Does peer sentiment affect firm investment?
Evidence from the home building industry

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Abstract

Using data from public homebuilders in the U.S. over 2003Q1-2017Q4, this paper examines the effect of peer firm sentiment on firm investment decisions. Peer sentiment is measured by the NAHB/Wells Fargo Housing Market Index, derived from a monthly survey of homebuilders' perceptions about the conditions of the single-family housing market. We find that a one-standard-deviation increase in the peer sentiment index induces homebuilders to increase their land inventory by 4.8% and homebuilding expenses (inflation-adjusted) by 15.5%. However, the positive relationship between building activities and peer sentiment is only strong when it is clear that the majority of the builders share similar beliefs. We also find that firms that overbuild compared to their peers have significantly lower stock returns.

Key words: *peer effect, herding, investment, sentiment, homebuilders*

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I. Introduction

Merriam-Webster defines sentiment as "an attitude, thought, or judgment prompted by feeling".[1] Thus, in economics and finance the term 'sentiment' is often used in connection with the assumption that asset prices may deviate from their fundamental values or discounted expected future cash flows due to emotion or feelings. However, Merriam-Webster also defines sentiment as "a specific view or notion", in other words, an "opinion." Within this definition, investor sentiment captures the idea that heterogenous actors may have rational differences of opinion with respect to expected future cash flows. Thus, in a world with incomplete information and uncertainty about observed signals of future expected cash flows, a natural question is how observations of other actors' sentiments about future economic conditions affect one's own investment decisions.

To answer this question, we focus on the role that sentiment plays in influencing a firm's key production decisions. However, gaging the impact of sentiment on firm decisions is problematic as direct measures of peer sentiment are difficult to observe. To overcome this problem, our analysis centers on the actions of homebuilders – an industry that has significant economic impact and has an observable measure of peer sentiment. The economic importance of the homebuilding industry is well known. For example, over 300,000 firms are engaged in home construction, ranging from small one-person builders/contractors to several large firms having market capitalization over a billion dollars.[2] In addition, the homebuilding industry represents a sizeable segment of the US economy as the National Association of Home Builders estimates that homebuilding activities contribute approximately 15-to-18% of the US Gross Domestic

[1] See Webster's *New Collegiate Dictionary* (1981), pg. 1048.
[2] See IBIS*World*: https://clients1.ibisworld.com/reports/us/industry/keystatistics.aspx?entid=169.

Product (GDP).[3] Furthermore, most importantly for our purposes, homebuilder sentiment is observable, making the industry a natural laboratory for the study of peer influence on firm level production decisions.

By focusing on the homebuilding industry, we make use of the NAHB/Wells Fargo Housing Market Index (HMI) published by the National Association of Homebuilders (NAHB) to measure homebuilder belief. This index is derived from a monthly survey conducted by NAHB since 1985, in which approximately 400 members are asked to rate their views about the current and future conditions of the single-family housing market. The Housing Market Index is then constructed based on their responses, ranging from 0 (all respondents are pessimistic) to 100 (all respondents are optimistic). This index is widely followed and often interpreted as homebuilder confidence. Thus, our primary research question asks whether there exists a significant relationship between this index and building activities.

Our analysis focuses on the production activity of publicly traded homebuilders, which account for approximately one-third of the homebuilding activity in the US. Essential to our goal is determining whether peer firm sentiment affects building activities beyond the effect of market fundamentals. Thus, to isolate the sentiment component in the HMI, we first regress the index against a set of market fundamentals and then use the residuals as the measure of homebuilder sentiment. We find that the level and change in homebuilder production (land lots and building expenses) are positively associated with the orthogonalized homebuilder peer sentiment index. We find that a one-standard-deviation increase in the orthogonalized HMI will induce homebuilders to increase their lot inventory by 4.8% and homebuilding expenses by 15.5%. This

[3]See https://www.nahb.org/en/research/housing-economics/housings-economic-impact/housings-contribution-to-gross-domestic-product-gdp.aspx.

result remains robust even after controlling for homebuyer sentiment. However, the positive relationship between building activities and peer sentiment is strongest when most of the builders share similar beliefs. When the survey respondents are divided in their opinions about the direction of the housing market, developers tend to reduce their building activities.

The literature offers two key theoretical justifications for the observed herding behaviors of firms, learning and reputational concerns. The learning motivation is associated with information cascades, where followers mimic leaders because the former infer useful information from the latter's actions (Banerjee, 1992). As a result, information cascades are especially likely when industry leaders are perceived to possess better information (Bikhchandani, Hirshleifer, and Welch, 1998). Alternatively, firms can be under pressure to herd in order to avoid falling behind their competitors and thus be perceived as losers (Scharfstein and Stein, 1990). These theories generally imply that smaller and less profitable firms are more likely to be followers. Contrary to this hypothesis, we find that homebuilders, regardless of their size and profitability levels, are equally likely to be influenced by peer sentiment. However, we do find evidence that the peer effect is stronger on firms held by more institutional investors.

Our paper contributes to three strands in the literature. First, we provide new insight into the effect of peer firm opinions on firm behaviors, often associated with herding. The economics and finance literature has well established that peer effects are important in shaping the behaviors of individuals and institutions. For example, the characteristics and behaviors of peer firms affect observed outcomes in a variety of settings including capital structure decisions (Leary and Roberts, 2014; MacKay and Phillips, 2005; Welch, 2004), financial reporting (Beatty, Liao, and Yu, 2013), corporate governance (Foroughi, Marcus, Nguyen, and Tehranian, 2016; John and Kadyrzhanova, 2008) and corporate investment (Diop, 2018, Foucault and Fresard, 2014;

Ozoguz and Rebello, 2013).[4] However, unlike directly observed firm characteristics (such as stock price returns) or behaviors (such as debt and equity issuance), firm sentiment remains relatively unexplored.

