Appendix

Figure A.1: Independent Patents and Employment in Young Firms in Time Series

Figure plots an annual fraction of independent US patents (in red dashed line) and the fraction of employment in young firms (in blue continuous line), and shows that the two measures are correlated in time-series. The patent data sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The new firm sample is the near universe of employer firms covered by the U.S. Census LBD database.

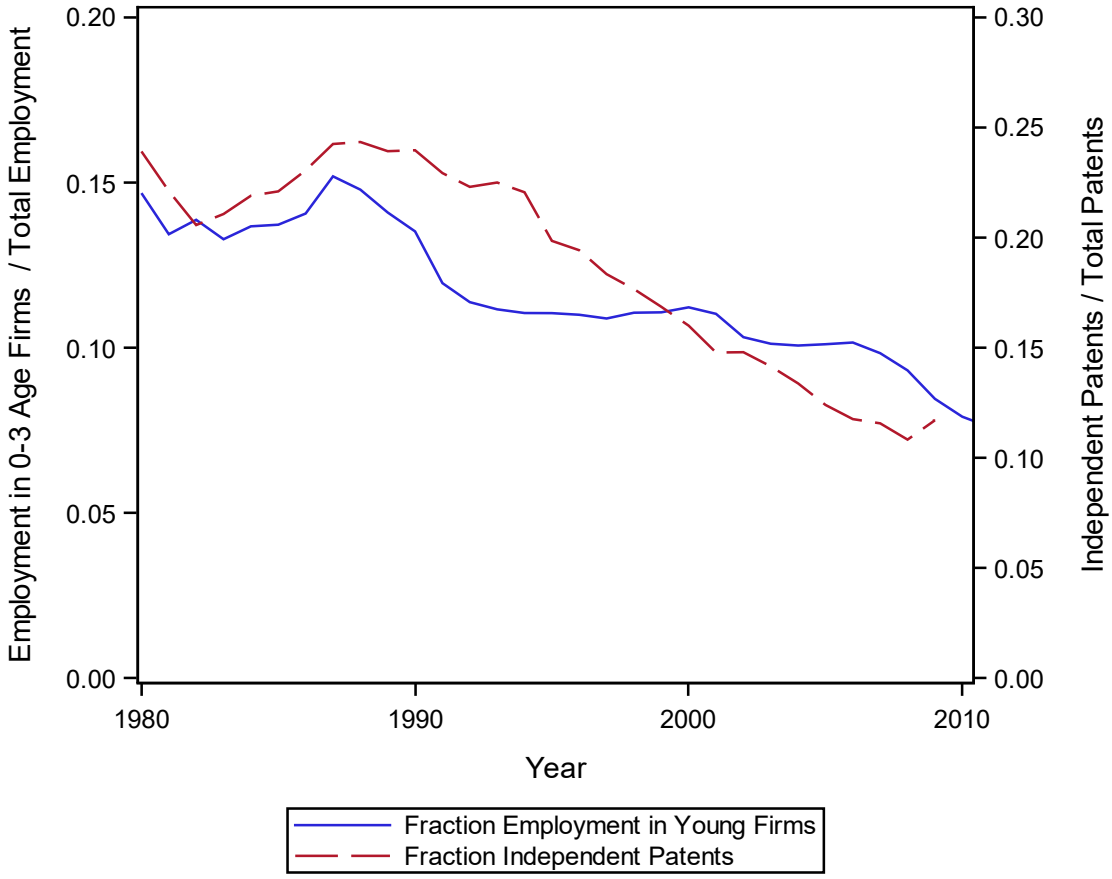
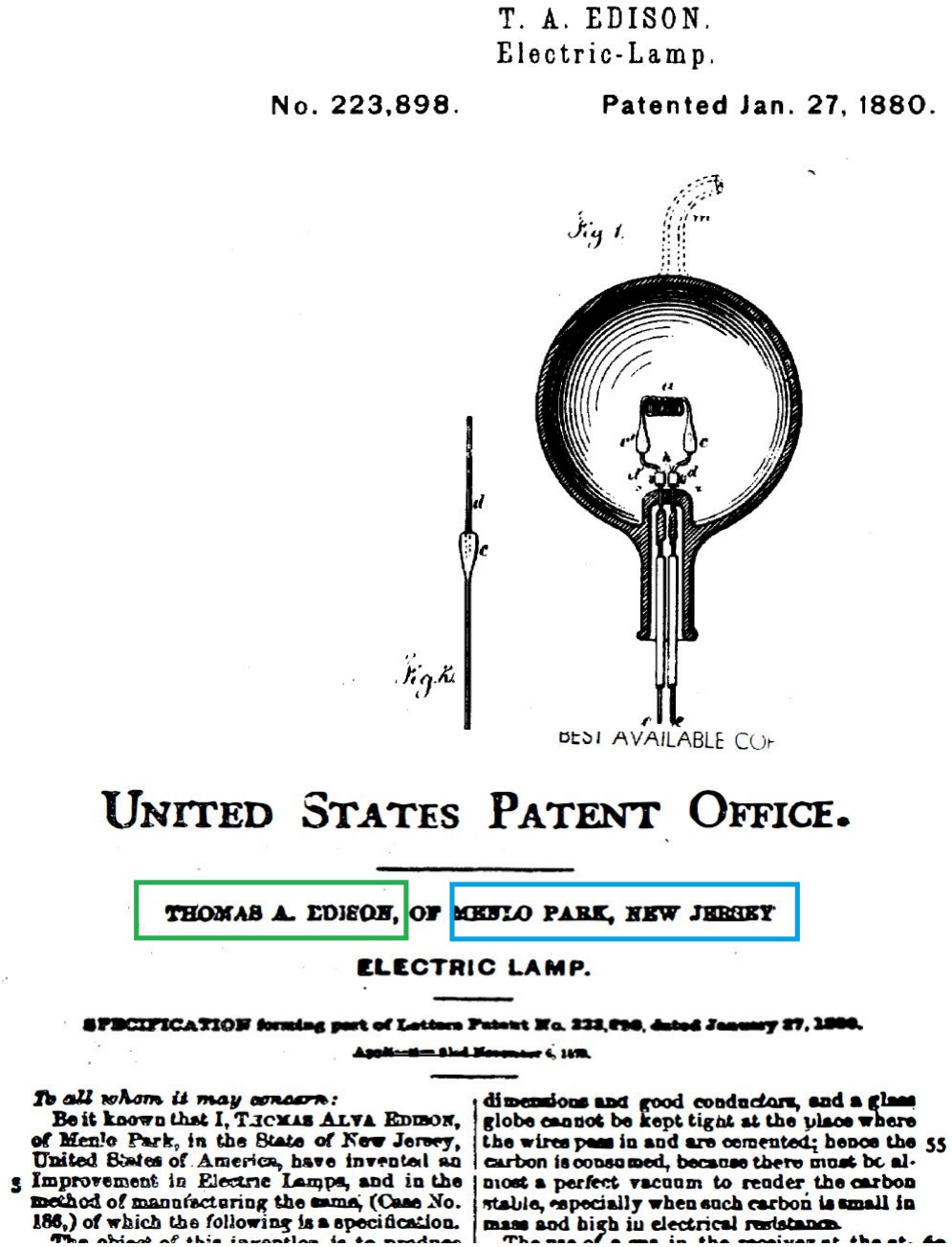


Figure A.2: Example Independent Patent

Figure shows an example of an independent issued by the U.S. Patent and Trademark Office (USPTO). The independent inventors produced inventions on their own means or through financing by local angel investors (Lamoreaux, Sokoloff, 2005; Lamoreaux, Sokoloff, and Sutthiphisal 2009; Nicholas 2010). These patents are usually either unassigned, assigned to the inventor, or other individuals (e.g., investors). Independent inventors usually either sold off their patents to large firms for commercialization or founded own startups for commercialization. The patent displayed in this figure is the famous light-bulb invention by Thomas Edison, who in 1880 founded a Edison Electric Light Company to market his new invention.



