Firm Location and the Value-Growth Premium*

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Abstract

We investigate the value-growth premium puzzle by merging insights from urban economics and finance that relate firm location to its stock performance. The value-growth premium in locations with high historical house price appreciation is 3.6% larger per year than the premium in areas that experienced little house price appreciation. The link between housing value appreciation and the cross-section of returns supports investment-based models explaining the value premium; moreover we find the house price channel reduces growth firm returns rather than increasing returns of value firms. House price appreciation remains significant after controlling for common explanations of the premium.

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1 Introduction

A growing literature in both finance and urban economics relates firm location to a range of financial characteristics. For example, studies have found that firms in the same geographic area exhibit comovement in returns (Pirinsky and Wang, 2006) and conformity in their financing policies and capital structures (Pirinsky and Wang, 2006; Gao et al., 2011). Firm location is also linked to payout policies (John et al., 2011), equity issuance (Loughran and Schultz, 2006) and corporate debt yield spreads (Arena and Dewally, 2012). Furthermore, firm location is important for ownership structure as evidenced by Coval and Moskowitz (2001) who find that mutual funds that bias their holdings towards local firms exhibit increased performance and by Ling et al. (2021) who show that institutional investors take advantage of location-based information asymmetries by tilting towards firms with headquarters located nearby. We add results to this literature by connecting appreciation in local housing prices with the cross-section of firm stock returns to explain the value-growth premium.

One channel relating housing values and asset prices is through the utility function of investors. The models of Piazzesi et al. (2007) and Fillat (2008) contain composition risk faced by investors, where shocks to the value of housing affect the value of services obtained from housing as well as the price of housing as an asset. In these models, composition risk produces changes in stock prices that are unrelated to firm cash flow news. In contrast, Lustig and Van Nieuwerburgh (2005) present a model with housing collateral – housing value relative to human wealth – to explain stock returns. In addition to the consumption risk channel, their collateral value of housing model implies that a decrease in housing values erodes collateral exposing households to idiosyncratic labor income risk, which adds a liquidity factor to the stochastic discount factor and thus predicts higher returns on stocks. While the accompanying empirical support for each of these theories is found at the aggregate level, housing values vary dramatically across the country suggesting the need to consider the impact of local variation in housing returns on stock returns.

We take up this task by merging insights from models in urban economics that link housing markets with firm location decisions and with traditional asset pricing models to provide an explanation to the observed value-growth premium. In urban economics, the Rosen-Roback framework for city growth contends that labor productivity is a key factor in determining firm locations and the theoretical models built on their framework recognize the endogenous link between firm location (across cities), housing prices, and labor productivity (Rosen, 1979; Roback, 1982).[1] In a general equilibrium setting, firm growth is often accompanied by demand for additional labor. In order to attract new workers, firms offer wages that compensate for relative housing (and other location specific) costs. However, new workers increase the demand for housing, which increases housing costs. Thus, to the extent that firms experience positive growth, the proceeds from that growth are not fully returned to shareholders but are partly paid out to employees to compensate for expectations of rising housing costs that arise from the firm's associated expected increase in labor demand.[2]

[1]See Glaeser (2008) for an excellent exposition of this classical framework describing central problems encountered in urban economics as well as a review of the empirical literature supporting the theory.

[2]The intuition from the Rosen-Roback framework is consistent with the model of Donangelo et al. (2019) who demonstrate that measures of labor share – the costs associated

While the Rosen-Roback framework provides the intuition connecting local housing values and labor costs, we also rely on insights from the neoclassical investment-based model proposed by Belo et al. (2014) and extended in Kim (2018), which links labor adjustment costs and expected returns. In these models a firm's labor hiring decision is analogous to an investment decision where the complimentary inputs of labor and capital are subject to adjustment costs. Firms choose investment projects, conditional on hiring costs, to maximize firm value given a stochastic discount factor to value its cash flows. Aggregate productivity and adjustment cost shocks impact the marginal cost of hiring and investing. Differences in firms' productivity and the interaction between adjustment costs and the aggregate adjustment cost shock endogenously generates a negative relation between firms' hiring rates and risk premiums. Given that higher housing costs increase labor costs, we conjecture that the negative return-hiring relation for firms with investment opportunities will be steeper for firms located in high housing price locales.

We empirically test these insights using data on firm headquarter locations and their stock returns over the period spanning 2000 to 2019. Our analysis reveals the following primary findings: First, consistent with the intuition of the Rosen-Robak framework, we find that firms with the highest average labor costs are those located in areas experiencing the largest increases in housing values. Second, we find a strong negative correlation between house price appreciation at the headquarters location and subsequent stock returns based on regressions controlling for the Fama-French

with the labor component of operating leverage – produce variation in expected returns across firms. Firms with high labor share have cash flows that are more sensitive to economic shocks with the added volatility generating higher expected returns.

5-factors. The returns on growth stocks are highly sensitive to housing values–with growth firms in markets with high levels of housing value appreciation having significantly lower returns than growth firms located in regions with stagnant housing markets. However, we find that the returns of value firms are significantly less correlated with the housing market, i.e. the returns of value firms are similar across all regions. Our results indicate that a long/short strategy of buying value stocks in low housing price return markets and shorting growth stocks in high house price appreciation markets would produce an average risk-adjusted return of 10.8 percent per year.

We then proceed to explore a variety of possible alternative channels that could account for the observed correlation between the value-growth premium and house price appreciation. First, focusing on the link between institutional ownership and stock returns (Phalippou, 2007, 2008; Coval and Moskowitz, 2001; Ling et al., 2021), we find that the importance of institutional ownership in explaining the value-growth premium is magnified after controlling for firm location. Second, after controlling for the effects of financial leverage and operating leverage on stock returns (Gulen et al., 2011; Novy-Marx, 2011; Choi, 2013; Cao, 2015), we continue to find that the value-growth premium is correlated with location. Third, we find empirical support for the labor cost adjustment model of Belo et al. (2014). Regression results show that the marginal impact of investment is greater for growth firms after conditioning on house price appreciation, indicating that the value-growth premium is partially a function of the lower returns on firms located in areas with high house price appreciation. Fourth, we demonstrate that our results linking the value-growth premium to local housing markets is not a function of whether firms are located in rural or urban markets (Loughran and Schultz, 2005). Fifth, we explore the link between location and industry as suggested by Tuzel and Zhang (2017). Our results support this link as we find evidence that industries with heavy reliance on local labor markets have the greatest correlation between the value-growth premium and house price appreciation.

Finally, we use the strong evidence of a correlation between the value-growth premium and local housing markets to test two trading strategies. First, we create a long-short trading strategy of taking a long position in value firms located in low HPI areas while selling short growth firms in high HPI areas. Second, we form a long-short portfolio that is taking a long position in value firms and selling short growth firms in the high-HPI areas. Over the period from 2000 to 2020, the portfolios generated cumulative total returns of 811% and 442%, respectively, which is significantly higher than the total cumulative return on the S&P500 of 289%. However, the portfolio performances vary through time. Using a time-series regression framework, we find that the these trading strategies are pro-cyclical indicating outperformance during periods of economic expansion. As a result, our analysis linking the value-growth premium to local housing markets offers a plausible explanation for the disappearance of the value-growth premium in recent years (Fama and French, 2021; Lev and Srivastava, 2019).

Our results support the investment-based theories in the asset pricing literature. Assuming that firms face similar productivity shock distributions across regions, appreciation in housing values generates higher wages and hence higher adjustment costs. Firms with less flexibility in dealing with these cost shocks are riskier and hence earn higher returns. According to the investment-based models of Gulen et al. (2011) and Zhang (2005) the inflexibility of value firms relative to the flexibility of growth firms drives the value-growth premium and our analysis points to a channel allowing that flexibility to impact relative returns.

Our results show that growth firms located in areas with high house price appreciation face the largest adjustment cost shocks and may tend to delay or forgo capital expenditures, as suggested by Kim (2018). This causes significantly lower returns for these firms. In our sample, the value-growth premium in locales with high house price appreciation is significant and 3.6 basis points larger on an annual basis than the premium in areas with little housing value appreciation. Our explanation of the lower returns of growth firms relative to value firms is novel since the focus of most applications of investment-based theory to explain the value-growth spread provide explanations of why value firms outperform growth firms.

In the next section we discuss our sources of data. In Section 3 we outline our empirical results relating housing and the cross-section of returns. In section 4, we detail how our results survive in the presence of alternative explanations of the value-growth premium. Section 5 presents evidence for a trading strategy based on the link between location and the value-growth premium, and Section 6 concludes.

2 Data

Our data consists of firms listed on the New York Stock Exchange (NYSE), the American Stock Exchange (Amex) and Nasdaq over the period from 2000 to 2019. We obtained firm monthly stock returns from the Center for Research in Security Prices (CRSP) and annual accounting data from COMPUSTAT. Following Fama and French (1993), we calculate each firm's book-to-market ratio (BM) as the book value (BE) in December of year $t-1$ divided by its market value (ME) in December of year $t-1$. Firm size is defined as the firm's equity market value (ME) at portfolio formation in July of year t. The summary statistics of these variables are shown in Panel A of Table 1. We have information on 9,308 firms. Figure 1 shows the frequency count of number of unique firms by year. Consistent with trends in the equity market, we note a substantial decline in the number of publicly traded firms over the sample period.

Following Fama and French (1993), we form five portfolios based on BM. A firm that files a 10-K form on or before December 31 of year $t-1$ is eligible for inclusion in a portfolio staring July 1 of year t. We include firms in the growth portfolio in year t if their year $t-1$ BM ratios are below the 20th percentile in the cross-section of BM. Correspondingly, we classify firms into the portfolio of value firms if year their $t-1$ BM ratios exceeds the 80th percentile. Panel B of Table 1 reports the summary statistics for the five BM portfolios. Consistent with the literature, we note that firms in the growth portfolio are larger (measured by market equity – share price times shares outstanding at year end) and employ more operating and financial leverage than value firms.[3] In addition, we note that growth firms have higher levels of institutional ownership than value firms, which is not surprising since institutional investors tend to favor larger firms.[4] Table 1 reports the

[3]Operating leverage is defined as annual operating costs divided by total assets (AT), where operating costs are calculated following Novy-Marx (2011) as the cost of goods sold (COGS) plus selling, general, and administrative expenses (XSGA). Financial leverage is the firm's market leverage as in Fan et al. (2012).

