting categories are used as the delisting return. In the second step, the monthly raw return is the delisting return if the monthly raw return is missing, or the compounded raw return with the delisting return if the monthly raw return is not missing. Overall, the portion of delisting firms in the sample is negligible, and inferences from return tests throughout the paper are unchanged when the analysis is repeated without this delisting adjustment.

4. A note on the relation of the paper to the post-earnings-announcement drift (PEAD). First, the paper focuses on regional financial statement performance while PEAD is a firm-level phenomenon. Second, whereas PEAD portfolios focus on extreme good- and bad-news firms, the paper summarizes performance within each region using all firms, including those with good, bad, and varying performance levels, expected and unexpected. In addition, PEAD portfolios comprise of firms across all regions, while the investment strategies employ firms within each region. Further, the investment sorts all regions into portfolios based on the overall profitability performance in each region; not on each firm's news as PEAD strategies do. Also, the analysis employs earnings announced within several weeks after each fiscal quarter-end and then calculate stock returns beginning on the following month; thus the return accumulation period begins two

to eight weeks subsequent to firms' earnings announcements -- only after the period during which PEAD returns are mostly significant.

5. The paper refers to a demand-supply analysis, such as calculating the ratio of corporate employees relative to the supply of real estate properties available for sale. In addition to the information provided in the paper, we note that this examination is challenging because financial statements and common datasets, such as Compustat, only provide firms' total number of employees and not the locations of where employees work. For this reason prior research provides only limited guidance to assess whether regional real estate demand from local employees is material. To overcome the data limitation, we use a number of datasets obtained or collected from public sources.

   In particular, we first obtain data from Zillow on the supply of properties available for sale (for the exact URL link, please see: http://www.zillow.com/research/data; where the residential dataset that provides detailed information at the zip code level is For-Sale Inventory (Raw)). Second, we use geographic location and number of employees from firms' annual financial statements available from the Compustat's Fundamentals Annual File. Overall, using these data sources we examine marginal demand power from corporate employees relative to the supply of real estate properties available for sale.

   In addition to the results in the paper, we conduct another employee-related analysis using micro-level employee data across all U.S. establishments, leveraging a powerful dataset that we obtain from the Real Estate and Financial Markets Lab of University of California Berkeley's Fisher Center. This dataset, called the National Establishment Time Series (NETS), provides detailed information about each establishment across the United States (e.g., 18,956,031 observations in 2009), including each establishment's exact location, industry classification, number of employees,

and identifiers of the firms employing these employees. Although the NETS dataset includes a few years only, with non-continuous coverage over time, and it requires substantial cleaning and programming to handle, this dataset allows a micro analysis of the demand power from corporate employees across regional housing markets.

Using this analysis, we find that the local-to-total employee fraction across U.S. firms (not only in the banking industry) varies between 0.2 percent and 100 percent, with a mean of 89 percent. This finding reflects an average of 18 to 28 local employees (0.89*20 to 0.89*32) for a property that is available for sale, further highlighting the significant marginal demand power for housing driven by changes in regional firms' performance.

6. Appendix Table A1 reports detailed results on all the pairwise correlations used to construct Table 3 in the paper (Table 3 in the paper reports results from analyzing overlaps in real estate price changes and profitability changes across regions using pairwise correlations).

7. Appendix Table A2 reports detailed information about the sum of corporate employees for firms headquartered in each Case-Shiller region and the related-region supply of residential real estate properties available for sale, reported for all regions and by region (it is used to construct the ratios reported in Table 4 in the paper).

8. Two points regarding the construction and the number of factors in the stock return analyses reported in the paper. First, we also consider adding an additional, investment-based factor. However, we stop at five factors to follow the widely accepted asset pricing literature that includes the Carhart's (1997) momentum factor and because controlling for more factors is problematic given that correlations among the underlying variables are likely to result in poor diversification of some of the portfolios used to construct factors (e.g., Fama and French 2015). Second, we

provide detailed information about forming the additional factors. Specifically, following Fama and French (1993), we sort all observations at the end of each month into two IB groups, with group 1 (2) including observations with low (high) IB, and three book-to-market (BTM) groups, with group 1 (3) including observations with low (high) BTM. We then construct six portfolios (L/L, L/M, L/H, H/L, H/M, and H/H) from the two IB groups and the three BTM groups intersections, with the first letter in each X/X combination referring to the IB portfolio (low, high) and the second letter referring to the BTM portfolio (low, medium, high). Next, we calculate monthly value-weighted returns on the six portfolios over the subsequent quarter after the quarterly profitability information becomes available. We calculate the IB1 factor for each month as the average of the monthly returns on the three high-IB portfolios (H/L, H/M, H/H) minus the average of the monthly returns on the three low-IB portfolios (L/L, L/M, L/H). As a sensitivity check, we calculate the second factor, IB2, using a similar procedure, except that we sort into IB deciles only and then each month we use the average of the monthly returns on the three high-IB portfolios minus the average of the monthly returns on the three low-IB portfolios.

9. To conduct a two-step Fama and MacBeth (1973) procedure, a monthly factor-mimicking regional profitability information portfolio, *FRegionalProfit*, is formed based on regional profitability changes across regions. This factor is formed following the procedure that Fama and French (1993, 2015) use in forming their factors (e.g., *HML*). Specifically, at the end of each month all observations are sorted into groups based on *BTM* and a firm's assigned regional profitability rank which is based on its location. The regional rank is based on the most recent regional profitability quarterly sort of the 20 regional profitability quarterly changes. The high/low regional profitability groups are defined as regions with highest/lowest changes in the most recent regional financial statement profits for firms in these regions. The high, medium and low *BTM* groups are defined based on the terciles of firms' *BTM* ratios computed each month based on

firms' most recent annual book value of equity and their market value of equity each month. We then construct six portfolios each month from the intersection of the two reginal profitability ranking groups and the three *BTM* group, and calculate the returns on each of the six portfolios for each subsequent month. *FRegionalProfit* is then calculated each month as the *BTM*-neutral portfolio, defined as the average of the monthly returns on the three high portfolios minus the average of the corresponding monthly returns on the three low portfolios. Similar to the *IB* factors constructed above, we also construct the *FRegionalProfit* by sorting into ten regional profitability rank portfolios and using the average returns on the three highest portfolios minus the three lowest portfolios. The inferences from the two ways of constructing the factor are unchanged, and thus we report results using the first way.

10. Additional Analyses. These analyses further probe the regional-profitability-equity link and the mechanism of how geographic financial statement information is processed in stocks.

    a. *Probing the Information Processing Mechanism of Regional Profitability*. If the documented stock return patterns are driven by REIT investors' delayed processing of regional profitability, one would expect stock returns to gradually reflect information as it diffuses over time. A direct prediction thus is that investment strategies beginning after the effect of regional profitability changes on real estate dissipates should yield lower or no profitable stock returns.

    To execute this test, we use a difference-in-differences analysis that examines how stock return outcomes from regional profitability shocks (treatment) differ across control groups with varying elapsed times after the profitability shocks. The control groups are the average, normal returns on firms in the same risk profile. Thus, the difference in

abnormal returns across varying elapsed lags since the shocks allows a direct test of the profitability shock effect.

As a practical design matter, we note that control groups should not include firms for which we examine return outcomes (i.e., REIT stocks). A possible solution is to estimate control group returns by constructing "synthetic" factor returns in a similar way that Fama and French (1993) do, except that portfolios underlying the factors exclude REITs. An alternative solution is insightful and can be used in other REIT-based analyses. Specifically, the Fama-French factors do not include sample firms because REITs are excluded in their construction (see Fama and French 1993, p. 9). Thus, in this setting the control groups are the (non-REIT) average returns on the Fama-French factors.

