

# Bridging the Digital Divide: Challenges and Opportunities in Rural Broadband Access and Adoption in Tennessee

**Sreedhar Upendram, Ph.D.**

Community Economic Development Specialist  
University of Tennessee

**Isabella Baxter, MLIS**

Agriculture and Natural Resources Librarian  
University of Maryland

**Makayla Lerner**

Undergraduate Research Assistant  
University of Tennessee

Making it Count: Applying Science to Support Universal Broadband Adoption  
October 27, 2021

# Outline

- Motivation
- Challenges and Opportunities
- Programs in Tennessee
- Market Power
- Broadband as public good
- Summary and Conclusions

# Motivation

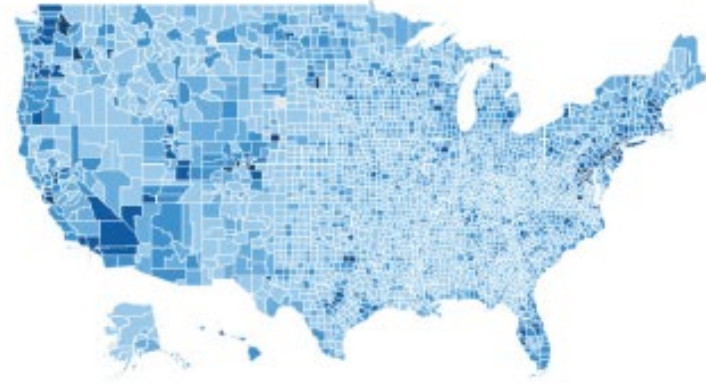
- Anecdotal evidence of families spending time in McDonald's parking lots to access internet, so that children can complete homework
- August 2017 Rural Task Force Town Hall Meeting in Maynardville, TN – opinion poll:
  - Broadband access
  - Opioid issues
- Data on broadband access and inputs from Extension agents across Tennessee

# FCC vs Microsoft data

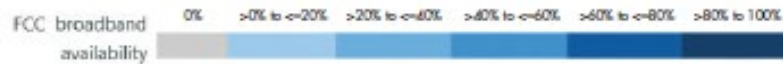
FCC indicates broadband is not available to 24.7M people



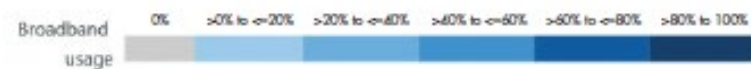
Microsoft data indicates 162.8M people do not use the internet at broadband speeds



\* FCC fixed broadband has or "could" provide greater than or equal to 25Mbps / 3Mbps



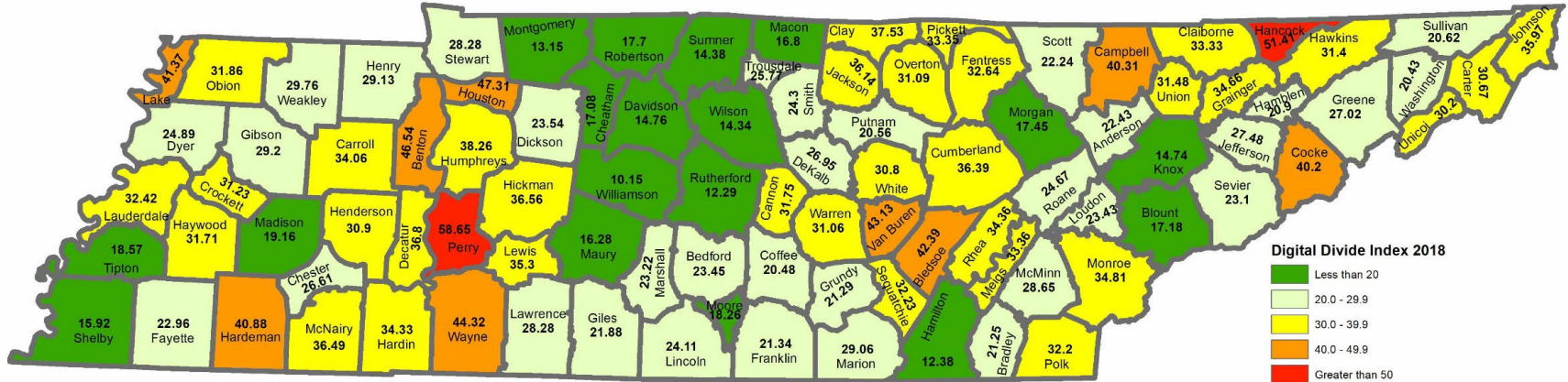
Broadband speed greater than or equal to 25Mbps



Data sources: FCC 2018 Broadband Report based on Form 477 data from December 2016 and Microsoft data from September 2018

Source: Disconnected, The Federal Reserve Bank of Kansas City

# Digital Divide in Tennessee



Source: Purdue 2018 Digital Divide Index

- Digital divide is defined as the gap between underserved communities that have poor or limited internet access and the communities that have relatively better access to broadband internet (25 download/3 upload megabits per second)
- Digital Divide index:
  - An index of 100 indicates highest digital divide and that of 0 indicates no digital divide
  - Tennessee digital divide index ranges from 10.15 to 58.65.
  - Only 53.4% of Tennessee residents in 2019 have adopted broadband

