Productivity and Survival in the Cotton Textile Mills During the Great Depression

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April 6, 2025

Abstract

Productivity fell during the Great Depression. This paper examines the cotton textile industry, and finds that product per worker fell as plant size increased, that plant size positively predicts plant survival, but that output per labor dollar rose with the size of plants. I examine why this might have occurred, and find suggestive evidence that it was access to credit which was key to survival, and likely to firm size.

1 Introduction

The Great Depression was a calamity. Everyone agrees that the fall in the price level was of great importance; authors disagree over whether the associated collapse in the banking system was the result of illiquidity (a view typified by Friedman and Schwartz, 1962) or was due to the insolvency of the debtors. (For an exploration of this view, see Temin 1976). The beginning of the Great Depression is conventionally dated to the stock market collapse of late 1929, although the causes of that started in 1928. (Sumner 2015). It was not a single event, but rather a series of slumps. The banking system had started to recover when another crash came in late 1930; then another slump in 1931; and then the worst of it all, the long interregnum between the 1932 election and Roosevelt's inauguration, when the market believed that gold would be devalued and Hoover would not budge. Unemployment surged from 3.2 to 25 percent, the highest rate in American history. (Margo 1993) Real output fell by some 30 percent, and total factor productivity fell by 18 percent. (Ohanian 2001) This was largely due to the loss of organizational knowledge as firms went bankrupt. The economy would improve until the depression of 1937-38, but would never achieve the same level of health until after World War II.

This paper explores Census of Manufactures data on the cotton textile industry from the eve of the Great Depression. The primary predictor of plant survival was plant size alone. Marginal product per worker was falling as plant size increased, but since wages per worker were also falling, output per wage dollar increased as firms got larger.

I propose that we're missing access to credit. I develop the theory that larger firms could borrow more and on better terms. In an era when accounting statements may not be credible, the size of the plant is. Having a large establishment binds the firm owner to a place, and leaves them unable to skip out on their debts. Date of opening is unknown from the dataset, but we know from modern studies of factories that factories start small and grow over time (Foster, Haltiwanger, and Syverson 2016), which suggests that smaller firms would lack established relationships to creditors. In support of this, I propose using regional

variation in the banking panics of the Great Depression to estimate the impact of credit access on firm survival. In lieu of my own data, I am able to rely upon other authors who have estimated the causal impact of bank closures in support of my preferred explanations.

I am able to eliminate some alternative explanations, such as company towns distorting productivity figures, and can argue against measurement error, and differing levels of competition in different use cases of textiles. Company towns cannot be the explanation, because my findings remain even after only observing firms in large cities which are not plausibly company towns. The others do not have a dispositive test, but do fail tests which would have suggested that they are correct.

2 The Great Depression

The Great Depression did not affect firms evenly. Other papers have explored why some firms lived and others died during the Great Depression. Bresnahan and Raff (1991) were the first to tabulate the Census of Manufactures data, focusing on the automotive industry. They found, as with my study, that larger firms were less likely to close, but because they found that productivity also predicted firm survival. Bigger plants were more productive than small ones. Scott and Ziebarth (2015) look at the radio industry, where they find that scale economies played little role in firm survival, and that having a brand was a far better predictor of survival.

Access to credit played a substantial role in firm survival. Bernanke (1983) outlines the theory that "intermediation between some classes of borrowers and lenders requires nontrivial market-making and information-gathering service", and that the collapse in local banks made credit hard to access and firm collapse certain. Several studies have used discontinuities at the borders of Federal Reserve districts to get to study the effects of bank closures on firm closures. (Richardson and Troost 2009, Ziebarth 2013, Jalil 2014) Lee and Mezzanotti (2014) use differential exposure to external credit to estimate the effects of financial crises,

and estimate that 22 percent of the decline in manufacturing during the Great Depression was due to credit constraints. Loualiche, Vickers and Ziebarth (2017) show that firms were affected by credit shocks which occurred only to other branches of the same firm. Babina, Garcia, and Tate (2023) constructed a network of firm relationships, and found that firms which were better connected to cash rich firms had a better chance of surviving the recession. This effect was especially large for small firms, indicating that access to reliable credit was of incredible importance for businesses more exposed to cash-flow troubles. Benmelech, Frydman, and Papanikolaou (2017) use a dataset of large industrial firms to find variation in the need to raise external funds. They too find that losing accessing to credit markets was extremely damaging, and accounted for 10 to 33 percent of the decline in the employment of large firms.

2.1 The Cotton Textile Industry

The cotton textile industry was undergoing a broader shift from North to South, which started after about 1880. This should be thought of as a shift in the "center of gravity" of the industry, not a migration (Galenson 1975), as the South was simply growing much faster. Only in the 1920s did we see the number of spindles decline in the North, and only by about 3 percent. This shift was not due to transport costs – the actual growing of cotton had steadily shifted to the southwest, and the costs of water transportation. Morris (1953) claims, and it is universally agreed, that wages were lower in the South. The figures in my dataset back this up. Morris also asserts that workers in the South were more industrious per person, which my data set contradicts. A simple comparison of the South (defined as the old Confederacy) and the Northeast (New England plus the Mid-Atlantic) shows that there was no statistically significant difference in regional productivity.

The industry was enormous – to give some examples from Galenson, on the onset of the Great Depression the cotton industry employed 66 percent of all industrial workers in South Carolina, 44 percent in North Carolina, and 35 percent in Georgia. Nevertheless,

most plants were quite small, with a median of 190 workers, and a mean of 328 in 1929. The industry was technologically stable during the years of our study. The plants did not tend to be unionized (Galenson estimates no more than 15 percent of the workforce in New England could have been unionized on the eve of the depression). The South had been the first to adopt ring spinning, which is less skill intensive than mule spinning (Galenson 1975), but by 1929, there were no substantial differences in technology between regions.

The dataset includes both spinning and weaving firms, engaged in producing an incredibly varied set of goods. (A brief perusal of the dataset shows them making yarn, awning stripes, canvas gloves, draperies, cords and tassels, and cotton felt). In 1929, the vast majority of firms owned only a single plant, with only 60 plants out of 1261 being owned by a multiplant firm. Only 17 of plants were a subsidiary of a mother firm.

3 Data and Empirical Strategy

I used data from the Census of Manufactures during the years 1929, 31, 33, and 35. This data was coded by the ICPSR, and I would like to thank Daniel Raff, Tim Breshahan, Changkeun Lee, and Margaret Levenstein for their work in creating it. The dataset is comprehensive, with only minor inconsistencies in questions between years. The important questions – employment, wages, production – are asked in every year. The Census is comprehensive, and is not based on a sample of firms, allowing us to track survival and changes in size over time.