Second, our work compliments the corporate finance literature showing that actions by peer firms from the same industry often impact corporate decisions. For example, firm decisions regarding capital structure are often related to industry average leverage ratios (Welch (2004) and MacKay and Phillips (2005)) while changes in peer firm stock prices influence corporate investment decisions (Foucault and Fresard (2014) and Ozoguz and Rebello (2013)). We also test whether homebuilders who follow their peers will be rewarded in the short run with higher stock performance. However, the results do not support this hypothesis. Rather, we find that firms that overbuild compared to their peers exhibit significantly lower subsequent stock returns. This result is consistent with the view that building is an irreversible investment and thus overbuilding is more detrimental to firm performance than underbuilding.

Finally, our paper extends the literature examining herding in the housing market. The majority of the literature concentrates on the demand side, that is, the herding behaviors of homebuyers and speculators (see, for example, Piazzesi & Schneider (2009), Case & Shiller (2003), Case, Shiller, & Thompson (2014)) . In contrast, DeCoster and Strange (2012), Wang and Zhou (2000) and Grenadier (1996) are the few theoretical work focusing on the tendency of homebuilders to overbuild. Building on learning and reputational herding models, DeCoster and

[4] In an extensive survey on corporate governance by Graham and Harvey (2001), a large number of CFO respondents acknowledge the importance of considering peer firm financing decisions in forming their own capital structure policies. Consistent with this finding, Welch (2004) and MacKay and Phillips (2005) show that industry average leverage ratios are important determinants of firm capital structures. Furthermore, Leary and Roberts (2014) document that equity return shocks of peers affect a firm's debt and equity issuance decisions while Foucault and Fresard (2014) and Ozoguz and Rebello (2013) show that stock prices of peer firms also influence corporate investment.

Strange (2012) demonstrate that both forces can lead to rational overbuilding in the residential market. On one hand, overbuilding can occur when later developers choose to follow early movers who receive inaccurate signals. On the other hand, herding can also arise because builders want to prevent banks from making inferences about their true quality. In either case, it is optimal for developers to herd even when they believe that the "wisdom of the crowd" is in the wrong. Two earlier papers adopt a game-theoretic framework to explain overbuilding in the real estate market. First, Grenadier (1996) treats development decisions as optimal strategies in a game of option exercise. Faced with declining demand level and building values, developers may simultaneously rush to build in fear of preemption by competitors, causing a concentration of building activities in a market downturn. Wang and Zhou (2000) present a different framework based on two stages. In their model, developers decide on quantity first and price second. Regardless of their approaches, all three papers arrive at the same conclusion that overbuilding is the outcome of rational decision making on the part of builders. Our work compliments these earlier papers by offering empirical evidence on herding behaviors from the supply side of the housing market at the firm level.

The rest of the paper is organized as follows. Section II discusses the data and empirical methods used to test peer sentiment effects. Section III presents the results and section IV concludes.

II. Data and Methodology

1. Measure of peer sentiment

To measure homebuilder sentiment, we use the NAHB/Wells Fargo Housing Market Index developed by the National Association of Homebuilders (NAHB)[5]. The index is computed from responses to a monthly survey of NAHB members about their view of the single-family housing market. The survey asks respondents to rate their opinion on the market conditions for (1) current sales of new homes, (2) expected sales of new homes in the next six months, as well as (3) traffic of prospective buyers of new homes. Builders rate current sales and sales expectations as "good," "fair" or "poor", and traffic of prospective buyers as "high to very high," "average" or "low to very low". Approximately 400 responses are received each month. For each of the three questions, the percentages of responses in the Good/High and Poor/Low categories are computed and seasonally adjusted. NAHB computes an index for each series according to the formula (Good/High – Poor/Low +100)/2. The overall HMI is a weighted average of these three component indices and their weights are based on their correlations with single-family housing starts.[6] All indices range between 0 and 100, with an index number above 50 indicating that more builders view market conditions as good than poor. An index number of 100 means that all respondents answer Good/High and vice versa.

[5] Data can be obtained from: http://www.nahb.org/en/research/housing-economics/housing-indexes/housing-market-index.aspx

[6] For robustness, we also create our own composite index from these three series. Following common practice, we perform principal component analysis on the three series to extract their common factor (Baker and Wurgler, 2006, 2007; Ling et al., 2015; Soo, 2018). Not surprisingly, the correlation between the two indices is 0.996 which suggests that the two are almost interchangeable. We obtain similar results using this composite index in place of the HMI.

The index is covered regularly on major news media, such as *The Wall Street Journal*, Fox Business News, and CNBC, to name a few, as an indication of homebuilders' sentiment. Market analysts also commonly rely on HMI as an indicator of the direction the housing market is heading in the near term. Most important for our analysis, the index provides information about the breadth of optimism in the housing market. In other words, it tells us how many builders are feeling positive about the market, but it does not directly measure how positive they feel. Thus, this measure is not affected by extreme sentiment of any individual firm and is a clean indicator of where "the crowd" stands.

One important feature of the HMI is that it is calculated from a large and diverse group of homebuilders in the country, including large tract builders, regional builders, local builders, custom homebuilders and remodelers. Since the respondents have different focuses in terms of geography and/or market segments, it is difficult for any individual firm to infer private information from the aggregate index. We make use of this feature to achieve a clean test of the peer sentiment effect. As will be discussed in the next section, our empirical test is performed at the individual firm level; that is, we regress each individual firm's building activities in each quarter against the aggregate index in the previous quarter.

There are, however, two potential concerns about using the HMI as a proxy for peer sentiment. First, as with any survey, one may question whether respondents answered the survey questions honestly. While there are no perfect tests to confirm this, the correlation between HMI and aggregate single-family housing starts and building permits from 1985 to 2017 is more than 0.77. Figure 1 plots the three series over the 1985-2017 period. In addition, Goodman (1994) and Marcato and Nanda (2016) show that the index is useful in predicting future housing starts. This

suggests that homebuilders' rating of the market conditions in the survey are closely aligned with their actual behaviors.

