Do public libraries impact local labor markets? Evidence from Appalachia

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Job Market Paper

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Abstract

This paper investigates the effect of public library programs and participation on unemployment and labor force participation in Appalachia. Appalachia is an economically distressed area, mostly rural, and with a sustained lower level of labor force participation and a higher level of unemployment. As public library programs can be countercyclical to labor market outcomes, I use public library staff and the amount of print resources and computers available as instruments. The results show that neither adult nor children's programs and participation affect local labor market outcomes. These results are robust across different specifications. Spatial econometric estimates corroborate the main results and provide evidence of spatial spillover effects, especially for children's programs.

Keywords: Local Labor Market, Labor Force Participation, Public Library, Unemployment, Appalachia
JEL Classification: R59, J64, L39, H40

1 Introduction

"Aiding job seekers is increasingly viewed as a vital role for public libraries, [...]"

Denise Davis, Director ALA in

Jerrard (2009)

"[Aiding job seekers] is exactly what library should be doing. We're truly helping to bridge the digital divide. [...] It's natural for us to respond to a crisis in our community"

Pam Reese, Nashville Public Library in

Jerrard (2009)

The idea that public libraries are only about books amid advances in technology, such as computers and the internet, has reduced the perceived importance of public libraries to local communities. Yet, in 2014, there were 9,305 public libraries in the United States, 3.9% more public libraries than in 2010. These public libraries received 4.6 in-person visits per capita and \$12.1 billion in revenue, which, compared to 2010, represents a 12% increase in in-person visits and 7% increase in revenues.

To remain relevant, public libraries have been adapting their services to match a new demand for services and materials (Goulding, 2006; Jerrard, 2009; Hunt, 2017). For example, public libraries have been expanding the number of programs and resources offered. In 2014, there were 4.5 million programs offered to adults and children, with 101.9 million attendees. This represented a 20% increase in the number of programs and 17% increase in the number of attendees compared to 2010. In terms of collection materials, in 2014 there were over 1.2 billion materials covering books, e-books, video, and audio. This corresponded to an increase of 29% of collection materials from 2010. The composition of these materials also changed. In 2014, books were 66.1% of the materials and e-books were 18.4%, while in 2010, books represented 86.4% of the materials and e-books 2% (The Institute of Museum and Library Services, 2017).

Library programs can be roughly divided into those for children and those for adults. Children's programs usually focus on book-related activities and entertainment activities. Adult programs

focus on book activities, development of skills, and job search services.[1] This paper investigates the impact of these public library programs for children and adults and their participation on local labor markets outcomes, in particular, unemployment and labor force participation.

By focusing on public library programs, this paper contributes to the literature of the effect of library use. The most relevant work in this literature is Bhatt (2010). She finds that an increase in library usage increases time spent reading, decreases time spent watching TV, and, for school-age children, increases homework completion rates. Betts (1995) and Farber and Gibbons (1996) utilize the possession of a library card at age 14 as a proxy for innate ability, but they did not evaluate the impact of library programs directly on wages. Further, Liu (2004) uses cross-section of countries and find that public libraries' literacy programs affect economic productivity measured by gross domestic product per capita.

This paper also contributes to the active labor market programs (ALMP) literature that started with Ashenfelter (1978) and has been summarized by Heckman et al. (1999), Card et al. (2010), and Card et al. (2018), among others. Most public library adult programs have a focus on employment by helping develop new skills and finding jobs, similar to some of the government programs. Children's programs, on the other hand, can have indirect impact on local labor markets since parents may see public libraries as possible substitutes for daycare services (Smith and Rivera, 2004; Parrish, 2013). I contribute to this literature by focusing on (i) labor market programs that are overlooked, and (ii) rural areas that have lower levels of private and public labor market programs.

To evaluate the impact of the public library programs on local labor market outcomes, I combine datasets on county demographic characteristics and labor statistics with a novel dataset on public libraries. The Public Library System (PLS) dataset is an annual survey considered to be the census of public libraries in the United States. From the PLS, I collect data on the number of programs and program participation[2], as well as a variety of information about each public library system.[3]

I restrict my analysis to the Appalachian region (Figure 1). Appalachia is a 205,000 square-mile area that follows the Appalachian Mountains, encompassing 13 states and 420 counties from

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[1]For a complete list of programs for school-age children visit http://www.ala.org/alsc/kickstart. For a list of services and programs for adults visit http://www.ala.org/tools/atoz/adultservices/adult_lib_svcs.

[2]Unfortunately, I cannot differentiate the extensive and intensive margins of public library use such as visits, attendance, circulation, among others. In other words, it is not possible to know how many different people attended these programs versus people who participated in the programs several times.

[3]A public library system is composed of a central library and its branches and bookmobiles.

southern New York to northern Mississippi (Appalachian Regional Commission, 2018). Appalachia covers remote rural areas and important urban areas as well. However, the region is mostly rural as 70% of its counties are non-metropolitan areas hosting 42% of its population (Appalachian Regional Commission, 2018; Stephens and Partridge, 2011). Appalachia is, and has been, a systematically lagging region associated with lower levels of labor force participation and higher levels of unemployment (Dorsey, 1991; Isserman and Rephann, 1993; Stephens and Deskins, 2018). For instance, this is the only region in the US with a dedicated policy-making commission, the Appalachian Regional Commission, which has been in place for over 50 years (Isserman and Rephann, 1993; Sayago-Gomez et al., 2017).

In terms of labor market, Appalachia has lower level of skill and suffer from "missing markets", i.e., the lack of high skilled labor and low returns to skill (Bollinger et al., 2011; Betz and Partridge, 2012). Also, the region has difficulties in attracting firms and retaining talent (Kahn, 2009). Thus, according to the ALMP literature, labor market programs should be effective in areas like Appalachia, that is, low skilled workers and those who have been unemployed for longer times. However, rural areas have a lower number of private and public labor market programs (Whitener, 1991; Green et al., 2003; Dunham et al., 2005). In addition, rural areas have lower levels of internet access, which is an important tool in today's labor market (Stenberg et al., 2009; Hampton, 2018). Thus, in such areas, public libraries could bridge this gap by offering both some labor market programs and internet access.

The identification comes from the within variation in the number of public library programs and program participation. However, these programs and their attendance can be endogenous to local labor markets. In other words, if public library programs are used as counter-cyclical policies, areas with high unemployment and low labor force participation may be more likely to have more adult programs and less children's programs, for example. This renders OLS estimation biased and unable to provide causal inference. Hence, I make use of an instrumental variable (IV) approach. More specifically, I use the number of librarians without master's degree and the amount of print material and computers for public use as instruments for the number of programs and the participation in these programs.

Libraries need both monetary and physical resources to promote programs and to attract patrons. Because public library funding comes mostly from local government, this is likely to be

contemporaneously correlated with local labor markets. In turn, physical resources, such as the instruments, are less likely to be contemporaneously associated to local labor markets outcomes. On the one hand, although the flow of purchases of books and computers may change during recessions and booms, the volume of these resources in the library is less likely to change over time. This should be especially true for rural areas since patrons have reduced access to the internet and newer technologies such as e-readers and computers (Swan et al., 2013; Real and Rose, 2017). On the other hand, librarians without master's degree are usually those who offer and run programs, which should influence the selection into specific programs.

The results show adult and children's program and participation do not affect local labor market outcomes. These results are consistent across different specifications: quantile regressions show no difference across the distribution of labor market outcomes; using the Great Recession as an exogenous shock, there is no evidence that public library programs were more or less effective during this time; propensity score matching estimation also show no results from public library programs and participation.

However, spatial econometric estimations that account for spatial dependence and possible spillovers find suggestive results of indirect effect of library programs and participation. More specially, neighboring children's programs and participation have a positive effect on local labor market outcomes, i.e., decrease unemployment and increase labor force participation. Conversely, neighboring adult participation has a negative impact on local labor market outcomes.

These results are consistent with those in the active labor market program literature in that programs are largely ineffective. Given the aggregate nature of the data on public library programs, I am unable to explore neither individual nor program heterogeneous effects. The spatial econometric results are especially important in light of evidence that job search service assistance benefits participants at the expense of those who do not participate in such programs (Gautier et al., 2017).

With the recent trend of budget cuts to public library and the shift on public library focus to programs to help local communities, it is important to understand the effectiveness of public library programs. This is the first attempt to explore such questions. However, data limitations prevents the analysis on a more granular level that would allow to better understand possible effects and disentangle the mechanisms at work. Therefore, given the importance of public library in the American community (Wiegamd, 2015) further research in the same vein of policy program

evaluation is warranted.

