How does labor market size affect firm capital structure? Evidence from large plant openings

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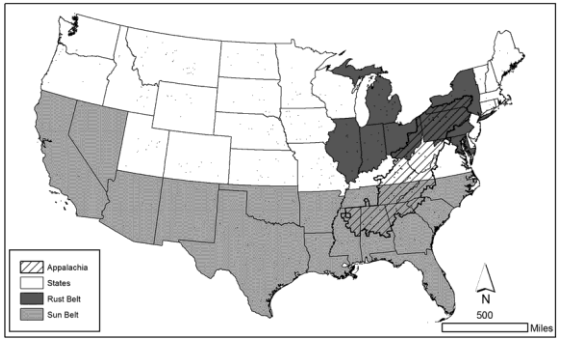
Situation

- **The size of the US labor market** varies considerably.
  - across geographic areas, economic sectors, and time.
- **Rust Belt vs. Sun Belt**
  - Rust Belt
    - formerly home to America's chief manufacturing cities.
    - great losses in manufacturing jobs in recent decades (Kahn, 1999)
  - Sun Belt cities have recently observed a considerable expansion in manufacturing labor markets.



- Firms that operate in larger labor markets have significantly higher leverage.
- **What might explain the association between labor market size and firm capital structure?**

Research Question

- Whether and how the size of labor markets in which firms operate affects their capital structure decisions
  - **The premise of the model**: large labor markets facilitate workers in their job search, which makes losing their jobs less costly (Petrongolo and Pissarides, 2006)
    - → In such market, when firms use more debt, the marginal compensating premium for increased risk of job loss is smaller (Titman, 1984; Agrawal and Matsa, 2013)
      - ➔ Given these smaller indirect costs of financial distress, **firms operating in large labor markets may use more debt in their capital structure**.
  - Empirical setting
    - **The size of a local labor market** increases abruptly due to **a large plant opening.**
    - **Local counties** that either win a larger manufacturing plant (**"winners"**) or lose the competition (**"runners-up"**) (Greenstone and Moretti, 2004; Greenstone, Hornbeck, and Moretti, 2010)
      - → **The effect of an increase in labor market size on corporate capital structure** by comparing changes in **leverage** between **the two groups of firms**

Main Findings

- **A typical new manufacturing plant** in the sample leads to **a 22.4% increase** in the county's manufacturing **labor market** relative to the runner-up.
  - **Two years after the plant opening, manufacturing firms operating in the winner county increase their leverage ratios by 2.3 percentage points.**
    - In contrast, manufacturing firms in the runner-up county do not change their leverage during the same period.
    - **Four years** after the plant opening, firms in the winner county increase their leverage by **3.9 percentage points** relative to those in the runner-up county.

➔ An increase in the local labor market size, which reduces workers' job loss costs, leads firms to increase the use of debt in their capital structure.

Contribution

- Search frictions in the labor market & corporate capital structure decisions
  - Previous research examining related questions
    - state-level changes in unemployment insurance benefits (Agrawal and Matsa, 2013)

- Large literature on agglomeration spillovers
  - Firms' increased debt usage is another significant benefit of firm clustering in local areas.
    - improved incentives for managers (Harris and Raviv, 1990), interest tax deductions (Graham, 2000)

- This paper provides novel evidence that labor market size is an important determinant of worker earnings after a job loss.

Model

- A simple static trade-off model
  - conceptual links between the size of labor markets and corporate leverage policy
    - The framework for production is adapted from Acemoglu (1997) and that for capital structure is from Titman (1984) and Berk et al. (2010).
  - $\boldsymbol{L}$: a firm's leverage ratio (defined as the ratio of debt to the sum of equity and debt)
  - $\boldsymbol{T}(\boldsymbol{L})$: a tax benefit (generated by $\boldsymbol{L}[\mathbf{0},\mathbf{1}]$)
    - an increasing, concave function of $\boldsymbol{L}$ (Graham, 2000)
  - $\boldsymbol{p}(\boldsymbol{L})$: the probability of financial distress
  - $\boldsymbol{C_F}(\boldsymbol{L})$: the loss given financial distress
    - $\boldsymbol{p}(\boldsymbol{L})$ and $\boldsymbol{C_F}(\boldsymbol{L})$ are increasing, convex functions of $\boldsymbol{L}$.

