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The Granular Origins of House Price Volatility

Isaiah Hull, Conny Olovsson, Karl Walentin and Andreas Westermark

December 2017
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The Granular Origins of House Price Volatility*

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Abstract

Recent work has shown that microeconomic shocks at the firm and sector level account for a substantial share of output volatility. We examine whether this relationship holds for house price growth volatility, which also declined during the Great Moderation and increased after 2001. Using a novel dataset of all property transactions in Sweden over the 2009-2017 period, we demonstrate that the following are positively associated with house price growth volatility: 1) the employment, income, and output shares of a volatile sector (manufacturing); 2) employment growth volatility; and 3) exposure to idiosyncratic shocks to firms. (JEL E30, O14, R20)

Keywords: Idiosyncratic Shocks, Great Moderation, Real Estate

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1 Introduction

Recent work has shown that a substantial share of aggregate fluctuations originate from granular shocks.\footnote{An early theoretical literature explores how standard macroeconomic models can be modified to incorporate sector and firm level shocks that drive aggregate fluctuations. See Jovanovic (1987), Horvath (1998), Horvath (2000), and Bak et al. (1998), which depart from the Lucas (1977) assumption that granular shocks “average out” and do not generate aggregate fluctuations.} Gabaix (2011) finds that the 100 largest firms account for one-third of U.S. output fluctuations. Carvalho and Gabaix (2013) and Acemoglu et al. (2012) demonstrate that sectoral shocks also affect output volatility; and Carvalho and Gabaix (2013) show that the decline in manufacturing, which is a volatile sector, contributed to the decline in output volatility often referred to as the Great Moderation. Mack and Martinez-Garcia (2012) find that house price growth volatility also experienced a secular decline over the same period; however, the origins of the latter decline remain understudied.\footnote{While volatility remains understudied in our context, existing work explores the impact of manufacturing employment on housing returns (Case and Mayer (1996)).}

We examine whether the same granular factors explain house price growth volatility using a unique dataset of all property transactions in Sweden over the 2009-2017 period. Our dataset allows us to exploit geographic and time variation to identify the impacts of manufacturing share and exposure to firm-specific shocks on house price growth volatility. Furthermore, the comprehensive geographic coverage enables us to measure aggregate, local, and idiosyncratic house price growth volatility. We are not aware of any other research that has measured all sources of volatility and has explored the relationship between those measurements and microeconomic shocks.\footnote{The existing literature provides estimates of the size of the idiosyncratic component of volatility (e.g. Landvoigt et al. (2015) and Giacoletti (2017)).}

Our dependent variable in all regression exercises is house price growth volatility, measured at the property level. We construct this variable by first computing returns on repeat sales and then applying the Davidian and Carroll (1987) method to obtain the property level instantaneous volatility. The first exercise estimates the impact of manufacturing share at the county level in 2008 on our measure of volatility for housing transactions between 2009 and 2017. We find that a 10 percentage point (ppt) increase in the manufacturing share implies a 0.82 to 1.43ppt increase in house price growth volatility. For the median property, this is equivalent to a 12% to 21% increase in house price growth volatility. These results are largely invariant to specification and remain significant whether we adjust standard errors for heteroskedas-
ticity and autocorrelation or cluster them at the narrowest geographic unit. We also show that the results hold in an instrumental variables (IV) setting.

We next examine the degree to which manufacturing employment share affects house price growth volatility through employment growth volatility. Carvalho and Gabaix (2013) suggest that a high manufacturing share is associated with an increase in the magnitude of aggregate fluctuations. We find that local variation in employment growth volatility is positively associated with house price growth volatility. When we include employment growth volatility in the original regression specification, the coefficient on manufacturing share is reduced from 19.5 to 11.5, but remains statistically significant at the 1% level. Furthermore, removing manufacturing share approximately doubles the coefficient on employment growth volatility. This suggests that manufacturing employment share affects house price growth volatility through employment growth volatility.

Finally, we test the claim that exposure to firm-specific shocks increases house price growth volatility. We do this by constructing local Herfindahl-Hirschman Indices (HHIs). A high HHI value implies high firm concentration, indicating that local employment and income are more exposed to firm-specific shocks. Our preferred regression specification includes county-time fixed effects, time-varying local controls, and property level controls. We find that a one standard deviation increase of the local HHI index is associated with a 0.80 to 1.25ppt increase in house price growth volatility. For the median property, this is equivalent to a 11% to 18% increase in house price growth volatility. These findings are largely invariant to the choice of specification and are robust to choice of standard error adjustment.

