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Tao Chen, Jarrad Harford and Chen Lin

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Financial Flexibility and Corporate Cash Policy

Tao Chen*

Nanyang Technological University

Jarrad Harford

University of Washington

Chen Lin

The University of Hong Kong

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Abstract

Debt capacity creates financial flexibility and collateral-based debt capacity is the least sensitive to cash flow shocks. Using variation in real estate prices as exogenous shocks to corporate financing capacity, we investigate the causal effects of financial flexibility on firms' cash policies. We find strong evidence that increases in debt capacity lead to smaller corporate cash reserves and declines in the marginal value of cash holdings. We further find that the decrease in cash holdings is more pronounced in firms with higher hedging needs, greater investment opportunities, financial constraints, better corporate governance and lower local real estate price volatility.

Keywords: Financial Flexibility; Collateral Value; Cash Policy; Real Estate Prices

JEL classification: G32; G31; R30

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1. Introduction

Financial flexibility refers to a firm's ability to access financing at a low cost and respond to unexpected changes in cash flows or investment opportunities in a timely manner (Denis, 2011). A survey of CFOs in Graham and Harvey (2001) suggests that financial flexibility is the most important determining factor of corporate capital structure decisions, but flexibility is not often studied as a primary determinant of corporate financial policies.[1] Consequently, as pointed out in Denis (2011), an interesting and unresolved research question remains: "To what extent are flexibility considerations first-order determinants of financial policies?" In this paper, we directly test the effects of financial flexibility on corporate cash holdings by exploiting exogenous shocks to a specific source of firms' debt capacity.

As the amount of cash US firms hold on their balance sheets has grown, so has interest in how they manage liquidity and access to capital. While the literature documents substantial support for the precautionary savings hypothesis put forth by Keynes (1936), we still know relatively little about how firms trade-off debt capacity and cash reserves, and specifically the degree to which increases in the supply of credit substitute for internal slack. Answers to such questions are important not only for a better understanding of cash and liquidity policy in general, but also for assessing the effect of the credit channel on real activity.

Typically, debt capacity has been treated generically and it is often modelled as equivalent to negative cash, suggesting that more debt capacity requires lower cash needs. However, some authors point out that the capacity to issue debt, when based on the firm's ability to generate cash flows to support it, is only useful in funding investment in response to positive demand shocks. Importantly, unused capacity to issue cash flow-supported debt is not a useful store of slack that reduces the need to hedge to support investment when cash flows are low (see, for example, Acharya, Almeida and

[1] DeAngelo and DeAngelo (2007) discuss preservation of financial flexibility as an explanation for observed capital structure choices. Gamba and Triantis (2008) provide a theoretical analysis of the effect of financial flexibility on firm value. Denis and McKeon (2012) lend further support that, in the form of unused debt capacity, financial flexibility plays an important role in capital structure. Campello, et al. (2011) and Duchin, et al. (2010) provide evidence on financial flexibility in the 2007-8 financial crisis.

Campello (2007)). We recognise this and study asset-based debt capacity, specifically capacity based on the value of the firm's real estate as collateral.

Cash studies typically control for leverage or cash substitutes, such as net working capital. Faulkender and Wang (2006) show cash policy is more important when firms are financially constrained. Nevertheless, to our knowledge, none of the extant studies have directly examined the causal role of debt capacity in shaping corporate cash policies.[2]

The paucity of the research into the effect of debt capacity on cash policy is likely to be partially driven by a lack of readily available measures of financing capacity. The fact that financing capacity is endogenous has also hindered such attempts. For instance, firms' cash balance and liquidity policy may exert feedback effects on firms' financing capacity. Unobservable firm heterogeneity correlated with both debt capacity and corporate liquidity policies may also bias the estimation results.

In this paper, we make use of a novel experiment developed by Chaney, Sraer and Thesmar (2012). Specifically, we use changes in the value of a firm's collateral value caused by variations in local real estate prices (at the state or Metropolitan Statistical Area (MSA) level) as an exogenous change to the financing capacity of a firm, increasing its financial flexibility. A representative US firm holds a substantial amount of real estate assets, representing 26% of its total assets, in our sample. Existing literature points out that pledging collateral such as real estate assets, can alleviate agency costs caused by moral hazard and adverse selection, enhance firms' financing capacity and allow firms to borrow more in the presence of incomplete contracting (Barro, 1976; Stiglitz and Weiss, 1981; Hart and Moore, 1994; Jimenez et al., 2006). Consistent with theory, empirical studies show firms with greater collateral value can raise external funding at lower costs (e.g. Berger et al., 2011; Lin et al., 2011) and invest more (Chaney et al., 2012).[3] If debt capacity exerts first-order effects on a firm's cash policy, we expect an exogenous shock increasing real estate values to translate into a lower

[2] Most of the extant research in this area provides, at most, indirect evidence, by primarily focusing on the relationship between cash flow risk and cash holdings. Studies use industry cash flow volatility to proxy for cash flow risk (e.g., Opler et al., 1999; Bates et al., 2009) and find this measure is positively associated with cash holdings. Han and Qiu (2007) use a firm-level measure of cash flow volatility and find consistent results. More recently, Duchin (2010) finds that investment opportunity risk increases cash holdings.

[3] Berger et al. (2011) use a rough measure indicating whether collateral was pledged at loan origination, and Lin et al. (2011) use tangibility to proxy for collateral value. One pertinent concern is that tangibility is a noisy measure of collateral value, while another concern is that collateral requirement and loan spread may be jointly determined by unobservable factors, which results in an endogeneity concern.

precautionary need to stockpile cash. Likewise, following a large deterioration in collateral value, firms would confront more stringent external financing, and consequently hold more cash. A key advantage of our identifying strategy is that it not only provides variation in exogenous shocks to debt capacity, but also solves concerns over omitted macro variables by allowing multiple shocks to different firms at different times at different locations (states or MSAs).

Primarily, we find strong evidence that increases in real estate values lead to smaller corporate cash reserves. The representative US public firm holds 14 cents less cash for each additional $1 of collateral over the 1993-2007 period. The results are maintained after controlling for remaining potential endogeneity concerns as in Chaney et al. (2012),[4] where we first instrument for the real estate price index by the interaction between the mortgage interest rate and the local housing supply elasticity, and second we control for the interactions between firms' initial characteristics and the real estate price index. Additionally, in placebo tests, the cash reserves of the firms not holding real estate assets are not affected by real estate price fluctuations.[5]

Other characteristics may influence the relationship between the value of a firm's real estate and its cash holdings. Whereas the collateral value of a dollar of real estate may not vary according to firm characteristics, managers' assessment of the substitutability between cash and debt capacity will vary with firm characteristics. Specifically, the cash policy of financially unconstrained firms is indeterminate, while constrained firms trade-off forgoing investment to preserve capacity to fund future investment. Thus, financially constrained firms will use an increase in debt capacity to spend cash holdings on additional current investment, just as firms with greater investment opportunities will more actively substitute away from higher cash reserves when possible. Therefore, the effect of debt capacity on cash holdings depends on the level of financial constraint and investment opportunities. Similarly, the degree to which firms need cash reserves as a hedge depends on the correlation between their cash flows and investment opportunities. If they are positively correlated, then cash reserves are less important as a hedge and so a change in collateral-based debt capacity will have

[4] There are two endogeneity concerns. The first one is that real estate prices could be correlated with investment opportunities and thus cash holdings. The second one is that the decision to own or lease real estate may be correlated with firms' investment opportunities and thus cash holdings. We will discuss and deal with these concerns in detail in Sections 3.3 and 3.4.

[5] As we discuss later, the placebo findings, coupled with the interactions between real estate prices and firm characteristics, mitigate Davidoff's (2016) critique of supply elasticity IVs.

little effect on cash policy.

Governance also matters. Banks may offer a lower conversion ratio between collateral and debt due to the risk of lending to firms with greater agency problems. Further, since debt involves bank monitoring, self-interested managers would not view it as being a direct substitute for internal slack (Fama, 1985; Houston and James, 1996). These combined effects lead us to expect that the effect of debt capacity on cash holdings will be muted for firms with poor corporate governance.

Accordingly, and to further refine our understanding of the effects of debt capacity on cash holding decisions, we study how firm characteristics shape the observed relationship between debt capacity and cash reserves. Through subsample analysis, we find that the effects of real estate value are only negative and significant in the subset of firms with higher hedging needs, which is consistent with our expectation. In further subsample tests, we find that the decrease in cash holdings following increased collateral value is more pronounced in firms with greater investment opportunities, more financial constraint, better corporate governance, and lower historical local real estate volatility. We further find that our results are highly robust in the subsample of small firms located in large states, which are less subject to measurement error with regard to their real estate location and a possible endogeneity concern arising from corporate policies affecting local growth opportunities and real estate prices.

Our findings of the strong effect of financial flexibility on cash holdings rely on one important underlying assumption: higher collateral value reduces the marginal benefit of holding cash. We can test this assumption by directly testing the prediction for the marginal value of cash holdings using the Faulkender and Wang (2006) approach. We find that following exogenous shocks to collateral value, the marginal value of cash decreases. Quantitatively, a high real estate-holding firm’s value of a marginal dollar of cash is approximately 22% lower than that of an otherwise similar firm. In further exploration, we find that for firms with prior financial constraint, shareholders value cash less after a positive exogenous shock to the value of the firm’s real estate. In such firms, increasing collateral value provides greater benefits to the firms as managers can use collateral to more easily access external financing. In addition, our empirical results are robust to control for potential sources of endogeneity, as in Chaney et al. (2012).

These additional results increase our confidence in our primary finding on the relationship between financing flexibility and cash policy, as shown by how changes in debt capacity change cash holdings. An alternative explanation would have to be consistent with not only the main result, but also these additional results. The hypothesis that managers trade-off debt capacity with cash holdings not only survives the placebo test and the instrumental variables approach, but also predicts these additional findings.

We contribute to the literature in several ways. First, we study the financial flexibility generated by collateral-based debt capacity. Second, we establish a causal relationship between such capacity and cash policy. Finally, we show that managers' willingness to substitute between debt capacity and cash varies according to the firm's existing level of financial constraints, the correlation between its investment opportunities and its cash flows, agency conflicts and the stability of its collateral value. In doing so, our paper contributes to, and is related to, the cash holdings literature, as well as the growing literature on financial flexibility as a determinant of corporate financial policies.

2. Sample and Data

The sample construction and empirical approach in the first part of the paper closely follows Chaney et al. (2012), who identify local variation in real estate prices as an exogenous and meaningful shock to firms' debt capacity. That study focuses exclusively on the credit channel's effect on real investment. We start from the universal sample of Compustat firms that were active in 1993 with non-missing data on total assets. We require the firm to have been active in 1993, as this is the latest year when data on accumulated depreciation on buildings is still available in Compustat. We retain firms whose headquarters are in the US and only keep in the sample firms that exist for at least three consecutive years. We further exclude firms operating in finance, insurance, real estate, construction, and mining. We also restrict the sample to firms not involved in major acquisitions. The firms also needed to have data for us to calculate the market value of real estate assets and also non-missing data for the major variables in the cash equation.[6] We obtained a final sample of 26,242 firm-year observations associated with 2,790 unique firms.

Our key variable of interest is the market value of real estate assets. First, we define real estate assets as the summation of three major subcategories of property, plant and equipment (PPE): buildings, land and improvement, and construction in progress. These values are at historical cost, rather than marked-to-market, and we need to recover their market value. Next, we estimate the average age of those assets using the procedure from Chaney et al. (2012). Specifically, we calculate the ratio of the accumulated depreciation of buildings (*dpacb* in Compustat) to the historic cost of building (*fatb* in Compustat) and multiply by the assumed mean depreciable life of 40 years (Nelson et al., 2000), giving us the average age of the real estate assets. Thus, we obtain the average year of purchase for the real estate assets. Finally, for each firm's real estate assets (*fatp+fatb+fatc* in Compustat), we use a real estate price index to estimate the market value of these real estate assets for 1993 and then calculate the market value for each year in the sample period (1993 to 2007).[7] We use both state-level and MSA-level real estate price indices. The real estate price indices are obtained from the Office of Federal Housing Enterprise Oversight (OFHEO). We match the state-level real estate price index with our accounting data using the state identifier from Compustat. For the MSA-level real estate price index, we use a mapping table between zip code and MSA code maintained by the US Department of Labor's Office of Workers' Compensation Programs (OWCP), to match with our accounting data by zip code from Compustat.

To be more specific, we obtain the real estate value in 1993 as the book value (*fatp+fatb+fatc* in Compustat), which is multiplied by the cumulative price increase from the acquisition year to 1993. For purpose of illustration, consider Aerosonic Corp., which had an accumulated depreciation of buildings of $0.501 million in 1993, and a historic cost of buildings of $2.093 million in 1993. We get the proportion of buildings used of 0.239 (*dpacb/fatb* in Compustat) and obtain the average age of the

[6] We use companies without real estate in placebo tests later. The real estate and non-real estate samples are similar on most key dimensions and we implement interactions between firm characteristics and real estate prices to deal with the few differences we find.

[7] We stop our sample period in 2007 for two reasons. First, there is a limit to how far away we are willing to get from our measurement year of 1993. Second, the 2008 financial crisis conflates a sharp real estate price change with a financing crisis (in corporate debt as well as bank lending) and a recession. We stopped our sample in 2007 because the crisis directly affected both real estate values and cash holdings, invalidating any inferences we would try to draw about a firm's normal cash-collateral trade-off from those years.

real estate assets of 9 years by multiplying 0.239 with the assumed mean depreciable life of 40 years. Consequently, we get the average year of purchase for the real estate assets to be 1984. Then we use the cumulative price increase in the state real estate price index and MSA real estate price index from 1984 to 1993, and multiply by the historical cost of real estate assets (*fatp*+*fatb*+*fatc* in Compustat) ($2.499 million) to get the market value of real estate assets in 1993 for the company. We further adjust for inflation, divide by total assets, and obtain our final measure, *RE Value*. Aerosonic has a value of 17.567% for *RE Value* in 1993, using state-level real estate prices. For the subsequent years, we estimate the real estate value as the market value at 1993 multiplied by the cumulative price increase from 1993 to that year.

