Online Appendix

"Firm Leverage, Consumer Demand, and Employment Losses during the Great Recession"

by

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MEASUREMENT ERROR IN COUNTY-LEVEL LEVERAGE

This proof derives the results discussed in Section VI.C related to measurement error in county-level leverage. Consider the following model:

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2 + \varepsilon,$$

where $\epsilon \sim \mathcal{N}(0, \sigma_\varepsilon^2)$. In our case, $y = \Delta$ Log(Emp)$_{07-09}$, $x_1 = \Delta$ Log(HP)$_{06-09}$, and $x_2 =$ Leverage$_{06}$, where $\bar{x}_2 \equiv$E$[x_2] > 0$ (positive sample mean). Suppose x_2 is measured with error:

$$x_2 = x_2^* + \eta,$$

where $\eta \sim \mathcal{N}(\mu_\eta, \sigma_\eta^2)$. Assume x_1 and x_2 are independent, the measurement error is mean zero ($\mu_\eta = 0$), and η is independent from x_1 and orthogonal to x_2 and y. Define $\bar{x}_2^* \equiv \mathrm{E}[x_2^*]$, $\bar{x}_1 \equiv \mathrm{E}[x_1]$, $\bar{y} \equiv \mathrm{E}[y]$, $\sigma_{x_1}^2 \equiv \mathrm{Var}[x_1]$, $\sigma_{x_2^*}^2 \equiv \mathrm{Var}[x_2^*]$, $\sigma_{x_1,y} \equiv \mathrm{Cov}[x_1, y]$, $\sigma_{x_2^*,y} \equiv \mathrm{Cov}[x_2^*, y]$, and $\sigma_{x_1 x_2^*,y} \equiv \mathrm{Cov}[x_1 x_2^*, y]$. Further, define

$$\mathbf{x} \equiv \begin{bmatrix} 1 \\ x_2 \\ x_1 \\ x_1 x_2 \end{bmatrix} \text{ and } \boldsymbol{\beta} \equiv \begin{bmatrix} \alpha \\ \beta_2 \\ \beta_1 \\ \beta_3 \end{bmatrix}.$$

(Note the change in the ordering; this simplifies the derivations below.)

Standard OLS minimization implies

$$\boldsymbol{\beta} = \underbrace{\mathrm{E}[\mathbf{x}\mathbf{x}']}_{\mathbf{Q}_{xx}}{}^{-1} \underbrace{\mathrm{E}[\mathbf{x}y]}_{\mathbf{Q}_{xy}}.$$

Expanding out $\mathbf{Q}_{xx}$, we obtain

$$\mathbf{Q}_{xx} = \begin{bmatrix} 1 & \mathrm{E}[x_2] & \mathrm{E}[x_1] & \mathrm{E}[x_1 x_2] \\ \mathrm{E}[x_2] & \mathrm{E}[x_2^2] & \mathrm{E}[x_1 x_2] & \mathrm{E}[x_1 x_2^2] \\ \mathrm{E}[x_1] & \mathrm{E}[x_1 x_2] & \mathrm{E}[x_1^2] & \mathrm{E}[x_1^2 x_2] \\ \mathrm{E}[x_1 x_2] & \mathrm{E}[x_1 x_2^2] & \mathrm{E}[x_1^2 x_2] & \mathrm{E}[x_1^2 x_2^2] \end{bmatrix}.$$

Using independence of x_1 and x_2 and substituting, we can rewrite $\mathbf{Q}_{xx}$ as

$$\mathbf{Q}_{xx} = \begin{bmatrix} 1 & \bar{x}_2^* & \bar{x}_1 & \bar{x}_2^* \bar{x}_1 \\ \bar{x}_2^* & \sigma_{x_2^*}^2 + \sigma_\eta^2 + (\bar{x}_2^*)^2 & \bar{x}_2^* \bar{x}_1 & \bar{x}_1(\sigma_{x_2^*}^2 + \sigma_\eta^2 + (\bar{x}_2^*)^2) \\ \bar{x}_1 & \bar{x}_2^* \bar{x}_1 & \sigma_{x_1}^2 + \bar{x}_1^2 & (\sigma_{x_1}^2 + \bar{x}_1^2)\bar{x}_2^* \\ \bar{x}_2^* \bar{x}_1 & \bar{x}_1(\sigma_{x_2^*}^2 + \sigma_\eta^2 + (\bar{x}_2^*)^2) & (\sigma_{x_1}^2 + \bar{x}_1^2)\bar{x}_2^* & (\sigma_{x_1}^2 + \bar{x}_1^2)[\sigma_{x_2^*}^2 + \sigma_\eta^2 + (\bar{x}_2^*)^2] \end{bmatrix},$$

which can be expressed more compactly as a Kronecker product:

$$\mathbf{Q}_{xx} = \begin{bmatrix} 1 & \bar{x}_1 \\ \bar{x}_1 & \sigma^2_{x_1} + \bar{x}_1^2 \end{bmatrix} \otimes \begin{bmatrix} 1 & \bar{x}_2^* \\ \bar{x}_2^* & (\sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2) \end{bmatrix}.$$

Because both elements of the Kronecker product are invertible, the inverse of the product equals the product of the inverses:

$$\mathbf{Q}_{xx}^{-1} = \frac{1}{\sigma^2_{x_1}(\sigma^2_{x_2^*} + \sigma^2_\eta)} \begin{bmatrix} \sigma^2_{x_1} + \bar{x}_1^2 & -\bar{x}_1 \\ -\bar{x}_1 & 1 \end{bmatrix} \otimes \begin{bmatrix} \sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2 & -\bar{x}_2^* \\ -\bar{x}_2^* & 1 \end{bmatrix}$$

$$= \frac{1}{\sigma^2_{x_1}(\sigma^2_{x_2^*} + \sigma^2_\eta)} \begin{bmatrix} (\sigma^2_{x_1} + \bar{x}_1^2)[\sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2] & -(\sigma^2_{x_1} + \bar{x}_1^2)\bar{x}_2^* & \bar{x}_1(\sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2) & \bar{x}_2^*\bar{x}_1 \\ -(\sigma^2_{x_1} + \bar{x}_1^2)\bar{x}_2^* & \sigma^2_{x_1} + \bar{x}_1^2 & \bar{x}_2^*\bar{x}_1 & -\bar{x}_1 \\ -\bar{x}_1(\sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2) & \bar{x}_2^*\bar{x}_1 & \sigma^2_{x_2^*} + \sigma^2_\eta + (\bar{x}_2^*)^2 & -\bar{x}_2^* \\ \bar{x}_2^*\bar{x}_1 & -\bar{x}_1 & -\bar{x}_2^* & 1 \end{bmatrix}.$$