[4]Institutional ownership is downloaded from WRDS Thomson Reuters Institutional

presence of the standard value-growth premium found in the literature. For our sample and study period, we note that the the mean return on the value portfolio is 0.6% per month (or 7.2% per year) greater than the mean growth portfolio return.

To explore the relationship between firm location and the value-growth premium, we follow the literature and denote the firm's location as the location of its headquarters (Coval and Moskowitz, 1999; Ivković and Weisbenner, 2005; Loughran and Schultz, 2005). As noted by Pirinsky and Wang (2006), corporate headquarters are closely tied to the firm's core business functions and serve as the center for information exchange between the firm and its stakeholders. The address of the firm's principal executive office is a mandatory reporting requirement of the SEC. Thus, we identify firm headquarter locations by scraping the "principal executive offices" ZIP code from each firm's 10-K and 10-KSB filings in the EDGAR system of the SEC.[5] We use the first three digits of the ZIP code (ZIP3) as a proxy for the firm's location.[6] The ZIP3 measure is a rough approximation of the metropolitan statistical area (MSA) but captures more precise changes in local housing markets in large cities while retaining a sufficient area to measure real estate price changes relevant to the firm's location.[7]

We note that the 9,308 firms are located in 732 3-digit Zip Codes. Panels A and B of Figure 2 show the headquarters locations of growth firms ver-

(13f) Holdings. (The Securities and Exchange Commission's (SEC) Form 13F is a quarterly report that is required of all institutional investment managers with at least $100 million in assets under management.)

[5]Our web scraping code is based on Spamann and Wilkinson (2019).

[6]Overall, there are 929 3-digit ZIP Codes in the country (USA). We delete those ZIPs, that do not have firm headquarters or whose HPI is not reported by the Federal Housing Finance Agency (FHFA).

[7]See Bogin et al. (2019) for a comparison on housing price indexes at various levels of geographic aggregation.

sus value firms, respectively. We calculate the frequency of firms in each HPI category as the time series average number of growth and value firms per one million population in each state during the period 2000-2019. The state population is from 1990 United States Census. Darker colors represent higher concentrations of firms per million population. Not surprising, we note that California, Nevada, Colorado, Minnesota, and Massachusetts have the highest concentration of growth firms per million in population while the distribution of value firms is much broader.

We use the quarterly 3-digit ZIP code (ZIP3) Housing Price Index (HPI) from the Federal Housing Finance Agency (FHFA). We define the one-year holding period HPI return as the total return for the past four quarters. We classify the ZIP3 into yearly holding period return terciles to capture broad movements in housing markets. Table 2 reports the one-year transition matrix for the ZIP3 HPI groups. As expected, we note a high degree of persistence in housing markets over time. For example, the probability that a location characterized as having high appreciation in year t remaining in the same category in year $t + 1$ is 67%. Similarly, the probability of a location remaining in the low house price appreciation category from year t to $t + 1$ is 56%. At the same time, we also note relatively high probabilities of transition from low to high and high to low at 6.7% and 7.7%, respectively.

As noted in Table 1 Panel A, the average annual house price (HPI) return is 3.6% and ranges from -33% (in 2008 in Stockton, CA) to 38% (in 2005 in Bakersfield, CA). Figure 3 shows the geographic distribution of HPI portfolios. The darker color reflects ZIP3s experiencing greater real estate price appreciation from 2000 to 2019. By comparing Figure 2 and 3, we see that areas with high real estate price appreciation have greater concentrations of growth firms.

3 The Value-Growth Premium and Location

We use a standard portfolio double sorting method (Fama and French, 1993) to study how housing costs affect the value-growth premium. We create a five by three sorting of stocks into portfolios based on their market-to-book equity values in June of each year and the one-year lagged housing price index return for the firm's headquarters location. Table 3 reports the number of firms within each portfolio. Panel A reports the total number of firm observations ever sorted into the portfolios over the period 2000 to 2019 while panel B notes the monthly average number of unique firms in each portfolio. We find more firms in areas characterized as having high house price growth (40%) than in areas with low house price growth (27%). This is consistent with areas that experience higher house price growth having greater population and thus more firms than areas with less population and lower house price appreciation. In panel B, we see that, on average, 983 firms at any given time were classified as growth stocks while 2,073 firms were classified as value stocks.

We begin by demonstrating the link between housing and wages since Belo et al. (2014) establishes the link between firm risk premiums and their labor costs. In Table 4 we report the average labor cost over the period 2000-2019 for each of the 15 portfolios formed from a five by three double sorting on firm book-to-market ratio (B/M) and 3-digit Zip Code HPI return, respectively. Average labor cost are measured by selling, general and administrative expense (SG&A) divided by employee counts (EMP).

Consistent with Belo et al. (2014) and Zhang (2005) we find that labor costs are higher for growth firms than for value firms. Growth firms have labor costs between 50% and 65% higher than value firms. Interestingly, we find that labor costs are highest for firms located in high HPI areas regardless of whether the firm is categorized as growth or value. This establishes the connection between high HPI and high adjustment costs.

We report in Table 5 the fifteen portfolio's postformation mean equally weighted returns (Panel A) and abnormal returns (Panel B). The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets.[8] The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The double sorting of firms into portfolios based on housing market performance and book-to-market ratio provides several insights into the classical value-growth premium.

First, consistent with findings in the literature, we find a positive difference between the returns for value firms and growth firms (the value-growth premium) that ranges between 0.5 and 0.8 percent per month (6 to 9.6 percent per year). The value-growth premium is statistically significant across all housing market return portfolios. Interestingly, we note a positive

[8] The associated t-statistic is based on bootstrapped standard errors and indicates whether the difference is statistically different from zero.

relation between the value-growth premium and housing market return. The value-growth premium is largest for firms with headquarters located in markets characterized as having high housing price growth. This is consistent with our hypothesis that in markets with elastic housing supply (and hence low house price appreciation) growth firms are less penalized by expectations of higher costs if those growth options materialize. In contrast, in markets that experienced higher house price appreciation, growth firms under perform more relative to value firms. We find a similar result with risk adjusted returns (Panel B).

Next, we examine the performance difference of growth and value portfolios across housing markets (high minus low). Here, we find that growth firms in markets that experienced high housing price returns significantly under perform growth firms in markets with low house price appreciation. In Table 5 Panel A, the average monthly return for growth firms in high HPI return markets was 0.5 percent lower than growth firms located in low HPI return markets. Interestingly, we see no statistically significant difference in the average returns in the other book-to-market portfolios across housing market portfolios. We find the same pattern in risk-adjusted returns reported in Panel B. However, closer examination of the average return in each of the 15 portfolios reveals that the value-growth premium is driven by growth firms in high HPI return markets under performing all other stocks. In fact, the average portfolio returns suggest that the strongest value-growth premium exists in a long/short strategy of buying value stocks located in low housing price return markets and shorting growth stocks in markets having high house price appreciation. This strategy would produce a risk-adjusted return of 0.9 percent per month (10.8

percent per year).[9] Again, these results are consistent with our primary hypothesis that firms without growth options are less sensitive to changes in input prices. This finding is consistent empirical studies showing that employee wage costs are relatively sticky (Hall, 2005a,b).

To confirm the findings that growth firms under perform in high housing return markets, we employ a regression of the portfolio returns on the Fama-French five factor and the lagged HPI return:

$$\begin{aligned} r_{z,t} &= \beta_1(Mkt - Rf)_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t \\ &\quad + \beta_6 HPI.return_{z,t-1} + \delta_t + \delta_z + e_{z,t} \end{aligned} \quad (1)$$

where r_{zt} is the excess return of ZIP3 portfolio z at month t, $Mkt - Rf$ represents the market portfolio risk premium, SMB is the size factor, HML is the book-to-market factor, RMW is the profitability factor, and CMA is the investment factor. Our regression estimation follows the method outlined in Donangelo et al. (2019). Table 6 reports the results. The estimated models include year-quarter fixed effects (δ_t) and ZIP3 fixed effects (δ_z) to control for heterogeneity across time and location. Standard errors are clustered at the ZIP3 level. Column 1 reports the estimated coefficients for the regression for firms sorted into the low book-to-market portfolio (growth firms) while column 5 shows the coefficients for firms in the high book-to-market portfolio (value firms). Consistent with the literature, we see that most of the Fama-French factors (market risk premium, size (SMB) effect, growth (HML) effect, RMW effect, and CMA effect) are statistically significant; the two exceptions are that the HML coefficient in the growth portfolio and the

[9] We systematically test this strategy in section 5.

RMW factor in portfolio (3) are statistically insignificant. The insignificant HML coefficient for firms in the growth portfolio is consistent with the earlier observation that growth stocks under perform. We also find that the HPI return is negative and statistically significant (at the 1% level) for the growth portfolio. The estimated coefficient indicates that a 1 percentage point increase in the lagged housing market return results in a 3.3 percent decline in the risk-adjusted growth stock portfolio returns.

In Table 7, we report the estimation results for the regression of the value-growth premium identified in Table 5 on the one-year housing price holding period return. Columns (1) through (4) introduce a variety of fixed-effects specifications. While the inclusion of fixed effects does reduce the magnitude of the HPI return coefficient, we note that the coefficient in the fully saturated model (column 4) remains positive and statistically significant. The estimated coefficient suggests that a one-percentage point increase in the local house price return is associated with a 2.8 percent increase in the value-growth premium. Finally, in column (5) we introduce a dummy variable that denotes economic recession periods. The negative and statistically significant coefficient indicates that the value-growth premium declines during periods of economic stress, but we note that the HPI return coefficient remains positive and statistically significant. Thus, we conclude that the impact of the housing market on the value-growth premium is robust to the general economic condition.