The paper is organized as follows. Section 2 describes the data. Section 3 describes our empirical strategy and results. Finally, Section 4 concludes.

2 Data

We use a unique dataset that consists of all property transactions in Sweden over the 2009-2017 period. Each observation contains the sales date, final price, property type, street address, GPS coordinates, number of rooms, and area in square meters. It also contains each property’s county and parish, which we recover by reverse geocoding its GPS co-
ordinates.\footnote{Län and församling are Swedish geographic designations that roughly translate to county and parish. Län is the largest subnational administrative unit and församling is the smallest.}

We limit the sample to properties that were sold at least twice over the 2009-2017 period and compute annualized returns for each sales pair. Following Landvoigt et al. (2015), we drop abnormal returns (> 50\%) and sales pairs with a short holding period (< 6mo.). This leaves us with 42,462 properties with at least two sales.

In addition to property transaction data, we also collect the number of establishments located within commuting distance (25km) of the GPS coordinate centroid of each parish for the largest firms in Sweden: Volvo, Ericsson, Electrolux, Svenska Cellulosa, Scania, Atlas Copco, Sandvik, SKF, Assa Abloy, Vattenfall, ICA, Securitas, Telia, and Axel Johnson. The centroid is computed as the average latitude and longitude of all properties located within the same parish. We also compute the distance in kilometers between each property and its parish and county centroids.

Our regressor of interest in most specifications is manufacturing’s share of employment at the county level. We use both time-varying (annual) and static measures. For the static case, we always use the 2008 value, which predates our sample and limits potential endogeneity issues. For the dynamic case, we use the contemporaneous value of the manufacturing share for the years it is available (2009-2015). This variable is constructed by Statistics Sweden. In addition to manufacturing’s share of employment, we also use manufacturing’s share of income and output in different regressions.

Finally, we collect county level controls for population density, real per capita income, real per capita income growth, and employment growth. These variables are produced by Statistics Sweden. Population density is measured annually and is defined as persons per square kilometer. Real per capita income is measured annually and is used to compute real per capita income growth. Nominal income is deflated to real per capita income using the consumer price index. Employment growth is computed as the percentage change in the number of individuals employed in a given county since the previous quarter. For all level variables, we use either static or time-varying versions as controls, depending on the regression specification. For the regressions that contain the static versions, we always use the 2008 value, which predates our sample and limits potential issues with endogeneity.

The aforementioned descriptive statistics at the property and county level are shown in Table 1. Figure 1 contains two county level maps of Sweden. Subfigure (a) shows the geographic distribution of house
price growth volatility. Subfigure (b) shows manufacturing’s share of employment. A darker shade indicates higher volatility in (a) and a higher manufacturing share in (b).

3 Empirical Results

We first regress property level returns, \( r_{jt} \), from repeat sales on location-time fixed effects, \( \gamma_{kt} \), and a vector of property level controls, \( X_{jt} \):

\[
 r_{jt} = X_{jt}\beta + \gamma_{kt} + \epsilon_{jt}. \tag{1}
\]

In equation (1), \( t \) refers to the time period, \( j \) to the property, and \( k \) to the geographic location. We use a quarterly time period in all specifications. For the location, we use the narrowest available unit, parish.\(^5\)

We next extract the regression residuals:

\[
 \hat{\epsilon}_{jt} = r_{jt} - X_{jt}\hat{\beta} - \hat{\gamma}_{kt}. \tag{2}
\]

Following Davidian and Carroll (1987), we use the following unbiased estimator of the standard deviation of \( \epsilon_{jt} \) as our measure of volatility:

\[
 \hat{\sigma}_{jt} = \sqrt{\frac{\pi}{2}}|\hat{\epsilon}_{jt}|. \tag{3}
\]

Note that equation (1) removes the aggregate, local, and idiosyncratic level components of the first moment, but does not affect volatility. Since our dataset contains aggregate, local, and idiosyncratic variation, \( \hat{\sigma}_{jt} \) will capture changes in all volatility components.

