

Agglomeration and Productivity Spillovers

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Background

1. Local governments increasingly compete to attract new businesses
2. Local governments bid for new firms by offering
 - a. Property and Corporate Tax Abatements
 - b. Construction of Roads and Other Infrastructures
 - c. Free Land, Electricity
 - d. Training, Bonds
3. Examples
 - \$56 million (\$100,000 per job) subsidy given to Boeing by Chicago
 - \$200 million (\$80,000 per job) subsidy for Toyota plant in Georgetown, Kentucky
 - \$250 million (\$165,000 per job) subsidy for Mercedes plant in Vance, Alabama
4. Controversial policies
 - a. Politicians and businesses extol benefits
 - b. Others criticize as a waste of public monies

What are the Consequences of Providing Local Subsidies?

- Not much is known. Theoretical Predictions are Ambiguous
Limited empirical evidence
- We Investigate Two Empirical Questions
 - (1) How Do these Policies Affect Existing Local Firms?
 - Is There Evidence of Productivity Spillovers for Local Firms?
 - If So, Which Local Firms Are Likely to Benefit the Most?
 - (2) Do these Policies Increase Cost of Labor?
- The Size of Productivity Spillovers is Relevant to determine the Efficient Level of Public Subsidies

- We test what happens to local employers when a county successfully attracts a new, large manufacturing establishment by offering incentives

- In particular, we ask

(1) Does the opening of a large manufacturing plant in a county affect the productivity of incumbent plants in the same county?

We estimate plant-level production functions using sample of plants that existed in the county at least 7 years before the new plant opening

(2) We investigate potential mechanisms for these spillovers:

Do the productivity gains depend on economic linkages between the new plant and the incumbent plant?

- Worker flows
- Input output flows
- Technological similarities

(3) How many jobs are created? What happens to wages?

Finding the Right Counterfactual

- To answer these questions we need to determine what would have happened to jobs and the productivity of firms located in the county *in the absence of the plant opening*
- We need a valid counterfactual for the experience of the county in the absence of the plant opening
- This is a difficult question: firms locate in counties where their profits are maximized
- We can not simply look at the experience of the average US county, because it may not be the right counterfactual

Why Finding the Right Counterfactual is Difficult

- Firm location decision depends on
 - 1) Local factors that affect costs of production:
transportation infrastructure, union density, workers skills, etc.
 - 2) Incentives
- Example of wrong counterfactual:
If firms in counties that are more attractive or are willing to offer more incentives also have higher productivity growth

→ Comparing counties that attract a new plant and counties that do not attract the new plant will overstate the true effect of the plant on productivity
- We need a county that is identical in productivity growth, costs of production and subsidies

Our Solution

- We collected data on location of new plants from a corporate real estate journal called '*Site Selection*'. Monthly article called "Million Dollar Plant"
- Selection of future location for new plant
 - List of ≈ 100 potential counties
 - Short list ≈ 10
 - Finalists ≈ 2
 - Winner = 1
- The "*Million Dollar Plants*" articles report the county that the plant chose (i.e., the 'winner'), as well as the one or two runner-up counties (i.e., the 'losers').
- The losers are counties that have survived a long selection process, but narrowly lost the competition.
- We use the losers as a counterfactual for the winners

Case Study: Greenville BMW Plant

The Decision Process

1. In 1990, BMW announces consideration of 250 sites
2. 20 counties are semi-finalists
3. 2 finalists: Greenville, SC and Omaha, NE
4. In 1992, BMW announces Greenville, SC is winner

Rationale for Decision

1. Subsidy worth \$115 million
2. Low union density
3. Supply of qualified workers
4. 58 German companies in the area
5. Good transportation infrastructure

Ex-ante Anticipated Effects

1. Expected 5-year economic impact of \$2 billion
2. 2,000 direct jobs
3. Another 2,000 jobs in related industries

Example: Magna Int'l built a new plant to produce roofs, side panels, and doors for BMW

DATA SOURCES

1. *Site Selection*'s "Million Dollar Plant" articles

2. Standard Statistical Establishment List
We match MDP openings to plant-level data
47 matches in manufacturing industries

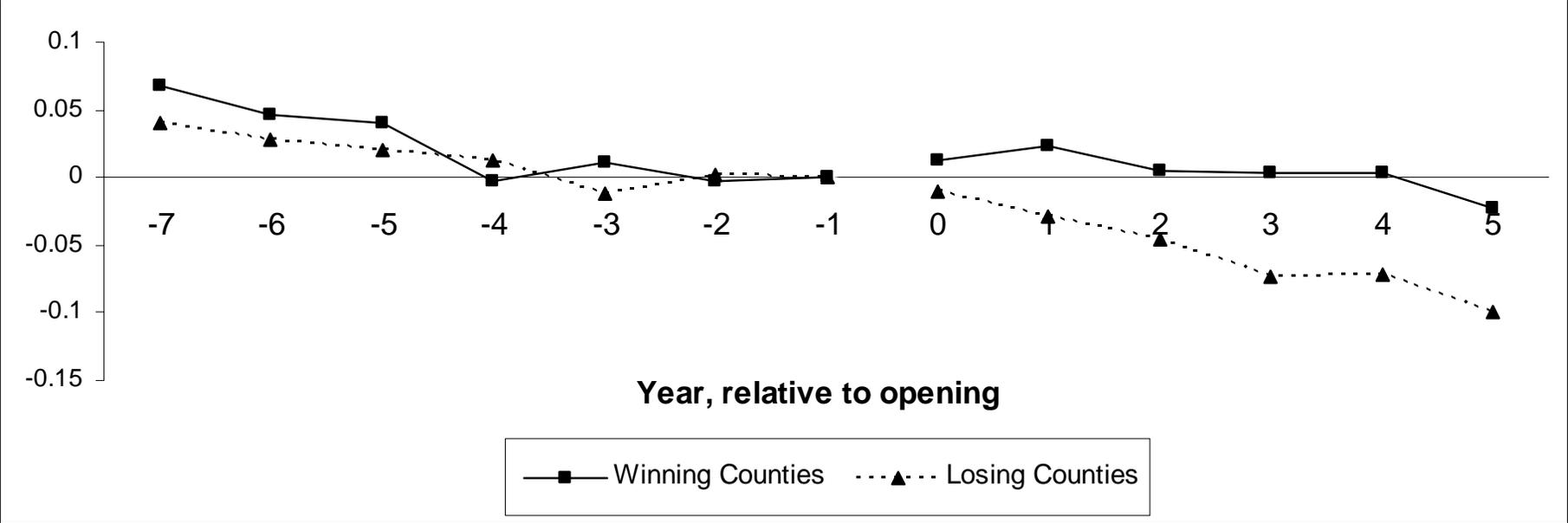
3. Annual Survey of Manufacturers
Sample of Plants that Appear in the data in each of the 7
Years Preceding the Plant Opening.