# Challenges

- Barriers to broadband expansion: Tennessee is among 18 states in the U.S. that have barriers in developing municipally owned broadband networks
- Population density:
  - Tennessee: 161.3 people per square mile.
  - Metropolitan counties: 252.3 people per square mile
  - Micropolitan counties: 89.5 people per square mile
  - Non-core counties: 44.9 people per square mile.
- Right-of-way or easements: Slow and laborious
- Topography: Presence of hills, valleys and tree coverage
- Low Adoption and use in rural Tennessee: reliable signal and affordability
- COVID-19 pandemic: broadband access was a huge challenge for many rural students and remote workers

# Library mobile internet hotspot program

- Patrons can check out internet hotspots for 2-3 days free-of-charge
- Compliance with library policy and University of Tennessee Information Technology policy.
- Fill out a short survey on usage, experience and willingness to pay for internet
- Local public libraries administer the program in collaboration with University of Tennessee Extension
- Internet speed tests – University of Tennessee Extension and librarians

## LIBRARY MOBILE HOTSPOT PROGRAM

### WHAT:

You are invited to borrow a Mobile hotspot to access internet at home for 2-3 days and complete a survey as part of a research project

### WHERE:

**Collinwood Depot Branch Library**  
101 East Depot St, Collinwood, TN 38450

### WHEN:

**MAY 15, 2018 - MAY 14, 2019**

### HOW MUCH:

**\$0.00**

#### Contact:

**Sreedhar Upendram**  
Assistant Professor  
2621 Morgan Circle  
227C Morgan Hall  
Knoxville, TN 37996-4518

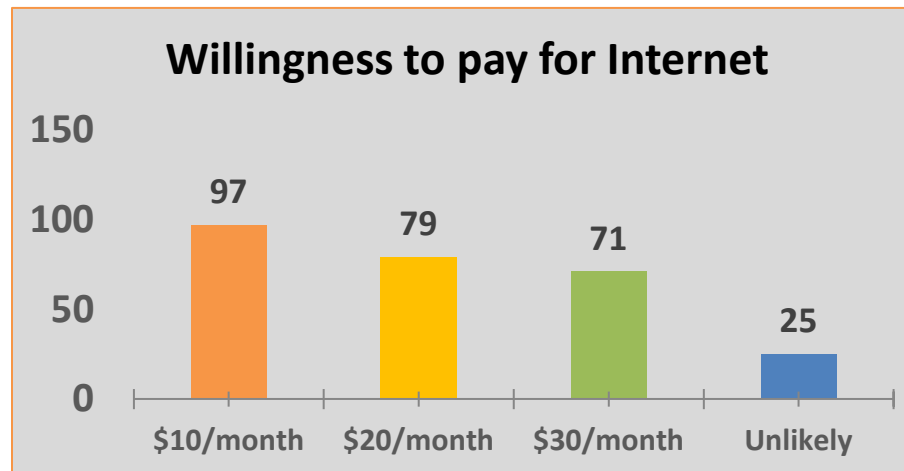
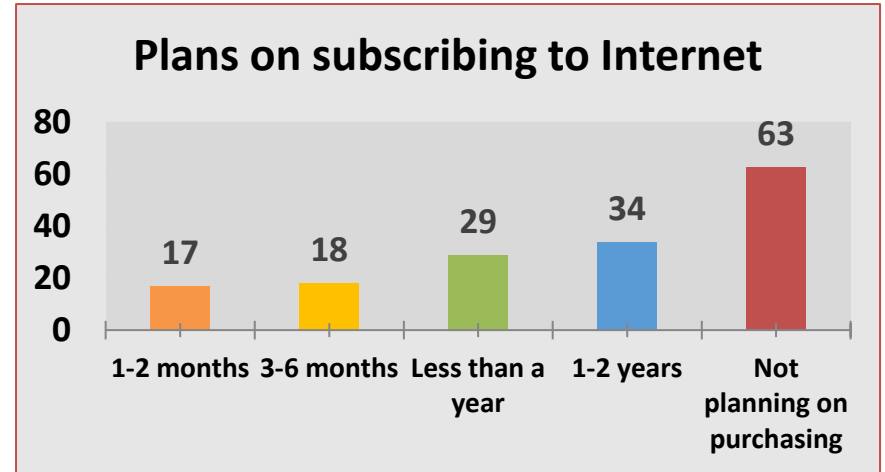
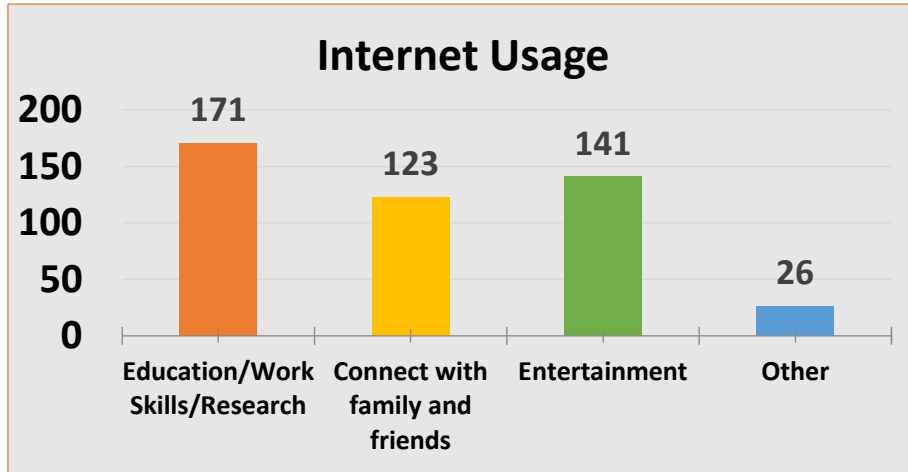
Phone: 865-974-7410