3.1 Volatile Sector Share

We first test the claim that dependence on volatile sectors of production increases house price growth volatility. We do this by exploiting county and county-time variation in manufacturing, which Carvalho and Gabaix (2013) identify as a volatile sector:

\[
 \hat{\sigma}_{jt} = M_{it}\zeta + X_{jt}\theta + Z_{it}\eta + \xi_t + \mu_k + \nu_{jt}. \tag{4}
\]

In equation (4), \( M_{it} \) is manufacturing’s share of employment, income, or output in county \( i \) at time \( t \); \( X_{jt} \) is a vector of property level

\(^5\)All results are robust to using county, rather than parish.
controls; \( Z_{it} \) is vector of county level controls; \( \xi_t \) is a time fixed effect; and \( \mu_k \) is a parish fixed effect.

Table 2 contains our baseline results. Note that we use a volatility measure that is constructed by performing the equation (1) regression with parish-year-quarter fixed effects. Column 1 tests our core hypothesis using manufacturing’s share of employment at the county level in 2008. No controls are included. Column 2 adds yearly fixed effects and columns 3-9 include year-quarter fixed effects. Columns 4-9 include property level characteristics as controls: area in square meters, dummies for the number of rooms, dummies for the property type, and distance from the county’s center in kilometers.

Other than \( \text{distance to county center}_j \), the distance between a property and its county’s GPS centroid, we omit all property level controls from the tables to save space and improve readability. Column 5 includes static, county level controls for the log of population density and the log of real per capita income. And finally, columns 6-9 include time-varying controls for the log of real income per capita (annual), the log of population density (annual), real per capita income growth (annual), and employment growth (quarterly). Column 7 clusters standard errors at the parish level. All other columns use heteroskedasticity and autocorrelation robust standard errors. Note that time-varying controls are not available for all years at the county level. Including them forces us to reduce our sample size from 40,784 to 15,030. Note also that we cannot use location fixed effects in this specification because we only have variation in the regressor of interest at the county level.

Our preferred specifications are given in columns 5 and 6. Note that the coefficients on manufacturing employment share are positive and significant at the 1% level and indicate that a unit increase in manufacturing’s employment share would increase house price growth volatility by between 8.2 and 14.3ppt. Since manufacturing share ranges from 0 to 1, it may be more instructive to compare the county with the lowest manufacturing share of employment in 2008, Stockholm (0.145), to the county with the highest, Kalmar (0.366). This would translate into a 1.8 to 3.16ppt increase in house price growth volatility. For the median property, this is equivalent to a 25% to 45% increase in house price growth volatility. Finally, our results for manufacturing’s share of income and output at the county level in 2008 are both significant at the 1% level and quantitatively similar to our baseline results. They also hold and explain a high share of variation in aggregate and local volatility in a separate cross-sectional regression.\(^6\)

\(^6\)We perform a separate cross-sectional regression of the county mean of property volatility on the average manufacturing share of income. This yields a coefficient estimate of 16.4
We next extend our initial result by using a time-varying measure of manufacturing’s share of employment in columns 1-8 of Table 3. This enables us to include parish fixed effects to soak up cross-sectional variation that could comove with manufacturing’s share. We also include time-varying county level controls, year-quarter fixed effects, and property level controls in our preferred specification, which is shown in columns 7-8. Note that column 2 uses an IV specification, where manufacturing’s employment share is instrumented by a one period lag of itself. All other columns use OLS. Additionally, all columns use heteroskedasticity and autocorrelation robust standard errors, except column 8, which clusters standard errors at the parish level. Again, we find that the impact of manufacturing’s share of employment on house price growth volatility remains positive and is statistically significant at the 1-5% level in all specifications. The magnitude of the effect is similar to what we identified in Table 2.

### 3.2 Employment Growth Volatility

We next test the hypothesis that manufacturing employment share drives house price growth volatility through employment growth volatility. In columns 9-10 of Table 3, we include employment growth volatility as a regressor. We compute this control as the standard deviation of county level employment growth over the 2009-2017 period. Comparing columns 5 and 9, we can see that manufacturing’s employment share remains significant, but its magnitude declines from 19.5 to 11.5. Similarly, removing manufacturing’s employment share in column 10 increases the magnitude of employment growth volatility from 1.4 to 2.2. This suggests that the impact that manufacturing’s share of employment has on house price growth volatility may be related to the impact it has on employment growth volatility.  

### 3.3 Exposure to Firm-Specific Shocks

Our final exercise, shown in Table 4, explores the impact of exposure to firm-specific shocks on house price growth volatility. This test is closely

and an adjusted R-squared of 0.34. These results are available on request.