2 Background

2.1 Public Library in the US

Public libraries are usually taken for granted (Dubner, 2007). In the US, they started as privately-financed institutions that offered book-lending services. The Boston Public Library, founded in 1852, is the first to receive regular local government support. The expansion of public libraries was facilitated by donations of Andrew Carnegie, who helped fund the construction of over 1,500 public libraries in the US alone. However, the funds provided by Mr. Carnegie were to support the construction only, and not to be used in the endowment of these libraries. This led local governments into the public libraries business (Getz, 1980; Wiegamd, 2015).

Public libraries have been, and are still, valued by patrons (Wiegamd, 2015). According to the Pew Research Center, black and Hispanic populations, as well as students, job seekers, people without internet access at home are those who value public libraries services the most (Pew Research Center, 2013b, 2014). In turn, parents, more educated people, and the high income population are more likely to utilize public library services (Pew Research Center, 2013c, 2014). However, there is an overall lack of knowledge of the services public libraries offer (Bertot et al., 2012; Pew Research Center, 2013a,b; Rainie, 2016).

Nevertheless, public libraries are little studied by economists and policy scholars.[4] The first economic study on public libraries is Tiebout and Willis (1965) who discuss the public nature of public libraries. In other words, public libraries are a public good that generates positive externalities, and thus have under provision of services. Most studies that followed can be classified into two strands: one focusing on demand, unit-costs and cost-benefit analysis (Pfister and Milliman, 1970; Goddard, 1970; Feldstein, 1976; Stratton, 1976; Getz, 1980; DeBoer, 1992; Hammond, 1999); and another focusing on the technical efficiency of public libraries (Sharma et al., 1999; Vitaliano, 1997, 1998; Hemmeter, 2006; Ferreira Neto and Hall, 2017).[5]

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[4]For instance, Knight and Nourse (1969) commission's report asked for further studies on public libraries instead of providing recommendations per se. Even though there are numerous journals specialized on libraries, a focus on the impact or policy outcome of libraries is scarce.

[5]Other papers used similar methods to study public libraries in other countries like Australia (Worthington, 1999), Belgium (Witte and Geys, 2011), and the United Kingdom (Hammond, 2002, 2009).

On the other hand, there are few studies that analyze the impact of public libraries on different outcomes. For instance, using an instrumental variable approach, Bhatt (2010) finds that an increase in library use increases time spent reading, decreases time spent watching TV and for children at schools, it increases homework completion rates. Fujiwara et al. (2017) use a survey of users and non-users of public libraries in the UK showing a positive association between public library use and self-reported happiness and health status. Conversely, Ferreira Neto (2018) studies the impact of government funding on private donations to public libraries in the US, and finds suggestive results of a crowd-in effect.

In terms of the labor market, the research on the impact of public libraries is scarce. For instance, Stine (2008) look at how volunteer workers impact the demand for labor from public libraries. He finds a complementary relationship between volunteer work and library staff. Further, although not focused on library use *per se*, Betts (1995) and Farber and Gibbons (1996) use information of library card holding to proxy for unobservable ability in a Mincerian wage regression. To the best of my knowledge, this is the first paper to investigate the impact of public library programs on local labor market outcomes.

2.2 Active Labor Market Programs

The ALMP literature mostly focuses on the government programs created by the Area Redevelopment Act in 1961 (LaLonde, 2003), and has been extensively summarized by Greenberg et al. (2003), Heckman et al. (1999), Card et al. (2010), and Card et al. (2018), among others. Most adult programs do focus on labor market outcomes, which is similar to some of the private and public programs that have been in place for over several decades.

LaLonde (2003) divides government training and employment programs into four types: skill development, work experience, employability development, and job development. Brown and Koettl (2015), in turn, classify these programs into those focusing on labor supply, labor demand, and matching. Public library programs targeting adults that are associated with labor market outcomes can be summarized in three areas: job search assistance, human capital enhancement, and entrepreneurial and small business programs (Bertot et al., 2012; Rainie, 2016). Therefore, public library programs are related to programs in skill development and employability development following the former classification and all of the latter classification.

The results that are most relevant for this paper are the ineffectiveness of public sector employment programs, and the positive impact of job search assistance programs. There are also some heterogeneity in the results depending on the investigated outcomes, the program type, and the treatment groups, with larger effects for women and those who were unemployed longer (Heckman et al., 1999; Kluve, 2010; Card et al., 2010, 2018). Also, Card et al. (2018) argue that ALMP have larger effects during recession times, i.e., low growth and high unemployment. These results, then, should help put the results found for public libraries into perspective. One caveat is that while this literature utilizes individual level data, this is not available for public library programs, and the analysis in this paper is at a more aggregated level.

3 Data

3.1 Labor Market Outcomes

Unemployment and labor force participation data come from the Local Area Unemployment Statistics (LAUS) provided by the Bureau of Labor Statistics (BLS). I follow the BLS and define the labor force participation rate as the ratio between labor force status and population over 15 years old. Table 1 provides summary statistics for all counties in the US (Panel A) and those in Appalachia (Panel B).

Similar to previous studies Appalachian counties have lower labor force participation and higher unemployment compared to other counties in the US. Table 1 also splits the counties into those with and without a public library system. In both Appalachia and the US, counties with a public library system have, on average, lower unemployment and higher labor force participation.

3.2 The Public Library Survey

Information from public libraries come from the Public Library Survey (PLS). The PLS has been collected annually since 1988 covering approximately 9,300 public library systems comprising over 17,000 individual public library outlets (central library, branches, and bookmobiles). The survey covers all 50 states, the District of Columbia, and outlying territories and has over a 98% rate of response. As such it is considered the census of public libraries in the US (The Institute of Museum and Library Services, 2018).

Figure 2 shows the number of public library systems per county. As discussed in Getz (1980) and Wiegamd (2015), New England stands out in terms of number of public libraries in each county. The same is true in Illinois, specially around Chicago and Pennsylvania, home of Andrew Carnegie. Arkansas, Minnesota, Mississippi, and Georgia are the states with the most counties without a public library system.

The Institute of Museum and Library Services (IMLS) reports that no governmental program is attached to the PLS, and it is not mandatory. Therefore, there are no incentives for over or underreporting information provided, which covers several features including location, administrative data such as staff information, revenue by source, expenditures, among others; and service and use, such as circulation, visits, programs, materials, among others. Until 2005, the PLS was collected by the Institute of Education Sciences and the US Department of Education. Since 2006, the survey has been collected by the IMLS. Since 2009 the PLS has reported the rate of response per state. Appalachian states have a 100% response rate, with the exception of Pennsylvania that had an average response rate of 99.6%.

The variables of interest are the adult and children library programs. The PLS collects data on the number programs and participation in these programs, and reports these data for all (total) programs, children's programs, and since 2009 young adult programs. Ideally the PLS would record not only the total number of programs and participation, but also the repeated participation in these programs. Unfortunately, as this is not the case I am unable to differentiate between extensive and intensive margins of public library use.

For my analysis, I calculate the number of adult programs as the difference in total programs from children's programs. Similarly, the participation in adult programs is the difference in total program attendance minus children's program attendance. Further, because data on these programs largely begins in 2006, I restrict my sample to the years from 2006 to 2015. Figures 3 and 4 show the average number of adults and kids programs in 2006 and 2015 for Appalachia.

As described in section 1, the number of programs and participation are likely endogenous to labor market outcomes. Thus, I use other library information as instruments for the number of programs and participation. More specifically, I use the number of print materials, the number of computer with internet access for public use, and number of librarians without a American Library Association certified Master's degree. These variables proxy for quality and capacity of

running programs and attracting patrons. To take into account the heterogeneity due to location and density, all library variables are scaled by county population.

3.3 Demographic and Industry Characteristics

Other independent variables used are demographic and industry controls. Demographic control, namely, race, gender, age composition comes from the Census Bureau through the Area Health Resource Files. Ideally, I would like to incorporate some measure of education. However, there is no dataset that I know of that systematically collects education attainment at the county level on a yearly basis. The closest to this would be the American Community Survey, but the statistics provided are for a 5-year period. The average weekly wage for total manufacturing and total services come from the Quarterly Census of Employment and Wages (QCEW) provided by the BLS.