One notable issue is that we do not consider the value of any new real estate purchases or sales subsequent to 1993. This practice has advantages and drawbacks. The advantage is that it successfully avoids any endogeneity between real estate purchases and investment opportunities, while the disadvantage is that it introduces noise into our measure. As documented in Chaney et al. (2012), firms do not typically sell real estate assets to realise the capital gains when confronted with an increase in their real estate value, thus alleviating some of our concerns stemming from measurement error.[8] Finally, we standardise our measure of market value of real estate assets by firms' total assets. This standardisation will help us make dollar-to-dollar economic interpretations of the effect of collateral value on cash policy. For a representative firm from 1993 to 2007, the market value of real estate represents 26% of the firm's total assets.[9] Real estate is therefore a sizable proportion of firms' assets on balance sheet. It is worth noting that, although real estate prices trended up over our sample period, so, too, did other asset prices. Therefore, as a fraction of firm asset value, changes in real estate value could be positive or negative. In other words, there is a great variation in both the changes of real estate value (in both directions) and the changes of cash holdings (again in both directions on a year-to-year basis) for the empirical estimation. Our specifications are careful to also address potential trends. The summary statistics of these two variables can be found in table 1. More summary statistics will be discussed in section 3.2.

[8] We also test the robustness of the results using only data from 1993 to 1999, for which the measurement error is less a concern. We find our results are consistent.

[9] Our measures differ in magnitude with Chaney et al. (2012) as we are scaling real estate value using total book assets to better interpret the cash regressions, while Chaney et al. (2012) use PPE to standardise major variables of real estate value.

3. Financial Flexibility and Cash Holdings

We begin our analysis by examining the effects of financial flexibility induced by collateral shocks on cash holdings. In this section, we describe our estimation strategy and summary statistics, and then report the empirical results. Further, we provide instrumental variable analysis to cope with any lingering endogeneity concerns and present additional robustness tests. This initial part of our analysis generally follows Chaney et al.'s (2012) analysis of investment following collateral shocks. Finally, we conduct subsample analysis to look at the effects of investment opportunities, financial constraint, corporate governance, and local real estate price volatility in shaping the relationship between debt capacity and cash holdings.

3.1. Estimation Model and Variables

To determine the sensitivity of cash reserves to collateral value, we augment the standard cash equation in the literature (e.g., Opler et al., 1999; Bates et al., 2009) by introducing a variable capturing the value of real estate owned by the firm (*RE value*). While our primary focus is to show the effect of real asset value fluctuations on firms' cash holdings, we follow an approach similar to that in Bates et al. (2009) and regress the change in cash ratios on the change in real estate value and a battery of control variables. By focusing on the effect of changes in collateral value on changes in cash reserves, the key coefficients are identified using only within-firm variation over time. Specifically, for firm *i*, with headquarters in location *j* (state or MSA), in fiscal year *t*, we construct the following model:

$$\Delta(Cash)_{i,j,t} = \alpha + \beta_1 \times \Delta(RE\ value)_{i,j,t} + \beta_2 \times RE\ price\ index_{j,t} + \delta' X + \varepsilon_{i,j,t}, \quad (1)$$

where the dependent variable $\Delta(Cash)$ refers to the change in the ratio of cash and short-term investments to total assets, or to net assets, following Opler et al. (1999) and Bates et al (2009).[10] Δ(*RE value)* is the change in market value of real estate assets in the fiscal year *t* scaled by total assets. *RE price index* controls for state- or MSA-level of real estate prices in location *j* in fiscal year *t*.

The vector X includes a set of firm-specific control variables following the cash literature. These parameters are: 1) log firm size, measured as the log of real inflation-adjusted book assets; 2) market to book ratio, as the market value of assets over book value of assets; 3) leverage, as total debt scaled by total assets; 4) investment as capital expenditures divided by total assets; 5) dividend-paying dummy, with one indicating the firm pays dividends and zero otherwise; 6) cash flow to total assets; 7) NWC, calculated as non-cash net working capital to total assets; 8) acquisition intensity, as acquisitions divided by total assets; 9) R&D/sales; 10) industry cash flow risk, defined as the standard deviation of industry average cash flow-to- assets for the previous ten years; 11) two-digit SIC industry (or firm) fixed effects and year fixed effects. The detailed definitions are provided in Appendix A.

We include market-to-book ratio and R&D/sales to control for investment opportunities. For firms with greater investment opportunities, underinvestment is more costly, and these firms are expected to accumulate more cash. We include NWC as an independent variable because net working capital can substitute for cash and therefore we expect firms with a higher value for net working capital to hold less cash. Firms with more capital expenditures use cash and so are predicted to have less, and thus Capx/assets is predicted to be negatively correlated with the level of cash holdings.[11] Similarly, acquisition intensity also proxies for the investment level of a firm and it is expected to negatively affect cash holdings (Bates et al., 2009). Additionally, acquisition intensity also helps to control for the realization of agency costs if managers of firms with excess cash holdings conduct acquisitions for their private benefit (Jensen, 1986; Harford, 1999). Leverage is predicted to be negatively associated with cash holdings as interest payments decrease the ability of firms to hoard cash. Also, including

[10] We also test the robustness of the results using log value of cash to net assets as an alternative measure (Bates et al., 2009) and our results are maintained.

[11] Later on in Section 3.2, we show that our results are not affected if we drop NWC and Capx/assets, which are potentially jointly determined with cash. The insensitivity of the coefficients to their inclusion reduces our concerns about the empirical effect of this potential problem.

leverage in the model helps to control for the refinancing risk of the firm.Harford et al. (2014) showd that firms increase cash holdings to mitigate the refinancing risk, which will be higher with greater leverage. Firms paying dividends are expected to have better access to debt financing and will therefore hold less cash. Industry cash flow risk captures cash flow uncertainty. One would predict firms with greater cash flow risk to hold more precautionary cash (Opler et al., 1999; Bates et al., 2009).

Our primary focus is the estimate of β_1, the coefficient on Δ(*RE value)*. A negative and statistically significant β_1 in regression (1) would be evidence for the causal effect of collateral-based debt capacity on cash holdings, as it suggests that firms reduce cash balances after the appreciation of real estate values due to exogenous shocks. Therefore, this would be consistent with the precautionary savings hypothesis, as an analogous impact is expected on the downside of the cycle when adverse shocks occur to the firm's real estate assets. Since Δ(*RE value)* is at the firm level, and cash ratios and Δ(*RE value)* use the same divisor, an advantage of this model specification is that β_1 captures how sensitively a firm's cash holding responds to a $1 increment in the value of real estate owned by the firm.

3.2. Baseline Regression Results

After restricting the sample based on the availability of data for cash holdings and major independent variables in equation (1), we obtain a final sample consisting of 26,242 firm-year observations associated with 2,790 unique firms from 1993 to 2007. Panel A of Table 1 reports the corresponding summary statistics.

From Panel A of Table 1, we find the ratio of cash to total assets has a mean of 0.18 and a standard deviation of 0.22, comparable with the literature (Opler et al., 1999; Bates et al., 2009). It has substantial variation in both the cross-sectional (with an average of the cross-sectional standard deviation of 0.19) and time-series (with an average of the time-series standard deviation of 0.11) dimensions. The ratio of cash to net assets is higher since cash and marketable assets have been subtracted from the denominator. The changes in Cash/Assets and Cash/Net Assets have a mean of

0.002 and 0.029, respectively.

Our major independent variable of interest, *RE value*, has two versions: one using state-level real estate price indexes, while the other uses MSA-level real estate price indexes to compute the market value of the firm's real estate assets. Both of the measures are scaled using total book assets. The two versions yield similar values: the former (using state real estate price indexes) has a mean value of 0.25 with a standard deviation of 0.40, while the latter has a mean of 0.24 and a standard deviation of 0.39.[12] Again, both of the measures have large cross-sectional and time-series variation. For instance, *RE value using state-level price index* has a between-firm standard deviation of 0.37 and a within-firm standard deviation of 0.13. The changes in RE value for the two measures both have a mean of 0.5% and a standard deviation of 0.081.

Table 2 shows the regression results. The dependent variables are the change in Cash/Assets in columns (1) to (6) and the change in Cash/Net Assets in columns (7) to (12). For each dependent variable, we first report the regressions of change in cash ratios on a set of control variables and our major independent variable of interest Δ(*RE value*) calculated using the state real estate price index, and then Δ(*RE value*) using the MSA real estate price index. All the variables are winsorized at the 1st and 99th percentiles to alleviate the concerns about extreme values. Following Chaney et al. (2012), we report the heteroskedasticity-consistent standard errors clustered at the state-year or MSA-year level.[13] We first report the pooled OLS results controlling for industry and year fixed effects in column (1). We further include an additional variable, land ownership in 1993 (the ratio of land value in 1993 to total assets), to avoid the risk that real estate value is simply picking-up cross-sectional variation in land ownership. We find that Δ(*RE value*) has a negative coefficient (β_1) that is statistically significant at the 1% level, which is consistent with managers trading off debt capacity and cash reserves in managing their access to capital. More importantly, we can characterise the degree of substitution. Specifically, based on the estimates in column (1) when using state real estate price index to compute Δ(*RE value*), the representative firm reduces its cash reserves by $0.142 for each additional $1 of real estate owned by the firm, holding other factors constant. The effect is not only statistically significant,

[12] The time series correlation of these two measures is as high as 0.936.

[13] According to Chaney et al. (2012), this clustering structure is conservative given the major explanatory variable of interest *RE value* is measured at the firm level (See Bertrand et al., 2004). We check the sensitivity by clustering at the firm level, and all the regressions reported in the paper are robust to this alternative clustering strategy.

but also economically large.

Starting in column (2), we further control for firm and year fixed effects. There is a well-documented trend in cash holdings (Bates, et al. 2007) that, when combined with generally increasing real estate prices, may lead to spurious inferences in a change regression (although these would work against us). Including the fixed effects in the change regression effectively controls for this. In column (2), We find that the estimated coefficient of Δ(*RE value*) is negative and statistically significant at the 1% level. The magnitude is similar to that obtained using OLS regressions. The result confirms our expectation that the change in real estate value materially affects within-firm variation in cash holdings.

In column (3), we add an additional control variable, state real GDP growth, to further control for the possibility that local growth opportunities may correlate with both local real estate price and firms' cash policy. We find that both the significance and magnitude of β_1 are unchanged.

Because short and long run investment are endogenous variables, in column (4), we exclude NWC and Capx/assets to determine whether our results are sensitive to using them as control variables. We find that the magnitude of the coefficient on Δ(*RE value*) is only slightly reduced and our primary inference is not affected.

In column (5), we replicate the estimation performed in column (2) using the MSA real estate price index, rather than the state index. As argued in Chaney et al. (2012), using MSA-level real estate prices has advantages and disadvantages. The advantage is that it makes our identifying assumption that cash holdings are uncorrelated with local real estate prices easier to accept. It also offers a more accurate source of variation in real estate value (Chaney et al., 2012). The downside is we assume that all the real estate assets owned by a firm are located in the headquarters city, which may be potentially subject to more measurement error. As shown in column (3), the coefficient estimate β_1 remains stable, at 0.154, and statistically significant at the 1% level.

In columns (7) through (12), we change the dependent variable to the ratio of cash and short-term investments to net assets. The coefficient estimates in columns (7) and (8) for Δ(*RE value*) are negative and statistically significant at the 1% level. The economic magnitudes are larger compared to columns (2) and (5) since cash and marketable assets have been subtracted from the denominator in the cash ratio. One may be concerned about a potential mechanical relation when using the cash to asset ratio because firms with more cash as percentage of assets may have less of other assets. Thus, we will focus on cash to net assets in our further analysis of cash holdings. Using different denominators for the dependent and independent variables can also alleviate concerns that the results are driven by the correlation due to the common divisor.

The control variables also generate interesting findings, consistent with previous results in the cash literature. Both the market-to-book ratio and R&D/sales have positive coefficients, supporting the hypothesis that firms with larger investment opportunities are more inclined to accumulate a large cash balance to accommodate future investment. The coefficient estimates for Capx/assets and acquisition intensity are both negative and significant at the 1% level for all the model specifications, echoing the results in Bates et al. (2009) that firms with higher level of investment hold less cash. Leverage has a negative and significant coefficient, documenting the fact that firms do not tend to simultaneously increase cash and have high leverage. Firms paying dividends are expected to have easier access to external financing, which explains the negative and significant coefficients on the dividend-paying dummy. We also find that NWC has a negative coefficient estimate, consistent with the substituting role of net working capital to cash reserves. Industry cash flow risk is not always significantly positive. The primary explanatory power of cash flow risk comes in explaining cash levels in the cross-section, so it is possible that the slow-moving changes in industry cash flow risk do not have sufficient variation to explain changes in cash.

There is little consistent theoretical guidance as to which control variables should be included in cash regressions, so we follow the existing empirical cash literature for comparability. We test the robustness of our results by dropping some of the control variables with different combinations and stepwise regressions. As shown in Appendix B, our results are robust to these different combinations of control variables.