In sum, we repeat the stock return tests from Section V, except that the buy/sell investment decisions begin four months after the month in which all information is available for ranking the regional profitability changes across U.S. regions. We then compare how abnormal stock return outcomes differ across the different points of making the initial investments. Appendix Table A3 reports the results of this analysis, with future stock returns shown for investment strategies beginning X months after the month in which all regional profitability indices become publicly available. Panel A reports firm-level summary of future returns, and Panel B reports portfolio analysis results. The main takeaway from both panels is that the future abnormal returns are generally insignificant beyond four months after the month in which information about all regional profitability changes becomes available, gradually dissipating after that. Appendix Table A3 also shows that the stock return patterns across the different initial investment points closely mirror the evidence from the impulse response analysis. In particular, the impulse

response analysis shows that most of the regional profitability changes manifest in house price changes over the three-four months subsequent to the change and dissipate after that. If REIT investors gradually incorporate regional profitability information in their decisions, most of the future abnormal stock returns are likely to manifest over the three-four months subsequent to the change. The table documents that this indeed is the case, further supporting the mechanism of how regional financial statement information manifests in investments in real estate and in REIT stocks. Overall, findings from Appendix Table A3 further show how geographic financial statement information is processed in stock prices.

b. Can Risk Explain the Documented Return Patterns? The equity investment strategies show significant abnormal returns and thus they provide evidence of mispricing. However, although the abnormal returns can be attributable to mispricing from geographic profitability information being nontrivial to obtain or process, they may also be attributable to an omitted risk factor. Even though the return tests employ asset pricing models for expected return that control for risk and are widely accepted in cutting-edge asset pricing research, we investigate the possibility that an unknown omitted risk factor drives the return findings.

Specifically, we begin by conducting a two-step Fama-MacBeth analysis that examines whether a risk factor is priced. This test constructs a regional-profitability-based factor and analyzes whether there is a positive risk premium for this factor in a cross-sectional regression analysis (e.g., Fama and MacBeth 1973; Fama and French 1992). In the first step, we estimate the following time-series regressions at the portfolio level:

$$R_{p,m} - R_{f,m} = \lambda_p + \beta_{p,MKTRF,m} \cdot MKTRF_m + \beta_{p,SMB,m} \cdot SMB_m + \beta_{p,HML,m} \cdot HML_m + \\ + \beta_{p,UMD,m} \cdot UMD_m + \beta_{p,RegionalProfit,m} \cdot FRegionalProfit_m + \kappa_m,$$

where *FRegionalProfit* is a monthly factor-mimicking regional profitability information portfolio formed based on regional profitability changes across regions, following the procedure that Fama and French (1993, 2015) use in forming their factors (e.g., *HML*; for brevity see the appendix for detailed information about this factor formation). The analysis first focuses on the 48 industry portfolios following Fama and French (1997), with portfolio returns from Kenneth French's website. The analysis also employs the 25 and 100 portfolios (constructed on the intersection of 5-by-5 and 10-by-10 *BTM* and *MVE* portfolios, respectively) following Fama and French (1993). Explaining the cross-sectional patterns in these Fama-French portfolio returns has attracted interest and been widely used in the literature (e.g., Lettau and Ludvigson 2001). We use the time-series portfolio regressions to obtain the predicted factor loadings (betas) for each of the portfolios, estimated using five-year rolling windows that end at month *m*, with the requirement of at least ten portfolio-month observations in each window.

In the second step, we estimate cross-portfolio monthly regressions of portfolio excess returns for month *m*+1 on the predicted rolling betas, such that each regression pools predicted betas for the 48 (and then the 25 or 100) portfolios, as follows:

$$R_{p,m+1} - R_{f,m+1} = \phi_{m+1} + \gamma_{MKTRF,m+1} \cdot \hat{\beta}_{p,MKTRF,m} + \gamma_{SMB,m+1} \cdot \hat{\beta}_{p,SMB,m} + \gamma_{HML,m+1} \cdot \hat{\beta}_{p,HML,m} \\ + \gamma_{UMD,m+1} \cdot \hat{\beta}_{p,UMD,m} + \gamma_{FRegionalProfit,m+1} \cdot \hat{\beta}_{p,FRegionalProfit,m} + \sigma_{m+1},$$

where $\hat{\beta}_{p,MKTRF,m}$, $\hat{\beta}_{p,SMB,m}$, $\hat{\beta}_{p,HML,m}$, $\hat{\beta}_{p,UMD,m}$, and $\hat{\beta}_{p,FRegionalProfit,m}$ are the predicted portfolio betas estimated in the first step using data conditioned on month *m*. We aggregate and conduct tests on the estimates following the Fama and MacBeth (1973) procedure.

Appendix Table A4 reports the results of the second stage following the second step above. With respect to the Fama-French factors, the inferences are consistent with prior research (e.g., Petkova 2006; Core et al. 2008). The mean estimated coefficients on the market, size, book-to-market, and momentum factors are 0.003, 0.003, 0.006, and –0.001 (with respective Fama-MacBeth t-statistics of 0.61, 1.26, 2.17, and –0.10), respectively. Turning to the coefficient of interest, the mean estimated coefficient on $\hat{\beta}_{p,FRegionalProfit,m}$ across the monthly cross-sectional regressions, i.e., $\gamma_{FRegionalProfit,m+1}$, is 0.003, with a Fama-MacBeth t-statistic of 1.14. The additional analysis in this table reveals similar inferences when we use the 25 and 100 Fama-French portfolios to execute this test. In particular, using the 25 and 100 portfolios results in a mean estimated $\gamma_{FRegionalProfit,m+1}$ coefficient across the monthly cross-sectional regressions, of –0.001 in both cases, with Fama-MacBeth t-statistics of –0.26 and –0.53, respectively.

The insignificance of the estimated coefficient associated with the regional profitability factor, $\gamma_{FRegionalProfit,m+1}$, is inconsistent with an omitted risk factor associated with regional financial statement information. Rather, this result is consistent with abnormal returns being attributable to the processing of nontrivial information (e.g., Hong and Stein 1999).

c. *How is Regional Profitability Information Processed by Real Estate Forecasters?* We test how real estate forecasters process past information about regional profitability. The analysis focuses on the relation between future forecast errors of real estate price changes and current-period regional profitability information, similar to the logic developed in the analysts' literature and other related settings (see, e.g., Grullon and Michaely 2002).

Real estate forecasts are obtained from Zillow and Econoday, two readily accessed and recognized sources of real estate forecasts. The Zillow forecasts are available for free via press releases on the company's website, where we hand collect the forecasts, one-by-one, from their press releases. The other forecasts are from Econoday Inc., a major provider of economic data, where we purchase these forecasts. The forecasts are limited in their coverage of regions and time periods. Because of the data limitation and to abstract from unknown procedures implemented by the forecast providers, we focus on annual forecasts for the 20-city composite without seasonal adjustments available from both sources. Forecast errors are constructed as actual realizations of real estate price changes using the Case-Shiller index minus the corresponding-period forecasts. Then we use regression models that regress these forecast errors on past profitability changes in the corresponding region. Appendix Table A5 reports results from regression models of future forecast errors of real estate price changes on current-period profitability changes in the corresponding-region. The table shows that the estimated coefficient on the regional profitability changes is significant using both Econoday (t-statistic = 2.17) and Zillow (t-statistic = 2.39). This finding indicates that past regional profitability information is not fully processed in both sets of real estate forecasts, providing evidence that at least one group of informed experts, namely real estate forecasters, does not fully process regional profitability information. This finding is consistent with the evidence from the stock return analyses showing that REIT investors do not fully processed regional profitability information.

d. Why is Regional Profitability Information not Fully Priced? At this stage a natural question arises: what can drive the delayed stock price adjustment to regional profitability information? Obtaining and processing regional profitability information are not trivial indeed, as

suggested above. But is there a possible way in which investors process regional profitability information that can explain the documented abnormal return patterns? In this analysis, we conjecture a possible way in which REIT investors process geographic profitability information and then examine whether the data are consistent with such a way.