Table 2 provides the descriptive statistics for the variables used in the econometric model. In terms of demographics, most of the population is white (91%), female (50.5%), and between 15 to 64 years (65.5%). For industry and employment, the weekly wage in manufacturing ($779) is larger than the weekly wage in services ($528). With regards to library programs and participation, there are on average more than two times the number of children's programs (210) than adult programs (103). Also, the participation in children's programs (5,403) is on average about three times the participation in adult programs (1,742).

4 Empirical Strategy

To investigate the effects of public library programs on the local labor market outcomes, I estimate the following model:

$$y_{cst} = \beta_0 + \beta_1 Adu_{cst} + \beta_2 Kid_{cst} + X_{cst}\delta + \mu_c + \eta_s + \theta_t + \varepsilon_{cst} \tag{1}$$

where y is either the unemployment rate (UR) or labor force participation rate ($LFPR$) in county c, in state s and year t. The library program variables, Adu and Kid, measure either the average number of programs per capita, or average participation per capita, for adults and children's programs respectively.

The vector X contains relevant control variables following the previous literature that explains

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local labor market outcomes (Partridge and Rickman, 1997; Partridge, 2001; Stephens and Deskins, 2018). Hence, I include demographic controls, such as race (Cajner et al., 2017), gender (Black et al., 2014) and age composition (Hipple, 2016); as well as industry controls (Partridge, 2001), such as the average weekly wage in manufacturing and services as a whole, and the lagged unemployment rate (Blanchard and Katz, 1992). μ_c, η_s, θ_t are county, state and year fixed effects (Pesaran, 2006); and ε_{cst} is an error term.

The coefficients of interest in this model are β_1 and β_2, which should be interpreted as the percentage point impact of the additional program or participation per person on the unemployment rate and labor force participation rate. If β_1 and β_2 are positive, this suggests that public library programs have a negative impact on the unemployment rate as larger participation and more programs would be associated with a higher unemployment rate. Conversely, a negative sign would suggest positive impact on the unemployment rate. The opposite is true for the labor force participation rate. That is, if β_1 and β_2 are positive (negative), then public library programs will have a positive (negative) impact on the labor force participation rate.

However, OLS estimation probably does not provide causal evidence on the impact of public library programs on local labor markets outcomes. These estimations are likely biased due to an endogeneity problem. As the local labor markets changes, i.e., unemployment rate and labor force participation rate increase (decrease), libraries can respond to these changes by offering (cutting) programs or by incentivizing (discouraging) participation (Jerrard, 2009; Hunt, 2017). If there is a procyclical relationship between public libraries programs and unemployment rate the OLS estimates would be biased upward, or vice versa.

Therefore, I use an instrumental variable (IV) approach. Because I have two endogenous variables, adult and children's programs, at least two instruments are needed for proper identification. In this paper I use the linear constant effect instrumental variable model. Therefore, for the instrument to be valid, it must affect the dependent variable only through the endogenous independent variable. To provide unbiased estimation, the instrument must be strongly correlated with the endogenous variable, but uncorrelated with the error term, hence uncorrelated with the dependent variable itself (Angrist and Pischke, 2009; Cunningham, 2018). The two sets of instruments used are: (i) the average number of computers with internet for public use (*Computer*) and the average number of librarians without a Master's degree per person (*Librarian*) for program participation;

and (ii) the average number of computers with internet for public use (*Computer*) and the average number of print materials per person (*Books*) for the number of programs. Formally:

$$\mathbb{E}[Instrument, \varepsilon] = 0$$
$$\mathbb{E}[Instrument, \upsilon] = 0$$

(2)

$$\text{cov}(Endogenous, Computer) \neq 0$$
$$\text{cov}(Endogenous, Librarian) \neq 0$$
$$\text{cov}(Endogenous, Books) \neq 0$$

(3)

where $Instrument = \{Computer, Librarian, Books\}$ and $Endogenous = \{Adu, Kid\}$.

The unbiased effect of public library programs on the local labor markets is estimated using a two-stage least square framework, in which in the first stage (Eq. 4), the instruments are regressed on the endogenous variables, also controlling for other control variables used in the second stage, as well as the various fixed effects.

$$Adu_{cst} = \alpha_0 + Instrument_{cst}\alpha_1 + X_{cst}\phi + \mu_c + \eta_s + \theta_t + \upsilon_{cst}$$
$$Kid_{cst} = \alpha_0 + Instrument_{cst}\alpha_1 + X_{cst}\phi + \mu_c + \eta_s + \theta_t + \upsilon_{cst}$$

(4)

In the second stage (Eq. 5), the predicted value $\widehat{Adu_{cst}}$ and $\widehat{Kid_{cst}}$ are used in lieu of the observed values. Thus, the estimated equations are:

$$y_{cst} = \beta_0 + \beta_1\widehat{Adu_{cst}} + \beta_2\widehat{Kid_{cst}} + X_{cst}\delta + \mu_c + \eta_s + \theta_t + \varepsilon_{cst}$$

(5)

4.1 Instrument Validity

The endogeneity problem arising in Equation 1 is due to the possible simultaneity of unemployment rate and labor force participation rate with the number of public library programs and their attendance. Public libraries are not randomly assigned to location throughout the country; however,

most of them have been in place for over five decades at minimum.[6] Further, public libraries can be used as a policy instrument providing more or fewer programs in response to changes in the local labor markets.

Equations 2 and 3 show the two assumptions that must hold for identification when using an IV approach, i.e., the exclusion restriction and existence of a "first stage". To properly identify the effect of public library programs on local labor markets, I need a set of instruments that are uncorrelated with the local labor markets, but highly correlated with the number of programs and participation in these programs. I argue that the capacity of offering a program and attracting patrons meet both criteria.

To offer a program, public libraries require both an appropriate level of funding and availability of resources for the programs. According to the IMLS, in 2014, approximately 85.2% of public library funding came from local government, while the remaining part comes from state government (7%), federal government (0.4%), and other sources (7.4%) (The Institute of Museum and Library Services, 2017). Since most revenue stems from local government, this funding is expected to be contemporaneously correlated with regional business cycles and local labor markets. This is corroborated by several reports of public libraries across the country losing part of their revenue due to struggling local governments (Blau, 2011; Warburton, 2013; Smith, 2015; Kelley, 2015; Davis, 2015; Stepleton, 2015; Woods, 2015; Cleaver, 2015).[7]

Public libraries also require trained staff, physical space, and materials (print and computers), at a minimum, in order to offer such programs. A priori, because these variables are related to the capacity of the library, they should not be contemporaneously correlated with regional business cycles, but they should be strongly correlated to the programs offered by the library. Such features make these variable good candidates for instruments.

First, I focus on the exclusion hypothesis. According to the American Library Association (2018) there are six jobs in a public library: pages, library assistants or technicians, librarians, library managers, library directors and other professionals.[8] Thus, given the several occupations

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[6] According to Stratton (1976), in 1972 there were 7,109 public libraries in the country which corresponds to over 78% of the libraries that existed in 2014 according to the Institute of Museum and Library Services (IMLS, 2017).

[7] In response to budget cuts, several proposal for levies have the introduced in the ballots to specifically fund public libraries, either creating, renewing or increasing existing levies. These proposals have been mostly successful in the the ballots (Howard Fleeter & Associates, 2017; Spokane Public Library, 2017; Hrin, 2018; Fallows, 2014).

[8] A *page* is usually a part-time job and is responsible to keep items in order. A *library assistant* can be either part-time or full-time job and generally performs clerical duties. *Librarians* are full-time employees that decide the items

in public libraries, librarians should be less susceptible to business cycle fluctuations. In addition, education (bachelors and masters degree) is shown to be a determinant in job security (Hashimoto and Raisian, 1985; College Board, 2017).

As for the number of computers and print materials, they are a stock variable. Even though the flow of purchases of computers and books by libraries vary with budgetary allocation, libraries store such materials to provide their different services. Also, there is a physical constraint in the number of books and computers public libraries can have. Therefore, given the stock feature of these variables, they should be contemporaneously uncorrelated to both unemployment rate and labor force participation rate. Table 3 shows OLS regression of the instruments on local labor market outcomes, conditional on the control variables and fixed effects used in the main analysis. The results suggest these variables are not contemporaneously correlated, satisfying the exclusion restriction.

Now I turn my attention to the existence of a first stage, that is, the correlation of instruments and endogenous variables. The set of variables chosen proxy for the quality of programs and number of programs. Since librarians without masters degree are those responsible to provide programs, and programs for job seekers usually require computer and internet access, these should be good predictors of participation. For instance, people may select into those programs in which the librarian is better prepared, more approachable, or have a better reputation.