Email: [supendra@utk.edu](mailto:supendra@utk.edu)

#### Sponsored by:

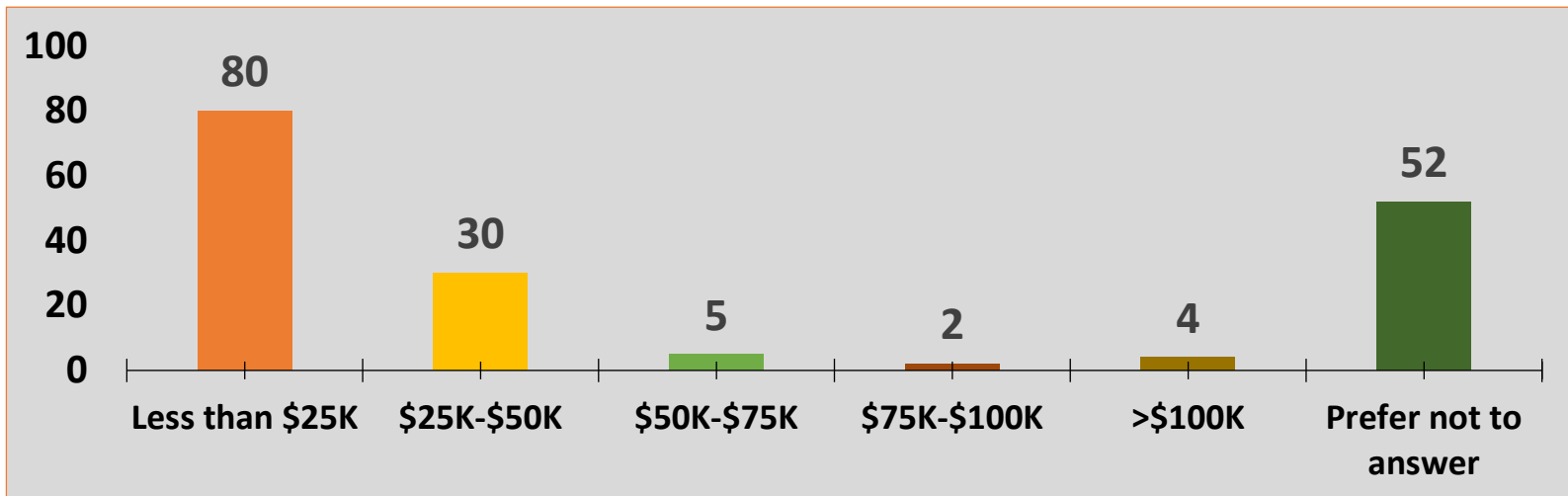
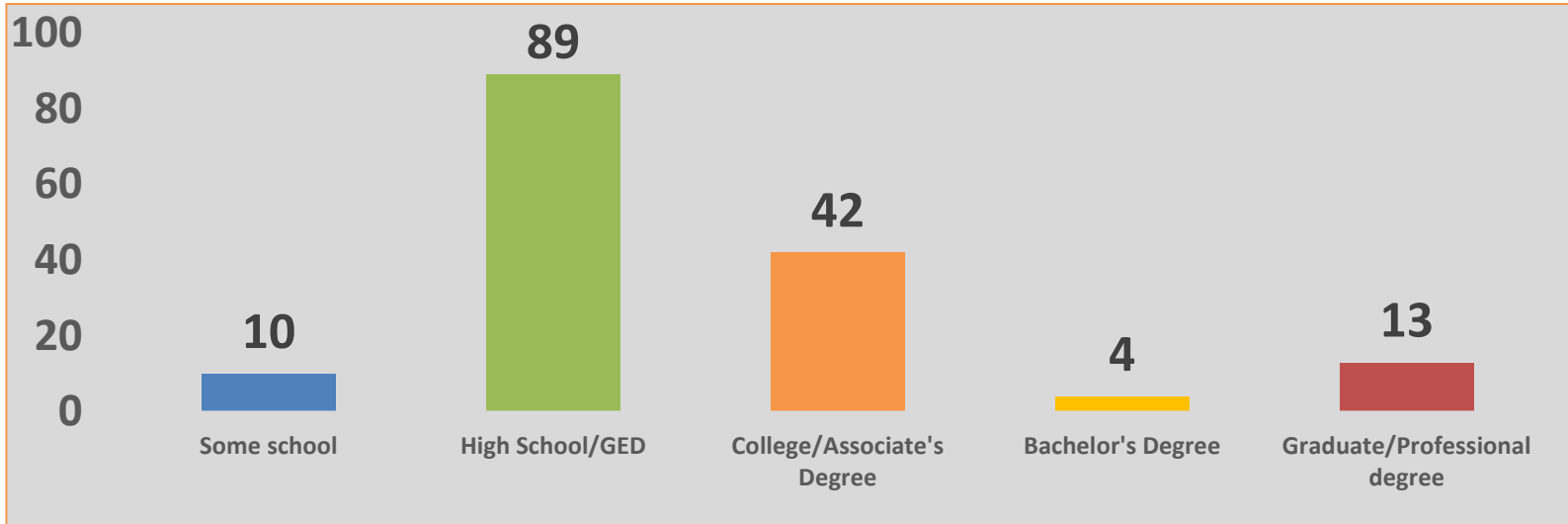
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# Results