4. Industry Linkages
 - a. CPS Outgoing Rotation Group Transitions

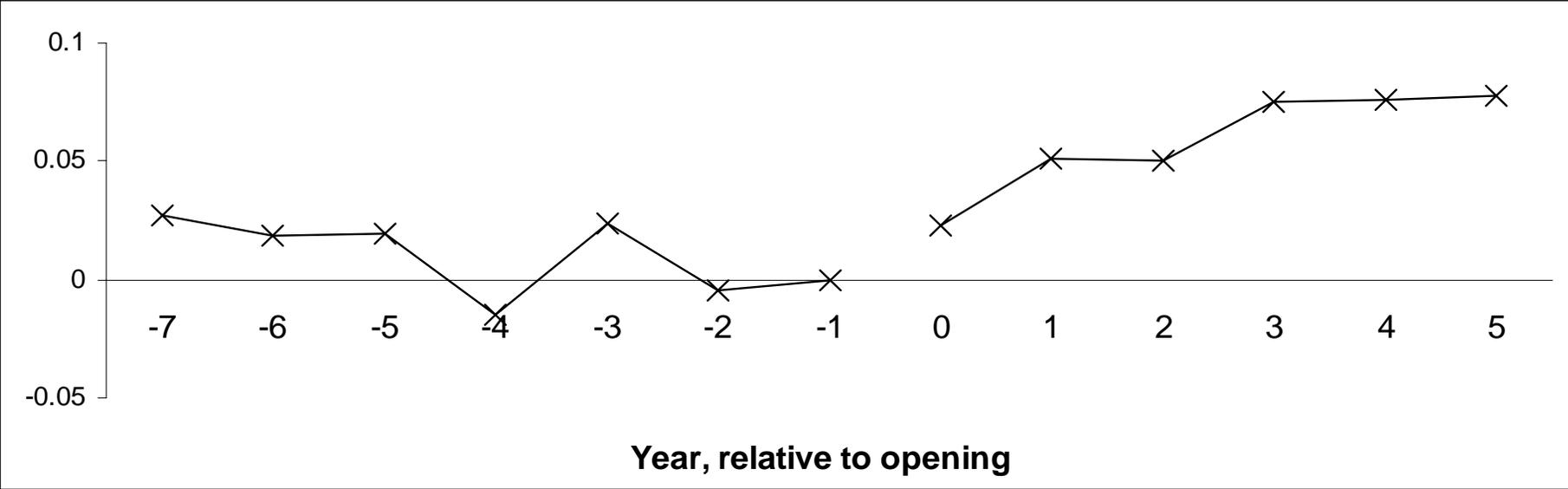
 - b. Technology Proximity. Patent Citations, Input-Output of R&D Expenditures (Ellison, Glaeser, and Kerr 2007)