4 Alternative Channels

4.1 Does Leverage or Ownership Explain the Value-Growth Premium?

Since the seminal investment-based model of Zhang (2005), the value premium has been linked to adjustment costs of firms when investing or divesting. The empirical evidence using proxies for firm flexibility such as financial leverage and operating leverage suggest that value firms are slower to respond to changing economic conditions making them riskier than growth firms. The increased risk of value firms is accompanied by the concomitant higher expected returns (for example, see Gulen et al., 2011; Novy-Marx, 2011; Choi, 2013; Cao, 2015). In other empirical work exploring possible explanations of the value premium, Phalippou (2007, 2008) find that the return spread between value and growth firms is significant only for firms with little or no institutional ownership, where institutional ownership is meant to proxy for the ability to short a stock. The link between firm location and institutional ownership is established in Coval and Moskowitz (2001) and Ling et al. (2021) where a mutual fund's proximity to a firm's headquarters provides informational advantages for these types of institutional stock holders.

In this section, we explore the relation between firm institutional ownership, financial leverage, operating leverage and firm location. We check to see if the relation between housing value appreciation and returns, particularly the returns of growth firms, are subsumed by conditioning on financial leverage, operational leverage, or institutional ownership.

Table 8 reports alpha from the Fama-French model for the double sorting of portfolios segmented into firms with low institutional ownership (Panel A) and high institutional ownership (Panel B). We classify firms as having low or high institutional ownership if the institutional ownership rate is below the 20^{th} or 80^{th} percentile in the cross-section, respectively. Consistent with Phalippou (2008), the value-growth premium remains in the low institutional ownership firms, but is not present in firms with high institutional ownership. Furthermore, within the low ownership group, we see that the value-growth premium is most evident in the firms located in areas with high house price returns.

Table 9 reports alpha from the Fama-French model for the double sorting of portfolios segmented into firms with low operating leverage (Panel A) and high operating leverage (Panel B). We classify firms as having low or high operating leverage if the the operating leverage rate is below the 20^{th} or 80^{th} percentile in the cross-section, respectively. Consistent with Novy-Marx (2011), the value-growth premium remains in the high operating leverage firms, and the value-growth premium is magnified in the firms located in areas with high house price returns.

As in Table 5, we find that the value-growth premium for firms in locales with the highest appreciation in housing values is driven by the low returns of growth firms rather than the high returns of value firms. Our results indicate that while a lack of institutional ownership and a high operating leverage are important in explaining the value-growth premium, the premium is magnified by firms located in high HPI regions.

In Table 10, we report the coefficient estimates of the regression model:

$$\begin{aligned} r_{it} &= \beta_1 HPI.return_{i,t-1} + \beta_2 Book.to.market.ratio_{i,t} + \beta_3 Size_{i,t} \\ &\quad + \beta_4 Operating.leverage_{i,t} + \beta_5 Financial.leverage_{i,t} \\ &\quad + \beta_6 Institutional.ownership_{i,t} + \delta_{j,t} + e_{i,t}. \end{aligned} \tag{2}$$

Our focus in this section is β_1, the sensitivity of firm excess returns to housing price changes controlling for operational and financial leverage, as well as the level of institutional ownership and location fixed effects. The results indicate that higher institutional ownership is associated with lower stock returns for all firms and higher operational leverage is associated with higher returns. The negative relation between financial leverage and returns is only significant for the second book-to-market portfolio. After controlling for the leverage and ownership variables, we continue to see that growth firms are negatively correlated with local house price returns although the coefficient on HPI return is attenuated compared to the same coefficient in Table 6. The estimated coefficients for HPI returns in the other portfolios are not statistically significant. Thus, the results point to a continuing role for house price appreciation to explain the value-growth premium even after controlling for institutional ownership and operating leverage.

4.2 Do Labor Adjustment Costs Explain the Value-Growth Premium?

While much of the investment-based theory literature does not account for labor costs adjustments, the theory of Belo et al. (2014) includes labor costs as a compliment to capital when making investment decisions, with both capital and labor subject to adjustment costs. The firm chooses investments and labor, conditional on the adjustment costs, to maximize its equity dividend value. In the investment-based model the stochastic discount factor is a function of aggregate productivity and aggregate adjustment shocks rather than derived from modeling the consumer's problem. The intuition from the model is that as labor becomes more expensive, it becomes more costly to adjust. Given the complimentarity of labor and capital, expensive labor can cause a firm to postpone investment even if the cost of capital is low.

In Table 4 we see that labor costs and investment are largest for growth firms in high housing price locales. As discussed above, the relation between housing price appreciation and labor costs confirms the intuition in the Rosen-Roback framework and the negative relation between investment and returns is well documented. These results in conjunction with the theory of Belo et al. (2014) suggest that if housing price appreciation increases adjustment costs of labor, then higher wages should result in a steeper investment-return relation. Our conjecture is that growth firms in high housing markets face such a steep investment-return relation that they forego potentially profitable growth options, hence reducing their returns.

In Table 11 we test if the negative investment-return relation is steeper in the presence of housing value appreciation. Our measure of investment is defined as the annual percentage change of total assets (AT). Panel A of Table 11 contains the results of four specifications of the following regression:

$$r_{i,t} = \beta_1 INV_{i,t} + \beta_2 HPI.return_{i,t-1} + \beta_3 INV_{i,t} \times HPI.return_{i,t-1} + controls + \delta_t + \delta_i + e_{i,t}, \quad (3)$$

where $r_{i,t}$ is the excess return of firm i at month t, the investment is INV and the HPI Return is $HPIReturn$. We include firm level financial leverage, operating leverage, and institutional ownership as controls in columns (3) and (4). We also test specifications that include time fixed effects δ_t and firm fixed effects δ_i. In panel A we use the full sample of firms. Regardless of the inclusions of firm fixed effects or controls, we find that the negative relation between returns and investment is statistically significant and the marginal impact of investment on returns becomes more negative when interacted with local housing values.

Panel B of Table 11 contains regressions with firm and time fixed effects for firms grouped by Book-to-Market ranking. In these regressions we include the controls making these results comparable to specification (4) in panel A. The negative relation between investment and returns continues to be negative for each grouping of firms, but only firms that fall in the growth portfolio exhibit a significant negative interaction of investment and housing value appreciation. The result that the marginal impact of investment on returns is steeper for growth firms conditional on housing value appreciation is consistent with the investment theory of Belo et al. (2014) and explains how the value premium partially reflects the lower returns of firms located in area with high housing value appreciation.

4.3 Do Urban versus Rural Areas Explain the Location Pattern?

In this section, we turn to examine whether the firm's location as being either rural or urban explains the observed link between the value-growth premium and local house price returns. Loughran and Schultz (2005) note that firms in rural locations tend to have lower institutional ownership, lower analyst coverage, and lower trading activity. As a result, these forces could lead to firms in rural areas commanding higher risk premiums. Thus, to the extent that housing price returns are a function of urban versus rural locations, then our results could simply reflect differences in information flow surrounding rural firms rather than the observed housing market returns. Table 12 reports the Fama-French alpha for the double sorting of portfolios segmented into firms in urban areas (Panel A) and rural areas (Panel B). Interestingly, we find the value-growth premium exists in rural and urban areas. However, when segmenting the rural and urban areas into portfolios based on housing price returns, we see that the value-growth premium is strongest in locations characterized as having high house price returns. Furthermore, in Table 13, we report the coefficient estimates of the firm-level regression model after controlling for firm's urban versus rural location. The results consistently hold that the value-growth premium exists in urban areas which experience high house price returns. The results in Table 12 and 13 confirm the analysis reported above that the source of the value-growth premiums appears to be the result of growth firms in locations with high housing returns under performing other firms.

4.4 Does the Interaction of Location and Industry Explain the Value-Growth Premium?

In this section, we explore whether the value-growth premium across housing markets is a function of a particular industry group. As discussed by Tuzel and Zhang (2017), if a firm in the same industry responds to the same production shock, then differences in location between the firms will affect their returns via their respective local production shocks. Thus, in Table 14, we report the value-growth premium for firms located in low, medium, and high HPI return markets segmented by the ten primary industry groups. The results reveal a strong value-growth premium in locations with high house price returns for firms in the machinery (industry group 3), wholesale/retail (industry group 7), healthcare (industry group 8) and other (industry group 10) industry categories. Interestingly, only firms in the business equipment industry (group 5) have value-growth premiums across all HPI return locations, but the premium in the high HPI markets is relatively weak. The results in Table 14 are similar to those reported in Yogo (2006), who notes that the value-growth premium rewards investors for business cycle risk. Thus, our analysis provides a channel to support this view since industries that have heavy reliance on local labor markets (e.g. retail, healthcare, and machinery manufacturing) tend to have the greatest value-growth premiums in markets that experienced significant house price appreciation.

5 Testing Location Based Trading Strategies

Based on the 5x3 portfolio sorting results reported in Table 5, we test two trading strategies. First, targeting firms that had the highest and lowest abnormal returns, we form a portfolio composed of a long position in value firms located in low HPI areas with a short position in growth firms located in high HPI areas. We refer to this trading strategy as the low-high portfolio. Second, focusing on the area with the highest average value-growth premium, we form a portfolio of taking a long position in value firms while selling short growth firms located in high HPI areas. We refer to this trading strategy as the high-HPI portfolio. We form portfolios in July of each year and rebalance annually.

We back-test the historical performance of the two strategies compared with the S&P500. Figure 4 shows the cumulative returns from these portfolios over the period from 2000 to 2020 and provides two interesting insights. First, over the twenty-one year period, the high-low and high-HPI portfolios outperform the S&P500. Furthermore, these portfolios substantially outperform the traditional Fama-French HML factor (the traditional value-growth premium). An investor implementing the low-high trading strategy in January 2000 would have accumulated total returns of 811% while the high-HPI portfolio would have generated total accumulated returns of 442%. In contrast, the S&P500 produced total cumulative returns of 289%.