# Educational attainment and Income



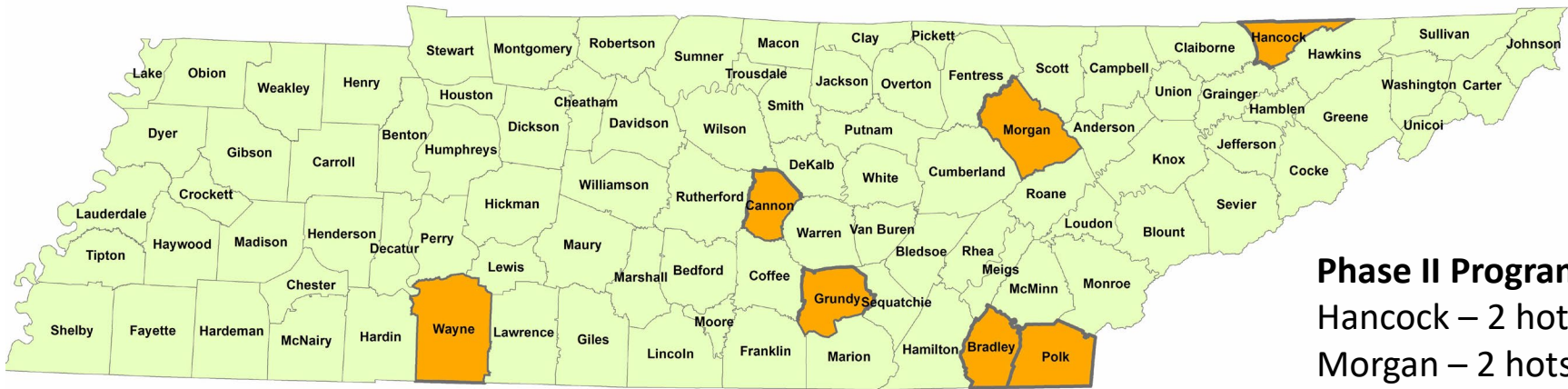
# Limitations

- One of the biggest challenge – internet signal strength – terrain, hills, valleys.
- Sustainability with Federal E-rate program – librarians reluctant due to paperwork
- Buy-in from County Commission and local Government
- Entertainment and social media use – incentivize educational program and training workforce development

# Summary of Past Projects

- Helped 109 families with children to access internet for school work
- Helped 395 adults in rural communities to access internet
- High interest and demand for internet in rural communities in TN – waitlist of 30+
- Over 90% of users highly satisfied and 84% likely to recommend to family/friends
- Findings from this study - leverage funding with State and Federal agencies
- Opportunities to partner with other libraries, school districts, state parks and healthcare providers

# Community Engaged Seed Grant: Access

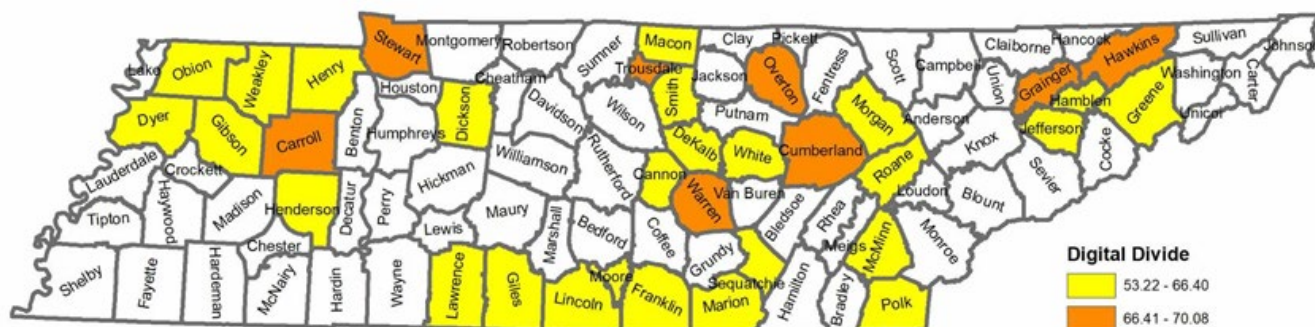


**Phase II Program:**  
Hancock – 2 hotspots  
Morgan – 2 hotspots  
Cannon – 2 hotspots  
Grundy – 2 hotspots  
Bradley – 11 hotspots  
Polk – 2 hotspots  
Wayne – 2 hotspots

- Pilot program had 162 rural households provided with internet access in Hancock, Bledsoe and Wayne counties, by partnering with public libraries. Mobile hotspots were checked out more than 13 times per month, on average.

# One UT Grant: Digital Literacy - Adoption

Year 1: 34 Counties  
Eastern Region: 14  
Central Region: 5  
Western Region: 15



Year 2: 34 Counties  
Eastern Region: 10  
Central Region: 14  
Western Region: 10

\*Counties and years are subject to change

# ARC Grant: Pikeville Downtown Wifi Program



Appalachian Regional  
Commission's Grant -  
[Downtown Wi-Fi Grant](#) -  
\$75,000:

- Offers free internet to residents and visitors for 1 year
- Surveys – business owners, Farmers' market vendors, local government offices and visitors