T. A. EDISON.
Electric-Lamp.

No. 223,898. Patented Jan. 27, 1880.

Fig 1.

Fig 2.

BEST AVAILABLE COPY

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY

ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 223,898, dated January 27, 1880.

Application filed November 4, 1879.

To all whom it may concern:

Be it known that I, THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America, have invented an Improvement in Electric Lamps, and in the method of manufacturing the same, (Case No. 186,) of which the following is a specification.

dimensions and good conductors, and a glass globe cannot be kept tight at the place where the wires pass in and are cemented; hence the carbon is consumed, because there must be almost a perfect vacuum to render the carbon stable, especially when such carbon is small in mass and high in electrical resistance.

Figure A.3: Example Firm Patent

Figure shows an example of a patent assigned to a U.S. firm (e.g., General Electric) by the U.S. Patent and Trademark Office (USPTO) at the time of the patent grant. Patents assigned to firms are usually produced by inventors employed within large firms with in-house R&D labs who would have been contractually obliged to assign their inventions to their employers (Lamoreaux, Sokoloff, and Sutthiphisal 2009; Nicholas 2010).

A. SWAN.
INCANDESCENT LAMP.
APPLICATION FILED JUNE 7, 1905.

905,478. Patented Dec. 1, 1908.

Fig. 1.

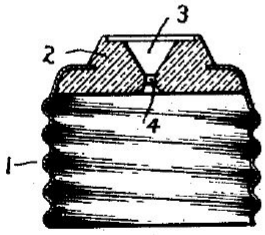
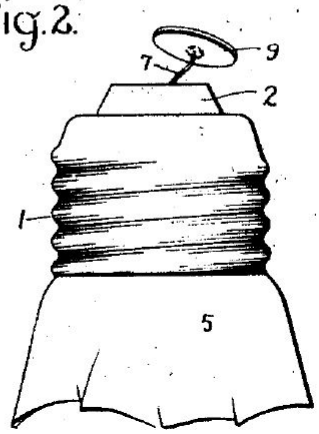


Fig. 2.



UNITED STATES PATENT OFFICE.

ALFRED SWAN, OF NEW YORK, N. Y., ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INCANDESCENT LAMP.

No. 905,478. Specification of Letters Patent. Patented Dec. 1, 1908.

Application filed June 7, 1905. Serial No. 264,078.

To all whom it may concern:

Be it known that I, ALFRED SWAN, a subject of the King of Great Britain, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Incandescent Lamps, of which the following is a specification.

for connecting the leading-in wire to the under side of the center contact so that the solder does not show at all from the outside and connection is made with the contact direct and not through the solder used in connecting the leading-in wire thereto.

In accordance with my invention, I form

Figure A.4: County Geographic Distribution of 1930s Bank Suspensions and 1920s Independent Patenting

This figure shows the nationwide geographic distribution of early 1930s bank suspensions (panel A), 1920s independent (panel C), and 1920s firm (panel E) patents filed at the county level, and how those change once state fixed effects and a control for the log of 1920s population of that county are included (panels B, D, and F).

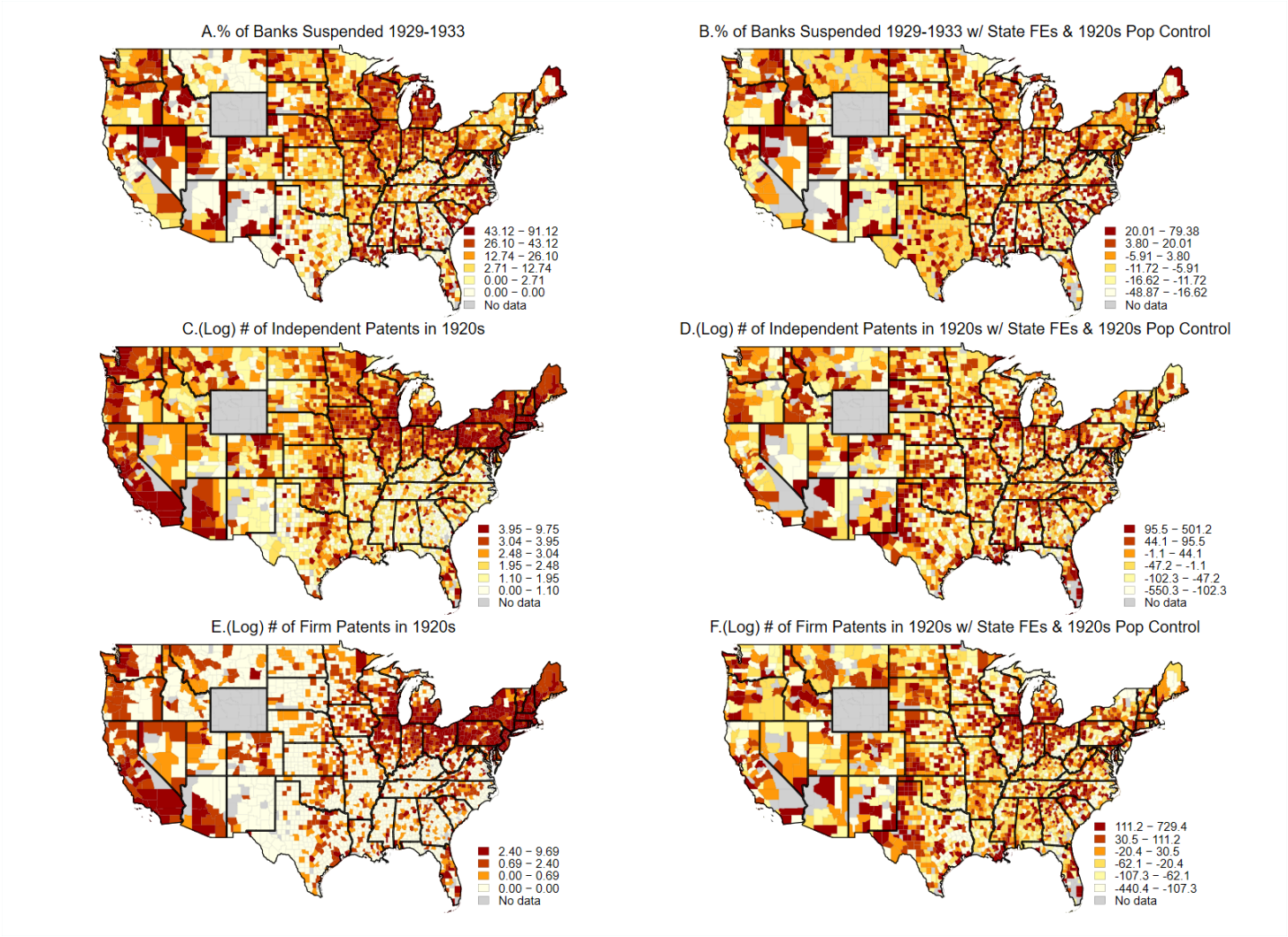
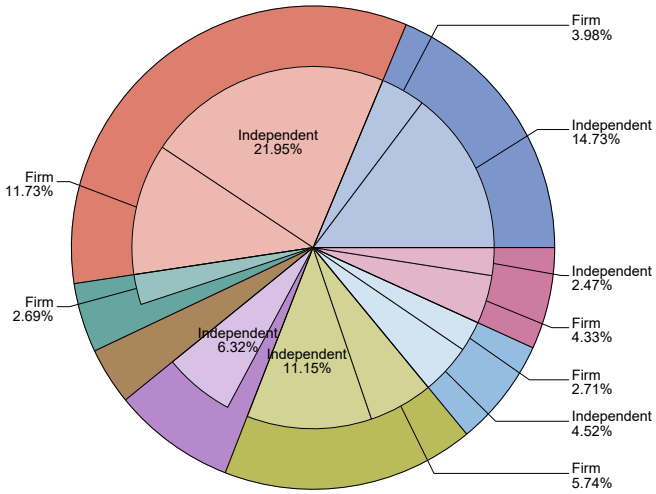


Figure A.5: Distribution of Patents by Technology Class for Firm and Independent Patents

This figure shows the distribution of patents by eight technology classes (outer slices) and the distribution of independent and firm patents within each technology class (inner slices within each outer slice). Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. The eight technology classes correspond to the highest level of Cooperative Patent Classification (CPC) classifications by the U.S. Patent and Trademark Office (USPTO). Sub-figure (a) shows the distribution for patents filed over 1910–1929, and sub-figure (b) for patents filed over for 1930–1949.