Additionally, the more inputs (computers and books) that are available, the easier it should be to provide output in the form of programs. Table 4 reports the first-stage estimation results, providing evidence of strong correlation between library programs and the instruments. Since I have more than one endogenous variable, I compute the heteroskedastic-robust conditional F-Statistics, reported in Table 4. The estimated F-Statistics show values above 12 for all adults and children's program and participation, suggesting the set of instruments used are good instruments (Stock and Yogo, 2005).

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that are needed, offer programs and training, and help people in general. *Library managers* are middle managers responsible for daily operations, while *library directors* are the main leadership in the library. For more details on visit http://www.ala.org/educationcareers/careers/librarycareerssite/typesofjobs.

5 Results

Table 5 shows the OLS and IV results for two sets of regressions. The first two columns report the results for the unemployment rate, while the last two columns report the results for the labor force participation rate. Panel A focuses on the number of programs, and Panel B focuses on the participation.

The OLS results show no statistical significant correlation between adult or children's programs and participation with the unemployment rate. Conversely, children's programs and participation are positively and statistically correlated with the labor force participation rate. As previously discussed, the OLS estimation does not provide causal inference in this case as library programs and participation are likely endogenous to labor market outcomes. The IV results show that neither adult nor children's programs and participation affect unemployment rate, similar to the OLS results, but also do not affect the labor force participation.

Public library programs (and participation) may not help people find jobs, however they should reduce the cost of joining the labor market, especially for adult programs. Adults programs focus on job services and skills training (Bertot et al., 2012; Hunt, 2017). These programs are designed to help adults find and keep their jobs which should positively impact labor force participation and negatively impact unemployment. This should be particularly true in Appalachia, where people have less access to formal training (Haaga, 2004; Pollard and Jacobsen, 2017) and to the internet at home (Stenberg et al., 2009).

However, similar to active labor market programs (Heckman et al., 1999; LaLonde, 2003; Card et al., 2018), these programs may suffer from a selection bias. In other words, these programs target low-skilled and/or first-time workers (Goulding, 2006; Jerrard, 2009) who may have a higher cost of joining the labor market, especially in rural areas such as Appalachia. Thus, individual level data would be ideal to disentangle these heterogenous effects, but it is not available for public library programs.

In light of the discussion so far, at least three possible extension or robustness tests come to mind, considering the limitations data on public library program and participation impose. Building on the different costs associated with joining and remaining in the labor market, it may be the case that the OLS estimations are not representative of the distribution of labor market outcomes. Therefore,

I use quantile regressions to test this hypothesis.

In addition, if public libraries see their programs, especially those for adults, as a response to a crisis, it may be that they are more effective during recession times, similar to active labor market programs (Card et al., 2018). Hence, I use the Great Recession as an exogenous shock to evaluate if these programs were more effective in this time. Also, even though Appalachia should receive special attention as demonstrated so far, it may be that Appalachian counties without libraries are not good control group for those with a public library system. Thus, I make use of propensity score matching to create a different control group.

5.1 Robustness Checks

5.1.1 Quantile Regression

One possible concern is that the cost associated with joining the labor market and/or finding a job varies along the distribution of labor force participation and unemployment. In other words, it may be less costly to join the labor market in areas with higher labor force participation and easier to find a job in areas with low unemployment. To test this hypothesis, I use quantile regression as described in Koenker and Bassett (1978), and re-estimate equation 1 for different quantiles of the dependent variable. Particularly, I focus on the 10th, 25th, 50th, 75th and 90th quantiles.

Figure 5 summarizes the results using for the OLS estimates and Figure 6 summarizes the results using the predicted value of the first stage (Equation 4) instead. The results in both cases show that the estimates along the distribution are not statistically different from the OLS ones, which corroborates the main results.[9] Because the predicted values are used in Figure 6 in lieu of observable values, one can expect larger confidence intervals for the quantile estimates, however, the point estimates lie within the OLS estimates confidence interval, which reduces this concern.

5.1.2 Great Recession Shock

According to the active labor market programs literature, these programs are more successful during a recession (Card et al., 2018). Public library programs' main focus is on job search assistance, which is likely more demanded in economic downturns. As reported by several outlets, since the Great

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[9]Complete results are available upon request.

Recession (2008-2009), several public libraries have lost part of their revenues from local governments due to budgetary issues. As a consequence, libraries had to reduce their hours of operation to remain in business (Blau, 2011; Warburton, 2013; Smith, 2015; Kelley, 2015; Davis, 2015; Stepleton, 2015; Woods, 2015; Cleaver, 2015).

Ergo, I use the Great Recession as an exogenous shock that caused some libraries to reduce their hours of operations. The Great Recession had heterogenous effects throughout the country impacting counties in different ways, even in more similar regions like Appalachia. If public library programs are similar to those privately and publicly provided elsewhere, during the Great Recession counties that had their public libraries more affected, i.e., had their hours of operation reduced, should see worst labor market outcomes than those not affected. Formally:

$$y_{cst} = \gamma_0 + \gamma_1 RH_{cst} + \gamma_2 GR_t + \gamma_3 (RH * GR)_{cst} + X_{cst}\delta + \mu_c + \eta_s + \theta_t + \varepsilon_{cst} \qquad (6)$$

where RH is an indicator variable that equals one if the public library operated less hours in year t than $t-1$ and GR is an indicator variable for the Great Recession, i.e., equals one for the years of 2008 and 2009. The remaining variables and parameters are similar to those in equation 1. The parameter of interest in this case is γ_3. In addition, I include the adult and children's program and interact with γ_3 to test the for different effects from these programs.

Note that this is not a traditional difference-in-difference analysis since the reduction of hours is an endogenous decision given public libraries' budget constraint. Further, there is no expectation that libraries with and without reduced hours of operation had similar pre-trends in terms of programs and participation. Nevertheless, given the aggregate nature of the data, this analysis yields extra evidence on the possible effect of public library programs and participation on local labor market outcomes.

The results for this analysis are presented in table 6. Panel A shows the estimated results for Equation 6; Panel B and Panel C show the results using the interaction of number of programs and participation with the exogenous shock parameter (γ_3). Overall, similar to previous analysis, there is no evidence that public library programs impact labor market outcomes. Even in recession times, when according to Card et al. (2018) labor market programs are more effective, there is still no evidence of such, at least on an aggregate level. Individual outcomes may vary, but as previously

mentioned I am unable to test it with the current data.

5.1.3 Propensity Score Matching

The instrumental variable approach generates exogenous variation that enables the causal identification of public library programs and participation on local labor markets outcomes. However, it may be the case that "the control group" for Appalachian counties with public library systems are not ideal. For instance, public library systems are not randomly assigned in the country, and there can be other unobservables that systematically bias the results.

To try to control for this possible selection problem, I employ a propensity score matching approach to create another "control group" for Appalachian counties with public library systems. Intuitively, the idea is to find comparable counties to those in Appalachia that have a public library system in terms of observable characteristics that determine, directly or indirectly, labor market outcomes. Thus, if a public library is the only difference between these counties, its effect would be identifiable when comparing these groups.

The propensity score matching method removes the necessity of using instrumental variables, given the matching should have controlled for the unobservables that could affect the public library programs and local labor markets. Ichimura and Taber (2001) show that the propensity score matching is a special case of instrumental variable approach. Wooldridge (2016), on the other hand, argues that using instrumental variables for matching purposes increases inconsistency.

Therefore, I use socio-demographic characteristics as well as industry characteristics, more specially the employment location quotient (LQ_e). The LQ_e accounts for the relative importance of the industry to the county. Using the predictions from a logit model in which the dependent variable is the presence of a public library system, I select the observations closest to those in Appalachia with a public library system, or "treated counties".

Table 7 has the comparison of means between treated (Appalachian counties with public library) and control groups. Panel A shows the matching variables while Panel B shows the local labor market outcomes. Table 8 presents the estimated results for a empirical model similar to Equation 1. The results corroborate previous analysis so far, providing extra evidence that, on an aggregate level, public library programs and participation do not affect local labor market outcomes.

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5.2 Spatial Spillovers

Halleck Vega and Elhorst (2016) note three stylized facts about local unemployment rates: the strong correlation over time (Blanchard and Katz, 1992), the parallel to national trends (Pesaran, 2006), and the correlation across space (Patacchini and Zenou, 2007). So far in this paper, only the first two issues were taken into account, as time-lagged unemployment rate and year fixed effects have been included in the regressions. Thus, in this subsection I take a step further and (i) control for spatial dependence of local labor market outcomes, and (ii) evaluate the spillover effects of library programs.