3.3. Endogeneity and Instrumental Variable Estimation

We follow Chaney et al. (2012) in addressing two potential endogeneity concerns with this experiment: (1) real estate prices can be correlated with investment opportunities and thus cash holdings; (2) the decision to own or lease real estate may be correlated with firms' investment opportunities and thus cash holdings.

To deal with the first endogeneity concern, we use MSA-level real estate prices and then conduct placebo tests on firms without real estate holdings. Our instrument comes from interacting local housing supply elasticity with the nationwide real interest rate at which banks refinance their home loans, as in Himmelberg et al. (2005).[14] The belief is that the interest rate affects the real estate prices differently for locations with different land supply elasticities. The demand for real estate increases as the mortgage rate decreases. For a location with very high elasticity in land supply, the increase in demand will mostly translate into more quantity through new construction, rather than higher real estate prices. For a location with non-elastic land supply, the decrease in the interest rate will mostly translate into higher housing prices. In summary, the change in the interest rate should have a larger effect on real estate prices for locations with lower elasticities of land supply. Therefore, we construct and estimate the following first-stage regression to predict the real estate price index in MSA *j* at fiscal year *t*:

$$RE\ price\ index_{j,t} = \alpha_j + \gamma_t + \beta_1 \times Housing\ supply\ elasticity_j \times Interest\ rate_t + \mu_{j,t}, \quad (2)$$

where housing supply elasticity measures constraints on land supply at the MSA level. α_j is an MSA fixed effect and γ_t captures the year fixed effects. We replicate columns (1) and (2) of Table 3 in Chaney et al. (2012) and report the first-stage results in Appendix C. Column (1) reports the results directly using the measure of local land supply elasticity as provided in Saiz (2010), and column (2) uses groups of MSAs by quartile of supply elasticity. As expected, the interaction of housing supply elasticity and interest rate has a positive and statistically significant coefficient at the 99% confidence level, indicating that the positive effect of a decreasing mortgage rate on real estate prices is stronger in MSAs with lower land supply elasticity. The F-test for the weak instruments is 39.99, well above 10,

[14] Local housing elasticity is only available at MSA level, provided in Saiz (2010). Davidoff (2016) argues that housing supply elasticity is not a good instrument, but notes that the interactions performed in Chaney et al. (2012) and included here "obviate the need for a price instrument conditional on different assumptions from those evaluated in this paper".

which puts us at ease that we do not need to be concerned about a weak IV problem (Staiger and Stock, 1997; Stock et al., 2002).

In the second-stage regression, we use the predicted *RE price index* to calculate Δ(*RE value*) and also use the index itself as an explanatory variable in equation (1). As we use different samples in the first-stage and second-stage regressions, we adjust our standard errors by bootstrapping. The second-stage results are presented in columns (6) and (9) of Table 2 for the ratio of cash to total assets, and the ratio of cash to net assets, respectively. In column (6), the coefficient estimated from the IV regression is negative, significant at the 1% level, and the absolute value of 0.162 is slightly larger than the one from the fixed effects regression.

We also replace land supply elasticity with a geographical measure of land (percentage of undeveloped land of each MSA as in Saiz (2010)) and use its interaction with the mortgage rate as an instrument for local real estate price indexes. Our results, in column (10) of Table 2, are similar to those obtained in column (9).

3.4. Addressing the Second Endogeneity Concern

The second potential source of endogeneity is that firms which are more likely to own real estate are also more sensitive to local demand shocks. We address this concern by controlling for the interactions between firms' initial characteristics and the real estate price index (*RE price index*). To be more specific, the initial characteristics include five quintiles of firm age, firm size, ROA, as well as two-digit SIC industry dummies and MSA dummies, all of which are shown to play an important role in the ownership decision by Chaney et al. (2012).[15]

The results are shown in Columns (11) and (12) in Table 2. After adding those additional controls into the regression, the coefficient estimates of Δ(*RE value*) remain negative and statistically significant at the 1% level across both of the model specifications. The magnitudes slightly increase to 0.301 in the fixed effects regression, and 0.292 in the IV regression. We further check the robustness of our

[15] As shown in Table 4 of Chaney et al. (2012), older, larger and more profitable firms are more likely to own real estate assets. The results are consistent if we use the state-level real estate price index.

results using additional measures of cash holdings: cash to total assets and log value of cash scaled by net assets. In unreported results, the coefficients of Δ(*RE value*) are still negative and significant in those specifications.

3.5. Placebo Tests

We conduct placebo tests by regressing the change in cash ratios on the average change of RE value of other firms in the same state/ MSA and the real estate price index for firms with zero real estate holdings. In the context of our experiment, those firms' cash holdings should be immune to the value fluctuations of real estate held by firms in the same location and to local real estate price changes in general. If, instead, the change in real estate values capture something else about local conditions, then either the RE price indices or the change in RE value for collocated firms would load significantly. The results are tabulated in Table 3. As can be seen in columns (1) and (2), we find that both the change in real estate value of other real estate holding firms in the same location and the real estate price index are not statistically different from zero, indicating that those firms with zero real estate holdings are not directly influenced by housing price changes. This is strong evidence that the channel is through real estate collateral as we argue, and not through some unmodelled investment opportunity effect.

3.6. Hedging Needs

Acharya, et al. (2007) draws a distinction between firms with high and low hedging needs, where hedging needs are determined by the correlation between cash flows and growth opportunities. If high, then hedging needs are low (cash flow is available to finance growth opportunities and cash flow-based debt capacity is also high at that time). They measure hedging needs by using the correlation between the firm's cash flows and industry median R&D intensity or 3-year-ahead industry median sales growth. We do the same and also add industry median M/B.

The results, in Table 4, demonstrate that the effects of collateral value increases are stronger in firms with higher hedging needs (lower correlations). Specifically, the effects are negative and significant in the high hedging needs subsamples, while not significant in the low hedging needs subsamples. The differences between the coefficients in the two subsamples are statistically significant, as shown by the Wald tests. We assign to the group of high correlation those firms for which the empirical correlation between cash flow and growth opportunities is in the top tercile of the sample, and to the group of low correlation those firms for which this correlation is in the bottom tercile of the sample. The results are qualitatively similar if we use ±0.2 cutoffs following Acharya et al. (2007), or if we use positive versus negative correlation. High hedging needs suggest that the firm holds cash as a way to shift slack to high growth opportunity states. Because real estate's value as collateral is a similar store of slack uncorrelated with cash flows, the substitution should be greater for those firms and it is. Our findings using collateral-based debt capacity provide specific evidence supporting the assertion in Acharya, et al. (2007) that general debt capacity can be a poor store of slack.If debt capacity is supported by cash flows, then the capacity decreases with the cash flows, making it a poor hedge. Debt capacity created by real estate collateral is different in that it is not supported by the firm's cash flows and is therefore less susceptible to problems created by correlation between cash flows and investment opportunities. As we showed in sections 3.3 and 3.4, any potential correlation between real estate values and investment opportunities is small enough that it does not affect our results.

3.7. Further Exploration of Cash Holdings

As previously described, we found that exogenous shocks in collateral value significantly affect firms' cash holdings. In this section, we reestimate our results by partitioning the sample into high or low growth opportunity subsamples, financially constrained or unconstrained firms, subsamples with good or bad corporate governance, and subsamples with high or low local real estate price volatility, to refine our understanding of the effect and further corroborate our interpretation. We also look at small firms in large states that may be less affected by measurement error or concern about potential endogeneity from the firm's actions driving local growth opportunities. Since a change regression with fixed effects can better control for firm-specific trends across time, we will focus on this model specification.[16] As we obtain consistent results using the state-level real estate price index, we only

[16] All of the results are robust to models with industry fixed effects.

report subsample results using the MSA-level real estate price index for brevity.

3.7.1. More vs. Less Investment Opportunities

In section 3.2, we find that the coefficient on the market to book ratio is consistently positive across all the models, suggesting that firms with better growth opportunities are more likely to accumulate a large cash balance to accommodate future investment (Bates et al., 2009). In other words, firms with more investment opportunities tend to have stronger financing needs and tend to hold more cash to mitigate financing frictions. Strictly speaking, any time a firm cannot exhaust its positive NPV projects, it is financially constrained. However, the literature typically separates firms with limited or costly access to external finance from those that, while having normal access to external finance, have such strong investment opportunities that they have not exhausted them all. For us, the implication is the same: firms that have not moved far along their investment opportunity set will have a greater incentive to substitute away from cash through investment when collateral value increases.

Intuitively, a change in collateral value will induce more substitution away from cash holdings in firms with more investment opportunities as these firms tend to have more unexploited investment opportunities. As such, they are more sensitive to changes in access to external financing, particularly when the access is provided by collateral that has low information asymmetry. Specifically, because firms trade-off cash holdings against investment, those with greater investment opportunities will spend down cash holdings for positive NPV projects, resulting in a higher substitution between real estate value and current cash holdings. We test this hypothesis by dividing the sample into high and low growth opportunity subsamples, and reestimate our results. We place a firm in the high investment opportunity subsample if its market-to-book ratio is in the top tercile of the sample, and in the low investment opportunity group if its market-to-book ratio is in the bottom tercile of the sample. We also try an alternative measure of investment opportunities by using each firm's mean sales growth rate in the past five years to alleviate the concern that the replacement value in the construction of market-to-book ratio may change corresponding to a firm's change in real estate value. The results are presented in Panel A of Table 5.

As expected, using both of our measures of investment opportunities, we consistently find that the estimated coefficients on Δ(*RE value*) are much larger in the high investment opportunity firms than in the low investment opportunity firms. To test the equality of the Δ(*RE value*) coefficients between the two subsamples, we rely on a Wald test. As shown in the third line from the bottom of Panel A, all of the null hypotheses of equality between the two subgroups are rejected at the 95% confidence level. For instance, when using the market to book ratio to measure growth opportunities, the coefficient estimate of Δ(*RE value*) for firms with higher investment opportunities is -0.667 (column (1)), almost 2.5 times the coefficient for firms with lower investment opportunities (-0.284 in column (2)). This suggests that the negative effect of collateral shocks on cash holdings is mostly driven by the high investment opportunities subsample.

3.7.2. Financially Constrained vs. Unconstrained Firms

As found in section 3.2, larger firms, those paying dividends, and firms with a higher ROA are expected to have easier access to external financing, and hold lower cash reserves. In this section we assess whether the effect of collateral shocks is more substantial for financially constrained firms. As with our investment opportunities analysis, the degree to which firms will actively substitute between collateral-based debt capacity and cash reserves is directly affected by the cost of holding an additional dollar of cash today. For firms facing concave investment functions, financial constraints keep them from advancing along the investment curve. Relaxing that constraint will result in immediately drawing down internal slack for current investment. We use four different measures of financial constraint, specifically Hadlock and Pierce's (2010) financial constraint index (*HP index*), Whited and Wu's (2006) financial constraint index (*WW index*), payout policy, and bond ratings. A firm is regarded as financially constrained if its HP index (WW index) falls in the top tercile of the whole distribution, and unconstrained if it is in the bottom tercile of the distribution. We also employ the traditional payout-based constraint definition: firms paying a dividend are regarded as unconstrained firms, while firms not paying a dividend are constrained firms. Finally, firms without an investment-grade bond rating (where investment grade is defined as *splticrm* in Compustat at BBB- or higher) are categorised as financially constrained, and financially unconstrained firms are those whose bonds are rated as investment grade.[17]

The HP index is measured as follows:

$$HP\ index_{i,t} = -0.737 \times Firm\ size_{i,t} + 0.043 \times Firm\ size_{i,t}^{2} - 0.040 \times Firm\ age_{i,t}, \tag{3}$$

where firm size equals the log of inflation-adjusted book assets, and firm age is the number of years the firm is listed with a non-missing stock price on Compustat. In calculating this index, we follow Hadlock and Pierce and winsorize (i.e., cap) firm size at (the log of) $4.5 billion, and firm age at 37 years.

The WW index is calculated as follows:

$$WW_{i.t} = -0.091 \times \frac{CF_{i.t}}{AT_{i,t-1}} - 0.062 \times Dividend\ Dummy_{i,t} + 0.021 \times Leverage_{i,t} - 0.044 \times Log(AT_{i,t}) + 0.102 \times Industry\ Sales\ Growth_{i,t} - 0.035 \times Sales\ Growth_{i,t}, \tag{4}$$

where CF is operating cash flow and AT is book assets. Dividend Dummy is the indicator for dividend payment, which takes the value of one if the firm pays cash dividends in the year and zero otherwise. Leverage is calculated as total debt scaled by total assets. Industry Sales Growth is the average sales growth of all firms in the firm's three-digit SIC industry. Investment grade is a dummy variable that equals one if the S&P rating is BBB- or higher and zero otherwise.

Panel B of Table 5 reports the results. Across all of our measures of financial constraint, we consistently find that the estimated coefficients of Δ(*RE value*) are significantly larger in the

[17] The results are qualitatively similar if we use an indicator of whether the firm has a bond rating or not (e.g., Faulkender and Petersen, 2006; Harford et al., 2014).

constrained firms than unconstrained firms, as shown by the larger magnitudes in the constrained subsample and the Wald tests. Thus, constrained managers choose to more actively substitute away from cash holdings when their collateral-based debt capacity increases.

3.7.3. Good vs. Bad Corporate Governance

Under agency theory, debt constrains managers, and accessing the capital markets provides discipline (Easterbrook, 1984; Jensen 1986). As such, entrenched managers will not view debt capacity and cash as substitutes and poorly-governed firms will not reduce cash holdings as much as firms with better corporate governance. To test this hypothesis, we divide the sample into good governance and bad governance subsamples and reestimate our results. We use three measures of corporate governance: product market competition, institutional holdings and G-Index. Institutional holdings are measured by the percentage of common shares owned by institutional investors. The G-Index is taken from Gompers et al. (2003), based on 24 antitakeover provisions. Higher index levels correspond to more managerial power and poorer corporate governance. We categorise a firm as well-governed if its institutional holdings (G-Index or HHI) are in the top (bottom) tercile of the sample, and as poorly-governed if its institutional holdings (G-Index or HHI) are in the bottom (top) tercile of the sample.