Stemming from the permanent income economic theory (e.g., Friedman 1956), more persistent regional profitability changes should result in more substantial implications for the housing and equity markets. More specifically, the permanent income theory describes how economic agents spread spending over their lifetimes, positing that consumption at any point in time is determined not only by current income but also by the expected income in future years; that is, the "permanent income." The permanent income hypothesis thus states that changes in permanent income, rather than changes in temporary income, drive patterns in income spending. This theory has been empirically validated and used to explain major macro phenomena (e.g., Hall 1978; Bernanke 1984; Shapiro and Slemrod 2003). In this paper, the permanent income theory dictates that a highly persistent change to the financial performance in a region should have a stronger wealth effect on individuals employed in the region, which manifests in stronger demand for real estate in that region and thus in higher real estate price changes; and vice versa.

The above reasoning provides an ex ante prediction. If REIT investors do not adequately calibrate for the persistence of regional profitability changes, and thus do not process the full effect of regional profitability changes on REIT stock prices, abnormal returns will be higher (lower) in regions with more (less) persistent regional profitability changes. Indeed, prior research suggests that investors do not adequately process the persistence

of firm-level profitability performance components (e.g., Sloan 1996), which further raises the possibility that REIT investors may not adequately process the differential persistence in profitability performance changes across regions.

To execute this analysis, each region's persistence in regional profitability changes is estimated using the slope from an AR(1) regression model of the regional profitability performance change on its lagged value (and an intercept). Then, the sample is split into three persistence groups, and the abnormal return analyses are conducted for each of the subsamples.

Appendix Table A6 reports the findings, summarized as follows: (a) for the lowest persistence group, abnormal returns from the firm-level tests as well as the zero-cost investment portfolio strategy are largely insignificantly different from zero; (b) for the highest persistence group, abnormal returns from the firm-level tests as well as the zero-cost investment portfolio strategy are statistically significant at the 5 percent level; and (c) the findings for the highest persistence group are also economically significant, with abnormal returns about twice as those for the full sample (specifically, in annual terms: firm-level abnormal returns vary between 7.4 and 8.6 percent; abnormal return on the zero-cost portfolio = 17.8 percent).

Together, this evidence, that future abnormal returns increase with the persistence in regional profitability changes, is consistent with REIT investors do not adequately process the different persistence in profitability changes across U.S. regions, and thus the associated implications for regional housing markets and REIT stock prices. In addition, the findings throughout the study do not collectively point to alternative explanations for the documented patterns in housing and stock markets. It rather supports the conjecture

that the nontrivial nature of regional profitability information leads to predictable REIT returns.

e. *Other Tests.* The following robustness tests are conducted in addition to those in the paper: (a) conducting impulse response analysis in each of the Case-Shiller regions; (b) using raw returns in the investment analyses; (c) using nominal GDP instead of real GDP in the regression predicting future real estate price changes. The results indicate the same inferences as those reported throughout the paper.[3]

[3] In particular, Appendix Table A7 reports the regional impulse response analyses for Case-Shiller metropolitan regions. Appendix Table A8 reports results for returns analyses using raw returns (for the firm-level tests; regarding the portfolio tests the regressions include varying regressors and they are not meaningful with the regressors other than average returns). Finally, replacing nominal with real GDP in the regressions of the cross-section of real estate valuation results in same significance on the regional profitability change; in the interest of brevity and because the results are essentially the same this table is not tabulated).

References

Bernanke, B. S. 1984. "Permanent Income, Liquidity, and Expenditure on Automobiles: Evidence from Panel Data." *Quarterly Journal of Economics* 99 (3), 587–614.

Carhart, M. M. 1997. "On Persistence in Mutual Fund Performance." *Journal of Finance* 52 (1), 57–82.

Core, J., W. Guay, and R. Verdi. 2008. "Is Accruals Quality a Priced Risk Factor?" *Journal of Accounting and Economics* 46 (1), 2–22.

Fama, E. F., and K. R. French. 1992. "The Cross-Section of Expected Stock Returns." *Journal of Finance* 47 (2), 427–465.

Fama, E. F., and K. R. French. 1993. "Common Risk Factors in the Returns of Stocks and Bonds." *Journal of Financial Economics* 33 (1), 3–56.

Fama, E. F., and K. R. French. 1997. "Industry Costs of Equity." *Journal of Financial Economics* 43 (2), 153–193.

Fama, E. F., and K. R. French. 2015. "A Five-Factor Asset Pricing Model." *Journal of Financial Economics* 116 (1), 1–22.

Fama, E. F., and J. D. MacBeth. 1973. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy* 81 (3), 607–636.

Friedman, M. 1956. "*A Theory of the Consumption Function*." New Jersey: Princeton University Press.

Grullon, G., and R. Michaely. 2002. "Dividends, Share Repurchases, and the Substitution Hypothesis." *Journal of Finance* 57 (4), 1649–1684.

Hall, R. E. 1978. "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence." *Journal of Political Economy* 86 (6), 971–987.

Hong, H., and J. Stein. 1999. "A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets." *Journal of Finance* 54 (6), 2143–2184.

Hong, H., and J. Stein. 2003. "Differences of Opinion, Short-Sales Constraints and Market Crashes." *Review of Financial Studies* 16 (2), 487–525.

Ivis, F. 2006. "Calculating Geographic Distance: Concepts and Methods." *Proceedings of the 19th Conference of Northeast SAS User Group* (Philadelphia, PA), 17–20.

Lettau, M., and S. Ludvigson. 2001. "Resurrecting the (C)CAPM: A Cross-Sectional Test when Risk Premia are Time-Varying." *Journal of Political Economy* 109 (6), 1238–1287.

Petkova, R. 2006. "Do the Fama-French Factors Proxy for Innovations in Predictive Variables?" *Journal of Finance* 61 (2), 581–612.

Shapiro, M. D., and J. Slemrod. 2003. "Consumer Response to Tax Rebates." *American Economic Review* 93 (1), 381–396.

Sloan, R. G. 1996. "Do Stock Prices Fully Reflect Information in Accruals and Cash Flow about Future Earnings?" *The Accounting Review* 71 (3), 289–315.

APPENDIX TABLE A1
Characteristics of Regional Housing Markets and Profitability Changes Across U.S. Regions