Model

- A simple static trade-off model
  - W: **the wage** paid by the firm to produce output
  - K: **the cost** invested by the worker (e.g., effort) for required skills
  - S: **the present value of investments** in skills
    - Positive if the worker stays within the current firm or moves to a firm that uses the same skills (zero at all other firms)
  - u: **the probability** the worker is not able to find another job using current skills when the worker is laid off from the current firm → **search frictions**
    - **Assumption**: if a firm becomes financially distressed (with a probability $p(L)$), the worker is laid off with a probability of one.

Model

- A simple static trade-off model

$$\max_{L} \; T(L) - p(L) \cdot C_F(L) - W$$

$$\text{s.t. } W + [1 - p(L) \cdot u] \cdot S \geq K + e(o)$$

  - $\boldsymbol{e(o)}$: the worker's outside option and wages due to an entry
    - The value of a constant $\boldsymbol{e} > \mathbf{0}$ if a large plant opens ($\boldsymbol{o} = \mathbf{1}$), and zero otherwise ($\boldsymbol{o} = \mathbf{0}$)

    → Excess demand of labor

  - Take-it-or-leave-it **wage offer** to the worker

$$W = K - [1 - p(L) \cdot u] \cdot S + \; e(o)$$

  - **The first-order condition**

$$T'(L) = p'(L) \cdot (\mathrm{u} \cdot \mathrm{S} + \mathrm{C}_F(L)) + p(L) \cdot C'_F(L)$$

Model

- A simple static trade-off model

$$T'(L) = p'(L) \cdot (\mathrm{u} \cdot \mathrm{S} + \mathrm{C}_F(L)) + p(L) \cdot C_F'(L)$$

→ The optimal leverage ratio is decreasing in $\boldsymbol{u}$.

– **Main prediction**: an increase in labor market size (i.e., smaller $\boldsymbol{u}$) would lead to an increase in the optimal leverage ratio, $\boldsymbol{L}^*$.

compensating differentials for the risk of job loss conditional on the firms' financial distress

$$W = K + p(L)uS - S + e(o)$$

– **Wage prediction**: the net impact of reduced search costs due to plant opening on equilibrium wages is ambiguous.

Empirical Approach

- A Quasi-natural Experiment = a treatment is applied due to social or political factors, such as a change in laws or implementation of a new government program.
  - The opening of a large manufacturing plant in a given county

    → an abrupt expansion of the local labor market in the sector
    - Given that workers concentrate their job searches in local areas (Moretti, 2011; Manning and Petrongolo, 2017)
    - This increase in labor market size reduces the costs of financial distress stemming from frictions associated with workers finding a similar employer.

      ➔ leads the existing firms in the local labor market to increase debt usage
  - **Endogeneity concerns about plant opening decision**
    - rankings of potential large manufacturing plant sites from the corporate real estate journal **Site Selection** (Greenstone and Moretti, 2004; Greenstone, Hornbeck, and Moretti, 2010)

      (1) the county that succeeded in attracting the new plant (**the winner**)

      (2) the county that was a final candidate but narrowly lost out (**the runner-up**)

      ➔ **Both counties satisfy most of the important specifications for the new site**, such as labor availability, transportation infrastructure, and employee quality of life.

Empirical Approach

- A Quasi-natural Experiment
  - focused on the **manufacturing** sector
    - **Industry- or sector-specific human capital** is more important for **manufacturing workers.** (Jacobson et al., 1993; Couch and Placzek, 2010)

      → the introduction of a new **manufacturing** employer may not significantly affect job search costs for **nonmanufacturing** workers.
    - Manufacturing industries generally produce **nationally** (as opposed to locally) tradable goods (Glaeser and Kohlhase, 2004)

      → able to avoid alternative explanations related to **local product market competition**.

Data

- Data Sources and Sample Construction
  - **"Million dollar plants"(MDP) articles** from 1980 to 1995
    - Hand-collected data on the opening of large manufacturing plants from **Site Selection**
    - Site Selection stopped publication of this feature after 1995
    - information on the location (city and county) that the firm chose for the new plant site
    - one or two runner-up locations considered by the firm
  - **Plant level data**
    - the Census Bureau's Standard Statistical Establishment List (SSEL)
    - Longitudinal Business Database (LBD)

    → all establishments in the winner and runner-up counties that are owned by firms
  - **Firm level data**
    - Compustat