The statistical methods used in this paper are extremely simple. To say that a plant survived, I defined it as appearing in 1929 and not appearing in 1935. Because this is a binary variable, I used a logistic regression when comparing with productivity and firm size.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x \tag{1}$$

I defined productivity as the gross value added divided by the number of wage employees,

with gross value added being simply the total value of products less the costs of materials and fuel. I defined firm size as the number of wage employees. I am satisfied that these specifications are not substantially affecting the results – they remain when aggregating salaried employees into the size of the firm, and they work when choosing different end dates for survival. I defined labor costs as the total wages paid over a year. I define a "big city" as being one in which two or more plants appear, which I use to roughly test for market power.

4 Results

Large firms were more likely to survive. Every additional 100 employees in 1929 increased the chance that a plant survived to 1935 by 15 percent. Output per worker fell with plant size. Every 100 dollars of additional gross value added per worker predicts a 2 percent greater likelihood the plant closed. The negative association of productivity and survival remains even after controlling for firm size, and is robust to trimming outliers.

However, accounting for differences in wages flips the correlation of size and productivity. Output per dollar paid in wages is increasing as plant size increases.

To test if management had any impact on firm survival, I see if a higher ratio of salaried to wage workers predicted a greater rate of survival. It did not, and in fact firms with a greater ratio of salaried to unsalaried workers were more likely to close. 2 I test if a new measure of productivity which includes all salaried employees affects the likelihood of survival, and find it does not.

Plants which were a subsidiary of another firm were substantially larger than firms which were not. Multi-branch firms did not tend to have plants which were larger than single branch firms. There were no significant differences in survival between subsidiary and non-subsidiary plants. Dividing into three regions, the Northeast, the South, and the rest, there were no significant differences in productivity or size. If anything, firms in the Northeast were more productive than those in the South, even after differences in labor cost are taken

into account.

5 Discussion

It is not necessarily clear that there is inefficiency. We cannot observe capital intensity, and it could be that larger plants are using more labor intensive technologies. Larger plants could be hiring lower-skilled workers, and choosing a form of production which has fewer machines per worker. It could also be due to market power, with large firms able to extract more.

We do not have enough detail to reasonably estimate local labor market power, but what we can do is assume that there are fewer distortions in a town with two textile employers, rather than one. There are no significant differences in all of the associations between places which had only one employer, and those which had multiple. If market power was entirely responsible for the falling labor wages, then we should at least expect to see a difference.

This test can eliminate another possible driver of falling output per person, which are company towns. If employers were providing their employees compensation in the form of housing, this would drive productivity upwards. I do not believe this to be the case. It is generally agreed that cotton textile company towns were more prevalent in the South than in the North. Yet, productivity per worker was higher in the Northeast than in the South, the opposite of what we would expect.

More dispositively, I test whether productivity and firm size remain negatively correlated even after excluding all towns and cities with only one plant. I cannot exhaustively investigate each plant and find if they are a company town or not, but since much of the advantage from a company town comes from being able to provide public goods (Mendez and van Patten, 2022), I think we can reasonably assume that any town with more than one cotton plant is not a company town. Rerunning the regression of firm size and productivity, we can see that firm size remains strongly negatively associated with productivity, as shown in Figure 2 It is possible that there was some non-obvious subsidization of housing, and that

this varied with firm size, but this seems entirely implausible.

It is conceivable that small plants were more likely to be something akin to a labor cooperative. A textile shop of perhaps ten people might well hire their family members, and pay above market wages.

I also do not believe this to be due to measurement error. First, the sources which have used the dataset claim that it is unlikely to be affected by serious measurement error. (Vickers and Ziebarth, 2024) Second, my results are robust to trimming outliers. I am suspicious of some of the plants with very high marginal product per worker, but dropping them does not significantly affect the results.

What best explains the survival of large plants would be that large plants require more capital to form, which places them in relationships with local lenders. During a downturn, when everyone needs credit to survive, lenders lent to the places they had a relationship with and could trust. This was a time when standardized accounting was almost non-existent, and small firms would not be able to prove that they were profitable, and wouldn't move. (Galenson 1975)

I assume that there are two types of workers, high and low-skill. The difference between the two is that high-skill workers can work more machines, and do not need as much direction. Low-skill workers can work fewer machines per person, and require more direction, but work for a lower wage. Thus, large firms will have increasing output per labor dollar, but this is made up for in having to pay more in non-wage supervision. In a world without major negative shocks, the two can co-exist. However, the interaction with creditors leaves them better prepared for the Great Depression, and so large plants were more likely to survive.

6 Conclusion

When it came to surviving the Great Depression, size mattered. To explain this, I showed how prior work strongly suggests that access to credit was more accessible to larger firms,

and helped firms survive. I am able to argue against some other explanations, but cannot fully refute them.

Future work should focus on directly testing the cost of credit in different places and times, and its effect on firm survival. If the cost of borrowing can be directly observed in the years available, this would be a great help; otherwise we must use shocks to particular regions as evidence of the effect of credit for different sized firms.

References

Babina, Tania, Diego García, and Geoffrey Tate, "Friends During Hard Times: Evidence from the Great Depression," *Journal of Financial and Quantitative Analysis*, September 2024, *59* (6), 2647–2694.

Bernanke, Ben S., "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," *The American Economic Review*, 1983, *73* (3), 257–276. Publisher: American Economic Association.

Bloom, Nicholas, Benn Eifert, Aprajit Mahajan, David McKenzie, and John Roberts, "Does Management Matter? Evidence from India *," *The Quarterly Journal of Economics*, February 2013, *128* (1), 1–51.

Bresnahan, Timothy F. and Daniel M. G. Raff, "Intra-Industry Heterogeneity and the Great Depression: The American Motor Vehicles Industry, 1929-1935," *The Journal of Economic History*, 1991, *51* (2), 317–331. Publisher: Cambridge University Press.

Chicu, Mark and Nicolas L. Ziebarth, "Multi-market contact and competition: evidence from the Depression-era portland cement industry," *International Journal of Industrial Organization*, 2013, *31* (5), 603–611. Publisher: Elsevier.

Clark, Gregory, "Factory Discipline," *The Journal of Economic History*, 1994, *54* (1), 128–163. Publisher: Cambridge University Press.

Foster, Lucia, John Haltiwanger, and Chad Syverson, "The Slow Growth of New Plants: Learning about Demand?," *Economica*, 2016, *83* (329), 91–129. _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/ecca.12172.

Friedman, Milton and Anna Schwartz, "A Monetary History of the United States, 1867-1960 | Princeton University Press," November 1971. ISBN: 9780691003542.

GALENSON, ALICE CAROL, "The Migration of the Cotton Textile Industry from New England to the South: 1880 to 1930." Ph.D., Cornell University, United States – New York 1975. ISBN: 9798660321238.