Panel A. Cross-sectional overlap in month-over-month regional real estate price changes (Spearman/Pearson correlations below/above the diagonal)

		region1	region2	region3	region4	region5	region6	region7	region8	region9	region10	region11	region12
region1	DC-Washington	1.000	0.585	0.684	0.592	0.782	0.777	0.490	0.695	0.696	0.527	0.559	0.632
region2	MI-Detroit	0.526	1.000	0.796	0.504	0.512	0.561	0.569	0.791	0.636	0.475	0.570	0.502
region3	MN-Minneapolis	0.665	0.649	1.000	0.597	0.592	0.642	0.669	0.804	0.692	0.510	0.579	0.544
region4	OH-Cleveland	0.571	0.487	0.517	1.000	0.444	0.572	0.661	0.645	0.597	0.571	0.604	0.581
region5	CA-San Diego	0.766	0.479	0.583	0.435	1.000	0.771	0.473	0.500	0.533	0.415	0.441	0.590
region6	CA-San Francisco	0.754	0.486	0.531	0.511	0.754	1.000	0.525	0.611	0.595	0.506	0.544	0.699
region7	CO-Denver	0.386	0.521	0.606	0.594	0.380	0.352	1.000	0.536	0.512	0.525	0.521	0.622
region8	IL-Chicago	0.724	0.622	0.694	0.600	0.509	0.548	0.396	1.000	0.646	0.584	0.590	0.642
region9	MA-Boston	0.683	0.634	0.704	0.578	0.546	0.584	0.508	0.617	1.000	0.490	0.425	0.522
region10	NC-Charlotte	0.444	0.349	0.356	0.524	0.313	0.380	0.424	0.481	0.462	1.000	0.596	0.648
region11	OR-Portland	0.446	0.421	0.379	0.559	0.320	0.371	0.404	0.461	0.338	0.489	1.000	0.720
region12	WA-Seattle	0.639	0.373	0.459	0.607	0.581	0.664	0.558	0.596	0.535	0.573	0.629	1.000
region13	AZ-Phoenix	0.600	0.441	0.493	0.313	0.577	0.587	0.380	0.489	0.499	0.371	0.427	0.518
region14	CA-Los Angeles	0.802	0.480	0.569	0.401	0.809	0.748	0.211	0.586	0.534	0.357	0.369	0.622
region15	TX-Dallas	0.566	0.425	0.584	0.732	0.432	0.551	0.825	0.580	0.666	0.715	0.644	0.640
region16	FL-Miami	0.682	0.367	0.517	0.286	0.546	0.500	0.306	0.505	0.417	0.233	0.357	0.476
region17	FL-Tampa	0.678	0.436	0.570	0.359	0.534	0.525	0.325	0.554	0.509	0.305	0.461	0.579
region18	GA-Atlanta	0.604	0.582	0.606	0.670	0.521	0.584	0.698	0.662	0.683	0.623	0.570	0.607
region19	NV-Las Vegas	0.471	0.396	0.411	0.281	0.558	0.421	0.214	0.392	0.319	0.276	0.434	0.479
region20	NY-New York	0.744	0.589	0.699	0.428	0.483	0.428	0.288	0.688	0.764	0.356	0.299	0.528

		region13	region14	region15	region16	region17	region18	region19	region20	**Statistics (excluding diagonal)** **Min**	**Max**	**Std.Dev**
region1	DC-Washington	0.703	0.828	0.617	0.719	0.731	0.621	0.593	0.735	**0.386**	**0.828**	**0.108**
region2	MI-Detroit	0.578	0.552	0.497	0.572	0.586	0.660	0.527	0.651	**0.349**	**0.796**	**0.103**
region3	MN-Minneapolis	0.615	0.599	0.623	0.616	0.650	0.688	0.491	0.694	**0.356**	**0.804**	**0.101**
region4	OH-Cleveland	0.401	0.443	0.751	0.343	0.446	0.662	0.323	0.450	**0.281**	**0.751**	**0.122**
region5	CA-San Diego	0.630	0.859	0.497	0.611	0.605	0.536	0.681	0.377	**0.313**	**0.859**	**0.133**
region6	CA-San Francisco	0.686	0.784	0.633	0.632	0.627	0.655	0.556	0.330	**0.330**	**0.784**	**0.121**
region7	CO-Denver	0.480	0.338	0.841	0.357	0.439	0.695	0.343	0.273	**0.211**	**0.841**	**0.154**
region8	IL-Chicago	0.543	0.575	0.646	0.541	0.616	0.778	0.454	0.682	**0.392**	**0.804**	**0.099**
region9	MA-Boston	0.451	0.525	0.686	0.405	0.477	0.665	0.369	0.764	**0.319**	**0.764**	**0.115**
region10	NC-Charlotte	0.482	0.443	0.728	0.347	0.442	0.665	0.388	0.400	**0.233**	**0.728**	**0.120**
region11	OR-Portland	0.643	0.480	0.695	0.533	0.625	0.665	0.544	0.367	**0.299**	**0.720**	**0.113**
region12	WA-Seattle	0.604	0.619	0.710	0.543	0.634	0.678	0.545	0.510	**0.373**	**0.720**	**0.074**
region13	AZ-Phoenix	1.000	0.722	0.439	0.840	0.817	0.519	0.685	0.581	**0.313**	**0.840**	**0.124**
region14	CA-Los Angeles	0.662	1.000	0.480	0.720	0.649	0.577	0.698	0.390	**0.211**	**0.859**	**0.151**
region15	TX-Dallas	0.351	0.422	1.000	0.360	0.531	0.718	0.332	0.423	**0.297**	**0.841**	**0.150**
region16	FL-Miami	0.657	0.641	0.307	1.000	0.781	0.495	0.712	0.383	**0.233**	**0.840**	**0.152**
region17	FL-Tampa	0.657	0.581	0.484	0.687	1.000	0.608	0.662	0.516	**0.305**	**0.817**	**0.114**
region18	GA-Atlanta	0.481	0.551	0.736	0.405	0.518	1.000	0.473	0.591	**0.364**	**0.778**	**0.091**
region19	NV-Las Vegas	0.522	0.566	0.297	0.551	0.534	0.364	1.000	0.484	**0.214**	**0.712**	**0.128**
region20	NY-New York	0.597	0.519	0.389	0.483	0.575	0.534	0.442	1.000	**0.273**	**0.764**	**0.142**

Panel B. Cross-sectional overlap in year-over-year regional real estate price changes (Spearman/Pearson correlations below/above the diagonal)

		region1	region2	region3	region4	region5	region6	region7	region8	region9	region10	region11	region12
region1	DC-Washington	1.000	0.541	0.754	0.583	0.873	0.813	0.222	0.781	0.643	0.408	0.452	0.643
region2	MI-Detroit	0.295	1.000	0.843	0.789	0.654	0.737	0.756	0.764	0.661	0.666	0.621	0.637
region3	MN-Minneapolis	0.804	0.624	1.000	0.793	0.811	0.829	0.767	0.888	0.781	0.622	0.564	0.703
region4	OH-Cleveland	0.396	0.606	0.485	1.000	0.662	0.664	0.503	0.755	0.432	0.529	0.600	0.547
region5	CA-San Diego	0.882	0.475	0.798	0.492	1.000	0.891	0.465	0.699	0.545	0.406	0.393	0.639
region6	CA-San Francisco	0.825	0.545	0.766	0.481	0.901	1.000	0.393	0.736	0.557	0.545	0.462	0.731
region7	CO-Denver	0.181	0.743	0.670	0.338	0.321	0.274	1.000	0.338	0.343	0.277	0.365	0.502
region8	IL-Chicago	0.793	0.412	0.791	0.480	0.677	0.683	0.280	1.000	0.636	0.731	0.583	0.844
region9	MA-Boston	0.681	0.615	0.880	0.292	0.652	0.625	0.448	0.702	1.000	0.405	0.094	0.510
region10	NC-Charlotte	0.269	0.494	0.338	0.334	0.227	0.393	0.112	0.504	0.343	1.000	0.718	0.840
region11	OR-Portland	0.199	0.304	0.172	0.357	0.211	0.241	0.308	0.295	-0.025	0.488	1.000	0.829
region12	WA-Seattle	0.604	0.390	0.560	0.295	0.642	0.719	0.402	0.742	0.545	0.708	0.567	1.000
region13	AZ-Phoenix	0.734	0.580	0.772	0.397	0.669	0.740	0.566	0.762	0.653	0.605	0.451	0.712
region14	CA-Los Angeles	0.903	0.367	0.723	0.392	0.930	0.879	0.097	0.742	0.569	0.364	0.265	0.750
region15	TX-Dallas	0.457	0.731	0.702	0.601	0.525	0.719	0.933	0.649	0.575	0.638	0.673	0.658
region16	FL-Miami	0.834	0.340	0.761	0.279	0.731	0.690	0.476	0.790	0.603	0.334	0.457	0.755
region17	FL-Tampa	0.774	0.411	0.784	0.259	0.701	0.661	0.459	0.767	0.695	0.428	0.440	0.773
region18	GA-Atlanta	0.560	0.705	0.707	0.549	0.637	0.763	0.767	0.724	0.723	0.646	0.500	0.765
region19	NV-Las Vegas	0.675	0.465	0.628	0.384	0.741	0.649	0.328	0.653	0.488	0.418	0.653	0.728
region20	NY-New York	0.760	0.358	0.787	0.229	0.517	0.468	0.120	0.848	0.885	0.487	0.153	0.710