Panel C of Table 5 shows the findings. Consistent with the agency-based predictions above, the effect of collateral shocks on cash holdings is more pronounced in the firms with higher institutional holdings, more market competition and low G-Index (better governance).

3.7.4. High vs. Low Local Real Estate Price Volatility

The effect of a change in the value of a firm's real estate on its debt capacity will depend on the expected permanence of the change. Firms located in an MSA with a history of high real estate price fluctuations would rationally view house appreciation as a temporary event, and attach greater uncertainty to the future value of the real estate assets that they hold (likewise, banks considering lending against that real estate). Therefore, following real estate appreciation, such firms would be more reluctant to reduce cash holdings, relative to firms located in an MSA with low historical real estate price volatility. We directly test this conjecture in this subsection.

We measure local real estate price volatility by the standard deviation of the MSA real estate price index in the previous five years for a given MSA. High local real estate price volatility is coded when the local real estate price volatility falls in the top tercile of the sample, and low local real estate price volatility when the local real estate volatility is in the bottom tercile of the sample. Panel D of Table 5 reports the results. Consistent with our expectation, we find that the effect of collateral shocks is stronger in the subset of firms located in MSAs with low real estate price volatility. The fact that the degree of the substitution is related to the volatility of real estate prices further strengthens our interpretation that the empirical result is due to the debt capacity channel.

3.7.5. Small Firms in Large States vs. Large Firms in Small States

Finally, we examine a subset of the sample: small firms located in large states. Doing so has two advantages. First, since small firms usually have real estate assets concentrated in one area, our assumption that all the real estate assets owned by a firm are located in the headquarters city should be less affected by measurement error. Second, the policies of small firms in large states are less likely to change the overall business environment and local housing prices, which further alleviates the concern that there may be some feedback effect from corporate policies on local housing markets. The consistency of our results in this subsample further strengthens our interpretation of our previous findings.

To directly test this, we first divide the sample according to firm size. The results are shown in columns (1) and (2) in Panel E of Table 5. We find that β_1 is negative and significant in both the large firm and small firm subsamples. In columns (3) and (4), we further divide the sample according to the ratio of firm size to state GDP. We place a firm into the high group if the value of this ratio is in the top tercile of the sample, and the low group if this ratio is in the bottom tercile of the sample. Lower values of this ratio should indicate small firms in (economically) large states, while higher values should identify large firms located in small states. We find that our results are maintained in both of the subsamples, indicating that measurement error and endogeneity is less of a concern in driving our results.

The results of our further analysis of investment opportunities, financial constraints, corporate governance, local real estate price volatility, and small firms in large states both refines our inferences and provides further support for our causal interpretation of trade-off between debt capacity and cash holdings due to precautionary demand (based on our earlier tests that include IV estimation and placebo tests). Even if the possibility remains that an unmodelled factor causes both real estate prices to increase and cash to decrease, that factor would also have to explain these results.

4. Financial Flexibility and the Marginal Value of Cash Holdings

So far, we have found robust evidence that firms reduce cash holdings after a collateral shock increases their debt capacity. We recognise that there is one underlying assumption for the strong impact of financial flexibility on cash holdings: higher collateral value reduces the marginal benefit of holding cash. As the supply of credit increases, allowing firms to rely more on external financing, cash should be less valuable. We test this hypothesis in this section by looking at the effect of collateral shocks on the marginal value of cash holdings using the Faulkender and Wang (2006) approach. One caveat is that if firms dynamically rebalance their cash holdings to the new equilibrium level, then the marginal value of an additional dollar of cash may remain the same. If they only partially adjust, then the value should decline.

4.1. Model Specification and Variables

We augment the model first developed in Faulkender and Wang (2006) by introducing our variable of interest, *RE value*. We then test our hypothesis by including an interaction term between RE value and the change in cash. Specifically, we construct the following model:

$$r_{i,j,t} - R^B_{i,j,t} =$$

$$\alpha_0 + \beta_1 \times \frac{\Delta Cash_{i,j,t}}{Market\ cap_{i,j,t-1}} + \beta_2 \times RE\ value_{i,j,t} \times \frac{\Delta Cash_{i,j,t}}{Market\ cap_{i,j,t-1}}$$

$$+\beta_3 \times RE\ value_{i,j,t} + \beta_4 \times RE\ price\ index_{j,t} + \delta' X + \varepsilon_{i,j,t} \quad (5)$$

where the dependent variable is the abnormal stock return $r_{i,j,t} - R^B_{i,j,t}$ over the fiscal year *t* in location *j*. $r_{i,j,t}$ is the stock return for firm *i* during fiscal year *t* and $R^B_{i,j,t}$ is the benchmark return in year *t*. We adopt two methods in calculating the benchmark return: (1) value-weighted return based on market capitalisation within each of the 25 Fama-French portfolios formed basing on size and book-to-market ratio; (2) value-weighted industry-adjusted returns.[18] $\Delta Cash_{i,j,t}$ captures firms' unexpected changes in cash reserves from year *t-1* to *t*. Following Faulkender and Wang (2006), we standardise $\Delta Cash_{i,j,t}$ by the one-year lagged market value of equity ($Market\ cap_{i,j,t-1}$). This standardisation allows us to interpret β_1 as the dollar change in shareholder wealth for a one-dollar change in cash holdings, since stock return is the difference of market value of equity between *t* and *t-1* ($Market\ cap_{i,j,t} - Market\ cap_{i,j,t-1}$) divided by $Market\ cap_{i,j,t-1}$. More detailed definitions of the variables are available in Appendix A.

The vector X includes a set of firm-specific control variables. These indicators are: (1) changes in earnings before extraordinary items ($\Delta Earnings_{i,t}$); (2) changes in net assets ($\Delta NetAssets_{i,t}$); (3) changes in R&D ($\Delta R\&D_{i,t}$); (4) changes in interest expense ($\Delta Interest_{i,t}$); (5) changes in dividend payout ($\Delta Dividends_{i,t}$); and (6) net financing, defined as new equity issues plus net new debt issues ($NetFinancing_{i,t}$). All these variables are scaled by $Market\ cap_{i,t-1}$. We also include the interaction between $\Delta Cash_{i,t}$ and the one-year lagged value of cash holdings ($Cash_{i,t-1}$), and the interaction between $\Delta Cash_{i,t}$ and leverage ($Leverage_{i,t}$). Following Dittmar and Mahrt-Smith (2007) and Masulis

[18] Masulis et al. (2009) argue that industry-adjusted return is used as an alternative to alleviate the concern that market-to-book ratio is likely to be endogenous when using size and market-to-book ratio adjusted returns. As we find later on, the results are similar for both the industry-adjusted returns and size and market-to-book ratio adjusted returns in our regressions, we will focus on industry-adjusted returns in the subsample analysis for brevity. Gormley and Matsa (2014) show using the "industry-adjusted" and "size and M/B adjusted" stock returns can bias the regression estimates. We use the benchmark portfolio fixed effects specification using the code as provided by the authors, and find that our results are robust to the adjustment.

et al. (2009), we also include the interaction between $\Delta Cash_{i,t}$ and a measure of financial constraint, which is a dummy variable. One indicates the firm's Hadlock and Pierce (2010) financial constraint index (*HP index*) is in the top tercile of the sample, and zero otherwise.[19]

Our primary interest is the coefficient estimate of the interaction between $RE\ value_{i,j,t}$ and $\frac{\Delta Cash_{i,j,t}}{Market\ cap_{i,j,t-1}}$, β_2. A negative and statistically significant β_2 in regression (4) would support our hypothesis that investors place a lower value on internal cash when positive shocks occur to firms' debt capacity.

4.2. Regression Results

We match our sample of real estate value information with variables needed for the marginal value of cash regressions, and obtain a final sample of 17,015 firm-year observations. The change in cash standardised by lagged value of market capitalisation has a mean (median) value of 0.5% (0.1%), with a standard deviation of 11.9%. Consistent with Faulkender and Wang (2006), the annual excess stock returns are right-skewed.

Table 6 presents the baseline regressions in regard to the value of cash. In columns (1) to (5), the dependent variable is the industry-adjusted excess return during fiscal year *t*, and in columns (6) to (10), it is the size and market-to-book adjusted excess return of the stock during fiscal year *t*. All regressions control for year and industry (or firm) fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the state-level or MSA-level are reported in the brackets.[20] Across all four OLS models, we consistently find that the interaction term between *RE value* and the change in cash has a negative coefficient, statistically significant at the 1% level, supporting our hypothesis that cash is less valuable following an increase in a firm's debt capacity.

[19] For the details of the calculation, please see Section 3.7.2.

[20] All of the results are robust to clustering the standard errors at the firm level.

To better interpret the economic effects, we replace *RE value* with a dummy variable (*High RE value*). One indicates the market value of the real estate asset held by the firm is larger than the sample median, and zero otherwise. By doing so, we can directly compare the marginal value of cash holding for a high RE value firm compared to a low RE value firm. The results are presented in columns (3) and (8) of Table 6. Again, we find the estimated coefficients of the interaction between $\frac{\Delta Cash_{i,j,t}}{Market\ cap_{i,j,t-1}}$ and *High RE value* are negative and significant. To quantify the economic magnitude, the marginal value of cash for the high RE holding firms is on average 22.3% lower than that of low RE holding firms, holding other factors unchanged (column (3)). We find similar and consistent results when we absorb cross-firm differences by including firm fixed effects in columns (4) and (9) and investigate the effects of collateral shocks on the within-firm variations in the marginal value of cash.

To address the endogeneity concern that real estate prices could be correlated with investment opportunities and thus the value of cash, we implement an IV strategy similar to that in section 3.3 by instrumenting real estate prices by the interaction of interest rates and local housing supply elasticity. Columns (5) and (10) report the IV regression results for industry-adjusted excess return and size and M/B adjusted excess return respectively.[21] The results show that our findings are robust to the IV estimation. We also find that our results are still consistent after controlling for interactions between firms' initial characteristics and the real estate price index, and we do not tabulate those results here for brevity.

4.3. Further Exploration of the Marginal Value of Cash Holdings

Faulkender and Wang (2006) find that financially constrained firms have larger marginal values of cash. In this section, we further explore whether the effect of debt capacity on the value of cash is more pronounced in firms with higher levels of financial constraints.

As in section 3.7.2, we replicate our baseline regression in subsamples of constrained and unconstrained firms. Financial constraint assignments are based on HP index, WW index, firm dividend payout policy, and investment-grade bond ratings as previously described in section 3.7.2.

[21] Standard errors are adjusted by bootstrapping as in section 3.3.

Table 7 presents the empirical results.

As predicted by our hypothesis, the negative impact of collateral value on the marginal value of cash holdings is only significant in the subset of firms with prior financial constraint. To be more specific, when using HP index, WW index, payout policy, or investment-grade as measures of financial constraint, the interaction between *RE value* and change in cash is negative and statistically significant in constrained firms, but insignificantly different from zero in unconstrained firms at conventional significance levels.[22]

5. Concluding Remarks

We explicitly examine the causal effect of financial flexibility on corporate cash policies. Using variation in local real estate prices as shocks to the collateral value owned by the firms, we find strong evidence that increases in real estate values lead to smaller corporate cash reserves. Quantitatively, we show that one additional dollar in collateral value results in a decrease of about 14.2 cents in cash reserves for a representative US firm. We further find that the decrease in cash holdings is more pronounced in firms that have higher hedging needs, greater investment opportunities, financial constraints, better corporate governance, or lower historical real estate price volatility. Next, we find that, following collateral appreciation, the marginal value of cash holdings declines, and the decline is more prominent in financially constrained firms.

An alternative story would have to explain not only the main result, but also all of the interactions and refinements. Nonetheless, endogeneity is still a concern, so we conduct placebo tests and instrument real estate prices using interactions of the long-term interest rate and local housing supply elasticity and control for the interactions between firms' initial characteristics and the real estate price index. We find that our results are robust to these approaches. We also find that our results are robust when applied to examining small firms located in economically large states, which are less affected by measurement error and endogeneity concerns.

[22] The results are consistent if we use state-level real estate price index.

Taken together, our findings lend support, and give economic meaning, to the management of cash holdings within the context of overall firm financial flexibility. We also emphasise, and provide evidence on, the importance of collateral-based debt capacity, which serves as a better store of slack for firms needing to hedge to support future investment. As this kind of debt capacity is comparable to cash in that dimension, it serves as a direct substitute for holding more cash. We hypothesise, and find, that firms whose cash policies more directly reflect these hedging needs will more actively substitute between collateral-based debt capacity and cash. We further demonstrate the real effects of this collateral channel by showing that firms facing a greater cost to holding cash (more investment opportunities and/or constraint) more actively draw down current cash when the value of their real estate increases. These findings bolster our interpretation while simultaneously showing how the substitutability between cash and debt capacity varies across firms.

References

Acharya, V., Almeida, H., Campello, M., 2007. Is cash negative debt? A hedging perspective on corporate financial policies. *Journal of Financial Intermediation* 16, 515-554.

Barro, R. J., 1976. The loan market, collateral, and rates of interest. *Journal of Money, Credit, and Banking* 8 (4): 439–56.

Bates, T. W., Kahle, K. M., Stulz, R.M., 2009. Why do U.S. Firms hold so much more cash than they used to? *The Journal of Finance* 64, 1985-2021.