Second, the strong relationship between HMI and building activities suggests that the index is a proxy for macro-economic conditions since it is correlated with factors such as GDP and employment. Thus, to isolate the component of HMI that is independent of overall economic conditions, we follow the literature in regressing the index against a set of six covariates: growth in the industrial production index, growth in personal consumption, change in unemployment rate, a dummy for NBER recessions, change in the 30-year fixed mortgage rate, and one-quarter lagged change in the Case-Shiller house price index (see, for example, Baker and Wurgler, 2006, 2007; Kumar and Lee, 2006; Ling, Ooi, and Le, 2015; Soo, 2018).[7] The residuals from this regression are then used to test if building activities are driven by the component of peer belief that is independent of fundamentals.

2. Base model and data

Data on homebuilding activities and other financial measures of homebuilders are obtained from SNL Financials, a data service provided by SandP Global Market Intelligence. The database includes 32 public homebuilders, which covers all 19 operating public companies in the homebuilding industry in the U.S. as of Jan 2018 except Green Brick Partners. The remaining 13 builders in the sample either merged, were acquired, went private or stopped operating prior to 2018. Table 1 lists the homebuilders in our sample. These companies are regularly present in the annual Builder Magazine (www.builderonline.com) ranking of the top 100 builders by sales and sales revenue. For example, in 2017, 20 out of the 32 builders are

[7] All data can be found from the Federal Reserve Statistical Release, Bureau of Economic Analysis, and the Federal Reserve Bank of St. Louis and are measured at quarterly intervals from 1985Q1 to 2017Q4.

present in the ranking and accounted for 207,839 sales, equivalent to 69.5% of the top 100 builder total sales. Thus, changes in building activities of these firms have a meaningful impact on the U.S. housing supply. We also note that considerable heterogeneity exists in builder size as measured by market capitalization in 2017Q4. For example, the smallest builder is Comstock Holding Companies with a market cap of $6 million while the two largest builders, D.R. Horton and Lennar, are valued at $15 and $19 billion, respectively. Furthermore, we note that half of the operating builders have market caps less than $2 billion and thus are often considered small cap companies by common industry standards, while 32% of the sample have market caps between $3 and $10 billion, which is typical of mid cap companies.

To study the effect of peer sentiment on homebuilding activities, we estimate the following regression model:

$$Building\ activities_{i,t} = \alpha + \beta HMI_{t-1} + \gamma Firm\ controls_{i,t-1} + \delta Market\ controls_{t-1} + \theta_i + \varepsilon_{i,t}, \quad (1)$$

where *i* and *t* denote builder and quarter, respectively. We measure building activities using two different proxies. The first proxy is the inflation-adjusted homebuilding expenses (in log) including all expenses related to the construction and sale of residential properties incurred by builder *i* in quarter *t*. The second measure of building activities is the number of land lots (in log) in inventory that are ready for sale or development. To prepare the land, builders must male significant investments in surveying, designing, and constructing on-site and off-site improvements to the land (e.g., sewers, streets, and utilities).

The main independent variable of interest is HMI, which is the quarter-end orthogonalized housing market index provided by NAHB. In addition, we also use a composite

index created from performing principal component analysis as described in subsection above. Panel A of Table 2 reports the original as well as orthogonalized indices. The original HMI has a mean of 49.5 over the 1985Q1-2017Q4 period, while the orthogonalized index has a mean of 0 as expected of a regression residuals series. The three component sub-indices are also reported in Table 2. The mean values of the two series on present and expected sales in the next 6 months are both above 50, which suggest that on average builders are positive about sales prospects. Interestingly, the third series on traffic of prospective buyers has a mean value of only 38.6, significantly lower than the other two. This indicates that most builders are pessimistic about buyer traffic. Not surprisingly, the pairwise correlations between these three indices are very high at 0.97-0.98, and after orthogonalization they remain high in the 0.93-0.95 range. In addition, we also report the summary statistics of a homebuyer's sentiment index, which we will return to in a latter section.

Firm controls include Tobin's Q and the ratio of cash flow to assets (Cashflow/Asset). These factors are commonly found to affect firm investment decisions (see Hayashi (1982) and Fazzari, Hubbard, and Petersen (1988)). In addition, investment may also result from changes in the cost of capital. For example, investment may increase when interest rates are low or when stocks are overpriced. Hence, it is important to also control for the cost of debt and equity financing. For each builder in each quarter, we calculate their cost of debt as the amount of interest paid in that quarter divided by total debt, and their equity issuance as the proceeds from sale of common equity (adjusted for inflation). To control for the effect of the general economy as well as the housing market conditions on investment, model (1) also includes the change in unemployment rate and change in the national Case-Shiller house price index. Lastly, the regression is run with a set of firm fixed effects θ_i. The error terms are clustered by firms.

Our study period covers 2003Q1-2017Q4 because of data unavailability for firm characteristics prior to 2003. In total there are 1,086 firm-quarter observations and their descriptive statistics are shown in Panel B of Table 2. The average builder has 59,050 lots in inventory, with a low of 229 and a high of 396,000 lots. They spend on average $333 million on homebuilding costs in a quarter (adjusted for inflation during the quarter), which generally include land development, construction, and marketing and sales expenses.

IV. Empirical results

1. Base results

Table 3 shows the relationship between the orthogonalized builder sentiment index and building activities. The coefficients on the peer sentiment indices are positive and statistically significant at 5% in all specifications. In terms of magnitude, we find that that a one-standard-deviation increase in the orthogonalized HMI (10.83) induces homebuilders to increase building expenses by as much as 15.5% and land lot inventory by 4.8%. Given that the average building expense in each quarter is $333 million (Table 2), this translates to an average increase of about $51.6 million for each homebuilder. The corresponding increase in the number of available land lots is 2,834 for each homebuilder, and a total of 53,854 lots for all 19 operating homebuilders in the sample. To provide a context for comparison, the average number of new single-family housing starts over the 1985-2017 period in the whole nation is 256,500 units each quarter (Figure 1). The total increase in land inventory due to peer sentiment of all 19 operating builders in our sample would account for 21% of this supply. Overall, these results confirm our hypothesis that peer sentiment has a sizeable effect on homebuilder behaviors and thus on housing supply.