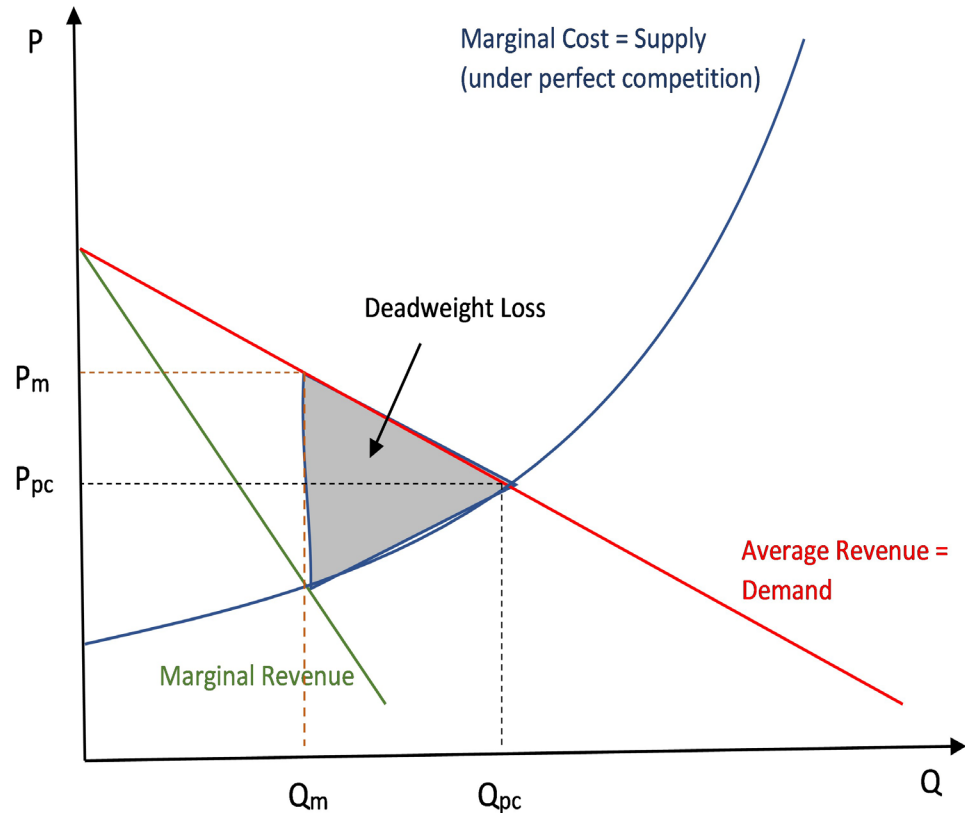
# Market Power

- One ISP provider in many counties
- High broadband prices –\$70+/month
- Prices out most rural and economically distressed households



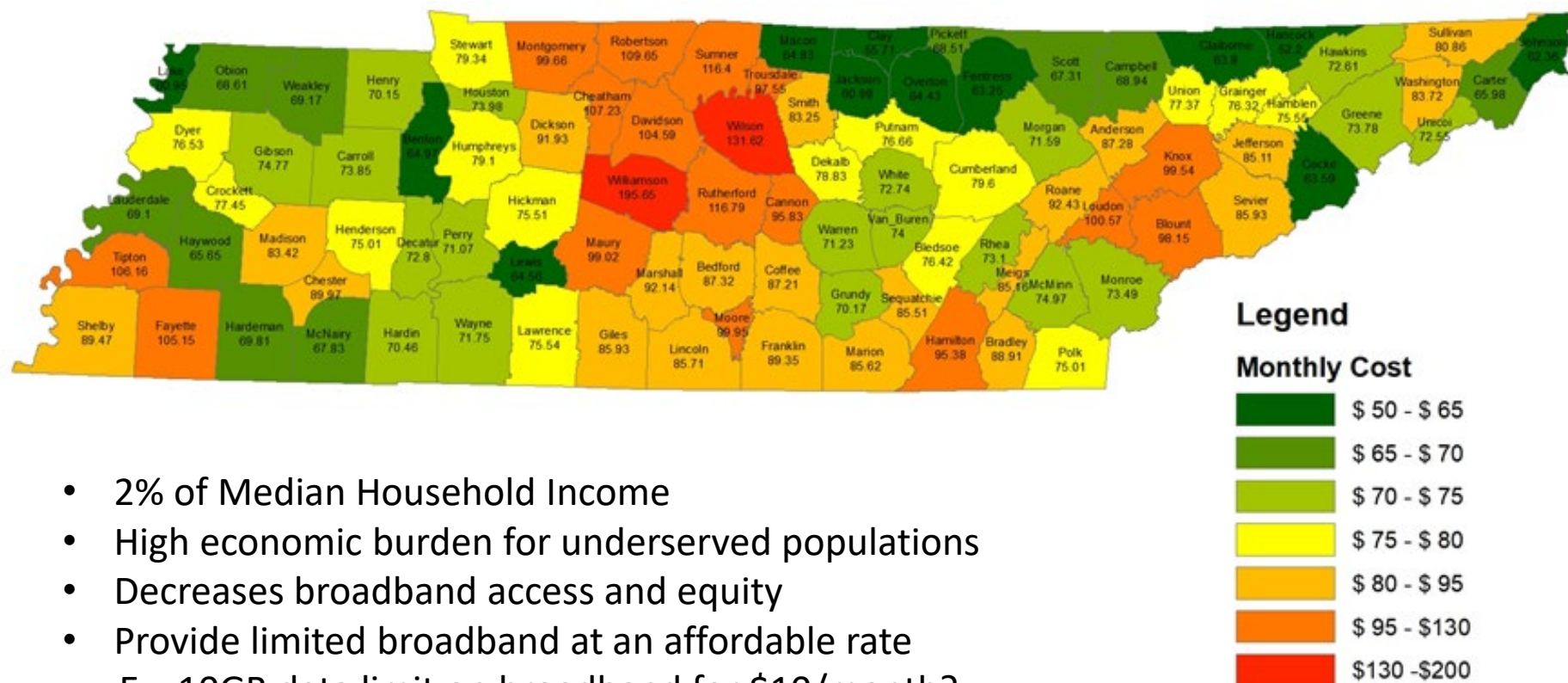
# Perfect Competition vs Monopoly Power

- Market under perfect competition vs monopoly
- Deadweight loss – societal cost due to market inefficiency
- High Price leads to fewer subscriptions, less access and welfare loss
- *Pareto optimal* solutions