(a) Patents filed over 1910–1929



(b) Patents filed over 1930–1949

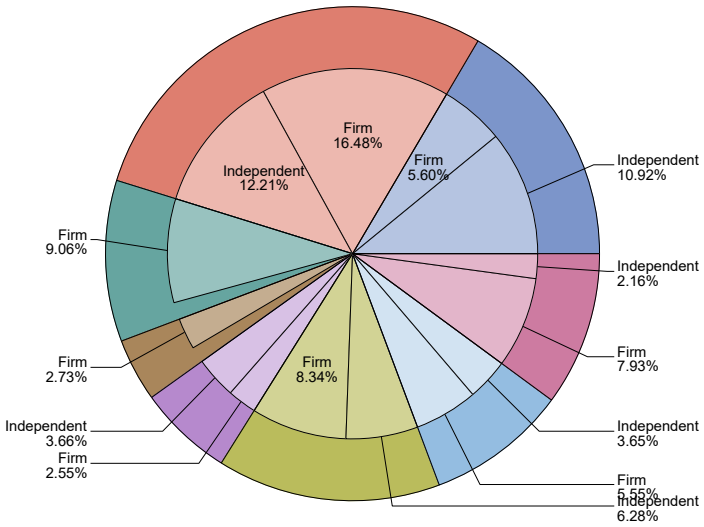
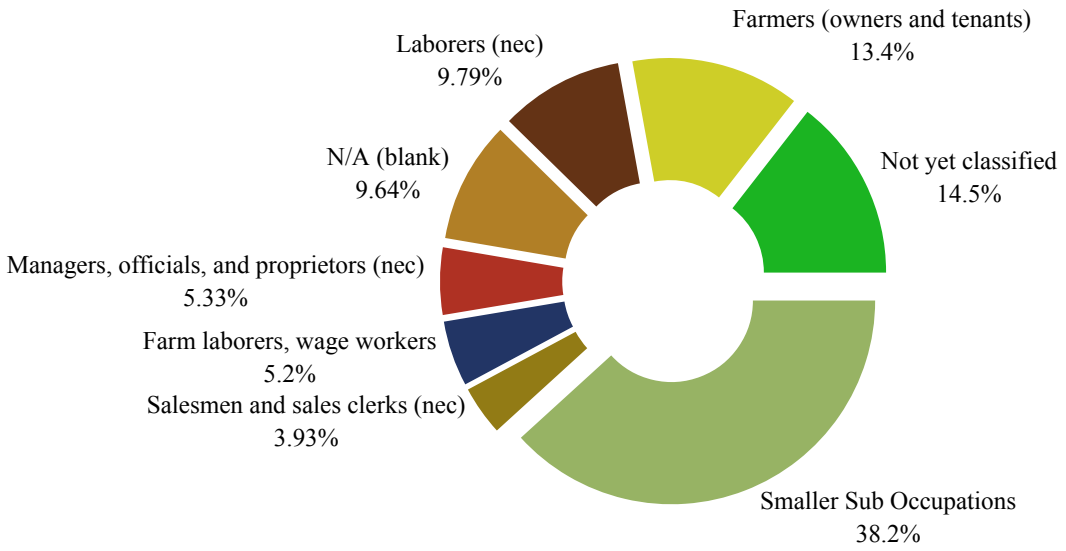


Figure A.6: Distribution of Occupations for the 1930 Census Males and Male Inventors from Exact Name Match Round

The sub-figure (a) shows the distribution of occupations for 35 million males males who are 17 years of age or older in the 1930 Census, and the sub-figure (b) for 72 thousands inventors who we uniquely match to the 1930 Census using exact name and county match (including unique match after middle name filtering, but do not use occupation filter to disambiguate multiple matches).

(a) Census Population



(b) Inventors from Exact Name Match

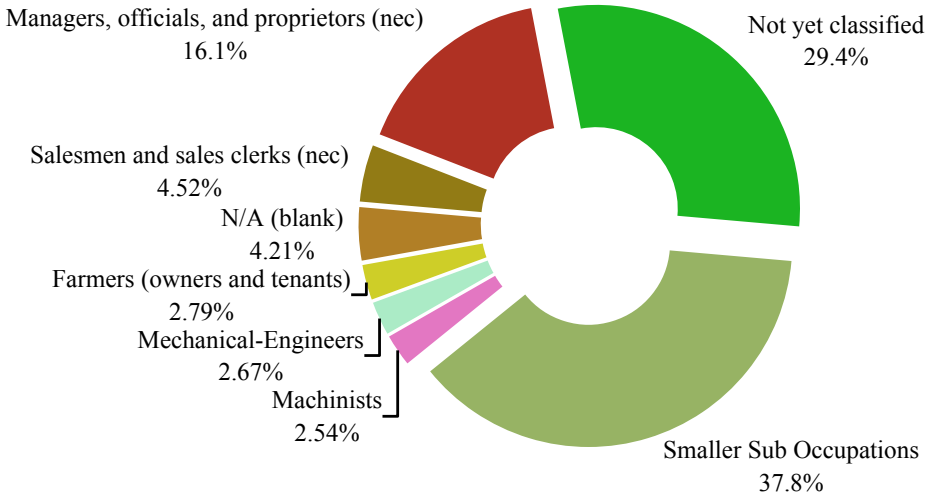


Figure A.7: Distribution of Inventors by Gender and Age: Firm versus Independent Inventors

The sub-figure (a) shows the distribution by gender for all people who were 17 years of age or older in the 1930 Census ("1930 Census"), for independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors"), for firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors"), for independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents"), for firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents"). Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. The sub-figure (b) shows the distribution by age for all males who were 17 years of age or older in the 1930 Census ("1930 Census"), for male independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors"), for male firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors"), for male independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents"), for male firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents"). The means (medians) for each group are: "1930 Census"—39.4 (37); "All Indep. Inventors"—43.5 (42); "All Firm Inventors"—41.3 (40); "Indep. Inventors w/ 2+ Patents"—43.3 (42); "Firm Inventors w/ 2+ Patents"—40.1 (39). Online Appendix B describes the procedure of matching inventors to complete-count U.S. Censuses and provides statistics on matching rates. Note, the categories do not always sum to a 100% due to rounding by the software used to produce the figures.

