



Munich Personal RePEc Archive

Do public libraries impact local labor markets? Evidence from Appalachia

B Ferreira Neto, Amir

Florida Gulf Coast University

9 October 2018

Online at <https://mpa.ub.uni-muenchen.de/110906/>
MPRA Paper No. 110906, posted 15 Dec 2021 00:27 UTC

Do Public Libraries Impact Local Labor Markets? Evidence from Appalachia

Amir Borges Ferreira Neto

Department of Economics and Finance

Lutgert College of Business

Florida Gulf Coast University

10501 FGCU Boulevard South

Fort Myers, FL 33965-6565

em: aborgesferreiraneto@fgcu.edu

ORCID: 0000-0001-9369-4854

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 cyclical to business cycles, i.e. labor market outcomes, I use public library staff and the amount and computers available as instruments. OLS estimates show no effect of adult or children's programs and participation on local labor market outcomes. Spatial econometric estimates provide evidence of indirect effects of adults programs and children participation on labor force participation.

Keywords: Local Labor Market, Labor Force Participation, Public Library, Unemployment, Appalachia

JEL Classification: R59, J64, L39, H40

Acknowledgment: I would like to thank Izabella Barbosa, Christopher Boudreaux, Brooke Conaway, John Deskins, Ricardo Freguglia, Daniel Grossman, Inácio Fernandes, Brad Humphreys, Randy Jackson, Jeffrey Lin, Josh Matti, Larissa Marioni, Eduardo Minuci, Adam Nowak, Hyunwoong Pyun, Amanda Ross, Justin Ross, Juan Sayago, Alexandre Scarcioffolo, Laura Schiavon, Shishir Shakya, Adam Storeygard, Christopher Yench, and Yang Zhou for helpful comments and discussion. I am particularly grateful to Josh Hall for his advice and guidance.

Disclosure statement: This is to acknowledge any financial interest or benefit that has arisen from the direct applications of your research

1 Introduction

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, educational 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. 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, as well as a variety of information about each public library system.²

By focusing on public library programs, this paper first contribute to the literature of urban amenities and its effect, in particular, 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 local labor market literature, in particular, to the active labor market programs (Ashenfelter, 1978) which has been summarized by Heckman et al. (1999), Card et al. (2010), and Card et al. (2018), among others. The ALMP literature

¹For 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.

²A public library system is composed of a central library and its branches and bookmobiles.

mostly focuses on the government programs created by the Area Redevelopment Act in 1961 (LaLonde, 2003). The most relevant results in this literature for this paper are the ineffectiveness of public sector employment programs, and the positive impact of job search assistance programs. In addition, there are 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.

Similar to some of the government programs, most public library adult programs have a focus on employment by helping develop new skills and finding jobs (Bertot et al., 2012; Rainie, 2016). Children’s programs, on the other hand, can have an impact on local labor markets since parents may see public libraries as possible substitutes for daycare services (Smith and Rivera, 2004; Parrish, 2013). Thus, I contribute by focusing on overlooked labor market programs and rural areas, which have lower levels of private and public provided labor market programs.

I restrict my analysis to the Appalachian region. 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).

Library programs and program participation, however, can be endogenous to local labor markets. 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, rendering OLS estimation biased. 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 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 given historical building constraints, and the reduced access to the internet and newer technologies such as e-readers and computers by patrons (Swan et al., 2013; Real and Rose, 2017). On the other hand, librarians without master’s degree are less likely to take on managerial positions hence being responsible to offer and run programs, which should influence the quantity and the selection into specific programs.

The results show adult and children’s program and participation do not affect local labor market outcomes. However, spatial econometric estimations that account for spatial depen-

dence and possible spillovers find suggestive results that there are some indirect effects from adult programs and children’s participation on the labor force participation. These results are consistent with those in the active labor market program literature in that programs are largely ineffective. Given I do not have access to participants data on public library programs, I am unable to explore individual or 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, even though, data limitations prevents the analysis on a more granular level.

2 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. Public libraries have been, and are still, valued by patrons (Wiegand, 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.³ The first economic study on public libraries is Tiebout and Willis (1965) who discuss the public nature of public libraries. 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, 2018).

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, finding 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) investigates the effect of volunteer workers on public libraries’ demand for labor,

³For 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.

and finds a complementary relationship between volunteer work and library staff.

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. However, while in the US these have higher labor force participation, in Appalachia they have lower labor force participation. Although these groups are not directly comparable, this shows suggestive evidence on the uniqueness of Appalachia with respect to its labor market.

This uniqueness of Appalachia is multifaceted. [Durlauf \(2012\)](#) points to poverty traps to explain Appalachia’s persistent poverty and inequality, in particular he focus on educational attainment and migration pattern issues. [Betz and Partridge \(2012\)](#) point that migration in Appalachia has different effects compared to the rest of the United States in that economic growth attracts lower skilled migrants. As pointed by [James and James \(2015\)](#), Appalachia has been dependent of its natural resources, however, it can be a heterogenous region with subregional differences and concentration of self-employment ([Stephens and Partridge, 2011](#)). [Kahn \(2009\)](#) adds that Appalachia misses large cities, and its urban centers are far from high amenity areas. In addition, the region has difficulties in attracting firms and retaining talent. Lastly, [Bollinger et al. \(2011\)](#) concludes that Appalachia suffer from “missing markets” i.e., the lack of high skilled labor and low returns to skill.

Thus, according to the ALMP literature, labor market programs should be effective in areas like Appalachia, with 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.

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 book-mobiles). 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](#)).

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 1 and 2 show the average number of adults and kids programs in 2006 and 2015 for Appalachia.

Because the number of programs and participation are likely endogenous to labor market outcomes I use other library information as instruments for the number of programs and participation. More specifically, I use the number of computer with internet access for public use, and number of librarians without a American Library Association certified Master's degree. The number of librarians without a Master's degree is the difference between the number of librarians and those with a 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, library programs and participation are scaled by county population. The instrumental variables, number of computers and librarians without Master's degree are scaled by the unduplicated service population, which is calculated by the IMLS and represents the service area population without overlapping state service areas.⁴

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 average weekly wage for total manufacturing and total services come from the Quarterly Census of Employment and Wages (QCEW) provided

⁴The analysis with library population scaled by unduplicated service population yields similar results in terms of magnitude, sign and statistical significance and is available upon request.