Two methods to take the three features of local labor market outcomes have been proposed. On the one hand, Bailey et al. (2016) proposes to deal with these issues in a two-step procedure, in which the aggregate shocks are de-factored from local labor market outcomes, and the resulting variables modeled using spatial econometrics. On the other hand, Halleck Vega and Elhorst (2016) argue against this method, proposing another one that deals with the three issues concomitantly. I follow more closely the method proposed by Halleck Vega and Elhorst (2016).

A general formulation of spatial econometric models is

$$y = \rho W y + X\beta + WX\gamma + \varepsilon \tag{7}$$

$$\varepsilon = \lambda W \varepsilon + \upsilon \tag{8}$$

where W is the spatial weight matrix used to spatially lag the variable of interest. The spatial autogressive model (SAR) includes only the ρ parameter, the spatial error model (SEM) includes only the λ parameter, and the spatial lag of X model (SLX) includes only the γ parameter. LeSage and Pace (2014b) argue that applied works such as this, should focus on two models only: the spatial Durbin model (SDM), which is the linear combination of SAR and SEM models, and the spatial Durbin error model (SDM), which is the nested version of the SEM and SLX models. The former includes both ρ and γ parameters, while the latter includes λ and γ parameters.

The key difference between the SDM and SDEM models is that, while the former is a global spillover specification, the latter is a local spillover one. In other words, the global spillover implies

an endogenous feedback effect, which are spillovers from higher-order neighbors as well (LeSage and Pace, 2014b). LeSage and Pace (2014b) argue that global spillover phenomena should be rarer than local spillovers. For the case of local labor markets, this should be specially true (Patacchini and Zenou, 2007; Halleck Vega and Elhorst, 2016), and hence I estimate the SDEM model. An extra benefit of the SDEM model lies in the fact that the spatially-lagged variables can be interpreted as the indirect effect while the non-spatially-lagged are the direct effect.

Because of the endogeneity issue discussed throughout the paper, the spatial estimations would still be biased with respect to library programs. Therefore, I use the IV estimator described in Millo and Piras (2012). Table 9 shows the results for the SDEM model with and without an IV approach. The estimated models use a contiguity weight matrix of type queen.[10]

First I consider the results for unemployment rate. Neither adult nor children's program or participation have a direct impact on the unemployment rate. Conversely, the results show that neighboring adult programs and participation increase the unemployment rate, while children's program and participation decreases it. The results for labor force participation are similar to those for the unemployment rate. In particular, neighboring adult participation decreases labor force participation, whilst neighboring children's program and participation increases it.

The additional neighboring children program per 1,000 people decreases the unemployment rate in 0.06 percentage points and increase labor force participation in 0.312 percentage points, or 186 people. The additional participant per 1,000 people in neighboring adult program increases the unemployment rate in 0.002 percent points and decreases labor force participation in 0.007 percent points. Conversely, the additional participant per 1,000 people in neighboring children's program decreases the unemployment rate in 0.001 percentage points and increases labor force participation in 0.009 percentage points, or 5 people.

Intuitively, although public library programs targeting adults focus on job search activities, they also supply entertainment and skill-developing programs. People may select into the latter programs more often if the cost of searching remain too high. In this case, job-seekers would try and look for programs that would help them develop their skills before (re)joining the labor market, or else at programs that increase their leisure. As for the indirect effect of children's programs, as parents

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[10]LeSage and Pace (2014a) argue that the specification of the weight matrices should not have large impact on estimates and inferences.

are hired or join the labor market actively looking for jobs in neighboring counties, they may make use of the neighboring public libraries for their children if they see public libraries as substitutes for day care (Noble, 1988; Smith and Rivera, 2004) which can be prohibitively expensive, especially for lower-skilled workers.

In sum, the spatial econometric analysis corroborates the previous section in that public library programs and participation have no direct effect on labor market outcomes. Nevertheless, it suggests that there is an indirect effect, which is more prominent for children's program.

6 Conclusion and Policy Implication

The objective of this paper is to investigate the effect of public library programs in local labor markets. More specially, I focus on the impact of the number of children's and adult programs and participation on unemployment and labor force participation. I restrict my analysis to the Appalachian region because: it is a lagging region, suggesting a high level of unemployment and poverty; mostly rural, which implies fewer private and public labor market programs and lower levels of internet access; and with unique features in terms of labor market outcomes, in particular, lower levels of labor force participation.

Since the provision of public library programs can be endogenous to local business cycles, I use an instrumental variable approach. The results provide no evidence that public library programs and participation affect local labor market outcomes, at least in an aggregate level. These results are robust across different specifications and control groups.

Spatial econometric estimates, however, show suggestive result that there is an indirect effect of public library programs and participation, specially for children's program. In particular, neighboring children's program and participation decrease the unemployment rate and increase the labor force participation, while neighboring adult participation increase the unemployment rate and decreases labor force participation.

Policy implications are two-fold. First, given the recent trend in budget cuts from public libraries and the shift on provision of services, the results are suggestive that, overall, public libraries are not able to help people find and keep jobs. This may vary within the population (gender, race, education level, etc.) but in this paper I am unable to test for these heterogenous effects. Therefore,

public libraries must be aware of their budget allocation in order to be the most effective for their communities. Further, different programs can be more or less effective, but data limitation also does not allow me to test for these effects.

Secondly, in light of the spatial econometric models, children's program have a short-term impact on local labor markets, however, in neighboring counties. This reinforces children's programs importance, since they can also have a long-term effect on local labor market via educational outcomes (Bhatt, 2010), which is an important predictor of long-term employment, income, among others. Thus, since public libraries already offer on average five times more children's than adult programs, the cost of increasing the former should be smaller. Also, these programs are more likely to have larger impacts in their communities over time.

The caveats of this paper are the aggregate nature of the data and the inability to disentangle intensive and extensive margins. Future studies should focus on acquiring, ideally, data at the individual level, and identifying the patrons that participate in each library program. Also, focusing on the type of library programs is important to make results more comparable to studies on private and public active labor market programs. The use of experimental methods can be helpful in identifying the mechanisms that help individuals join the labor force and through which programs these mechanisms work better.

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Tables and Figures

Table 1: Summary Statistics for Local Labor Market Outcome Variables

Statistic	All Counties	With Libraries	Without Libraries
Panel A: _United States_			
Unemployment Rate	6.96	6.82	7.52
	(2.98)	(2.95)	(3.06)
Labor Force Participation Rate	54.73	60.30	57.45
	(8.73)	(8.37)	(9.70)
N	31,093	24,861	6,232
Panel B: _Appalachia_			
Unemployment Rate	8.19	8.11	8.47
	(2.80)	(2.75)	(2.93)
Labor Force Participation Rate	54.39	54.32	54.60
	(6.85)	(6.77)	(7.08)
N	4,200	3,222	978

Standard deviations in parenthesis. There is information missing for seven counties for the US, all in the state of Louisiana in the year 2006.

Table 2: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Demographic:					
Population	4,200	59,688	97,311	2,138	1,231,527
Percent Female	4,200	0.505	0.017	0.325	0.564
Percent Asian	4,200	0.006	0.010	0.000	0.118
Percent Black	4,200	0.065	0.111	0.0001	0.826
Percent Other Race	4,200	0.002	0.007	0.000	0.151
Percent Two or more Races	4,200	0.011	0.005	0.002	0.046
Percent American Indian	4,200	0.004	0.015	0.0001	0.280
Percent Latin	4,200	0.027	0.032	0.002	0.339
Percent White	4,200	0.911	0.114	0.154	0.993
Percent < 15yo	4,200	0.178	0.022	0.035	0.288
Percent 15–64yo	4,200	0.655	0.026	0.548	0.780
Percent > 64 yo	4,200	0.167	0.032	0.059	0.334
Industry/Employment:					
Avg. Weekly Wage for Total Manufacturing ($100s)	4,200	7.787	2.153	0.000	21.427
Avg. Weekly Wage for Total Services ($100s)	4,200	5.279	1.073	0.000	11.853
Unemployment	4,200	2,070	3,347	36	48,202
Labor Force	4,200	28,366	49,901	796	653,196
Library:					
Avg. Adult Participation (1000s)	4,200	1.988	4.602	0.000	67.848
Avg. Number of Adult Programs	4,200	117.277	256.262	0.000	3,988
Avg. Children's Participation (1000s)	4,200	6.229	12.778	0.000	181.539
Avg. Number of Children's programs	4,200	240.276	456.139	0.000	5,480
Avg. Number of Print Materials (1000s)	4,200	75.160	121.865	0.000	1,204
Avg. Number of Computers	4,200	27.554	46.665	0.000	498.000
Avg. Number of Librarians without M.A.	4,200	2.381	4.478	0.000	47.880
Adult Participation Per 1,000 People	4,200	43.844	86.928	0.000	1,376
Adult Programs Per 1,000 People	4,200	2.750	5.417	0.000	97.316
Children Participation Per 1,000 People	4,200	131.214	203.051	0.000	2,822
Children's Programs Per 1,000 People	4,200	5.884	10.582	0.000	136.264

Table 3: Exclusion Restriction for Books and Masters

	Dependent variable:					
	Unemployment Rate			Labor Force Participation Rate		
Books	0.032			0.046		
	(0.044)			(0.247)		
Computer		111.356			−79.330	
		(90.799)			(417.275)	
Librarian			0.462			0.976
			(0.540)			(1.033)
R-Squared	0.889	0.889	0.889	0.900	0.901	0.900

Clustered standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01. *Note:* N=4,200 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; year, county and state fixed effects.