Jalil, Andrew J., "Monetary Intervention Really Did Mitigate Banking Panics During the Great Depression: Evidence Along the Atlanta Federal Reserve District Border," *The Journal of Economic History*, 2014, *74* (1), 259–273. Publisher: [Economic History Association, Cambridge University Press].

Lee, James and Filippo Mezzanotti, "Bank Distress and Manufacturing: Evidence from the Great Depression," *Working Paper*, December 2014. Number: 220971 Publisher: Harvard University OpenScholar.

Loualiche, Erik, Chris Vickers, and Nicolas L Ziebarth, "Firm Networks in the Great Depression," September 2023.

Margo, Robert A., "Employment and Unemployment in the 1930s," *Journal of Economic Perspectives*, June 1993, *7* (2), 41–59.

Morris, James A., "Cotton and Wool Textiles-Case Studies in Industrial Migration," *The Journal of Industrial Economics*, 1953, *2* (1), 65–83. Publisher: Wiley.

Méndez, Esteban and Diana Van Patten, "Multinationals, Monopsony, and Local Development: Evidence From the United Fruit Company," *Econometrica*, 2022, *90* (6), 2685–2721. _eprint: https://onlinelibrary.wiley.com/doi/pdf/10.3982/ECTA19514.

Ohanian, Lee E., "Why Did Productivity Fall So Much during the Great Depression?," *The American Economic Review*, 2001, *91* (2), 34–38. Publisher: American Economic Association.

Richardson, Gary and William Troost, "Monetary Intervention Mitigated Banking Panics during the Great Depression: Quasi-Experimental Evidence from a Federal Reserve District Border, 1929–1933," *Journal of Political Economy*, 2009, *117* (6), 1031–1073. Publisher: The University of Chicago Press.

Scott, Peter and Nicolas Ziebarth, "The Determinants of Plant Survival in the U.S. Radio Equipment Industry During the Great Depression," *The Journal of Economic History*, December 2015, *75* (4), 1097–1127.

Temin, Peter, *Did Monetary Forces Cause the Great Depression?*, New York, NY: W. W. Norton & Company, December 1975.

Ziebarth, Nicolas L., "Identifying the Effects of Bank Failures from a Natural Experiment in Mississippi during the Great Depression," *American Economic Journal: Macroeconomics*, January 2013, *5* (1), 81–101.