Data

- Data Sources and Sample Construction
  - **40 manufacturing plant opening cases from 1980 to 1995**
    - the treatment window as four years before and after a plant opening for each event
    - Parent firms in the sample to have at least 3% of their employees located in either the winner or the runner-up county
  - **The final sample**: approximately **5900 firm-year observations** from 1976 to 1999
    - Rounded to the nearest hundred or thousand to follow the Census Bureau's disclosure rules

Data

- Data Sources and Sample Construction
  - Plant observations
    - **The Census of Manufacturers (CMF)**: all manufacturing plants with at least one employee for years ending "2"or "7"(census years), including approximately 300,000 plants in each census.
    - **The Annual Survey of Manufacturers (ASM)**: about 50,000 plants for noncensus years
      → Plants with more than 250 employees are always included in the ASM, whereas those with fewer employees are randomly sampled, with the probability increasing in size.
    - total value of shipments, labor hours, and wage bills
  - Employer–employee matched data
    - **The Census Bureau's LEHD program:** the implications of local labor market size for the magnitude of displaced workers' earnings loss
      - based on the state unemployment insurance (UI) records and covering about 96% of private sector employment in 30 states from 1985 to 2008
      - earnings, employers, locations, industries / age and sex

Data

- Summary Statistics
  - Manufacturing plant opening events

	(1)
Total number of events	40
Total number of winner counties	43
Total number of runner-up counties	59
Distribution of events by year:	
1980–1987	20
1988–1995	20
Distribution of winner counties by region:	
Northeast and Midwest	10
South and West	33
Distribution of runner-up counties by region:	
Northeast and Midwest	25
South and West	34
New plants relative to winner counties:	
Total employees	0.41
	(1.01)

Data

- Summary Statistics
  - Firm observations

Sample:	(1) Winner	(2) Runner-up	(3) All other firms	(4)	(5) (1)–(2)	(6) (1)–(3)
Statistic:	Mean	Mean	Mean	SD	*t*-statistic	*t*-statistic
% employees in winner/runner-up counties	0.25	0.25	–	–	0.20	–
Leverage	0.33	0.36	0.33	0.27	−1.99	0.14
Cash holdings	0.11	0.10	0.15	0.19	1.14	−3.32
Log assets	5.48	5.30	4.56	2.16	0.94	6.66
Tangibility	0.32	0.30	0.28	0.17	1.75	4.41
Market-to-book	1.83	1.66	2.14	2.25	1.41	−2.46
Return on assets	0.14	0.14	0.10	0.23	−0.30	4.52
Labor intensity	8.72	8.91	8.22	6.82	−0.37	1.20
Capex	0.27	0.25	0.35	0.42	0.56	−3.45
R&D	0.04	0.03	0.06	0.11	1.05	−4.79
Sales growth	0.07	0.08	0.10	0.32	−0.50	−1.85
Observations	276	413	44,599	–	–	–

Empirical Analysis

- Baseline results
  - Effect of new manufacturing plants on leverage of existing manufacturing firms

Panel A: Baseline results

	(1)	(2)	(3)
Dependent variable:		Leverage (%)	
After × Winner	3.089	2.852	3.267
	(1.034)	(1.039)	(0.997)
After	NR	NR	NR
	NR	NR	NR
Winner	−2.489	−2.404	−2.658
	(1.011)	(1.045)	(0.944)
log(assets)	–	1.411	0.856
	–	(1.167)	(0.991)
Tangibility	–	22.770	21.780
	–	(5.593)	(5.694)
Market-to-book	–	0.815	0.666
	–	(0.591)	(0.677)
ROA	–	−29.290	−25.370
	–	(3.309)	(3.353)
Firm fixed effects	Y	Y	Y
Year fixed effects	Y	Y	
Event fixed effects		Y	Y
Industry × year fixed effects			Y
Observations	5900	5900	5900
R^2	0.7314	0.7436	0.7791

Empirical Analysis

- Baseline results
  - Effect of new manufacturing plants on leverage of existing manufacturing firms

Panel B: Using event-by-year fixed effects

	(1)	(2)	(3)	(4)
Dependent variable:		Leverage (%)		
After × Winner	3.415	3.329	3.977	3.860
	(1.570)	(1.544)	(1.388)	(2.037)
Winner	−2.635	−2.643	−3.058	−4.847
	(1.232)	(1.245)	(1.097)	(2.831)
Firm-level controls		Y	Y	Y
Firm fixed effects	Y	Y	Y	Y
Event × year fixed effects	Y	Y	Y	
Industry × year fixed effects			Y	
Event × industry × year fixed effects				Y
Observations	5900	5900	5900	5900
R^2	0.7413	0.7535	0.7891	0.8716

