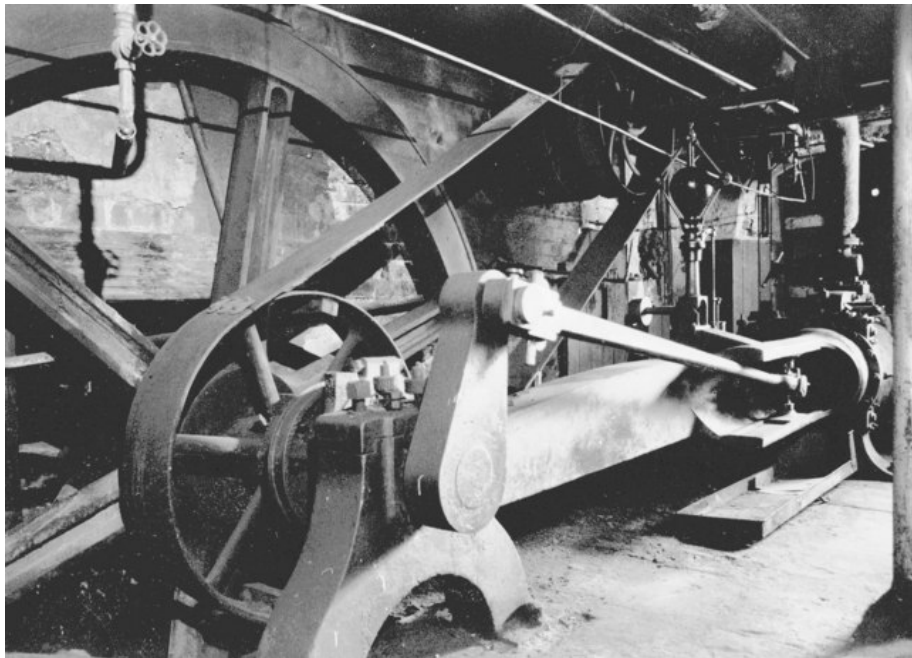
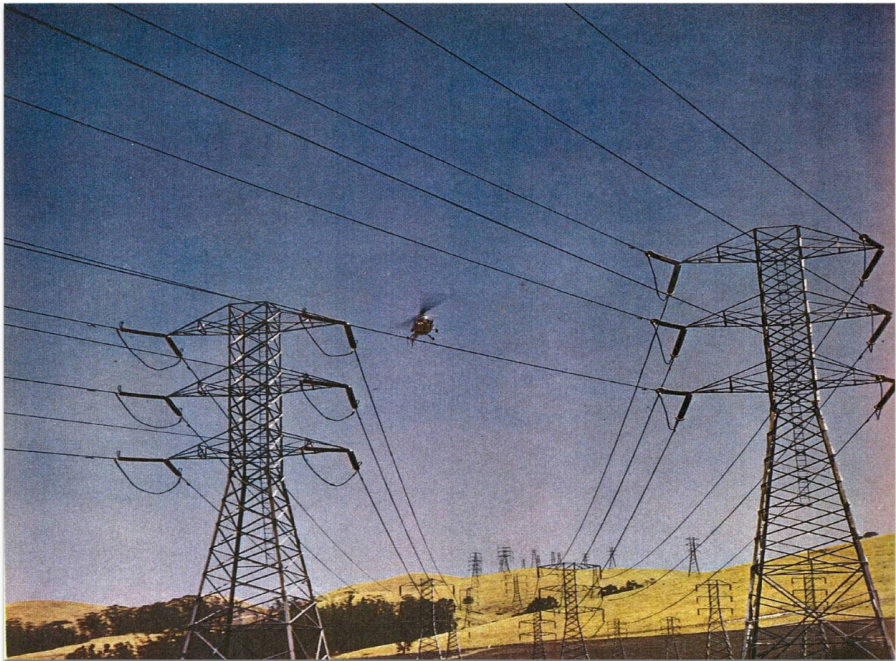


# Taking Technology to Task: The Skill Content of Technological Change in Early Twentieth Century U.S.

Rowena Gray

January 2012





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- use of instrumental variables strategies to deal with issue of endogeneity of electricity