Table 4: First Stage Results for Adults and children's programs

	Adults		Children	
	Programs	Participation	Programs	Participation
Books	0.514		2.142***	
	(0.510)		(0.387)	
Computer	2.747***	50.919***	1.309**	69.049***
	(0.800)	(11.908)	(0.619)	(19.009)
Librarian		-40.782		216.015**
		(41.306)		(86.170)
R-Squared	0.723	0.738	0.865	0.876
Robust Conditional F-Statistics	18.4	12.9	12.3	13.0

Dependent variable: heading spans the four value columns.

Clustered standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01. *Note:* N=4,200 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, time-lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; year, county and state fixed effects.

Table 5: Results for Library Programs and Participation on Unemployment Rate and Labor Force Participation Rate

	Dependent variable:			
	Unemployment Rate		Labor Force Participation Rate	
	OLS	IV	OLS	IV
Panel A: *Programs*				
Adults	−0.001	0.061	0.034	−0.065
	(0.010)	(0.068)	(0.021)	(0.168)
Children	−0.008	−0.002	0.054**	0.057
	(0.006)	(0.044)	(0.026)	(0.122)
R-Squared	0.866	0.862	0.901	0.899
Panel B: *Participation*				
Adults	0.0002	0.001	0.001	−0.007
	(0.001)	(0.004)	(0.001)	(0.009)
Children	−0.0001	0.002	0.002*	0.004
	(0.001)	(0.002)	(0.001)	(0.004)
R-Squared	0.866	0.863	0.900	0.897

Clustered standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01. *Note:* N=4,200 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; year, county and state fixed effects. Instruments: average print materials per capita, average computers for public use per capita, and average librarians without master's degree per capita.

Table 6: Exogenous Shock Results for Library Programs and Participation on Unemployment Rate and Labor Force Participation Rate

| | Dependent variable: | |
	Unemployment Rate	Labor Force Participation Rate
Panel A: *Dummy Variable*		
Reduced Hour	−0.029	−0.161
	(0.058)	(0.118)
Reduced Hour * Great Recession	0.195	−0.178
	(0.143)	(0.280)
R-Squared	0.861	0.914
Panel B: *Programs*		
Adults	0.082	−0.153
	(0.109)	(0.282)
Children	0.061	−0.007
	(0.137)	(0.417)
Reduced Hour*Adults*Great Recession	−0.002	−0.019
	(0.039)	(0.060)
Reduced Hour*Children*Great Recession	−0.001	−0.003
	(0.014)	(0.030)
R-Squared	0.849	0.909
Panel C: *Participation*		
Adults	0.003	−0.013
	(0.005)	(0.013)
Children	0.004	0.004
	(0.003)	(0.006)
Reduced Hour*Adults*Great Recession	−0.002	0.001
	(0.002)	(0.004)
Reduced Hour*Children*Great Recession	0.001	−0.001
	(0.001)	(0.002)
R-Squared	0.852	0.907

Clustered standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01. *Note:* N=3,649 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, time-lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; year, county and state fixed effects. Instruments: average print materials per capita, average computers for public use per capita, and average librarians without master's degree per capita.

Table 7: Comparison of Means Between Groups

	Control		Treated	
	Mean	St. Dev	Mean	St. Dev.
Panel A: Matching Variables				
Demographic:				
Population	70,255	262,290	64,088	103,078
Percent Female	0.51	0.015	0.51	0.017
Percent White	0.91	0.112	0.92	0.106
Percent Black	0.06	0.109	0.06	0.102
Percent 15–64yo	0.66	0.031	0.66	0.025
Percent SNAP Recipients	0.13	0.086	0.14	0.100
Personal Income per capita	26,007	12,349	26,385	9,927
Employment Location Quotient:				
Construction	0.84	0.635	0.82	0.562
Education and Health Services	1.01	0.444	1.02	0.421
Financial Activities	0.57	0.254	0.58	0.254
Information	0.47	0.429	0.47	0.481
Leisure and Hospitality	0.88	0.423	0.86	0.398
Manufacturing	1.74	1.117	1.63	1.146
Trade, Transportation, and Utilities	0.97	0.236	0.97	0.247
Natural Resources and Mining	1.57	2.504	1.95	3.617
Professional and Business Services	0.46	0.404	0.44	0.319
Other:				
Avg. Weekly Wage for Total Manufacturing	8.00	2.061	7.95	2.206
Avg. Weekly Wage for Total Services	5.35	1.196	5.32	1.092
One-year Lagged Unemployment Rate	8.11	3.116	8.09	2.786
Outcome Variables:				
Unemployment Rate	8.07	2.947	8.18	2.773
Labor Force Participation Rate	59.44	7.147	54.18	6.842

N: 3649. Treated group are counties in Appalachia with a public library system. Control group are counties in the US without a public library system matched to "treated group" using propensity score matching method.

Table 8: Propensity Matching Results for Library Programs and Participation on Unemployment Rate and Labor Force Participation Rate

	Dependent variable:	
	Unemployment Rate	Labor Force Participation Rate
Panel A: *Programs*		
Adults	0.003	−0.003
	(0.006)	(0.014)
Children	−0.001	−0.009
	(0.003)	(0.014)
R-Squared	0.889	0.927
Panel B: *Participation*		
Adults	0.0001	−0.002*
	(0.0004)	(0.001)
Children	−0.00002	0.001
	(0.0003)	(0.001)
R-Squared	0.889	0.927

Clustered standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01. *Note:* N=7,298 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, time-lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; year, county and state fixed effects.

Table 9: Spatial Dependence and Spillovers of Library Program and Participation

| | *Dependent variable:* | | | |
| | Unemployment Rate | | Labor Force Participation Rate | |
	SDEM	SDEM-IV	SDEM	SDEM-IV
Panel A: *Programs*				
Adults	0.010**	0.411	−0.020	−1.453*
	(0.004)	(0.251)	(0.015)	(0.848)
Children	−0.002	−0.208	0.012	0.730
	(0.003)	(0.133)	(0.008)	(0.450)
Spatially Lagged Adults	0.016	0.073*	0.012	−0.184
	(0.011)	(0.039)	(0.035)	(0.136)
Spatially Lagged Children	−0.019***	−0.062**	0.162***	0.312***
	(0.006)	(0.030)	(0.018)	(0.103)
λ	0.107***	0.151	0.200***	0.153
	(0.023)		(0.022)	
Panel B: *Participation*				
Adults	0.0005	0.002	−0.001	−0.016
	(0.0003)	(0.002)	(0.001)	(0.010)
Children	−0.0003**	0.00003	0.002***	−0.003
	(0.0001)	(0.001)	(0.0004)	(0.003)
Spatially Lagged Adults	0.002***	0.002***	−0.006**	−0.007***
	(0.001)	(0.001)	(0.002)	(0.003)
Spatially Lagged Children	−0.001***	−0.001***	0.009***	0.009***
	(0.0003)	(0.0003)	(0.001)	(0.001)
λ	0.107***	0.111	0.202***	0.193
	(0.023)		(0.022)	