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 (277) than adult programs (135). Also, the participation in children’s programs (7,269) is on average about three times the participation in adult programs (2,290).

4 Empirical Strategy

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; Manning and Petrongolo, 2017). Two methods to take the three features of local labor market outcomes into account have been proposed: on the one hand, Bailey et al. (2016) suggest 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 presenting an alternative that deals with the three issues concomitantly. I follow more closely the method used by Halleck Vega and Elhorst (2016), Zeilstra and Elhorst (2014) and Rios (2017).

A general formulation of spatial econometric models is

$$\begin{aligned} y &= \rho W y + X \beta + W X \gamma + \varepsilon \\ \varepsilon &= \lambda W \varepsilon + v \end{aligned} \tag{1}$$

where W is the spatial weight matrix used to spatially lag the variable of interest. The spatial autoregressive 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 (SDEM), 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 SDM is a global spillover specification, the SDEM 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), as the main expected spillover effects to work through commuting patterns, thus 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.

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

$$\begin{aligned} y_{ct} &= Lib_{ct}\beta_1 + WLib_{ct}\beta_2 + X_{ct}\delta_1 + WX_{ct}\delta_2 + \mu_c + \varepsilon_{ct} \\ \varepsilon_{ct} &= \lambda W\varepsilon_{ct} + v_{ct} \end{aligned} \tag{2}$$

where y is either the unemployment rate (UR) or labor force participation rate ($LFPR$) in county c and year t . Lib is a vector with the library program variables: average adult and children number of programs per capita, or average adult and children participation per capita. The vector X contains relevant control variables following the previous literature that explains local labor market outcomes such as demographic controls (race, gender and age composition), industry controls (average weekly wage in manufacturing and services as a whole), the time-lagged unemployment rate, and contemporaneous and time-lagged national unemployment rate. μ_c , are county fixed effects; and ε_{ct} is an error term. As noted by [Halleck Vega and Elhorst \(2016\)](#), the inclusion of the common factors (national unemployment rate) precludes the use of time fixed effects due to perfect collinearity. Appendix A show the results using time fixed effects and the results are similar to those in the main analysis.

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 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. The two instruments used are: the average number of computers with internet for public use and the average number of librarians without a Master's degree per served person for program participation. 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, the instruments are regressed on the endogenous variables, also controlling for other control variables used in the second stage, as well as the regional fixed effects.

4.1 Instrument Validity

There is a possible simultaneity of the 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.⁵ Further, public libraries can be used as a policy instrument providing more or fewer programs in response to changes in the local labor markets.

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](#)).⁶

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 variables good candidates for instruments.

Exclusion criteria: According to the [American Library Association \(2018\)](#) there are six occupations in a public library: pages, library assistants or technicians, librarians, library managers, library directors and other professionals.⁷ Librarians should be less susceptible to business cycle fluctuations since education (bachelors and masters degree) is shown to be a determinant in job security ([Hashimoto and Raisian, 1985](#); [Kambayashi and Kato, 2017](#)), and librarians with a Masters degree should be the result of past decision making thus uncorrelated with current regional business cycles.

⁵According 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).

⁶In 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 ballots ([Howard Fleeter & Associates, 2017](#); [Spokane Public Library, 2017](#); [Hrin, 2018](#); [Fallows, 2014](#)).

⁷A *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 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/librarycareersite/typesofjobs>.

The number of computers can be considered a stock variable. Even though the flow⁸ of purchases of (upgrade) computers by libraries vary with budgetary allocation, libraries have physical constraint for storage and use of their materials. This physical constraint from the public library building is likely to be historically determined, thus contemporaneously uncorrelated to both unemployment rate and labor force participation rate.

Relevance criteria: The set of variables chosen also proxy for the quantity and quality of programs and number of programs. According to the American Library Association⁹ a Masters degree is required by employers for most librarian positions. Given the different occupations in public library, one should expect that the librarians with a Masters degree to take on administrative duties as managers and directors, while those without masters degree to be responsible for library programs. Additionally, people, may select into those programs in which the librarian is better prepared, more approachable, or have a better reputation, making it good predictors for participation as well.

On the other hand, computers and internet access are usually required for adult programs focused on job seekers. Also, the amount and quality of inputs (books and computers) available should make it easier to provide more and better programs for both children and adults. Since I have more than one endogenous variable, I compute the heteroskedastic-robust conditional F-Statistics reported in Table 3 Panel C. 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).

5 Results

Table 3 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.¹⁰

The OLS results show no statistical significant correlation between adult’s programs and participation with the unemployment rate and the labor force participation rate. Conversely, children’s programs are negatively and statistically correlated with the unemployment rate and positively and statistically correlated with the labor force participation rate. Children’s participation has a positive and statistical significant correlation with the labor force participation rate. As previously discussed, the OLS estimations are likely endogenous to labor market outcomes, hence the instrumental variable approach. 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.

⁸The Institute of Museum and Library Services (2017) and The Institute of Museum and Library Services (2019) show that for the period in study there is no big change in the kind of collection hold by public libraries, even though changes in the collection have occurred over time.

⁹<http://www.ala.org/educationcareers/libcareers/become>

¹⁰One possible concern is the heterogenous effects across the distribution of labor force participation and unemployment given differential costs associated with the labor market. Appendix C shows results for quantile regressions without the spatial dependence and show no difference across the distribution of labor market outcomes.

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.

Table 4 shows the results for the SDEM model with and without an IV approach.¹¹ The estimated models use an inverse k-near-neighbors weight matrix considering the four nearest neighbors.¹² First I focus on the non-IV and on the statistical significant results. For the unemployment rate, while adult participation is positive correlated with it, children participation has a negative correlation with it. For labor force participation, adult and children's programs have a positive effect on the it; in turn, neighboring adults' programs have a negative effect on the labor force participation rate. As for the participation in public library programs, both children's participation and neighboring children's participation are positively associated with the labor force participation, while neighboring adults participation is negatively associated with it.

Once we take into the potential endogeneity into account, i.e., employ the instrumental variable approach most of the results are not statistically different from zero, similar to the non-spatial model. Only two of the parameters of interest are statistically significant, and only for the labor force participation rate: neighboring adults' program and neighboring children participation. The additional neighboring adults' program per 1,000 served people decreases the labor force participation by 0.131 percentage points, while the additional neighboring children participation per 1,000 served people increases the labor force participation by 0.003 percentage points.

