

The Long-Run Effect of Public Libraries on Children: Evidence from the Early 1900s

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Introduction

In 1848, Andrew Carnegie immigrated with his family from Scotland to Pennsylvania at the age of 13. He immediately began work at a cotton mill as a low-skilled bobbin boy, earning \$1.20 a week.¹ A nearby resident opened up his personal library to the ‘local working boys,’ giving Carnegie access to a large set of books. Carnegie attributed much of his success as a businessman to this private library, and he wanted to provide a similar experience to children everywhere by funding the construction of public libraries in underserved communities.²

After a successful career in business, Carnegie followed through on this resolution, funding the construction of thousands of libraries worldwide, including 1,618 in the United States. He first funded the construction of a library in 1880, in his birthplace of Dunfermline, Scotland. In the following years he paid for the construction of a handful of public libraries in his home state of Pennsylvania. He then formalized his grant program, expanding it to other communities across the United States. Carnegie’s requirements were simple: a town had to agree to supply a public plot of land for the new library and fund the library annually at an amount greater than or equal to 10% of the initial grant value.

In this extended abstract, I use these Carnegie-funded public libraries to provide the first evidence that public libraries have long-run positive effects on children. I measure these effects by linking children from the 1900–1930 census to adult records in the 1940 census. I use an iterative matching procedure, increasing accuracy by relying on 1940 records that match to multiple early

¹The New York Times, “Obituary: Carnegie Started as a Bobbin Boy,” August 12, 1919.

²Carnegie wrote in his autobiography: ‘I resolved, if ever wealth came to me, that it should be used to establish free libraries, that other poor boys might receive opportunities similar to those for which we were indebted to that noble man’ (Carnegie, 1901).

census years. I then use within-family variation in the timing of when children got access to a Carnegie Library to measure the causal effect of public library access on adult outcomes. My regression specifications are similar to those used by Aaronson and Mazumder (2011), who measure the causal effect of Rosenwald school construction grants on children's school attendance during a similar time period. I show that access to a Carnegie grant increased educational attainment, did not affect wage income, and increased non-wage (self-employment) income. My results highlight the importance of non-wage income and non-pecuniary outcomes in measuring the returns to education and the causal effects of local institutions on children. This may be especially important in a historical context where a larger fraction of the population was self-employed and engaged in highly unsafe occupations.

A handful of papers measure the causal effect of public libraries on individuals or communities. Kevane and Sundstrom (2014) measure the expansion of public libraries across the United States in the early 1900s. And contemporaneous work by Berkes and Nencka (2019) shows that Carnegie's library construction grants increased patenting activity when compared to towns receiving a grant offer that never materialized. And Gilpin, Karger, and Nencka (2020) show that sharp increases in public library investment causes increases in library usage and children's test scores. My paper is the first to measure the long-run effects of public libraries on children.

My work draws on a large literature from the library sciences field, which ethnographically profiled and gathered information about Andrew Carnegie's library construction grants. Most notably, Bobinski (1969) digitized and standardized information from the Carnegie Corporation's microfilm archives, producing a table of all of the grants Carnegie made to towns and cities. In other important work, Daniel (1961) discusses the expansion of public libraries across the United States and Klinenberg (2018) traces the importance of social infrastructure like public libraries in the functioning of society. These sources provided important historical context for my empirical findings.

Data

Library Data

Andrew Carnegie did not publicize his interest in funding the construction of new public libraries. Still, after news spread of his first grants to construct public libraries in Southwestern Pennsylvania, politicians and officials in hundreds of cities and towns sent Carnegie unsolicited requests for funds to build new public libraries. Carnegie did not have time to respond to the requests he received for library funding, so after directing and overseeing the first few grants himself, he quickly put his personal secretary, James Bertram, in charge of the application process. Bertram would only seriously consider requests from city and town officials, but many members of the general public sent him letters requesting funds for a library. When he received a letter from a local resident of a town, he asked that they find an elected official who could submit an official request for a library (Bobinski 1969). In most cases, Bertram conducted the entire application and grant process by mail. Bertram also ensured that library construction grants only went to towns that committed to spending 10% of the grant amount on annual upkeep of the library. Carnegie

scaled his grant amounts by the population of each town, targeting a grant amount of \$2 per person in most cases. So in letters to cities and towns requesting funds, Bertram requested current population counts, which he often verified using publicly available tabulations from decennial census data (Bobinski 1969).