(a) Distribution by Gender

(b) Distribution by Age

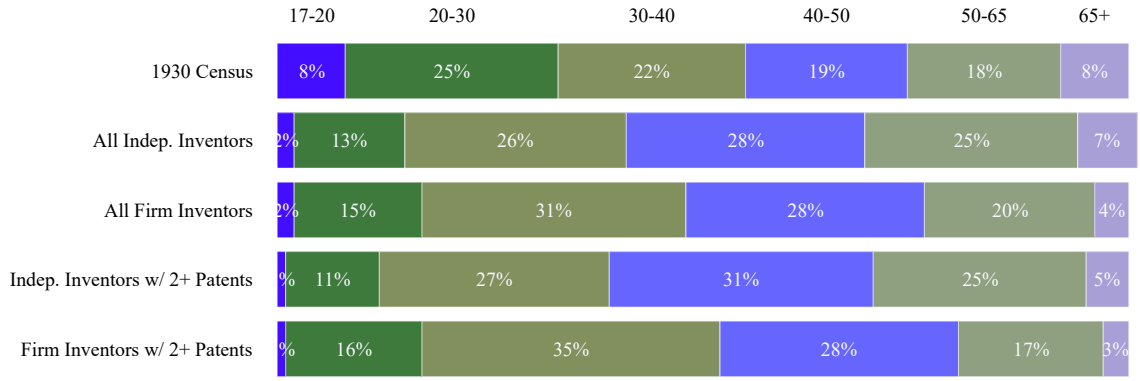
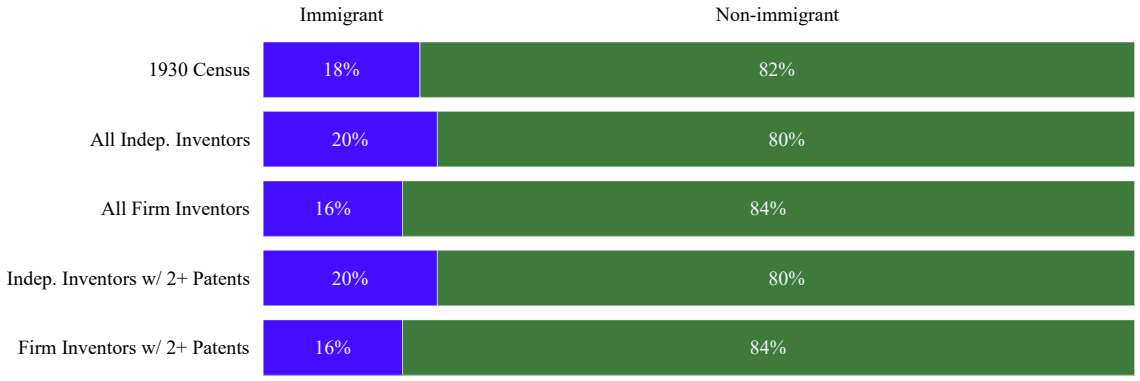


Figure A.8: Distribution of Inventors by Immigrant and Marital Status: Firm versus Independent Inventors

The sub-figure (a) shows the distribution by immigrant status for all males who were 17 years of age or older in the 1930 Census ("1930 Census"), for male independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors"), for male firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors"), for male independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents"), for male firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents"). Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. The sub-figure (b) shows the distribution by marital status for all males who were 17 years of age or older in the 1930 Census ("1930 Census"), for male independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors"), for male firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors"), for male independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents"), for male firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents"). Online Appendix B describes the procedure of matching inventors to complete-count U.S. Censuses and provides statistics on matching rates. Note, the categories do not always sum to a 100% due to rounding by the software used to produce the figures.

(a) Distribution by Immigrant Status



(b) Distribution by Marital Status

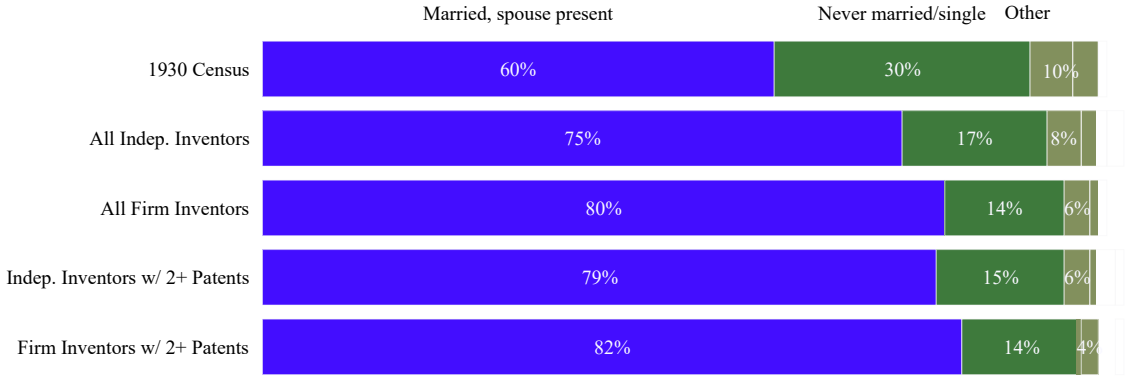


Figure A.9: Distribution of Earnings Scores: Firm versus Independent Inventors

The figure shows the distribution of earnings scores for all males who were 17 years of age or older in the 1930 Census ("1930 Census" in both figures), for male independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors" in left figure), for male independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents" in left figure), for male firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors" in right figure), for male firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents" in right figure). Earnings scores range from 0 (lowest percentile) to 100 (highest percentile) and are based on the rankings of earnings derived from occupation held by an individual. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. Online Appendix B describes the procedure of matching inventors to complete-count U.S. Censuses and provides statistics on matching rates.

(a) Distribution of Earnings Scores: Independent Inventors (left figure) vs Firm Inventors (right figure)

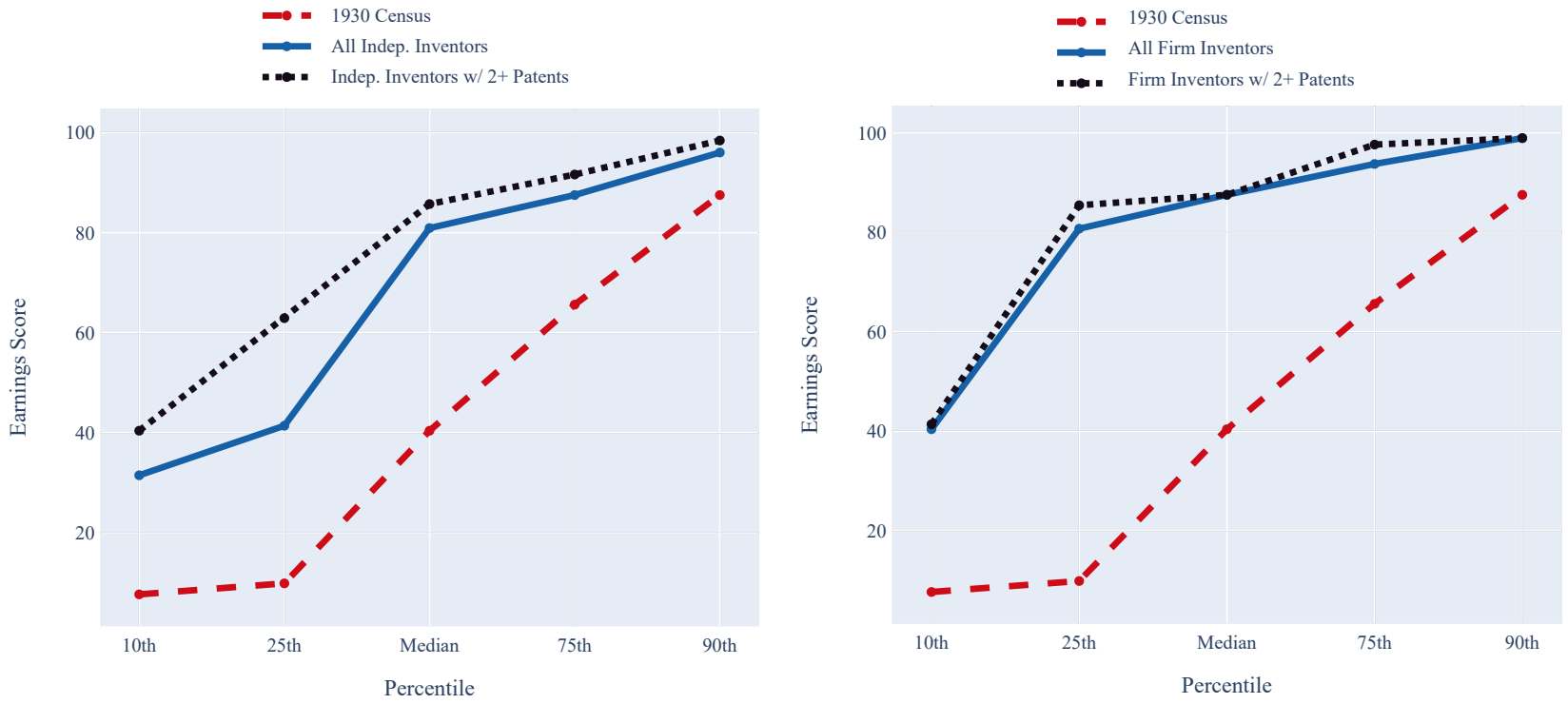


Figure A.10: Distribution of Home Values: Firm versus Independent Inventors

The figure shows the distribution of home values for all male owners who were 17 years of age or older in the 1930 Census ("1930 Census" in both figures), for male independent inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Indep. Inventors" in left figure), for male independent inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Indep. Inventors w/ 2+ Patents" in left figure), for male firm inventors filing any number of patents over 1925–1934 and matched to the 1930 Census ("All Firm Inventors" in right figure), for male firm inventors filing at least two patents over 1925–1934 and matched to the 1930 Census ("Firm Inventors w/ 2+ Patents" in right figure). Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. Online Appendix B describes the procedure of matching inventors to complete-count U.S. Censuses and provides statistics on matching rates.