 - c. Input-Output Matrices to Determine Customers and Suppliers

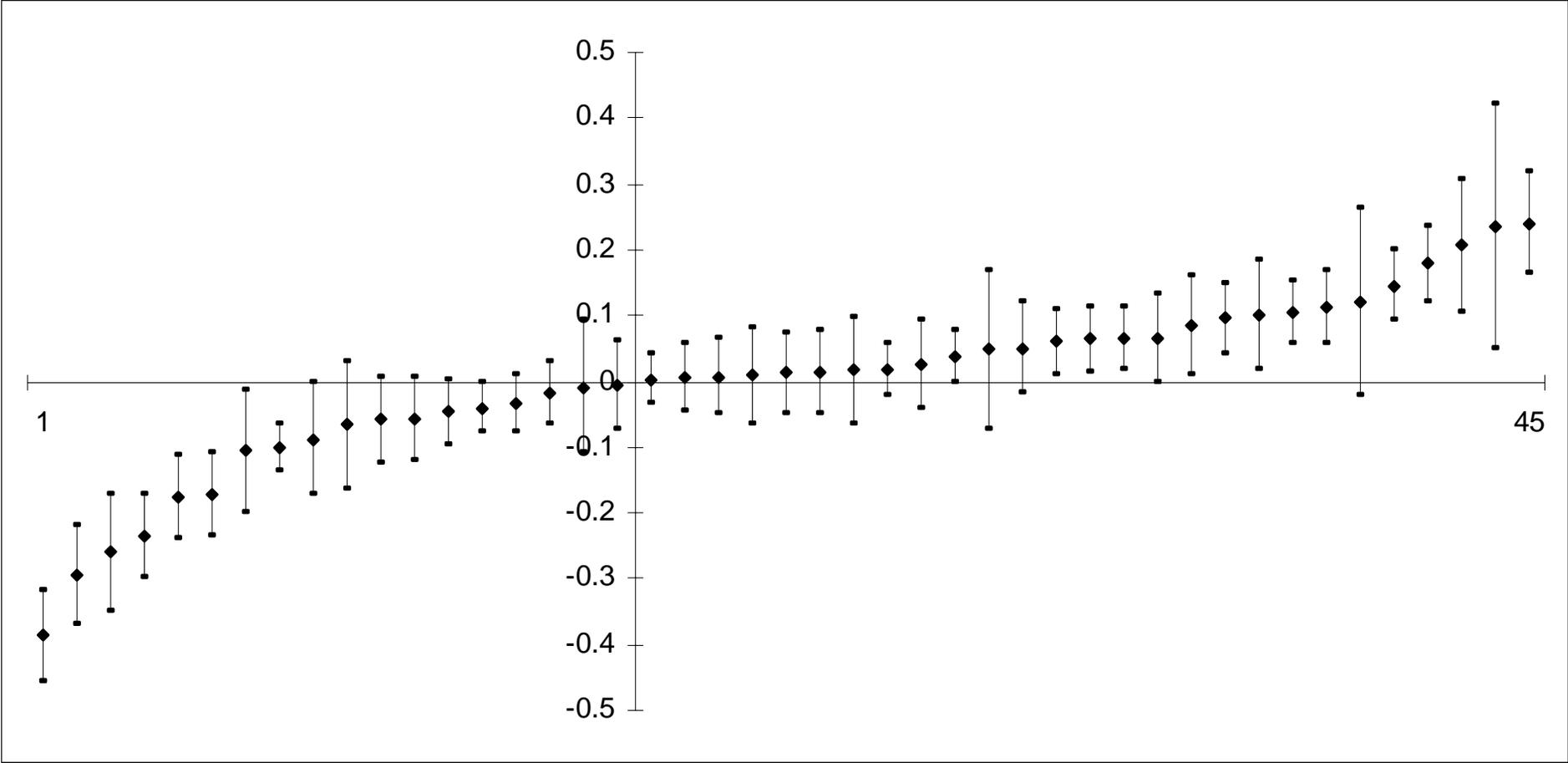
The Effect of a “Million Dollar Plant” Opening on Incumbents’ Productivity



Difference: Winners – Losers



Distribution of Productivity Gains



What are the economic forces that can explain these productivity spillovers?

(1) Knowledge Spillovers and Human Capital Spillovers

- Physical proximity leads to better sharing of ideas and/or faster adoption of new technologies
- For example: Productivity and wages are higher in cities with more college graduates (Moretti 2004); Patent citations are more likely to come from same state or metropolitan area (Jaffe et al. 1993)

(2) Large labor markets are more efficient

- Better match between workers and firms match in areas where there are many firms offering jobs and many workers looking for job.
- Workers prefer to be in areas with thick labor markets to reduce the probability of being unemployed. Firms prefer to be in areas with thick labor markets to reduce the probability of having unfilled vacancies.

Table 9. How the Productivity Effect Varies with Economic Distance

	(1)	(2)	(3)	(4)	(5)	(6)
CPS Worker Transitions	0.0701** (0.0237)					
Citation pattern		0.0545** (0.0192)				
Technology Input			0.0320+ (0.0173)			
Technology Output				0.0596** (0.0216)		
Manufacturing Input					0.0060 (0.0123)	
Manufacturing Output						0.0150 (0.0196)

DO THE GAINS IN TFP TRANSLATE INTO PROFITS?

Table 10. Wages and Number of Plants in the County

Panel 1	
(Census of Population)	
Dep. Var.:	
log(Wage)	
(1)	
D-in-D	0.0268+ (0.0139)
R-squared	0.3623
Observations	1057999

Notes:

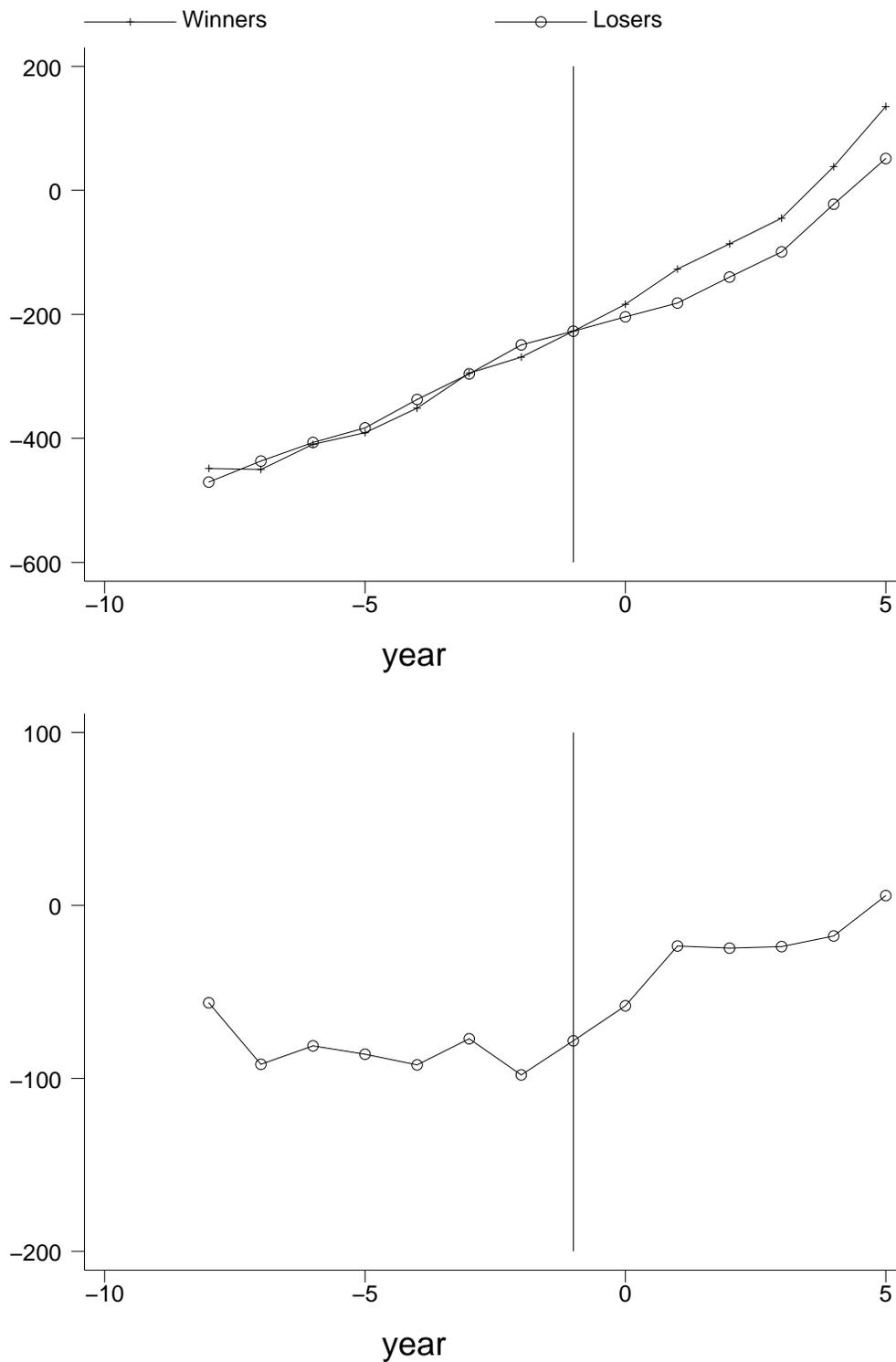
1. Difference in Difference Style Estimator.

2. Wage Equation Adjusted for Standard Mincer Covariates, Plus Case Fixed Effects. Estimates Based on Two Censuses – at least 1 Year Before Opening and at Least 3 Years After Opening

Table 10. Wages and Number of Plants in the County

	Panel 1 (Census of Population)	Panel 2 (Census of Manufacturers)	
	Dep. Var.: log(Wage) (1)	Dep. Var.: Log(Plants) (2)	Dep. Var.: Log(Total Output) (3)
D-in-D	0.0268+ (0.0139)	0.1264* (0.0556)	0.1192 (0.1041)
R-squared	0.3623	0.9983	0.9897
Observations	1057999	209	209

Figure 1: The Effect of Plant Opening on 1-Digit Industry Wage Bill in Winner and Loser Counties



Notes: Top Panel: Conditional average wage bill in winner and loser counties. To facilitate the comparison, the scale of the average wage bill in winner counties has been adjusted to equal the wage bill in loser counties at time t-1.

Bottom panel: difference in conditional average wage bill in winner and loser counties.