Expanding out $\mathbf{Q}_{xy}$, we obtain

$$\mathbf{Q}_{xy} = \begin{bmatrix} \mathrm{E}[y] \\ \mathrm{E}[x_2 y] \\ \mathrm{E}[x_1 y] \\ \mathrm{E}[x_1 x_2 y] \end{bmatrix} = \begin{bmatrix} \bar{y} \\ \sigma_{x_2^*,y} + \bar{x}_2^*\bar{y} \\ \sigma_{x_1,y} + \bar{x}_1\bar{y} \\ \sigma_{x_1 x_2^*,y} + \bar{x}_1\bar{x}_2^*\bar{y} \end{bmatrix},$$

where the equality in the second element follows from η being mean zero and uncorrelated with y, while the equality in the last element follows from

$$\begin{aligned} \mathrm{E}[x_1 x_2 y] &= \mathrm{Cov}[x_1 x_2, y] + \mathrm{E}[x_1 x_2]\mathrm{E}[y] \\ &= \mathrm{Cov}[x_1(x_2^* + \eta), y] + \bar{x}_1\bar{x}_2^*\bar{y} \\ &= \mathrm{Cov}[x_1 x_2^*, y] + \mathrm{Cov}[x_1\eta, y] + \bar{x}_1\bar{x}_2^*\bar{y} \\ &= \sigma_{x_1 x_2^*,y} + \mathrm{E}[x_1 y\eta] - \mathrm{E}[x_1\eta]\mathrm{E}[y] + \bar{x}_1\bar{x}_2^*\bar{y} \\ &= \sigma_{x_1 x_2^*,y} + \bar{x}_1\bar{x}_2^*\bar{y}, \end{aligned}$$

where the second line uses $\mathrm{E}[x_1 x_2] = \mathrm{E}[x_1]\mathrm{E}[x_2]$, and the fifth line uses independence of η from x_1 and orthogonality to y. Multiplying and collecting terms, we obtain

$$\begin{aligned} \beta_1 &= \frac{\sigma_{x_1,y}}{\sigma^2_{x_1}} - \bar{x}_2^* \frac{\sigma_{x_1 x_2^*,y} - \sigma_{x_2^*,y}\bar{x}_1 - \sigma_{x_1,y}\bar{x}_2^*}{\sigma^2_{x_1}(\sigma^2_{x_2^*} + \sigma^2_\eta)}. \\ \beta_2 &= \frac{\sigma_{x_2^*,y}}{\sigma^2_{x_2^*} + \sigma^2_\eta} - \bar{x}_1 \frac{\sigma_{x_1 x_2^*,y} - \sigma_{x_2^*,y}\bar{x}_1 - \sigma_{x_1,y}\bar{x}_2^*}{\sigma^2_{x_1}(\sigma^2_{x_2^*} + \sigma^2_\eta)}. \\ \beta_3 &= \frac{\sigma_{x_1 x_2^*,y} - \sigma_{x_2^*,y}\bar{x}_1 - \sigma_{x_1,y}\bar{x}_2^*}{\sigma^2_{x_1}(\sigma^2_{x_2^*} + \sigma^2_\eta)}. \end{aligned}$$

To characterize the attenuation bias, define the univariate unbiased (i.e., error-free) regression coefficients $\tilde{\beta}_1$ and $\tilde{\beta}_2$:

$$\tilde{\beta}_1 \equiv \frac{\sigma_{x_1,y}}{\sigma^2_{x_1}}.$$
$$\tilde{\beta}_2 \equiv \frac{\sigma_{x_2^*,y}}{\sigma^2_{x_2^*}}.$$

Note that as $\sigma^2_\eta \to 0$, β_3 approaches its unbiased value

$$\beta_3^* = \frac{\sigma_{x_1 x_2^*,y} - \sigma_{x_2^*,y}\bar{x}_1 - \sigma_{x_1,y}\bar{x}_2^*}{\sigma^2_{x_1}\sigma^2_{x_2^*}},$$

while the remaining unbiased coefficients can be expressed in terms of β_3^* and the unbiased univariate coefficients:

$$\beta_1^* = \tilde{\beta}_1 - \bar{x}_2^*\beta_3^*.$$
$$\beta_2^* = \tilde{\beta}_2 - \bar{x}_1\beta_3^*.$$
$$\alpha^* = \bar{y} - \bar{x}_1\tilde{\beta}_1 - \bar{x}_2^*\beta_2^*.$$

Denote by λ the fraction of the variance in x_2 that is due to the variance in the true x_2^*:

$$\lambda \equiv \frac{\sigma^2_{x_2^*}}{\sigma^2_{x_2^*} + \sigma^2_\eta},$$

where $\lambda \in (0, 1]$ is known as the *reliability ratio*. Given these definitions, we can express the coefficients as functions of the unbiased β_3^*, univariate regression coefficients $\tilde{\beta}_1$ and $\tilde{\beta}_2$, and reliability ratio λ:

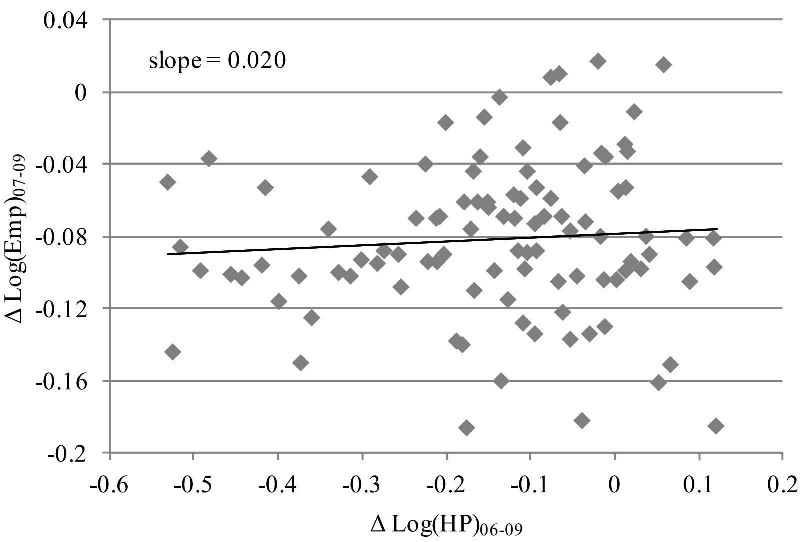
$$\beta_1 = \tilde{\beta}_1 - \bar{x}_2^*\beta_3^*\lambda.$$
$$\beta_2 = \left(\tilde{\beta}_2 - \bar{x}_1^*\beta_3^*\right)\lambda.$$
$$\beta_3 = \beta_3^*\lambda.$$
$$\alpha = \bar{y} - \bar{x}_1\tilde{\beta}_1 - \bar{x}_2^*\beta_2.$$