		region13	region14	region15	region16	region17	region18	region19	region20	**Statistics (excluding diagonal)** **Min**	**Max**	**Std.Dev**
region1	DC-Washington	0.791	0.901	0.480	0.871	0.827	0.516	0.743	0.805	**0.181**	**0.903**	**0.215**
region2	MI-Detroit	0.716	0.611	0.776	0.678	0.674	0.750	0.696	0.546	**0.295**	**0.843**	**0.151**
region3	MN-Minneapolis	0.747	0.756	0.755	0.796	0.783	0.758	0.714	0.760	**0.172**	**0.888**	**0.141**
region4	OH-Cleveland	0.584	0.593	0.714	0.579	0.553	0.706	0.584	0.427	**0.229**	**0.793**	**0.151**
region5	CA-San Diego	0.638	0.940	0.587	0.725	0.706	0.643	0.787	0.481	**0.211**	**0.940**	**0.184**
region6	CA-San Francisco	0.754	0.868	0.746	0.750	0.728	0.744	0.704	0.459	**0.241**	**0.901**	**0.167**
region7	CO-Denver	0.508	0.149	0.912	0.432	0.451	0.690	0.391	0.065	**0.065**	**0.933**	**0.223**
region8	IL-Chicago	0.783	0.749	0.719	0.768	0.753	0.835	0.716	0.773	**0.280**	**0.888**	**0.150**
region9	MA-Boston	0.491	0.483	0.597	0.449	0.468	0.633	0.483	0.866	**-0.025**	**0.885**	**0.188**
region10	NC-Charlotte	0.660	0.483	0.687	0.553	0.595	0.769	0.598	0.531	**0.112**	**0.840**	**0.166**
region11	OR-Portland	0.742	0.447	0.690	0.714	0.738	0.723	0.690	0.268	**-0.025**	**0.829**	**0.212**
region12	WA-Seattle	0.818	0.740	0.682	0.813	0.843	0.769	0.736	0.701	**0.295**	**0.844**	**0.131**
region13	AZ-Phoenix	1.000	0.741	0.640	0.915	0.928	0.637	0.730	0.677	**0.397**	**0.928**	**0.115**
region14	CA-Los Angeles	0.721	1.000	0.595	0.808	0.756	0.644	0.765	0.470	**0.097**	**0.940**	**0.211**
region15	TX-Dallas	0.675	0.531	1.000	0.655	0.666	0.799	0.583	0.450	**0.450**	**0.933**	**0.113**
region16	FL-Miami	0.818	0.793	0.566	1.000	0.970	0.654	0.838	0.475	**0.279**	**0.970**	**0.176**
region17	FL-Tampa	0.850	0.733	0.633	0.880	1.000	0.677	0.815	0.586	**0.259**	**0.970**	**0.158**
region18	GA-Atlanta	0.711	0.624	0.853	0.654	0.715	1.000	0.694	0.590	**0.500**	**0.853**	**0.081**
region19	NV-Las Vegas	0.672	0.724	0.620	0.825	0.812	0.727	1.000	0.632	**0.328**	**0.838**	**0.129**
region20	NY-New York	0.728	0.503	0.465	0.459	0.710	0.658	0.597	1.000	**0.065**	**0.885**	**0.207**

Panel C. Cross-sectional overlap in regional profitability changes (Spearman/Pearson correlations below/above the diagonal)

		region1	region2	region3	region4	region5	region6	region7	region8	region9	region10	region11	region12
region1	DC-Washington	1.000	0.060	0.369	0.303	0.043	0.106	0.230	0.300	0.034	0.122	0.094	-0.064
region2	MI-Detroit	0.165	1.000	0.220	0.433	-0.091	-0.056	-0.047	0.218	0.094	0.081	0.187	0.352
region3	MN-Minneapolis	0.237	0.185	1.000	0.287	0.061	0.039	0.180	0.074	-0.006	-0.079	0.223	-0.172
region4	OH-Cleveland	0.268	0.407	0.239	1.000	-0.082	0.107	-0.029	0.337	0.115	0.378	0.200	0.191
region5	CA-San Diego	0.076	-0.074	-0.076	-0.078	1.000	0.139	0.159	-0.015	0.137	-0.118	0.034	-0.121
region6	CA-San Francisco	0.048	0.235	0.197	0.253	0.135	1.000	0.289	0.087	0.271	-0.127	0.293	0.020
region7	CO-Denver	0.072	-0.083	0.095	0.023	0.081	0.232	1.000	0.244	0.195	-0.008	0.119	-0.092
region8	IL-Chicago	0.241	0.246	0.137	0.312	-0.002	0.267	0.248	1.000	-0.099	-0.205	0.180	0.272
region9	MA-Boston	0.087	0.147	0.149	0.153	0.150	0.344	0.164	0.265	1.000	0.261	0.147	0.117
region10	NC-Charlotte	0.139	0.095	0.108	0.182	-0.028	0.008	0.023	0.153	0.073	1.000	0.023	-0.001
region11	OR-Portland	0.049	0.177	0.310	0.159	0.080	0.277	-0.031	0.210	0.148	0.140	1.000	0.039
region12	WA-Seattle	0.134	0.340	-0.022	0.218	-0.049	0.003	-0.088	0.058	0.085	0.036	-0.070	1.000
region13	AZ-Phoenix	0.167	0.065	-0.055	0.148	0.102	0.244	0.079	0.242	0.203	0.071	0.123	0.003
region14	CA-Los Angeles	0.259	0.143	0.189	0.297	0.046	0.324	0.143	0.213	0.166	0.126	0.184	0.080
region15	TX-Dallas	0.173	0.084	-0.068	0.154	0.199	0.362	0.144	0.331	0.181	0.079	0.300	0.034
region16	FL-Miami	0.105	0.213	0.277	0.143	0.046	0.199	0.103	0.238	0.130	0.128	0.227	0.085
region17	FL-Tampa	0.127	0.243	0.191	0.284	-0.158	0.219	0.136	0.234	0.181	0.107	0.132	-0.055
region18	GA-Atlanta	0.150	0.316	0.200	0.395	0.011	0.049	-0.001	0.323	0.231	0.228	0.268	0.117
region19	NV-Las Vegas	0.204	-0.081	0.023	0.168	0.124	0.220	0.218	0.211	0.127	0.034	0.075	-0.008
region20	NY-New York	0.307	0.143	0.240	0.343	0.087	0.232	0.050	0.333	0.103	0.197	0.215	0.072