Berger, A., Frame, S., Ioannidou, V., 2011. Tests of ex ante versus ex post theories of collateral using private and public information. *Journal of Financial Economics* 100, 85-97.

Bertrand, M., Duflo, E., Mullainathan, S., 2004, How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics* 119, 249-275.

Campello, M., Giambona E., Graham, J., Harvey, C., 2011. Liquidity management and corporate investment during a financial crisis. *Review of Financial Studies* 24, 1944-1979.

Chaney, T., Sraer, D., Thesmar, D., 2012. The collateral channel: How real estate shocks affect corporate investment. *American Economic Review* 102, 2381-2409.

DeAngelo, H., DeAngelo, L., 2007. Capital structure, payout policy, and financial flexibility. Unpublished working paper. University of South California.

Denis, D. J., 2011. Financial flexibility and corporate liquidity. *Journal of Corporate Finance* 17, 667-674.

Denis, D. J., McKeon, S. B., 2012. Debt financing and financial flexibility evidence from proactive leverage increases. *Review of Financial Studies* 25, 1897-1929.

Dittmar, A., Mahrt-Smith, J., 2007. Corporate governance and the value of cash holdings. *Journal of Financial Economics* 83, 599-634.

Duchin, R., 2010. Cash holdings and corporate diversification. *The Journal of Finance* 65, 955-992.

Duchin, R., Ozbas, O., Sensoy, B. A., 2010. Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics* 97, 418-435.

Fama, E., 1985. What's different about banks? *Journal of Monetary Economics* 15, 29–39.

Faulkender, M., Petersen, M. A., 2006. Does the source of capital affect capital structure? *Review of Financial Studies* 19, 45-79.

Faulkender, M., Wang, R., 2006. Corporate financial policy and the value of cash. *The Journal of Finance* 61, 1957-1990.

Gamba, A., Triantis, A., 2008. The value of financial flexibility. *The Journal of Finance* 63, 2263-2296.

Gormley, T. A., Matsa, D. A., 2014. Common errors: How to (and not to) control for unobserved heterogeneity. *Review of Financial Studies* 27, 617-661.

Graham, J.R., Harvey, C. R., 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics* 60, 187–243.

Hadlock, C. J., Pierce, J. R., 2010. New evidence on measuring financial constraints: Moving beyond the KZ index. *Review of Financial Studies* 23, 1909-1940.

Han, S., Qiu, J., 2007. Corporate precautionary cash holdings. *Journal of Corporate Finance* 13, 43–57.

Harford, J., 1999. Corporate cash reserves and acquisitions. *The Journal of Finance* 54, 1969-1997.

Harford, J., Mansi, S.A., Maxwell, W. F., 2008. Corporate governance and firm cash holdings in the US. *Journal of Financial Economics* 87, 535-555.

Harford, J., Klasa, S., Maxwell, W. F., 2014. Refinancing risk and cash holdings. *The Journal of Finance* 69, 975-1012.

Hart, O., Moore, J., 1994. A theory of debt based on the inalienability of human capital. *Quarterly Journal of Economics* 109 (4): 841–79.

Himmelberg, C., Mayer, C., Sinai, T., 2005. Assessing high house prices: Bubbles, fundamentals and misperceptions. *Journal of Economic Perspectives* 19, 67-92.

Houston, J., James, C., 1996. Bank information monopolies and the mix of private and public debt claims. *Journal of Finance* 51, 1863–1889.

Jensen, M. C., 1986, Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76, 323-329.

Jimenez, G., Salas, V., Saurina, J., 2006. Determinants of collateral. *Journal of Financial Economics* 81, 255-281.

Keynes, J. M., 1936. *The General Theory of Employment, Interest and Money*. Harcourt Brace, London.

Nelson, T. R., Potter, T., Wilde, H. H., 2000. Real estate asset on corporate balance sheets. *Journal of Corporate Real Estate* 2 (1): 29–40.

Opler, T., Pinkowitz, L., Stulz, R. M., Williamson, R., 1999. The determinants and implications of corporate cash holdings. *Journal of Financial Economics* 52, 3-46.

Saiz, A., 2010. The geographic determinants of housing supply. *The Quarterly Journal of Economics* 125, 1253-1296.

Staiger, D., Stock, J. H., 1997. Instrumental variables with weak instruments. *Econometrica* 65, 557–86.

Stiglitz, J. E., Weiss, A., 1981. Credit rationing in markets with imperfect information. *American Economic Review* 71 (3): 393–410.

Whited, T., Wu, G., 2006. Financial constraints risk. *Review of Financial Studies* 19, 531-559.

Appendix A Variable Definitions

Variable	Definition *(Compustat data codes are italicised)*
Real estate value	
RE value (using state real estate price index)	The market value of the firm's real estate assets as of year t scaled by the book value of assets, using state real estate price index. Source: Compustat, OFHEO
RE value (MSA real estate price index)	The market value of the firm's real estate assets as of year t scaled by the book value of assets, using MSA real estate price index. Source: Compustat, OFHEO
State real estate price index	Home Price Index (HPI) at the state level, a broad measure of the movement of single-family home prices in the United States. Source: OFHEO
MSA real estate price index	Home Price Index (HPI) at the MSA level, a broad measure of the movement of single-family home prices in the United States. Source: OFHEO
Analysis of Cash Holdings	
Cash/Assets	The ratio of cash and short-term investments to total assets, calculated as *che/at.* Source: Compustat
Cash/Net Assets	The ratio of cash and short-term investments to net assets, calculated as *che/(at-che).*Source: Compustat
Log(Cash/Net Assets)	Log of the ratio of cash and short-term investments to net assets. Source: Compustat
Market/book	Market value of assets over book value of assets: *((at-ceq)+(csho*prcc_f))/at*. Source: Compustat
Log firm size	Log of the real inflation-adjusted book value of total assets (*at*). Source: Compustat
Leverage	All debt (*dltt+dlc*)/*at*. Source: Compustat
Capx/assets	Capital expenditures to total assets: *capx*/*at*. Source: Compustat
Cash flow	Cash flow to total assets: (*oibdp-xint-txt-dvc*)/*at*. Source: Compustat
Dividends paying dummy	Indicator set to 1 if firm pays dividends: Set to 1 if *dvc*>0. Source: Compustat
NWC	Non-cash net working capital to total assets: *(wcap-che)/at.*Source: Compustat
Acq. intensity	Acquisitions to total assets: *aqc/at.* Source: Compustat
R&D/Sales	Expenditures on research and development to sales: *xrd* (set to 0 if missing)/*sale*. Source: Compustat
Ind. cash flow risk	Standard deviation of industry cash flow to firm's total assets. The calculation method follows Bates, Kahle, and Stulz (2009). For each firm-year observation, the standard deviation of cash flow to total assets is calculated for the previous 10 years. We then average the standard deviation of cash flow to total assets each year across each two-digit SIC code. Source: Compustat
Hedging needs	Proxied by the correlation between cash flow and growth opportunities. The higher the correlation indicates lower hedging needs (cash flow is available to finance growth opportunities). The calculation of the correlation between cash flow and growth opportunities follows Acharya, Almeida and Campello (2007). We use quarterly data from Compustat to compute cash flow and growth opportunities and their correlations. Cash flow is measured by the firm's cash flow from current operations. Growth opportunities are measured using industry-level median past-three-year R&D intensity, industry-level median market/book ratio, and industry-level median three-year-ahead sales growth rate. Source: Compustat

Investment Grade	Firms without an investment-grade bond rating (investment-grade meaning splticrm at BBB- or higher) are categorised as financially constrained, and financially unconstrained firms are those whose bonds are rated as investment grade. Source: Compustat
G-index	Taken from Gompers et al. (2003), based on 24 antitakeover provisions. Higher index levels correspond to more managerial power and poorer corporate governance. Source: Gompers et al. (2003)
Institutional ownership	Institutional ownership is measured by the percentage of common shares owned by institutional investors. Source: CDA/Spectrum Institutional 13(f) filings
Analysis of the Marginal Value of Cash Holdings	
Industry-adjusted annual excess stock returns	Fama–French (1997) industry value-weighted returns. Source: Ken French's web site
Size and M/B adjusted annual excess stock returns	Fama–French size and book-to-market matched portfolio returns. Source: Ken French's web site
Leverage	All debt (*dltt+dlc*)/Market value of total assets (*(at-ceq)+(csho*prcc_f)*). Source: Compustat
Constrained (dummy)	A dummy variable with one indicating the firm's Hadlock and Pierce (2010) financial constraint index (HP index) is in the top tertile of the sample and zero otherwise. Source: Compustat
$\Delta Cash_t$	Change in cash (*che*). Source: Compustat
$\Delta Earnings_t$	Change in earnings before extraordinary items (*ib+xint+txdi+itci*). Source: Compustat
$\Delta NetAssets_t$	Change in net assets (*at-che*). Source: Compustat
$\Delta R\&D_t$	Change in R&D (*xrd*, set to 0 if missing). Source: Compustat
$\Delta Interest_t$	Change in interest (*xint*). Source: Compustat
$\Delta Dividends_t$	Change in common dividends (*dvc*). Source: Compustat
$NetFinancing_t$	New equity issues (*sstk−prstkc*) + Net new debt issues (*dltis-dltr*). Source: Compustat

Appendix B

Financial Flexibility and Corporate Cash Holdings: Robustness of Control Variables

This table reports the effect of financial flexibility on corporate cash holdings. The dependent variable is the change in Cash/Assets. RE value is the market value of the firm's real estate assets as of year t scaled by the book value of assets, using state real estate price index. State real estate price index measures the growth in real estate prices in that state from 1993 until that year. All other variables are defined in Appendix A. All regressions control for year and firm fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the state-year level are reported in brackets.

*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable							
	Δ(Cash/Assets)							
	Firm FE	Firm FE	Firm FE	Firm FE	Firm FE	Firm FE	Firm FE	Firm FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ(RE value (using state real estate price index))	-0.146***	-0.109***	-0.111***	-0.085***	-0.123***	-0.122***	-0.152***	-0.151***
	[0.011]	[0.011]	[0.011]	[0.011]	[0.012]	[0.012]	[0.012]	[0.012]
State real estate price index	-0.012	-0.018	-0.012	-0.008	-0.003	-0.003	-0.001	-0.004
	[0.019]	[0.018]	[0.018]	[0.018]	[0.017]	[0.017]	[0.017]	[0.017]
Market/book		0.006***	0.007***	0.007***	0.007***	0.007***	0.008***	0.007***
		[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Log firm size		0.031***	0.029***	0.017***	0.021***	0.021***	0.021***	0.023***
		[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.002]	[0.003]
Leverage			-0.046***	-0.027***	-0.022***	-0.022***	-0.023***	-0.039***
			[0.006]	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]

Cash flow				0.214***	0.211***	0.212***	0.210***	0.216***
				[0.010]	[0.010]	[0.010]	[0.010]	[0.011]
Dividends paying dummy				-0.012***	-0.011***	-0.011***	-0.008**	-0.009***
				[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Acq. intensity					-0.277***	-0.277***	-0.301***	-0.301***
					[0.015]	[0.015]	[0.015]	[0.015]
R&D/sales						0.001	0.002	0.001
						[0.002]	[0.002]	[0.002]
Capx/assets							-0.489***	-0.489***
							[0.026]	[0.026]
NWC								-0.023***
								[0.005]
Ind. cash flow risk			-0.013	0.004	0.024	0.024	0.011	0.018
			[0.100]	[0.100]	[0.100]	[0.100]	[0.100]	[0.099]
State real GDP growth	0.031	-0.007	-0.007	0.007	0.001	0.001	0.042	0.039
	[0.053]	[0.051]	[0.050]	[0.048]	[0.048]	[0.048]	[0.048]	[0.048]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,858	23,858	23,858	23,858	23,858	23,858	23,858	23,858
Adjusted R^2	0.004	0.025	0.032	0.074	0.088	0.088	0.115	0.117

Appendix C

First-Stage Regressions: The Effect of Local Housing Supply Elasticity and the Real Interest Rate on the MSA Real Estate Price Index

This table reports the first-stage regression of the MSA real estate price index on the interaction between the interest rate and local housing supply elasticity, as defined in Saiz (2009). The table essentially replicates the results in columns (1) and (2) of Table 3 in Chaney et al. (2012). Column (1) uses the raw measure of housing supply elasticity, while column (2) use quartile of the elasticity. All regressions control for year as well as MSA fixed effects. Heteroskedasticity-consistent standard errors clustered at the MSA level are reported in brackets.
*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable	
	MSA Real Estate Price Index	
	(1)	(2)
Local housing supply elasticity × Interest rate	0.028***	
	[0.004]	
First quartile of elasticity × Interest rate		-0.064***
		[0.007]
Second quartile of elasticity × Interest rate		-0.046***
		[0.008]
Third quartile of elasticity × Interest rate		-0.014**
		[0.007]
MSA fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
F-test	39.99***	32.89***
Observations	1,358	1,358
Adjusted R^2	0.94	0.94

Table 1
Summary Statistics

This table reports the summary statistics for the major variables used in this paper. The primary sample is drawn from Compustat firms from 1993 to 2007 that existed in 1993. RE value is the market value of the firm's real estate assets as of year *t* scaled by the book value of assets, using a state real estate price index or MSA real estate price index. State real estate price index measures the growth in real estate prices in that state from 1993 until that year. MSA real estate price index measures the growth in real estate prices in that MSA from 1993 until that year. All other variables are defined in Appendix A.