7This result also holds in a cross-sectional regression, where we regress the county level mean of property volatility on the county level employment growth volatility and manufacturing income share. For manufacturing share, we average observations over the time dimension. This county level regression yields an adjusted R-squared of 0.47, which suggests that manufacturing share and employment growth volatility explain a high share of the aggregate and local volatility. These results are available on request.
related to Gabaix (2011), which finds that the idiosyncratic movements of the largest 100 firms in the U.S. account for a substantial share of aggregate fluctuations. If such shocks do not “average out,” as suggested by Lucas (1977), then firm level idiosyncratic shocks may generate aggregate fluctuations. Here, we examine this claim for house price growth volatility. The regressor of interest in all specifications is the Herfindahl-Hirschman Index (HHI) at the parish level, which we compute as follows:

$$hhi_{i} = s_{0}^{2} + ... + s_{F}^{2}. \quad (5)$$

Note that $s_{l}$ is firm l’s share of establishments in parish k.\(^{8}\) We compute this using data on the number of establishments within commuting distance (25km) of each parish’s GPS centroid for each of the largest firms in Sweden: Volvo, Ericsson, Electrolux, Svenska Cellulosa, Scania, Atlas Copco, Sandvik, SKF, Assa Abloy, Vattenfall, ICA, Securitas, Telia, and Axel Johnson. Using the narrowest geographic unit, parish, allows us to include county-year-quarter fixed effects in columns 7-9, which absorb all permanent and county level variation in volatility. We use two different regression specifications:

$$\hat{\sigma}_{jt} = \log(hhi_{k})\zeta + X_{jt}\theta + Z_{kt}\eta + \xi_{i} + \mu_{i} + \nu_{jt}. \quad (6)$$

The first specification, given in equation (6), includes parish level controls, $Z_{kt}$; time fixed effects, $\xi_{i}$; and county fixed effects, $\mu_{i}$. The second specification, given in (7), replaces county and year-quarter fixed effects with county-year-quarter fixed effects, $\kappa_{it}$:

$$\hat{\sigma}_{jt} = \log(hhi_{k})\zeta + X_{jt}\theta + Z_{kt}\eta + \kappa_{it} + \nu_{jt}. \quad (7)$$

In column 1 of Table 4, we perform the regression with no controls. We next add year fixed effects in column 2 and year-quarter fixed effects in columns 3-6. In columns 3-8, we limit the sample to cover only years 2015-2017. This is to limit potential endogeneity issues, since our measure of firm concentration is only available for 2017. Importantly, however, our specifications with the most extensive set of controls 6-9 and county-year-quarter fixed effects suggest that this does not appear to bias the coefficient estimates upward in the full sample. Column 8 clusters standard errors at the parish level. All other columns use

\(^{8}\)Since we cannot compute market share at the parish level, we instead use a measure of establishment share for the largest firms in Sweden. Note that we use parish, rather than county, since parish is a narrower geographic unit and is available for establishment location data; however, the results are not sensitive to the choice of geographic unit or the commuting distance assumption.
heteroskedasticity and autocorrelation robust standard errors. For all estimates, we find a positive, quantitatively similar effect that is significant at the 1% level. Our preferred specifications in columns 7 and 9 suggest that a doubling of firm concentration is associated with a 0.8 to 1.25ppt increase in house price growth volatility. For the median property, this is equivalent to an 11% to 18% increase in house price growth volatility.

4 Conclusion

We find that granular factors that have been shown to account for a substantial share of output volatility also have an economically significant impact on house price growth volatility. Using a unique dataset of all Swedish property transactions over the 2009-2017 period and exploiting the geographical cross-section, we show that the following factors are positively associated with house price growth volatility: 1) the employment, income, and output shares of a volatile sector (manufacturing); 2) employment growth volatility; and 3) exposure to idiosyncratic shocks to firms. Furthermore, the impact of the volatile sector share on house price growth volatility appears to operate through employment growth volatility.

Our results suggest that the decline in manufacturing’s employment share in developed countries could explain part of the reduction in house price growth volatility during the Great Moderation. In particular, the reduction in Sweden’s manufacturing employment share from 27.7% to 11.7% since 1970 could account for a 2.3ppt (33%) decline in house price growth volatility. Similarly, the 17.5ppt decline in manufacturing share in the U.S. since 1970 would account for a 2.5ppt decline in house price growth volatility.