Intuitively, the more adults' programs to help people find job, the less is the cost of looking for jobs and participating in the labor market. However, if adults are selecting into (participating) neighboring counties programs, they may opt out of the labor market or not accept jobs they would otherwise. Children's programs should also reduce the cost of joining the labor market as parents may see public libraries as substitutes for day care (Noble, 1988; Smith and Rivera, 2004) which can be prohibitively expensive, especially for lower-skilled workers¹³ and have to commute to work or actively look for jobs.

¹¹Because the estimation of spatial panel models rely on balanced panels only, the results presented in the main text consider only the 360 counties with public libraries during the all the period of analysis. Appendix B provides estimates considering counties with no public libraries as zero programs and participation. The results are consistent in terms of sign, magnitude and statistical significance.

¹²LeSage and Pace (2014a) argue that the specification of the weight matrices should not have large impact on estimates and inferences.

¹³In response to the use of public libraries as substitutes for day care, some public libraries have imple-

6 Conclusion and Policy Implication

The objective of this paper is to investigate the effect of public library programs in local labor markets. More specifically, 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. Spatial econometric estimates, however, show suggestive result that there is some indirect effect of public library programs and participation.

Policy implications are two-fold. Firstly, in light of the spatial econometric models, the results suggest that public libraries provide not only education services, but also can create other direct and indirect benefits to local communities. In particular, they can help patrons look for, find, and keep jobs. Cutting support to public libraries may result in reduced hours of operation, fewer number of programs and patrons served. Hence, budget cuts can create unwanted consequences in terms of local labor markets outcomes.

Second, children's programs may have both a short- and long-term impact on labor market outcomes. In the short-term they may be used by parents to join the labor market, while also being important for educational outcomes (Bhatt, 2010), which is an important predictor of long-term employment and income. In addition, if adult's are selecting into programs that allow them to find better job opportunities these should spillover into other outcomes such as income and health, for example.

These results should be taken with a grain of salt as they may vary within the population (gender, race, education level, etc.) and across programs. However, in this paper I am unable to test for these heterogenous effects. 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 publicly provided active labor market programs.

References

American Library Association (2018). Types of Library Jobs. Accessed August 28, 2018.

Appalachian Regional Commission (2018). The Appalachian Region. Accessed July 30, 2018.

Ashenfelter, O. (1978). Estimating the Effect of Training Programs on Earnings. *The Review of Economics and Statistics*, 60(1):47–57.

mented the so-called “unattended child policies” which require that children must have a parent (or supervisor, such as an older sibling) at all times whilst in the library.

- Bailey, N., Holly, S., and Pesaran, M. (2016). A Two-Stage Approach to Spatio-Temporal Analysis with Strong and Weak Cross-Sectional Dependence. *Journal of Applied Econometrics*, 31(1):249–280.
- Bertot, J., McDermott, A., Lincoln, R., Real, B., and Peterson, K. (2012). 2011-2012 Public Library Funding & Technology Access Survey: Survey Findings & Report. Technical report, Information Policy & Access Center, University of Maryland College Park, College Park, MD.
- Betts, J. R. (1995). Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth. *The Review of Economics and Statistics*, 77(2):231–50.
- Betz, C. R. and Partridge, M. D. (2012). Country Road Take Me Home: Migration Patterns in Appalachian America and Place-based Policy. *International Regional Science Review*, 36(3):267–295.
- Bhatt, R. (2010). The impact of Public Library Use on Reading, Television, and Academic Outcomes. *Journal of Urban Economics*, 68(2):148 – 166.
- Blanchard, O. and Katz, L. (1992). Regional Evolutions. *Brookings Papers on Economic Activity*, 23(1):1–76.
- Blau, R. (2011). Funding Cuts Closing Book on All 62 branches in Queens Library. *Daily News*.
- Bollinger, C., Ziliak, J. P., and Troske, K. R. (2011). Down from the Mountain: Skill Upgrading and Wages in Appalachia. *Journal of Labor Economics*, 29(4):819–857.
- Card, D., Kluve, J., and Weber, A. (2010). Active Labour Market Policy Evaluations: A Meta-Analysis. *The Economic Journal*, 120(548):F452–F477.
- Card, D., Kluve, J., and Weber, A. (2018). What Works? A Meta Analysis of Recent Active Labor Market Program Evaluations. *Journal of the European Economic Association*, 16(3):894–931.
- Cleaver, J. (2015). New Hartford Library Grapples with Budget Cuts. *Utica Observer Dispatch*.
- Davis, A. (2015). Looming Crisis: Several Local Libraries Preparing for Cuts if State Budget Isn’t Passed. *The Bradford Era*.
- DeBoer, L. (1992). Economies of Scale and Input Substitution in Public Libraries. *Journal of Urban Economics*, 32(2):257–268.
- Dorsey, S. (1991). The Strange Case of the Missing West Virginia Labor Force. *Growth and Change*, 22(3):49–65.
- Dubner, S. J. (2007). If Public Libraries Didn’t Exist, Could You Start One Today? Accessed on July 21, 2018.