Summary of Results

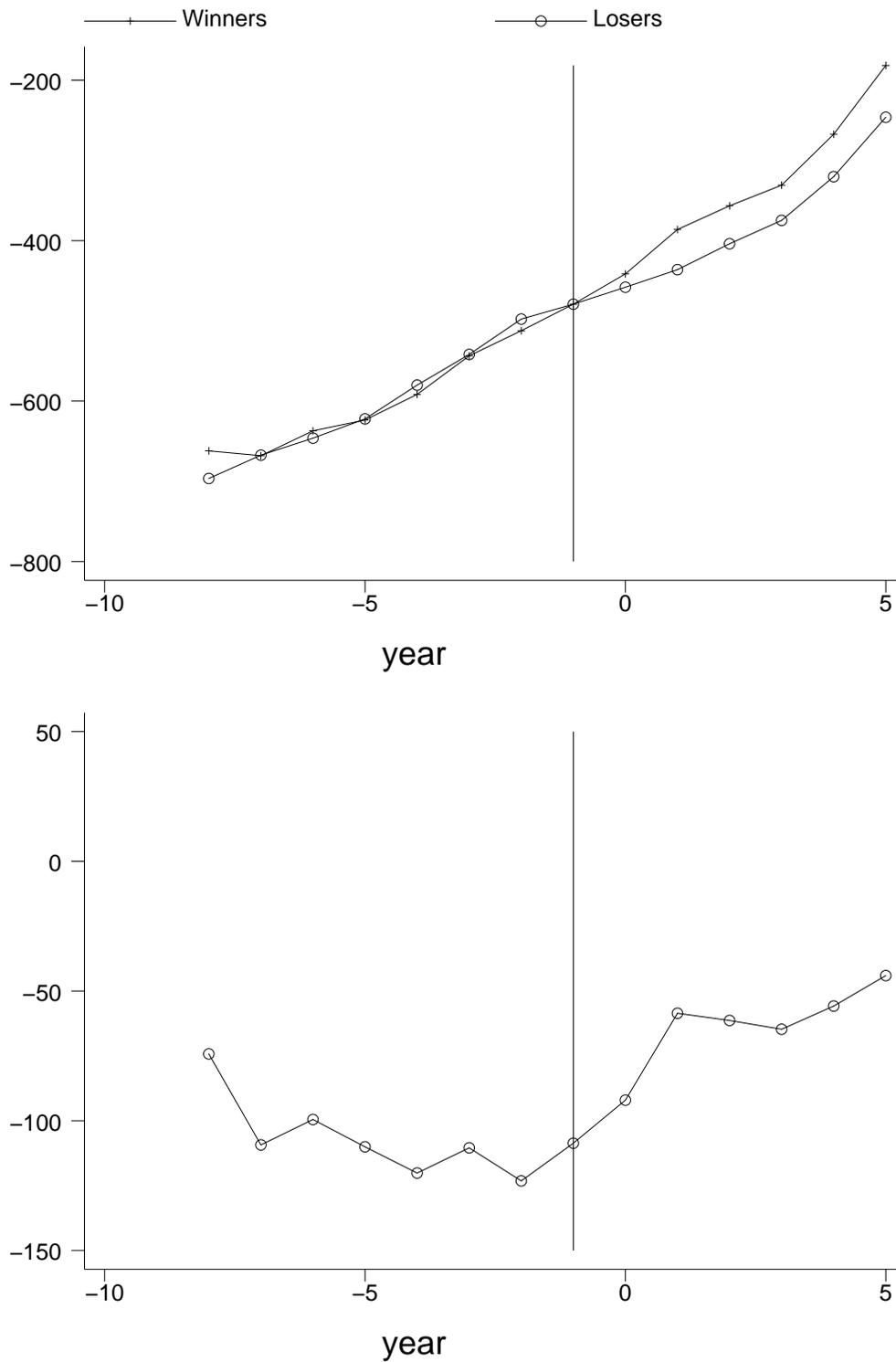
1. In 7 Years Prior to Opening, Trends in Productivity Among Incumbent Plants are Similar in Winning and Losing Counties
2. In the 5 Years After the Opening of the New Plant, Incumbent Plants in Winning Counties experience a 12% Increase in Productivity Across All industries
3. Incumbents Face Higher Prices for Labor and Other Local Inputs
 - Productivity Increases Don't Fully Translate into Profits

4. The Impact on Productivity Varies with Economic Distance

- a. Spillovers are Larger for Pairs of Industries with High Flows of Workers
- b. Spillovers are Larger for Pairs of Industries with Similar Technologies
- c. Little Evidence that Input and Output Flows Affect Spillovers

5. Overall, Existing Establishments in Winning Counties Experience Growth in Employment and Investment

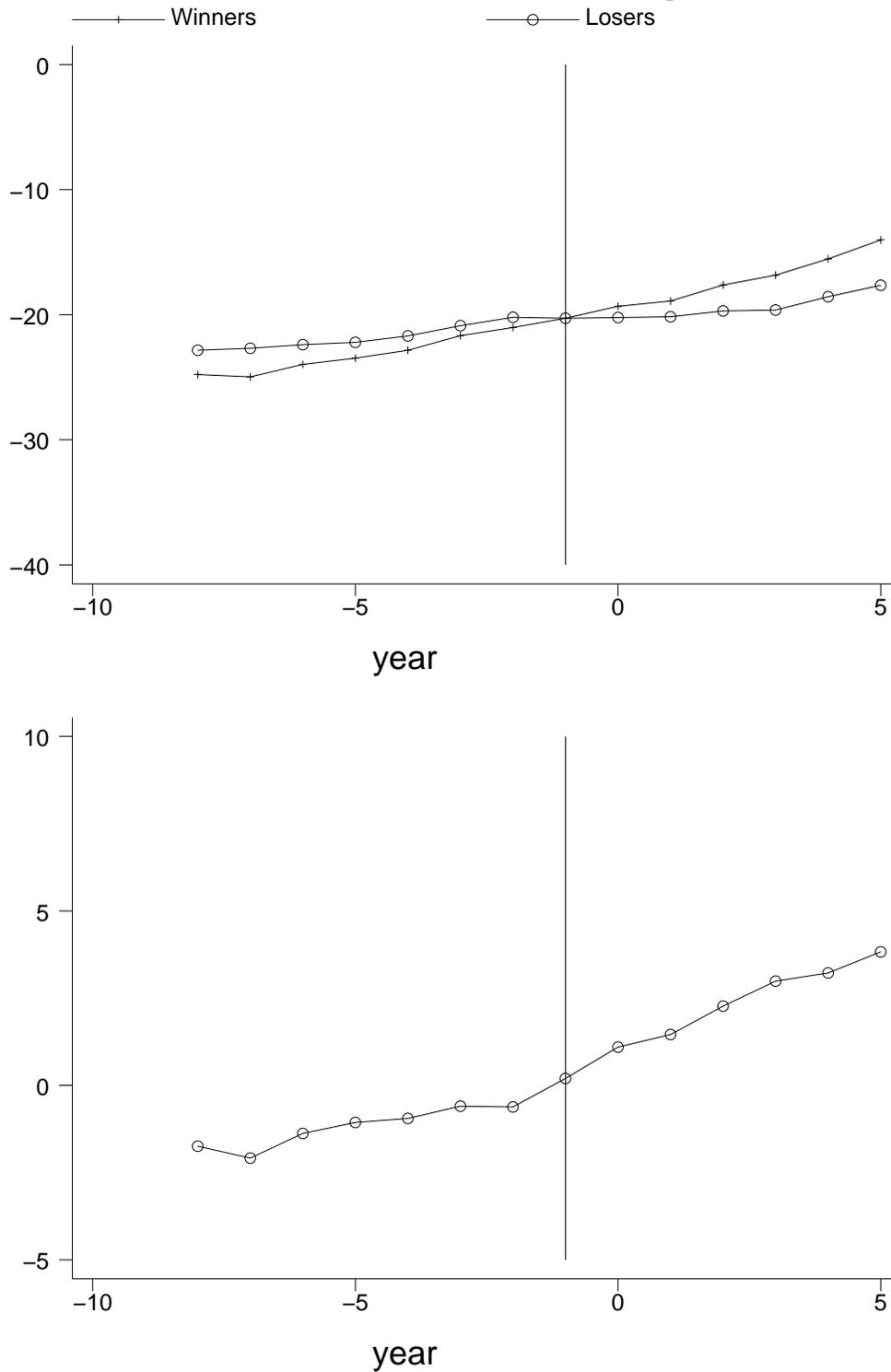
Figure 2: The Effect of Plant Opening on 1-Digit Industry Wage Bill in Winner and Loser Counties - Winner and Loser Sample