A Appendix

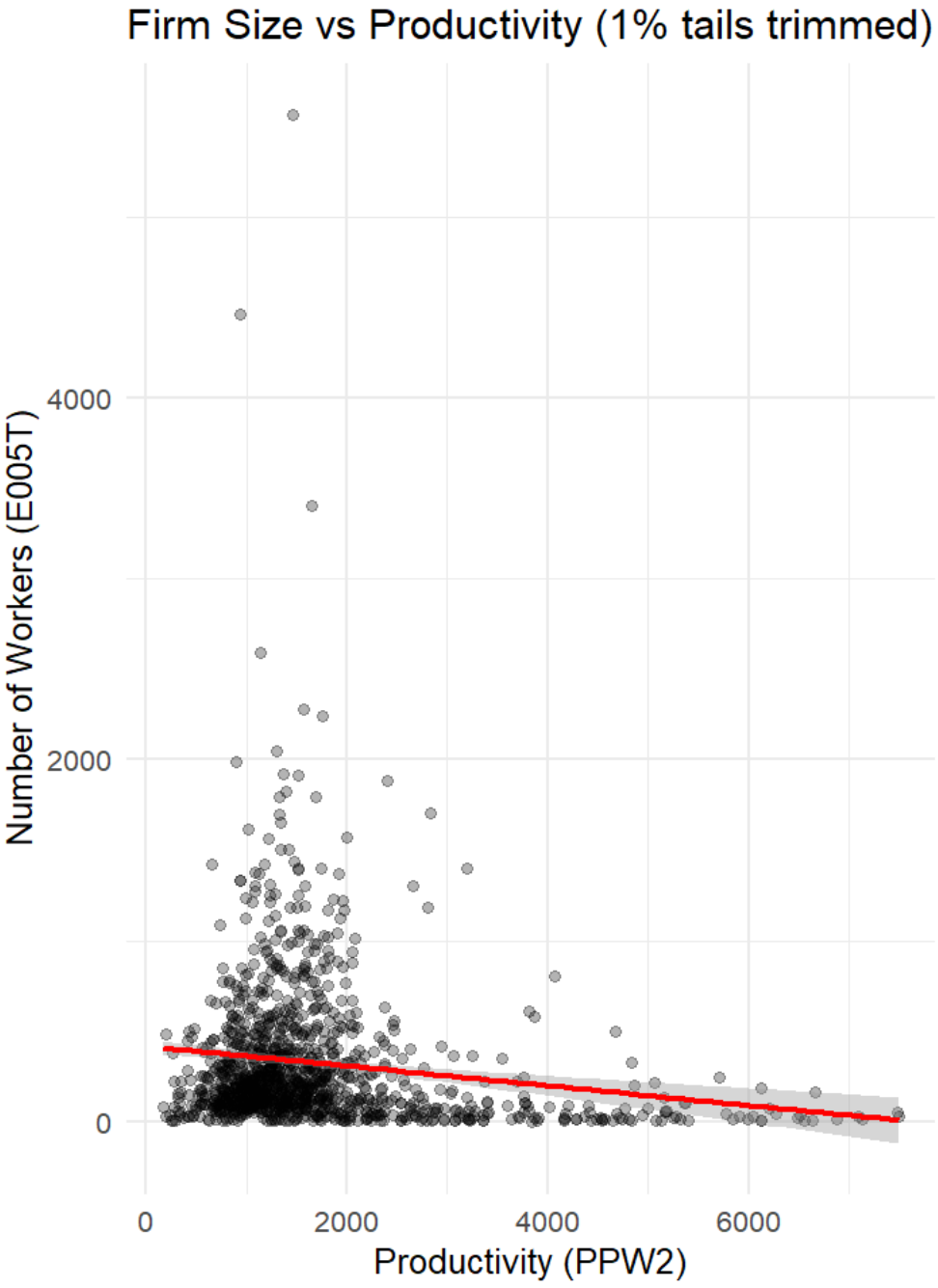

Figure 1

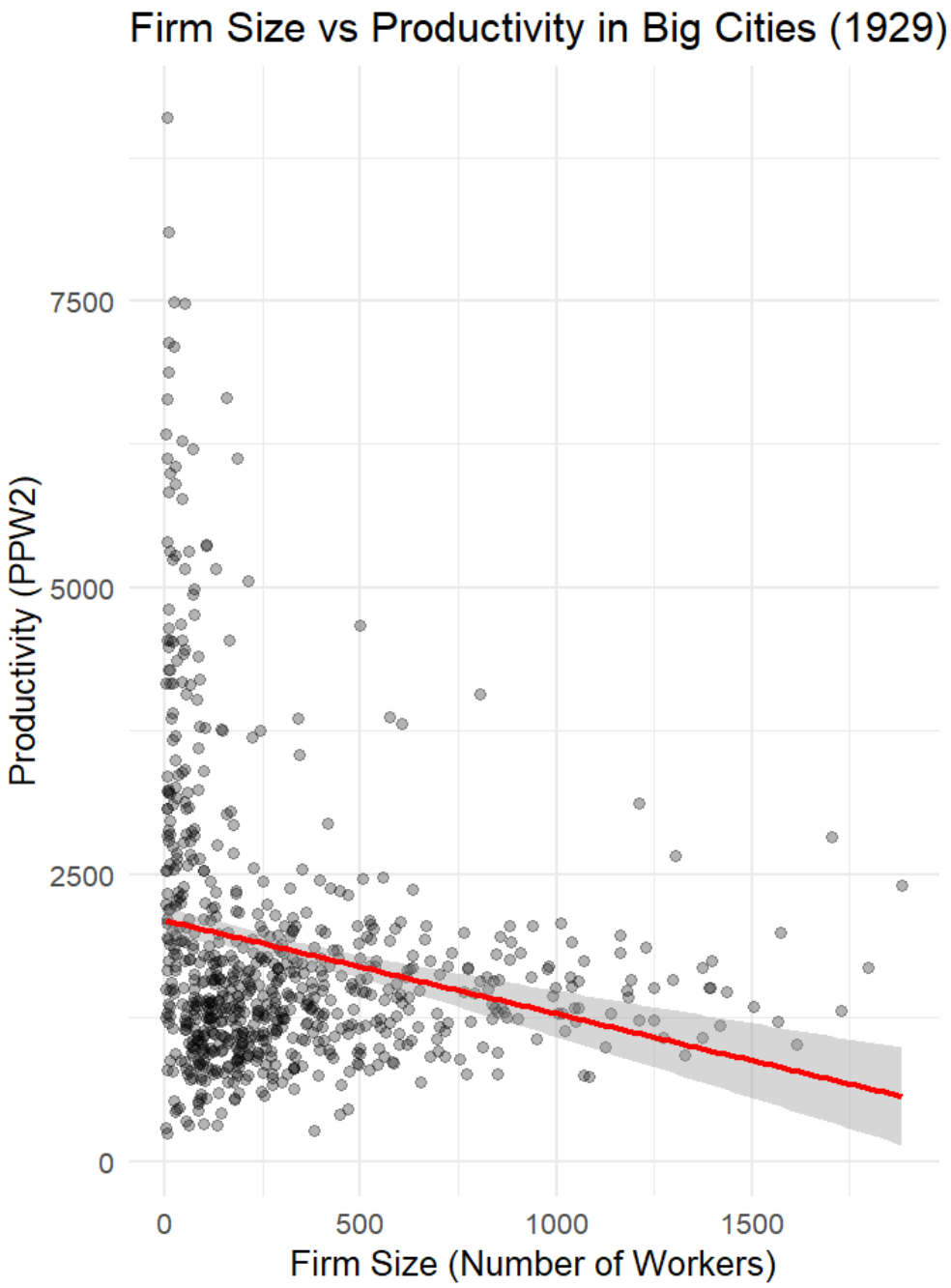
Firm Size vs Productivity in Big Cities (1929)
Productivity (PPW2)
7500
5000
2500
0
0
500
1000
1500
Firm Size (Number of Workers)

Figure 2

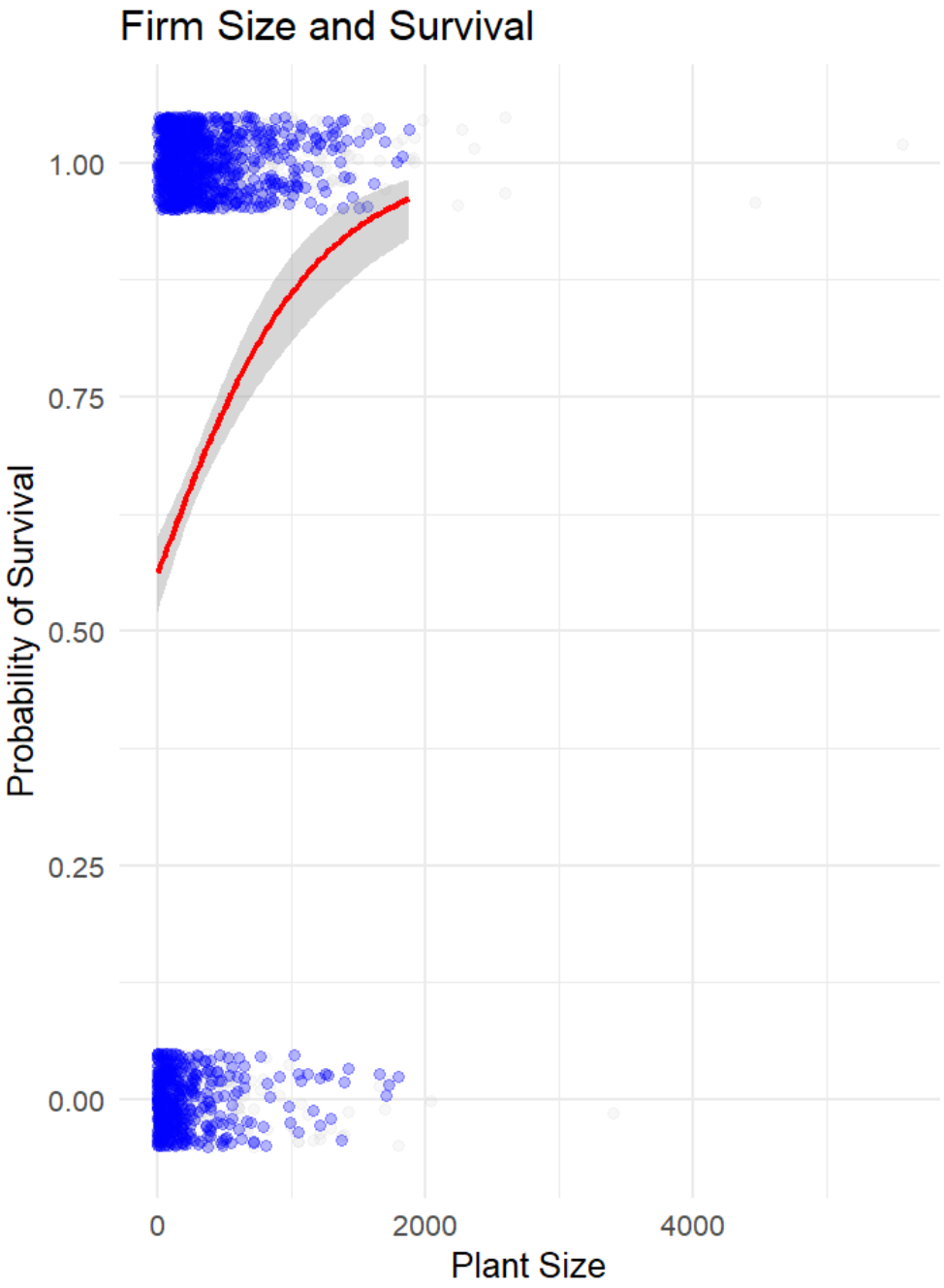
Firm Size and Survival
1.00
0.75
0.50
0.25
0.00
Probability of Survival
0
2000
4000
Plant Size