(a) Distribution of Home Values: Independent Inventors (left figure) vs Firm Inventors (right figure)

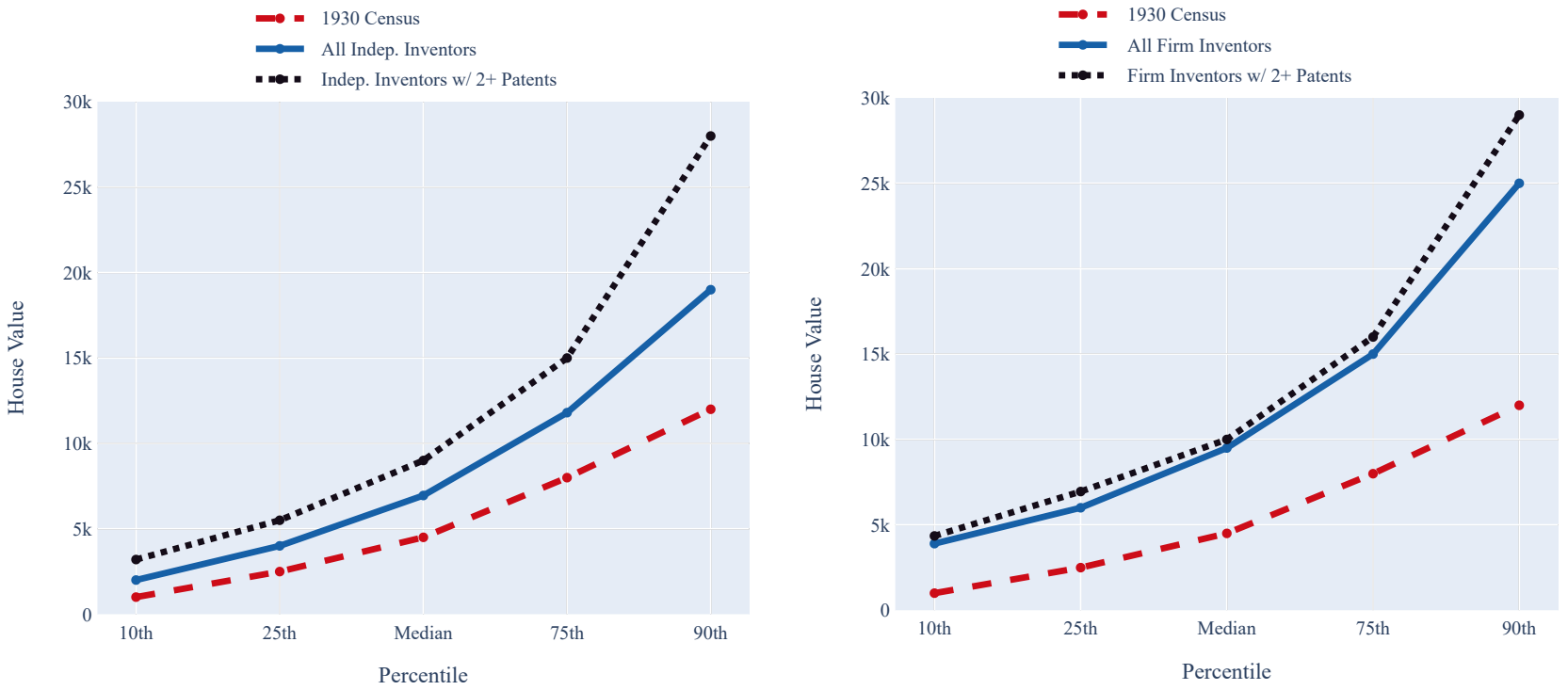


Figure A.11: Bank Distress and Independent Patent Quality (Total Citations)

The figure shows estimates from a differences-in-differences regression of the total number of future patent citations citing independent patents on bank distress during the Great Depression. The sample of independent patents is the near universe of all independent patents granted by the U.S. Patent and Trademark Office (USPTO). The sample of future patent citations comes from the near universe of all citing patents granted by the USPTO, including independent, U.S firm, and non-U.S. patents. The unit of observation is county-time, where time is a five-year period. We start the sample with the 1910–1914 period because citation data start in 1910. The dependent variable is the logarithm of the total number of future patent citations received by independent patents in the county and five-year period. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on independent innovations are the coefficients on the interaction between Bank Distress and five-year indicators that measure the relative change in patenting between areas with higher bank distress relative to the reference period of 1925–1929. Specifically, we plot betas and 95% confidence intervals from the differences-in-differences regression: $Ln(NumberPatentCitations+1)_{cst} = \alpha_c + \gamma_{st} + \sum \beta_t \, 1_t \, BankDistress_{cs} + \epsilon_{cst}$ where c denotes a county, s – a state, and t – a five-year period. α_c is county fixed effects; γ_{st} is state-time fixed effects; five-year indicators equal 1 for a given time period (e.g., 1910-14), and 0 otherwise. Standard errors are clustered at the county level.

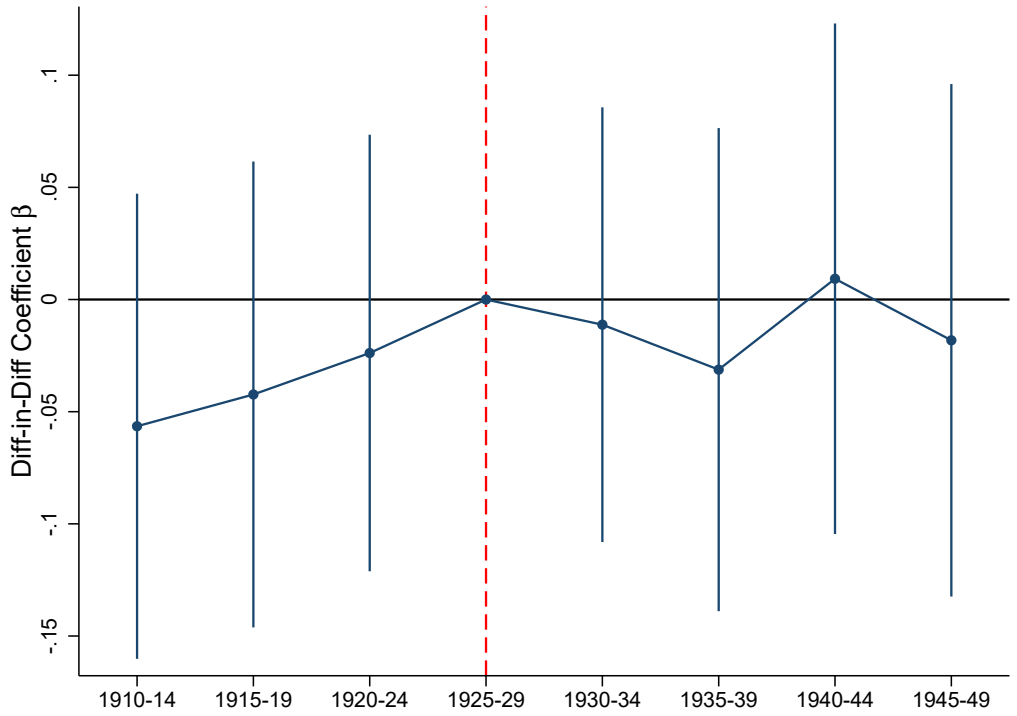


Figure A.12: Bank Distress and Independent Patent Quality
(Average Citations/Patent)