Panel A. Analysis of Cash Holdings

	Mean	Std.	Q1	Median	Q3	Obs.
Cash holdings						
Cash/Assets	0.180	0.222	0.021	0.084	0.258	26,242
Cash/Net Assets	0.304	0.458	0.022	0.091	0.347	26,228
Δ(Cash/Assets)	0.002	0.120	-0.030	0.001	0.040	23,868
Δ(Cash/Net Assets)	0.029	0.605	-0.034	0.001	0.047	23,854
Real estate value						
RE value (using state real estate price index)	0.246	0.396	0	0.061	0.330	26,242
RE value (using MSA real estate price index)	0.240	0.390	0	0.050	0.321	25,275
Δ(RE value (using state real estate price index))	0.005	0.081	-0.002	0	0.002	23,870
Δ(RE value (using MSA real estate price index))	0.005	0.081	-0.001	0	0.001	22,997
State real estate price index	0.602	0.204	0.432	0.572	0.735	26,242
MSA real estate price index	0.597	0.210	0.412	0.571	0.746	25,290
Firm characteristics						
Market/book	2.194	1.805	1.105	1.529	2.473	26,242
Log firm size	4.707	2.298	3.129	4.592	6.287	26,242
Leverage	0.251	0.312	0.025	0.184	0.354	26,242
Capx/assets	0.057	0.056	0.021	0.041	0.073	26,242
Cash flow	-0.005	0.209	-0.026	0.065	0.111	26,242
Dividends paying dummy	0.276	0.447	0	0	1	26,242
NWC	0.064	0.285	-0.035	0.090	0.223	26,242
Acq. Intensity	0.004	0.007	0	0	0.004	26,242
R&D/sales	0.083	0.170	0	0.005	0.077	26,242
Ind. cash flow risk	0.081	0.032	0.052	0.086	0.104	26,242
Land ownership 1993	0.135	0.182	0.000	0.072	0.215	26,242
State real GDP growth	0.036	0.023	0.020	0.036	0.050	26,242

Panel B. Sample used in the Analysis of the Marginal Value of Cash Holdings						
	Mean	Std.	Q1	Median	Q3	Obs.
Excess stock returns during the fiscal year						
Industry-adjusted annual excess stock returns	-0.018	0.604	-0.365	-0.095	0.194	17,015
Size and M/B adjusted annual excess stock returns	-0.022	0.608	-0.380	-0.113	0.180	17,015
Real estate value						
RE value (using state real estate price index)	0.275	0.410	0	0.106	0.373	21,920
RE value (using MSA real estate price index)	0.268	0.403	0	0.097	0.362	21,095
State real estate price index	0.609	0.202	0.438	0.580	0.739	21,920
MSA real estate price index	0.604	0.208	0.420	0.581	0.751	21,107
Firm characteristics						
Leverage	0.179	0.182	0.023	0.128	0.278	21,920
Constrained (dummy)$_t$	0.333	0.471	0	0	1	19,288
(The variables below are scaled by the market value of equity of the firm of fiscal year t - 1.)						
ΔCash$_t$	0.005	0.119	-0.029	0.001	0.035	21,920
Cash$_{t-1}$	0.157	0.213	0.023	0.074	0.193	21,920
ΔEarnings$_t$	0.012	0.177	-0.038	0.007	0.051	21,920
ΔNetAssets$_t$	0.039	0.355	-0.051	0.033	0.149	21,920
ΔR&D$_t$	0.001	0.007	0	0	0.002	21,920
ΔInterest$_t$	0.001	0.015	-0.003	0	0.005	21,920
ΔDividends$_t$	0.001	0.095	0	0	0	21,920
NetFinancing$_t$	0.026	0.177	-0.034	0	0.066	21,920

Table 2
Financial Flexibility and Corporate Cash Holdings

This table reports the effect of financial flexibility on corporate cash holdings. The dependent variables are the change in Cash/Assets in columns (1) to (6), and change in Cash/Net Assets in columns (7) to (12). RE value is the market value of the firm's real estate assets as of year t scaled by the book value of assets, using state real estate price index or MSA real estate price index. State real estate price index measures the growth in real estate prices in that state from 1993 until that year. MSA real estate price index measures the growth in real estate prices in that MSA from 1993 until that year. In instrumental variable (IV) regressions, real estate prices are instrumented using the interaction of interest rates and local housing supply elasticity provided in Saiz (2010). In column (10), we use the interaction between a geographical measure of land (percentage of undeveloped land of each MSA as in Saiz (2010)), rather than real estate price elasticity, and the mortgage rate as the instrumental variable. All other variables are defined in Appendix A. All regressions control for year and industry (or firm) fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the state-year or MSA-year level are reported in brackets.
*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable											
	Δ(Cash/Assets)						Δ(Cash/Net Assets)					
	OLS	Firm FE	Firm FE	Firm FE	Firm FE	IV, Firm FE	Firm FE	Firm FE	IV, Firm FE	IV, Firm FE	Firm FE	IV, Firm FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Δ(RE value (using state real estate price index))	-0.142***	-0.151***	-0.151***	-0.125***			-0.265***					
	[0.010]	[0.011]	[0.012]	[0.011]			[0.054]					
Δ(RE value (using MSA real estate price index))					-0.154***	-0.162***		-0.281***	-0.264***	-0.259***	-0.301***	-0.292***
					[0.012]	[0.021]		[0.055]	[0.099]	[0.100]	[0.054]	[0.100]
State real estate price index	-0.016**	-0.005	-0.004	-0.006			-0.033					
	[0.008]	[0.017]	[0.017]	[0.017]			[0.085]					
MSA real estate price index					-0.017	-0.022		-0.075	-0.046	-0.044	-1.119	3.966*
					[0.017]	[0.057]		[0.080]	[0.291]	[0.364]	[0.874]	[2.200]
Market/book	0.006***	0.007***	0.007***	0.007***	0.007***	0.008***	0.023***	0.023***	0.027***	0.027***	0.023***	0.027***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.008]	[0.009]	[0.006]	[0.009]
Log firm size	0.002***	0.023***	0.023***	0.020***	0.024***	0.025***	0.127***	0.131***	0.142***	0.140***	0.137***	0.142***
	[0.001]	[0.003]	[0.003]	[0.002]	[0.003]	[0.004]	[0.016]	[0.016]	[0.024]	[0.024]	[0.016]	[0.027]
Leverage	-0.017***	-0.039***	-0.039***	-0.024***	-0.039***	-0.041***	-0.186***	-0.182***	-0.197***	-0.196**	-0.176***	-0.196**
	[0.004]	[0.007]	[0.007]	[0.006]	[0.007]	[0.013]	[0.040]	[0.041]	[0.091]	[0.096]	[0.042]	[0.097]

Capx/assets	-0.341***	-0.488***	-0.489***		-0.494***	-0.504***	-1.892***	-1.941***	-2.065***	-2.072***	-1.849***	-1.955***
	[0.018]	[0.026]	[0.026]		[0.027]	[0.049]	[0.147]	[0.150]	[0.267]	[0.282]	[0.145]	[0.264]
Cash flow	0.185***	0.216***	0.216***	0.210***	0.218***	0.219***	0.711***	0.726***	0.736***	0.734***	0.708***	0.714***
	[0.008]	[0.011]	[0.011]	[0.010]	[0.011]	[0.022]	[0.059]	[0.059]	[0.118]	[0.118]	[0.056]	[0.126]
Dividends paying dummy	-0.013***	-0.009***	-0.009***	-0.010***	-0.010***	-0.011**	-0.022	-0.029**	-0.036	-0.036*	-0.026*	-0.029
	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]	[0.005]	[0.014]	[0.014]	[0.022]	[0.021]	[0.015]	[0.023]
NWC	-0.006	-0.023***	-0.023***		-0.022***	-0.025***	-0.056*	-0.053	-0.062	-0.063	-0.060*	-0.074
	[0.003]	[0.005]	[0.005]		[0.006]	[0.009]	[0.033]	[0.034]	[0.055]	[0.055]	[0.036]	[0.057]
Acq. intensity	-0.251***	-0.301***	-0.301***	-0.271***	-0.306***	-0.308***	-0.753***	-0.775***	-0.772***	-0.772***	-0.770***	-0.757***
	[0.013]	[0.015]	[0.015]	[0.015]	[0.015]	[0.029]	[0.053]	[0.053]	[0.095]	[0.094]	[0.055]	[0.097]
R&D/sales	0.003**	0.001	0.001	0.001	0.002	0.001	0.018	0.018	0.011	0.011	0.019	0.012
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.004]	[0.020]	[0.020]	[0.033]	[0.031]	[0.022]	[0.034]
Ind. cash flow risk	-0.021	0.019	0.018	0.100	0.034	0.127	0.991**	1.053**	1.616**	1.632*	1.122**	1.379*
	[0.086]	[0.099]	[0.099]	[0.104]	[0.103]	[0.163]	[0.495]	[0.515]	[0.819]	[0.37]	[0.505]	[0.799]
Land ownership 1993	0.006											
	[0.004]											
State real GDP growth			0.039	0.012			0.327					
			[0.048]	[0.049]			[0.274]					
Ind. fixed effects	Yes	No	No	No	No	No	Yes	No	No	No	No	No
Firm fixed effects	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial controls × MSA real estate prices	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	23,858	23,858	23,858	24,283	22,985	19,332	23,844	22,971	19,321	19,321	22,297	18,732
Adjusted R^2	0.117	0.117	0.117	0.086	0.119	0.119	0.058	0.058	0.058	0.058	0.034	0.033

Table 3
Financial Flexibility and Corporate Cash Holdings: Placebo Tests Using Firms without Real Estate Assets Holding

This table reports placebo tests for the effect of financial flexibility on corporate cash holdings, using firms without real estate assets holding. Specifically, we regress the change of cash on state or MSA real estate price index and the average change of RE value of other firms in the same state/ MSA for firms without real estate assets ownership. The dependent variable is the change in Cash/Net Assets. RE value is the market value of the firm's real estate assets as of year t scaled by the book value of assets, using state real estate price index or MSA real estate price index. State (MSA) real estate price index measures the growth in real estate prices in that state (MSA) from 1993 until that year. All other variables are defined in Appendix A. All regressions control for year and industry (or firm) fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the state-year or MSA-year level are reported in brackets.
*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable	
	Δ(Cash/Net Assets)	
	(1)	(2)
Average change of RE value of other firms in the same state	-0.390	
	[0.905]	
Average change of RE value of other firms in the same MSA		0.338
		[0.558]
State real estate price index	-0.206	
	[0.211]	
MSA real estate price index		-0.197
		[0.196]
Market/book	0.026***	0.027***
	[0.006]	[0.006]
Log firm size	0.180***	0.181***
	[0.023]	[0.021]
Leverage	-0.188***	-0.185***
	[0.056]	[0.061]
Capx/assets	-2.880***	-2.914***
	[0.242]	[0.242]
Cash flow	0.791***	0.799***
	[0.072]	[0.074]
Dividends paying dummy	0.006	0.004
	[0.049]	[0.047]
NWC	-0.067	-0.066
	[0.044]	[0.043]
Acq. Intensity	-1.207***	-1.219***
	[0.101]	[0.101]
R&D/sales	0.015	0.015
	[0.022]	[0.019]
Ind. cash flow risk	1.721	1.776
	[1.182]	[1.199]
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	10,617	10,491
Adjusted R^2	0.064	0.064

Table 4
Financial Flexibility and Corporate Cash Holdings: Hedging Needs

This table reports the subsample tests for the effect of financial flexibility on corporate cash holdings, based on hedging needs, proxied by the correlation between cash flow and growth opportunities. Higher correlation indicates lower hedging needs (cash flow is available to finance growth opportunities). The dependent variable is the change in Cash/Net Assets. The calculation of the correlation between cash flow and growth opportunities follows Acharya, Almeida and Campello (2007). We use quarterly data from Compustat to compute cash flow and growth opportunities and their correlations. Cash flow is measured by the firm's cash flow from current operations. Growth opportunities are measured using industry-level median past-three-year R&D intensity, industry-level median market/book ratio, and industry-level median three-year-ahead sales growth rate. We assign to the group of high correlation those firms for which the empirical correlation between cash flow and growth opportunities is in the top tercile of the sample, and to the group of low correlation those firms for which this correlation is in the bottom tercile of the sample. RE value is the market value of the firm's real estate assets as of year t scaled by the book value of assets, using MSA real estate price index. MSA real estate price index measures the growth in real estate prices in that MSA from 1993 until that year. All other variables are defined in Appendix A. All regressions control for year and firm fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the MSA-year level are reported in brackets. Test "High corr = Low Corr" reports the Wald test of equality of the Δ (RE value) coefficients between the firms with high and low correlations between cash flow and growth opportunities.