Figure 3

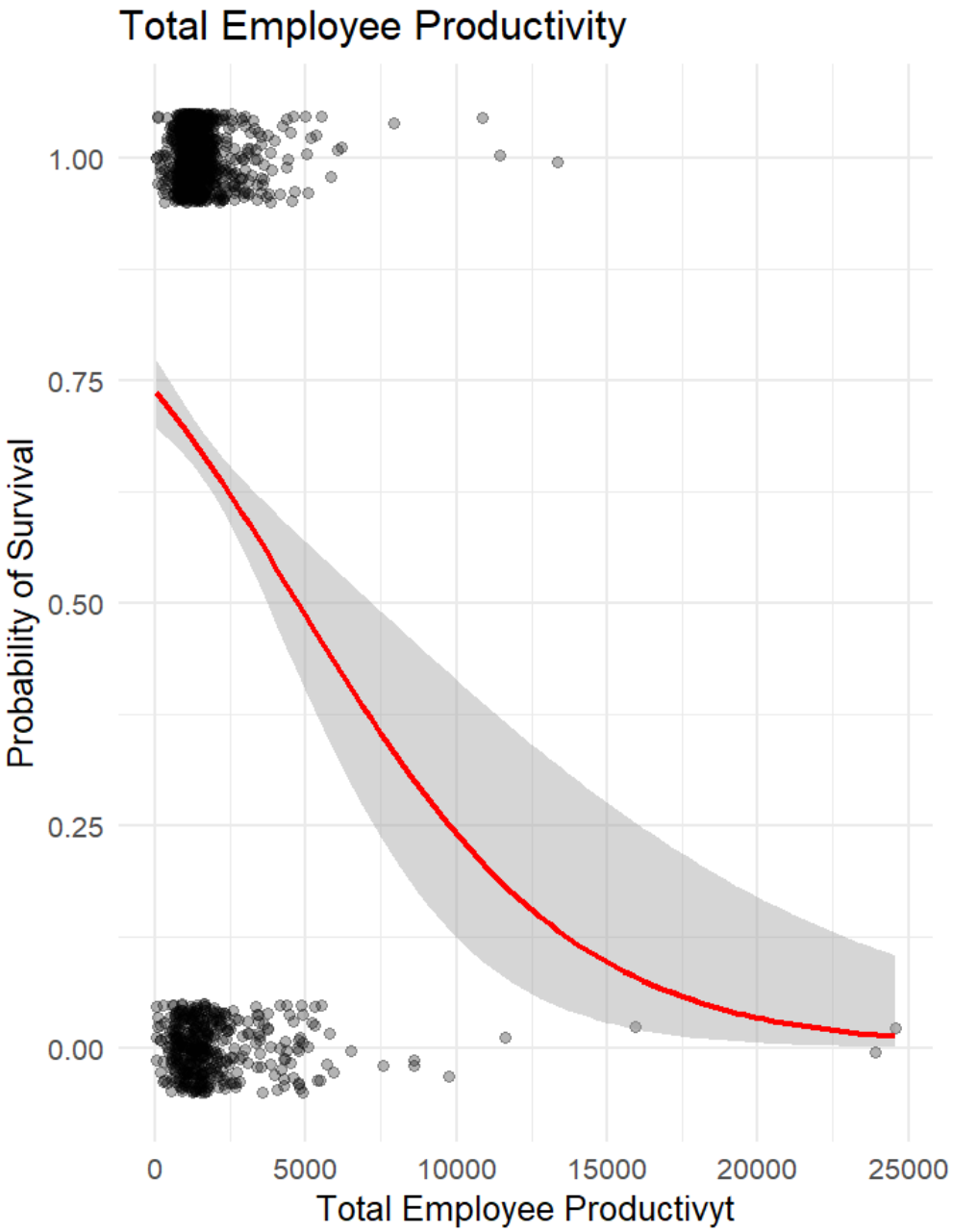
Total Employee Productivity
1.00
0.75
0.50
0.25
0.00
Probability of Survival
0
5000
10000
15000
20000
25000
Total Employee Productivyt