The figure shows estimates from a differences-in-differences regression of the average independent patent quality on bank distress during the Great Depression. The sample of independent patents is the near universe of all independent patents granted by the U.S. Patent and Trademark Office (USPTO). The sample of future patent citations comes from the near universe of all citing patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-time, where time is five-year period. We start the sample with the 1910-1914 period because citation data start in 1910. The dependent variable is the average future patent citations, which is equal to the total number of future patent citations received by independent patents in the county and five-year period plus 1 divided by the number of independent patents plus 1. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on independent innovations are the coefficients on the interaction between Bank Distress and five-year indicators that measure the relative change in patenting between areas with higher bank distress relative to the reference period of 1925–1929. Specifically, we plot betas and 95% confidence intervals from the differences-in-differences regression: $Av.Cit_{cst} = \alpha_c + \gamma_{st} + \sum \beta_t \, 1_t \, BankDistress_{cs} + \epsilon_{cst}$ where c denotes a county, s – a state, and t – a five-year period. α_c is county fixed effects; γ_{st} is state-time fixed effects; five-year indicators equal 1 for a given time period (e.g., 1910-14), and 0 otherwise. Standard errors are clustered at the county level.

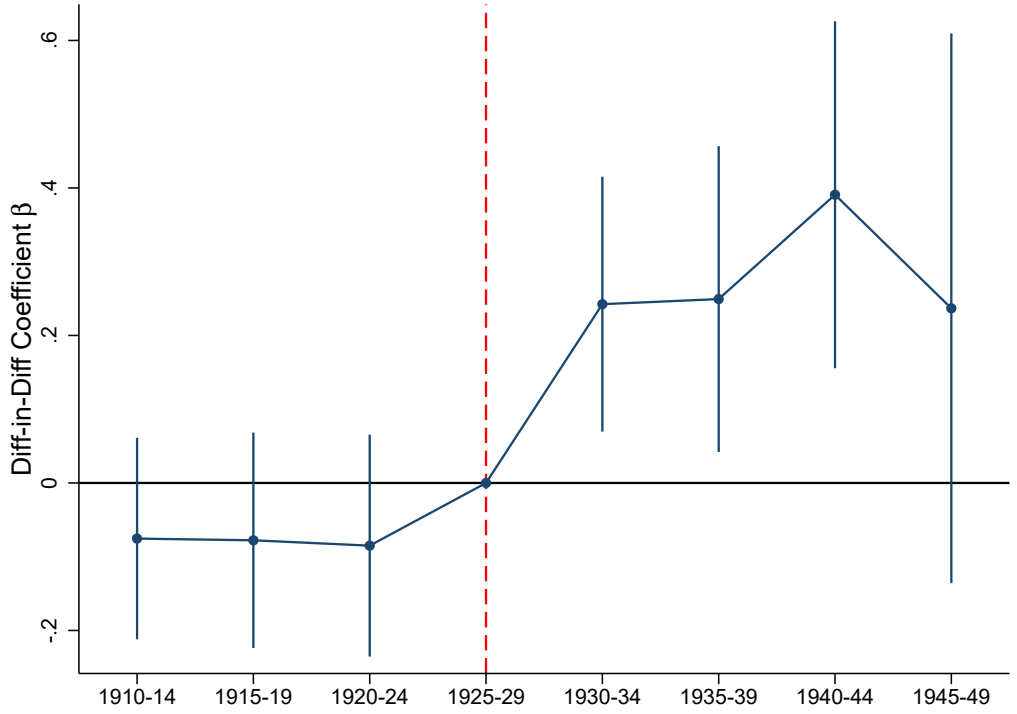


Table A.1: Robustness: Different Measures of Bank Distress and Innovation Quantity

The table shows that the results on independent patenting remain robust when using different measures of distress. The sample is the near universe of independent patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. The unit of observation is county-decade, for the period 1910–1940. In all columns, the dependent variable is the logarithm of the number of independent patents filed over ten-year periods within each county. In columns 1 and 4, we use the standard treatment variable, defined as one if there is any bank suspension in the county from 1930 through 1933. In columns 2 and 4, Bank Distress > Median is an indicator variable equal to 1 for counties with an above median % of deposits in suspended banks, calculated as the cumulative deposits in bank suspended from 1930 through 1933 as a share of bank deposits in 1929. In columns 3 and 6, we measure bank distress splitting at the bottom tercile, with a variable that is one is above the bottom tercile of the share of bank deposit affected. While columns 1-3 use the standard specification, columns 4-6 also include controls for size (population) interacted with the After1929 indicator. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Ln(# Independent Patents+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Distress X After1929	-0.127***			-0.082***		
	(-4.47)			(-2.78)		
Bank Distress>Med X After1929		-0.053**			-0.053**	
		(-2.24)			(-2.28)	
Bank Distress>33p. X After1929			-0.095***			-0.071***
			(-3.62)			(-2.69)
Ln(Population, 1920) X After1929				-0.092***	-0.103***	-0.098***
				(-6.00)	(-6.98)	(-6.55)
StateXTime FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910	1910	1910
End Decade	1940	1940	1940	1940	1940	1940
Adj R-Sq	0.895	0.894	0.894	0.896	0.896	0.896
Obs	11,900	11,900	11,900	11,792	11,792	11,792

Table A.2: Robustness: Different Definitions of Independent Innovation Outcomes

The table shows estimates from a differences-in-differences regression of the number of patents by independent inventors on bank distress during the Great Depression. The specification, sample, and analyses are exactly the same as the main table in the paper. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. There are only two differences here. First, the variable independent patenting is transformed differently across columns 1-4, as reported at the bottom of the table. In particular, in column 1, for comparison we do the main transformation using log and adding a unit. In column 2, we use only log-transformation without adding a unit (i.e. zero-patent observations get dropped). In column 3, the data is transformed using inverse hyperbolic sine transformation (IHS). In column 4, we log transform adding 0.5. In column 5, we use the same transformation as in column 1, but add to independent patents also the patents that are assigned to a firm which name contains inventors' last or first name (i.e., eponymous firm names, which are likely founded by the inventors or their family members). Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	# Independent Patents				
	(1)	(2)	(3)	(4)	(5)
BankDistress X After1929	-0.127***	-0.142***	-0.119***	-0.108***	-0.127***
	(-4.47)	(-4.20)	(-3.48)	(-3.17)	(-4.43)
StateXTime FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y
LHS	ln(x+1)	Ln(x)	IHS(x)	Ln(x+.5)	+Eponymous
Start Decade	1910	1910	1910	1910	1910
End Decade	1940	1940	1940	1940	1940
Adj R-Sq	0.895	0.882	0.878	0.874	0.896
Obs	11,900	10,666	11,900	11,900	11,900

Table A.3: Robustness: Weighting by Size

The table shows estimates from a differences-in-differences regression of the number of patents by patent type on bank distress during the Great Depression. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The unit of observation is county-decade, for the period 1910–1940. In column 1, we limit the sample to independent patents and define the dependent variable as the logarithm of one plus the number of independent patents filed over ten-year periods within each county. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. In column 2, we limit the sample to patents assigned to U.S. firms and define the dependent variable as the logarithm of one plus the number of U.S. firm patents filed over ten-year periods within each county. In column 3, the dependent variable is the logarithm of one plus the number of all U.S. patents filed over ten-year periods within each county. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. We weight observations by the (log) population in 1920, therefore giving more weight to large counties. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Ln(# Ind. Patents+1)	(2) Ln(# Firm Patents+1)	(3) Ln(# Total Patents+1)
BankDistress X After1929	-0.121*** (-4.28)	0.013 (0.48)	-0.099*** (-3.24)
StateXTime FE	Y	Y	Y
County FE	Y	Y	Y
Start Decade	1910	1910	1910
End Decade	1940	1940	1940
Adj R-Sq	0.905	0.907	0.913
Obs	11,792	11,792	11,792