The second insight is that these trading strategies have much higher volatility than the S&P500. Thus, in order to evaluate their risk-adjusted performance we calculate rolling Sharpe ratios. We measure the rolling window Sharpe ratios as:

$$Sharpe\,ratio_t = \sqrt{k}\frac{E(r_{p,t-k} - rf_{t-k})}{\sqrt{Var(r_{p,t-k} - rf_{t-k})}} \quad (4)$$

and calculate the Sharpe ratios over 5-year ($k = 60$) rolling windows. Figure 5 reveals high volatility in the rolling Sharpe ratios. Over the full sample period (2005-2020), the low-high portfolio produced the highest risk-adjusted returns, with an average Sharpe ratio of 1.430. In contrast, the S&P500 and the high-HPI portfolios had average Sharpe ratios of 1.357 and 1.176, respectively. However, we also note that the low-high and high-HPI portfolios appear to underperform the S&P500 on a risk-adjusted basis in more recent years (following 2013).

In order to understand these performance differences, we employ a time-series regression framework to assess what factors impact the risk-adjusted returns. Our goal is to determine what economic conditions lead to the observed performance differences. Thus, we regress the Sharpe ratios on macroeconomic variables that capture changes in: (a) the overall economy (the quarterly US gross domestic product [GDPC1] and the monthly unemployment rate [UNRATE]), (b) conditions in the credit markets (the federal funds rate [FEDFUNDS], credit spread–the difference in returns on Baa- and Aaa-rated long-term industrial corporate bonds [Baa-Aaa], and the yield curve as measured as the difference between the 10-year Treasury constant maturity yield and the 3-month Treasury constant maturity yield [T10Y3MM]), and (c) conditions in the overall housing market (housing market supply [MSACSR] and the rental vacancy rate [RRVRUSQ156N]). We measure the housing market supply as the ratio of houses for sale to houses sold, which indicates how long the current for-sale inventory would last given the current sales rate if no additional new houses were built. The rental vacancy rate is the proportion of the rental inventory that is vacant for rent. All macroeconomic variables, credit market factors, and housing market factors are available from the St. Louis Federal Reserve Bank website (https://fred.stlouisfed.org/).

Table 15 reports the time-series regression results of rolling Sharpe ratios. Interestingly, the results indicate that only the factors associated with the credit markets are statistically significant. We note that the coefficients for the Fed Funds rate and the term spread are positive while the coefficient on the credit spread is negative.

The estimated coefficients are consistent with the low-high and high-HPI trading strategies being pro-cyclical. When the economy is expanding, interest rates tend to rise, credit spreads shrink, and the yield curve becomes steeper. Thus, the regression results indicate that low-high and high-HPI trading strategies generally outperform the market during periods of economic expansion. In contrast, during periods of economic weakness, characterized as having low interest rates and high credit risk premiums, the location based value-premium strategies underperform the overall market.

6 Conclusion

In this paper, we study the connection between local housing markets and firm stock returns. We merge the insights from models in urban economics that link housing markets to firm growth with neoclassical investment-based models linking firm stock returns with labor productivity. Our empirical analysis examines the cross-section of stock returns linked to housing markets at firm headquarter locations. We find that growth firms in markets with high house price appreciation under-perform firms in markets characterized as stagnant or low appreciating housing markets. Furthermore, we find that the classic value-growth premium identified in the asset pricing literature is a function of growth firms in high house price appreciation markets significantly under-performing value firms. Our results are consistent with intuition obtained from the Rosen-Robak model in urban economics that firm location plays a significant role in firm growth as well as the investment-based theories from the asset pricing literature.

While most of the literature attempting to explain the value-growth premium focuses on the question of why value firms outperform growth firms, our results indicate that an important component of the spread comes from the under-performance of growth stocks. We find that growth firms located in high house appreciation markets significantly under-perform other firms. The intuition provided by the neoclassical investment theory provides a possible explanation of this phenomenon; growth firms located in areas with high house price appreciation face the largest adjustment cost shocks and tend to delay or forgo capital expenditures, reducing profits and lowering returns. Our results point towards potential interactions with other explanations of the value-growth premium. In particular, the marginal impact of high labor costs on the returns of growth firms may increase with a lack of investors ability to short the stock or based on the leverage structure of the firm. We leave these additional possibilities to future research.

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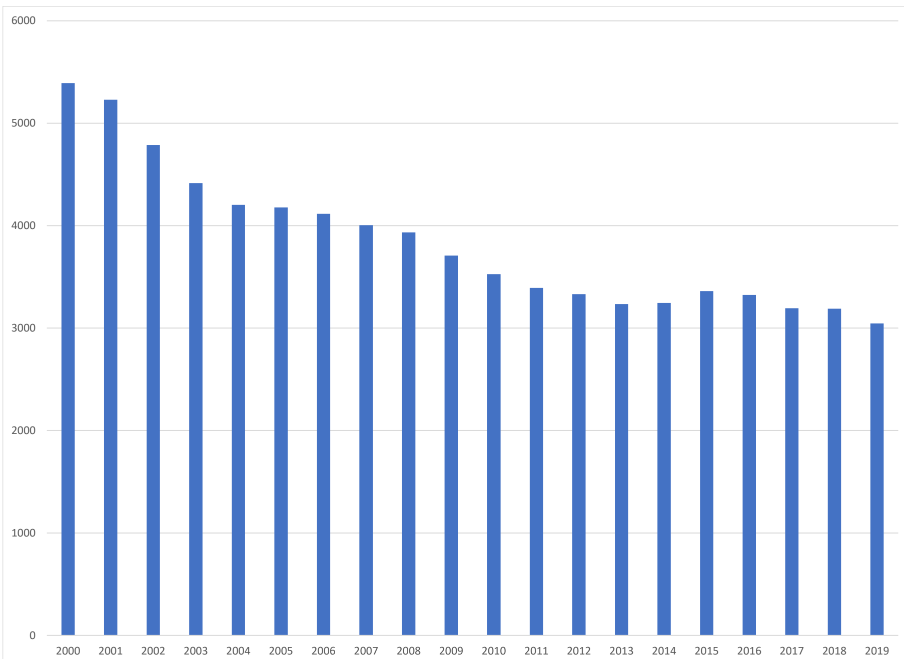
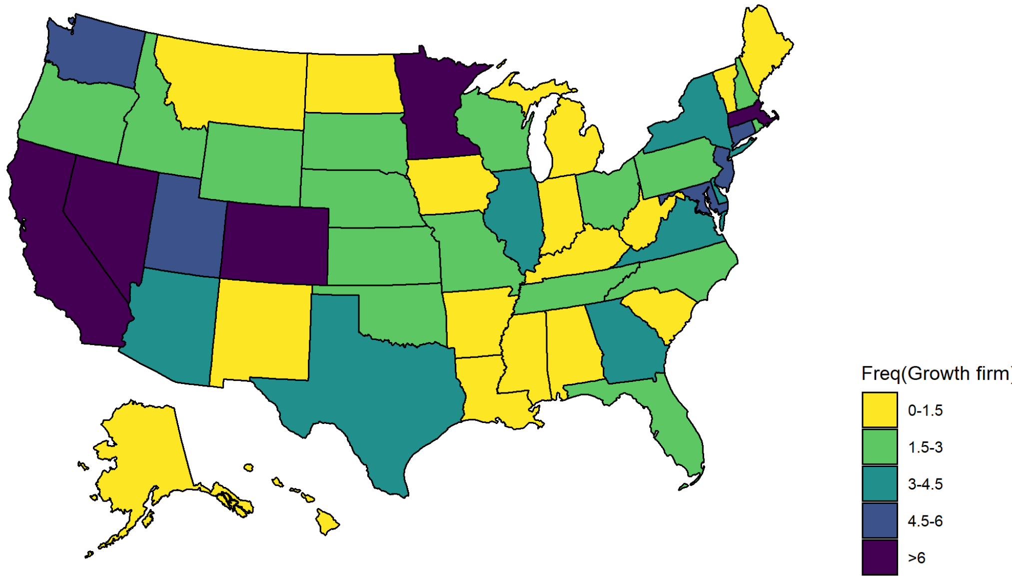
Figure 1: Frequency counts of firms by year

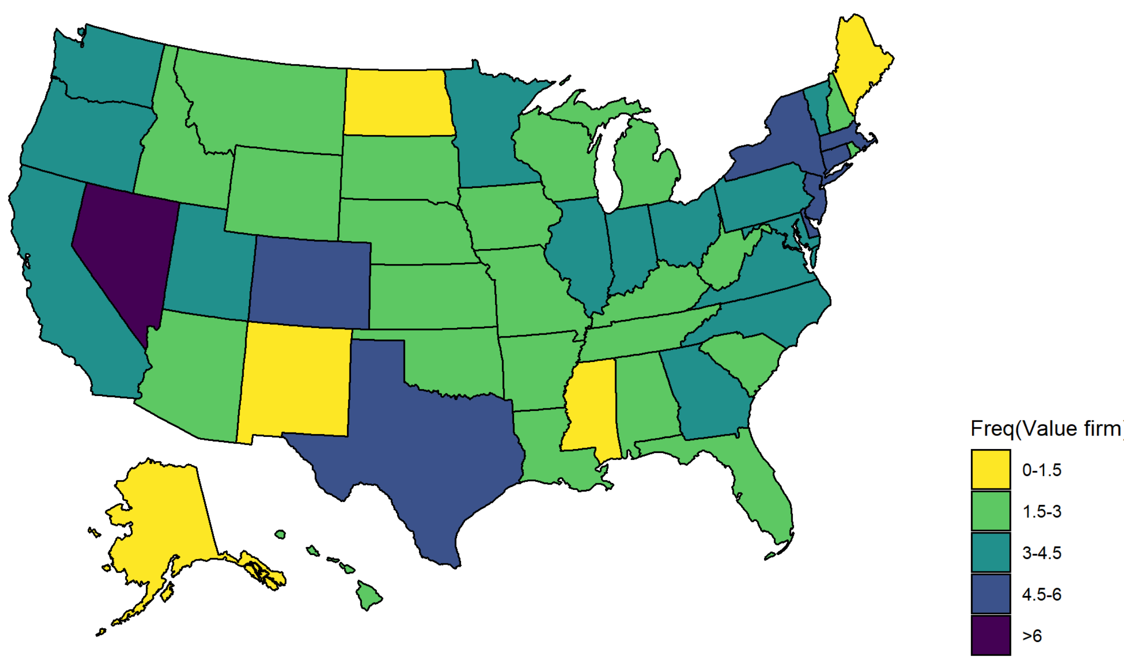


The figure plots the frequency of firm counts in each year. The sample period is January 2000 through December 2019.