Empirical Analysis

- Treatment intensity: effects of plant opening conditional on fraction of affected firm employees
  - Fraction of firm employees in affected counties and effect of new manufacturing plants on leverage of existing manufacturing firms

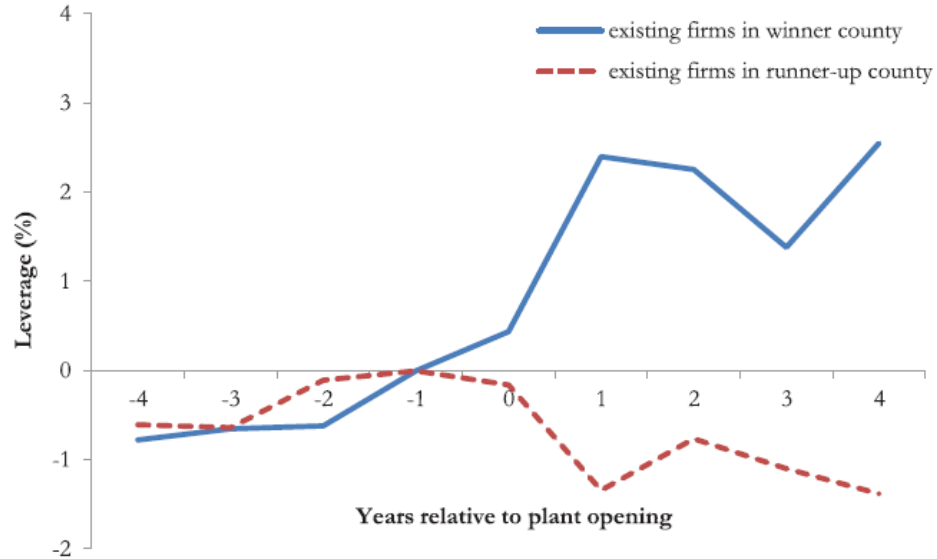
	(1)	(2)
Fraction of employees:	Large	Small
Dependent variable:	Leverage (%)	
After × Winner	4.592	0.304
	(1.673)	(1.379)
After	−2.000	0.542
	(1.061)	(1.129)
Winner	−1.860	−2.687
	(1.519)	(1.213)
Firm-level controls	Y	
Firm fixed effect	Y	
Year fixed effects	Y	
Event fixed effects	Y	
Observations	5900	
R^2	0.7444	
After × Winner × (Large − Small)	4.288	
t-statistic	1.83	

Empirical Analysis

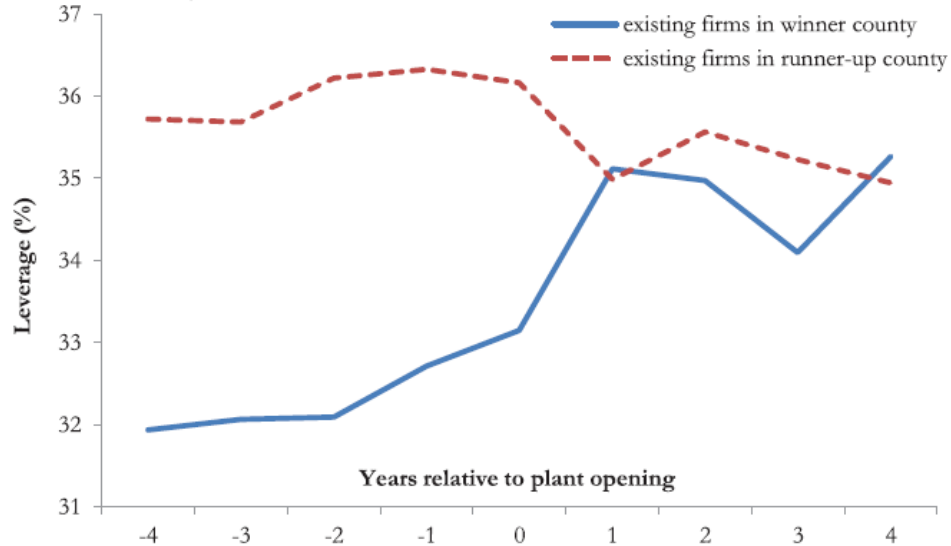
- Dynamic effects of plant opening on firm leverage
  - Dynamic effect of new plants on leverage of existing manufacturing firms

