Online Appendix for "Identifying the effects of bank failures from a natural experiment in Mississippi during the Great Depression"

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1 Results including timber establishments

As noted in the text, there is something anomalous in the timber industry with a massive spike in the number of plants in 1929 relative to 1927 and relative to 1931. This leads to a non-trivial reduction in the sample size of around 1/3. I rerun the basic regressions including this group of plants. I do not rerun all the regressions instead focusing on the regressions for output and labor variables. The results from including the timber industry are reported in Tables 1 and 2. The basic patterns are present for all the variables when the timber data are included. There is still a very large fall in revenue and output, both statistically and economically, somewhat offset by an increase in price. Turning to the labor side, again there is very little differential in wage earners across the two regions. There is a significant fall in hours worked though less so statistically speaking. This then translates into a rise in wages. So while I continue to insist that there is something suspect about the timber data, the basic results reported in the paper are unaffected by including this group of plants.

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2 Results using different degrees of tail trimming

In the baseline results, I trimmed the 1% tails of the wage and price distributions to limit the degree of measurement error. I now consider the effects of choosing different degrees of trimming. The top half of Table 3 reports the results when no trimming is applied (the first 3 columns) and when the 5% tails of the wage distribution are trimmed (the second 3 columns). It is clear that the results remain roughly unchanged with very limited evidence that the shock had any differential impacts on wages across the two regions of Mississippi. The bottom half of Table 3 repeats this exercise for the price distribution. Again the results relative to the baseline case are roughly unchanged. The point estimates show a consistent positive differential effect on prices in the St. Louis region of Mississippi. However, the degree of statistical uncertainty is greater.

3 Entry and exit

The differences between the plant and county-level and the long-run effects all suggest important adjustments on the extensive margin of plant entry and exit. The difficulty with examining this dimension of adjustment is that the results are not DD estimates. The reason is that there is no pre-treatment data since the treatment occurs between 1929 and 1931, the earliest data I have. The exit information between 1929 and 1931 falls exactly when the crisis is occurring and there is no information about which plants entered in 1929. This difficulty implies that any differential effects may be driven by persistent differences in the two regions. Note, however, that for there to be a steady state number of plants in the long-run, persistent differences in entry rates across regions must be matched by persistent differences in exit. For example, assume that entry rates were always lower in the St. Louis region. Then this could potentially explain lower observed entry rates between 1929 and 1931. But this difference would then have to be matched with a lower exit rate for there to be a steady state implying more significant effects on the exit margin. A similar effect would be present in the long-run effects.

With this difficulty in mind, the specification for the exit probit, besides including industry fixed effects, employs the following two independent variables. First, one of the best predictors of plant survival is age (Dunne, Roberts and Samuelson, 1989). While I do not know a plant's age at the beginning of the sample, I do know that a plant is 2 years older if I observe the plant in a subsequent census. So I control for this part of a plant's age by including indicators for how many censuses a particular plant has been observed. It is crucial to control for age in the exit regressions. The reason is that initial differences in entry or exit rates lead to different average ages of plants subsequently. Without controlling for age then, these different average ages are estimated as differences between the two regions in exit rates. Second, I control for the size of the plant in terms of revenue in the exit regressions, which is also a strong predictor of exit. For the entry probit, I only include industry controls besides time and region fixed effects.

Table 4 shows that initially exit rates do not appear to differ substantially and, in fact, the exit rate appears to be slightly lower in the St. Louis Federal Reserve region of Mississippi. On the other hand, entry rates are significantly lower though this difference is imprecisely estimated. In an accounting sense, to square the plant and county-level results, either the rate at which plants enter or exit must change or the type of plants that enters or exits must change. The fact that the results for differences in entry and exit rates across regions are not conclusive suggests that the changes in the composition of plants that enter and exit may play a crucial role. The problem is that without a pre-treatment year, it is very difficult to be able to say anything directly about changes in the composition of those entering and exiting stemming from this banking crisis.

By the last census year, exit rates are lower in the St. Louis region and, surprisingly, entry rates are also substantially lower. These long-run difference in exit and entry rates are economically quite significant. For example, the long-run difference in exit rates is -.22 off a mean of .56. This suggests that plants that survive the initial crisis in the St. Louis region are more able to stand the further contraction in aggregate demand as the Depression deepens between 1931 and 1933. Rather than a scarring effect of the banking crisis, my results imply a "what doesn't kill you makes you stronger" view of the banking crisis. On the other hand, the much lower entry rates tentatively point to potentially lingering effects of the banking failures on the provision of credit for new ventures.