*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable					
	Δ(Cash/Net Assets)					
	Corr (Cash Flow, Past-Three-Year R&D Intensity)		Corr (Cash Flow, Market/book)		Corr (Cash Flow, Three-Year-Ahead Sales Growth)	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Δ(RE value (using MSA real estate price index))	-0.090	-0.518***	-0.130	-0.462**	-0.089	-0.521***
	[0.102]	[0.185]	[0.090]	[0.192]	[0.067]	[0.191]
MSA real estate price index	0.313	-0.339	-0.062	0.087	-0.120	0.265
	[0.264]	[0.243]	[0.210]	[0.194]	[0.119]	[0.209]
Market/book	0.035**	0.018**	0.031**	0.008	0.027***	0.014
	[0.015]	[0.009]	[0.012]	[0.009]	[0.009]	[0.013]
Log firm size	0.213***	0.135***	0.135***	0.081***	0.131***	0.081***
	[0.037]	[0.033]	[0.034]	[0.027]	[0.026]	[0.031]
Leverage	-0.103	-0.130	-0.235*	-0.112	-0.115	-0.220***
	[0.119]	[0.092]	[0.125]	[0.086]	[0.094]	[0.084]
Capx/assets	-2.688***	-2.889***	-1.884***	-1.780***	-1.507***	-2.181***
	[0.435]	[0.420]	[0.333]	[0.299]	[0.246]	[0.327]
Cash flow	1.204***	0.635***	1.090***	0.458***	0.798***	0.707***
	[0.176]	[0.137]	[0.207]	[0.130]	[0.116]	[0.158]
Dividends paying dummy	-0.011	-0.073***	-0.047	-0.033	-0.054**	-0.036
	[0.054]	[0.028]	[0.029]	[0.038]	[0.027]	[0.034]
NWC	-0.053	-0.185***	-0.234***	-0.141**	-0.158**	-0.192***
	[0.086]	[0.071]	[0.082]	[0.057]	[0.076]	[0.062]
Acq. intensity	-0.752***	-1.014***	-0.550***	-0.810***	-0.578***	-0.759***
	[0.142]	[0.140]	[0.113]	[0.134]	[0.114]	[0.118]
R&D/sales	0.051	0.006	-0.022	0.033	0.041	-0.007
	[0.051]	[0.038]	[0.060]	[0.043]	[0.044]	[0.049]
Ind. cash flow risk	2.068	2.722	1.057	0.441	-0.305	1.601
	[2.375]	[2.152]	[1.042]	[1.110]	[0.998]	[1.031]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Test "High Corr = Low Corr"	3.97**		3.61*		3.58*	
Observations	3,494	3,299	3,945	3,936	3,953	3,928
Adjusted R^2	0.074	0.095	0.151	0.049	0.139	0.061

Table 5
Further Explorations of Financial Flexibility and Corporate Cash Holdings

This table reports the subsample tests for the effect of financial flexibility on corporate cash holdings, based on growth opportunity, financial constraint, corporate governance, local real estate price volatility, and firm size relative to state GDP in Panels A to E, respectively. The dependent variable is the change in Cash/Net Assets. Growth opportunity category assignments use ex ante criteria based on market to book ratio or mean sales growth rate in the past 5 years, where firms in the top tercile of the market to book ratio or mean sales growth rate in the past 5 years are regarded as those with high growth opportunity and firms in the bottom tercile are assigned as low growth opportunity firms. Financial constraint assignments are based on Hadlock and Pierce (2010) index (HP index), Whited and Wu (2006) index (WW index), firm dividend payout policy, and bond ratings. A firm is regarded as financially constrained if its HP index (WW index) falls in the top tercile of the whole distribution, and unconstrained if in the bottom tercile of the distribution. Firms paying dividends are regarded as unconstrained firms, while firms not paying dividend are constrained firms. Firms without an investment-grade bond rating (investment-grade meaning splticrm at BBB- or higher) are categorized as financially constrained, and financially unconstrained firms are those whose bonds are rated as investment grade. Corporate governance categories are based on product market competition, G-index, and on institutional holdings. A firm is regarded as having good governance if its institutional holding (G-index or HHI) falls in the top (bottom) tercile of the distribution in the sample, and bad governance if its institutional holding (G-index or HHI) falls in the bottom (top) tercile of the distribution. Local real estate price volatility is measured as the standard deviation of the MSA real estate price index in the previous five years for a given MSA. High local real estate price volatility is coded when the local real estate price volatility falls in the top tercile of the sample, and low local real estate price volatility when the local real estate volatility is at the bottom tercile of the sample. RE value is the market value of the firm's real estate assets as of year t scaled by the book value of assets, using MSA real estate price index. In columns (3) to (6) of Panel A, RE value is scaled by the value of net assets for ease of interpretation. MSA real estate price index measures the growth in real estate prices in that MSA from 1993 until that year. All other variables are defined in Appendix A. All regressions control for year and firm fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the MSA-year level are reported in brackets. Test "High Growth Opp. = Low Growth Opp.", Test "Const. = Unconst.", Test "Good Governance = Bad Governance", Test "High Local Real Estate Volatility = Low Local Real Estate Volatility", and Test "Large Size = Small Size" or "High Firm Size/ State GDP = Low Firm Size/ State GDP" report the Wald test of equality of the RE value coefficients between the firms with high growth opportunity and low growth opportunity, with and without financial constraint, with good and bad corporate governance, with high and low local real estate volatility, and small firm in large states and large firm in small states, respectively.

*, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. High vs. Low Growth Opportunity

	Dependent Variable			
	Δ(Cash/Net Assets)			
	Market/book		Mean Sales Growth in the Past 5 Years	
	High	Low	High	Low
	(1)	(2)	(3)	(4)
Δ(RE value)	-0.667***	-0.284***	-0.416***	-0.179***
(using MSA real estate price index)	[0.178]	[0.084]	[0.123]	[0.067]
MSA real estate price index	-0.485**	0.074	-0.141	0.097
	[0.241]	[0.072]	[0.192]	[0.131]
Log firm size	0.222***	0.053**	0.125***	0.206***
	[0.029]	[0.025]	[0.026]	[0.033]
Leverage	-0.130*	-0.240***	-0.255***	-0.159**
	[0.070]	[0.067]	[0.094]	[0.065]
Capx/assets	-3.016***	-0.903***	-1.605***	-1.529***
	[0.308]	[0.129]	[0.199]	[0.273]
Cash flow	0.880***	0.673***	0.828***	0.393***
	[0.104]	[0.115]	[0.123]	[0.091]
Dividends paying dummy	-0.071	-0.031*	-0.009	-0.025
	[0.054]	[0.017]	[0.044]	[0.026]
NWC	-0.102**	-0.392***	-0.126*	-0.098**
	[0.043]	[0.063]	[0.075]	[0.045]
Acq. intensity	-1.561***	-0.371***	-0.607***	-0.876***
	[0.172]	[0.058]	[0.083]	[0.140]
R&D/sales	0.022	0.077	-0.007	0.054
	[0.021]	[0.087]	[0.036]	[0.056]
Ind. cash flow risk	2.219	0.218	1.221	0.961
	[1.903]	[0.478]	[1.050]	[1.036]
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Test "High Growth Opp. = Low Growth Opp."	9.63***		4.03**	
Observations	7,666	7,750	7,148	7,006
Adjusted R^2	0.236	0.400	0.264	0.174

Panel B. Financially Constrained vs. Unconstrained

	Dependent Variable							
	Δ(Cash/Net Assets)							
	HP Index		WW Index		Payout Policy		Investment Grade	
	Const.	Unconst.	Const.	Unconst.	Const.	Unconst.	Const.	Unconst.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ(RE value (using MSA real estate price index))	-0.307***	-0.264**	-0.304***	-0.232**	-0.418***	-0.326***	-0.340***	-0.253***
	[0.046]	[0.104]	[0.035]	[0.116]	[0.091]	[0.060]	[0.048]	[0.038]
MSA real estate price index	-0.085**	0.016	-0.142***	-0.305	-0.020	-0.141***	-0.112***	-0.006
	[0.042]	[0.206]	[0.043]	[0.253]	[0.046]	[0.053]	[0.038]	[0.017]
Market/book	0.029***	0.026***	0.020***	0.025***	0.021***	0.020***	0.021***	0.004
	[0.007]	[0.006]	[0.007]	[0.007]	[0.007]	[0.004]	[0.004]	[0.003]
Log firm size	0.022**	0.257***	-0.003	0.291***	-0.001	0.020***	0.013***	-0.006***
	[0.010]	[0.027]	[0.010]	[0.028]	[0.004]	[0.005]	[0.003]	[0.002]
Leverage	-0.081	-0.152***	-0.053	-0.132**	-0.205***	-0.087***	-0.094***	-0.022
	[0.060]	[0.057]	[0.042]	[0.060]	[0.047]	[0.030]	[0.024]	[0.025]
Capx/assets	-0.724***	-2.615***	-0.840***	-2.811***	-1.306***	-1.490***	-1.434***	-0.332***
	[0.091]	[0.235]	[0.120]	[0.263]	[0.165]	[0.134]	[0.108]	[0.066]
Cash flow	0.131	0.695***	-0.025	0.688***	0.365***	0.565***	0.546***	0.050
	[0.102]	[0.072]	[0.106]	[0.077]	[0.097]	[0.052]	[0.044]	[0.107]
NWC	-0.355***	-0.082**	-0.338***	-0.082*	-0.037	-0.009	-0.009	-0.085**
	[0.074]	[0.041]	[0.084]	[0.042]	[0.065]	[0.027]	[0.022]	[0.040]
Acq. intensity	-0.447***	-1.371***	-0.416***	-1.460***	-0.540***	-0.743***	-0.702***	-0.297***
	[0.051]	[0.142]	[0.045]	[0.168]	[0.075]	[0.068]	[0.046]	[0.040]
R&D/sales	-0.310*	0.014	-0.257	0.018	0.002	0.044**	0.032**	0.130**
	[0.160]	[0.020]	[0.290]	[0.020]	[0.027]	[0.017]	[0.014]	[0.063]

Ind. cash flow risk	0.108	2.623**	-0.054	2.282	0.602	1.149	0.887*	-0.469*
	[0.258]	[1.314]	[0.264]	[1.561]	[0.538]	[0.785]	[0.488]	[0.264]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Test "Const.= Unconst."	6.42**		3.05**		9.56***		2.67*	
Observations	7,634	9,696	6,850	8,723	11,117	8,230	20,716	2,255
Adjusted R^2	0.248	0.050	0.318	0.042	0.056	0.039	0.053	0.102

Panel C. Good vs. Bad Corporate Governance

	Dependent Variable					
	Δ(Cash/Net Assets)					
	Market Competition		G-Index		Institutional Holding	
	High	Low	Low	High	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Δ(RE value) (using MSA	-0.447***	-0.174*	-0.298***	-0.161***	-0.316***	-0.200**
real estate price index)	[0.109]	[0.095]	[0.082]	[0.042]	[0.046]	[0.090]
MSA real estate price index	-0.335	0.064	0.053	-0.017	-0.285***	-0.037
	[0.211]	[0.131]	[0.118]	[0.051]	[0.074]	[0.208]
Market/book	0.010	0.009	0.034***	-0.000	0.032***	0.005
	[0.007]	[0.006]	[0.012]	[0.010]	[0.008]	[0.004]
Log firm size	0.155***	0.080***	0.083***	0.030**	0.076***	0.221***
	[0.026]	[0.021]	[0.031]	[0.012]	[0.015]	[0.028]
Leverage	-0.181**	-0.068	0.082	-0.118**	-0.138	-0.084*
	[0.076]	[0.059]	[0.088]	[0.058]	[0.094]	[0.049]
Capx/assets	-2.367***	-1.817***	-1.139***	-0.582***	-1.319***	-2.042***
	[0.250]	[0.220]	[0.191]	[0.127]	[0.146]	[0.236]
Cash flow	1.182***	0.562***	0.921***	0.156	0.717***	0.464***
	[0.139]	[0.081]	[0.192]	[0.178]	[0.140]	[0.073]
Dividends paying dummy	-0.033	0.013	-0.049**	0.020	-0.029***	0.052
	[0.024]	[0.034]	[0.023]	[0.014]	[0.010]	[0.070]
NWC	-0.087	0.024	-0.456***	-0.305***	-0.345***	-0.035
	[0.074]	[0.052]	[0.176]	[0.110]	[0.072]	[0.042]
Acq. intensity	-0.872***	-0.855***	-0.653***	-0.223***	-0.577***	-0.966***
	[0.112]	[0.100]	[0.108]	[0.045]	[0.060]	[0.133]
R&D/sales	0.022	0.028	-0.061	-0.025	0.040	0.016
	[0.014]	[0.033]	[0.060]	[0.125]	[0.045]	[0.018]
Ind. cash flow risk	1.517	0.142	0.262	-0.074	0.006	0.864
	[1.262]	[0.713]	[0.599]	[0.422]	[0.368]	[1.463]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Test "Good Governance = Bad Governance"	8.30***		5.30**		20.09***	
Observations	7,620	7,498	2,632	1,424	7,913	7,108
Adjusted R^2	0.030	0.087	0.145	0.088	0.212	0.038

Panel D. High vs. Low Local Real Estate Price Volatility

	Dependent Variable	
	Δ(Cash/Net Assets)	
	Local Real Estate Volatility	
	High	Low
	(1)	(2)
Δ(RE value)	-0.191**	-0.245***
(using MSA real estate price index)	[0.092]	[0.091]
MSA real estate price index	-0.393	-0.295
	[0.312]	[0.313]
Market/book	0.015**	0.003
	[0.008]	[0.007]
Log firm size	0.202***	0.203***
	[0.032]	[0.030]
Leverage	-0.346***	-0.088
	[0.074]	[0.081]
Capx/assets	-2.018***	-2.335***
	[0.291]	[0.299]
Cash flow	0.671***	0.801***
	[0.115]	[0.118]
Dividends paying dummy	-0.022	0.025
	[0.023]	[0.029]
NWC	-0.142**	-0.116
	[0.071]	[0.078]
Acq. intensity	-0.799***	-0.782***
	[0.100]	[0.101]
R&D/sales	0.010	0.007
	[0.032]	[0.029]
Ind. cash flow risk	-1.821*	1.019
	[1.038]	[0.969]
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Test "High Local Real Estate Volatility = Low Local Real Estate Volatility"	3.55*	
Observations	7,020	7,402
Adjusted R^2	0.102	0.146