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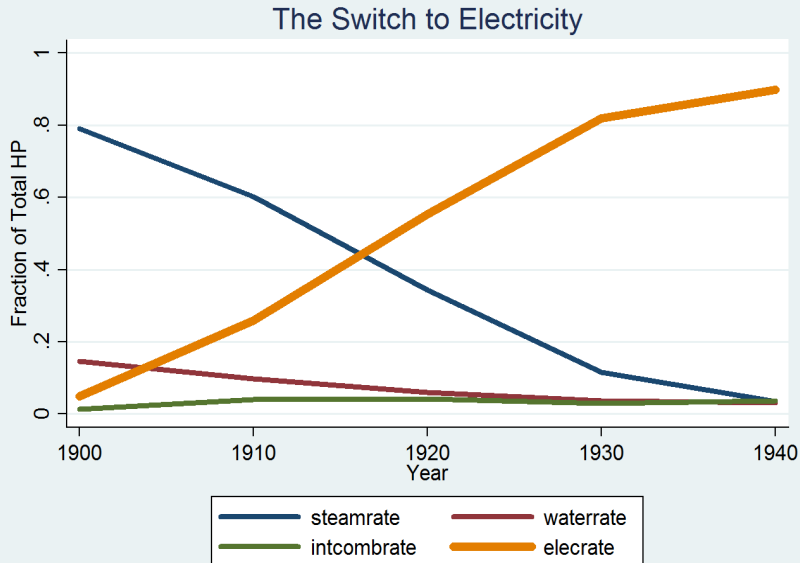
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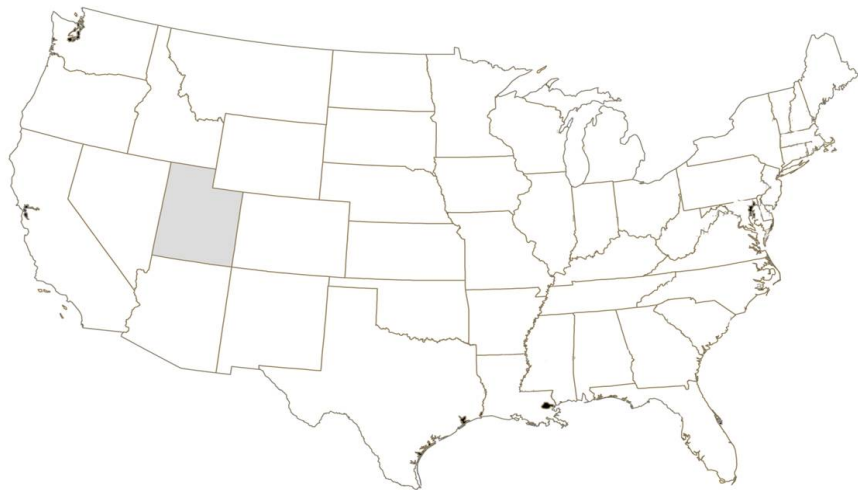
Goldin and Katz (2008) summarize their work on this topic through U.S. history

- they argued that technological change became skill-biased around 1890 and that the decline in wage differentials to 1950 was driven by educational attainment rather than changing technologies