The Carnegie Corporation preserved the correspondence between Bertram and community leaders. Drawing on these documents, Bobinski painstakingly collected exact dates, locations, and grant amounts for the grants Carnegie gave to cities and towns. In total, Bobinski calculated that Carnegie funded the construction of 1,618 libraries in 1,417 cities in the United States. In Figure 1, I link the digitized data from Bobinski to cities and I mark the modern-day zip codes of cities that received money from Carnegie. Figure 1 shows that some cities received grants in the late 1800s while other cities received grants in the early 1900s. And grants were given to cities and towns across the United States. My econometric specifications will rely on spatial and intertemporal variation in the availability of Carnegie libraries, and Figure 1 confirms that there is a significant amount of variation within states and over time in the availability of Carnegie libraries.

Census Microdata

I use complete count census data to measure the causal effect of public library access on children. I measure childhood demographic characteristics in the 1900–1930 census data and I measure adult outcomes in the 1940 census, which was the first national census in the U.S. to contain individual-level educational attainment and income information. I restrict my attention to men, because many women’s last names changed from childhood to adulthood, making it difficult to match women across decennial census years. I link the 1900–1930 census records to 1940 census records using an iterative matching technique, drawing from Abramitzky, Boustan, and Eriksson (2012). My final matched sample consists of 17.8 million people with both an adult census record in 1940 and a childhood census record in 1900, 1910, 1920, or 1930.

Methodology

For each person in my matched sample, I use the binary measure $1(GrantByAge5)$ —an indicator for whether each child received a Carnegie grant by the age of 5. Almost all Carnegie-funded libraries were constructed within four years of when the grant was given. So, this treatment indicator is an indicator of whether each child had access to a Carnegie library during their childhood. I can now analyze the effect of Carnegie grant exposure on adult outcomes of children. I model that relationship using specifications of the form:

$$Outcome_i = \beta_0 + \beta_1 * 1(GrantByAge5)_{y(i),c(i)} + \Pi X_i + \varepsilon \quad (1)$$

where i indexes individuals, $Outcome_i$ is an outcome measured in the 1940 census, and X_i is a matrix of controls. My use of cohort*city-level variation in exposure to Carnegie grants draws from several papers measuring the effect of school construction on children. Duflo (2001) uses the exposure of different cohorts of students in regions of Indonesia to a school construction program

and measures the effect of the program on educational attainment. In related work Aaronson and Mazumder (2011) link Julius Rosenwald’s funding for black schools in the South in the early 1900s to children’s school attendance using a methodology that I follow closely.

Results

Education

I begin by looking at the effect of Carnegie grant exposure on years of educational attainment, high school graduation rates, and college attendance rates. These results provide strong evidence that access to a Carnegie grant increased educational attainment. In Table 1, I present the main set of regression results (see Equation 1) with years of schooling as an outcome. With a baseline set of controls, children with access to a Carnegie grant by age five had 0.57 more years of educational attainment than children without access to a Carnegie grant. But most of this gap is driven by selection on observables. When I control for neighborhood fixed effects, the difference drops to 0.18 years, and the effect of a Carnegie grant on years of educational attainment settles between 0.08 and 0.13 years when I add additional controls. In my within-family specification, a Carnegie grant received by age five increases educational attainment by 0.10 years.

Income

Now that I have established that Andrew Carnegie’s library construction grants increased children’s educational attainment, I analyze the effect of Carnegie grants on income. In Table 2, I measure the effect of Carnegie grants on log annual wage income. The first column shows that Carnegie gave grants to communities where children would grow up to have more wage income than children from communities which did not receive a grant. But once I control for neighborhood fixed effects (in column 2), exposure to a Carnegie grant is associated with a 2 log point decline in adult wage income. Adding additional controls implies that Carnegie grants had a negative effect on wage income, and in the within-family specification, Carnegie grants had a precise null effect on wage income.