4 What was the role of the banking crisis in the Depression?

What do these results mean for the debate about the role of banks in the Great Depression. Before turning to the implications, it is important to keep in mind that the comparison is between a region that has a banking crisis (Atlanta) and an absolute banking meltdown (St. Louis). Within a couple of months, 20% of banks fail in the Atlanta region, a terrible situation. It is only that over the same period of time, 35% of banks are out of operation in the St. Louis region of Mississippi. The question then is whether if we compared a situation with no bank failures to one where 15% failed, would the result be the same? Almost surely not. My intuition would suggest that there is a convex relationship between the two. Losing the first percentage of banks is not nearly as costly for manufacturing outcomes as losing the last percent.[1] In other words, these estimates are local average treatment effects. So using them to extrapolate to other hypothetical situations must be done with caution.

There are other reasons to be cautious in extrapolating these results. First, as emphasized before, Mississippi is not very representative of the U.S. economy of a whole. It is rather under-developed with many small firms and a large fraction of its economy devoted to agriculture. Its industry is mainly concentrated in consumer non-durables. These differences provide reasons to think that the estimates may be an under or over estimate. That being said, the treatment effect can be though of as a short-run elasticity with respect to the percentage of banks that failed. This is an instrumental variables interpretation of the effect where all plants in a particular region experience the total percentage of bank failures in that area. This is a rather rough calculation since it does not attempt to order the banking failures before the output declines. Instead it treats them as concurrently with causation running from banking collapse. This calculation and the estimates in the paper did not attempt to distinguish between the effects of bank failures due to illiquidity versus those due to insolvency. Finally, the calculation will also ignore any possible general equilibrium effects.

Now the estimates using the plant-level within estimator imply an elasticity of close to -1.6 for revenue given the difference between the regions in bank failure rates was around .15 log points.[2] A somewhat heroic calculation would then suggest the following: With around 15% of banks failing from 1929 to 1931 (Bernanke, 1983) and an approximately 60% fall in manufacturing revenue, then my results for Mississippi suggest that 40% of the total fall in revenue (1.6*.15/.60) can be attributed to the meltdown in the financial sector. This fraction would be slightly larger if I used

[1] To be sure, this is considering the "assets" side of bank failures, loans. On the "liabilities" side, losing $1 of deposits is losing $1 in deposits. So to the extent that the liabilities side predominantly effects demand, I would expect less convexity in the effect.

[2] There would be a slightly lower elasticity if instead of using percentage of banks that failed, I instead used percentage of deposits relative to pre-crisis levels.

the county-level estimates. Turning to physical output, I find an elasticity of around -2.5 (37/15) using the within estimator. Given a decline in industrial production of approximately 50% between 1929 and 1931 (Bernanke, 1983), I estimate that 75% ($2.5 * 15/50$) of the fall can be explained by the banking crisis.

Now moving to the economy as a whole, it is important to emphasize these results strictly speaking only apply to manufacturing. There are reasons to believe that the effect on other parts of the economy are larger or smaller than for manufacturing. For example, the role of credit in agriculture is quite large. Many farmers borrow against their future crop to purchase seeds, fertilizer, and farm equipment. I know of no modern studies that estimates the impact of a financial shock on the agricultural sector. Presumably, similar effects should be present for the service sector as well, but like agriculture, little to no modern work has been done to actually quantify these effects due to a lack of plant-level data.

From an aggregate perspective, Yet even assuming that the banking crisis has no effects on other non-manufacturing sectors of the economy, an unlikely assumption, the banking crisis from an accounting standpoint still explains a large fraction of the overall decline in aggregate output. In 1930, manufacturing comprised 25% of total income with this percentage falling to 19% at the nadir of the Depression. In a purely accounting sense, 30% of the fall in aggregate income can be attributed to the fall in manufacturing income. Combining this with my heroic estimates on real output using the plant-level estimate, this suggests that 22.5% (.3*.75) of the fall in aggregate output can be attributed to bank failures through their effect on the manufacturing sector. This is a sizable fraction even under this extreme assumption, but it still leaves a large fraction of the decline in output unexplained over the first two years of the Depression.