Notes: Top Panel: Conditional average wage bill in winner and loser counties. To facilitate the comparison, the scale of the average wage bill in winner counties has been adjusted to equal the wage bill in loser counties at time $t-1$.

Bottom panel: difference in conditional average wage bill in winner and loser counties.

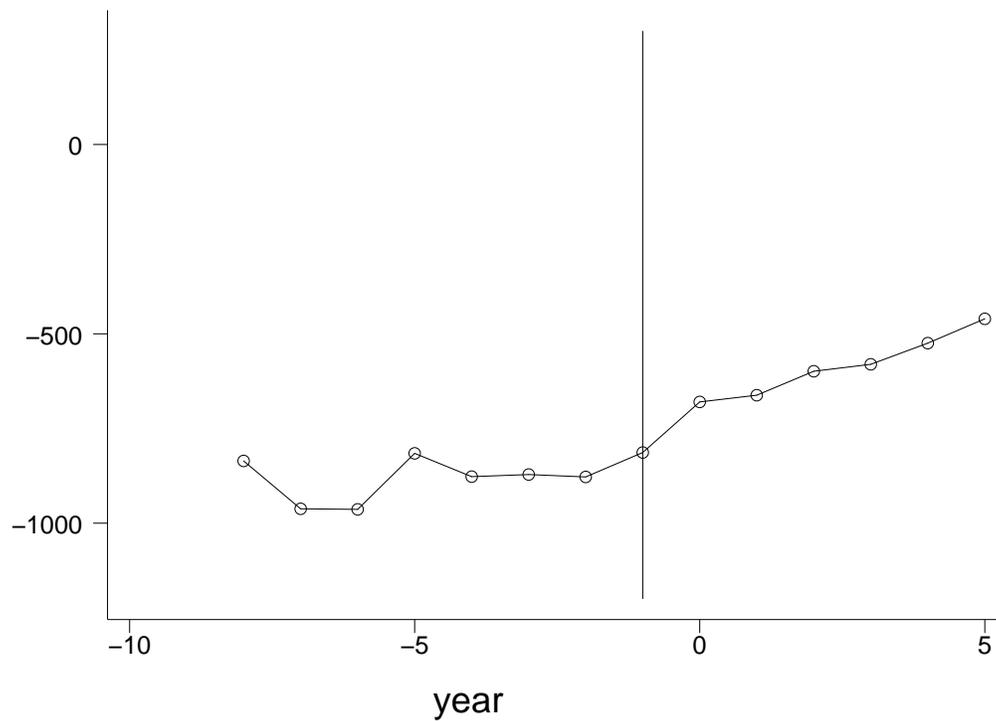
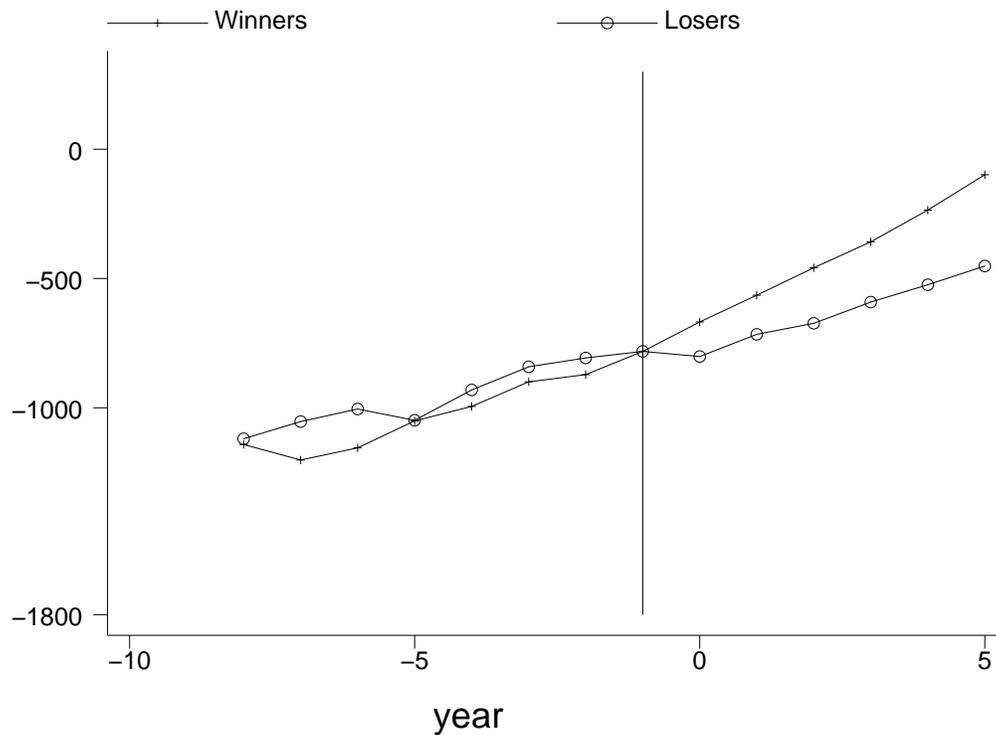
Appendix Figure 1: The Effect of Plant Opening on 1-Digit Industry Employment in Winner and Loser Counties - Winner and Loser Sample