- Dunham, K., Goger, A., Henderson-Frakes, J., and Tucker, N. (2005). Workforce Development in Rural Areas: Changes in Access, Service Delivery and Partnerships. Technical report, U.S. Department of Labor. Employment and Training Administration Occasional Paper 2005-07.
- Durlauf, S. N. (2012). Poverty Traps and Appalachia. In Ziliak, J., editor, *Appalachian Legacy: Economic Opportunity After the War on Poverty*. Cambridge, Washington, DC.
- Fallows, D. (2014). What a Library Levy Means to a West Virginia Town. *The Atlantic*.
- Farber, H. S. and Gibbons, R. (1996). Learning and Wage Dynamics. *The Quarterly Journal of Economics*, 111(4):1007–1047.
- Feldstein, K. F. (1976). *The Economics of Public Libraries*. PhD thesis, Massachusetts Institute of Technology.
- Ferreira Neto, A. B. (2018). Charity and Public Libraries: Does Government Funding Crowd Out Donations? *Journal of Cultural Economics*. DOI: 10.1007/s10824-018-9318-4.
- Ferreira Neto, A. B. and Hall, J. (2018). Economies of Scale and Governance of Library Systems: Evidence from West Virginia. *Economics of Governance*. DOI: 10.1007/s10101-018-0215-2.
- Fujiwara, D., Lawton, R. N., and Mourato, S. (2017). The Health and Wellbeing Benefits of Public Libraries. *Economia della Cultura*, (2):203–212.
- Gautier, P., Muller, P., van der Klaauw, B., Rosholm, M., and Svarer, M. (2017). Estimating Equilibrium Effects of Job Search Assistance. *Journal of Labor Economics*. DOI:10.1086/697513.
- Getz, M. (1980). *Public Libraries: An Economic View*. The Johns Hopkins University Press.
- Goddard, H. C. (1970). *A Study in the Theory and Measurement of Benefits and Costs in the Public Library*. PhD thesis, Indiana University.
- Goulding, A., editor (2006). *Public Libraries in the 21st Century: Defining Services and Debating the Future*. Ashgate Publishing Company.
- Green, G. P., Galetto, V., and Haines, A. (2003). Collaborative Job Training in Rural Areas. *Journal of Research in Rural Education*, 18(2):78–85.
- Haaga, J. (2004). Demographic and Socioeconomic Change in Appalachia. Technical report, Population Reference Bureau.
- Halleck Vega, S. and Elhorst, J. (2016). A Regional Unemployment Model Simultaneously Accounting for Serial Dynamics, Spatial Dependence and Common Factors. *Regional Science and Urban Economics*, 60(C):85–95.

- Hammond, C. J. (1999). The Technology of Library Service Provision: A Cost Function Analysis of Public Library Systems in the United Kingdom. *Information Economics and Policy*, 11:271—295.
- Hampton, K. N. (2018). Device Divides, Mobile vs Wired Broadband: The Social Implications for Urban and Rural Communities. available at SSRN: <https://ssrn.com/abstract=3139753>.
- Hashimoto, M. and Raisian, J. (1985). Employment Tenure and Earnings Profiles in Japan and the United States. *The American Economic Review*, 75(4):721–735.
- Heckman, J. J., Lalonde, R. J., and Smith, J. A. (1999). The Economics and Econometrics of Active Labor Market Programs. volume 3 of *Handbook of Labor Economics*, pages 1865 – 2097. Elsevier.
- Hemmeter, J. A. (2006). Estimating Public Library Efficiency Using Stochastic Frontiers. *Public Finance Review*, 34(3):328–348.
- Howard Fleeter & Associates (2017). Analysis of Property Tax Levies for Library Purposes . Technical report.
- Hrin, E. (2018). Library Levy Up for a Vote. *Times West Virginian*.
- Hunt, K., editor (2017). *Library Programs and Services for New Adults*. Libraries Unlimited.
- Isserman, A. M. and Rephann, T. J. (1993). Geographical and Gender Differences in Labor Force Participation: Is there an Appalachian Effect? *Growth and Change*, 24:539–578.
- James, R. D. and James, A. C. (2015). Regional Income Convergence in Appalachia: Exploring the Factors of Regional Economic Growth in a Transitioning Economy. *Southeastern Geographer*, 55(2):164–192.
- Jerrard, J. (2009). *Crisis In Employment : A Librarian's Guide to Helping Job Seekers*. American Library Association.
- Kahn, M. (2009). Cities, Economic Development, and the Role of Place-Based Policies: Lessons for Appalachia. University of Kentucky Center for Poverty Research Discussion Paper Series, DP2009-12.
- Kambayashi, R. and Kato, T. (2017). Long-term employment and job security over the past 25 years: A comparative study of japan and the united states. *ILR Review*, 70(2):359–394.
- Kelley, A. (2015). State Budget Impasse Forces Library Cuts. *WNEP*.
- Kluge, J. (2010). The effectiveness of European active labor market programs. *Labour Economics*, 17:904–918.
- Knight, D. M. and Nourse, E. S., editors (1969). *Libraries at Large: Tradition, Innovation and The National Interest*. R.R. Bowker Company.

- Koenker, R. W. and Bassett, G. W. (1978). Regression Quantiles. *Econometrica*, 46:33—50.
- LaLonde, R. J. (2003). Employment and Training Programs. In Moffitt, R. A., editor, *Means-Tested Transfer Programs in the United States*, pages 517 – 585. University of Chicago Press.
- LeSage, J. P. and Pace, R. K. (2014a). The Biggest Myth in Spatial Econometrics. *Econometrics*, 2:217–249.
- LeSage, J. P. and Pace, R. K. (2014b). What Regional Scientists Need to Know About Spatial Econometrics. *The Review of Regional Studies*, 44:13–32.
- Liu, L. G. (2004). The contribution of public libraries to countries’ economic productivity: a path analysis. *Library Review*, 53(9):435–441.
- Manning, A. and Petrongolo, B. (2017). How Local Are Labor Markets? Evidence from a Spatial Job Search Model. *American Economic Review*, 107(10):2877–2907.
- Noble, K. B. (1988). Library as Day Care: New Curbs and Concerns. *The New York Times*.
- Parrish, T. N. (2013). Libraries Double as Unofficial Day Cares. *Trib Total Media*.
- Patacchini, E. and Zenou, Y. (2007). Spatial Dependence in Local Unemployment Rates. *Journal of Economic Geography*, 7(2):169–191.
- Pesaran, M. (2006). Estimation and Inference in Large Heterogeneous Panels with a Multi-factor Error Structure. *Econometrica*, 74(4):967–1012.
- Pew Research Center (2013a). How Americans Value Public Libraries in Their Communities. Technical report.
- Pew Research Center (2013b). Library Services in the Digital Age. Technical report.
- Pew Research Center (2013c). Parents, Children, Libraries, and Reading. Technical report.
- Pew Research Center (2014). From Distant Admirers to Library Lovers: A Typology of Public Library Engagement in America. Technical report.
- Pfister, R. L. and Milliman, J. W. (1970). Economic Aspects of Library Service in Indiana. Technical report, Indiana University, Bloomington. Graduate Library School. Indiana Library Studies Report 7.
- Pollard, K. and Jacobsen, L. A. (2017). The Appalachian Region: A Data Overview from the 2011-2015 American Community Survey. Technical report, Population Reference Bureau.
- Rainie, L. (2016). Libraries and Learning. Pew Research Center.
- Real, B. and Rose, R. N. (2017). Rural Libraries in the United States: Recent Strides, Future Possibilities, and Meeting Community Needs. American Library Association.