Robust standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01. *Note:* N=4,200 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two plus race, percent female, percent population between 15 and 64 years old, time-lagged unemployment rate, time-lagged average weekly wage on manufacturing, and service; spatially-lagged controls, year, county and state fixed effects. Spatial weight matrix defined as a contiguity matrix of type queen. Instruments: average print materials per capita, average computers for public use per capita, and average librarians without master's degree per capita.
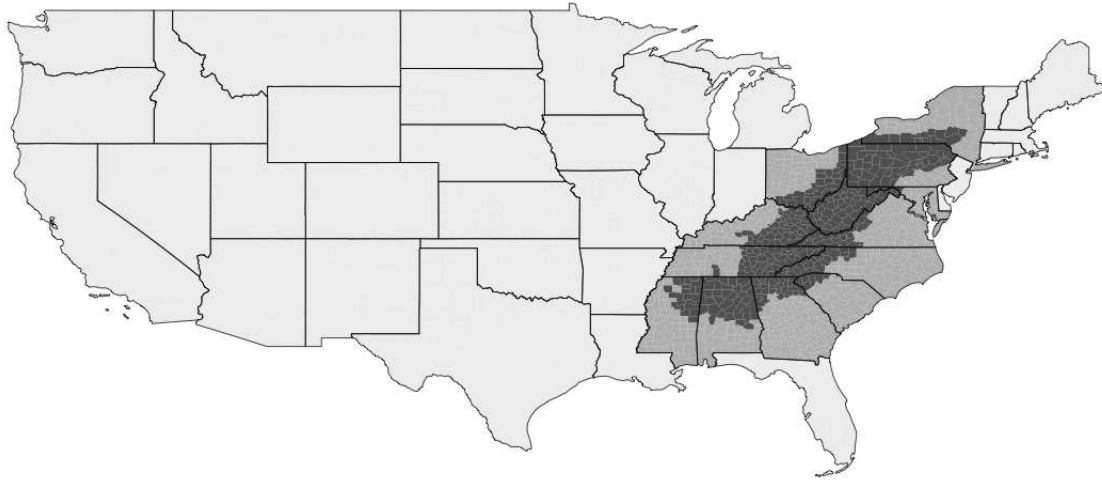
States that have any Appalachian county are in medium gray shade, and the Appalachia region is an dark gray shade.

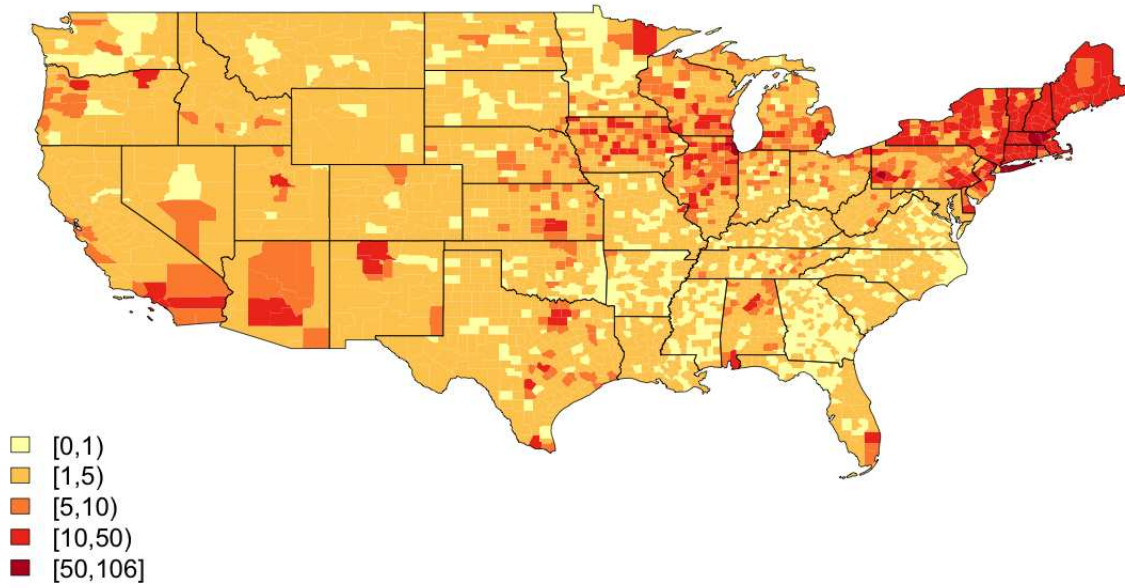Figure 2: Number of Libraries per County for the US

[0,1)
[1,5)
[5,10)
[10,50)
[50,106]

Figure 3: Number of Adults and Children Program in 2006

Adult Programs 2006

- [0,10)
- [10,50)
- [50,100)
- [100,1000]

Children Programs 2006

- [0,10)
- [10,50)
- [50,100)
- [100,1000]
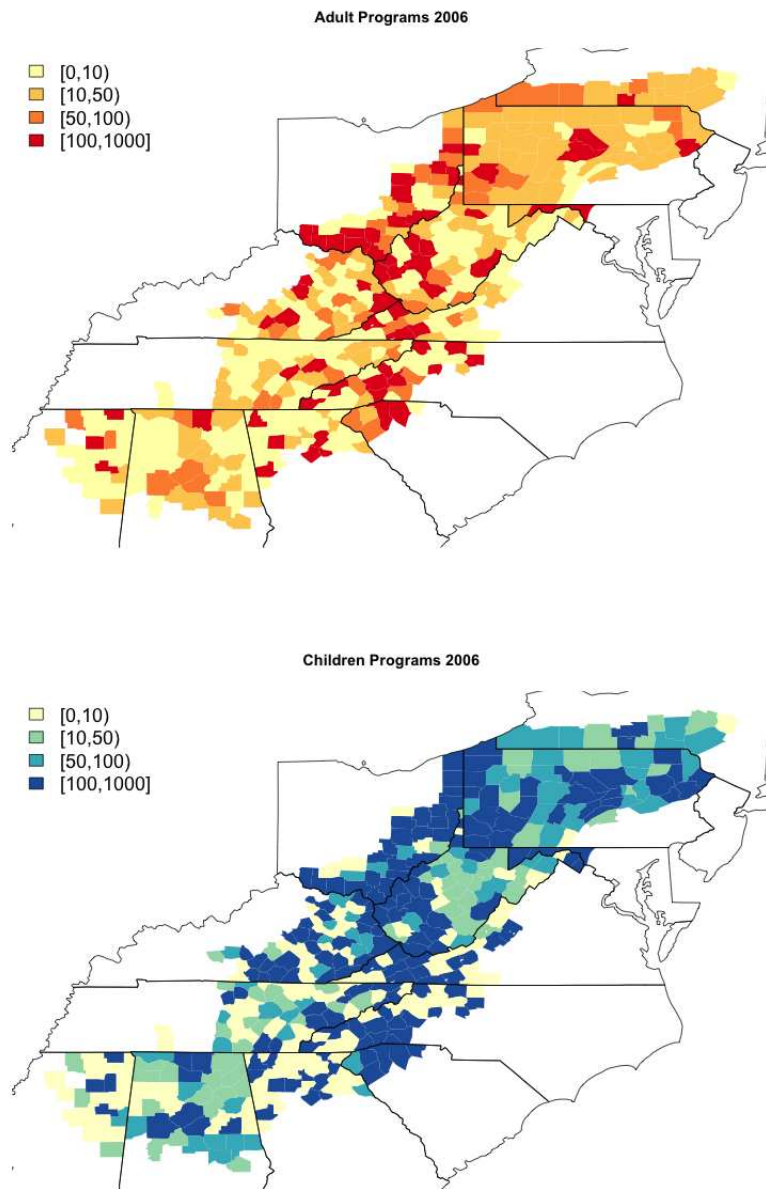
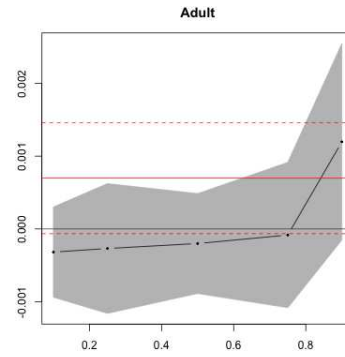Figure 4: Number of Adults and Children Program in 2015
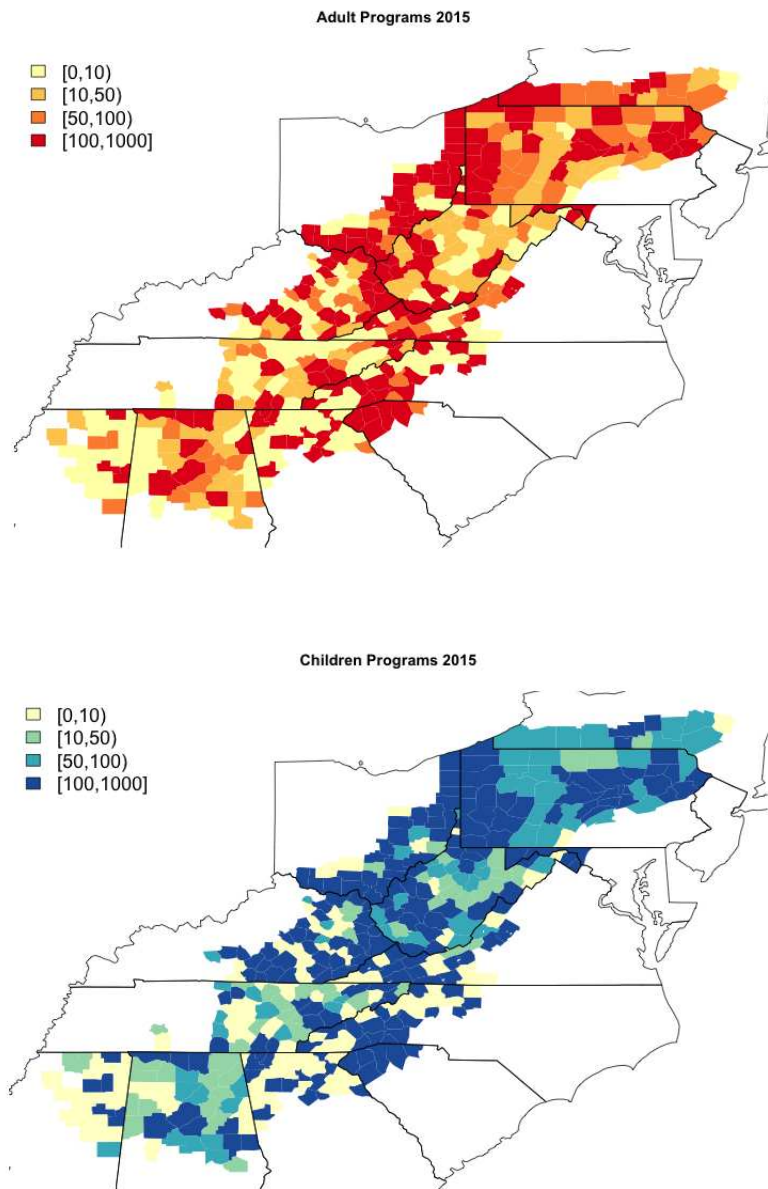
Figure 5: Quantile Regression Results using OLS