If x_2 is measured with error ($\sigma^2_\eta > 0$), we have $\lambda < 1$ and consequently $\beta_2 < \beta_2^*$ and $\beta_3 < \beta_3^*$. This is the attenuation bias. As for β_1, the result depends on the sign of $\bar{x}_2^*\beta_3^*$. In our case, we have $\bar{x}_2^* > 0$ (since $\bar{x}_2 > 0$ and $\mu_\eta = 0$) and $\beta_3^* > 0$ (since $\beta_3 > 0$), implying that $\beta_1 > \beta_1^*$ (since $\lambda < 1$), meaning β_1 is upward biased. Indeed, as $\sigma^2_\eta \to \infty$, we have $\lambda \to 0$ and consequently $\beta_2 \to 0$, $\beta_3 \to 0$, and $\beta_1 \to \tilde{\beta}_1$. Hence, if x_2 is measured with so much error that it becomes pure noise, the coefficients on x_2 and x_1x_2 both approach zero, while the coefficient on x_1 approaches its unbiased univariate estimate $\tilde{\beta}_1$ from below.

Figure 1
“Other” Industries

The plots are similar to those in Figure II, except that the sample is restricted to “other” industries.

Panel (A): 1st Quartile of Leverage06 (Other)



Panel (B): 4th Quartile of Leverage06 (Other)

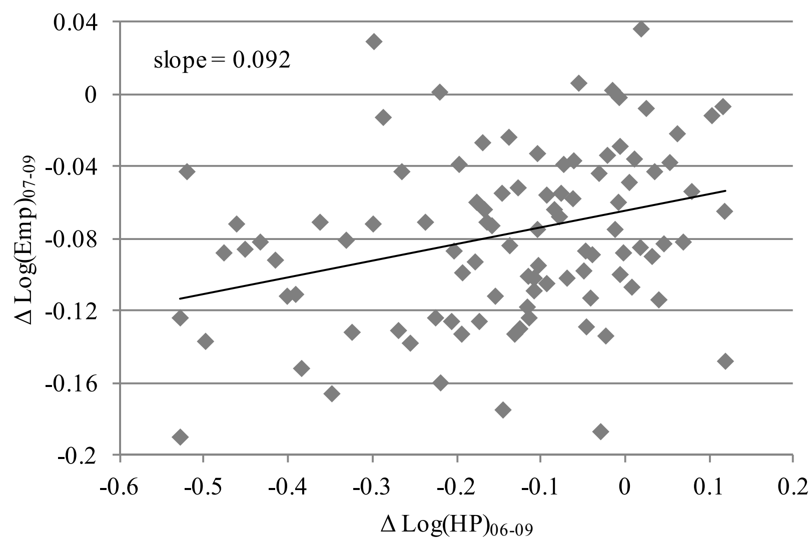


Figure 2
Expanding the Sample: County-Level Employment by All Firms in the LBD

The plots are similar to those in Figure III, except that county-level employment is total employment by all LBD firms in a county.

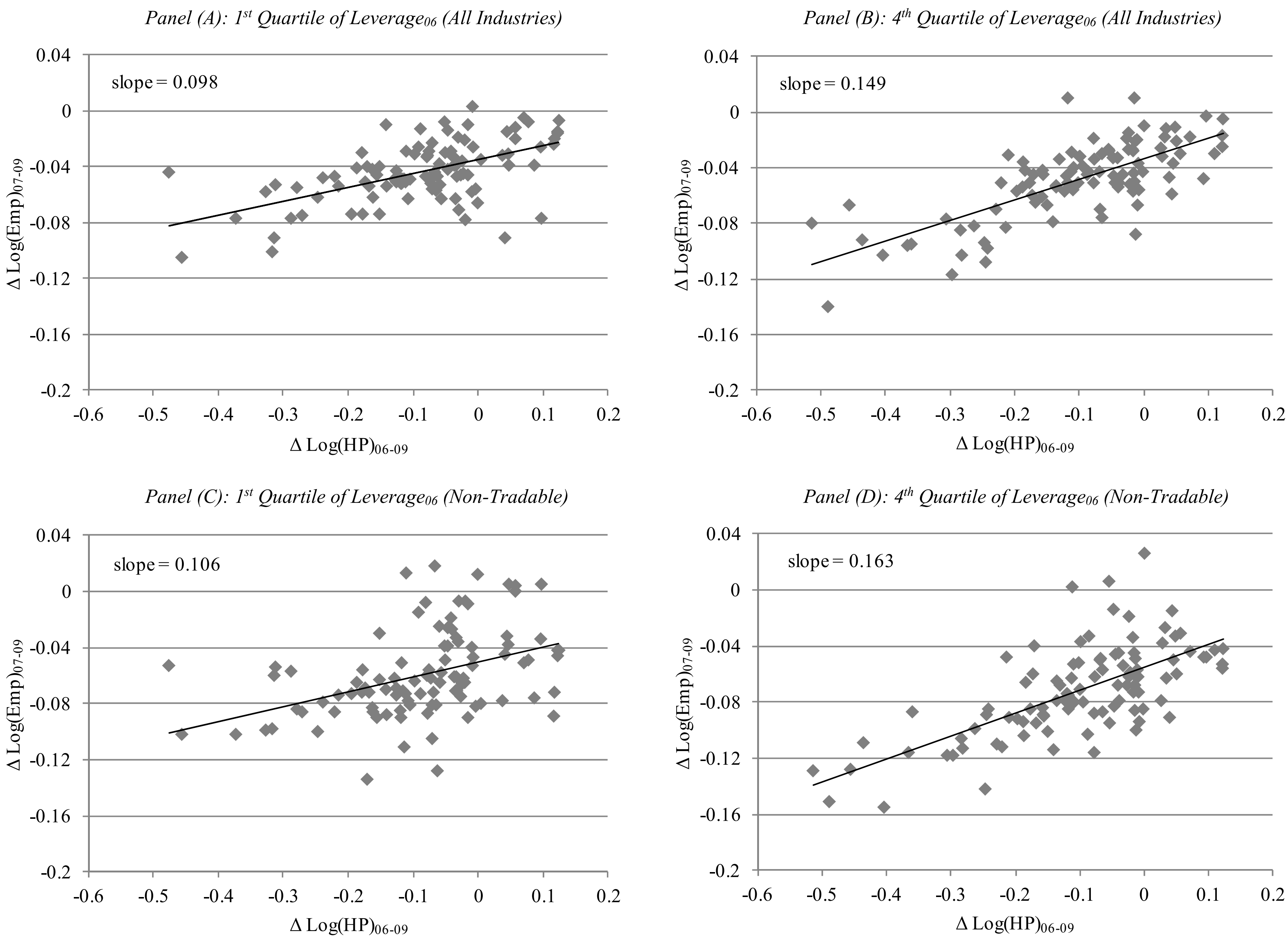
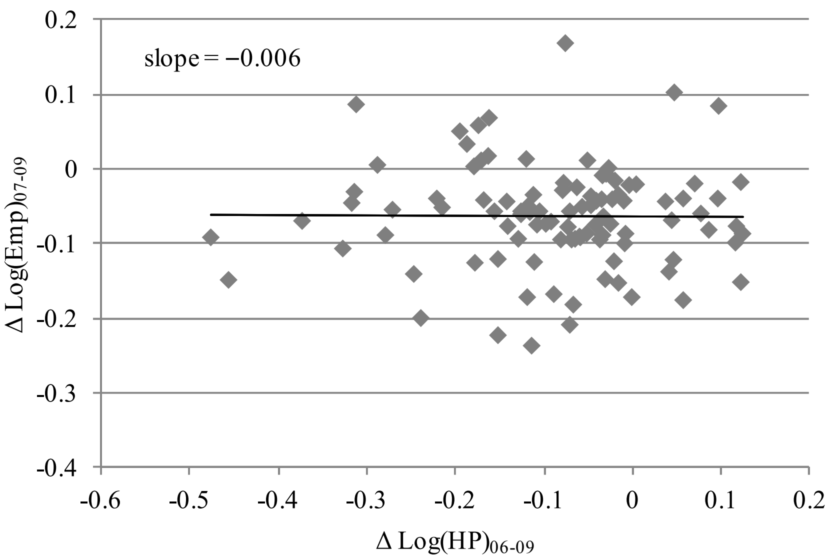