Regarding firm-specific control variables, we find that only the ratio of Cashflow-to-Asset is statistically insignificant. Its strong positive effect is in line with prior findings that cash flow is an important predictor of investment (see, for example, Fazzari et al., 1988; Lamont, 1997). Turning to the two market controls, they are mostly insignificant but carry the expected signs.

Thus far, we have found that the level of peer sentiment has a strong effect on the level of building activities. In Table 4, we estimate model (1) again using quarterly changes in all variables. The change is calculated from quarter *t-1* to quarter *t* and expressed as absolute changes in the first two columns and percentage changes in the last two columns. Only the coefficients on the absolute changes are statistically significant at the 1% level, while the percentage changes are either weak at 10% or insignificant. Thus, although there is evidence that peer sentiment influences housing construction in both levels and changes, we believe that the former effect is much stronger and more robust. We will therefore focus on the levels estimations in all subsequent tests.

Next, we investigate the individual effects of the three components of HMI, namely (a) current sale conditions, (b) sale conditions in the next six months, and (c) traffic of prospective buyers. We orthogonalize each series in a similar manner as the HMI and use the residuals to estimate the results presented in Table 5. We find that all three components are statistically and economically significant, except the buyer traffic series in the last specification. Their economic magnitude is also comparable.

2. Additional tests

In the first column of Table 6,[8] we examine the non-linearity of the peer firm sentiment effect by adding the square term of HMI into the model, which has a negative coefficient as predicted but is only weakly significant. In the second column, we test the robustness of the effect of HMI homebuyer sentiment. To measure homebuyer sentiment, we use responses from the Survey of Consumers, which is conducted monthly by the Survey Research Center at the University of Michigan (see http://www.sca.isr.umich.edu/ for details). Approximately 500 households from all states in the U.S. are chosen for each survey. We focus on the following question related to the respondents' attitude about home-buying conditions: "Generally speaking, do you think now is a good time or a bad time to buy a house?" Responses include "good," "bad," and "uncertain". Furthermore, a follow-up question asks respondents to provide reasons for their answers. The reasons for the "good" response are classified into six groups: "prices will increase," "prices low," "interest rates low," "rising interest rates," "good investment," and "time's good." We use the percentage of respondents who think it is a "good" time to buy "because price will increase" as a proxy for homebuyer sentiment. Ling et al. (2015), Piazzesi and Schneider (2009) and Soo (2018) use the responses to these survey questions as indication of optimism among homebuyers.

Similar to the orthogonalization exercise described earlier, we regress this buyer sentiment series on a set of economic variables and use the residuals as the component of sentiment unexplained by fundamentals. Prior to orthogonalization, the correlation between the original HMI and the homebuyer sentiment index is 0.53 (significant at 1% level), but it reduces to 0.27 (significant at 1% level) between the two residual series. This suggests an interesting

[8] For brevity, we only report the results using building expenses as the dependent variable from this section onwards.

insight that homebuyers and builders do not necessarily have the same expectations about the housing markets.

Consistent with our expectations, both sentiment indices appear significant in the first column of Table 6. Though its magnitude decreases by about 32%, the coefficient on HMI remains strongly robust. Not surprisingly, homebuyer sentiment is also an important driver of housing supply. Comparing their coefficients, we find that a one-standard-deviation increase in builder sentiment (10.83) is associated with a 10.5% increase, while that of buyer sentiment (2.82) leads to an 8.3% increase in the construction expenses invested by each homebuilder.

The third column of Table 6 provides another insight into the asymmetrical effect of sentiment. As previously explained, the original HMI ranges from 0 to 100, with an index number of 50 indicating that there are equal numbers of respondents feeling positive and negative about the housing market. In other words, index numbers close to 50 denote periods of high disagreement, while numbers closer to 0 or 100 are indicative of high consensus among builders. One would expect that the sentiment effect is weaker in the former case and stronger in the latter case. The third specification in Table 6 includes a dummy for quarters when the original HMI numbers range from 45 to 55, as well as an interaction term between this dummy and the orthogonalized HMI.[9] Interestingly, the sum of the coefficients on HMI and the interaction term is negative, suggesting that builders tend to reduce their building activities when the beliefs of their peers appear unclear.

Finally, in the last column we use the average value of HMI over the past six months in place of the one-quarter lagged index in all previous specifications. For this purpose, we use the

[9] We also test alternative ranges between 40 and 60 and obtain similar results.

original monthly HMI data provided by NAHB and orthogonalize them against the economic fundamental factors mentioned earlier in Section III.[10] For each month, we then calculate the average of the residuals over the past six months. To run the regression as specified in the last column of Table 6, we convert this monthly sentiment series into quarterly data (to match with the frequency of firm data) using the quarter-end values. The coefficient on this alternative measure of peer firm sentiment is again statistically and economically significant, confirming our earlier results.

3. Which firms herd?

The literature suggests learning and reputational concerns as two potential motivations for these herding behaviors. The purpose of this section, however, is not to disentangle these potential explanations. Instead, we examine their implication that mimicking behaviors are likely more pronounced among followers who are informationally constrained. Hence, we test for heterogeneity in firm sensitivity to peer sentiment. Specifically, for each year we sort firms into three groups based on firm-specific characteristics and the compare their building investment in response to HMI. For each characteristic, we create two indicators for firms in the second and third quantiles of the distribution. Following prior literature on firm herding, we focus on firm attributes that can proxy for incentives to herd: market capitalization, market-to-book ratio (MTB), return on asset (ROA), earnings growth, and institutional ownership. The first four variables are measures of a firm's size and profitability. Consistent with prior theories, we hypothesize that smaller and less profitable builders are likely followers in the market. In addition, mimicking behaviors should increase with the risk of being punished for going against

[10] We include all controls except the change in personal consumption because it is not available in monthly frequency.

the "wisdom of the crowd", typically in the form of lower stock price performance. On one hand, one might expect that builders are more inclined to herd if they are held by a higher proportion of individual, short term investors who are more susceptible to behavioral biases and whose frequent trades can influence stock prices. On the other hand, prior research also shows that even large, institutional investors are prone to behavioral biases (see, for example, Bodnaruk and Simonov, 2016; Cai, Han, Li, and Li, 2018; Haigh and List, 2005; Hau and Rey, 2008; Sias, 2004). Since institutional shareholders can have substantial influences on firm managers, we would expect firms with higher institutional ownership to be under more pressure cater to their demand.