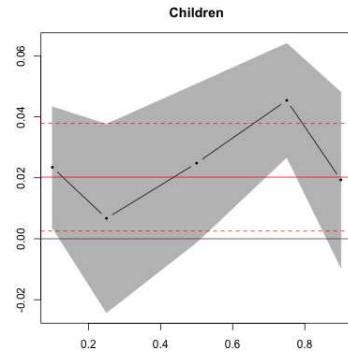## Panel A: Unemployment Rate
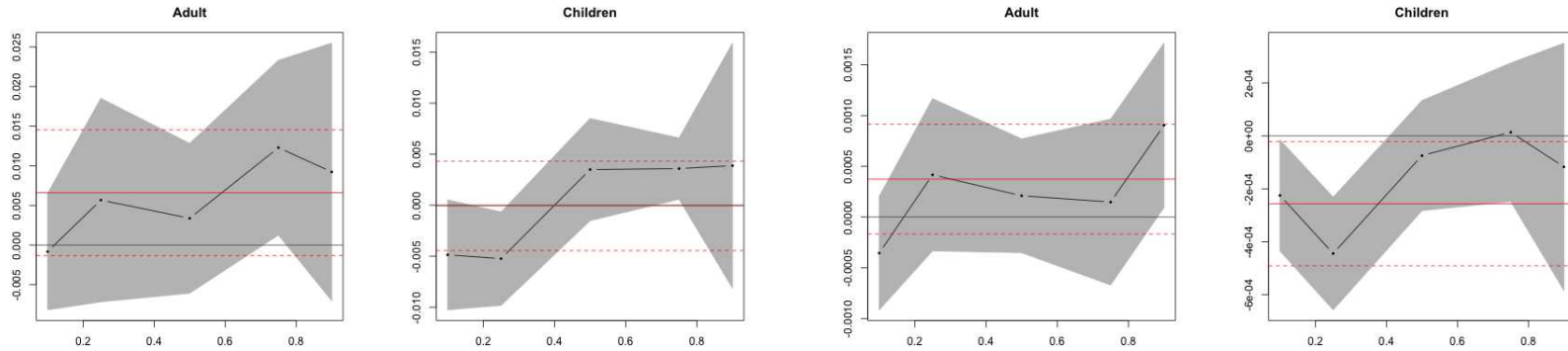
A1: Number of Programs

A2: Participation

PanelPanel B: Labor Force Participation Rate

B1: Number of Programs

B2: Participation
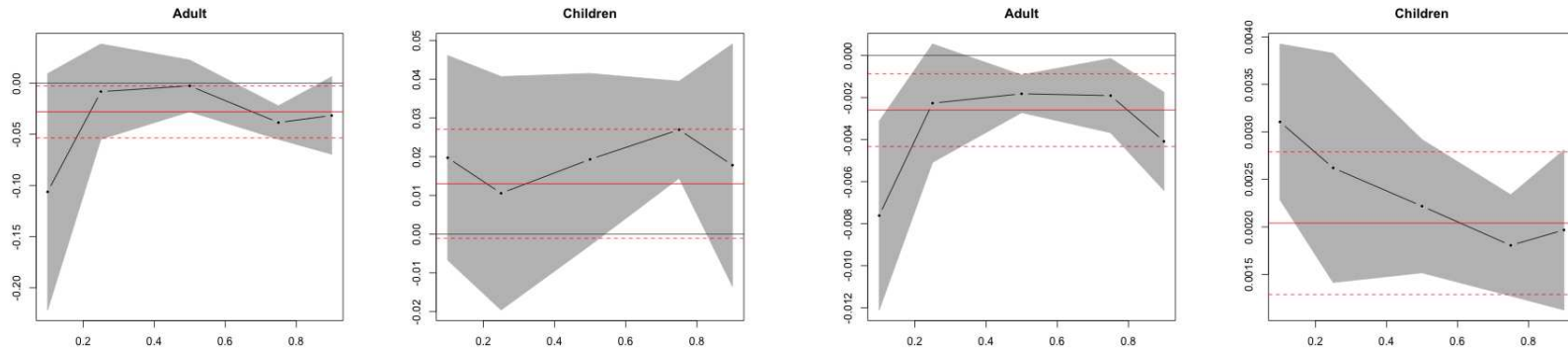
Note: Black dots are the slope coefficients for the each estimated quantile. The solid red line is the least squares estimate, and red dashed line is its confidence interval.

Figure 6: Quantile Regression Results using Predicted Values

Panel A: Unemployment Rate

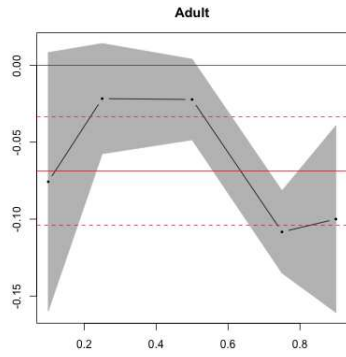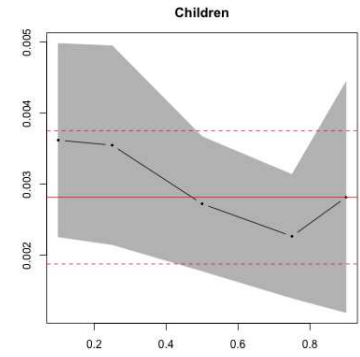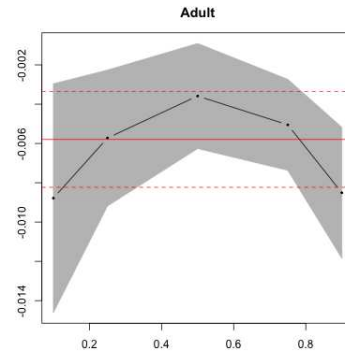A1: Number of Programs · A2: Participation

PanelPanel B: Labor Force Participation Rate

B1: Number of Programs · B2: Participation

Note: Black dots are the slope coefficients for the each estimated quantile. The solid red line is the least squares estimate, and red dashed line is its confidence interval.