Figure 2 (continued)

Panel (E): 1st Quartile of Leverage06 (Tradable)



Panel (F): 4th Quartile of Leverage06 (Tradable)

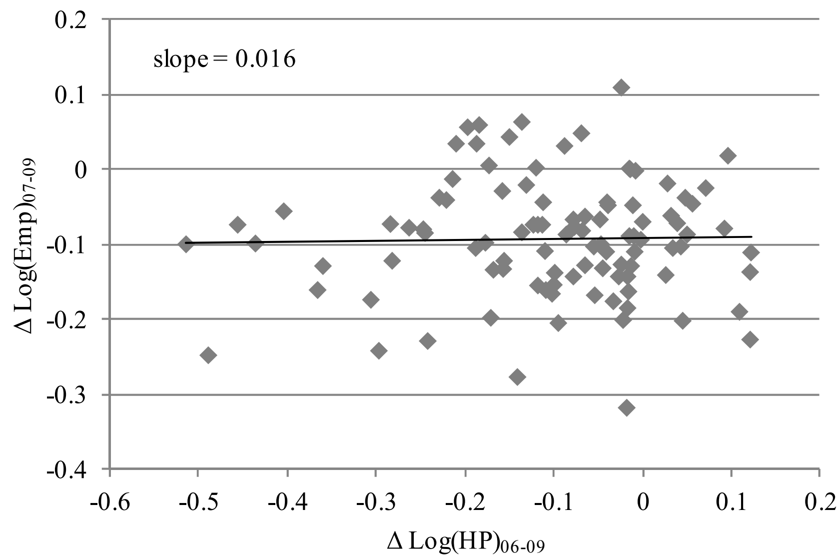


Table 1
Matching House Prices to Establishments

This table presents variants of the regressions in Table II. In Panel (A), the sample is restricted to establishments with non-missing ZIP code-level house prices. In Panel (B), establishments with missing ZIP code- or county-level house prices are assigned state-level house prices computed as population-weighted averages of available ZIP code-level house prices in the state. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Panel (A): Sample with Non-Missing ZIP Code- or County-Level House Prices

	Δ Log(Emp)$_{07\text{-}09}$	
Δ Log(HP)$_{06\text{-}09}$	0.064***	0.024
	(0.021)	(0.023)
Δ Log(HP)$_{06\text{-}09}$ $\times$ Leverage$_{06}$		0.119***
		(0.037)
Leverage$_{06}$		-0.026**
		(0.013)
Industry Fixed Effects	Yes	Yes
R-squared	0.04	0.04
Observations	227,600	227,600

Panel (B): Expanded Sample with Imputed State-Level House Prices

	Δ Log(Emp)$_{07\text{-}09}$	
Δ Log(HP)$_{06\text{-}09}$	0.079***	0.030
	(0.017)	(0.018)
Δ Log(HP)$_{06\text{-}09}$ $\times$ Leverage$_{06}$		0.129***
		(0.039)
Leverage$_{06}$		-0.022*
		(0.014)
Industry Fixed Effects	Yes	Yes
R-squared	0.02	0.02
Observations	327,500	327,500

Table 2
Alternative Clustering Methods

This table presents variants of the regressions in column (3) of Table II and column (1) of Panel (A) in Table 9 of the Online Appendix in which alternative clustering methods are used. In columns (1) and (2), standard errors are clustered at the firm level. In columns (3) and (4), standard errors are clustered at the county level. In columns (5) and (6), standard errors are clustered at the MSA level. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors are in parentheses. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07-09}$					
	Firm-Level Clustering		County-Level Clustering		MSA-Level Clustering	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Log(HP)$_{06-09}$	0.068***	0.029	0.068***	0.029*	0.068***	0.029*
	(0.014)	(0.018)	(0.010)	(0.015)	(0.012)	(0.017)
Δ Log(HP)$_{06-09}$ × Leverage$_{06}$		0.114***		0.114***		0.114***
		(0.038)		(0.027)		(0.031)
Leverage$_{06}$		-0.032***		-0.032***		-0.032***
		(0.010)		(0.009)		(0.010)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.03	0.04	0.03	0.04	0.03	0.04
Observations	284,800	284,800	284,800	284,800	284,800	284,800