		region13	region14	region15	region16	region17	region18	region19	region20	**Statistics (excluding diagonal)** **Min**	**Max**	**Std.Dev**
region1	DC-Washington	-0.004	0.283	0.293	0.153	0.260	-0.008	-0.090	0.348	**-0.090**	**0.369**	**0.115**
region2	MI-Detroit	-0.063	0.155	0.180	0.300	-0.020	0.057	-0.055	0.312	**-0.091**	**0.433**	**0.146**
region3	MN-Minneapolis	0.090	0.126	0.180	0.235	-0.192	0.234	-0.003	0.183	**-0.192**	**0.369**	**0.135**
region4	OH-Cleveland	0.207	0.296	0.223	0.215	0.270	0.301	0.015	0.438	**-0.082**	**0.438**	**0.131**
region5	CA-San Diego	0.063	-0.040	0.157	-0.068	-0.239	0.045	0.108	-0.036	**-0.239**	**0.199**	**0.102**
region6	CA-San Francisco	0.325	0.340	0.289	0.220	0.213	0.067	0.110	-0.042	**-0.127**	**0.362**	**0.127**
region7	CO-Denver	0.004	0.150	0.436	0.131	0.093	0.089	0.241	0.051	**-0.092**	**0.436**	**0.116**
region8	IL-Chicago	0.080	0.225	0.235	0.216	0.188	0.132	0.223	0.407	**-0.205**	**0.407**	**0.125**
region9	MA-Boston	0.152	0.123	0.226	-0.016	0.249	0.143	-0.047	0.025	**-0.099**	**0.344**	**0.091**
region10	NC-Charlotte	-0.004	0.041	0.144	0.011	0.341	0.199	0.086	0.182	**-0.205**	**0.378**	**0.119**
region11	OR-Portland	0.195	0.148	0.349	0.178	0.052	0.187	0.028	0.121	**-0.070**	**0.349**	**0.096**
region12	WA-Seattle	0.112	0.030	0.090	0.115	0.063	-0.069	-0.051	-0.036	**-0.172**	**0.352**	**0.118**
region13	AZ-Phoenix	1.000	0.136	0.159	0.028	0.021	0.073	0.065	0.272	**-0.067**	**0.367**	**0.110**
region14	CA-Los Angeles	0.210	1.000	0.188	0.352	0.370	-0.049	0.098	0.336	**-0.049**	**0.381**	**0.114**
region15	TX-Dallas	0.367	0.133	1.000	0.035	0.157	0.083	0.041	0.193	**-0.068**	**0.436**	**0.107**
region16	FL-Miami	-0.067	0.298	0.047	1.000	0.125	0.222	0.056	0.047	**-0.068**	**0.352**	**0.102**
region17	FL-Tampa	0.117	0.381	0.130	0.245	1.000	0.169	0.020	0.386	**-0.239**	**0.386**	**0.148**
region18	GA-Atlanta	0.056	0.065	0.164	0.227	0.302	1.000	0.438	0.077	**-0.069**	**0.438**	**0.120**
region19	NV-Las Vegas	0.314	0.270	0.206	0.130	0.156	0.175	1.000	0.177	**-0.090**	**0.438**	**0.119**
region20	NY-New York	0.269	0.336	0.221	0.134	0.232	0.213	0.264	1.000	**-0.042**	**0.438**	**0.128**

Notes: This table provided detailed information related to Table 3 in the paper. This table reports overlaps in real estate price changes and profitability changes across regions. Panel A (B) provides Spearman/Pearson correlations below/above the diagonal in month-over-month (year-over-year) real estate price changes. Panel C provides these correlations among regional profitability changes. The three highlighted columns provide statistics from summarizing, for each region, all pairwise correlations with all other regions in each panel. Table 1 provides details on the variables and sample.

APPENDIX TABLE A2
Demand-Supply Analysis of U.S. Corporate Employees Relative to the Related-Region Supply of Available Residential Real Estate Properties

Total Across All Regions

Begi. of Year:	2010			2011			2012			2013			2014			2015		
	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio
All Regions	32,634,908	1,632,728	20	33,092,790	1,720,278	19	33,829,341	1,585,138	21	34,505,039	1,166,609	30	35,333,058	1,123,050	31	35,932,126	1,123,834	32

Analysis at the Metropolitan Level

Begi. of Year:	2010			2011			2012			2013			2014			2015		
	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio	Corporate Employees	Properties Supply	Ratio
Phoenix	367,499	54,788	7	394,999	62,654	6	407,725	51,918	8	375,802	35,952	10	360,115	40,973	9	378,757	40,269	9
Los Angeles	1,003,169	59,889	17	1,056,392	59,025	18	1,012,073	52,726	19	1,018,180	25,563	40	924,787	25,493	36	900,258	29,195	31
San Diego	180,285	19,940	9	172,393	24,345	7	172,272	23,137	7	171,815	12,607	14	161,064	11,844	14	157,810	13,440	12
San Francisco	2,268,842	29,832	76	2,347,845	31,880	74	2,461,445	27,843	88	2,545,909	14,817	172	2,602,896	14,979	174	2,550,790	16,163	158
Denver	475,575	50,967	9	492,016	52,426	9	537,333	43,835	12	607,872	32,378	19	615,280	31,683	19	639,383	27,716	23
Washington	2,540,156	93,419	27	2,486,800	99,547	25	2,471,481	91,452	27	2,458,657	68,954	36	2,534,375	68,775	37	2,530,747	76,055	33
Miami	477,658	80,343	6	507,007	91,758	6	365,279	81,908	4	376,885	54,883	7	376,250	50,283	7	395,997	50,333	8
Tampa	689,823	123,427	6	730,273	132,552	6	884,770	107,814	8	954,829	75,111	13	1,004,677	78,760	13	930,456	78,590	12
Atlanta	2,836,287	173,254	16	2,825,611	175,955	16	2,917,257	165,493	18	2,937,585	121,428	24	3,083,928	119,230	26	3,140,758	120,336	26
Chicago	4,244,670	173,213	25	4,364,844	179,824	24	4,572,732	168,134	27	4,672,606	127,218	37	4,717,841	115,975	41	4,771,327	118,183	40
Boston	1,406,473	57,299	25	1,417,301	58,438	24	1,392,619	65,126	21	1,468,621	51,300	29	1,478,784	46,418	32	1,557,034	46,873	33
Detroit	1,300,213	64,128	20	1,356,644	55,783	24	1,378,934	46,452	30	1,427,418	37,303	38	1,446,164	35,845	40	1,512,823	37,522	40
Minneapolis	1,665,563	44,115	38	1,684,094	48,546	35	1,714,084	44,109	39	1,627,984	32,231	51	1,665,597	32,053	52	1,651,004	32,406	51
Charlotte	1,005,165	125,320	8	1,017,866	130,024	8	1,047,660	124,601	8	1,045,522	103,693	10	1,096,008	103,404	11	1,135,282	96,547	12
Las Vegas	298,798	21,624	14	307,775	22,605	14	314,001	20,021	16	322,573	10,092	32	324,823	12,433	26	330,772	13,048	25
New York	5,662,806	159,197	36	5,754,068	166,138	35	5,844,228	181,279	32	5,962,398	138,905	43	6,032,939	127,497	47	6,098,428	130,815	47
Cleveland	2,080,563	60,757	34	2,156,766	70,892	30	2,147,721	67,481	32	2,183,454	55,386	39	2,122,614	52,631	40	2,161,265	50,718	43
Portland	162,390	34,946	5	180,935	34,058	5	197,258	30,306	7	218,717	20,653	11	363,575	20,881	17	531,026	20,351	26
Dallas	3,349,506	167,786	20	3,205,328	181,931	18	3,296,765	152,138	22	3,331,824	122,333	27	3,521,591	107,722	33	3,585,203	101,505	35
Seattle	619,467	38,484	16	633,834	41,897	15	693,705	39,365	18	796,388	25,802	31	899,751	26,171	34	973,008	23,769	41

Notes: This table provided detailed information related to Table 4 in the paper. This table reports the sum of corporate employees for firms headquartered across the United States and the supply of residential real estate properties available for sale. Data on number of employees (Compustat: EMP) are from the Compustat North America Fundamentals Annual File (WRDS: FUNDA) available from WRDS, where number of employees are summed by fiscal year (Compustat: FYEAR). Housing supply data are from Zillow. Firms' corporate employees and Zillow's real estate supply are classified into Case-Shiller regions following the procedure used for developing the regional profitability indices. That is, based on firms' headquarters location or the Zillow's zip code, respectively, using: (a) a zip-code-coordinates mapping from the Census Gazetteer File, (b) regional coordinates from Google searches, and (c) the spherical distance of a firm's headquarters to its closest Case-Shiller region. Using firms in each region, annual sums of corporate employees are constructed. Both corporate employees and properties supply refer to the beginning of each year, and thus the Compustat data are as of Dec. 31, 2009 through Dec. 31, 2014, and the Zillow data are from beginning of Jan. 2010 through beginning of Jan. 2015. The series begin in Jan. 2010, the first month with available housing supply data.