The results are presented Table 7. While the coefficients of HMI remain significant throughout all specifications, only its interaction with institutional ownership is statistically significant. The positive sign supports the proposition that firms with higher institutional ownership are more likely to follow their peers. Apart from this attribute, we do not find evidence that other firm characteristics can help predict builders' incentive to mimic. In other words, firms of various size and profitability are equally likely to be influenced by peer sentiment.

4. Herding and stock performance

In this section, we examine a possible incentive for the herding behaviors observed above: we ask if firms who follow their peers will be rewarded in the short run with higher stock performance. If this hypothesis is true and firm managers' objective function is to maximize stock price performance, then we would expect herding to be prevalent among firms. Note that we do not aim to explain why investors reward or punish such behaviors, nor do we take any

position that they are good or bad for firm value. Our goal in this section is simply to document if there exists an observable incentive for firms to follow peer sentiment.

To test the above hypothesis, we run the following regression model:

$$Return_{i,t} = \alpha + \beta Deviation_{i,t-1} + \gamma Deviation_{i,t-1}^2 + \delta Controls_t + \theta_i + \varepsilon_t, \quad (2)$$

where *i* and *t* denote firm and quarter, respectively. The dependent variable is the excess return of firm *i*'s stocks:

$$Return_{i,t} = \left(\frac{Total\ Return\ Index_{i,t}}{Total\ Return\ Index_{i,t-1}} - 1\right) * 100 - RF_t, \quad (3)$$

where RF_t is the Treasury bill rate in period *t*, and the $Total\ Return\ Index$ for each builder *i* in each quarter is obtained from Bloomberg.

The explanatory variable of interest is $Deviation_{i,t}$, the absolute difference between the actual and predicted building expenses for builder *i* in quarter t. We estimate the predicted building expenses (in log) using the base model shown in the first column of Table 3 (equation 1). This prediction is the level of building expenses that builder *i* is expected to incur in quarter *t* if they follow peer sentiment. In other words, $Deviation_{i,t}$ is the absolute value of the residuals from estimating the model in the first column of Table 3. Essentially, this variable is a measure of the degree firm *i* deviates from their expected level of building expenses at quarter *t*. If the market rewards mimicking behaviors, then we should observe that higher errors are associated with lower stock returns and the coefficient β is expected to be negative.

Regarding the control variables, we employ three popular asset pricing models: capital asset pricing model (R_m-R_f), Fama-French three-factor model (R_m-R_f, SMB, and HML), and Fama-French five-factor model (R_m-R_f, SMB, HML, RMW, CMA). Data on these variables,

their definition and construction are available from Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). These control variables are also calculated over the period from quarter *t-1* to quarter *t* in a similar manner to the *Return* variable. The regression model includes a set of firm fixed effect θ_i.

Contrary to expectations, *Deviation* is not statistically significant any of the first three specifications in Table 9. These findings imply that any benefits or detriments of herding, if they exist, are unrelated to stock performance. However, we find an interesting result when the sign of the residuals is taken into consideration in the last specification (column 4). *Positive error* indicates a positive residual, meaning the actual building expenses are higher than that suggested by the sentiment model. The variable *Deviation* is still insignificant, but the interaction term is strongly significant at the 5% level. The coefficient suggests that firms who overbuild, defined as those with actual building expenses higher than their predicted level, are penalized with lower stock returns in the next quarter. On the other hand, firms that underbuild do not exhibit abnormal excess returns. This result is consistent with our intuition that, since building is an irreversible investment, overbuilding is more detrimental than underbuilding.

5. Peer sentiment and capital structure

Since peer sentiment significantly affects firm investment, it may also influence how firms finance their projects. To test for this effect, we regress builder capital structure on the one-quarter lagged sentiment index and a set of firm-specific control variables. We use three measures of capital structure: the ratio of total debt to total book assets *(Debt/Assets)*, the net change in debt *(Debt issuance)*, and the net change in common equity issues (*Equity issuance*). Control variables include three factors commonly identified by prior research as determinants of capital structures: MTB, profitability (measured as EBITDA/Total Assets), and tangibility

(measured as Net Property, Plant, and Equipment/Total Assets). These variables are also lagged by one quarter. The model includes firm fixed effects and standard errors are clustered by firms. As shown in Table 9, only the debt issuance decision has a weakly significant relationship with peer sentiment, and the negative sign of the coefficients implies that firms use less debt as the index increases. Nevertheless, the results in this table generally do not offer any conclusive evidence that peer sentiment does influence capital structure decisions of firms.

IV. Conclusion

This paper examines whether peer sentiment influences building activities. We use the NAHB/Wells Fargo Housing Market Index as a measure of homebuilder belief. To isolate the sentiment component in HMI, we first regress the index against a set of market fundamentals and then use the residuals as the measure of homebuilder sentiment. Using data from 32 public homebuilders in the US over 2003Q1-2017Q4, we find that a one-standard-deviation increase in the orthogonalized HMI induces homebuilders to increase their building activities by 4.8%-15.5%. This result remains robust even when homebuyer sentiment is controlled for. However, the positive relationship between building activities and peer sentiment is only strong when it is clear that the majority of the builders share similar beliefs. When the survey respondents seem to be divided in their opinions about the direction of the housing market, developers tend to reduce their building activities. In addition, we find that builders in our sample are equally likely to be influenced by peer sentiment, regardless of their size and profitability level. Finally, we test whether homebuilders who follow their peers are rewarded in the short run with higher stock performance. Although we do not find evidence of any rewards for herding behaviors, firms that overbuild compared to their peers have lower stock returns.

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Figure 1. Housing Market Index and housing starts, 1985-2017

This figure plots the monthly Housing Market Index and the number of single-family housing starts from 1985 to 2017.