Table A.4: Robustness: Controlling for the New Deal Relief Amount

The table shows that the results on lower independent patenting in high bank distress counties during the Great Depression remain robust to controlling for variable that proxy the magnitude of the New Deal relief intensity by county. The sample is the near universe of independent patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. The unit of observation is county-decade, for the period 1910–1940. In columns 1 through 4, the dependent variable is the logarithm of one plus the number of independent patents filed over ten-year periods within each county. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. In columns 1 and 2, respectively, we control for the size of the New Deal program in the county proxy by the amount of relief grants in the county per unit of population in 1920. In columns 3 and 4, we repeat the same analysis by instead of using the scaled version, we control for the total amount (log-transform) of relief funds. The data comes from Fishback et al. (2003). Even columns also control for population. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Ln(# Independent Patents+1)			
	(1)	(2)	(3)	(4)
BankDistress X After1929	-0.128***	-0.077***	-0.108***	-0.076***
	(-4.52)	(-2.66)	(-3.73)	(-2.64)
Relief/Pop X After1929	0.001***	0.001**		
	(2.85)	(2.36)		
Ln(Population, 1920) X After1929		-0.095***		-0.237***
		(-6.43)		(-8.98)
Ln(Relief)X After1929			-0.028**	0.134***
			(-2.50)	(6.54)
StateXTime FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910
End Decade	1940	1940	1940	1940
Adj R-Sq	0.893	0.894	0.893	0.895
Obs	11,764	11,764	11,860	11,764

Table A.5: Robustness: Matching Model

The table shows that the results on lower independent patenting in high bank distress counties during the Great Depression remain robust when we employ a matching model based on location, population, and pre-crisis patenting activity. The matching model is described in the text, and the sample considered is the one that is identified following the model discussed. The unit of observation is county-decade, where decades include 1920 and 1930. In columns 1 and 2, the dependent variable is the logarithm of the number of independent patents filed over ten-year periods within each county. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. In columns 3 and 4, the dependent variable is the logarithm of the number of firm patents filed over ten-year periods within each county. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. In odd columns there are no controls, while in even columns we control for population in 1920, unemployment rate in 1937, share of manufacturing, the log difference in retail sales in 1933 and 1929, a dummy for counties with fewer than 6 banks all interacted with the post dummy. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Ln(# Independent Patents+1)		Ln(# Firm Patents+1)	
	(1)	(2)	(3)	(4)
BankDistress X After1929	-0.128***	-0.131***	-0.019	-0.043
	(-3.02)	(-3.07)	(-0.49)	(-1.02)
StateXTime FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Controls	N	Y	N	Y
Start Decade	1910	1910	1910	1910
End Decade	1940	1940	1940	1940
Adj R-Sq	0.832	0.835	0.802	0.802
Obs	3,836	3,712	3,836	3,712

Table A.6: Robustness: Bank Distress and Innovation Quality Controlling for Size

The table shows estimates from a differences-in-differences regression looking at differences in patent quality metrics, where we also control for differences in (log) county population in 1920 interacted with After1929 indicator. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The sample of future patent citations includes all patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-decade, for the period 1910–1940. In column 1, the dependent variable is the logarithm of one plus the total number of future patent citations citing all independent patents filed over each ten-year period within a county. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. In column 2, we repeat the same analysis looking at all patents (firms and independent inventors). In column 3, we instead look at the (logarithm plus one) of the average number of citations received by independent patents. In column 4, we repeat the same analysis looking at all patents. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The bank treatment and controls are interacted with After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Ind. # Cit	(2) Tot. # Cit	(3) Ind. Avg Citations	(4) Tot. Avg Citations
BankDistress X After1929	-0.021	-0.012	0.058**	0.061**
	(-0.45)	(-0.25)	(2.04)	(2.17)
StateXTime FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910
End Decade	1940	1940	1940	1940
Adj R-Sq	0.802	0.825	0.375	0.401
Obs	11,792	11,792	11,792	11,792

Table A.7: Robustness: Bank Distress and Quality of Independent Innovation

The table shows estimates from a differences-in-differences regression looking at changes in patent quality metrics of independent patents, where we use different methods to construct the quality metrics for robustness. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample focuses on independent patents being cited. The sample of future patent citations includes all patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-decade, for the period 1910–1940. Across columns, the quality measure is defined in different ways. In column 1, citations are adjusted by the average number of citations in the same technology class over the period 1910–1940. The outcome is then log-transformed similar to the main analyses. In column 2, we use average citation without the log-transformation. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The bank treatment is interacted with After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Ind. Avg. Citations, CPC	(2) Ind. Avg. Citations (not logged)
BankDistress X After1929	0.058***	0.475***
	(4.23)	(3.79)
StateXTime FE	Y	Y
County FE	Y	Y
Start Decade	1910	1910
End Decade	1940	1940
Adj R-Sq	0.248	0.245
Obs	11,900	11,900

Table A.8: Bank Distress During the Great Depression and Innovation: Non-zero Citation Patents

The table shows estimates from a differences-in-differences regression looking at quantity of innovation. However, we now exclude from counts those patents with zero citations. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The sample of future patent citations includes all patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-decade, for the period 1910–1940. In these analyses, we examine the effect on patent measures by independents (columns 1 and 2) and firms (columns 3 and 4) focusing only on patents with non-zero citations. The outcome is always transformed as logarithm plus one. We also control for population in 1920 interacted with a post-dummy in even columns (2 and 4). Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Ln(# Ind.,>0 Cit)		Ln(#Firm,>0 Cit)	
	(1)	(2)	(3)	(4)
BankDistress X After1929	-0.087***	-0.058**	0.061**	0.008
	(-3.23)	(-2.04)	(2.36)	(0.30)
StateXTime FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910
End Decade	1940	1940	1940	1940
Adj R-Sq	0.884	0.885	0.893	0.894
Obs	11,900	11,792	11,900	11,792

Table A.9: Bank Distress During the Great Depression and Quality Distribution: Firm Analysis

The table shows estimates from a differences-in-differences regression looking at quality metrics. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The sample of future patent citations includes all patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-decade, for the period 1910–1940. In column 1, the dependent variable is the total number of firm patents in the top 1% of the citation distribution of the corresponding technology class during 1910–1940 that were filed in the county-decade. In column 2, the dependent variable is the total number of firm patents in the bottom 99% of the citation distribution of the corresponding technology class during 1910–1940 that were filed in the county-decade. Firm are patents that were assigned to a U.S. company at the time of the patent grant date. In column 3 and 4, we construct equivalent outcomes but looking at the top 10% and bottom 90%, and in 5 and 6, we look at top 25% and bottom 75%. The outcome is always transformed as logarithm plus one. We also always control for population in 1920 interacted with a post-dummy. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. The estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Top 1%	(2) Bot. 99%	(3) Top 10%	(4) Bot. 90%	(5) Top. 25%	(6) Bot. 75%
BankDistress X After1929	-0.002	0.003	-0.004	0.001	0.008	-0.000
	(-0.20)	(0.11)	(-0.27)	(0.03)	(0.37)	(-0.00)
StateXTime FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910	1910	1910
End Decade	1940	1940	1940	1940	1940	1940
Adj R-Sq	0.799	0.896	0.883	0.896	0.894	0.895
Obs	11,792	11,792	11,792	11,792	11,792	11,792

Table A.10: The 1917-1920 Agricultural Shock and the Quality of Independent Innovation

