

# Desert Places:

Cooperatives as infrastructure providers in marginalized areas

Strategy Science Conference

*May 1, 2020*

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# Organization of infrastructure provision

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**Growing interest in organization of activities at the intersection of public and private interests (Mahoney et al., 2009; Cabral et al., 2019; Luo & Kaul, 2019)**

- Infrastructure provision is a key challenge (Ostrom et al., 1993; Hart et al., 1997; Rangan et al., 2006)

**We focus on provision of broadband internet services**

- Digital inequality as a socio-economic concern (DiMaggio et al., 2001; 2004; Greenstein, 2019; Skiti, 2020)

# A growing topic of public conversation

The New York Times

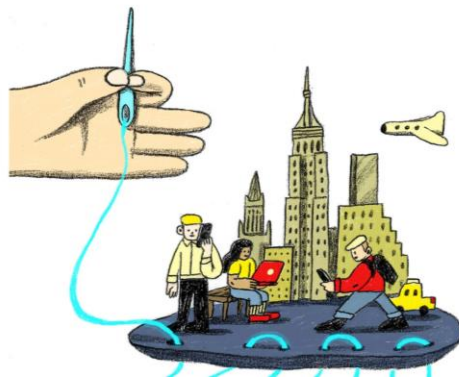
Opinion

## We Need a National Rural Broadband Plan

The government has given a lot of money to major telecommunications companies without much regulatory accountability.

By Christopher Ali  
Dr. Ali is an assistant professor at the University of Virginia.

Feb. 6, 2019



THE NEW YORKER

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ANNALS OF TECHNOLOGY

## THE ONE-TRAFFIC-LIGHT TOWN WITH SOME OF THE FASTEST INTERNET IN THE U.S.

Connecting rural America to broadband is a popular talking point on the campaign trail. In one Kentucky community, it's already a way of life.

By Sue Halpern  
December 3, 2019

Before Shani Hays began providing tech support for Apple from her home, in McKee, Kentucky, she worked at a prison as a corrections officer assigned to male sex offenders, making nine dollars an hour. After less than a year, she switched to working nights on an

# Research question

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## How is the provision of internet broadband best organized?

- Specifically, under what conditions might cooperative providers dominate for-profit firms?
- We answer that question using a comparative governance approach (Coase, 1960; Kaul & Luo, 2018; Luo & Kaul, 2019; Lazzarini, 2019)

# Dual benefits of infrastructure

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## Direct & excludable benefits

- Benefits to those who use the infrastructure themselves
- Potential to charge at point of access

## Indirect & non-excludable benefits

- Externalities generated for others in the community by infrastructure use, e.g., economic development (Banerjee et al., 2012), stronger employment (Hjort and Poulsen, 2019)
- Such externalities are typically ‘bounded’ in nature, available only within the immediate community (Coase, 1974; Ostrom, 1990; Luo & Kaul, 2019)

# For-profits vs. cooperatives

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## For-profit firms

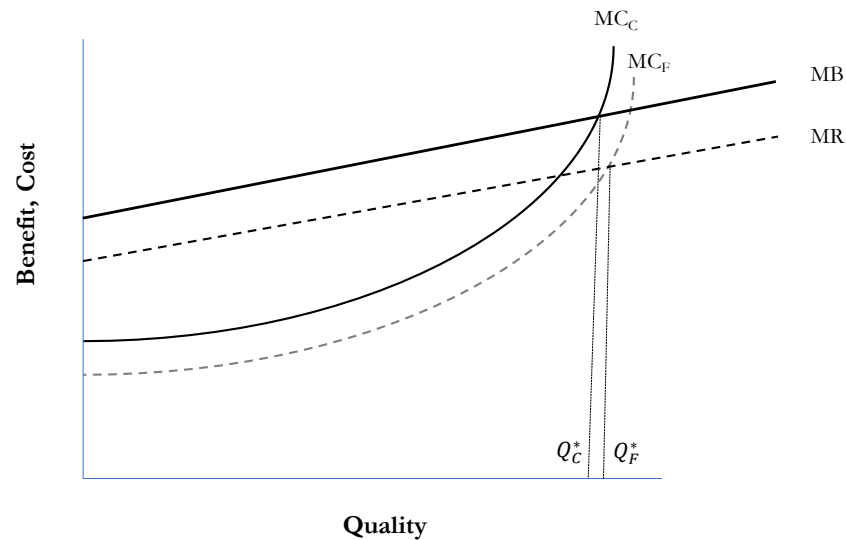
- May have superior efficiency given stronger incentives
- Will only value direct benefits, since they do not capture the value of externalities