Table 3
Instrumenting House Price Changes

This table presents variants of the regressions in Table II in which Δ $Log(HP)_{06\text{-}09}$ is instrumented with housing supply elasticity (columns (2) to (4)) and "share of unavailable land" (columns (6) to (8)), respectively. Both instruments are described in Saiz (2010). For brevity, the table only shows the first-stage regressions associated with columns (2) and (5). Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Instrument: Housing Supply Elasticity			Instrument: Share of Unavailable Land		
	Δ $Log(HP)_{06\text{-}09}$	Δ $Log(Emp)_{07\text{-}09}$		Δ $Log(HP)_{06\text{-}09}$	Δ $Log(Emp)_{07\text{-}09}$	
	First Stage	IV		First Stage	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Housing Supply Elasticity	0.073***					
	(0.017)					
Share of Unavailable Land				-0.304***		
				(0.086)		
Δ $Log(HP)_{06\text{-}09}$		0.080***	0.036		0.078***	0.035
		(0.021)	(0.022)		(0.020)	(0.020)
Δ $Log(HP)_{06\text{-}09} \times Leverage_{06}$			0.130**			0.130**
			(0.052)			(0.054)
$Leverage_{06}$			-0.032**			-0.033**
			(0.017)			(0.017)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.21	0.03	0.04	0.17	0.03	0.04
Observations	247,800	247,800	247,800	247,800	247,800	247,800

Table 4
Geographical Concentration Index

This table presents variants of the regressions in Table IV in which the sample is partitioned into non-tradable, "other," and tradable industries based on the geographical concentration (GC) index of Mian and Sufi (2014a). Industries in the top quartile of the GC index are classified as tradable; those in the bottom quartile are classified as non-tradable. Industries in the second and third quartiles of the GC index are classified as "other." Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$					
	Non-Tradable	Other	Tradable	Non-Tradable	Other	Tradable
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Log(HP)$_{06\text{-}09}$	0.081***	0.048***	0.003	0.033	0.027	-0.007
	(0.031)	(0.017)	(0.039)	(0.031)	(0.121)	(0.055)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$				0.133***	0.103**	0.031
				(0.040)	(0.050)	(0.117)
Leverage$_{06}$				-0.036**	-0.021**	-0.032*
				(0.016)	(0.009)	(0.017)
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.07	0.02	0.08	0.07	0.02	0.08
Observations	130,700	138,200	15,800	130,700	138,200	15,800

Table 5
"Other" Industries

This table presents variants of the regressions in Table IV in which the sample is restricted to "other" industries, i.e., industries that are neither tradable nor non-tradable. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$	
	(1)	(2)
Δ Log(HP)$_{06\text{-}09}$	0.075***	0.030
	(0.012)	(0.024)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$		0.122***
		(0.047)
Leverage$_{06}$		-0.028**
		(0.012)
Industry Fixed Effects	Yes	Yes
R-squared	0.04	0.04
Observations	150,800	150,800

Table 6
Excluding Tradable Industries

This table presents variants of the regressions in Table II in which tradable industries are excluded. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$	
	(1)	(2)
Δ Log(HP)$_{06\text{-}09}$	0.071***	0.033
	(0.018)	(0.020)
Δ Log(HP)$_{06\text{-}09}$ $\times$ Leverage$_{06}$		0.120***
		(0.041)
Leverage$_{06}$		-0.031**
		(0.015)
Industry Fixed Effects	Yes	Yes
R-squared	0.04	0.04
Observations	274,900	274,900

Table 7
Industries in Which Consumer Demand Shocks Have the Biggest Impact on Employment

This table lists the top ten industries in which house prices have the biggest impact on establishment-level employment—i.e., those with the highest coefficients of Δ Log(HP)$_{06\text{-}09}$—based on estimating column (1) of Table II separately for each 4-digit NAICS industry. Non-tradable industries are described in Mian and Sufi (2014a). "Other" industries are those that are neither tradable nor non-tradable.

4-digit NAICS	NAICS Description	Sector
7221	Full-Service Restaurants	Non-tradable
4441	Building Material and Supplies Dealers	Other
4461	Health and Personal Care Stores	Non-tradable
8111	Automotive Repair and Maintenance	Other
4539	Other Miscellaneous Store Retailers	Non-tradable
4431	Electronics and Appliance Stores	Non-tradable
4413	Automotive Parts, Accessories, and Tire Stores	Non-tradable
4411	Automobile Dealers	Non-tradable
4482	Shoe Stores	Non-tradable
3273	Cement and Concrete Product Manufacturing	Other

Table 8
Establishment Closures

This table presents variants of the regressions in Table II in which the sample also includes establishments that are closed down between 2007 and 2009. The dependent variable is a dummy indicating whether an establishment is closed during that period. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Establishment $Closure_{07\text{-}09}$	
	(1)	(2)
Δ $Log(HP)_{06\text{-}09}$	-0.009***	-0.004
	(0.002)	(0.003)
Δ $Log(HP)_{06\text{-}09} \times Leverage_{06}$		-0.029**
		(0.011)
$Leverage_{06}$		0.043***
		(0.007)
Industry Fixed Effects	Yes	Yes
R-squared	0.02	0.03
Observations	338,100	338,100

Table 9
Compustat-LBD Sample versus Full LBD Sample

This table presents variants of the regressions in Tables II, IV and Table 5 of the Online Appendix. In Panel (A) and columns (1) and (3) of Panel (C), the sample is the matched Compustat-LBD sample. In Panel (B) and columns (2) and (4) of Panel (C), the sample is the full LBD sample. In Panels (A), (B), and columns (1) and (2) of Panel (C), regressions are weighted by establishment size. In columns (3) and (4) of Panel (C), regressions are weighted by firm size. Industry fixed effects are based on 4-digit NAICS codes. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

Panel (A): Matched Compustat-LBD Sample

	Δ Log(Emp)$_{07\text{-}09}$			
	All	Non-tradable	Other	Tradable
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06\text{-}09}$	0.068***	0.074**	0.075***	0.009
	(0.018)	(0.035)	(0.012)	(0.019)
Industry Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.03	0.04	0.04	0.03
Observations	284,800	124,100	150,800	9,900

Panel (B): Full LBD Sample

	Δ Log(Emp)$_{07\text{-}09}$			
	All	Non-tradable	Other	Tradable
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06\text{-}09}$	0.108***	0.120***	0.110***	0.008
	(0.018)	(0.011)	(0.024)	(0.024)
Industry Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.04	0.02	0.04	0.04
Observations	4,542,300	910,300	3,449,600	182,400