# Tennessee Broadband Affordability



- 2% of Median Household Income
  - High economic burden for underserved populations
  - Decreases broadband access and equity
  - Provide limited broadband at an affordable rate
- Ex: 10GB data limit on broadband for \$10/month?

# Broadband that is Non-exclusive and Non-rival

	Exclusive	Non-exclusive
Rival	Private goods Ex: food, clothing, car, house	Common goods Ex: fish in open sea, atmosphere, public waterways, Parks
Non-rival	Club/Membership, Ex: Cable television, gym/clubs	Public goods Ex: Law enforcement, Street lighting, Emergency services

- Non-exclusive: Not exclude individuals from access
- Non-rival: Access of good by one individual does not reduce availability to others
- Internet – public good

# Federal and State Efforts

- Tennessee Broadband coverage map
- Deregulation efforts ongoing:
  - Electric cooperatives providing Broadband
  - Removing regulatory barriers to broadband investment
- Federal investments in broadband expansion
- Tax credits for broadband investment

# Emergency Broadband Benefit

D 145

- Temporary benefit of \$50 - \$75 per month
- One-time discount of up to \$100 for device
- Eligibility:
  - 135% of Federal poverty
  - SNAP
  - Medicaid
  - Lifeline
  - Supplemental Security Income
  - Federal Public Housing Assistance
  - Veterans Pension
  - Survival Benefit or tribal program
  - Reduced lunch or free lunch at school

## Department of Family and Consumer Sciences

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### EMERGENCY BROADBAND BENEFIT

May 2021

*Kimberly Davis, Family and Consumer Sciences Agent  
UT Extension Sequatchie County*

*Sreedhar Upendram, Assistant Professor  
Department of Agricultural and Resource Economics*

On December 27, 2020, the Consolidated Appropriations Act of 2021 became law and established an Emergency Broadband Benefit Connectivity Fund of \$3.2 billion. The Emergency Broadband Benefit (EBB) Program is a Federal Communications Commission (FCC) program to help families and households struggling to afford broadband internet service during the COVID-19 pandemic. This new benefit will help connect eligible households to access educational resources, job-related information, critical healthcare services, virtual classrooms and so much more.

#### Emergency Broadband Benefit Program Provisions

The EBB program will provide a **temporary** discount on bills of up to **\$50 per month** towards broadband service and associated equipment rentals for eligible households and up to **\$75 per month** for households on qualifying tribal lands.

Eligible households can also receive a **one-time discount of up to \$100** to purchase a laptop, desktop computer or tablet from participating providers if they contribute more than \$10 and less than \$50 towards the purchase price.

#### Eligibility for the Emergency Broadband Benefit Program

A household is eligible if a member of the household meets one of the criteria below:

- Has an income that is at or below 135 percent of the [Federal Poverty Guidelines](#) or participates in certain assistance programs, such as Supplemental Nutrition Assistance Program (SNAP), Medicaid, [Lifeline](#), Supplemental Security Income (SSI), Federal Public Housing Assistance (FPHA), Veterans Pension and Survivors Benefit or tribal programs (and you live on qualifying tribal lands);
- Received a federal Pell Grant during the current award year;

# Summary and Conclusions

- Tennessee is updating broadband coverage map
- Deregulation efforts ongoing but slow
- COVID-19 pandemic highlighted consequences of digital divide
- Demand-side management – incentives, subsidies and vouchers for consumers
- More than one ISP in each county can improve access and lower pricing that is affordable
- Treat internet as a public good
- Focus on broadband equity and inclusion
- Research funding for broadband affordability, demand-side policy options, testing market power and finding *pareto optimal* solutions

# References

- [Digital Divide Index – Purdue University](#)
- [Broadband Now – Internet access in Tennessee](#)
- [Community Networks](#)
- [Disconnected – The Federal Reserve Bank of Kansas City](#)
- <https://georgia4h.org/programs/focus-areas/agriculture-stem/science-technology-engineering-math/digital-ambassadors/>