## Member cooperatives (Hansmann, 1996; Ingram & Simons, 2000; Yue et al., 2013)

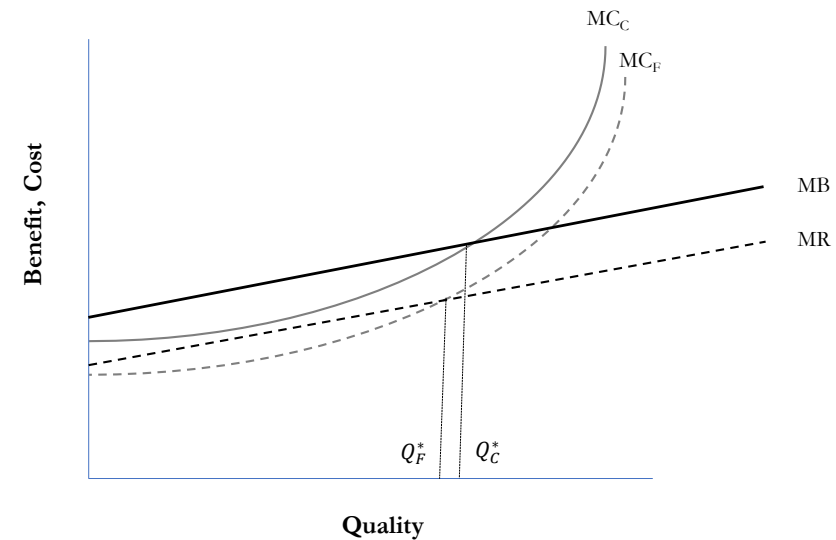
- Internalize local externalities since owners / decision makers are members of the community (Hart & Moore, 1996; 1998; Luo & Kaul, 2019)
- May be less efficient given weaker incentives / group decision making

# Quality of provision by organizational form

## For-profit dominates



## Cooperative dominates

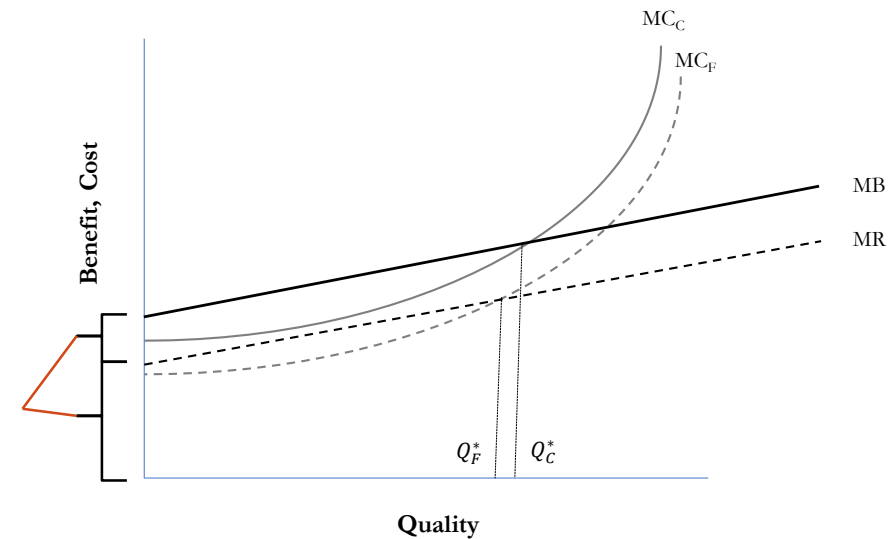


**H1: The lower the quality of for-profit provision, the more likely a cooperative is to enter.**

# Moderating effect of purchasing power

H2: The negative association between for-profit quality and co-op entry is stronger in low-income areas