Table 9 (continued)

Panel (C): Regressions Weighted by Establishment Size versus Firm Size

	Δ Log(Emp)$_{07\text{-}09}$			
	Establishment-Size Weights		Firm-Size Weights	
	Matched Compustat-LBD Sample	Full LBD Sample	Matched Compustat-LBD Sample	Full LBD Sample
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06\text{-}09}$	0.068***	0.108***	0.063**	0.078***
	(0.018)	(0.018)	(0.026)	(0.013)
Industry Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.03	0.04	0.03	0.01
Observations	284,800	4,542,300	284,800	4,542,300

Table 10
Robustness: Employment and Asset Growth

This table presents variants of the regressions in Table II in which Z and Δ $Log(HP)_{06-09}$ × Z are included as additional controls. In column (1), Z is the growth in firm-level employment from 2002 to 2006, Δ $Log(Emp)_{02\text{-}06}$. In column (2), Z is the growth in firm-level assets from 2002 to 2006, Δ $Log(Assets)_{02\text{-}06}$. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ $Log(Emp)_{07\text{-}09}$	
	(1)	(2)
Δ $Log(HP)_{06\text{-}09}$	0.026	0.024
	(0.024)	(0.019)
Δ $Log(HP)_{06\text{-}09}$ × $Leverage_{06}$	0.111**	0.113***
	(0.047)	(0.040)
Δ $Log(HP)_{06\text{-}09}$ × Δ $Log(Emp)_{02\text{-}06}$	0.027	
	(0.034)	
Δ $Log(HP)_{06\text{-}09}$ × Δ $Log(Assets)_{02\text{-}06}$		0.012
		(0.009)
$Leverage_{06}$	-0.033**	-0.033**
	(0.016)	(0.015)
Δ $Log(Emp)_{02\text{-}06}$	0.008	
	(0.018)	
Δ $Log(Assets)_{02\text{-}06}$		0.005
		(0.003)
Industry Fixed Effects	Yes	Yes
R-squared	0.04	0.04
Observations	284,800	284,800

Table 11
Robustness: Productivity

This table presents variants of the regressions in Table II in which Z and Δ $Log(HP)_{06-09}$ × Z are included as additional controls. In column (1), Z is the firm's return on assets, ROA_{06}. In column (2), Z is the firm's net profit margin, NPM_{06}. In column (3), Z is the firm's total factor productivity, TFP_{06}. ROA_{06} is the ratio of operating income before depreciation to total assets. NPM_{06} is the ratio of operating income before depreciation to sales. TFP_{06} is the residual from a regression of Log(Sales) on Log(Employees) and Log(PP&E) across all Compustat firms in the same 2-digit SIC industry. All three productivity measures are as of 2006. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ $Log(Emp)_{07-09}$		
	(1)	(2)	(3)
Δ $Log(HP)_{06-09}$	0.030	0.031	0.031
	(0.019)	(0.035)	(0.019)
Δ $Log(HP)_{06-09}$ × $Leverage_{06}$	0.101**	0.122***	0.108***
	(0.040)	(0.041)	(0.039)
Δ $Log(HP)_{06-09}$ × ROA_{06}	-0.024		
	(0.110)		
Δ $Log(HP)_{06-09}$ × NPM_{06}		-0.038	
		(0.161)	
Δ $Log(HP)_{06-09}$ × TFP_{06}			-0.049*
			(0.026)
$Leverage_{06}$	-0.034**	-0.036**	-0.029**
	(0.015)	(0.016)	(0.014)
ROA_{06}	0.133***		
	(0.029)		
NPM_{06}		0.149***	
		(0.030)	
TFP_{06}			0.027*
			(0.016)
Industry Fixed Effects	Yes	Yes	Yes
R-squared	0.04	0.04	0.04
Observations	284,800	284,800	284,800

Table 12
Robustness: Sensitivity to Aggregate Employment and House Prices (I)

This table presents variants of the regressions in Table II in which Z and Δ $Log(HP)_{06-09}$ × Z are included as additional controls. In column (1), Z is the 10-year elasticity of firm-level employment with respect to aggregate employment, $Elasticity_{Emp,10\text{-}year}$. In column (2), Z is the 20-year elasticity of firm-level employment with respect to aggregate employment, $Elasticity_{Emp,20\text{-}year}$. In column (3), Z is the 10-year elasticity of firm-level employment with respect to house prices, $Elasticity_{HP,10\text{-}year}$. In column (4), Z is the elasticity of firm-level employment with respect to house prices during the 2002 to 2006 housing boom, $Elasticity_{HP,02\text{-}06}$. $Elasticity_{Emp,10\text{-}year}$ and $Elasticity_{Emp,20\text{-}year}$ are computed by estimating a firm-level regression of Δ Log (Employment) on a constant and Δ Log (LBD Employment) using all available years from 1997 to 2006 and 1987 to 2006, respectively. $Elasticity_{HP,10\text{-}year}$ and $Elasticity_{HP,02\text{-}06}$ are computed as the employment-weighted average elasticity of employment with respect to house prices across all of the firm's establishments, where the latter is computed either by estimating an establishment-level regression of Δ Log(Employment) on a constant and Δ Log(HP) using all available years from 1997 to 2006 ($Elasticity_{HP,10\text{-}year}$) or as the percentage change in establishment-level employment divided by the percentage change in house prices during the 2002 to 2006 housing boom ($Elasticity_{HP,02\text{-}06}$). Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ $Log(Emp)_{07-09}$			
	(1)	(2)	(3)	(4)
Δ $Log(HP)_{06-09}$	0.027	0.027	0.029	0.029
	(0.019)	(0.019)	(0.020)	(0.019)
Δ $Log(HP)_{06-09}$ × $Leverage_{06}$	0.109**	0.110**	0.119***	0.120***
	(0.044)	(0.044)	(0.044)	(0.044)
Δ $Log(HP)_{06-09}$ × $Elasticity_{Emp,10\text{-}year}$	0.006*			
	(0.004)			
Δ $Log(HP)_{06-09}$ × $Elasticity_{Emp,20\text{-}year}$		0.005		
		(0.004)		
Δ $Log(HP)_{06-09}$ × $Elasticity_{HP,10\text{-}year}$			0.006	
			(0.008)	
Δ $Log(HP)_{06-09}$ × $Elasticity_{HP,02\text{-}06}$				0.007
				(0.008)
$Leverage_{06}$	-0.027*	-0.028*	-0.030**	-0.030**
	(0.016)	(0.016)	(0.016)	(0.016)
$Elasticity_{Emp,10\text{-}year}$	-0.005***			
	(0.002)			
$Elasticity_{Emp,20\text{-}year}$		-0.005***		
		(0.002)		
$Elasticity_{HP,10\text{-}year}$			-0.004*	
			(0.002)	
$Elasticity_{HP,02\text{-}06}$				-0.004*
				(0.002)
Industry Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.04	0.04	0.04	0.04
Observations	284,800	284,800	284,800	284,800