- Rios, V. (2017). What Drives Unemployment Disparities in European regions? A Dynamic Spatial Panel Approach. *Regional Studies*, 51(11):1599–1611.
- Sayago-Gomez, J.-T., Piras, G., Jackson, R., and Lacombe, D. (2017). Impact Evaluation of Investments in the Appalachian Region: A Reappraisal. *International Regional Science Review*. DOI: 10.1177/0160017617713822.
- Sharma, K. R., Leung, P., and Zane, L. (1999). Performance Measurement of Hawaii State Public Libraries: An Application of Data Envelopment Analysis. *Agricultural and Resource Economics Review*, 28(2).
- Smith, L. and Rivera, E. (2004). Turning Librarians Into Babysitters. *The Washington Post*.
- Smith, R. (2015). Cedar Rapids Library Board Hears First Suggestion on Budget Cuts. *The Gazette*.
- Spokane Public Library (2017). Measure No. 1 Library Operations Levy. Technical report.
- Stenberg, P., Morehart, M., Vogel, S., Cromartie, J., Breneman, V., and Brown, D. (2009). Broadband Internet’s Value for Rural America. Technical Report Economic Research Report Number 78.
- Stephens, H. and Partridge, M. (2011). Do Entrepreneurs Enhance Economic Growth in Lagging Regions? *Growth and Change*, 42(4):431–465.
- Stephens, H. M. and Deskins, J. (2018). Economic Distress and Labor Market Participation. *American Journal of Agricultural Economics*. DOI: 10.1093/ajae/aay065.
- Stepleton, I. (2015). Library Will Keep Staff, Hours Intact Despite Cuts. *Ribbon Press*.
- Stine, W. F. (2008). An Empirical Analysis of the Effect of Volunteer Labor on Public Library Employment. *Managerial Decision Economics*, 29:525–538.
- Stock, J. H. and Yogo, M. (2005). Testing for Weak Instruments in Linear IV Regressions. In Andrews, D. W. and Stock, J. H., editors, *Identification and Inference for Econometric Models*, pages 80–108. Cambridge University Press.
- Stratton, P. J. (1976). *Public Libraries: Their Structure, Use and Cost of Service Provision. An Analysis with Special Emphasis on Public Libraries in Illinois*. PhD thesis, Northern Illinois University.
- Swan, D., Grimes, J., and Owens, T. (2013). The State of Small and Rural Libraries in the United States. Technical Report Research Brief series, no. 5 (IMLS-2013-RB-05), Washington, DC.
- The Institute of Museum and Library Services (2017). Public Libraries in the United States Fiscal Year 2014. Washington, DC.
- The Institute of Museum and Library Services (2018). Public Libraries Survey. Accessed on July 18, 2018.

- The Institute of Museum and Library Services (2019). Public Libraries in the United States Fiscal Year 2016. Washington, DC.
- Tiebout, C. M. and Willis, R. J. (1965). The Public Nature of Libraries. In Conant, R. W., editor, *The Public Library and the City*, pages 94–101. M.I.T.. Press.
- Vitaliano, D. F. (1997). X-Inefficiency in the Public Sector: The Case of Libraries. *Public Finance Review*, 25(6):629–643.
- Vitaliano, D. F. (1998). Assessing Public Library Efficiency Using Data Envelopment Analysis. *Annals of Public and Cooperative Economics*, 69(1):107–122.
- Warburton, B. (2013). Libraries Around the Country Under Budget Pressure. *Library Journal*.
- Whitener, L. A. (1991). The JOBS Program and Rural Areas. *Rural Development Perspectives*, 7(2):21–26.
- Wiegand, W. A. (2015). *Part of Our Lives – A People’s History of the American Public Library*. Oxford University Press.
- Woods, D. (2015). Bridgeton Proposes to Close Cumberland County Library. *New Jersey*.
- Zeilstra, A. S. and Elhorst, J. P. (2014). Integrated Analysis of Regional and National Unemployment Differentials in the European Union. *Regional Studies*, 48(10):1739–1755.

Tables and Figures

Table 1: Summary Statistics for Local Labor Market Outcome Variables

Statistic	All Counties	With Libraries	Without Libraries
<u>Panel A: <i>United States</i></u>			
Unemployment Rate	6.96 (2.98)	6.82 (2.95)	7.52 (3.06)
Labor Force Participation Rate	54.73 (8.73)	60.30 (8.37)	57.45 (9.70)
N	31,093	24,861	6,232
<u>Panel B: <i>Appalachia</i></u>			
Unemployment Rate	8.19 (2.80)	8.11 (2.75)	8.47 (2.93)
Labor Force Participation Rate	54.39 (6.85)	54.18 (6.85)	55.76 (6.66)
N	4,200	3,649	551

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	Mean	St. Dev.	Min	Max
<u>Demographic: (N = 4,200)</u>				
Population	59,688	97,312	2,138	1,231,527
Percent Female	0.505	0.017	0.325	0.564
Percent Asian	0.006	0.010	0.000	0.118
Percent Black	0.065	0.111	0.0001	0.826
Percent Other Race	0.002	0.007	0.000	0.151
Percent Two or more Races	0.011	0.005	0.002	0.046
Percent American Indian	0.004	0.015	0.0001	0.280
Percent Latin	0.027	0.032	0.002	0.339
Percent White	0.911	0.114	0.154	0.993
Percent < 15yo	0.178	0.022	0.035	0.288
Percent 15–64yo	0.655	0.026	0.548	0.780
Percent > 64 yo	0.167	0.032	0.059	0.334
<u>Industry/Employment: (N = 4,200)</u>				
Avg. Weekly Wage for Total Manufacturing (\$100s)	7.787	2.153	0.000	21.427
Avg. Weekly Wage for Total Services (\$100s)	5.279	1.073	0.000	11.853
Unemployment	2,070	3,347	36	48,202
Labor Force	28,366	49,901	796	653,196
<u>Library: (N = 3,649)</u>				
Avg. Adult Participation (1000s)	2.290	4.867	0.000	67.848
Avg. Number of Adult Programs	134.985	270.552	0.000	3,988
Avg. Children’s Participation (1000s)	7.169	13.461	0.000	181,539
Avg. Number of Children’s programs	276.558	479.011	0.000	5,480
Avg. Number of Print Materials (1000s)	86.509	126.933	3.375	1,204.317
Avg. Number of Computers	31.714	48.729	0.000	498.000
Avg. Number of Librarians without M.A.	2.740	4.700	0.000	47.880
Unduplicated Served Population (1000s)	41.481	72.675	910.000	894.928

Note: Other Race Population includes non-white, non-black, non-american indian/alaska native, non-asian and, in in this paper the native hawaiian and other pacific islander individuals; Two or more Races include individuals who provided multiple races listed.

