The Collateral Channel: How Real Estate Shocks Affect Corporate Investment: Comment

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Abstract

Chaney, Sraer and Thesmar (2012) find that over the 1993–2007 period, a $1 increase in collateral (the value of real estate a firm actually owns) leads the representative US public corporation to raise its investment by $0.06. We first demonstrate that data Winsorization induces a strong bias in favour of finding this result. There is no relationship ($0.00 per $1) between the value of real estate a firm owns and its investment in the unaltered data. We also show that the identification approach based on local variations in real estate prices does not provide evidence on the collateral channel.

JEL classification: D22, G31, R30

Key words: Collateral, Real Estate Prices, Corporate Investment, Winsorization, Aggregate Shocks

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In “The Collateral Channel: How Real Estate Shocks Affect Corporate Investment”, Chaney, Sraer and Thesmar (2012)—henceforth, CST—study how variations in the value of real estate a firm owns affects its level of investment. They find that over the 1993–2007 period, a $1 increase in collateral (the value of real estate a firm actually owns) leads the representative US public corporation to raise its investment by 6 cents ($0.06). CST emphasize the economic significance of this sensitivity as real estate represents a sizeable fraction of the tangible assets that firms hold on their balance sheet.

In this comment, we show the fragility of their findings on the collateral channel in two ways. First, we show that Winsorization of data prior to the empirical analysis introduces a strong bias in favour of finding evidence for the collateral channel. In the unaltered data there is no evidence. The point estimate implies a 0 cent ($0.00) increase in the firm’s investment for a $1 increase in the value of its real estate. We provide an explanation for why Winsorization produces the bias. Second, even when the data is Winsorized as in CST, we demonstrate that their main quantitative finding—the 6 cents sensitivity of investment to a $1 increase in the real value of collateral a firm actually owns—is not robust to an econometric correction of their baseline specification and to the presence of real estate shocks common to all real estate holding firms (aggregate shocks). We find that the sensitivity of investment to local real estate shocks, as in CST, is $1.6$ cents while the sensitivity to aggregate real estate shocks is $4.5$ cents. This finding shows that CST’s identification strategy based on the comparison of investment by land-holding firms across areas with different variations in real estate prices (page 2382) does not identify a firm’s investment sensitivity to each additional dollar of real estate that the firm actually owns. We find no evidence for the collateral channel when using the unaltered data in this specification.

I. Empirical Specification

The main empirical specification from CST (using the same notation as in their paper) is

\[ INV_{it}^l = \alpha_i + \delta_t + \beta RE Value_{it} + \gamma P^l_t + \text{controls}_{it} + \epsilon_{it} \]

(1)

where \( INV_{it}^l \) is investment by firm \( i \) at time \( t \) located in the Metropolitan Statistical Area (MSA) \( l \). Parameters \( \alpha_i \) are firm fixed effects and \( \delta_t \) are time dummy variables designed to capture
macroeconomic fluctuations in real estate prices. \( REValue_{it} \) measures the market value of real estate assets owned by firm \( i \) at time \( t \). Due to data limitations, it is assumed that all real estate owned by a firm is located in MSA \( l \). \( P^l_t \) measures real estate prices at time \( t \) in area \( l \), and \( controls_{it} \) include the amount of cash on the balance sheet, the previous year’s ratio of the market value of the equity to the book value of equity, and the interaction of residential real estate prices with controls for ownership of real estate assets (i.e., quintile of firm age, return on assets, firm size measured by the total amount of assets, industry dummy and state dummy).\(^1\) All variables except market value of equity to book value of equity are normalized by past year’s Property Plant and Equipment (PPE).

Parameter \( \beta \) in (1) is the coefficient of interest in CST’s empirical analysis since it captures the sensitivity of investment to variations in real estate value the firm \textit{actually} owns.