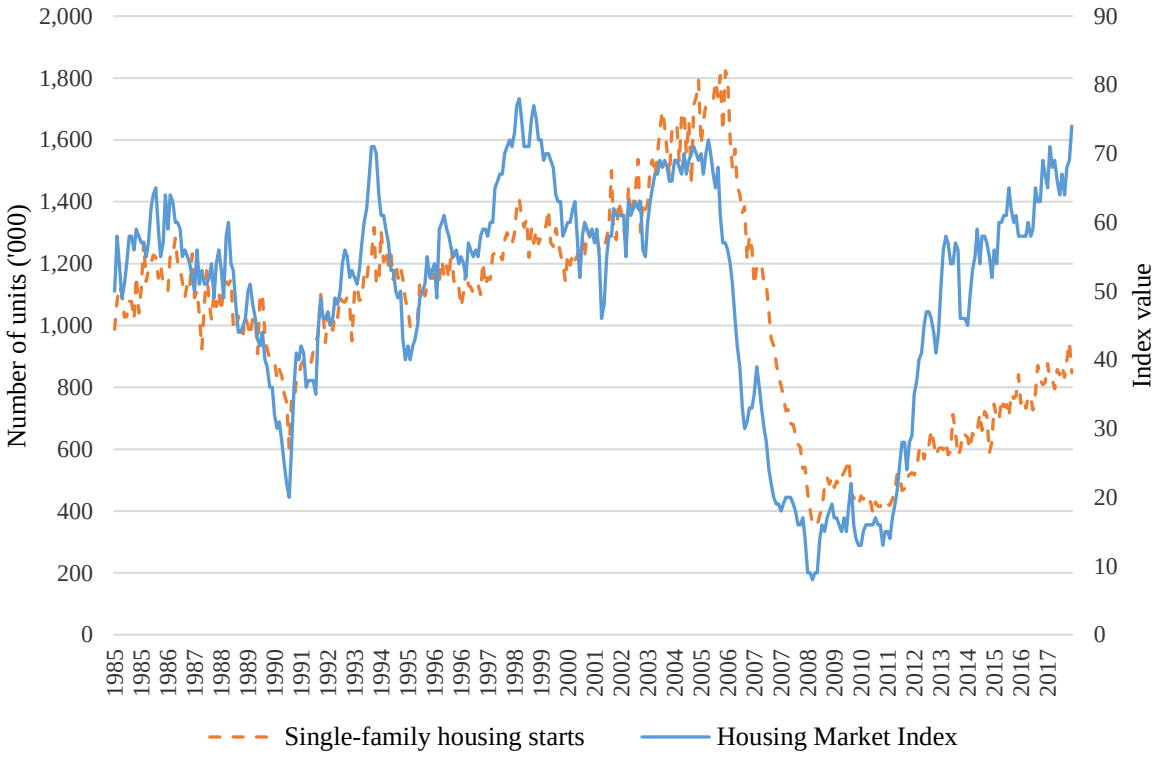

Table 1. List of public homebuilders covered in this study

This table lists 32 public homebuilders in the sample, their status, and their market capitalization as of 2017Q4.

	As of 2017Q4	Status	Market Capitalization ($M)
1	Comstock Holding Companies, Inc.	Current	$6
2	New Home Company, Inc.	Current	$262
3	Hovnanian Enterprises, Inc.	Current	$357
4	AV Homes, Inc.	Current	$372
5	Beazer Homes USA, Inc.	Current	$645
6	Century Communities, Inc.	Current	$918
7	M/I Homes, Inc.	Current	$958
8	William Lyon Homes (2)	Current	$1,104
9	LGI Homes, Inc.	Current	$1,639
10	M.D.C. Holdings, Inc.	Current	$1,789
11	Meritage Homes Corporation	Current	$2,065
12	TRI Pointe Group, Inc.	Current	$2,709
13	KB Home	Current	$2,729
14	Taylor Morrison Home Corporation	Current	$2,926
15	Toll Brothers, Inc.	Current	$7,238
16	PulteGroup, Inc.	Current	$9,535
17	NVR, Inc.	Current	$12,949
18	Lennar Corporation	Current	$15,065
19	D.R. Horton, Inc.	Current	$19,187
20	Brookfield Homes Corporation	Historical	N/A
21	CalAtlantic Group, Inc.	Historical	N/A
22	Centex LLC	Historical	N/A
23	Dominion Homes, Inc.	Historical	N/A
24	Orleans Homebuilders, Inc.	Historical	N/A
25	Ryland Group, Inc.	Historical	N/A
26	Tarragon Corporation	Historical	N/A
27	TOUSA, Inc.	Historical	N/A
28	UCP, Inc.	Historical	N/A
29	WCI Communities, Inc. (1)	Historical	N/A
30	WCI Communities, Inc. (2)	Historical	N/A
31	William Lyon Homes (1)	Historical	N/A
32	Woodbridge Holdings Corporation	Historical	N/A

Table 2. Summary statistics

This table reports the summary statistics of the sentiment indices and firm characteristics of the builders in our sample. *HMI* is the NAHB/Wells Fargo Housing Market Index. *Present sales* is the index computed from the responses to the question about the current sale conditions of new single-family homes. *Sales in the next 6 months* is the index computed from the responses to the question about the expected sale conditions of new single-family homes for the next six months. *Buyer traffic* is the index computed from the responses to the question about the traffic of prospective buyers. *Composite Index* is the first principal component of the *Present Sales*, *Sales in the next 6 months*, and *Buyer traffic* indices. *Homebuyer sentiment* is the percentage of households who think it is a good time to buy a house because prices will increase from the Survey of Consumers by the University of Michigan. *Total lots* in the number of land lots owned by builders that are available for sale. *Building expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. *Tobin's Q* is the ratio of a firm's market capitalization to total assets. *Cashflow/Asset* is the ratio of cash flow to total assets. *Cost of debt* is the ratio of total amount of interest paid to total debt. *Common equity issuance* is the inflation-adjusted dollar value of common equity issuance.