APPENDIX TABLE A3
Further Probing the Information Processing of Regional Profitability

Panel A. Summary from firm-level analysis: mean of quarterly time-series future stock returns from REIT investments beginning X months after the month in which all regional profitability indices become publicly available

	X = 1	X = 4	X = 7	X = 10
Market adjusted hedge return	0.014	0.010	-0.005	0.000
t-statistic	**3.267**	**1.826**	**-0.827**	**0.014**
FF adjusted hedge return	0.010	0.009	-0.003	0.001
t-statistic	**2.512**	**1.690**	**-0.496**	**0.118**
FFC adjusted hedge return	0.010	0.008	-0.002	0.001
t-statistic	**2.566**	**1.534**	**-0.398**	**0.267**
FFCIB1 adjusted hedge return	0.010	0.006	-0.002	0.002
t-statistic	**2.475**	**1.178**	**-0.283**	**0.313**
FFCIB2 adjusted hedge return	0.010	0.005	-0.002	0.001
t-statistic	**2.613**	**1.057**	**-0.436**	**0.293**

Panel B. Summary from portfolio-level analysis: future REIT returns for real-time portfolios constructed by quarterly sorting on regional profitability

		Future monthly portfolio stock returns for investment strategies beginning X months after the month in which all regional profitability indices become publicly available			
		X = 1	X = 4	X = 7	X = 10
Portfolio:		*Portfolio Alpha*	*Portfolio Alpha*	*Portfolio Alpha*	*Portfolio Alpha*
1 (Lowest)	Coefficient	-0.0004	0.0020	0.0048	0.0037
	t-statistic	-1.800	0.694	-0.180	1.178
2	Coefficient	0.0036	0.0036	0.0055	0.0059
	t-statistic	1.343	1.201	0.783	0.958
3	Coefficient	0.0041	0.0041	-0.0002	0.0039
	t-statistic	1.302	1.330	-0.071	1.235
4	Coefficient	0.0031	-0.0002	0.0034	0.0044
	t-statistic	0.961	-0.053	1.004	1.125
5 (Highest)	Coefficient	0.0068	0.0057	0.0051	0.0043
	t-statistic	2.810	1.903	1.842	1.446
	High minus low return	0.0072	0.0037	0.0003	0.0006
	t-statistic	***6.036***	***3.678***	***0.256***	***0.570***
	Zero-cost hedge return	0.0072	0.0037	0.0003	0.0006
	t-statistic	***3.080***	***1.500***	***-0.680***	***0.380***

Notes: The table reports results from stock investment analysis, focusing on future return patterns for alternative investment strategies based on varying elapsed times and examining how stock returns to regional profitability changes differ across control groups that have varying elapsed times after the changes. The future stock returns are for investment strategies beginning X months after the month in which all regional profitability indices become publicly available. Panel A (B) reports firm-level summary of future returns (portfolio analysis results). See the paper for more details.

APPENDIX TABLE A4
Can Risk Explain the Documented Return Patterns?

	Summary of monthly cross-portfolio regressions: 48 Fama-French industry portfolios			
	Mean	Std. Dev.	Std. Error	Fama-MacBeth t-statistic
α_{m+1}	0.008	0.043	0.004	2.070
$\gamma_{MKTRF,m+1}$	0.003	0.052	0.004	0.610
$\gamma_{SMB,m+1}$	0.003	0.028	0.002	1.260
$\gamma_{HML,m+1}$	0.006	0.030	0.003	2.170
$\gamma_{UMD,m+1}$	-0.001	0.061	0.005	-0.100
$\gamma_{FRegionalProfit,m+1}$	**0.003**	**0.030**	**0.003**	**1.140**
Adjusted R^2	0.216			

Additional analysis:

	Summary of monthly cross-portfolio regressions: 25 Fama-French portfolios (constructed on 5 size and 5 book-to-market portfolios, including dividends)			
	Mean	Std. Dev.	Std. Error	Fama-MacBeth t-statistic
$\gamma_{FRegionalProfit,m+1}$	**-0.001**	**0.036**	**0.003**	**-0.260**
	Summary of monthly cross-portfolio regressions: 100 Fama-French portfolios (constructed on 10 size and 10 book-to-market portfolios, including dividends)			
	Mean	Std. Dev.	Std. Error	Fama-MacBeth t-statistic
$\gamma_{FRegionalProfit,m+1}$	**-0.001**	**0.027**	**0.002**	**-0.530**

Notes: The table reports results from the second stage of the two-step Fama and Macbeth (1973) procedure. In the first step, we estimate time-series regressions at the portfolio level, as described in Equation (7). *FRegionalProfit* is a monthly factor-mimicking regional profitability information portfolio formed based on regional profitability information, following the procedure that Fama and French (1993) use in forming the *HML* and *SMB* factors. The analysis first focuses on the 48 industry portfolios (Fama and French 1997), with portfolio returns from Kenneth French's website. The analysis also employs the 25 and 100 portfolios constructed on the intersection of 5-by-5 and 10-by-10 *BTM* and *MVE* portfolios, respectively, following Fama and French (1993). We use the time-series portfolio regressions to obtain predicted factor loadings (betas) for each of the portfolios, estimated using five-year rolling windows that end at month m, with the requirement of at least ten portfolio-month observations in each window. In the second step, we estimate cross-portfolio monthly regressions of portfolio excess returns for month m+1 on the predicted rolling betas, such that each regression pools predicted betas for the 48 (and then the 25 and 100) portfolios, as described in Equation (8). We aggregate and conduct tests on the estimates following the Fama and MacBeth (1973) procedure. Raw stock returns are from the CRSP Monthly Stock File, adjusted for delisting returns. Risk-free rate and Fama–French-Carhart factors are from the Fama–French Portfolios and Factors dataset on WRDS. Financial statement data are from Compustat North America Fundamentals Quarterly. To ensure the feasibility of investing in REITs when housing data exist across all regions, the analysis uses quarterly observations for which there are future index data for all regions, which is January 2000 (the last region for which housing data are available is Dallas). Thus, we use quarterly financial statement data beginning in Q4:1999. The sample consists of U.S. stocks in the intersection of CRSP and Compustat with data available to calculate quarterly changes to regional profitability, with quarterly profitability changes beginning Q4:1999, and with future stock returns available as of March 2015. Because the analyses require future returns, the investment construction quarters are Q4:1999-Q2:2014, with monthly stock returns beginning in March 2000 (one month after all regional profitability changes are available) and ending in November 2014 (last of the three months of stock returns—for September, October, and November—required for investing based on the Q2:2014 regional profitability indices available in middle of August 2014).

APPENDIX TABLE A5
How is Regional Profitability Information Processed by Real Estate Forecasters?