Notes: Top Panel: Conditional average employment in winner and loser counties. To facilitate the comparison, the scale of the conditional average employment in winner counties has been adjusted to equal the conditional average employment in loser counties at time t-1.

Bottom panel: difference in conditional average employment in winner and loser counties.

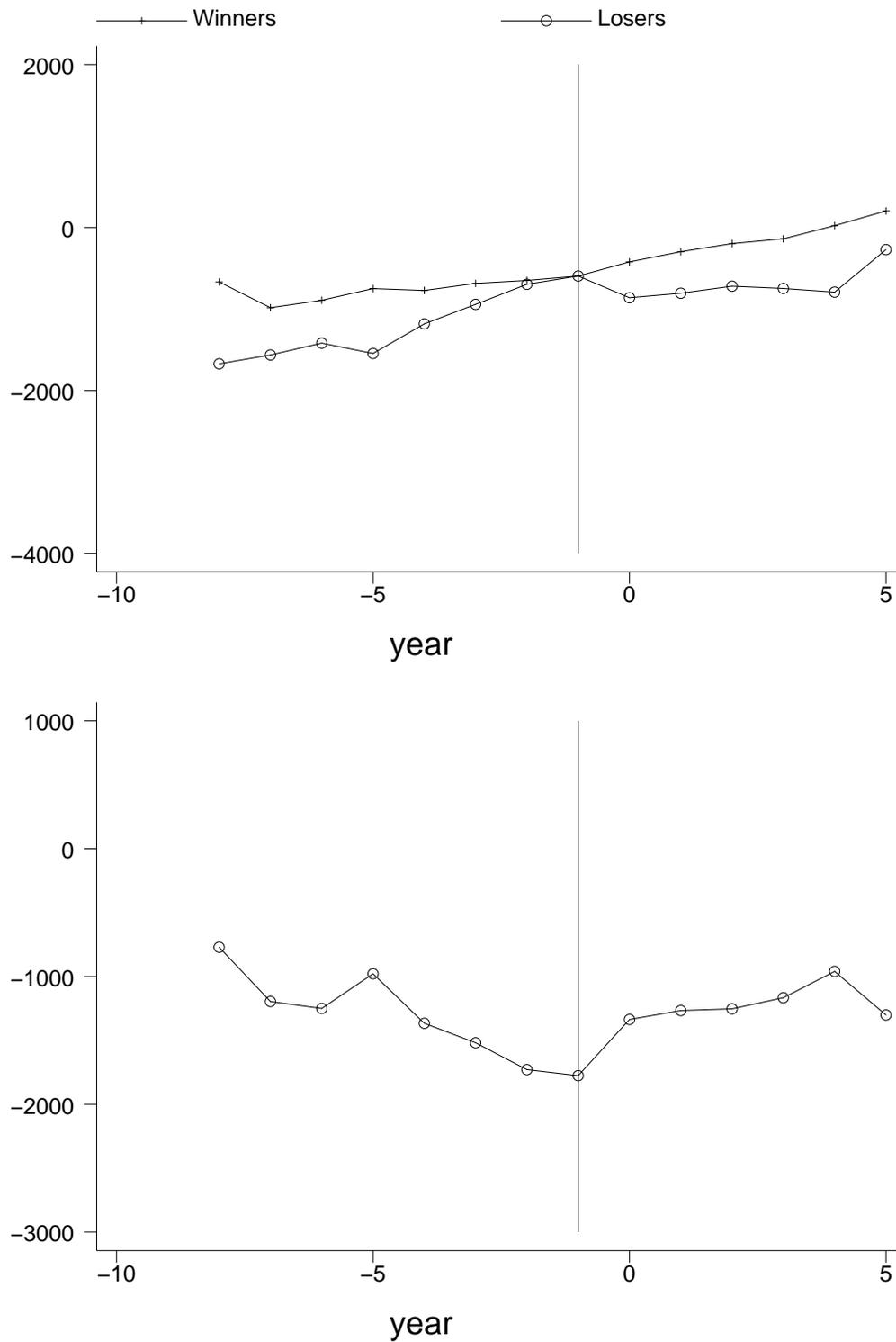
Figure 4: The Effect of Plant Opening on Wage Bill - Same Industry, Neighboring Counties - Winner and Loser Sample



Notes: Top Panel: Conditional average wage bill. To facilitate the comparison, the scale of the average wage bill in winner counties has been adjusted to equal the wage bill in loser counties at time t-1.

Bottom panel: difference in conditional average wage bill between winner and loser counties.