Table 3: Results for Library Programs and Participation on Unemployment Rate and Labor Force Participation Rate

	<i>Dependent variable:</i>			
	Unemployment Rate		Labor Force Participation Rate	
	OLS	IV	OLS	IV
<u>Panel A: Programs</u>				
Adults	-0.001 (0.010)	-0.061 (0.091)	0.024 (0.023)	-0.238 (0.251)
Children	-0.010* (0.006)	0.004 (0.077)	0.059** (0.026)	-0.034 (0.184)
R-Squared	0.859	0.854	0.908	0.892
<u>Panel B: Participation</u>				
Adults	0.000 (0.001)	-0.006 (0.009)	0.001 (0.001)	-0.024 (0.026)
Children	0.000 (0.000)	0.001 (0.003)	0.002* (0.001)	0.002 (0.006)
R-Squared	0.859	0.848	0.907	0.879
<u>Panel C: IV First Stage:</u>				
	Programs		Participation	
	Adults	Children	Adults	Children
Robust Conditional F-Statistics	29.48	27.16	17.23	12.83

Clustered standard errors in parentheses at county level. *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 or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, national unemployment rate and time-lagged national unemployment rate, and county fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.

Table 4: Spatial Dependence and Spillovers of Library Program and Participation

	<i>Dependent variable:</i>			
	Unemployment Rate		Labor Force Participation Rate	
	SDEM	SDEM-IV	SDEM	SDEM-IV
<u>Panel A: <i>Programs</i></u>				
Adults	0.008 (0.005)	-0.010 (0.058)	0.021* (0.011)	-0.101 (0.127)
Children	-0.020 (0.003)	0.022 (0.031)	0.053*** (0.008)	0.081 (0.078)
Spatially Lagged Adults	0.012 (0.011)	-0.009 (0.070)	-0.075*** (0.024)	-0.131** (0.062)
Spatially Lagged Children	-0.003 (0.008)	-0.011 (0.033)	0.025 (0.017)	0.033 (0.025)
λ	0.696*** (0.013)	0.646	0.251*** (0.022)	0.241
<u>Panel B: <i>Participation</i></u>				
Adults	0.001* (0.000)	-0.002 (0.006)	0.000 (0.001)	-0.007 (0.013)
Children	-0.001*** (0.000)	-0.001 (0.001)	0.003*** (0.000)	0.004 (0.003)
Spatially Lagged Adults	0.001 (0.001)	-0.002 (0.007)	-0.003* (0.002)	-0.005 (0.005)
Spatially Lagged Children	0.001 (0.000)	0.000 (0.002)	0.003*** (0.001)	0.003** (0.002)
λ	0.696*** (0.013)	0.633	0.252*** (0.022)	0.239

Robust standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01. *Note:* N=3,600 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, national unemployment rate and time-lagged national unemployment rate, and county fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.

Figure 1: Number of Adults and Children Program in 2006

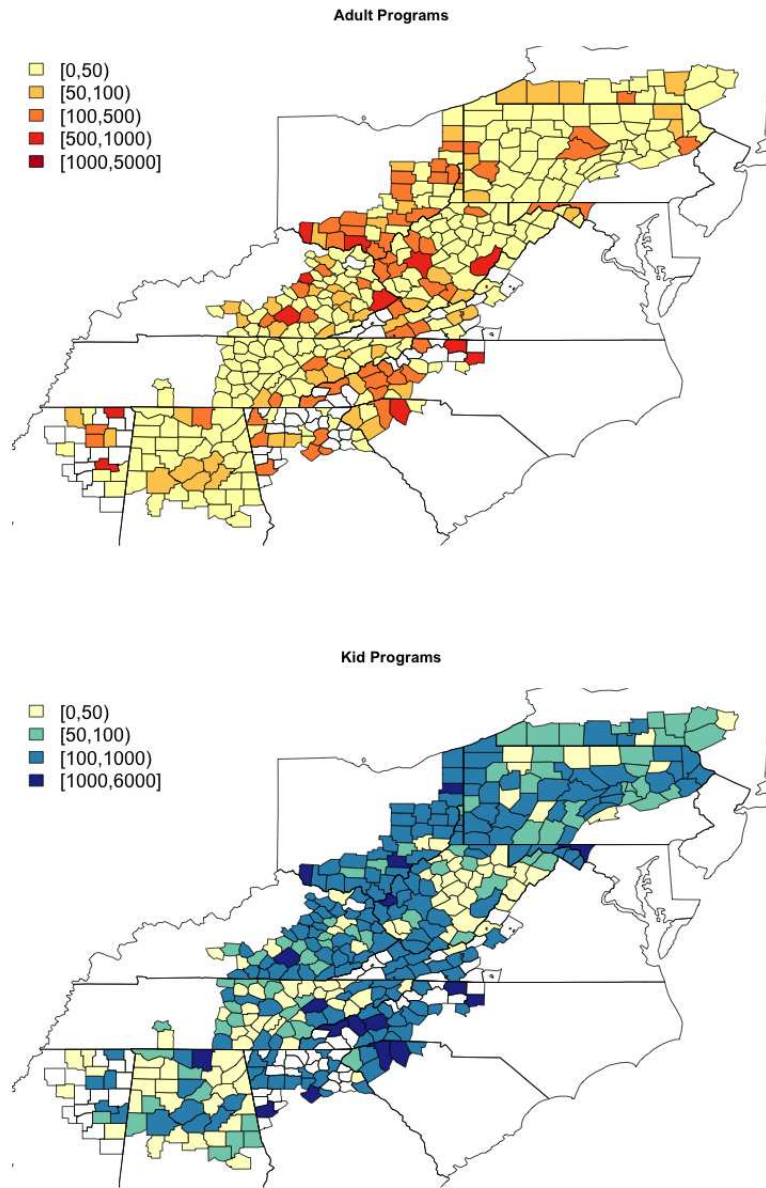
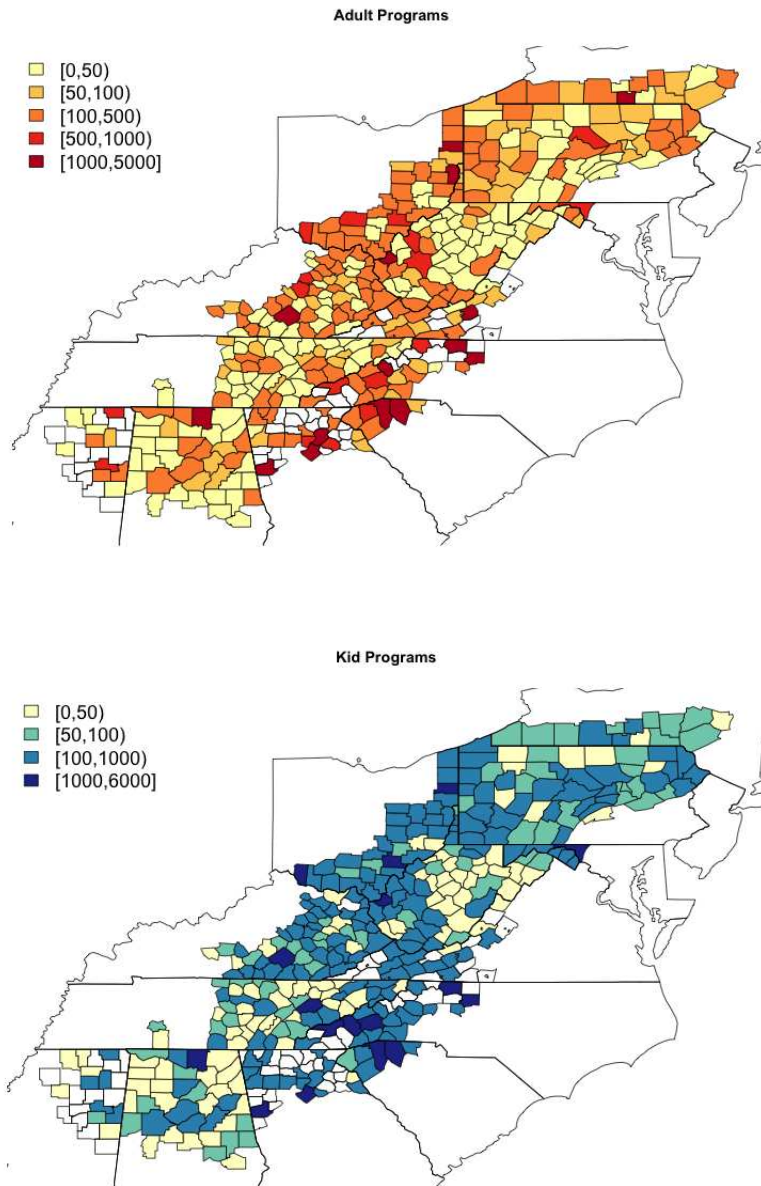


