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Do Municipal Broadband Networks Stimulate or Crowd Out Private Investment? An Empirical Analysis of Employment Effects

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15.1 Introduction

In March 2015, the FCC granted the petition of the City of Chattanooga Tennessee to preempt a state law that restricts municipally owned broadband ("muni-broadband") deployment (FCC 2015). As was the case for the *Open Internet Order*, the FCC's *Muni-Broadband Order* was preceded by a direct request from President Obama (White House 2015). Much of the debate concerning this action turned on whether the FCC has the legal authority to preempt state laws that restrict or prohibit muni-broadband development. Some legal scholars argue that the only preemption authority at the FCC's disposal, which derives from section 253 of the 1996 Telecommunications Act, concerns preempting state laws that deter entry for private-sector network deployment (Spiwak 2015). As the Supreme Court ruled in *Nixon v. Missouri*, the issue of preemption "does not turn on the merits of municipal telecommunications services" (Nixon v. Missouri 2004).

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To an economist, however, the merits of the policy should dictate the FCC's decision-making. The agency's legal authority to intervene is essential, but not something that lends itself to economic analysis. In response to the D.C. Circuit's ruling in *Verizon*, which provided a potentially alternative source of preemption authority in section 706, Chairman Wheeler stated that "I believe the FCC has the power—and I intend to exercise that power—to preempt state laws that ban competition from community broadband" (Wheeler 2014).

Setting aside the issue of the FCC's legal authority, an economist can ask whether it makes sense for the FCC to preempt state laws that discourage or prevent entry for muni-broadband projects in the first place. Could a state have any reasonable economic basis for discouraging its municipalities from entering the broadband business? If so, then FCC preemption would tend to undercut those reasonable bases. Moreover, if cost-benefit analysis dictates that the best policy is for the FCC to stay out of these affairs—namely, the cost of municipal intervention (for example, deterring private-sector deployment or diverting funding from other priorities) exceeds the benefits (for example, stimulating local economic activity)—the question of legal authority vanishes.

This chapter examines one purported benefit of government ownership of broadband access facilities—namely, stimulation of local economic activity. In Part I, I briefly review the highlights from the economics literature, beginning with what economists have uncovered between private-sector broadband investment and job multipliers (both total multiplier and spillover effects). In contrast, the connection between muni broadband and private-sector employment is harder to find. Economists posit that muni broadband might discourage investment by privately owned ISPs, thereby offsetting any incremental investment from local businesses that exploit the muni network. In Part II, I offer original empiricism that informs this "crowding-out hypothesis." Part III explores the policy implications of these findings.

15.2 Literature Review

The employment effects of capital expenditures in the broadband industry extend beyond the direct employees of the Internet service provider (ISP). "Direct effects" are jobs generated from activities such as installing fiber, while "indirect effects" are job gains associated with communication equipment suppliers. "Induced effects" are the jobs created when the employees of an input provider use their additional income to purchase more goods and services in the local economy. These three effects (direct, indirect, and induced)—collectively referred to as the “total multiplier”—are considered to be the key elements of a traditional analysis of economic impact.

Katz and Callorda (2014) studied the effects of repealing a sales tax exemption in Minnesota on the telecommunications industry. Based on an input-output analysis, they estimate that a $154 million reduction in broadband investment would eliminate 3323 jobs in the state, implying a total job multiplier of 21.6 jobs per million dollars of broadband investment (Katz and Callorda 2014). Audenrode and Sosa (2011) estimated that the effects of reassigning 300 MHz of additional spectrum to mobile broadband would trigger $15.1 billion in new capital spending per year (although the study pertains to mobile broadband, the authors rely on job multipliers derived from wireline services). The authors apply BEA Type II RIMS multipliers to calculate a weighted average of Construction (56%) and Broadcast and Communications Equipment (44%), implying 20.4 jobs for every $1 million invested (Audenrode and Sosa 2011). Using multipliers for telephone apparatus manufacturing (11.8), broadcast and wireless communications equipment (13.8), fiber-optic cable manufacturing (14.4), and construction (26.7), Eisenach et al. (2009) estimated separate multipliers for different types of broadband spending by applying weights to each of the industry multipliers based on the allocation of broadband capital spending to each industry (Singer et al. 2011). Table 15.1 summarizes the relevant literature on the total multiplier effects from broadband investment.

Table 15.1 Summary of total multipliers from broadband investment

Study	Annual investment ($B)	Projected total jobs (000s)	Total multiplier	Method
Crandall and Singer (2010)	30.4	509.5	**16.8**	Multiplier
Audenrode and Sosa (2011)	15.1	307.6	**20.4**	Multiplier
Katz and Callorda (2014)	0.2	3.3	**21.6**	Input-output
Singer and West (2010)	12.7	250.4	**19.7**	Multiplier

Notes Total multiplier is the sum of direct, indirect, and induced effects

Based on the consistency of these estimates, approximately 20 jobs per million dollars of broadband investment is a reasonable predictor of the short-term job impact from a hypothetical broadband deployment.