Figure 2: Headquarters location of growth firms versus value firms



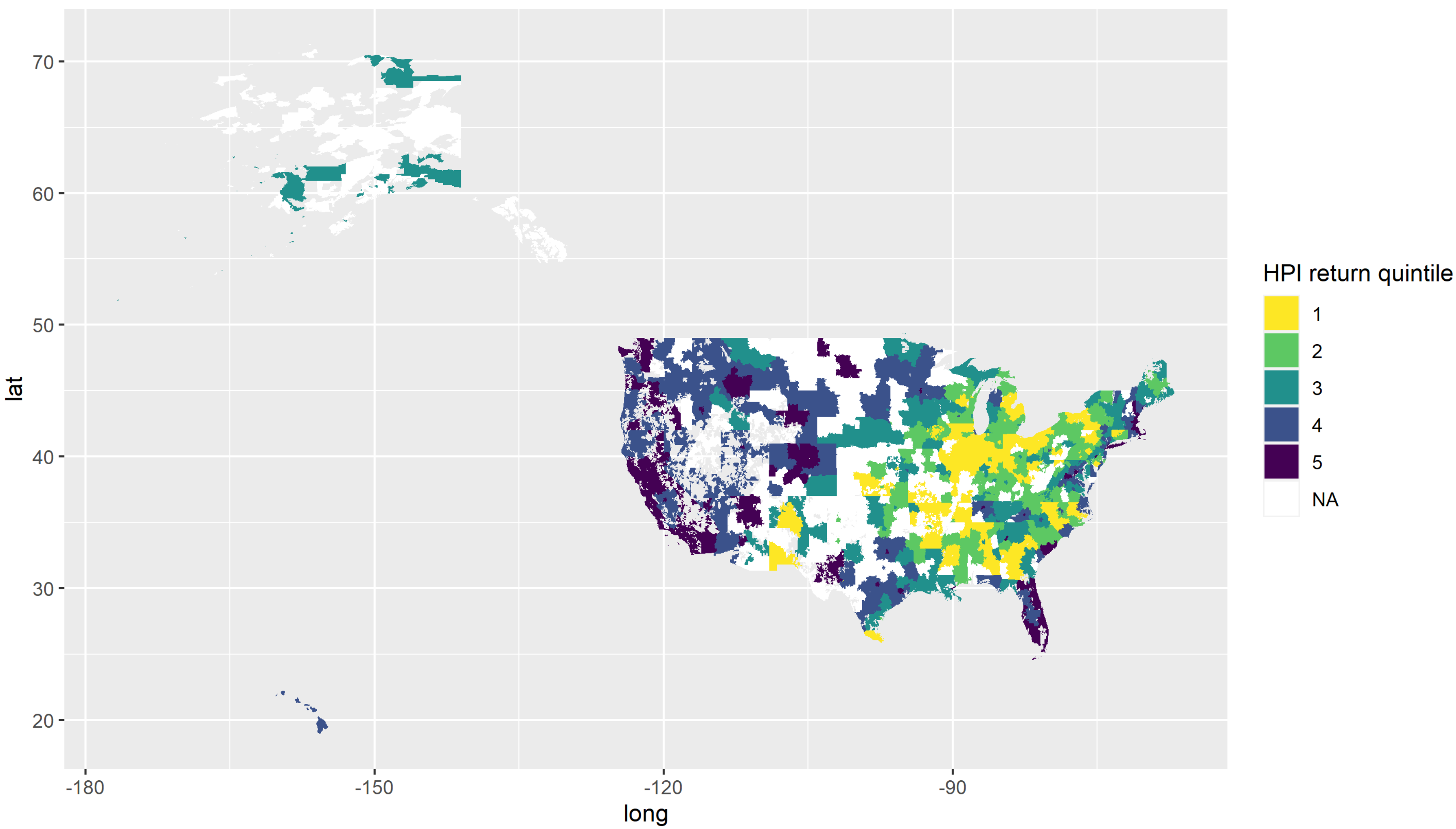
CO=6.8; NV=6.9;DC=6.9; MN=7.6; CA=8.0;MA=10.8.
Freq represents the number of firms per 1 million population.
The number of firms is the time-series average from 2000 to 2019.
A firm is added to the portfolio of growth firms if its book-to-market ratio is below the 20th percentile.



NV=6.3.
Freq represents the number of firms per 1 million population.
The number of firms is the time-series average from 2000 to 2019.
A firm is added to the portfolio of value firms if its book-to-market ratio exceeds the 80th percentile.

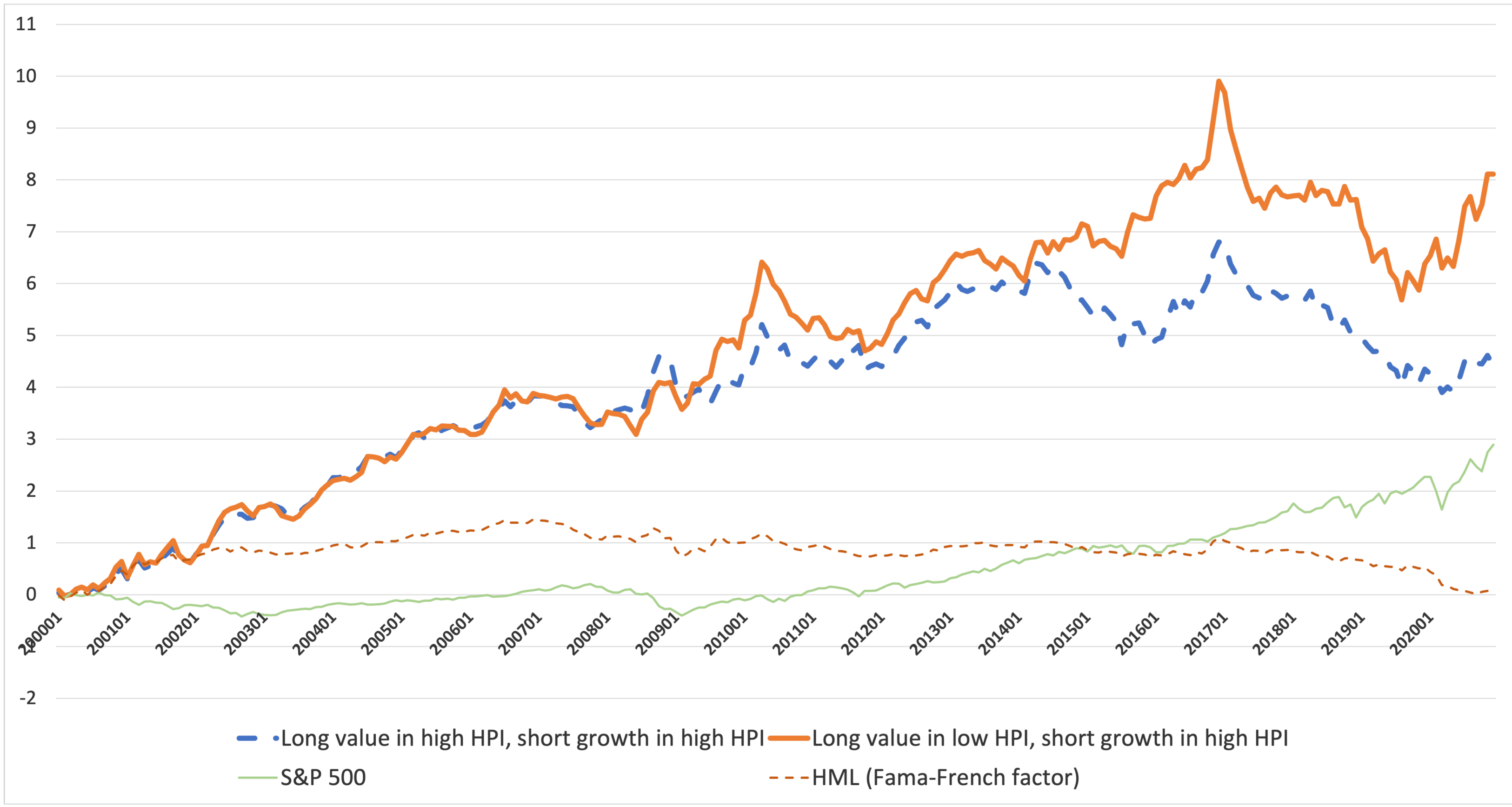
The maps plot the time-series average number of growth firms and value firms per 1 million population in each state over the period 2000-2019.

Figure 3: HPI portfolios



The map plots the time-series average of one-year holding period HPI return in each 3-digit Zip Code over the period 2000-2019. We include ZIP3 in quintile 1 if its HPI return is below the 20^{th} percentile in the cross-section of HPI returns. Correspondingly, we classify ZIP3 into quintile 5 if its HPI return exceeds the 80^{th} percentile. Three more quintiles are formed using the 40^{th} and the 60^{th} percentiles as breakpoints.

Figure 4: Cumulative returns



The figure plots the cumulative returns associated with various trading strategies. The low-high trading strategy (orange line) is long value firms located in the low HPI areas and short growth firms located in the high HPI areas. The high-HPI strategy (blue line) is long value firms located in the high HPI areas and short growth firms located in the high HPI areas. The green line is the S&P500. The red line corresponds to the Fama-French HML factor. The sample period is from January 2000 to December 2020.

Figure 5: Rolling Sharpe ratios

The figure plots the 5-year rolling Sharpe ratios measured as $\sqrt{k}\frac{E(r_{p,t-k}-rf_{t-k})}{\sqrt{Var(r_{p,t-k}-rf_{t-k})}}$ with $k = 60$. The low-high trading strategy (orange line) is long value firms located in the low HPI areas and short growth firms located in the high HPI areas. The high-HPI strategy (blue line) is long value firms located in the high HPI areas and short growth firms located in the high HPI areas. The green line is the S&P500. The sample period is from December 2004 to December 2020.