Variable	Observations	Mean	Std. Dev.	Min	Max
		Panel A: Sentiment indices			
Original indices					
Housing Market Index	133	49.95	17.40	9.00	78.00
Present sales	133	53.48	19.44	8.00	86.00
Sales in the next 6 months	133	57.79	17.28	15.00	83.00
Buyer traffic	133	38.60	13.41	7.00	62.00
Homebuyer sentiment	137	6.96	3.22	1.00	13.00
Orthogonalized indices					
Housing Market Index	133	0.00	10.83	-31.05	20.10
Present sales	133	0.00	12.00	-33.85	23.10
Sales in the next 6 months	133	0.00	11.34	-34.43	20.94
Buyer traffic	133	0.00	8.65	-24.92	22.14
Homebuyer's sentiment	135	0.00	2.82	-5.29	7.56
		Panel B: Firm characteristics			
Total lots	1,086	59,050.60	66,417.58	229.00	396,000.00
Building expenses (000)	1,086	332,843.20	352,487.30	2,042.20	2,083,199.00
Tobin's Q	1,086	0.60	0.45	0.00	4.33
Cashflow/Asset (%)	1,086	0.34	3.99	-32.61	26.25
Cost of debt (%)	1,086	1.53	1.03	0.01	24.57
Common equity issuance ($mil)	1,086	3.53	14.73	-2.23	287.64

Table 3. Effect of peer sentiment on homebuilding activities

This table reports the estimation of equation (1). *HMI* is the NAHB/Wells Fargo Housing Market Index. *Total lots* in the number of land lots owned by builders that are available for sale. *Homebuilding expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. *Tobin's Q* is the ratio of a firm's market capitalization to total assets. *Cashflow/Asset* is the ratio of cash flow to total assets. *Cost of debt* is the ratio of total amount of interest paid to total debt. *Common equity issuance* is the inflation-adjusted dollar value of common equity issuance. *Change in unemployment* is the quarterly change in national unemployment rate. *Change in HPI* is the quarterly change in the real Case-Shiller national home price index.

	Building expenses (log)	Total lots (log)
Peer sentiment	0.0143***	0.0044**
	(0.0023)	(0.0019)
Tobin Q	0.2652	0.3205
	(0.2270)	(0.1938)
Cashflow/Asset	0.0184***	0.0219***
	(0.0062)	(0.0048)
Cost of debt	-0.0895	-0.0654
	(0.0529)	(0.0412)
Common equity issuance	-0.0016	-0.0008
	(0.0013)	(0.0008)
Change in unemployment	-0.1208*	-0.0298
	(0.0614)	(0.0604)
Change in HPI	0.0002	0.0094
	(0.0129)	(0.0114)
Constant	12.1389***	10.3295***
	(0.1147)	(0.1008)
Observations	1,114	1,064
Number of builders	32	32
Adjusted R-squared	0.198	0.180

Table 4. Effect of peer sentiment on homebuilding activities – First difference

This table reports the estimation of equation (1). *HMI* is the NAHB/Wells Fargo Housing Market Index. *Composite Index* is the first principal component of the *Present Sales*, *Sales in the next six months*, and *Buyer traffic* indices. *Total lots* in the number of land lots owned by builders that are available for sale. *Building expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. *Tobin's Q* is the ratio of a firm's market capitalization to total assets. *Cashflow/Asset* is the ratio of cash flow to total assets. *Cost of debt* is the ratio of total amount of interest paid to total debt. *Common equity issuance* is the inflation-adjusted dollar value of common equity issuance. *Change in unemployment* is the quarterly change in national unemployment rate. *Change in HPI* is the quarterly change in the real Case-Shiller national home price index.

	Absolute changes		Percentage changes	
	Building expenses (log)	Total lots (log)	Building expenses (log)	Total lots (log)
HMI	0.0033**	0.0027***	0.0002*	-0.0001
	(0.0015)	(0.0005)	(0.0001)	(0.0001)
Tobin Q	-0.0368	0.0520**	-0.0048	0.0032***
	(0.0982)	(0.0219)	(0.0043)	(0.0010)
Cashflow/Asset	-0.0075***	0.0009	-0.0001	-0.0000
	(0.0027)	(0.0007)	(0.0001)	(0.0000)
Cost of debt	-0.0649	0.0007	-0.0019	0.0001
	(0.0459)	(0.0028)	(0.0022)	(0.0002)
Common equity issuance	0.0001	-0.0000	0.0000	0.0000*
	(0.0004)	(0.0002)	(0.0000)	(0.0000)
Change in unemployment	-0.0599***	-0.0345**	-0.0412**	-0.0296**
	(0.0166)	(0.0145)	(0.0160)	(0.0128)
Change in HPI	0.0036	0.0138***	0.0125	0.1276***
	(0.0049)	(0.0021)	(0.0329)	(0.0238)
Constant	0.0111***	-0.0053***	0.1622***	-0.0498***
	(0.0020)	(0.0007)	(0.0344)	(0.0089)
Observations	1,060	1,002	993	937
Number of builders	32	32	32	32
Adjusted R-squared	0.0570	0.0975	0.0187	0.0577

Table 5. Components of HMI

This table reports the estimation of equation (1) using the three component indices. *Present sales* is the index computed from the responses to the question about the current sale conditions of new single-family homes. *Sales in the next 6 months* is the index computed from the responses to the question about the expected sale conditions of new single-family homes for the next six months. *Buyer traffic* is the index computed from the responses to the question about the traffic of prospective buyers. *Total lots* in the number of land lots owned by builders that are available for sale. *Building expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. Control variables include: *Tobin's Q, Cashflow/Asset, Cost of debt, Common equity issuance, Change in unemployment, Change in HPI*.