Panel A. Econoday forecasts

	Future Forecast error of regional real estate price change		
	Estimate	Standard Error	t-statistic
$\Delta Prof_{region}$	**0.100**	**0.046**	**2.165**
Intercept	0.000	0.001	0.147
Adjusted R^2	0.154		

Panel B. Zillow forecasts

	Future Forecast error of regional real estate price change		
	Estimate	Standard Error	t-statistic
$\Delta Prof_{region}$	**0.068**	**0.029**	**2.389**
Intercept	0.000	0.000	0.347
Adjusted R^2	0.145		

Notes: The table reports results from regression models of future forecast errors of real estate price changes on the corresponding-region profitability change. Forecast errors are actual realizations of real estate price changes minus the corresponding-period forecasts from Econoday and Zillow. The paper provides more details on the variables and the sample.

APPENDIX TABLE A6
Information Processing Analysis: A Possible Way that Can Drive the Delayed Stock Price Adjustment to Regional Profitability Information

Panel A. Firm-level investment tests varying by persistence

	All		Lowest Persistence Group	Annual	Highest Persistence Group	Annual
Market adjusted hedge return	0.014	5.7%	0.020	8.4%	0.021	8.6%
t-statistic	**3.267**		**2.115**		**1.771**	
FF adjusted hedge return	0.010	4.1%	0.008	3.2%	0.020	8.0%
t-statistic	**2.512**		**1.078**		**2.110**	
FFC adjusted hedge return	0.010	4.1%	0.007	3.0%	0.018	7.4%
t-statistic	**2.566**		**1.049**		**2.068**	
FFCIB1 adjusted hedge return	0.010	3.9%	0.006	2.3%	0.019	7.8%
t-statistic	**2.475**		**0.846**		**2.203**	
FFCIB2 adjusted hedge return	0.010	3.9%	0.006	2.5%	0.018	7.4%
t-statistic	**2.613**		**0.876**		**2.157**	

Panel B. Portfolio-level investment tests varying by persistence

		Future monthly portfolio stock returns for investment strategies beginning X months after the month in which all regional profitability indices become publicly available					
		All	Annual	Lowest Persistence Group	Annual	Highest Persistence Group	Annual
Portfolio:		*Portfolio Alpha*		*Portfolio Alpha*		*Portfolio Alpha*	
1 (Lowest)	Coefficient	-0.0004		-0.0009		-0.0048	
	t-statistic	-1.800		-0.259		-0.937	
2	Coefficient	0.0036		0.0047		0.0085	
	t-statistic	1.343		1.547		2.262	
3	Coefficient	0.0041		0.0061		0.0069	
	t-statistic	1.302		1.617		1.638	
4	Coefficient	0.0031		-0.0009		-0.0015	
	t-statistic	0.961		-0.225		-0.410	
5 (Highest)	Coefficient	0.0068		0.0069		0.0090	
	t-statistic	2.810		2.106		1.824	
	Highest - Lowest	0.0072	9.0%	0.0078	9.8%	0.0138	17.8%
	t-statistic	***6.036***		***4.592***		***4.863***	
	Hedge return for a zero-cost investment portfolio	0.0072	9.0%	0.0078	9.8%	0.0138	17.8%
	t-statistic	***3.080***		***1.700***		***2.640***	

Notes: The table reports results from the firm- (portfolio-) level stock return investment tests for different persistence in regional profitability changes. Specifically, each region's persistence in regional profitability changes is estimated using the slope from an AR(1) regression model of the regional profitability performance change on its lagged value (and an intercept). Then, the sample is split into three persistence groups, and the abnormal return analyses similar to those in the paper are repeated in each of the subsamples. The paper provides more details.

APPENDIX TABLE A7
Impulse Response Analyses Across U.S. Case-Shiller Metropolitan Regions: Future Regional Real Estate Price Responses for Innovations in Profitability of Firms Located in Corresponding Regions

	Accumulated impulse response functions from profitability growth impulses									
	region1	region2	region3	region4	region5	region6	region7	region8	region9	region10
Real estate return response horizon	DC-Washington	MI-Detroit	MN-Minneapolis	OH-Cleveland	CA-San Diego	CA-San Francisco	CO-Denver	IL-Chicago	MA-Boston	NC-Charlotte
	Fraction									
1	0.328	0.492	0.527	0.727	0.273	0.353	0.473	0.394	0.629	0.486
2	0.550	0.742	0.776	0.926	0.473	0.583	0.720	0.634	0.862	0.736
3	0.699	0.869	0.894	0.980	0.620	0.731	0.852	0.779	0.949	0.864
4	0.800	0.934	0.950	0.994	0.728	0.827	0.920	0.867	0.981	0.930
5	0.868	0.966	0.976	0.999	0.807	0.890	0.959	0.920	0.993	0.964
6	0.914	0.983	0.989	1.000	0.865	0.931	0.978	0.953	0.997	0.982
7	0.945	0.992	0.995	1.000	0.908	0.957	0.989	0.972	0.999	0.991
8	0.966	0.996	0.998	1.000	0.939	0.974	0.995	0.985	1.000	0.995
9	0.980	0.998	0.999	1.000	0.962	0.985	0.997	0.992	1.000	0.998
10	0.989	0.999	1.000	1.000	0.978	0.992	0.997	0.996	1.000	0.999
11	0.996	1.000	1.000	1.000	0.991	0.997	0.997	0.999	1.000	1.000
12	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	region11	region12	region13	region14	region15	region16	region17	region18	region19	region20
	OR-Portland	WA-Seattle	AZ-Phoenix	CA-Los Angeles	TX-Dallas	FL-Miami	FL-Tampa	GA-Atlanta	NV-Las Vegas	NY-New York
	Fraction									
1	0.486	0.503	0.179	0.236	0.708	0.253	0.383	0.495	0.233	0.530
2	0.736	0.752	0.337	0.419	0.917	0.444	0.619	0.745	0.413	0.780
3	0.864	0.877	0.463	0.561	0.979	0.589	0.766	0.871	0.554	0.896
4	0.930	0.939	0.579	0.670	1.000	0.698	0.856	0.935	0.664	0.951
5	0.964	0.970	0.663	0.756	1.000	0.780	0.912	0.967	0.750	0.977
6	0.982	0.985	0.737	0.822	1.000	0.843	0.947	0.984	0.816	0.989
7	0.991	0.993	0.811	0.873	1.000	0.890	0.968	0.992	0.869	0.995
8	0.995	0.996	0.863	0.912	1.000	0.926	0.982	0.996	0.909	0.997
9	0.998	0.998	0.905	0.943	1.000	0.952	0.990	0.998	0.942	0.999
10	0.999	0.999	0.937	0.967	1.000	0.973	0.995	0.999	0.967	0.999
11	1.000	1.000	0.968	0.986	1.000	0.988	0.998	1.000	0.986	0.999
12	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Notes: The table reports results from impulse response analysis of future real estate price responses for changes in profitability of firms located in U.S. metropolitan regions. This analysis is complementary to that reported in Table 8 in the paper. See this table in the paper for more details.

APPENDIX TABLE A8
Analyses with Raw Returns

A. Repeating analysis with raw return 1: Summary of quarterly series of future raw stock returns for REIT investments based on lagged regional profitability in firm-level analysis

	Mean	Std. Err
Raw hedge return	0.014	0.000
t-statistic	**3.078**	

B. Repeating analysis of gradual processing of profitability information using raw returns: Mean of quarterly time-series future stock returns from REIT investments beginning X months after the month in which all regional profitability indices become publicly available (similar to that in Appendix Table A3)

	X = 1	X = 4	X = 7	X = 10
Raw hedge return	0.014	0.009	-0.005	0.000
t-statistic	**3.078**	**1.704**	**-0.733**	**0.035**