Figure 4

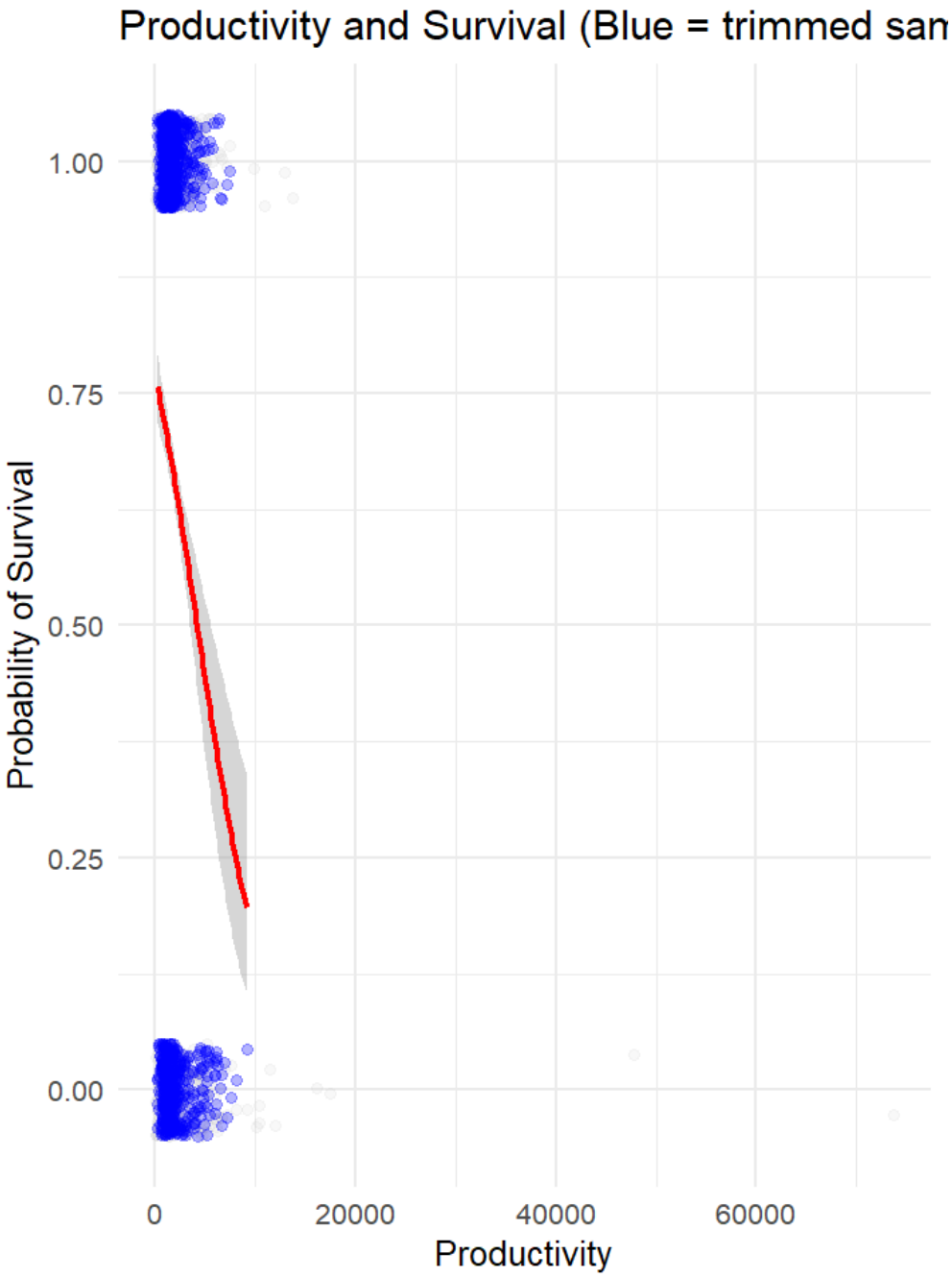

Figure 5: Controlling for Plant Size

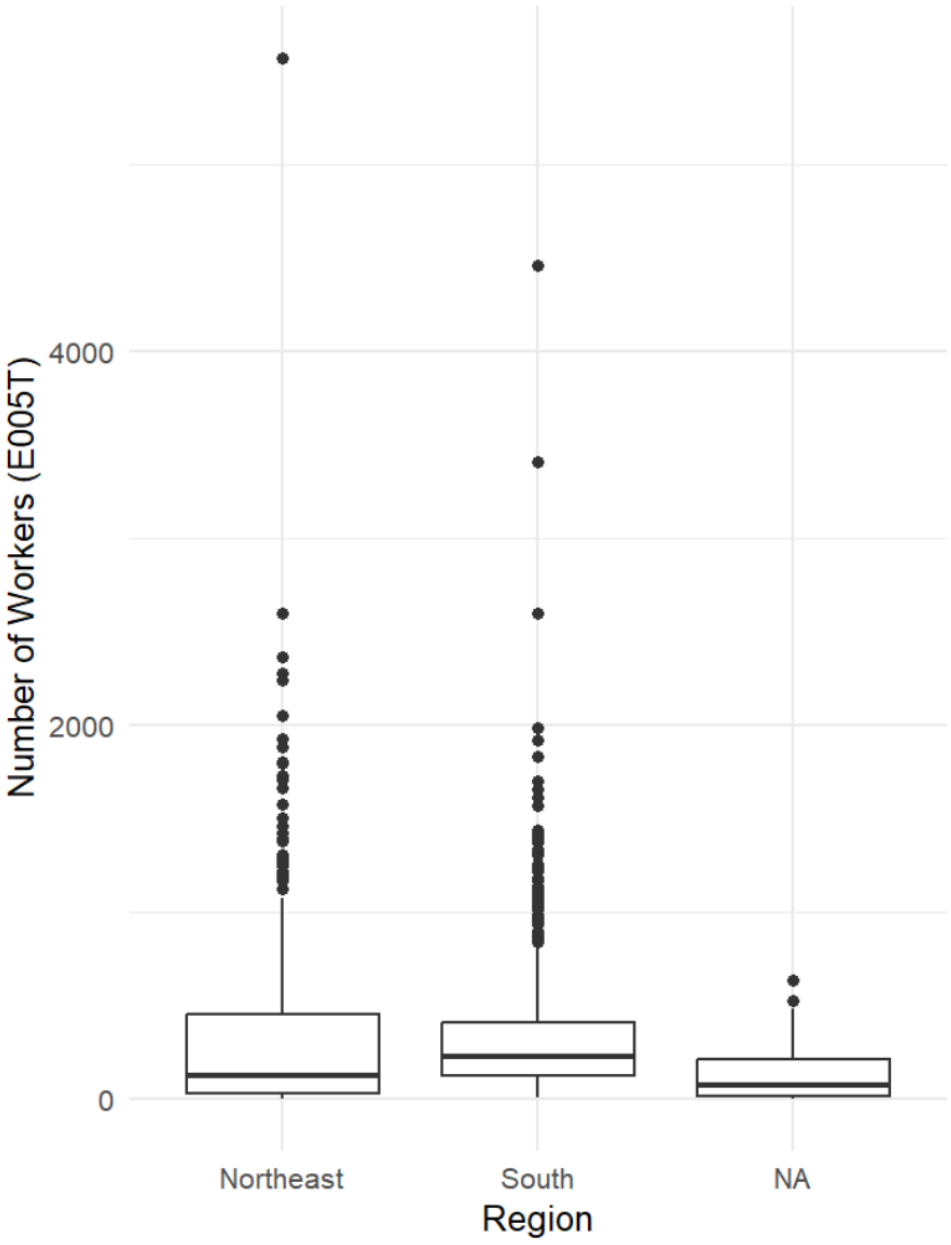

Figure 6: Size of Plants by Region

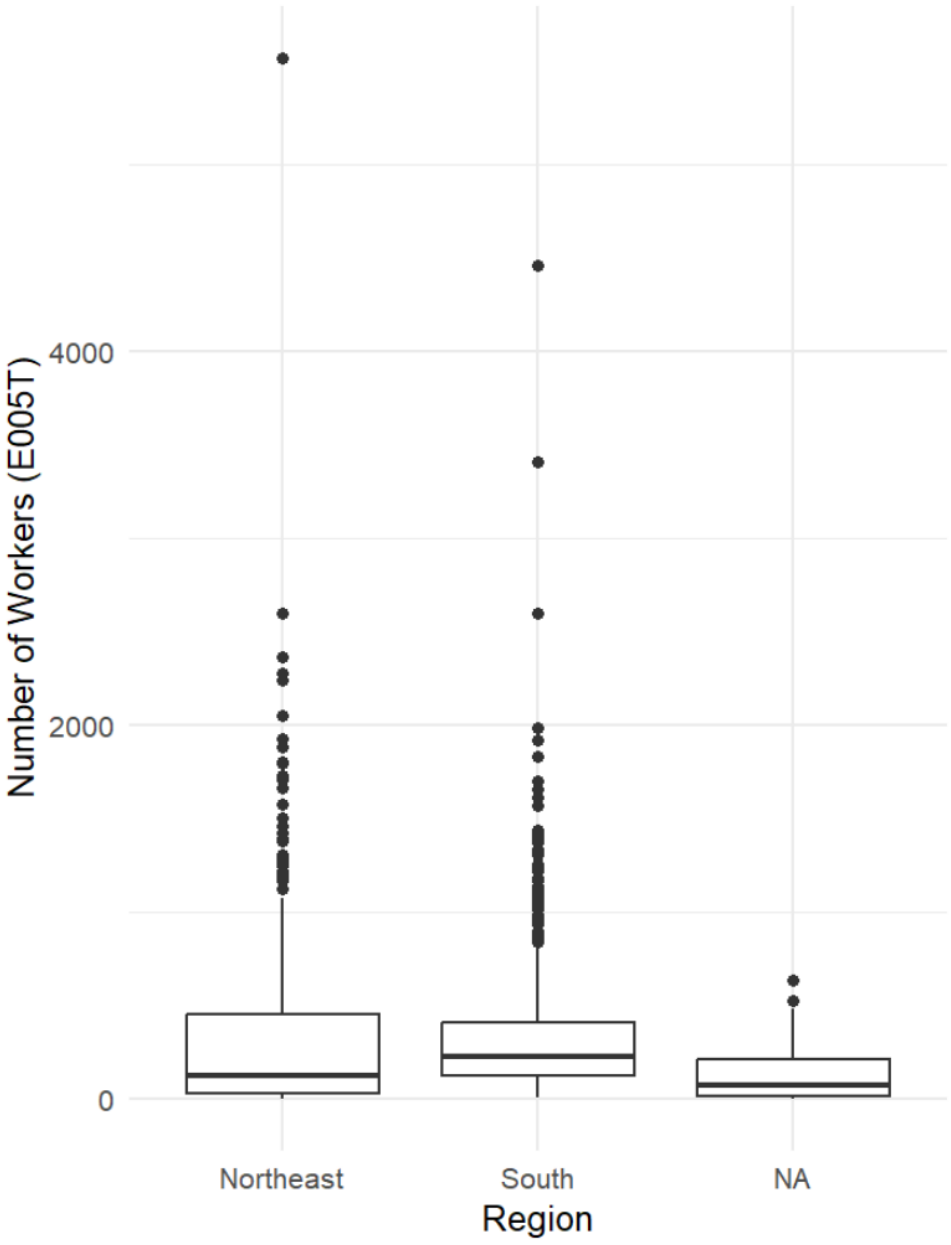

Figure 7: Productivity of Plants by Region

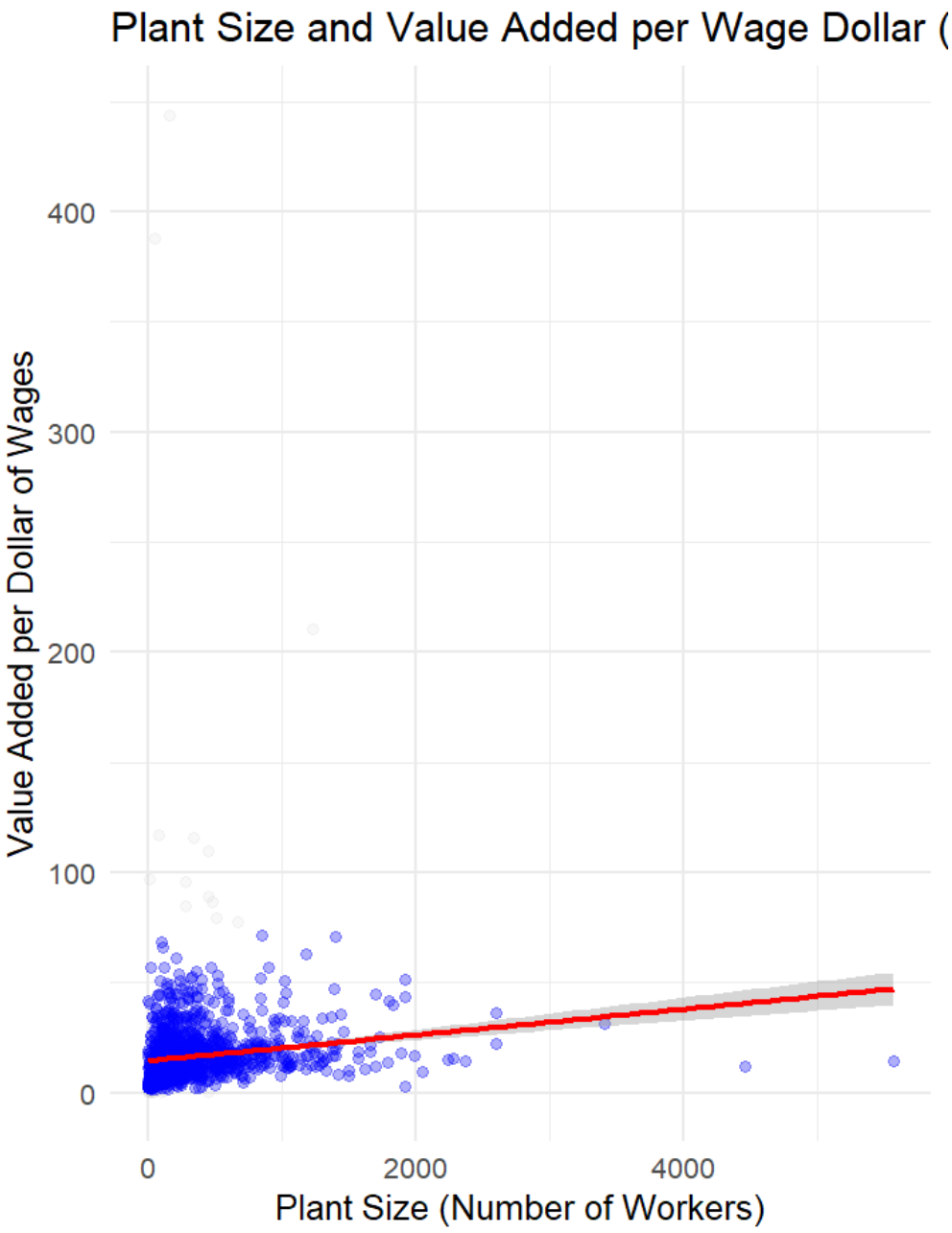

Figure 8: Value Added per Wage Dollar

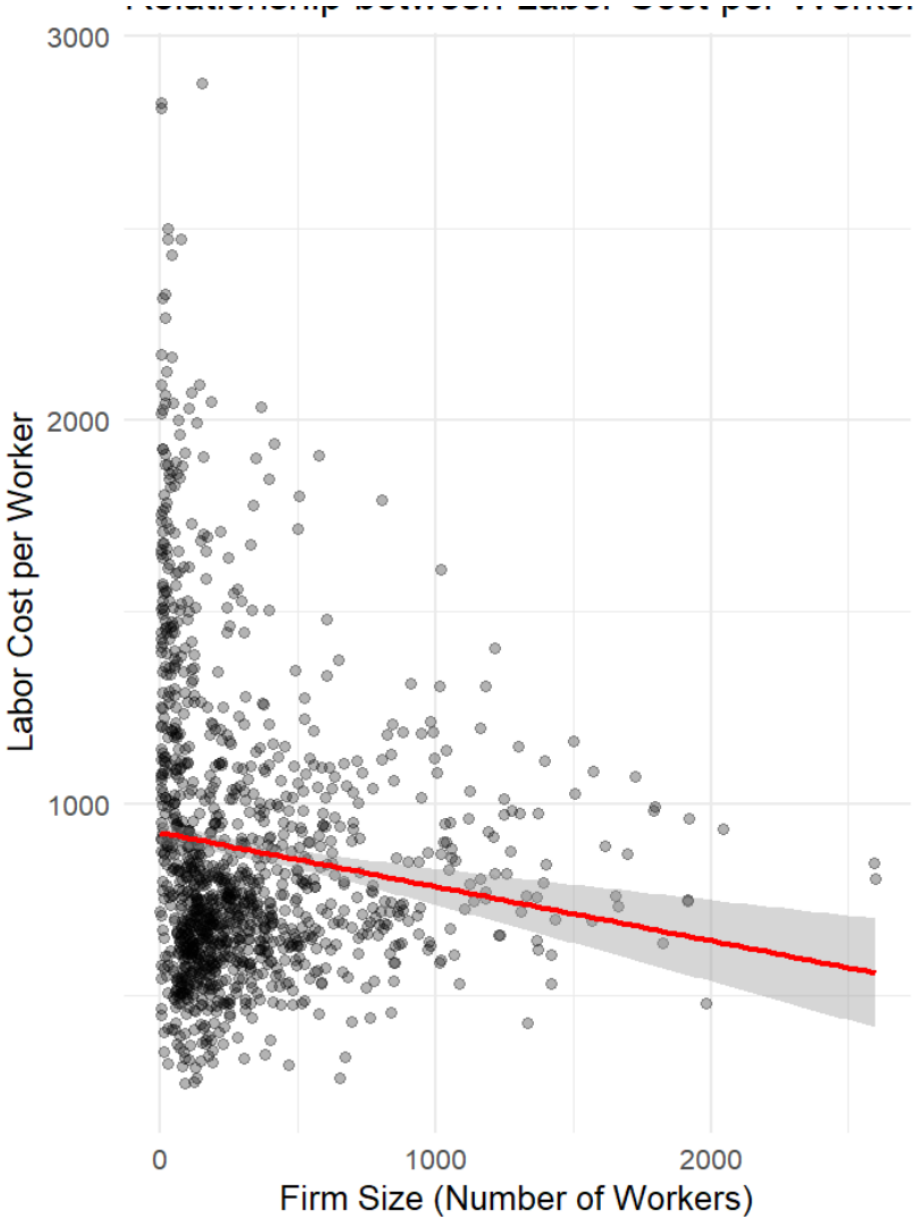

Figure 9: Labor Cost and Firm Size