	Building expenses (log)			Total lots (log)		
Present sales	0.013***			0.004**		
	(0.002)			(0.002)		
Sales in the next 6 months		0.016***			0.006***	
		(0.002)			(0.002)	
Buyer traffic			0.016***			0.004
			(0.003)			(0.002)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,114	1,114	1,114	1,064	1,064	1,064
Number of builders	32	32	32	32	32	32
Adjusted R-squared	0.198	0.225	0.181	0.181	0.191	0.174

Table 6. Additional tests

HMI is the NAHB/Wells Fargo Housing Market Index. *Homebuyer sentiment* is the percentage of households who think it is a good time to buy a house because prices will increase from the Survey of Consumers by the University of Michigan. It is orthogonalized against a set of economic fundamental variables. *Indicator(45<=HMI_{t-1}<=55)* is a dummy variable for quarters in which the original HMI numbers range from 45 to 55. *Average HMI of past 6 months* is the average value of the orthogonalized HMI over the previous 6 months. *Building expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. Control variables include: *Tobin's Q, Cashflow/Asset, Cost of debt, Common equity issuance, Change in unemployment, Change in HPI.*

	Building expenses (log)			
VARIABLES	(1)	(2)	(3)	(4)
HMI_{t-1}	0.0131***	0.0097***	0.0084***	
	(0.0029)	(0.0029)	(0.0026)	
HMI^2_{t-1}	-0.0002*	-0.0002**	-0.0005***	
	(0.0001)	(0.0001)	(0.0001)	
Homebuyer $sentimen_{t-1}$		0.0296***	0.0318***	
		(0.0097)	(0.0091)	
Indicator(45<=Original HMI_{t-1}<=55)			-0.7784***	
			(0.0738)	
HMI_{t-1}*Indicator(45<=Original HMI_{t-1}<=55)			-0.0650***	
			(0.0046)	
Average HMI of past 6 $months_{t-1}$				0.0251***
				(0.0018)
Control variables	Yes	Yes	Yes	Yes
Observations	760	760	760	760
Number of builders	22	22	22	22
Adjusted R-squared	0.273	0.277	0.322	0.456

Table 7. Which firms herd?

This table reports the heterogeneity in peer sentiment effect. *HMI* is the orthogonalized NAHB/Wells Fargo Housing Market Index. *Size* is measured by market capitalization. *MTB* is the market capitalization-to-book value ratio. *ROA* is the return-on-asset ratio. *Earnings growth* is the quarterly change in operating earnings. *Institutional ownership* is the percentage of outstanding common shares held by institutional investors. *Building expenses* is the inflation-adjusted dollar amount of homebuilding-related expenses. Control variables include: *Tobin's Q, Cashflow/Asset, Cost of debt, Common equity issuance, Change in unemployment, Change in HPI*.

	Building expenses (log)				
VARIABLES	Size	MTB	ROA	Earnings growth	Institutional ownership
HMI_{t-1}	0.0115***	0.0187***	0.0158***	0.0086*	0.0071**
	(0.0040)	(0.0038)	(0.0030)	(0.0050)	(0.0031)
Quantile 2 (medium)	0.3929***	0.0775	0.1029*	0.1030**	-0.0752
	(0.1258)	(0.0616)	(0.0519)	(0.0485)	(0.0747)
HMI_{t-1}*Quantile 2	0.0038	-0.0008	0.0005	-0.0073	0.0110***
	(0.0041)	(0.0042)	(0.0032)	(0.0050)	(0.0033)
Quantile 3 (high)	0.7633***	-0.0265	0.0120	0.0491	0.0468
	(0.1908)	(0.1166)	(0.0756)	(0.0626)	(0.1379)
HMI_{t-1}*Quantile 3	-0.0008	-0.0094	-0.0074*	-0.0056	0.0161***
	(0.0046)	(0.0065)	(0.0044)	(0.0036)	(0.0044)
Control variables	Yes	Yes	Yes	Yes	Yes
Observations	1,114	1,047	1,106	521	1,025
Number of builders	32	32	32	32	32
Adjusted R-squared	0.257	0.213	0.209	0.139	0.215

Table 8. Herding behaviors and stock returns

Deviation is the residuals obtained from estimating equation (1). *Positive error* is an indication variable for positive residuals. Control variables in the CAPM model include (R_m-R_f). Control variables in the Fama-French three-factor model include R_m-R_f, SMB, and HML. Control variables in the Fama-French five-factor model include R_m-R_f, SMB, HML, RMW, CMA.

	Excess return			
	CAPM	3-factor	5-factor	5-factor
VARIABLES	(1)	(2)	(3)	(4)
$Deviation_{t-1}$	0.3675	-0.1178	-0.1159	5.0176
	(2.6742)	(2.7696)	(2.7631)	(4.1455)
Positive $error_{t-1}$				3.3878
				(2.2111)
$Deviation_{t-1}$* Positive $error_{t-1}$				-9.7351**
				(4.6457)
Control variables	Yes	Yes	Yes	Yes
Observations	1,071	1,071	1,071	1,071
Number of builders	31	31	31	31
Adjusted R-squared	0.165	0.230	0.230	0.234

Table 9. Effect of peer sentiment on capital structure decisions

This table presents the effect of peer sentiment on various measures of capital structure. *Debt/Assets* is the ratio of total debt to total asset value. *Debt issuance* is the net change in total debt. *Equity issuance* is net change in common equity issuance. *HMI* is the orthogonalized NAHB/Wells Fargo Housing Market Index. MTB is the ratio of market value to book value of assets. *Net PPE/Asset* is the ratio of Net Property, Plant, and Equipment to total asset value. *EBITDA/Asset* is the ratio of EBITDA to total asset value.

	Debt/Assets	Debt issuance	Equity issuance
VARIABLES	(1)	(3)	(4)
HMI_{t-1}	-0.0003	-0.3474*	-0.0264
	(0.0005)	(0.1809)	(0.0453)
MTB_{t-1}	0.0002**	0.0577*	-0.0182
	(0.0001)	(0.0323)	(0.0166)
Net $PPE/Asset_{t-1}$	-0.0382	388.0350***	61.7774
	(1.0426)	(139.5132)	(55.6194)
$EBITDA/Asset_{t-1}$	-0.7808***	367.9140***	-64.5549***
	(0.2123)	(94.0484)	(19.4746)
Constant	0.4100***	-17.6048**	-0.2597
	(0.0238)	(8.3231)	(2.8087)
Observations	889	876	877
Number of builders	31	31	31
Adjusted R-squared	0.0904	0.0349	0.0292