	Total Revenue			Physical Output			Price		
	Within	Balanced	Unbalanced	Within	Balanced	Unbalanced	Within	Balanced	Unbalanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
St. Louis Fed 1931	-0.20***	-0.16*	-0.21**	-0.29**	-0.42**	-0.11	0.16**	0.12	0.15
	(0.07)	(0.09)	(0.19)	(0.14)	(0.19)	(0.17)	(0.08)	(0.09)	(0.09)
St. Louis Fed	-	-0.26**	-0.19**	-	-0.27	2.99***	-	0.05	0.04
		(0.11)	(0.08)		(0.19)	(0.15)		(0.06)	(0.11)
N	1670	734	1659	645	320	640	459	274	459
Adjusted R^2	0.64	0.54	0.40	0.54	0.78	0.73	0.86	0.94	0.89

Table 1: Effects on output variables These regression include plants from the timber industry. All dependent variables are in logs. The within specification includes plant-fixed effects. All the regressions include industry-specific time trends though the coefficients are excluded for clarity. The price and quantity effects are only for plants producing one good. Plant-clustered standard errors are reported in parenthesis.$^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$.

	Total Workers			Hours per wage earner			Average wage		
	Within	Balanced	Unbalanced	Within	Balanced	Unbalanced	Within	Balanced	Unbalanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
St. Louis Fed 1931	-0.00	0.040	-0.06	-0.10*	-0.08	-0.05	0.11	0.09	0.00
	(0.07)	(0.09)	(0.09)	(0.06)	(0.06)	(0.04)	(0.08)	(0.07)	(0.05)
St. Louis Fed	-	-0.35***	-0.26***	-	0.04**	0.01	-	.03**	-0.11**
		(0.10)	(0.07)		(0.02)	(0.01)		(0.04)	(0.03)
N	1669	740	1659	1519	675	1509	1524	679	1514
Adjusted R^2	0.46	0.53	0.48	0.16	0.16	0.18	0.13	0.291	0.36

Table 2: Effects on labor inputs These regressions include plants from the timber industry. All dependent variables are in logs. The within specification includes plant-fixed effects. All the regressions include industry-specific time trends though the coefficients are excluded for clarity. Standard errors are clustered at the plant-level and reported in parenthesis. $^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$

	No Tail Trimming			5% Tail Trimming		
	(1)	(2)	(3)	(4)	(5)	(6)
	Within	Balanced	Unbalanced	Within	Balanced	Unbalanced
			Panel A: Wage			
St. Louis Fed 1931	0.08	0.08	0.05	0.16**	0.13*	0.11**
	(0.09)	(0.09)	(0.06)	(0.08)	(0.07)	(0.05)
			Panel B: Price			
St. Louis Fed 1931	0.12	0.11	0.22*	0.04	0.14*	0.21***
	(0.10)	(0.11)	(0.12)	(0.07)	(0.08)	(0.08)
N	1183	622	1182	1044	557	1043
Adjusted R^2	0.13	0.27	0.35	0.18	0.38	0.47

Table 3: Effects on wage and price for different degrees of tail trimming. The first 3 columns are from no trimming and the second 3 columns are from trimming the 5% tails . The within specification includes plant-fixed effects. All the regressions include industry-specific time trends though the coefficients are excluded for clarity. Standard errors are clustered at the plant-level and reported in parenthesis. $^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$.

	Exit (1)	Entry (2)
St. Louis 1929 to 1931	-.05	-.15
	(.11)	(.11)
	-.02	*-.06*
St. Louis 1931 to 1933	.01	.08
	(.12)	(.15)
	.00	*.03*
St. Louis 1933 to 1935	-.56***	-.34**
	(.14)	(.16)
	-.22	*-.12*
Log Revenue	-.28***	-
	(.04)	
"Age" 1	.16	-
	(.12)	
"Age" 2	.12	-
	(.16)	

Table 4: Probits for plant entry and exit. Results include industry fixed effects and time fixed effects. Marginal effects calculated at the mean are reported in italics. The "age" variable is an indicator for how many previous censuses a plant has been observed in. Standard errors are clustered at the plant-level. $^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$.

References

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