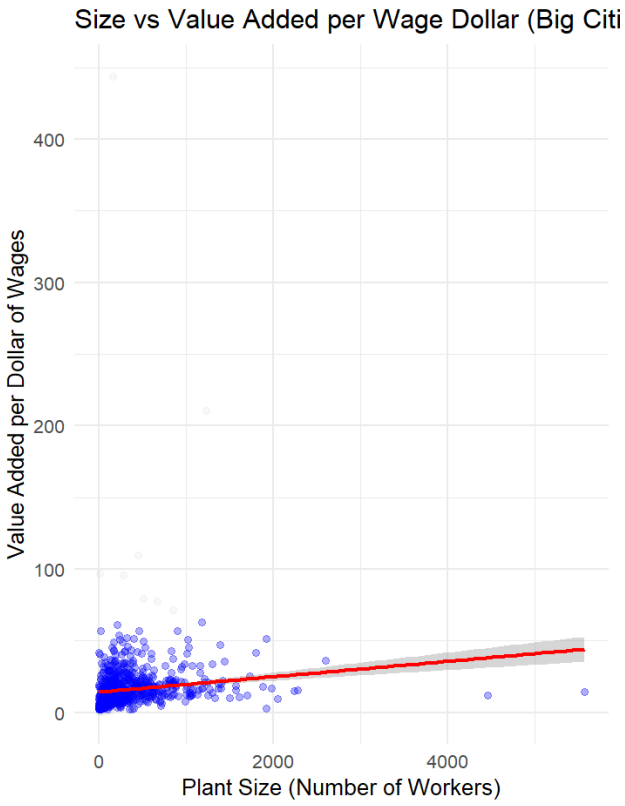

Figure 10: Size and Value Added per Wage Dollar

Table 1: Logistic Regression: Impact of Firm Size on Operating Status

	Estimate	Std. Error	z value	$\Pr(>\|z\|)$
Intercept	0.2629100	0.0821557	3.200	0.00137
Firm Size	0.0014244	0.0002242	6.352	2.13×10^{-10}

Significance codes: *** p<0.001, ** p<0.01

Null deviance: 1637.3 on 1278 degrees of freedom

Residual deviance: 1582.8 on 1277 degrees of freedom

Table 2: Impact of Salaried-to-Wage Worker Ratio on Firm Survival

	Estimate	Std. Error	z value	$\Pr(>\|z\|)$
Intercept	1.08264	0.07743	13.982	$< 2 \times 10^{-16}$
Salary Ratio	-4.16253	0.63382	-6.567	5.12×10^{-11}

Significance codes: *** p<0.001

Null deviance: 1548.0 on 1232 degrees of freedom

Residual deviance: 1473.3 on 1231 degrees of freedom

AIC: 1477.3