Since real estate prices, and hence the value of real estate owned by a firm, are likely correlated with its investment opportunities, CST use the Instrumental Variables (IV) approach. They use the following first-stage specification

\[
P^l_t = \alpha^l + \delta_t + \gamma E^l_t \times IR_t + u^l_t
\]

where \( \alpha^l \) are MSA level fixed effects, \( \delta_t \) are time dummy variables. \( E^l \) are the housing supply elasticities developed in Saiz (2010), and \( IR_t \) is the nationwide real interest rate at which banks refinance their home loans at time \( t \).

II. Evidence for the Collateral Channel

A. The Effect of Winsorization

CST follow—Winsorization—a common practice in finance and labour economics studies to ‘clean the data’.\(^2\) Winsorizing reduces values at the low and high ends of the sorted data to a predetermined cut-off point. As discussed in Bollinger and Chandra (2005), however, Winsorizing

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\(^1\)We use the data and programs available for the CST paper on the AER webpage. In addition, we downloaded firm level financial data from COMPUSTAT via WRDS and followed instructions from the readme file to merge this data with what is available on the AER webpage. All of our results use MSA level real estate prices. Chaney et al. (2012) report results using office prices but note that all of their results hold using MSA prices.

\(^2\)See, for example, Grinold and Kahn (2000), Angrist and Krueger (2000), among others. Tukey (1962) coined the term Winsorizing or Winsorization in honour of Charles P. Winsor.
data can induce or exacerbate biases in estimation. We demonstrate that this problem is severe for CST’s finding: their main result (6 cents increase in investment per $1 increase in the value of real estate the firm owns) is obtained only if the data is Winsorized.

Specifically, CST use the following Winsorization rule:

Finally, to ensure that our results are statistically robust, all variables defined as ratios are winsorized using as thresholds the median plus/minus five times the interquartile range. CST, p. 2386

This Winsorization for the key variables of interest gives a cut-off of 1.72 for $INV_{it}^l$ and 5.51 for $RE\ Value_{it}$. In the data, the cut-off for these variables is binding only on the upper threshold of the interquartile range. Therefore, the Winsorized data for these two variables used in estimation is characterized as

$$INV_{it}^l = \begin{cases} 1.72 & \text{if } INV_{it}^l \geq 1.72 \\ INV_{it}^l & \text{Otherwise} \end{cases}$$

(3)

$$RE\ Value_{it} = \begin{cases} 5.51 & \text{if } RE\ Value_{it} \geq 5.51 \\ RE\ Value_{it} & \text{Otherwise} \end{cases}$$

(4)

Table 1 compares CST’s main result (left column) to the case when the data is unaltered (right column). As shown in the table, the coefficient of interest (highlighted in bold) drops from 0.056 (nearly 6 cents increase in investment per dollar of increase in the value of real estate the firm owns) to essentially zero cents. Importantly, this finding shows that Winsorization is not a robustness exercise in the usual sense because without it, the estimated coefficient is not statistically different from zero.

Why does Winsorization have a drastic effect on CST’s findings? The intuition is as follows. Detecting the presence of the collateral channel requires a positive relationship between a firm’s $RE\ Value$ and investment. There are two categories of observations in the data that weaken this link. First, the observations with very high investment rates but very small $RE\ Value$ (i.e., they essentially do not own real estate). Second, the observations with very high $RE\ Value$ but low or moderate investment rates. A third category, those observations with high $RE\ Value$ and high investment rates, tend to support the positive link. When the data is unaltered, the effect of
Table 1: The Impact of Winsorizing Data on CST’s results

<table>
<thead>
<tr>
<th></th>
<th>Winsorized Data</th>
<th>Unaltered Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE Value (MSA Res. Prices), $\beta$</td>
<td>0.056***</td>
<td>-0.0002</td>
</tr>
<tr>
<td>MSA Res. Prices, $\gamma$</td>
<td>-0.0176</td>
<td>85.234</td>
</tr>
<tr>
<td>Cash</td>
<td>0.030***</td>
<td>-0.115</td>
</tr>
<tr>
<td>Market/Book</td>
<td>0.063***</td>
<td>-0.021</td>
</tr>
<tr>
<td>Init. Controls $\times$ MSA Res. Prices</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>16,320</td>
<td>16,320</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.317</td>
<td>0.060</td>
</tr>
</tbody>
</table>