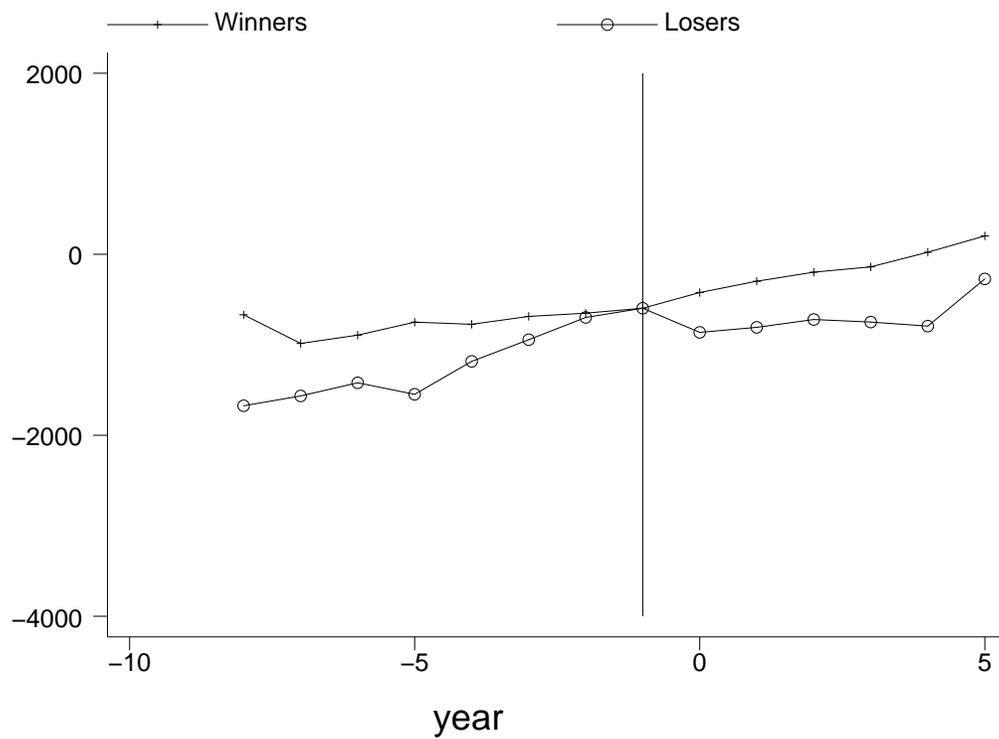
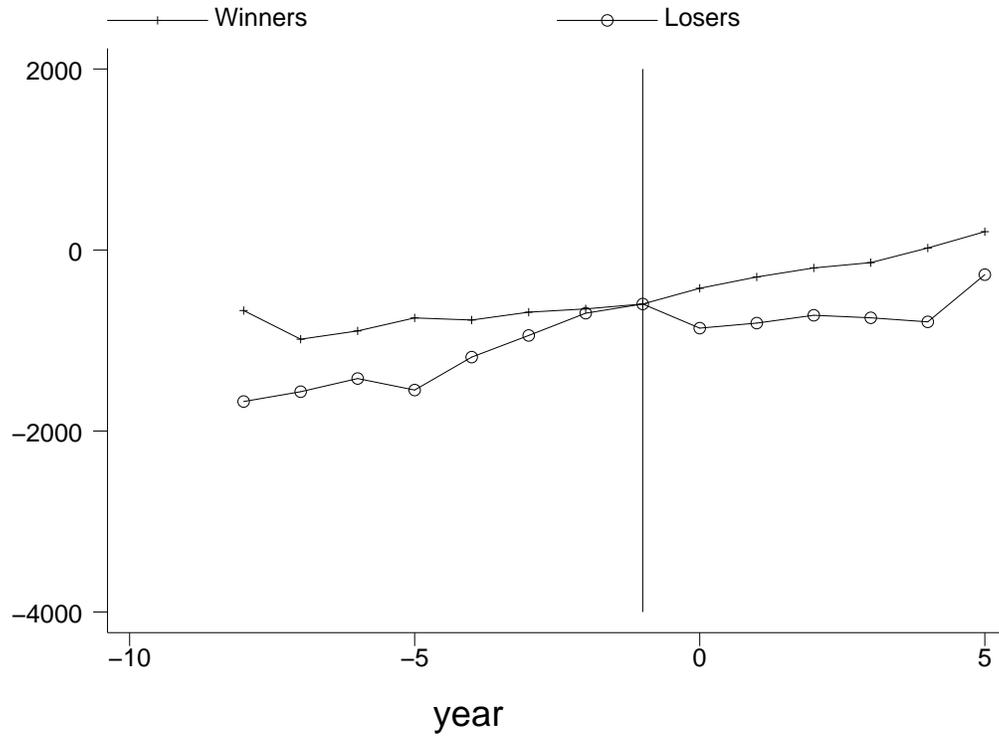
Figure 5: The Effect of Plant Opening on Wage Bill - Other Industries, Neighboring Counties - Winner and Loser sample



Notes: Top Panel: Conditional average wage bill. To facilitate the comparison, the scale of the average wage bill in winner counties has been adjusted to equal the wage bill in loser counties at time t-1.

Bottom panel: difference in conditional average wage bill between winner and loser counties.

Figure 6: THIS IS JUST A PLACE HOLDER



Notes: Top Panel: Conditional average property value in winner and loser counties. To facilitate the comparison, the scale of the conditional average property value in winner counties has been adjusted to equal the conditional average property value in loser counties at time $t-1$. Bottom panel: difference in conditional average property value in winner and loser counties.