Panel E. Small Firms in Large States vs. Large Firms in Small States

	Dependent Variable			
	Δ(Cash/Net Assets)			
	Firm Size		Firm Size/ State GDP	
	Large	Small	High	Low
	(1)	(2)	(3)	(4)
Δ(RE value)	-0.317***	-0.417***	-0.325***	-0.431***
(using state real estate price index)	[0.036]	[0.101]	[0.037]	[0.102]
State real estate price index	-0.153***	-0.374	-0.054	-0.125
	[0.059]	[0.305]	[0.052]	[0.287]
Market/book	0.030***	0.009	0.019***	0.010
	[0.008]	[0.007]	[0.007]	[0.006]
Leverage	-0.115***	-0.085	-0.099*	-0.115*
	[0.044]	[0.061]	[0.057]	[0.060]
Capx/assets	-0.978***	-2.462***	-0.718***	-2.553***
	[0.134]	[0.256]	[0.100]	[0.272]
Cash flow	0.216*	0.779***	0.268**	0.805***
	[0.125]	[0.074]	[0.113]	[0.071]
Dividends paying dummy	-0.011*	0.019	-0.011*	0.029
	[0.006]	[0.059]	[0.006]	[0.049]
NWC	-0.215***	0.068*	-0.259***	0.055
	[0.052]	[0.040]	[0.059]	[0.040]
Acq. intensity	-0.395***	-0.919***	-0.346***	-0.829***
	[0.042]	[0.197]	[0.043]	[0.185]
R&D/sales	-0.079	0.013	0.153	0.023
	[0.115]	[0.022]	[0.124]	[0.022]
Ind. cash flow risk	-0.164	0.960	-0.180	1.649
	[0.259]	[1.554]	[0.262]	[1.469]
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Test "Large Size = Small Size" or "High Firm Size/ State GDP = Low Firm Size/ State GDP"	0.15		0.86	
Observations	7,618	7,937	7,447	8,116
Adjusted R^2	0.219	0.236	0.109	0.214

Table 6
Financial Flexibility and the Marginal Value of Cash Holdings

This table reports the effect of financial flexibility on the marginal value of cash holdings. In columns (1) to (5), the dependent variable is the industry-adjusted excess returns during fiscal year *t*, and in columns (6) to (10), it is the size and market-to-book adjusted excess returns of the stock during fiscal year *t*. RE value is the market value of the firm's real estate assets as of year *t* scaled by the book value of assets, using state real estate price index or MSA real estate price index. State (MSA) real estate price index measures the growth in real estate prices in that state (MSA) from 1993 until that year. In OLS (High RE value) regressions, RE value is replaced by a dummy variable High RE value, with one indicating that the market value of the real estate asset held by the firm is larger than the sample median, and zero otherwise. In instrumental variable (IV) regressions, real estate prices are instrumented using the interaction of interest rates and local housing supply elasticity provided in Saiz (2010). All other variables are defined in Appendix A. All regressions control for year and industry (or firm) fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the state-year or MSA-year level are reported in brackets. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable									
	Industry-Adjusted Annual Excess Stock Returns					Size and M/B Adjusted Annual Excess Stock Returns				
	OLS	OLS	OLS (High RE value)	Firm FE	IV	OLS	OLS	OLS (High RE value)	Firm FE	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta Cash_t$	1.522***	1.541***	1.621***	1.623***	1.522***	1.650***	1.666***	1.728***	1.762***	1.654***
	[0.113]	[0.124]	[0.131]	[0.125]	[0.139]	[0.120]	[0.130]	[0.138]	[0.129]	[0.146]
RE value × $\Delta Cash_t$	-0.421**	-0.438**	-0.361***	-0.367**	-0.533***	-0.519***	-0.541***	-0.366***	-0.452**	-0.622***
	[0.175]	[0.178]	[0.119]	[0.181]	[0.205]	[0.173]	[0.180]	[0.120]	[0.183]	[0.205]
RE value (using state real estate price index)	0.039***					0.014				
	[0.012]					[0.012]				
RE value (using MSA real estate price index)		0.038***	0.033***	0.130***	0.043**		0.015	0.019*	0.111***	0.014
		[0.012]	[0.010]	[0.035]	[0.019]		[0.012]	[0.011]	[0.036]	[0.019]
State real estate price index	0.073					0.009				
	[0.062]					[0.073]				
MSA real estate price index		0.071	0.057	-0.068	0.105		0.026	0.018	-0.268***	0.068
		[0.044]	[0.045]	[0.097]	[0.088]		[0.046]	[0.046]	[0.101]	[0.090]
$Cash_{t-1}$ × $\Delta Cash_t$	-0.528***	-0.541***	-0.521***	-0.435***	-0.462***	-0.565***	-0.573***	-0.549***	-0.447***	-0.509***
	[0.106]	[0.111]	[0.111]	[0.131]	[0.179]	[0.110]	[0.115]	[0.114]	[0.138]	[0.173]

$Leverage_t \times \Delta Cash_t$	-1.387***	-1.325***	-1.249***	-1.454***	-1.320***	-1.496***	-1.425***	-1.368***	-1.603***	-1.395***
	[0.244]	[0.261]	[0.265]	[0.274]	[0.292]	[0.250]	[0.266]	[0.268]	[0.278]	[0.297]
Constrained $(dummy)_t \times \Delta Cash_t$	0.037	0.039	-0.007	-0.024	0.010	-0.038	-0.036	-0.072	-0.105	-0.061
	[0.113]	[0.128]	[0.131]	[0.135]	[0.189]	[0.118]	[0.134]	[0.137]	[0.141]	[0.185]
$Cash_{t-1}$	0.304***	0.313***	0.324***	0.708***	0.324***	0.260***	0.271***	0.281***	0.707***	0.278***
	[0.036]	[0.039]	[0.039]	[0.059]	[0.082]	[0.041]	[0.042]	[0.041]	[0.063]	[0.082]
$Leverage_t$	-0.557***	-0.545***	-0.547***	-1.196***	-0.533***	-0.718***	-0.704***	-0.707***	-1.376***	-0.703***
	[0.036]	[0.034]	[0.034]	[0.063]	[0.068]	[0.036]	[0.035]	[0.035]	[0.064]	[0.070]
Constrained $(dummy)_t$	-0.040***	-0.040***	-0.036***	0.072***	-0.033*	-0.041***	-0.041***	-0.037***	0.081***	-0.034*
	[0.014]	[0.013]	[0.013]	[0.024]	[0.019]	[0.014]	[0.013]	[0.013]	[0.025]	[0.019]
$\Delta Earnings_t$	0.259***	0.261***	0.260***	0.228***	0.256***	0.270***	0.272***	0.270***	0.239***	0.266***
	[0.029]	[0.028]	[0.028]	[0.028]	[0.060]	[0.029]	[0.030]	[0.030]	[0.029]	[0.062]
$\Delta NetAssets_t$	0.188***	0.198***	0.196***	0.165***	0.204***	0.195***	0.204***	0.203***	0.175***	0.212***
	[0.023]	[0.021]	[0.021]	[0.022]	[0.042]	[0.022]	[0.021]	[0.021]	[0.022]	[0.042]
$\Delta R\&D_t$	0.715**	0.724***	0.711**	0.739**	0.580	0.777***	0.779***	0.772***	0.742***	0.633
	[0.288]	[0.278]	[0.278]	[0.287]	[0.540]	[0.282]	[0.277]	[0.277]	[0.284]	[0.547]
$\Delta Interest_t$	-0.709**	-0.766***	-0.752**	-0.288	-0.954*	-0.757**	-0.799***	-0.782***	-0.306	-0.979*
	[0.294]	[0.295]	[0.296]	[0.323]	[0.589]	[0.297]	[0.299]	[0.300]	[0.331]	[0.582]
$\Delta Dividends_t$	0.126***	0.124***	0.121***	0.133***	0.123**	0.126***	0.125***	0.122***	0.137***	0.122**
	[0.031]	[0.031]	[0.032]	[0.032]	[0.054]	[0.032]	[0.032]	[0.033]	[0.032]	[0.056]
$NetFinancing_t$	-0.115***	-0.126***	-0.128***	-0.071	-0.119	-0.088**	-0.099**	-0.100**	-0.054	-0.093
	[0.039]	[0.041]	[0.041]	[0.044]	[0.082]	[0.039]	[0.041]	[0.041]	[0.044]	[0.082]
Ind. fixed effects	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Firm fixed effects	No	No	No	Yes	No	No	No	No	Yes	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,015	16,380	16,380	16,380	13,702	17,015	16,380	16,380	16,380	13,702
Adjusted R^2	0.131	0.131	0.132	0.148	0.130	0.150	0.150	0.151	0.174	0.148

Table 7
Further Explorations of Financial Flexibility and the Marginal Value of Cash Holdings

This table reports the subsample tests for the effect of financial flexibility on the marginal value of cash holdings. The dependent variable is the industry-adjusted excess returns during fiscal year t. Financial constraint assignments are based on Hadlock and Pierce (2010) index (HP index), Whited and Wu (2006) index (WW index), firm dividend payout policy and bond ratings. A firm is regarded as financially constrained if its HP index (WW index) falls in the top tercile of the whole distribution, and unconstrained if in the bottom tercile of the distribution. Firms paying dividends are regarded as unconstrained firms, while firms not paying dividends are constrained firms. Firms without an investment-grade bond rating (splticrm at BBB or higher) are categorised as financially constrained, and financially unconstrained firms are those whose bonds are rated as investment grade. RE value is the market value of the firm’s real estate assets as of year t scaled by the book value of assets, using state real estate price index or MSA real estate price index. MSA real estate price index measures the growth in real estate prices in that MSA from 1993 until that year. All other variables are defined in Appendix A. All regressions control for year and industry fixed effects, whose coefficient estimates are suppressed. Heteroskedasticity-consistent standard errors clustered at the MSA-year level are reported in brackets. Test "Const. = Unconst." reports the Wald test of equality of the coefficients of change in cash and the interaction between RE value and change in cash between the firms with and without financial constraint. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

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	Dependent Variable							
	Industry-Adjusted Annual Excess Stock Returns							
	HP Index		WW Index		Payout Policy		Investment Grade	
	Const.	Unconst.	Const.	Unconst.	Const.	Unconst.	Const.	Unconst.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta Cash_t$	1.658***	0.925***	1.932***	1.312***	1.576***	1.379***	1.580***	1.601***
	[0.100]	[0.189]	[0.248]	[0.144]	[0.096]	[0.247]	[0.093]	[0.509]
RE value × $\Delta Cash_t$	-0.559**	0.122	-0.611*	0.255	-0.524**	-0.133	-0.460***	0.514
	[0.217]	[0.266]	[0.339]	[0.285]	[0.205]	[0.310]	[0.176]	[0.448]
RE value (using MSA real estate price index)	0.048***	0.023	0.018	0.043	0.065***	0.023	0.045***	0.008
	[0.018]	[0.014]	[0.015]	[0.026]	[0.018]	[0.014]	[0.014]	[0.021]
MSA real estate price index	0.092	0.063	0.033	0.200*	0.139**	-0.034	0.092*	0.012
	[0.057]	[0.054]	[0.054]	[0.109]	[0.061]	[0.048]	[0.048]	[0.064]
$Cash_{t-1}$ × $\Delta Cash_t$	-0.590***	-0.199	-0.509***	-0.259	-0.549***	-0.264	-0.563***	1.272***
	[0.121]	[0.199]	[0.167]	[0.210]	[0.116]	[0.197]	[0.112]	[0.476]
$Leverage_t$ × $\Delta Cash_t$	-1.454***	-0.874**	-2.383***	-1.138**	-1.274***	-1.909***	-1.345***	-3.715**
	[0.278]	[0.422]	[0.576]	[0.458]	[0.260]	[0.465]	[0.238]	[1.890]
$Cash_{t-1}$	0.326***	0.239***	0.197***	0.531***	0.319***	0.265***	0.304***	0.541***
	[0.045]	[0.046]	[0.068]	[0.068]	[0.044]	[0.050]	[0.039]	[0.161]
$Leverage_t$	-0.564***	-0.439***	-0.520***	-0.550***	-0.596***	-0.418***	-0.537***	-0.546***
	[0.041]	[0.049]	[0.056]	[0.064]	[0.042]	[0.051]	[0.036]	[0.077]
$\Delta Earnings_t$	0.241***	0.396***	0.162***	0.250***	0.237***	0.694***	0.262***	0.412***
	[0.030]	[0.062]	[0.061]	[0.040]	[0.029]	[0.100]	[0.028]	[0.095]
$\Delta NetAssets_t$	0.235***	0.066	0.142***	0.265***	0.194***	0.224***	0.205***	0.118***
	[0.023]	[0.040]	[0.036]	[0.037]	[0.023]	[0.035]	[0.022]	[0.036]
$\Delta R\&D_t$	0.704**	1.315**	0.588	0.435	0.820***	0.180	0.777***	0.331
	[0.293]	[0.637]	[0.734]	[0.309]	[0.300]	[0.558]	[0.281]	[0.781]
$\Delta Interest_t$	-0.611*	-1.708***	-0.174	-1.204**	-0.654**	-2.599***	-0.840***	-0.084
	[0.328]	[0.563]	[0.552]	[0.530]	[0.308]	[0.764]	[0.298]	[1.159]
$\Delta Dividends_t$	0.111***	1.025***	0.110***	0.367	0.261	0.055	0.124***	0.538
	[0.024]	[0.335]	[0.020]	[0.274]	[0.282]	[0.038]	[0.031]	[1.025]
$NetFinancing_t$	-0.134***	-0.089	-0.112*	-0.050	-0.122***	-0.117	-0.125***	-0.071
	[0.048]	[0.066]	[0.064]	[0.077]	[0.046]	[0.073]	[0.042]	[0.084]
Ind. fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Test "Const.= Unconst."	12.23***		6.07**		5.28*		5.24*	
Observations	5,352	5,632	5,824	4,781	10,436	5,944	13,938	2,442
Adjusted R^2	0.134	0.162	0.167	0.122	0.128	0.186	0.131	0.183