The wage effects may be puzzling, because economists often find that human capital interventions increase wage income. But wage income is only one component of total income. Wage income includes all money a worker earned as an employee, but wage income excludes earnings from self-employment. In 1940, the Census Bureau did not ask respondents to report their non-wage income. However, the census did ask all non-institutionalized respondents to state whether or not they had received at least \$50 of non-wage income in the reference year. 33% of men in my matched sample of siblings reported having at least than \$50 of non-wage income. In Table 3, I show that Carnegie grants had large positive effects on non-wage income. The baseline specification (column 1) shows that Carnegie gave grants to communities where children would grow up to have less non-wage income. But once I add granular geographic controls, we see that Carnegie grants increased the probability that children had at least \$50 of non-wage income by 0.4–0.7 percentage points. And in my within-family specification (column 6), we see that Carnegie grants

increased the probability of having at least \$50 of non-wage income by 0.7 percentage points relative to a baseline of 33 percent in this sample.

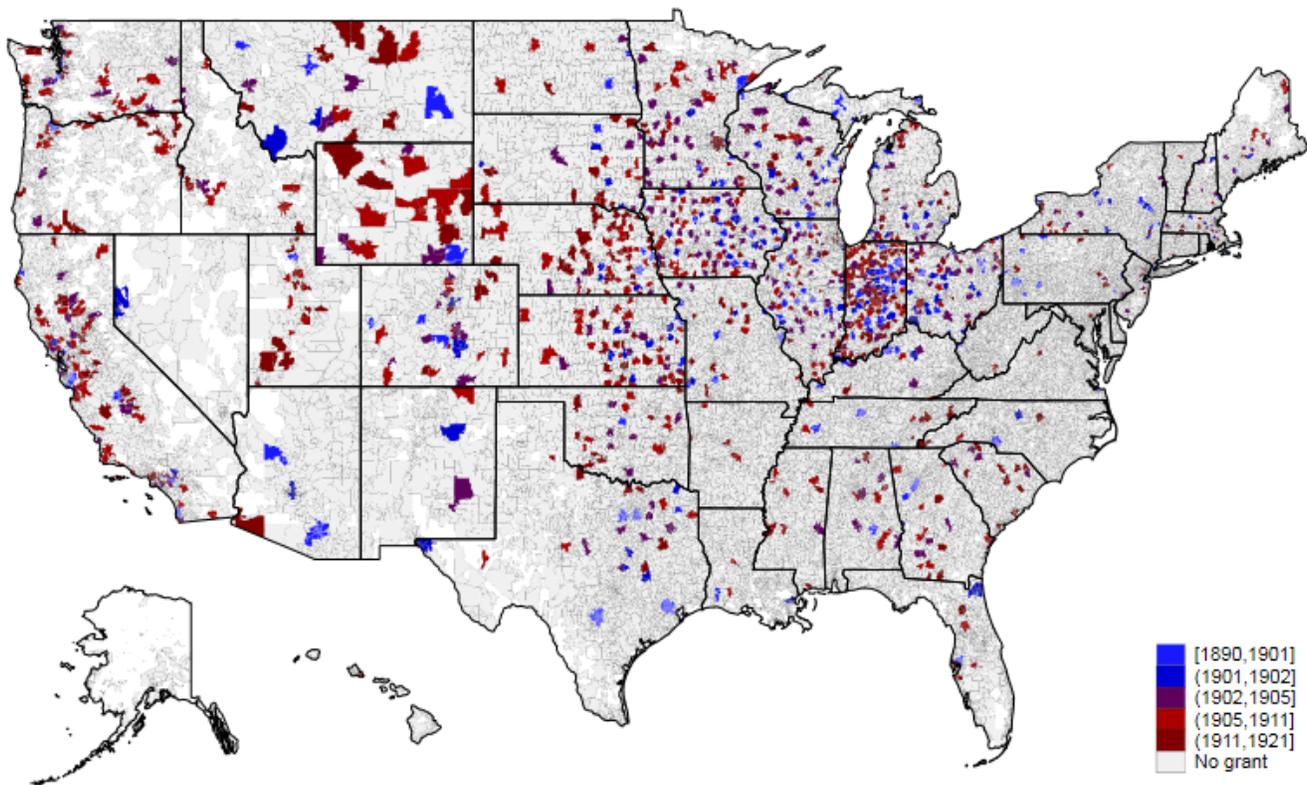
Conclusion

In this extended abstract, I link the rollout of Andrew Carnegie's public library construction grants to complete count census data. I show that access to a public library increased educational attainment, had no effect on wage income, and increased non-wage income. In the full paper, I show that children exposed to Carnegie grants shifted into safer, more entrepreneurial, and more prestigious occupations. The same patterns explain the puzzling results of Stephens and Yang (2014), who showed that compulsory schooling laws increased educational attainment and had no effect on children's wage income. Like Carnegie's library construction grants, compulsory schooling laws increased educational attainment and increased non-wage income by shifting people into safer, more entrepreneurial, and more prestigious occupations. Economists often use wage income to measure the returns to education and the causal effects of local institutions on children, but wage income is only one component of the returns to investment in human capital: non-wage income, occupational prestige, and occupational safety are other important outcomes to consider and in this paper I show that both Carnegie-funded public libraries and compulsory schooling laws had positive effects on adult outcomes that operated through these measures.