Table 1: Summary statistics

Panels A and B report time series averages for the firm characteristics (Panel A) and portfolio characteristics sorted on the book-to-market ratio (Panel B). The sample consists of 9,308 firms covering the period 2000-2019. Operating leverage is defined as annual operating costs divided by total assets (AT), where operating costs is cost of goods sold (COGS) plus selling, general, and administrative expenses (XSGA) following Novy-Marx (2011). Financial leverage is the firm's market leverage as in Fan et al. (2012). Average labor cost is measured by selling, general and administrative expense (SG&A) divided by employee counts(EMP). The 3-digit ZIP HPI return is the one-year holding period return for the 3-digit Zip code house price index (HPI) from the Federal Housing Finance Agency (FHFA). Firms in the sample are headquartered in 732 out of 929 3-digit ZIP Codes. We delete zip codes that do not have firm headquarters or that do not have a HPI reported by FHFA. In Panel B, the *t*-statistics are for a two-tailed mean difference test between the portfolio of value firms and the portfolio of growth firms. *** - significant at the 1% level, ** - significant at the 5% level, * - significant at the 10% level.

Panel A: Summary Statistics

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Monthly return	873074	0.010	0.181	-1.000	-0.064	0.004	0.070	19.884
Log(Size (ME))	873053	4,207	21,257	0.100	77.600	353.900	1,639	1,304,765
Book-to-market ratio (BEME)	873074	0.742	0.854	0.000	0.302	0.552	0.906	31.498
Operating leverage	869,784	0.828	0.752	0.021	0.262	0.656	1.167	3.778
Financial leverage	858,757	1.033	1.639	0.006	0.177	0.534	1.155	11.260
Institutional ownership	649,616	0.528	0.302	0.000	0.254	0.570	0.799	1.000
ZIP3-level annual HPI return	15372	0.036	0.061	-0.329	0.006	0.035	0.063	0.376

Panel B: Averages by book-to-market ratio quintiles

Variable	Growth	2	3	4	Value	Value-Growth	t-statistic
Monthly return	0.007	0.010	0.010	0.011	0.014	0.006*	1.833
Excess return	-0.001	0.001	0.002	0.003	0.005	0.006***	4.477
Size (ME) ($million)	7,839	5,505	3,733	2,645	1,648	-6,191***	-35.909
Book-to-market ratio (BEME)	0.176	0.380	0.566	0.812	1.664	1.488***	74.405
Operating leverage	0.970	0.866	0.788	0.700	0.730	-0.241***	-32.021
Financial leverage	1.371	0.865	0.945	0.948	1.009	-0.362***	-26.426
Institutional ownership	0.608	0.605	0.556	0.502	0.424	-0.184***	-40.658
Average labor cost	142.284	106.699	93.071	87.902	89.780	-52.504***	-28.601
ZIP3-level annual HPI return	0.039	0.038	0.038	0.037	0.037	-0.002***	-0.604

Table 2: Transition matrix of HPI return terciles

This table reports the 1-year transition matrix denoting the probability that a 3-digit Zip code located in portfolio i at $t = 0$ transitions to portfolio j. The portfolios represent annual HPI holding period return terciles. The sample contains 732 3-digit Zip codes having firm headquarters. The HPI is reported by Federal Housing Finance Agency (FHFA) and the sample period is January 2000 through December 2019.

	HPI return portfolios $(t = 1)$		
HPI return portfolios $(t = 0)$	Low	Medium	High
Low	0.561	0.372	0.067
Medium	0.275	0.528	0.198
High	0.077	0.254	0.671

Table 3: Number of firms in portfolios during the period 2000-2019

The Panel A of this table reports the total number of unique firms ever included in the 15 B/M-HPI portfolios over the period 2000-2019. Panel B reported the time series average of unique firms in each 15 portfolios over the period 2000-2019. The 15 portfolios are formed from a five by three double sorting on firm book-to-market ratio (B/M) and 3-digit Zip Code HPI return, respectively.

Panel A: Total number of unique firms			
	HPI return		
Book-to-Market	Low	Medium	High
Growth	2053	2531	3437
2	2019	2549	3124
3	2107	2632	3129
4	2258	2827	3149
Value	2212	2815	2924
Panel B: Average number of unique firms			
	HPI return		
Book-to-Market	Low	Medium	High
Growth	257	293	433
2	253	323	388
3	308	422	512
4	399	561	574
Value	567	750	756

Table 4: Average labor cost and investment in 15 portfolios

This table reports the average labor cost over the period 2000-2019 in Panel A and the average investment in Panel B. The 15 portfolios are formed from a five by three double sorting on firm book-to-market ratio (B/M) and 3-digit Zip Code HPI return, respectively. Average labor cost are measured by selling, general and administrative expense (SG&A) divided by employee counts (EMP). The investment is measured as the annual percentage change of total assets (AT).

Panel A: Labor costs

	HPI return		
Book-to-Market	Low	Medium	High
Growth	139.53	134.91	152.42
2	102.91	105.42	111.76
3	89.48	87.66	102.07
4	85.08	84.26	94.36
Value	84.43	83.25	101.67

Panel B: Investment

	HPI return		
Book-to-Market	Low	Medium	High
Growth	0.195	0.199	0.236
2	0.153	0.149	0.185
3	0.113	0.123	0.143
4	0.090	0.102	0.119
Value	0.049	0.044	0.065

Table 5: Equally-weighted returns and abnormal returns for 15 portfolios sorted by book-to-market ratio and HPI return

This table reports the average portfolio returns (Panel A) and Fama-French 3-factor abnormal returns (Panel B) of firms sorted into five book-to-market ratio (B/M) and three housing price return portfolios based on the firm's headquarters location (3-digit Zip Code). For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets. The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. The reported t-statistics are based on bootstrapped standard errors.

Panel A: HPI portfolio equally-weighted returns

Book-to-market Portfolios	Low	Medium	High	High-Low	Bootstrap t-stats
Growth	0.010	0.007	0.005	-0.005	-2.457
2	0.010	0.010	0.009	-0.001	-0.702
3	0.012	0.010	0.010	-0.002	-1.380
4	0.012	0.011	0.011	0.000	-0.328
Value	0.014	0.014	0.013	-0.002	-1.211
Value-growth	0.005	0.006	0.008		
Bootstrap t-stats	1.837	2.902	3.072		

Panel B: HPI portfolio abnormal returns

Book-to-market Portfolios	Low	Medium	High	High-Low	Bootstrap t-stats
Growth	0.002	0.000	-0.003	-0.005	-2.828
2	0.002	0.002	0.000	-0.001	-0.972
3	0.003	0.001	0.001	-0.002	-1.556
4	0.004	0.003	0.003	-0.001	-0.503
Value	0.006	0.005	0.004	-0.002	-1.177
Value-growth	0.004	0.005	0.007		
Bootstrap t-stats	2.070	3.694	4.771		

Table 6: Regressions of portfolio returns on HPI return and Fama-French five factors

This table reports the estimates of the regression model:

$$r_{z,t} = \beta_1(Mkt - Rf)_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 HPI.return_{z,t-1} + \delta_t + \delta_z + e_{z,t},$$

where r_{zt} is the excess return of a portfolio in 3-digit ZIP Codes (ZIP3) z at month t. The market portfolio $Mkt - Rf$, the size factor SMB, the book-to-market factor HML, the profitability factor RMW, and the investment factor CMA are downloaded from Ken French's website. HPI Return is the lagged one-year holding period HPI return. HPI is downloaded from the Federal Housing Finance Agency (FHFA). The regression includes year-quarter fixed effects δ_t and ZIP3 fixed effects δ_z. The sample period is January 2000 through December 2019. The coefficients are estimated using Ordinary Least Squares (OLS). The numbers in parentheses are the standard errors clustered by ZIP3. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Book-to-Market Portfolios				
	Growth	(2)	(3)	(4)	Value
HPI.return	−0.044***	−0.009	−0.010	0.019*	−0.015
	(0.012)	(0.011)	(0.011)	(0.010)	(0.012)
Mkt.RF	1.052***	1.048***	0.947***	0.830***	0.764***
	(0.021)	(0.020)	(0.022)	(0.020)	(0.024)
SMB	0.512***	0.496***	0.580***	0.570***	0.583***
	(0.030)	(0.031)	(0.029)	(0.024)	(0.030)
HML	0.006	0.235***	0.481***	0.527***	0.630***
	(0.038)	(0.040)	(0.035)	(0.032)	(0.038)
RMW	−0.139***	0.113***	0.055	0.079**	−0.130***
	(0.051)	(0.042)	(0.043)	(0.033)	(0.041)
CMA	−0.399***	−0.104*	−0.094*	−0.123***	−0.126**
	(0.073)	(0.063)	(0.051)	(0.043)	(0.053)
yrqtr FE	Yes	Yes	Yes	Yes	Yes
ZIP3 FE	Yes	Yes	Yes	Yes	Yes
ZIP3 Cluster	Yes	Yes	Yes	Yes	Yes
Observations	55,028	56,281	61,883	70,331	72,453
Adjusted R^2	0.181	0.159	0.163	0.156	0.127

Table 7: Regressions of value-growth equally weighted premium on HPI return

This table reports the OLS regressions of the equally weighted value-growth premium on the lagged one-year housing price holding period return (HPI.Return). USREC denotes a dummy variable for the Great Recession from NBER. The sample period is January 2000 through December 2019. The coefficients are estimated using Ordinary Least Squares (OLS). The numbers in parentheses are the standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
HPI.return	0.041***	0.038**	0.028	0.028*	0.025**
	(0.012)	(0.019)	(0.017)	(0.016)	(0.011)
USREC					−0.006**
					(0.003)
Constant	0.005***				
	(0.001)				
yrmonth FE	No	Yes	Yes	Yes	No
ZIP3 FE	No	No	Yes	Yes	Yes
State Cluster	No	No	Yes	Yes	Yes
Year Cluster	No	No	No	Yes	No
Observations	38,012	38,012	38,012	38,012	38,012
Adjusted R^2	0.0003	0.026	0.030	0.030	0.004

Table 8: Abnormal returns for low institutional ownership firms and high institutional ownership firms

This table reports the alpha from the Fama-French 3-factor model for firms sorted into five book-to-market (B/M) and three housing price return portfolios based on the firm's headquarters location (3-digit Zip Code). Panel A reports the subsample of low institutional ownership firms while Panel B reports the subsample of high institutional ownership firms. A firm is defined as low institutional ownership if the institutional ownership rate is below the 20th percentile in the cross-section. A firm is defined as high institutional ownership if the institutional ownership rate exceeds the 80th percentile. For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets. The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. The reported t-statistics are based on bootstrapped standard errors.