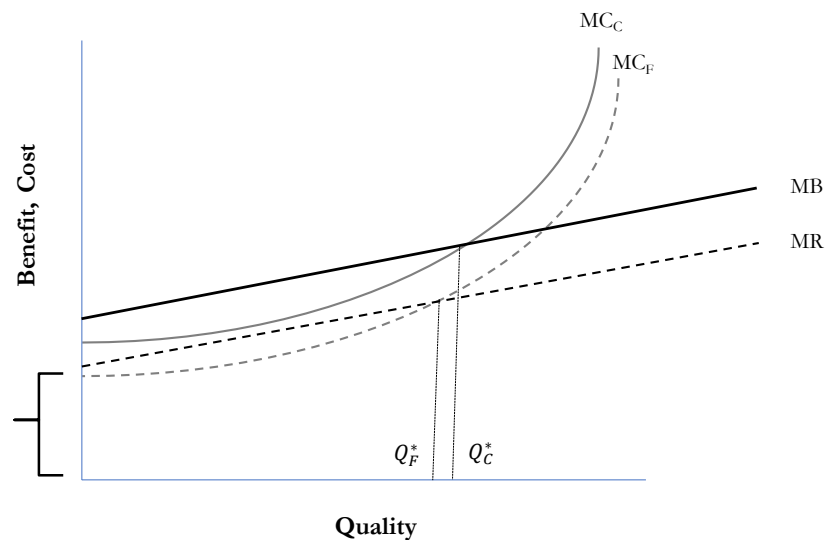
$(MB-MR)/MR \propto$   
Co-op Advantage





# Moderating effect of provision costs

$MC_F(0)/MR(0) \propto$   
Co-op Advantage

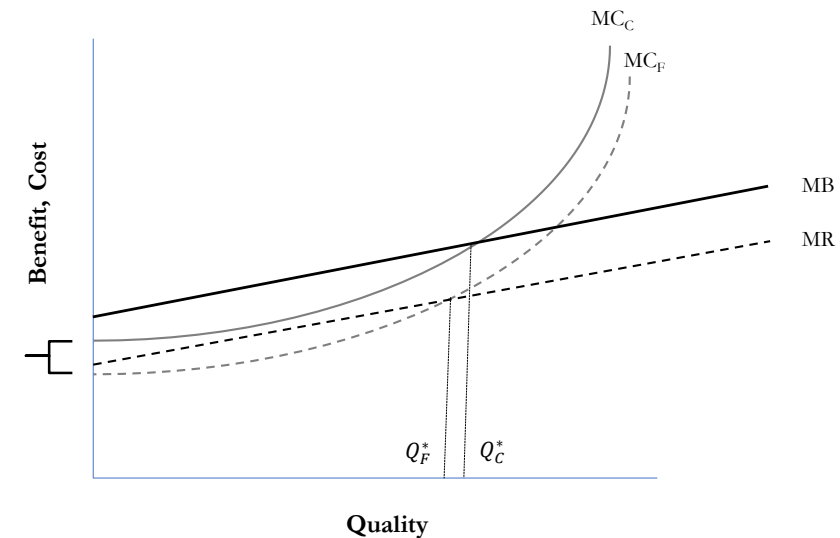


H3: The negative association  
between for-profit quality and  
co-op entry is stronger in rural  
areas

# Moderating effect of cooperation costs

H4: The negative association between for-profit quality and co-op entry is stronger in areas with a) low ethnic fragmentation b) low immigration

$$\frac{MC_F(0)}{MC_C(0)} \propto \text{Co-op Advantage}$$



# Data

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## Broadband provision data from the FCC, 2014-2017

- Comprehensive coverage of the United States at census block level (though we aggregate up to census tract)
- Data include records of provider, provision speed, and technology
- Some issues with data accuracy, but mitigated by panel structure + bias against us

## Hand collect data on ISPs to identify cooperatives

- Match ISP by name to various cooperative databases; also identify municipal providers

# Measures

## Dependent variable

- Entry of co-op provider (in census tract - year)
- Supplementary analyses use high-tech co-op entry, co-op speed

## Independent variable(s)

- For-profit speed (download speed in 100 mbps; average for tract)
- High-tech for-profit presence (high-tech=fiber, fixed wireless)

## Instrumental variable: *Connect America Fund*

- CAF funding for (low-quality) provision in selected areas after 2015
- Funding available only for for-profit providers (= exclusion)

**Final Sample: 285,320 census tract-years; 71,558 tracts**

## Moderators / Controls

- *Median HH income (log)*
- *Urban / Rural*
- *Ethnic diversity*
- *Immigration*
- *Population (log)*
- *Unemployment rate*
- *% over 65*
- *% bachelor's degree*
- *% Native American*
- *Municipal provision*
- *Areas with for-profit business provision*
- *Year FE*
- *Census tract FE*

# Cooperative broadband providers

**Cooperatives have greater coverage in low-income and rural communities, with low ethnic diversity and immigration...**

	For-profit		Cooperative		Muni.gov.		All
High-income	142,517	99.90%	8,064	5.65%	3,615	2.53%	142,664
Low-income	142,379	99.81%	14,173	9.94%	5,680	3.98%	142,656
Urban	177,746	100.00%	3,653	2.06%	3,910	2.20%	177,746
Rural	107,150	99.61%	18,578	17.27%	5,379	5.00%	107,574
High-ethnic diversity	142,568	99.94%	6,161	4.32%	4,153	2.91%	142,659
Low-ethnic diversity	142,328	99.77%	16,076	11.27%	5,142	3.60%	142,661
High-immigration	138,386	99.94%	7,251	5.24%	4,224	3.05%	138,475
Low-immigration	146,510	99.77%	14,980	10.20%	5,065	3.45%	146,845
Total number of census tracts							285,320