Notes: Instrumental variables (IV) estimation (Saiz elasticity $\times$ interest rate).

the first two categories dominates the third as there is a large number of observations in those two categories (1479 observations) compared to the third (21 observations). With Winsorizing, a significant bias is introduced in favour of strengthening a positive relationship—the evidence for the collateral channel—between RE Value and INV. Figure 1 shows the effects of Winsorization on the main variables of interest after applying the cut-offs shown in (3) and (4). It is helpful to link the quadrants with type I- and type II- errors. The null hypothesis is that a firm’s RE Value does not matter for investment, or that $\beta = 0$. The alternative is that $\beta > 0$. Winsorization, in effect, increases the chance of a type I error of rejecting the null hypothesis when it is true. As indicated in the upper-left quadrant I, Winsorization pushed down 716 observations with very high investment rates and very low to moderate actual RE Values (i.e., when the data is unaltered) to the threshold level. This transformation biases the data towards finding a positive relationship between RE Value and investment, or the evidence in favour of the collateral channel. Similarly for the 763 observations in the lower-right quadrant II, pushing high RE Values lower with corresponding low to moderate investment also increases the chance of a type I error and favours finding evidence for the collateral channel.

There are 21 observations that fall into the top-right quadrant III. Pushing these values down and to the left increases the chance of a type II error of not rejecting the null hypothesis when it is
false. In principle, this would be a good robustness check for CST. If the evidence for the collateral channel were present in the unaltered data and survived after pushing down these observations, that would indeed indicate the statistical robustness of the results. But as mentioned above, there are only 21 observations in this category, too few to offset the bias due the relatively large number of observations in quadrants I and II.

B. National, Rather Than Local, Shocks to Real Estate Prices Matter for Investment

CST’s identification strategy is based on the comparison of investment by land-holding firms across areas with different variations in real estate prices (page 2382). We re-examine the robustness of this identification to the presence of aggregate real estate shocks that are common to all real estate holding firms.

An Econometric Correction to Eliminate Bias:

Before proceeding, we make an econometric correction to CST’s baseline specification (1). The reason for this correction is as follows: The variable of interest, $RE\ Value_{it}$, is an interaction term
between (i) the initial real estate value $RE Value_{i,1993}$ normalized by $PPE_{i,t-1}$ and (ii) $P^d_t$, given as

$$RE Value_{it} = P^d_t \times \frac{RE Value_{i,1993}}{PPE_{i,t-1}} \equiv P^d_t \times RE Value_{i,1993}$$

where $RE Value_{i,1993}$ is the initial market value of real estate in 1993 normalized by lagged Property Plant and Equipment, $PPE_{i,t-1}$. Balli and Sørensen (2013) show that if a regression has an interaction term, say $X_1 \times X_2$, then the main terms $X_1$ and $X_2$ should be included in the empirical specification. If the main terms are not included then the interaction effect may be significant due to left-out variable bias. Since CST include only one of the main terms $P^d_t$ but not $RE Value_{i,1993}$, it is likely that the estimated $\beta$ is subject to this source of bias. Following Balli and Sørensen’s (2013) recommendation, therefore, we include $RE Value_{i,1993}$ in the empirical specification.

**Aggregate Shocks to Real Estate Holding Firms:**

We introduce the aggregate shocks that are common to all real estate holding firms by considering firms’ real estate value at the national price level denoted as $P^N_t$.

$$RE Value^N_{it} = P^N_t \times \frac{RE Value_{i,1993}}{PPE_{i,t-1}} \equiv P^N_t \times RE Value_{i,1993}$$

The modified specification that we estimate is

$$INV^I_{it} = \alpha_i + \delta_t + \beta RE Value_{it} + \phi RE Value^N_{it} + \gamma P^d_t + \psi RE Value_{i,1993} + controls_{it} + \varepsilon_{it}$$

We do not include $P^N_t$ by itself in specification (7) as it is perfectly collinear with the year fixed effects $\delta_t$ which is already present in the regression.