# The Switch to Electricity



# Electrification Rates by State: 1900



<20%



20-40%



40-60%



60-80%



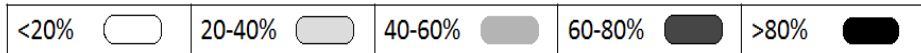
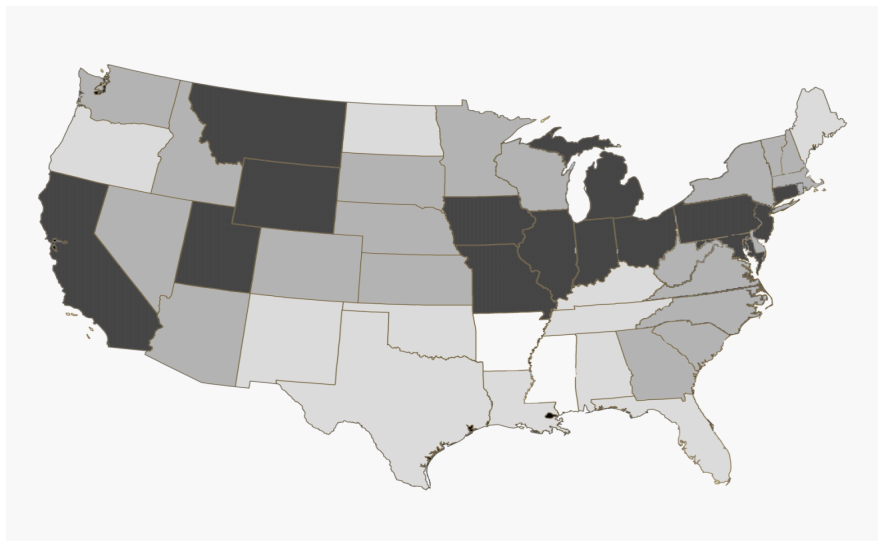
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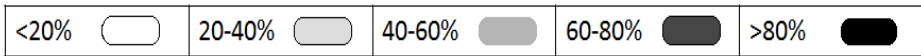
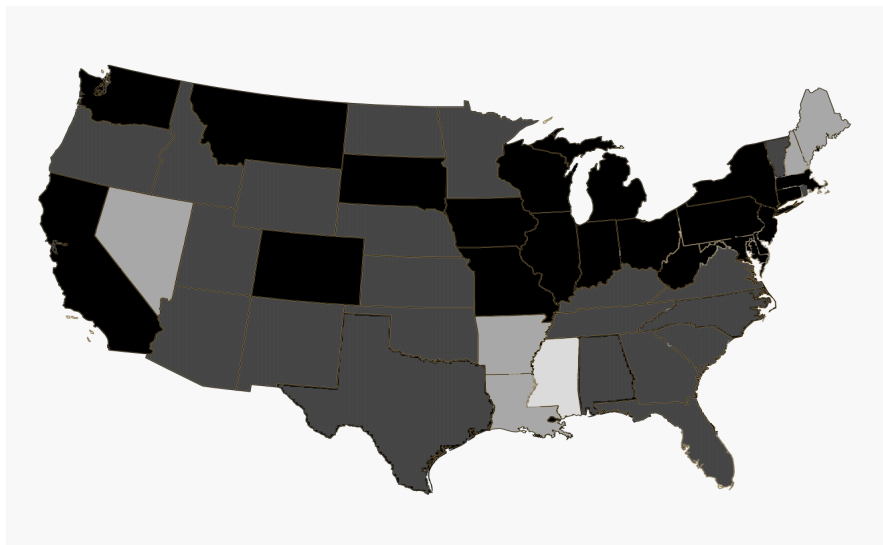




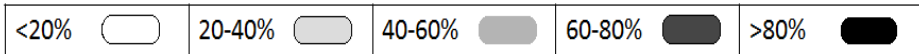
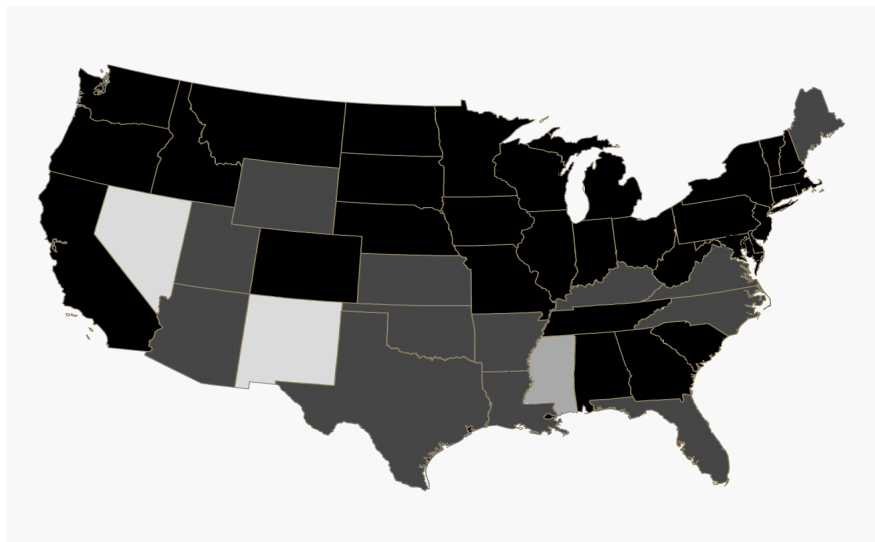
# Electrification Rates by State: 1920



# Electrification Rates by State: 1930



# Electrification Rates by State: 1940



## Historical Predictions

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Assembly line; mechanization