	(1)	(2)	(3)
Dependent variable:		Leverage (%)	
Coefficient:	Winner	Runner-up	[Winner − Runner-up]
d[t−4]	−0.778	−0.604	−0.174
	(0.997)	(0.804)	(1.148)
d[t−3]	−0.651	−0.638	−0.013
	(1.011)	(0.664)	(1.087)
d[t−2]	−0.620	−0.109	−0.512
	(0.765)	(0.672)	(1.015)
d[t−1]	0.000	0.000	0.000
	–	–	–
d[t]	0.436	−0.163	0.599
	(0.448)	(0.536)	(0.669)
d[$t+1$]	2.401	−1.340	3.740
	(0.756)	(0.656)	(1.006)
d[$t+2$]	2.258	−0.763	3.021
	(0.939)	(0.649)	(1.159)
d[$t+3$]	1.385	−1.100	2.485
	(0.919)	(0.877)	(1.276)
d[$t+4$]	2.551	−1.382	3.933
	(1.332)	(0.896)	(1.631)
Firm-level controls		Y	
Firm fixed effect		Y	
Year fixed effects		Y	
Event fixed effects		Y	
Observations		5900	
R^2		0.7441	

Panel A: With indexing to zero in year *t*-1



Panel B: Without indexing to zero in year *t*-1



Empirical Analysis

- Alternative explanations: selection and reversion to mean
  - Robustness of baseline results to preexisting difference in leverage

Panel A: Excluding MDP events with large pre-event difference in leverage

	(1)	(2)	(3)	(4)
Dependent variable:		Leverage (%)		
After × Winner	2.832	2.377	2.293	2.125
	(1.225)	(1.216)	(1.108)	(1.758)
After	−1.882	−1.533	−1.236	–
	(0.685)	(0.718)	(0.616)	–
Winner	−0.289	0.370	0.034	0.444
	(1.287)	(1.142)	(1.063)	(1.284)
Firm-level controls		Y	Y	Y
Firm fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y		
Event fixed effects		Y	Y	
Industry × year fixed effects			Y	
Event × year fixed effects				Y
Observations	4000	4000	4000	4000
R^2	0.7393	0.7541	0.7950	0.7621

Empirical Analysis

- Alternative explanations: selection and reversion to mean
  - Robustness of baseline results to preexisting difference in leverage

Panel B: One-to-one matched sample on pre-event leverage

	(1)	(2)	(3)	(4)
Dependent variable:		Leverage (%)		
After × Winner	4.229	3.662	4.006	3.776
	(2.313)	(2.138)	(2.110)	(2.121)
After	NR	NR	NR	–
	NR	NR	NR	–
Winner	−1.774	−1.012	−0.933	−1.066
	(1.755)	(1.404)	(1.612)	(1.440)
Firm-level controls		Y	Y	Y
Firm fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y		
Event fixed effects		Y	Y	
Industry × year fixed effects			Y	
Event × year fixed effects				Y
Observations	4500	4500	4500	4500
R^2	0.7245	0.7457	0.8037	0.7757

Empirical Analysis

- Mechanisms for the effects
  - Labor market size versus other mechanisms of agglomeration spillovers

Group:	(1) High labor flow	(2) Low labor flow	(3) High input-output	(4) Low input-output	(5) High citation	(6) Low citation	(7) High asset similarity	(8) Low asset similarity
Dependent variable:					Leverage (%)			
After × Winner	5.843	0.825	3.146	2.644	3.385	2.544	3.477	2.355
	(2.061)	(1.241)	(1.519)	(1.196)	(1.869)	(1.179)	(1.588)	(1.333)
Firm-level controls	Y		Y		Y		Y	
Firm fixed effect	Y		Y		Y		Y	
Year fixed effects	Y		Y		Y		Y	
Event fixed effects	Y		Y		Y		Y	
Observations	5900		5900		5900		5900	
R^2	0.7445		0.7448		0.7439		0.7439	
After × Winner × (High − Low)	5.019		0.502		0.841		1.122	
t-statistic	1.97		0.28		0.39		0.56	

Empirical Analysis

- Mechanisms for the effects
  - How does labor market size affect costs of financial distress?: Labor market size, wages, and labor productivity