	For-profit	Cooperative	Muni.gov.
High-income	168.21	151.81	423.77
Low-income	132.00	189.21	355.88
Urban	169.32	127.56	492.43
Rural	118.25	185.16	302.65
High-ethnic diversity	158.22	147.61	344.93
Low-ethnic diversity	142.00	186.39	412.45
High-immigration	161.46	155.11	422.61
Low-immigration	139.40	185.65	349.11
All	150.12	175.64	382.28

**...and provide higher average speeds in such communities, unlike for-profits**

# Main result

	DV: Coop entry				DV: For-profit internet mean speed/100	DV: Coop entry
	OLS	OLS	OLS	OLS	2SLS	2SLS
	Between	Between	Within	Within	1st stage	2nd stage
	M1	M2	M3	M4	M5	M6
For-profit internet mean speed/100		-0.0175*** [0.001]		-0.0022*** [0.000]		-0.0615*** [0.008]
1. For-profit internet mean speed/100	0.0066***	0.0004***	0.0162***	0.0176***	0.5676***	0.0510***

- Probability of co-op entry increases with decreasing for-profit internet speed, **supporting H1**
- Result holds both between and within census-tracts, and with IV2SLS regression
- Economic magnitude: 1 std. dev. Increase in for-profit mean speed reduces likelihood of coops by 0.3 pctg pt (4.25%)

# Negative association is...

	DV: coop entry							
	High income	Low income	Urban	Rural	High ethnic diversity	Low ethnic diversity	High immigration	Low immigration
	M7a	M7b	M8a	M8b	M9a	M9b	M10a	M10b
For-profit internet mean speed/100	-0.0019*** [0.000]	-0.0018*** [0.000]	-0.0007*** [0.000]	-0.0029*** [0.000]	-0.0012*** [0.000]	-0.0030*** [0.000]	-0.0014*** [0.000]	-0.0028*** [0.000]
Test of differences across split samples[P-val]:	0.04[0.8426]		48.26[0.0000]		41.18[0.0000]		27.46[0.0000]	

...not  
different by  
income level,  
so H2 is not  
supported

..stronger in  
rural areas,  
**supporting**  
H3

..stronger with  
lower ethnic  
diversity,  
**supporting**  
H4a

..stronger with  
lower  
immigration,  
**supporting**  
H4b

# Results with technology based measures are consistent

- Presence of high-tech for-profit is negatively associated with coop entry, **supporting H1**
- Effect is stronger for entry by high-tech coops
- Effect is stronger in rural areas and communities with low immigration

	DV: Coop entry	DV: High-tech coop	DV: Coop entry	DV: High-tech coop
	Full sample analyses			
	OLS	OLS	2SLS	2SLS
	Within	Within	2nd stage	2nd stage
	M11	M12	M13	M14
% covered by high tech for-profit internet	-0.0039*** [0.001]	-0.0050*** [0.001]	-1.4204*** [0.397]	-1.4403*** [0.404]



# Robustness / supplementary analyses

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## Income effects

- Association is weaker for top and bottom quartile income
- Association is stronger for Persistent Poverty Counties

## Continuous DV

- Results using Coop speed as the DV are consistent

## Coop types

- Results hold for internet cooperatives & legacy coops

## Municipal providers

- Municipal provider entry also negatively associated with for-profit quality
- However, association with municipal entry is weaker in low-income, rural, low ethnic fragmentation, and low immigration communities => **opposite of cooperatives**

# Contributions

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## Comparative governance perspective on public-private organizing

- Role of cooperatives (Hansmann, 1996; Hart & Moore, 1996; 1998) in realizing bounded externalities (Luo & Kaul, 2019) through private ordering (Williamson, 1996; Ahuja and Yayavaram, 2011)
- Cooperatives as an organizational form (Ingram & Simons, 2000; Yue et al., 2013; Boone & Ozcan, 2014) in competition with for-profits (Chatterji et al., 2020)

## Infrastructure provision

- Community organization as a (self-sufficient?) ‘third way’ to provide infrastructure (Ostrom, 1990)
- Potential solution to digital inequality in marginalized areas (DiMaggio et al., 2001; 2004; Hsieh et al., 2008; Greenstein, 2019)

# Thank you!

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