Table 13
Robustness: Sensitivity to Aggregate Employment and House Prices (II)

This table presents variants of the regressions in Table 12 of the Online Appendix. In columns (1) to (3), the elasticity of firm-level employment with respect to aggregate employment is computed over either a 15-year period ending in 2006 ($Elasticity_{Emp,15\text{-}year}$), 30-year period ending in 2006 ($Elasticity_{Emp,30\text{-}year}$), or as the percentage change in firm-level employment divided by the percentage change in aggregate employment during the 2001 recession ($Elasticity_{Emp,2001}$). In column (4), the elasticity of firm-level employment with respect to house prices is computed as the employment-weighted average percentage change in establishment-level employment divided by the percentage change in house prices during the 2001 recession ($Elasticity_{HP,2001}$). Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$			
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06\text{-}09}$	0.027	0.030	0.031	0.029
	(0.019)	(0.019)	(0.019)	(0.020)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$	0.110**	0.106**	0.115***	0.119**
	(0.044)	(0.041)	(0.041)	(0.045)
Δ Log(HP)$_{06\text{-}09}$ × $Elasticity_{Emp,15\text{-}year}$	0.005			
	(0.004)			
Δ Log(HP)$_{06\text{-}09}$ × $Elasticity_{Emp,30\text{-}year}$		0.005		
		(0.003)		
Δ Log(HP)$_{06\text{-}09}$ × $Elasticity_{Emp,2001}$			0.014	
			(0.099)	
Δ Log(HP)$_{06\text{-}09}$ × $Elasticity_{HP,2001}$				0.005
				(0.008)
Leverage$_{06}$	-0.028*	-0.031**	-0.029**	-0.030**
	(0.016)	(0.015)	(0.015)	(0.016)
$Elasticity_{Emp,15\text{-}year}$	-0.005***			
	(0.002)			
$Elasticity_{Emp,30\text{-}year}$		-0.001		
		(0.001)		
$Elasticity_{Emp,2001}$			-0.071***	
			(0.021)	
$Elasticity_{HP,2001}$				-0.003
				(0.002)
Industry Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.04	0.04	0.04	0.04
Observations	284,800	284,800	284,800	284,800

Table 14
Robustness: Activist Investors

This table presents variants of the regressions in Table II in which Z and Δ Log(HP)$_{06-09}$ × Z are included as additional controls. In column (1), Z is a dummy indicating whether a firm is targeted by an activist hedge fund in 2006, Hedge Fund$_{06}$. In column (2), Z is a dummy indicating whether a firm has significant (i.e., more than 5%) private equity ownership in 2006, Private Equity$_{06}$. Industry fixed effects are based on 4-digit NAICS codes. All regressions are weighted by establishment size. Standard errors (in parentheses) are clustered at both the state and firm level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07-09}$	
	(1)	(2)
Δ Log(HP)$_{06-09}$	0.032	0.029
	(0.019)	(0.019)
Δ Log(HP)$_{06-09}$ × Leverage$_{06}$	0.110***	0.115***
	(0.039)	(0.040)
Δ Log(HP)$_{06-09}$ × Hedge Fund$_{06}$	0.036	
	(0.036)	
Δ Log(HP)$_{06-09}$ × Private Equity$_{06}$		0.009
		(0.056)
Leverage$_{06}$	-0.032**	-0.032**
	(0.015)	(0.015)
Hedge Fund$_{06}$	-0.015*	
	(0.008)	
Private Equity$_{06}$		-0.015
		(0.011)
Industry Fixed Effects	Yes	Yes
R-squared	0.04	0.04
Observations	284,800	284,800

Table 15
Robustness: Employment and Asset Growth (County Level)

This table presents county-level variants of the regressions in Table 10 of the Online Appendix in which Z is the employment-weighted average value of Z across all firms in our sample within a county. County-level employment is total employment by all firms in our sample within a county. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07-09}$	
	(1)	(2)
Δ Log(HP)$_{06-09}$	0.024	0.022
	(0.020)	(0.020)
Δ Log(HP)$_{06-09}$ × Leverage$_{06}$	0.113**	0.116**
	(0.046)	(0.047)
Δ Log(HP)$_{06-09}$ × Δ Log(Emp)$_{02-06}$	0.019	
	(0.047)	
Δ Log(HP)$_{06-09}$ × Δ Log(Assets)$_{02-06}$		0.011
		(0.010)
Leverage$_{06}$	-0.036**	-0.034**
	(0.018)	(0.016)
Δ Log(Emp)$_{02-06}$	0.010	
	(0.008)	
Δ Log(Assets)$_{02-06}$		0.006
		(0.004)
County × Industry Controls	Yes	Yes
R-squared	0.13	0.13
Observations	1,000	1,000

Table 16
Robustness: Productivity (County Level)

This table presents county-level variants of the regressions in Table 11 of the Online Appendix in which Z is the employment-weighted average value of Z across all firms in our sample within a county. County-level employment is total employment by all firms in our sample within a county. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$		
	(1)	(2)	(3)
Δ Log(HP)$_{06\text{-}09}$	0.026	0.029	0.028
	(0.016)	(0.019)	(0.020)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$	0.104**	0.119**	0.107***
	(0.048)	(0.052)	(0.039)
Δ Log(HP)$_{06\text{-}09}$ × ROA$_{06}$	-0.020		
	(0.026)		
Δ Log(HP)$_{06\text{-}09}$ × NPM$_{06}$		-0.040	
		(0.045)	
Δ Log(HP)$_{06\text{-}09}$ × TFP$_{06}$			-0.044
			(0.048)
Leverage$_{06}$	-0.032**	-0.035**	-0.030**
	(0.015)	(0.016)	(0.013)
ROA$_{06}$	0.140***		
	(0.039)		
NPM$_{06}$		0.160***	
		(0.062)	
TFP$_{06}$			0.026
			(0.035)
County × Industry Controls	Yes	Yes	Yes
R-squared	0.13	0.13	0.13
Observations	1,000	1,000	1,000

Table 17
Robustness: Sensitivity to Aggregate Employment and House Prices (I) (County Level)