The table presents estimates from a differences-in-differences regression and shows the relationship between the 1917-1920 agricultural shock and subsequent innovation during the Great Depression. The estimation strategy relies on cross-sectional variation in the shock across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The unit of observation is county-decade, for the period 1910–1940. In all columns, the independent variable, CngCommPrice, 1917-1920 X After 1929, is the interaction between After1929 indicator and CngCommPrice, 1917-1920, which is the county-level change from 1917 to 1920 in the international commodity price index calculated for each county, where weights are the crop share of a given farm product out of total county farm output and prices are international farm product prices (Rajan and Ramcharan 2015). In column 1, the dependent variable is the interaction between After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards, and Bank Distress indicator, which equals 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. In column 2, similar to the analysis with bank distress, we look at the effect on the logarithm plus one of average citations by independent inventors. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. In column 3, we repeat the same analysis as column 2, but consider all U.S. patents (firm and independent). The estimates of the effect of the agricultural shock on patents are the coefficients on the interaction between CngCommPrice, 1917-1920 and After1929. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) BankDistress X After1929	(2) Ind. Avg Citations	(3) Tot. Avg Citations
CngCommPrice, 1917-1920 X After1929	0.029*** (6.53)	0.036*** (5.78)	0.030*** (5.15)
StateXTime FE	Y	Y	Y
County FE	Y	Y	Y
Start Decade	1910	1910	1910
End Decade	1940	1940	1940
Adj R-Sq	0.767	0.374	0.404
Obs	11,316	11,316	11,316

Table A.11: Robustness: The 1917-1920 Agricultural Shock and Innovation Controlling for Size

The table presents estimates from a differences-in-differences regression and shows the relationship between the 1917-1920 agricultural shock and subsequent innovation during the Great Depression. The only difference with the main analysis presented before is that each column now also controls for log of population in 1920 interacted with After 1929, to show that our results are not driven by differences across counties in size. The estimation strategy relies on cross-sectional variation in the shock across U.S. counties within a state, using as a treatment CngCommPrice, 1917-1920 X After 1929, which is the interaction between After1929 indicator and CngCommPrice, 1917-1920, which is the county-level change from 1917 to 1920 in the international commodity price index calculated for each county, where weights are the crop share of a given farm product out of total county farm output and prices are international farm product prices (Rajan and Ramcharan 2015). The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The unit of observation is county-decade, for the period 1910–1940. In column 1, we look at total innovation by independent inventors as outcome. In column 2, we instead look at the (log plus one) of average independent citations. Columns 3 and 4, repeat the same outcomes but for all U.S. patents (firm and independent; column 3 is the patent count, and column 4 is the citation measure). Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Ln(# Ind. Patents+1)	(2) Ind. Avg Citations	(3) Ln(# Total Patents+1)	(4) Tot. Avg Citations
CngCommPrice, 1917-1920 X After1929	-0.039*** (-5.97)	0.016*** (2.69)	-0.040*** (-5.57)	0.015*** (2.66)
StateXTime FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Start Decade	1910	1910	1910	1910
End Decade	1940	1940	1940	1940
Adj R-Sq	0.898	0.380	0.905	0.407
Obs	11,308	11,308	11,308	11,308

Table A.12: Bank Distress During the Great Depression and Innovation Quality in the Long Run

The table shows estimates from a differences-in-differences regression of the number of citations on bank distress during the Great Depression in the long-run. The estimation strategy relies on cross-sectional variation in bank distress across U.S. counties within a state. The sample is the near universe of all patents granted by the U.S. Patent and Trademark Office (USPTO) to either U.S. inventors or U.S. firms. The sample of future patent citations includes all patents granted by the USPTO, including independent, U.S firm and non-U.S. patents. The unit of observation is county-decade, where decades include 1910 through 1990. In column 1, we limit the sample to independent patents and define the dependent variable as the logarithm of one plus the number of citations received by independent patents filed over ten-year periods within each county. Independent are patents by inventors residing in the U.S. that were either unassigned or assigned to individuals at the time of the patent grant date. In column 2, we limit the sample to patents assigned to U.S. firms and define the dependent variable as the logarithm of one plus the number of citations received by U.S. firm patents filed over ten-year periods within each county. In column 3, the dependent variable is the logarithm of one plus the number of citations received by all U.S. patents filed over ten-year periods within each county. Bank Distress is an indicator variable equal to 1 for counties with at least one bank suspension during the Great Depression years of 1930 through 1933, inclusive. In the short run, the estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and the After1929 indicator, which equals one for the observations starting from the 1930s decade and onwards. In the long run, the estimates of the effect of bank distress on patents are the coefficients on the interaction between Bank Distress and After1939 indicator, which equals one for observations starting with the 1940 decade. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) Ln(Ind. # Cit+1)	(2) Ln(Firm # Cit.+1)	(3) Ln(Total # Cit.+1)
BankDistress X After1929	0.018	0.097*	0.008
	(0.36)	(1.96)	(0.15)
BankDistress X After1939	-0.082	0.265***	0.012
	(-1.51)	(4.16)	(0.21)
StateXTime FE	Y	Y	Y
County FE	Y	Y	Y
Start Decade	1910	1910	1910
End Decade	1990	1990	1990
Adj R-Sq	0.761	0.796	0.808
Obs	26,775	26,775	26,775

Table A.13: Robustness: the Great Depression and Individual Inventor Patenting

The table provides a robustness test to the analysis that examines the potential reallocation of independent inventors into firms during the 1930s in counties with greater bank distress during the Great Depression. In general, the estimation strategy is the same as in Table 10. However, we conduct two robustness tests. First, we check whether the same result also holds when we use an alternative definition of the bank distress treatment. In particular, in columns 2 and 4, we use a treatment that is based on a continuous definition of the treatment, unlike the split at the median reported in the main analysis (and also use in columns 1 and 3 of this table). Second, we check that our result hold using a smaller sample which should be characterized by higher quality of matching to Census data, as discussed in the paper. We report in columns 1 and 2 the results using the full sample (Full), while in columns 3 and 4 we use the close matches only sample, which only use those inventors that patented close to the Census, as discussed in the text (Close Only). Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Patent in Firm in 1930s			
	(1)	(2)	(3)	(4)
Bank Distress>Med	0.024**		0.033*	
	(2.05)		(1.79)	
Bank Distress %		0.090**		0.174**
		(2.27)		(2.56)
Sample	Full	Full	Close Only	Close Only
State FE	Y	Y	Y	Y
Patent Post	Y	Y	Y	Y
Pre Ind Pat	Y	Y	Y	Y
County Controls	Y	Y	Y	Y
Ind. Controls	Y	Y	Y	Y
Adj R-Sq	0.026	0.027	0.041	0.043
Obs	5,294	5,294	2,091	2,091

Table A.14: Placebo analysis: Bank Distress During the Great Depression and Individual Inventor Patenting Before the Great Depression

The table provides a robustness check for the result studying the reallocation of independent inventors into firms during the 1930s in counties with greater bank distress during the Great Depression. In particular, we try to replicate the result as identified for 1930s in Table 10 for periods that came before the depression, akin to a placebo analysis. In columns 1 and 2, we examine whether inventors that were independent in 1910s and still patenting in 1920s were more likely to move into firms in the 1920s in counties that were subsequently affected by the banking shock. In columns 3 and 4, we examine whether inventors that were independent in 1900s and still patenting in 1910s were more likely to move into firms in the 1920s in counties that were subsequently affected by the banking shock. In other words, apart from the timing, the set-up is consistent with one of the main analyses. Odd columns include state fixed effects, while even columns add additional county-level controls (population 1920) and individual level controls based on the pre census (homeownership, log of inventor age, status as an entrepreneur, and gender). Bank Distress % is defined at the county-level and equal to the ratio of bank deposits at banks suspended between 1930 and 1933 divided by total banks deposits in 1929. Standard errors are clustered at the county level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Patent in Firm in 1920s		Patent in Firm in 1910	
	(1)	(2)	(3)	(4)
Bank Distress>Med	0.001	0.006	-0.010	0.017
	(0.13)	(0.61)	(-1.07)	(1.38)
State FE	Y	Y	Y	Y
Patent Post	Y	Y	Y	Y
Pre Ind Pat	Y	Y	Y	Y
Controls	N	Y	N	Y
Adj R-Sq	0.018	0.025	0.006	0.016
Obs	11,650	11,207	5,995	2,213