Overall, it is an empirical question to identify the effect of electricity on relative demand for different types of labor

# Data Sources





- U.S. Population Censuses, 1880-1940



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- U.S. Censuses of Manufactures, 1880-1940



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- U.S. Censuses of Manufactures, 1880-1940
- *Dictionary of Occupational Titles, 1949*



ESTIMATES OF WORKER TRAIT REQUIREMENTS  
FOR 4,000 JOBS

*as defined in the*

DICTIONARY OF OCCUPATIONAL TITLES

(an alphabetical index)



UNITED STATES DEPARTMENT OF LABOR

Bureau of Employment Security

*Prepared by*

UNITED STATES EMPLOYMENT SERVICE



## Task Variables

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- 1 Manual– Strength

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- 2 Dexterity– Finger & Manual Dexterity, Motor & Eye-hand-foot Coordination
- 3 Clerical– Clerical & Numerical Accuracy
- 4 Managerial– Average of Clerical & Dealing with People & Direction, Control & Planning

## Task Variable Construction

DOT measures by occupation (1 to 5 scale)

- matched to census manufacturing occupations
- created manual, dexterity, clerical & managerial measures by occupation
- ran task “cleaning” regressions to eradicate pure demographic effects
- normalized each task measure to a (0,1) scale as per the 1880 distribution of occupations
- lastly constructed the state-year averages for the final LHS variables



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- managerial/dexterity+manual

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For this regression, the left-hand side includes data for native-born Americans only

# Baseline Results

	Dexterity/ Manual	Clerical/ Dexterity	Clerical/ Dexterity+Manual	Managerial/ Dexterity+Manual
Elecrate	-.17*** (.05)	.31*** (.08)	.22*** (.08)	.26*** (.11)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
R <sup>2</sup>	.83	.86	.87	.90
Observations	297	297	297	297

# Extended OLS

	Dexterity/ Manual	Clerical/ Dexterity	Clerical/ Dexterity+Manual	Managerial/ Dexterity+Manual
Elecrate	-.15** (.07)	.32*** (.10)	.25*** (.09)	.30*** (.09)
FBSshare	-.01 (.14)	.46*** (.16)	.45*** (.16)	.10 (.18)
Caplab	.03 (.05)	-.09* (.05)	-.07* (.04)	-.05 (.05)
EducProxy	-.001 (.01)	-.003 (.01)	-.003 (.007)	-.01 (.01)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
R <sup>2</sup>	.69	.90	.92	.95
Observations	198	198	198	198

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Female labor force tasks were not significantly associated with electricity but it did account for about half of the increase in female labor force participation over the period

## Endogeneity

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"There were many factories which introduced electric power because we engaged to save from 20 to 60 percent of their coal bills...those who first introduced electric power on this basis found that they were making other savings than those that had been promised, which might be called indirect savings"

Crocker-Wheeler Electric Company, 1901

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States adopted state-level regulation of the electric industry at different times from 1907 onwards

Regulation has been shown to have lowered prices and increased supply of electricity by making it easier for electric companies to grow and expand to new areas of business

# IV Results

	Dexterity/ Manual	Clerical/ Dexterity	Clerical/ Dexterity+Manual	Managerial/ Dexterity+Manual
Elecrate	<b>-.43*</b> (.26)	<b>.43</b> (.33)	<b>.22</b> (.29)	<b>-.05</b> (.32)
FBSshare	-.02 (.10)	.57*** (.11)	.55*** (.11)	.22* (.13)
Capperworker	.01 (.04)	<b>-.14***</b> (.04)	<b>-.13**</b> (.04)	<b>-.15***</b> (.11)
Year FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
First-stage F-stat	90	90	90	90
R <sup>2</sup>	.68	.91	.93	.95
Observations	194	194	194	194

## Robustness Checks

A variety of robustness checks were conducted on the data and the results were all consistent with the previous findings

Instrumented for FBShare using the Card (2001) shift-share instrument

State-specific time trends

Weighted by employment augmented with hours worked

Dropped outliers in electricity adoption and in economic activity

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- Results suggest that technological change has had a very consistent effect on relative demand for labor over a century and a half
- Further investigation of the mechanisms through which the task composition of the labor force changed over time is needed— what happened to the displaced workers who had previously done jobs that were relatively intensive in dexterity tasks?