This table presents county-level variants of the regressions in Table 12 of the Online Appendix in which Z is the employment-weighted average value of Z across all firms in our sample within a county. County-level employment is total employment by all firms in our sample within a county. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07-09}$			
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06-09}$	0.026	0.029	0.024	0.025
	(0.016)	(0.016)	(0.020)	(0.020)
Δ Log(HP)$_{06-09}$ × Leverage$_{06}$	0.107***	0.109***	0.114***	0.114***
	(0.036)	(0.037)	(0.043)	(0.043)
Δ Log(HP)$_{06-09}$ × Elasticity$_{Emp,10\text{-}year}$	0.005			
	(0.004)			
Δ Log(HP)$_{06-09}$ × Elasticity$_{Emp,20\text{-}year}$		0.006		
		(0.004)		
Δ Log(HP)$_{06-09}$ × Elasticity$_{HP,10\text{-}year}$			0.007	
			(0.011)	
Δ Log(HP)$_{06-09}$ × Elasticity$_{HP,02-06}$				0.005
				(0.011)
Leverage$_{06}$	-0.029**	-0.030**	-0.030**	-0.030**
	(0.013)	(0.013)	(0.013)	(0.013)
Elasticity$_{Emp,10\text{-}year}$	-0.006			
	(0.004)			
Elasticity$_{Emp,20\text{-}year}$		-0.005		
		(0.004)		
Elasticity$_{HP,10\text{-}year}$			-0.003	
			(0.006)	
Elasticity$_{HP,02-06}$				-0.004
				(0.006)
County × Industry Controls	Yes	Yes	Yes	Yes
R-squared	0.13	0.13	0.13	0.13
Observations	1,000	1,000	1,000	1,000

Table 18
Robustness: Sensitivity to Aggregate Employment and House Prices (II) (County Level)

This table presents county-level variants of the regressions in Table 13 of the Online Appendix in which Z is the employment-weighted average value of Z across all firms in our sample within a county. County-level employment is total employment by all firms in our sample within a county. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$			
	(1)	(2)	(3)	(4)
Δ Log(HP)$_{06\text{-}09}$	0.027	0.026	0.029	0.024
	(0.016)	(0.019)	(0.018)	(0.020)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$	0.108***	0.107***	0.113***	0.113***
	(0.037)	(0.037)	(0.040)	(0.043)
Δ Log(HP)$_{06\text{-}09}$ × Elasticity$_{Emp,15\text{-}year}$	0.006			
	(0.004)			
Δ Log(HP)$_{06\text{-}09}$ × Elasticity$_{Emp,30\text{-}year}$		0.005		
		(0.003)		
Δ Log(HP)$_{06\text{-}09}$ × Elasticity$_{Emp,2001}$			0.017	
			(0.088)	
Δ Log(HP)$_{06\text{-}09}$ × Elasticity$_{HP,2001}$				0.007
				(0.010)
Leverage$_{06}$	-0.030**	-0.030**	-0.028**	-0.029**
	(0.013)	(0.013)	(0.013)	(0.013)
Elasticity$_{Emp,15\text{-}year}$	-0.006			
	(0.004)			
Elasticity$_{Emp,30\text{-}year}$		-0.001		
		(0.003)		
Elasticity$_{Emp,2001}$			-0.082	
			(0.087)	
Elasticity$_{HP,2001}$				-0.002
				(0.006)
County × Industry Controls	Yes	Yes	Yes	Yes
R-squared	0.13	0.13	0.13	0.13
Observations	1,000	1,000	1,000	1,000

Table 19
Robustness: Activist Investors (County Level)

This table presents county-level variants of the regressions in Table 14 of the Online Appendix in which Z is the employment-weighted average value of Z across all firms in our sample within a county. County-level employment is total employment by all firms in our sample within a county. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07\text{-}09}$	
	(1)	(2)
Δ Log(HP)$_{06\text{-}09}$	0.030	0.031
	(0.019)	(0.019)
Δ Log(HP)$_{06\text{-}09}$ × Leverage$_{06}$	0.111***	0.113***
	(0.042)	(0.044)
Δ Log(HP)$_{06\text{-}09}$ × Hedge Fund$_{06}$	0.031	
	(0.019)	
Δ Log(HP)$_{06\text{-}09}$ × Private Equity$_{06}$		0.009
		(0.012)
Leverage$_{06}$	-0.031**	-0.030**
	(0.013)	(0.014)
Hedge Fund$_{06}$	-0.013	
	(0.009)	
Private Equity$_{06}$		-0.016
		(0.024)
County × Industry Controls	Yes	Yes
R-squared	0.13	0.13
Observations	1,000	1,000

Table 20
Simulating Measurement Error in County-Level Leverage

This table presents simulations based on the regression in column (2) of Table VII in which $Leverage_{06}$ is replaced by $Leverage_{06} + \eta$. In each simulation, η is drawn with replacement for each county from the distribution $\eta \sim N(0, \sigma^2_\eta)$, where $\sigma^2_\eta = \sigma^2_{Leverage_{06}} \times (1-\lambda)/\lambda$, and where λ is the reliability ratio as described in the proof included in this Online Appendix. Each regression is based on 1,000 simulations. The table reports the average coefficients and standard errors across all 1,000 simulations. County × industry controls are the county-specific employment shares of all 23 two-digit NAICS industries in 2006. All regressions are weighted by county size. Standard errors (in parentheses) are clustered at the state level. *, **, and *** denotes significance at the 10%, 5%, and 1% level, respectively.

	Δ Log(Emp)$_{07-09}$						
	λ = 1	λ = 0.9	λ = 0.75	λ = 0.5	λ = 0.25	λ = 0.1	λ = 0.001
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ Log(HP)$_{06-09}$	0.025	0.027	0.036**	0.048***	0.055***	0.064***	0.069***
	(0.019)	(0.018)	(0.017)	(0.014)	(0.011)	(0.009)	(0.008)
Δ Log(HP)$_{06-09}$ × Leverage$_{06}$	0.110***	0.103***	0.083***	0.053*	0.034	0.012	0.000
	(0.038)	(0.036)	(0.033)	(0.027)	(0.019)	(0.012)	(0.001)
Leverage$_{06}$	-0.029**	-0.026**	-0.022**	-0.014	-0.007	-0.003	-0.000
	(0.013)	(0.012)	(0.011)	(0.009)	(0.007)	(0.004)	(0.000)
County × Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Observations	1,000	1,000	1,000	1,000	1,000	1,000	1,000