The results in Table 2 show that even when the data is Winsorized as in CST, the main quantitative finding—the 6 cents sensitivity of investment to a $1 increase in the real value of collateral a firm actually owns—is not robust to the econometric correction of their baseline specification and to

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3. The market value of real estate a firm owns can be estimated from balance sheet data only up to 1993 because that was the last year accumulated depreciation was recorded in COMPUSTAT. Thus, $RE Value_{i,1993}$ measures the initial market value of real estate estimated from balance sheet data and $RE Value_{it}$ measures movements in the market value of those specific real estate assets coming from movements in $P^d_t$. This data limitation is why CST restrict their sample to active firms in 1993.

4. To ensure that the main term matches what is in the interaction term, we Winsorize $RE Value_{i,1993}$ and then multiply by $P^d_t$.

5. Our national real estate price index is constructed by the Office of Federal Housing Enterprise Oversight. This is the same data source used by CST to measure MSA level real estate prices, $P^N_t$. 

6
Table 2: Real Estate Prices and Investment Behaviour: Local versus Aggregate Real Estate Shocks

<table>
<thead>
<tr>
<th></th>
<th>Winsorized Data</th>
<th>Unaltered Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE Value (MSA Res. Prices), $\beta$</td>
<td>-0.0164</td>
<td>-0.0154</td>
</tr>
<tr>
<td>RE Value (National Prices), $\phi$</td>
<td>0.0452*</td>
<td>-0.0576</td>
</tr>
<tr>
<td>MSA Res. Prices, $\gamma$</td>
<td>0.001</td>
<td>54.221</td>
</tr>
<tr>
<td>RE Value (1993), $\psi$</td>
<td>0.007</td>
<td>0.0522</td>
</tr>
<tr>
<td>Cash</td>
<td>0.030***</td>
<td>-0.115</td>
</tr>
<tr>
<td>Market/Book</td>
<td>0.062***</td>
<td>-0.022</td>
</tr>
<tr>
<td>Init. Controls x MS Res. Prices</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
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<td>Yes</td>
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</tr>
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Notes: Instrumental variables (IV) estimation (Saiz elasticity × interest rate). *** denotes statistical significance at the 1% level, * denotes statistical significance at the 10% level.

the presence of aggregate real estate shocks common to all real estate holding firms. The sensitivity of investment to local real estate shocks, as in CST, is -1.6 cents and statistically insignificant while the sensitivity to aggregate real estate shocks is 4.5 cents, and statistically significant at the 10% level.\(^6\) This finding shows that CST's identification strategy based on local variations in real estate prices does not identify a firm's investment sensitivity to each additional dollar of real estate that the firm actually owns.\(^7\) Again, in the unaltered data there is no evidence for the collateral channel as shown in the third column of Table 2.

III. Conclusion

We re-examine the finding of Chaney, Sraer and Thesmar (2012) that over the 1993–2007 period, a

\(^6\)For the Winsorized data, when only the econometric correction is considered in the empirical specification, the estimated sensitivity reduces by half from approximately 6 cents as in Table 1 to approximately 3 cents. In the unaltered data, there is no evidence for the sensitivity of investment to real estate shocks. These results are available upon request.

\(^7\)We also checked whether land holding firms make larger debt issuances and repayments when the value of their real estate increases (Table 8 in CST). The results for local shocks to real estate value are statistically insignificant, similar to those in Table (2) for the Winsorized data.
$1 increase in collateral (the value of real estate a firm actually owns) leads the representative US public corporation to raise its investment by $0.06. We first demonstrate that data Winsorization induces a strong bias in favour of finding this result. There is no relationship ($0.00 per $1) between the value of real estate a firm owns and its investment in the unaltered data. We further show that even with Winsorized data, corporate investment is affected by aggregate real estate shocks instead of local real estate shocks. Our finding, therefore, shows that CST’s identification based on local real estate price variation does not provide evidence on the collateral channel.
References