	HPI return				Bootstrap
Book-to-market	Low	Medium	High	High-low	t-stats
Panel A: Low institutional ownership					
Growth	0.000	0.003	-0.007	-0.007	-1.164
2	0.004	0.001	0.004	0.000	-0.048
3	0.006	0.004	0.002	-0.004	-1.143
4	0.005	0.005	0.007	0.002	0.682
Value	0.011	0.011	0.009	-0.002	-0.507
Value-growth	0.011	0.008	0.016		
Bootstrap t-stats	1.619	1.641	4.158		
Panel B: High institutional ownership					
Growth	0.003	0.004	0.002	-0.001	-0.401
2	0.005	0.002	0.001	-0.003	-1.514
3	0.003	0.002	0.005	0.002	1.073
4	0.003	0.001	0.002	-0.001	-0.509
Value	0.002	0.000	0.000	-0.003	-0.774
Value-growth	-0.001	-0.004	-0.002		
Bootstrap t-stats	-0.242	-1.790	-1.034		

Table 9: Abnormal returns for low operating leverage firms and high operating leverage firms

This table reports the alpha from the Fama-French 3-factor model for firms sorted into five book-to-market (B/M) and three housing price return portfolios based on the firm's headquarters location (3-digit Zip Code). Panel A reports the subsample of low operating leverage firms while Panel B reports the subsample of high operating leverage. A firm is defined as low operating leverage if the operating leverage is below the 20th percentile in the cross-section. A firm is defined as high operating leverage if the operating leverage exceeds the 80th percentile. For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets. The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. The reported t-statistics are based on bootstrapped standard errors.

Book-to-market Portfolios	HPI return portfolios				Bootstrap t-stats
	Low	Medium	High	High-low	
Panel A: Low operating leverage					
Growth	0.001	-0.008	-0.008	-0.008	-0.694
2	-0.005	-0.003	-0.002	0.003	0.611
3	-0.001	0.001	0.000	0.001	0.360
4	0.000	0.001	0.001	0.001	0.696
Value	0.001	0.005	0.002	0.001	0.474
Value-growth	0.000	0.013	0.009		
Bootstrap t-stats	0.055	3.652	2.776		
Panel B: High operating leverage					
Growth	0.001	0.001	-0.003	-0.003	-1.386
2	0.001	0.002	0.002	0.001	0.414
3	0.005	0.002	0.003	-0.002	-0.698
4	0.004	0.003	0.006	0.002	0.631
Value	0.011	0.006	0.007	-0.004	-1.256
Value-growth	0.010	0.005	0.009		
Bootstrap t-stats	3.062	2.081	3.508		

Table 10: Panel regressions of equity returns and HPI returns

This table reports the estimates of the regression model:

$$r_{it} = \beta_1 HPI.return_{i,t-1} + \beta_2 Book.to.market.ratio_{i,t} + \beta_3 Size_{i,t} + \beta_4 Operating.leverage_{i,t} + \beta_5 Financial.leverage_{i,t} + \beta_6 Institutional.ownership_{i,t} + \delta_{j,t} + e_{i,t},$$

where $r_{i,t}$ is the excess return on stock i in month t. HPI.Return is lagged one-year holding period HPI return of ZIP3 z where stock i is located in. HPI is downloaded from the Federal Housing Finance Agency (FHFA). Book-to-market ratio and Size are the log of the firms's book-to-market ratio and market equity constructed following Fama and French (1992). Operating leverage is the log of the firm's annual operating costs divided by total assets(AT), where operating costs is cost of goods sold (COGS) plus selling, general, and administrative expenses (XSGA) following Novy-Marx (2011). Financial leverage is the log of the firm's market leverage as in Fan et al. (2012). The model includes SIC industry by year-month fixed effects δ_{jt}. The sample period is January 2000 through December 2019. The coefficients are estimated using Ordinary Least Squares (OLS). The numbers in parentheses are the standard errors clustered by firms. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Firm's excess return				
	Growth	(2)	(3)	(4)	Value
HPI.return	−0.023*	0.014	0.013	0.021*	0.014
	(0.012)	(0.014)	(0.012)	(0.011)	(0.014)
Book-to-market ratio	0.004***	0.010**	0.018***	0.015***	0.017***
	(0.001)	(0.005)	(0.006)	(0.004)	(0.002)
Size	0.008***	0.009***	0.008***	0.008***	0.013***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Operating leverage	0.014***	0.012***	0.009***	0.009***	0.012***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
Financial leverage	0.001	−0.001**	−0.001	−0.001	−0.001
	(0.0005)	(0.001)	(0.001)	(0.0005)	(0.001)
Institutional ownership	−0.006***	−0.007***	−0.007***	−0.006***	−0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry-yrmonth FE	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes
Observations	140,939	115,088	114,871	127,461	136,668
Adjusted R^2	0.112	0.114	0.168	0.261	0.212

Table 11: Regressions of firm returns on HPI return and investment

This table reports the estimates of the regression model:

$$r_{i,t} = \beta_1 INV_{i,t} + \beta_2 HPI.return_{i,t-1} + \beta_3 INV_{i,t} \times HPI.return_{i,t-1} + controls + \delta_t + \delta_i + e_{i,t},$$

where $r_{i,t}$ is the excess return of firm i at month t, the investment is INV and the HPI return is $HPI.return$. The investment is measured as the annual percentage change of total assets (AT). HPI Return is lagged one-year holding period HPI return of where firm i is located in. HPI is downloaded from the Federal Housing Finance Agency (FHFA). The controls include firm level financial leverage, operating leverage, and institutional ownership described in Table 10. The regression includes time fixed effects δ_t and potentially, firm fixed effects δ_i. Panel A contains four specifications for regressions using the full sample of firms. Panel B contains regressions with firm and time fixed effects for firms grouped by Book-to-Market ranking. The sample period is January 2000 through December 2019. The coefficients and standard errors are scaled by 100. The numbers in parentheses are the standard errors clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Full Sample

	(1)	(2)	(3)	(4)
INV×HPI	-3.271***	-2.888***	-3.260***	-3.002***
	(0.880)	(0.937)	(0.882)	(0.934)
INV	-0.560***	-0.888***	-0.525***	-0.728***
	(0.088)	(0.095)	(0.089)	(0.100)
HPI	-1.045***	-1.309***	-1.098***	-1.374***
	(0.390)	(0.439)	(0.399)	(0.438)
Controls	No	No	Yes	Yes
Firm FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	645,941	645,941	645,941	645,941
Adjusted R^2	0.115	0.115	0.115	0.114

Panel B: Book-to-Market Rankings

	Growth	(2)	(3)	(4)	Value
INV×HPI	-3.490**	2.867	-0.208	-3.084	-1.486
	(1.434)	(2.192)	(2.056)	(2.959)	(3.527)
INV	-0.535***	-0.438**	-0.548	-0.526**	-0.626**
	(0.172)	(0.198)	(0.192)	(0.251)	(0.273)
HPI	-1.231	-2.130**	-1.730*	1.261	-0.845
	(1.079)	(1.037)	(0.994)	(1.227)	(1.454)
Observations	122,931	106,707	103,805	108,876	112,251
Adjusted R^2	0.136	0.134	0.141	0.129	0.104

Table 12: Abnormal returns for urban versus rural firms

This table reports the alpha from the Fama-French 3-factor model for firms sorted into five book-to-market (B/M) and three housing price return portfolios based on the firm's headquarters location (3-digit Zip Code). Panel A reports the subsample of urban firms while Panel B reports the subsample of rural firms. A firm is defined as urban if its headquarters is located in core Metropolitan area according to the USDA-RUCA classification [https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/documentation/]. A firm is defined as rural if its headquarters is located out of core Metropolitan area. For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets. The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. The reported t-statistics are based on bootstrapped standard errors.

Book-to-market Portfolios	HPI return portfolios				Bootstrap t-stats
	Low	Medium	High	High-low	
Panel A: Urban					
Growth	0.002	0.000	-0.003	-0.005	-2.802
2	0.002	0.002	0.000	-0.002	-0.940
3	0.004	0.001	0.001	-0.002	-1.681
4	0.004	0.003	0.003	-0.001	-0.998
Value	0.005	0.005	0.004	-0.001	-0.601
Value-growth	0.003	0.005	0.007		
Bootstrap t-stats	1.576	3.434	4.784		
Panel B: Rural					
Growth	-0.003	0.002	-0.006	-0.003	-0.592
2	0.001	0.003	-0.002	-0.003	-0.725
3	0.002	0.003	0.003	0.001	0.202
4	-0.002	0.004	0.003	0.005	1.692
Value	0.006	0.008	0.005	-0.001	-0.347
Value-growth	0.009	0.006	0.011		
Bootstrap t-stats	1.995	1.967	2.296		