Figure 2: Number of Adults and Children Program in 2015



A Year Fixed Effects

Halleck Vega and Elhorst (2016) notes that time fixed effects only partially accounts for common factors, and that the inclusion of these common factors precludes the use of time fixed effects. In this appendix I provide the results for the use of time fixed effects in lieu of the common factors. The results in table A1 are similar to those in the main analysis.

Table A1: IV Regressions with Year Fixed and No Common Factor

	<i>Dependent variable:</i>			
	Unemployment Rate		Labor Force Participation Rate	
	IV	SDEM-IV	IV	SDEM-IV
<u>Panel A: Programs</u>				
Adults	-0.076 (0.104)	-0.024 (0.066)	-0.019 (0.238)	0.010 (0.142)
Children	-0.002 (0.079)	-0.025 (0.034)	0.086 (0.155)	0.127 (0.082)
Spatially Lagged Adults		-0.027 (0.081)		-0.064 (0.065)
Spatially Lagged Children		-0.015 (0.035)		0.034 (0.023)
λ		0.645		0.216
<u>Panel B: Participation</u>				
Adults	-0.007 (0.010)	-0.003 (0.006)	0.000 (0.023)	0.006 (0.014)
Children	0.001 (0.003)	-0.001 (0.001)	0.003 (0.005)	0.004 (0.003)
Spatially Lagged Adults		-0.003 (0.007)		0.000 (0.004)
Spatially Lagged Children		0.001 (0.002)		0.002 (0.002)
λ		0.639		0.212

Clustered standard errors in parentheses at county level for non-spatial models. Robust standard errors in parentheses for spatial models. *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 or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, and county and year fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.

B No Libraries as Zeroes

The estimation of spatial panel models rely on balanced panels only. In this appendix I consider all non-available (NA) library information as zeroes, thus including all 420 counties in Appalachia. The results are consistent with the main analysis in terms of sign, magnitude and statistical significance.

Table B1: Spatial Models Considering all Counties

	<i>Dependent variable:</i>			
	Unemployment Rate		Labor Force Participation Rate	
	SDEM	SDEM-IV	SDEM	SDEM-IV
<u>Panel A: Programs</u>				
Adults	-0.001 (0.005)	-0.026 (0.051)	0.029*** (0.011)	0.017 (0.110)
Children	-0.009*** (0.003)	-0.024 (0.028)	0.052*** (0.008)	0.109 (0.072)
Spatially Lagged Adults	-0.006 (0.013)	-0.046 (0.080)	-0.077*** (0.028)	-0.083 (0.083)
Spatially Lagged Children	-0.008 (0.008)	-0.027 (0.037)	0.021 (0.019)	0.047 (0.038)
λ	0.734*** (0.012)	0.669	0.342*** (0.020)	0.325
<u>Panel B: Participation</u>				
Adults	0.000 (0.000)	-0.003 (0.004)	0.001 (0.001)	0.004 (0.010)
Children	0.000 (0.000)	-0.001 (0.001)	0.002*** (0.000)	0.004 (0.003)
Spatially Lagged Adults	-0.001 (0.001)	-0.005 (0.006)	-0.004** (0.002)	-0.001 (0.006)
Spatially Lagged Children	0.000 (0.000)	0.000 (0.002)	0.000 (0.001)	0.001 (0.002)
λ	0.734*** (0.012)	0.651	0.343*** (0.020)	0.325

Robust standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01. *Note:* N=3,600 in all regressions. Controls: percent population asian, black, american indian, other race, latin, and two or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, national unemployment rate and time-lagged national unemployment rate, and county fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.