# Questions?

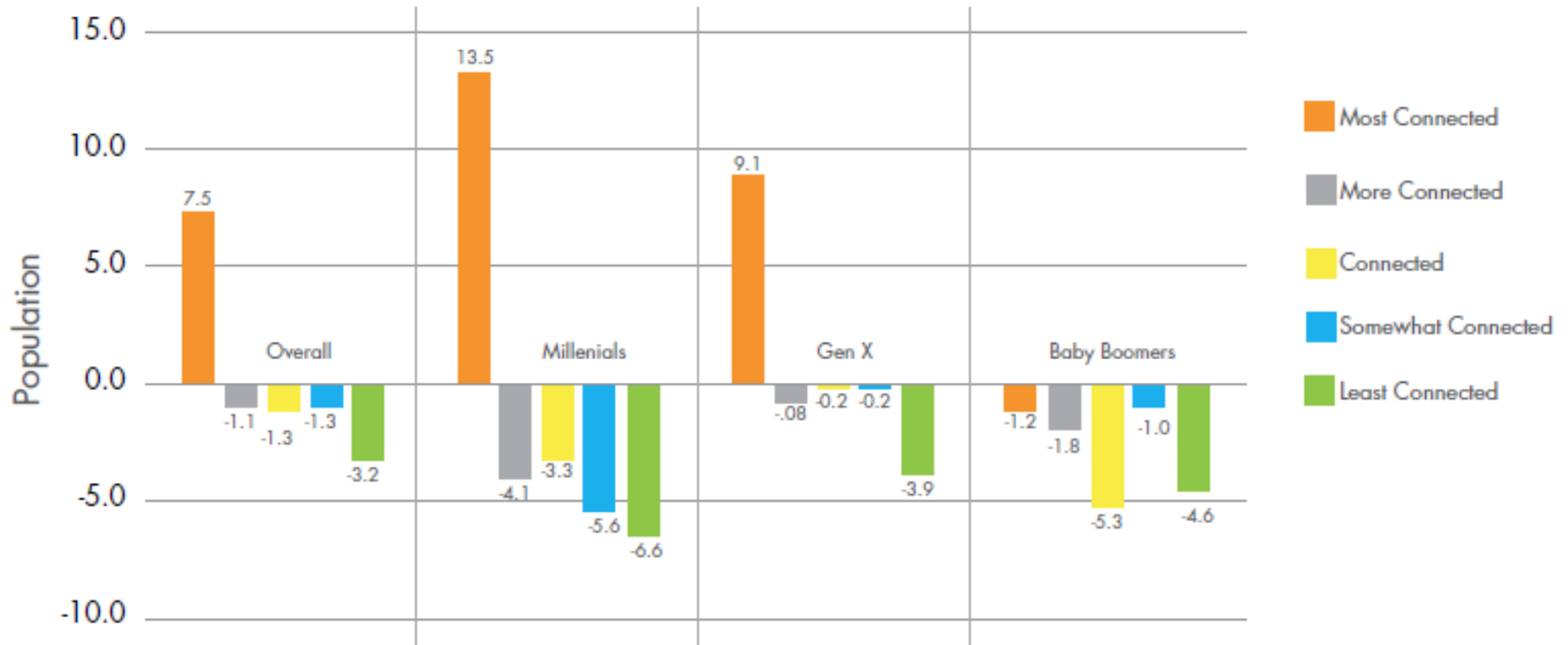
Sreedhar Upendram, Ph.D.  
Assistant Professor  
Department of Agricultural  
and Resource Economics  
227C Morgan Hall, 2621  
Morgan Circle  
Knoxville, TN 37996-4518

865-974-7410 Office  
[supendra@utk.edu](mailto:supendra@utk.edu)

Isabella Baxter, MLIS  
Agriculture and Natural Resources  
Librarian  
William E. Kirwan Hall Math Building,  
Room 2403M  
4176 Campus Drive  
University of Maryland,  
College Park, MD 20742

301-405-9153 Office  
[ibaxter@umd.edu](mailto:ibaxter@umd.edu)

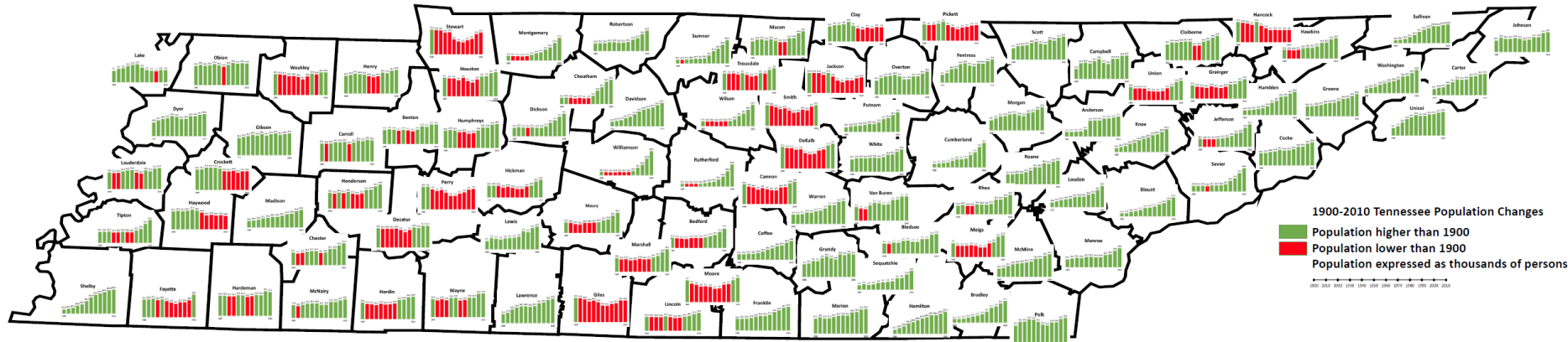
## POPULATION CHANGE IN RURAL COUNTIES BY DEGREE OF CONNECTIVITY



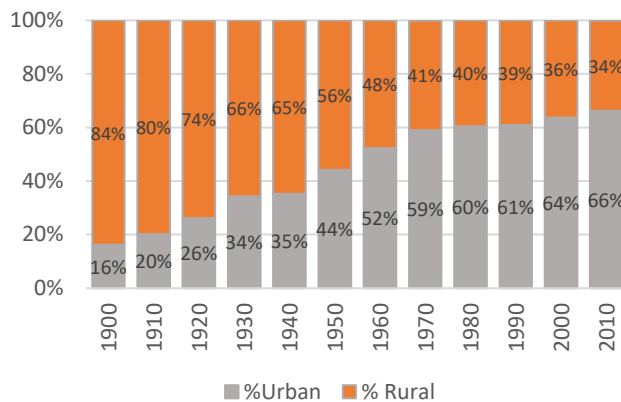
Source: Disconnected, The Federal Reserve Bank of Kansas City