References


## 5 Tables and Figures

Table 1: Descriptive statistics: property and county level

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property level statistics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>103.12</td>
<td>46.48</td>
<td>69</td>
<td>101</td>
<td>129</td>
<td>42559</td>
</tr>
<tr>
<td>Latitude</td>
<td>59.01</td>
<td>2.16</td>
<td>57.71</td>
<td>59.25</td>
<td>59.56</td>
<td>42559</td>
</tr>
<tr>
<td>Longitude</td>
<td>15.81</td>
<td>2.51</td>
<td>13.40</td>
<td>16.20</td>
<td>17.96</td>
<td>42559</td>
</tr>
<tr>
<td>Distance to county center (km)</td>
<td>35.52</td>
<td>27.49</td>
<td>14.41</td>
<td>30.50</td>
<td>48.38</td>
<td>42559</td>
</tr>
<tr>
<td>Annualized return</td>
<td>9.30</td>
<td>12.40</td>
<td>2.57</td>
<td>8.02</td>
<td>14.98</td>
<td>42559</td>
</tr>
<tr>
<td>Return volatility</td>
<td>10.22</td>
<td>10.71</td>
<td>3.25</td>
<td>6.93</td>
<td>12.81</td>
<td>42559</td>
</tr>
<tr>
<td><strong>County level statistics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real per capita income growth</td>
<td>2.70</td>
<td>0.27</td>
<td>2.50</td>
<td>2.67</td>
<td>2.88</td>
<td>20</td>
</tr>
<tr>
<td>Population density (persons / sqm)</td>
<td>48.59</td>
<td>74.23</td>
<td>14.46</td>
<td>27.89</td>
<td>51.90</td>
<td>20</td>
</tr>
<tr>
<td>Employment growth</td>
<td>0.66</td>
<td>0.24</td>
<td>0.56</td>
<td>0.67</td>
<td>0.81</td>
<td>20</td>
</tr>
<tr>
<td>Manufacturing income share</td>
<td>0.28</td>
<td>0.05</td>
<td>0.26</td>
<td>0.29</td>
<td>0.32</td>
<td>20</td>
</tr>
<tr>
<td>Manufacturing output share</td>
<td>0.28</td>
<td>0.04</td>
<td>0.27</td>
<td>0.30</td>
<td>0.31</td>
<td>20</td>
</tr>
<tr>
<td>Manufacturing employment share</td>
<td>0.28</td>
<td>0.05</td>
<td>0.25</td>
<td>0.28</td>
<td>0.32</td>
<td>20</td>
</tr>
<tr>
<td>Employment growth volatility</td>
<td>1.85</td>
<td>0.44</td>
<td>1.67</td>
<td>1.83</td>
<td>2.18</td>
<td>20</td>
</tr>
<tr>
<td>Herfindahl-Hirschman Index (HHI)</td>
<td>4007.23</td>
<td>557.48</td>
<td>3823.40</td>
<td>4114.73</td>
<td>4306.13</td>
<td>20</td>
</tr>
</tbody>
</table>

*Notes: The descriptive statistics are divided into property level and county level groups. Property level statistics include area in square meters, latitude, longitude, distance to county center, annualized return, and return volatility. We use an instantaneous, unbiased estimate of volatility at the property level, which is described in the Empirical Results section. County level statistics include real per capita income growth (annual), population density (annual), employment growth (quarterly), manufacturing income share (annual), manufacturing employment share (annual), and employment growth volatility. Each county level variable is averaged over its time dimension before descriptive statistics are computed. We include the HHI index in the list of county level variables; however, we also compute it at the parish level and include this measure in Table 4 regressions.*
Figure 1: Manufacturing share and house price growth volatility by county

(a) House Price Growth Volatility

(b) Manufacturing Share

Notes: A darker shade indicates a higher level of house price growth volatility in subfigure (a) and a higher manufacturing employment share in subfigure (b). House price growth volatility is computed at the property level and is averaged across properties over the 2009-2017 period. Manufacturing share is computed by Statistics Sweden and is averaged over the 2009-2015 period.
Table 2: Impact of 2008 manufacturing share on house price growth volatility