Table 13: Panel regressions of equity returns and HPI return

This table reports the estimates of the regression model:

$$
\begin{aligned}
r_{i,t} = {} & \beta_1 HPI.return_{i,t-1} + \beta_2 Rural_i + \beta_3 HPI.return_{i,t-1} \times Rural_i + \beta_4 Book.to.market.ratio_{i,t} \\
& + \beta_5 Size_{i,t} + \beta_6 Operating.leverage_{i,t} + \beta_7 Financial.leverage_{i,t} + \beta_8 Institutional.ownership_{i,t} \\
& + \beta_9 Labor.cost_{i,t} + \delta_{j,t} + e_{i,t},
\end{aligned}
$$

where r_{it} is the excess return on stock i in month t. HPI.Return is lagged one-year holding period HPI return of ZIP3 z where stock i is located in. HPI is downloaded from the Federal Housing Finance Agency (FHFA). A firm is defined as rural if its headquarters is located out of core Metropolitan area according to the USDA-RUCA classification [https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/documentation/]. Book-to-market ratio and Size are the log of the firms's book-to-market ratio and market equity constructed following Fama and French (1992). Operating leverage is the log of the firm's annual operating costs divided by total assets (AT), where operating costs is cost of goods sold (COGS) plus selling, general, and administrative expenses (XSGA) following Novy-Marx (2011). Financial leverage is the log of the firm's market leverage as in Fan et al. (2012). Labor cost is defined as firm's selling, general and administrative expenses (XSGA) divided by employee counts (EMP). The model includes SIC industry by year-month fixed effects δ_{jt}. The coefficients are estimated using Ordinary Least Squares (OLS). The numbers in parentheses are the standard errors clustered by firms. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Growth	(2)	(3)	(4)	Value
HPI.return	−0.029**	0.012	0.014	0.028**	0.016
	(0.013)	(0.014)	(0.013)	(0.014)	(0.016)
Rural areas	0.005	0.001	−0.002	−0.001	0.003
	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
HPI.return×Rural areas	0.002	0.014	0.041	0.023	0.036
	(0.044)	(0.037)	(0.032)	(0.033)	(0.034)
Book-to-market ratio	0.005***	0.007	0.012**	0.017***	0.017***
	(0.001)	(0.005)	(0.006)	(0.005)	(0.003)
Size	0.008***	0.008***	0.008***	0.008***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Operating leverage	0.015***	0.012***	0.008***	0.011***	0.017***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Financial leverage	0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Institutional ownership	−0.005***	−0.006***	−0.007***	−0.007***	−0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Average labor cost	0.004***	0.003**	0.001	0.002	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry-yrmonth FE	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes
Observations	120,510	102,386	100,291	106,809	111,209
Adjusted R^2	0.121	0.149	0.243	0.268	0.192

Table 14: Value-Growth Premiums by Industry

This table reports the value-growth premium for the HPI return portfolios segmented by the ten primary industry groups. The industry definition is downloaded from Ken French's website. The sample period is January 2000 through December 2019. The reported t-statistics in parentheses are based on bootstrapped standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

		HPI Return Portfolios		
	Industry	Low	Medium	High
1	Food, Tobacco, Textiles, Apparel, Leather, Toys	0.006	0.005	0.007
		(0.89)	(1.22)	(1.19)
2	Autos, TVs, Furniture, Household Appliances	0.000	-0.002	0.002
		(0.85)	(-0.30)	(0.24)
3	Machinery, Trucks, Planes, Chemicals, Off Furn, Paper, Com Printing	0.007	0.006**	0.009***
		(1.60)	(2.12)	(2.69)
4	Oil, Gas, and Coal Extraction and Products	-0.008	0.003	0.002
		(-0.05)	(1.54)	(-0.14)
5	Business Equipment	0.010**	0.009***	0.007*
		(2.13)	(2.70)	(1.71)
6	Telephone and Television Transmission	0.011	0.025	0.001
		(0.33)	(2.48)	(0.17)
7	Wholesale, Retail, and Some Services	0.007	0.005	0.006**
		(1.25)	(1.40)	(1.71)
8	Healthcare, Medical Equipment, and Drugs	0.005	0.009**	0.014***
		(0.79)	(1.73)	(2.30)
9	Utilities	0.000	0.012	0.009
		(-1.43)	(1.03)	(-0.50)
10	Other	0.002	0.002	0.006***
		(0.59)	(0.95)	(2.45)

Table 15: Time-series regressions of Sharpe ratios

This table reports the time-series regression results of rolling Sharpe ratios. Column (1) and (2) display the low-high strategy, which long value firms located in the low HPI areas and short growth firms located in the high HPI areas. Column (3) and (4) display the high-HPI strategy, which long value firms located in the high HPI areas and short growth firms located in the high HPI areas. Column (1) and Column (3) are five-year rolling Sharpe ratios while Column (2) and (4) are three-year rolling Sharpe ratios. The sample period is from December 2002 to December 2020. All the explanatory variables are lagged for one month. The quarterly US gross domestic product [GDPC1] and the monthly unemployment rate [UNRATE]), conditions in the credit markets (the federal funds rate [FEDFUNDS], credit spread [Baa-Aaa] defined as the difference in returns on Baa- and Aaa-rated long-term industrial corporate bonds, and the yield curve as measured as the difference between the 10-year Treasury constant maturity yield and the 3-month Treasury constant maturity yield [T10Y3MM]), and conditions in the overall housing market (housing market supply [MSACSR] and the rental vacancy rate [RRVRUSQ156N]). We measure the housing market supply as the ratio of houses for sale to houses sold, which indicates how long the current for-sale inventory would last given the current sales rate if no additional new houses were built. The rental vacancy rate is the proportion of the rental inventory that is vacant for rent. All macroeconomic variables, credit market factors, and housing market factors are available from the St. Louis Federal Reserve Bank website (https://fred.stlouisfed.org/). The reported t-statistics in parentheses are based on bootstrapped standard errors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Rolling Sharpe ratio			
	Low-high Strategy		High-HPI Strategy	
	5-year	3-year	5-year	3-year
Δ GDP growth rate	−0.339	0.147	0.064	−0.016
	(0.590)	(0.722)	(0.721)	(0.859)
Δ Unemployment rate	−4.726	−4.270	−4.758	−4.388
	(6.709)	(8.244)	(8.203)	(9.817)
Fed funds rate	44.113***	42.810***	84.096***	79.386***
	(4.572)	(5.363)	(5.590)	(6.386)
Credit spread	−21.365*	−72.737***	−2.746	−73.665***
	(12.265)	(14.719)	(14.995)	(17.527)
Term spread	51.457***	67.042***	87.880***	105.503***
	(7.072)	(7.508)	(8.646)	(8.941)
ΔHouses supply	0.360	−0.326	0.298	−0.307
	(0.649)	(0.770)	(0.793)	(0.917)
ΔRental vacancy	13.138	−16.900	−6.017	−26.508
	(16.012)	(18.991)	(19.577)	(22.614)
Constant	0.242	0.114	−1.357***	−1.198***
	(0.207)	(0.250)	(0.253)	(0.298)
Observations	193	217	193	217
Adjusted R^2	0.345	0.335	0.550	0.480

Appendix

Table A1: Abnormal returns for 15 portfolios sorted by book-to-market ratio and 3-year, 5-year HPI return

This table reports the alpha from the Fama-French 3-factor model for firms sorted into five book-to-market (B/M) and three housing price return portfolios based on the firm's headquarters location (3-digit Zip Code). Panel A reports the 3-year HPI return sorting while Panel B reports the 5-year HPI return sorting. For each portfolio, we follow the standard approach in Fama and French (1992) to measure the portfolio returns starting in July of each year t. The columns represent locations grouped into low, medium and high HPI return terciles. The column labeled "High-Low" is the difference between the portfolio returns for firms located in high and low HPI return markets. The rows report the mean portfolio returns for firms grouped into quintiles based on their book-to-market ratios. The row labeled "Value-Growth" reports the difference in average returns for firms sorted into the low (growth) and high (value) book-to-market ratio portfolios. The reported t-statistics are based on bootstrapped standard errors.

Book-to-market Portfolios	HPI Return Portfolios: Low	Medium	High	High-low	Bootstrap t-stats
Panel A: 3-year HPI return					
Growth	0.001	0.000	-0.002	-0.003	-1.814
2	0.002	0.002	0.000	-0.001	-0.979
3	0.003	0.002	0.001	-0.002	-1.253
4	0.004	0.003	0.002	-0.002	-1.584
Value	0.006	0.005	0.003	-0.003	-1.908
Value-growth	0.005	0.005	0.006		
Bootstrap t-stats	2.865	3.520	3.724		
Panel B: 5-year HPI return					
Growth	0.000	0.000	-0.002	-0.002	-1.253
2	0.001	0.002	0.000	-0.001	-0.429
3	0.003	0.001	0.002	-0.001	-0.993
4	0.004	0.003	0.001	-0.003	-2.049
Value	0.005	0.005	0.003	-0.002	-1.249
Value-growth	0.005	0.006	0.005		
Bootstrap t-stats	3.112	3.846	3.021		

Table A2: Regressions of portfolio returns on HPI return and Fama-French three factors

This table reports the estimates of the regression model:

$$r_{z,t} = \beta_1(Mkt - Rf)_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 HPI.return_{z,t-1} + \delta_t + \delta_z + e_{z,t},$$

where r_{zt} is the excess return of a portfolio in 3-digit ZIP Codes(ZIP3) z at month t. The market portfolio $Mkt - Rf$, the size factor SMB, the book-to-market factor HML are downloaded from Ken French's website. HPI.Return is lagged one-year holding period HPI return. HPI is downloaded from the Federal Housing Finance Agency (FHFA). The model includes year-quarter fixed effects δ_t and ZIP3 fixed effects δ_z.Portfolios are formed based on the book-to-market ratio in each ZIP3. The sample period is January 2000 through December 2019. The coefficients are estimated using Ordinary Least Squares (OLS). The numbers in parentheses are the standard errors clustered by ZIP3. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Book-to-Market Portfolios				
	Growth	(2)	(3)	(4)	Value
Mkt.RF	1.135***	1.041***	0.949***	0.832***	0.807***
	(0.024)	(0.022)	(0.020)	(0.020)	(0.022)
SMB	0.535***	0.438***	0.548***	0.526***	0.626***
	(0.034)	(0.031)	(0.028)	(0.025)	(0.028)
HML	−0.180***	0.229***	0.463***	0.505***	0.549***
	(0.043)	(0.038)	(0.032)	(0.026)	(0.036)
HPI.return	−0.044***	−0.009	−0.010	0.019*	−0.015
	(0.012)	(0.011)	(0.011)	(0.010)	(0.012)
yrqtr FE	Yes	Yes	Yes	Yes	Yes
ZIP3 FE	Yes	Yes	Yes	Yes	Yes
ZIP3 Cluster	Yes	Yes	Yes	Yes	Yes
Observations	55,028	56,281	61,883	70,331	72,453
Adjusted R^2	0.180	0.159	0.163	0.156	0.127