References

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Figure 1:
Carnegie Library Grants in United States
by year Carnegie agreed to grant



Note: I match Carnegie grants to city names in Census microdata. I then use a modern-day mapping of cities to zip codes to identify the zip codes associated with each Carnegie grant.

Table 1: Effect of Carnegie Grant on Years of Schooling

	1	2	3	4	5	6
1(Carnegie Grant by Age 5)	0.572 (0.034)	0.179 (0.019)	0.076 (0.018)	0.090 (0.009)	0.134 (0.010)	0.101 (0.017)
Child controls	Yes	Yes	Yes	Yes	Yes	Yes
Enumeration District (FEs)		Yes	Yes	Yes	Yes	Yes
Parent controls			Yes	Yes	Yes	Yes
County-by-Birth Year (FEs)				Yes	Yes	Yes
Census Microfilm Page (FEs)					Yes	
Household (FEs)						Yes
Observations	17,412,080	17,395,212	17,393,991	17,265,943	14,867,729	5,375,550
R ²	0.20	0.26	0.29	0.32	0.55	0.73
Mean dep. var.	8.99	8.99	8.99	9.01	9.00	8.88

Notes:

1. Data are the restricted 1900–1940 complete count census data, available through NBER.
2. Standard errors clustered at the childhood county of residence level.

Table 2: Effect of Carnegie Grant on Log Annual Wage Income

	1	2	3	4	5	6
1(Carnegie Grant by Age 5)	0.381 (0.032)	-0.022 (0.013)	-0.058 (0.011)	-0.045 (0.008)	-0.044 (0.009)	-0.003 (0.018)
Child controls	Yes	Yes	Yes	Yes	Yes	Yes
Enumeration District (FEs)		Yes	Yes	Yes	Yes	Yes
Parent controls			Yes	Yes	Yes	Yes
County-by-Birth Year (FEs)				Yes	Yes	Yes
Census Microfilm Page (FEs)					Yes	
Household (FEs)						Yes
Observations	16,766,377	16,749,418	16,748,204	16,618,602	14,182,462	5,027,116
R ²	0.07	0.11	0.12	0.15	0.41	0.61
Mean dep. var.	4.91	4.91	4.91	4.91	4.90	4.87

1. See notes to Table 1.

Table 3: Effect of Carnegie Grant on Probability \geq 50 Dollars of Non-Wage Income

	1	2	3	4	5	6
1(Carnegie Grant by Age 5)	-0.049 (0.004)	-0.001 (0.002)	0.004 (0.001)	0.004 (0.001)	0.005 (0.001)	0.007 (0.003)
Child controls	Yes	Yes	Yes	Yes	Yes	Yes
Enumeration District (FEs)		Yes	Yes	Yes	Yes	Yes
Parent controls			Yes	Yes	Yes	Yes
County-by-Birth Year (FEs)				Yes	Yes	Yes
Census Microfilm Page (FEs)					Yes	
Household (FEs)						Yes
Observations	17,240,954	17,223,995	17,222,752	17,094,494	14,687,385	5,292,713
R ²	0.07	0.10	0.11	0.14	0.40	0.60
Mean dep. var.	0.31	0.31	0.31	0.31	0.32	0.33

1. See notes to Table 1.