<table>
<thead>
<tr>
<th></th>
<th>(1) OLS</th>
<th>(2) OLS</th>
<th>(3) OLS</th>
<th>(4) OLS</th>
<th>(5) OLS</th>
<th>(6) OLS</th>
<th>(7) OLS</th>
<th>(8) OLS</th>
<th>(9) OLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>share (t = 2008)</td>
<td>(0.7579)</td>
<td>(0.7615)</td>
<td>(0.7612)</td>
<td>(0.9224)</td>
<td>(1.6379)</td>
<td>(2.6820)</td>
<td>(3.4682)</td>
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<tr>
<td>manufacturing income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.9367***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>share (t = 2008)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.3604)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>manufacturing output</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.5523***</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>share (t = 2008)</td>
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<td></td>
<td></td>
<td></td>
<td>(3.4615)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log(population density)</td>
<td>-0.1933**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(t = 2008)</td>
<td>(0.0752)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>log(per capita income)</td>
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<td>-0.0675</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(t = 2008)</td>
<td></td>
<td>(1.3151)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>log(population density)</td>
<td></td>
<td>-0.1705</td>
<td>-0.1705</td>
<td>-0.1837</td>
<td>0.0842</td>
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</tr>
<tr>
<td>(t = 2008)</td>
<td></td>
<td>(0.1248)</td>
<td>(0.1764)</td>
<td>(0.1241)</td>
<td>(0.1573)</td>
<td></td>
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<tr>
<td>log(per capita income)</td>
<td>-2.5433</td>
<td>-2.5433</td>
<td>-2.8830</td>
<td>-3.7545*</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(t = 2008)</td>
<td>(2.1835)</td>
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Notes: The dependent variable is the unbiased estimate of instantaneous house price return volatility at the property level, \(\sigma_{jt}\). We regress \(\sigma_{jt}\) on three measures of manufacturing dependence at the county level in 2008: 1) manufacturing’s share of employment; 2) manufacturing’s share of income; and 3) manufacturing’s share of output. Property controls include area in square meters, dummies for the number of rooms, dummies for the property type, and distance from the county’s center in kilometers. Static county controls include the log of real per capita income and the log of population density. Time-varying county controls include employment growth (quarterly), the log of per capita income (annual), per capita income growth (annual), and the log of population density (annual). Note that the time-varying controls are not available at the county level for all periods, which lowers the number of observations in 6-9. Standard errors are either Newey-West (NW) or clustered at the parish level (CL). *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.
Table 3: Impact of manufacturing share and employment volatility on house price growth volatility

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Notes: The dependent variable is the unbiased estimate of instantaneous house price return volatility at the property level, $\sigma_{jt}$. We regress $\sigma_{jt}$ on manufacturing’s employment share at the county level. Property level controls include area in square meters, dummies for the number of rooms, dummies for the property type, and distance from the county’s center in kilometers. Time-varying county controls include employment growth (quarterly), the log per capita income (annual), per capita income growth (annual), and the log of population density (annual). Note that the time-varying controls are not available at the county level for all periods, which lowers the number of observations in 6-8. Columns 7-8 include parish fixed effects. Columns 9 and 10 include employment growth volatility at the county level, computed as the standard deviation of employment growth over the 2009-2017 period. Standard errors are either Newey-West (NW) or clustered at the parish level (CL). *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.
Table 4: Impact of exposure to idiosyncratic shocks to firms on house price growth volatility

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Notes: The dependent variable is the unbiased estimate of instantaneous house price return volatility at the property level, \( \sigma_{jt} \). We compute the centroid of a parish as the mean longitude and latitude of properties located within it in our dataset. We then regress \( \sigma_{jt} \) on the parish level HHI index. HHI is computed using the number of establishments present in a given parish for each of the largest firms in Sweden: Volvo, Ericsson, Electrolux, Svenska Cellulosa, Scania, Atlas Copco, Sandvik, SKF, Assa Abloy, Vattenfall, ICA, Securitas, Telia, and Axel Johnson. Property level controls include area in square meters, dummies for the number of rooms, and dummies for the property type. For columns 3-8, we limit the sample to 2015-2017 to avoid possible issues with endogeneity, since the firm location data is only available for 2017. Columns 5 and 6 include county fixed effects. Columns 7-9 include county-year-quarter fixed effects. Columns 6-9 include additional parish level controls: the average property size, the average distance to the parish’s centroid in kilometers, and the log of the number of properties located in the parish. Standard errors are either Newey-West (NW) or are clustered at the parish level (CL). Note that k indexes parish. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.
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<td>Hedging Labor Income Risk</td>
<td>Sebastien Beitemier, Thomas Jansson, Christine A. Parlour and Johan Walden</td>
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