C 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 the empirical model without the spatial dependence for different quantiles of the dependent variable. Particularly, I focus on the 10th, 25th, 50th, 75th and 90th quantiles.

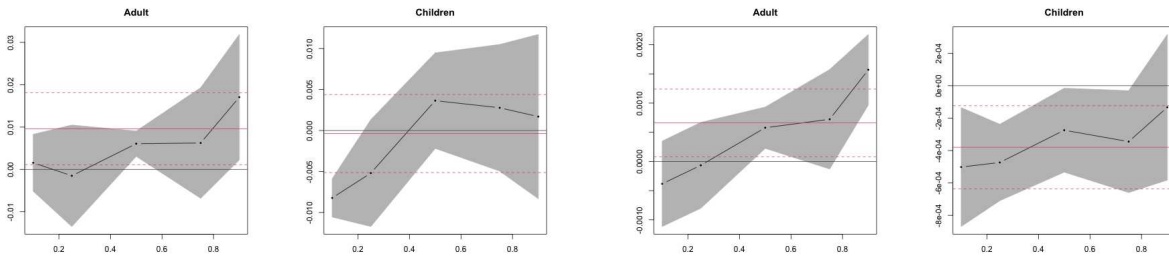
Figure C1 summarizes the results using for the OLS estimates and Figure C2 summarizes the results using the predicted value of the first stage instead. The results in both cases show that the estimates along the distribution are not statistically different from the OLS ones, which corroborates the main results. Because the predicted values are used in Figure C2 in lieu of observable values, one can expect larger confidence intervals for the quantile estimates. Complete results are available upon request.

Figure C1: Quantile Regression Results using OLS

Panel A: Unemployment Rate

A1: Number of Programs

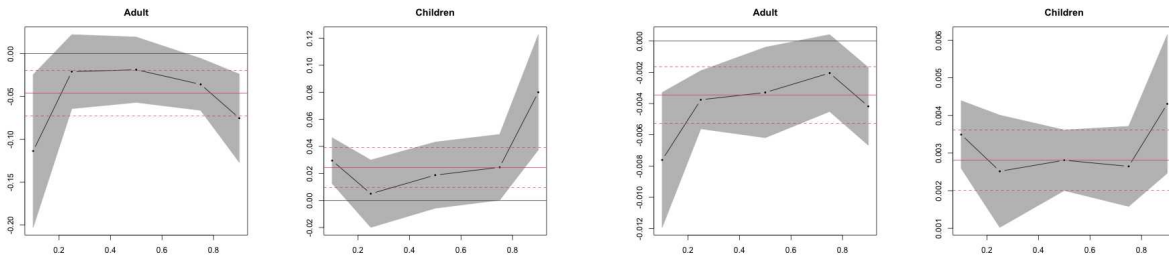
A2: Participation



Panel B: Labor Force Participation Rate

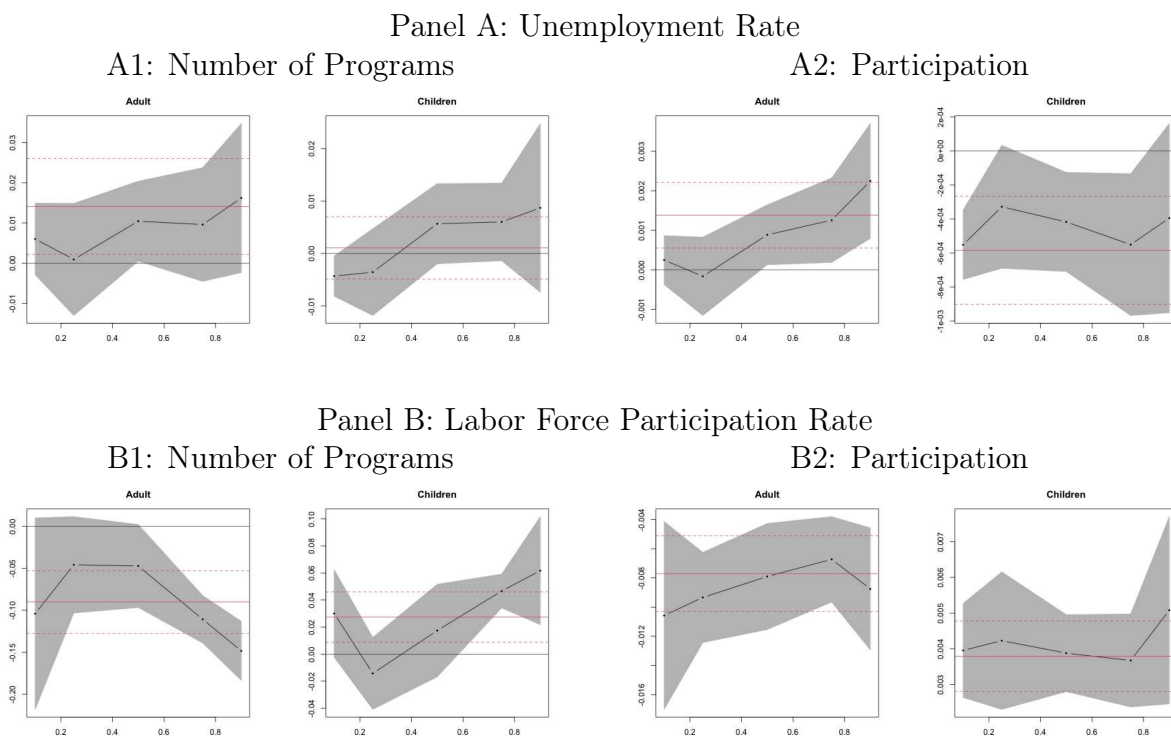
B1: Number of Programs

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. Controls: percent population asian, black, american indian, other race, latin, and two or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, national unemployment rate and time-lagged national unemployment rate, and state fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.

Figure C2: Quantile Regression Results using Predicted Values



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. Controls: percent population asian, black, american indian, other race, latin, and two or more races, percent female, percent population between 15 and 64 years old, 2-year time-lagged unemployment rate, time-lagged average weekly wage on manufacturing and service, national unemployment rate and time-lagged national unemployment rate, and state fixed effects. Instruments: average librarians without masters degree per served population and average number of computers for public use per served population.