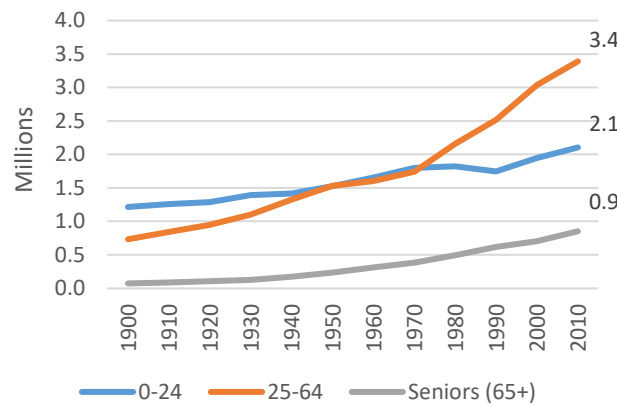
# 1900-2010 Population changes



Rural and Urban as % of population



Population breakdown by age



## Library Mobile Hotspot User Survey

### Internet Use Information

1. What device did you use to connect to the hotspot?  
Select all that apply
  - ☐ Personal laptop
  - ☐ Desktop computer
  - ☐ Smartphone
  - ☐ Tablet (e.g. iPad)
  - ☐ E-reader (e.g. Kindle)
  - ☐ Other \_\_\_\_\_
2. What are your top three uses of internet?
  - ☐ Helping my child with schoolwork
  - ☐ Learning new skills for work/job application/webinars
  - ☐ Connecting with family and friends
  - ☐ Research
  - ☐ Entertainment
  - ☐ Other \_\_\_\_\_
3. Please list three websites you visited using the device
  - ☐ \_\_\_\_\_
  - ☐ \_\_\_\_\_
  - ☐ \_\_\_\_\_
4. Please rate your internet skills (On a scale from 1-10, 1 being poor and 10 being excellent)
  - ☐ Before checking out the device \_\_\_\_\_
  - ☐ After checking out the device \_\_\_\_\_
5. Are you planning on subscribing broadband internet service for your household (in the next):
  - ☐ 1-2 months
  - ☐ 3-6 months
  - ☐ Less than a year
  - ☐ 1-2 years
  - ☐ Not planning on purchasing broadband internet
6. How satisfied are you with the library mobile hotspot lending program (On a scale from 1-10, 1 being poor and 10 being excellent)?  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
7. How likely are you to recommend the library mobile hotspot to a friend or family member? (On a scale from 1-10, 1 being highly unlikely and 10 very likely)?  
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

8. Please indicate the likelihood of purchasing broadband internet service for your household:

	Highly unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Very likely
\$10/month					
\$20/month					
\$30/month					

### Demographic information:

1. What is your year of birth? \_\_\_\_\_
2. How many children live in your household? \_\_\_\_\_
3. How many adults live in your household? \_\_\_\_\_
4. How far do you live from a public library?
  - ☐ Less than 5 miles
  - ☐ 5-20 miles
  - ☐ 20-50 miles
  - ☐ More than 50 miles
  - ☐ Do not know
5. What is your gender?
  - ☐ Male
  - ☐ Female
  - ☐ Prefer not to answer
6. What is your ethnicity?
  - ☐ White/Caucasian
  - ☐ African American
  - ☐ Hispanic/Latino
  - ☐ American Indian
  - ☐ Asian
  - ☐ Other \_\_\_\_\_
  - ☐ Prefer not to answer
7. What is your employment status?
  - ☐ Employed full-time
  - ☐ Employed part-time
  - ☐ Unemployed
  - ☐ Student
  - ☐ Retired
  - ☐ Other \_\_\_\_\_
  - ☐ Prefer not to answer
8. What is your annual household income?
  - ☐ Less than \$25,000
  - ☐ \$25,000-\$50,000
  - ☐ \$50,001-\$75,000
  - ☐ \$75,001-\$100,000
  - ☐ \$100,000 or more
  - ☐ Prefer not to answer
9. What is the highest level of education attained?
  - ☐ Some school
  - ☐ High School or GED
  - ☐ Some College/Associates Degree
  - ☐ Bachelor's Degree
  - ☐ Graduate/Professional Degree
  - ☐ Doctorate
  - ☐ Prefer not to answer

All information collected here is part of a University of Tennessee research project and is completely voluntary. All information will be kept strictly confidential. If you have questions about this survey, please contact Sreedhar Upendram at (865)-974-7410 or UTK IRB staff at (865)-974-7697.

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# Socio-economic data

Site	2017 Population	2017 Poverty rate	2017 Median Household income
Hancock County	6,605	20.8%	\$31,046
Bledsoe County	14,413	14.3%	\$42,398
Wayne County	16,713	16.8%	\$35,951
Tennessee	6,597,381	15.0%	\$53,813

Source: 2013-2017 American Community Survey, U.S. Census Bureau