	(1)	(2)	(3)
Sample:		Plants	
Dependent variable:	Average annual pay	Wage per hour	Labor productivity
After × Winner	−0.001	0.003	0.032
	(0.009)	(0.011)	(0.016)
After	−0.007	0.006	−0.023
	(0.006)	(0.005)	(0.01)
log(plant per firm)	0.007	0.015	0.014
	(0.004)	(0.005)	(0.009)
log(plant per segment)	0.002	0.006	0.007
	(0.003)	(0.005)	(0.014)
Plant fixed effects	Y	Y	Y
Industry × Year fixed effects	Y	Y	Y
Event fixed effect	Y	Y	Y
Observations	19,000	19,000	19,000
R^2	0.8211	0.7996	0.9169

Empirical Analysis

- Labor market size and earnings loss of displaced workers

Dependent variable:	(1) log(earnings)
d[t−3] × DS	NR
	NR
d[t−2] × DS	−0.523
	(0.302)
d[t−1] × DS	−0.146
	(0.351)
d[t] × DS	−1.296
	(0.814)
d[t + 1] × DS	−2.065
	(0.837)
d[t + 2] × DS	−1.837
	(0.710)
d[t + 3] × DS	−0.527
	(0.570)
d[t + 4] × DS	−0.885
	(0.546)
d[t + 5] × DS	−1.655
	(1.031)
d[t−3] × DS × Market size	NR
	NR
d[t−2] × DS × Market size	0.056
	(0.030)
d[t−1] × DS × Market size	0.019
	(0.035)
d[t] × DS × Market size	0.071
	(0.081)
d[t + 1] × DS × Market size	0.190
	(0.081)
d[t + 2] × DS × Market size	0.181
	(0.070)
d[t + 3] × DS × Market size	0.057
	(0.056)
d[t + 4] × DS × Market size	0.092
	(0.054)
d[t + 5] × DS × Market size	0.167
	(0.100)
Controls for d[t−3] to d[t + 5]	Y
Individual fixed effects	Y
Industry × year fixed effects	Y
Time-varying control	Y
Observations	75,000
R^2	0.6816

Alternative Explanation and Robustness

- Bargaining with employees
  - Alternative explanation
    - Plant opening → local job opportunities → employees' bargaining power
      → firms in the winner county could increase their financial leverage to improve their bargaining position in setting wages (Bronars and Deere, 1991; Matsa, 2010)

    ➔ not theoretically clear whether a plant opening would increase workers' bargaining power
    - The effect of a plant opening for firms with relatively high and low employee bargaining power is statistically not different between these groups.
  - Rather, a plant opening is more likely to increase employees' outside options by reducing labor market slack.
- Alternative measure of corporate leverage
  - Debt-to-assets ratio as an alternative measure of corporate leverage
  - The debt-to-capital ratio is a cleaner measure of corporate leverage (Welch, 2011).

* for the debt-to-capital ratio, it excludes all other liabilities besides interest-bearing debt

Alternative Explanation and Robustness

- Geographical distribution of winner and runner-up counties
  - runner-up localities are relatively concentrated in the Northeast and Midwest and winners are clustered in the South and West

    ➔ Is omitted economic factors specific to regions driving firm capital structure decisions?
  - No significant difference whether the counties are in the same regions or not
- Increased labor cost
  - An alternative explanation
    - increased labor demand in the winner county leads firms to increase their debt usage in part to finance higher wage bills (assuming that local labor supply is upward-sloping)
  - no significant change in wages in the winner versus runner-up counties (Slide 25)
  - Theoretically…
    - Debt is less suitable than equity to finance wages because a higher labor cost increases the firm's operating leverage (Schmalz, 2015).
    - An increase in expected wages would lead to a decrease in optimal financial leverage (Mauer and Triantis, 1994).

Alternative Explanation and Robustness

- County-wide shocks
  - local-level economic or financial shocks as a driver of the increase in leverage
  - Estimation of the effect of a manufacturing plant opening on the leverage of incumbent nonmanufacturing firms in the county and vice versa

    ➔ insignificant

Conclusion

- How the size of labor markets affects the capital structure choices of firms
  - The opening of a large manufacturing plant in a given county
  - ➔ The size of labor markets in which firms operate is an important determinant of the costs of using financial leverage and hence the capital structure decisions of firms
- Limitation
  - Limited type of industry
  - Limited explanation about the impact on the level of leverage
- Further research
  - MISSION!!! Labor market shocks other than the manufacturing industry (Labor demand)
  - Labor supply: boom of education about a specific set of skills

Thank you