The total multiplier-based jobs estimate does not account for additional spending in related downstream industries except for those industries that directly benefit from increased spending by broadband input providers. Broadband investment and higher broadband penetration have been shown to create additional, or "spillover" effects in myriad downstream industries, including in healthcare (Meyer et al. 2002) education (Working Party 2009), and energy (Horner 2017), whose ability to enrich and enhance their service offerings is increased by greater availability of broadband internet access (Mandel and Scherer 2012). Broadband spillover effects tend to concentrate in service industries such as financial services and healthcare, yet some have identified an effect in manufacturing as well (Litan et al. 2007). These spillovers have been measured to be roughly equal in magnitude to the direct employment effects generated by broadband investment Katz and Suter (2009). Table 15.2 summarizes the relevant economic literature on spillover effects.

Again, based on the consistency of these findings, it is reasonable to expect a spillover multiplier of slightly over one additional network-induced job per every job created via the total multiplier.

So do muni networks generate the expected employment effects? Muni-broadband deployment has been shown to have no discernible impact on private-sector employment (Deignan 2014). Using a difference-in-difference regression on panel data consisting of 23 years of observations from core-based statistical areas (CBSA), he finds that the private-sector employment effect from muni networks is not statistically significant. To address this paradox, he posits that "physical capital is an important input into the production process, but it does not create economic growth by itself.

Table 15.2 Summary of spillover effects from broadband investment

Study	Annual investment ($B)	Projected total jobs (000s)	Spillover jobs (000s) (spillover multiplier)
Crandall and Singer (2010)	30.4	961.0	452 (**0.89**)
PCIA (2013)	35.5	303.7	194.9 (**1.79**)
Katz and Suter (2009)	6.4	263.9	136.1 (**1.06**)
Atkinson and Schultz (2009)	5.2	498.0	268.5 (**1.17**)

Therefore, public investment plans that focus on end-states, such as attracting a certain business or building a fiber network, are focusing on the inputs of economic growth rather than a root cause, which could end up misallocating resources and encouraging rent-seeking" (Deignan 2014).

Public investment in a service that is competitively provided could perversely discourage future private investment by ISPs, which could have a depressing effect on private employment (Ford 2016). The reason is that publicly owned firms are not profit-maximizers, and thus can be expected to engage in predation (Sappington et al. 2000). From the perspective of an incumbent ISP (or potential entrant), the prospect of competing against a publicly-owned ISP could be sufficient to discourage the next round of investment. Ford notes that "[t]his deterrence effect is particularly pernicious at a time when private providers are undergoing widespread and costly upgrades to their networks. Paradoxically, the resulting lack of private supply may then be used to justify the municipal entry that caused the perceived lack of competition in the first place" (Ford 2016). Accordingly, there can be legitimate economics bases for a state to limit how one city may seek to induce economic migration from another city. As Ford notes, "While it is easy to see a city's leadership wanting to advantage its city over others, it is not clear why the federal and state governments should be complicit in the act" (Ford 2016). Although it might be welfare-reducing on net in cities currently served by private ISPs, muni-broadband may still have a role to play in broadband deployment in markets where private entry is not profitable. Ford concludes that muni-broadband "may be a symptom of the lack of a coherent, economically-informed federal (and state) policy for broadband deployment and adoption in economically-marginal communities" (Ford 2016).

In the FCC's *2015 Preemption Order*, the FCC claimed, without citation to any evidence, that "threat of entry or actual entry of a municipal provider spurs positive responses by the incumbent broadband provider [which] serves the goals of section 706" (FCC 2015). While it is documented that incumbent ISPs react positively (by increasing speeds) to new entry by Google Fiber and other *private* competitors that take profits into consideration when setting prices (Snyder 2015), there is no evidence in the FCC's record to suggest the same reaction will follow muni-broadband investment. Indeed, the FCC acknowledged in its National Broadband Plan that "[m] unicipally financed service may discourage investment by private companies" (FCC 2010). I refer to this theory as the "crowding-out hypothesis."

As noted by Ford, the root cause of any underinvestment in broadband infrastructure is the existence of a positive externality (not captured by ISPs or broadband consumers). ISPs will not deploy to neighborhoods where the private return does not exceed the cost of capital, even when the social return does. More competition in the form of muni-broadband does not treat the problem of underinvestment. To increase the private return, the solution should involve a subsidy to any willing provider, an issue to which I return in Part III.

15.3 Analysis of NTIA Data

To inform the crowding-out hypothesis, I analyzed the Commerce Department's National Telecommunications and Information (NTIA) State Broadband Initiative, which captures deployment data from December 2010 by provider and by download speed. Each observation in NTIA deployment data is at the block-id level, a 15-character FIPS code. The data were aggregated up from the block-id to the county-level based on fastest advertised speed reported by an ISP, which allows one to measure the extent of deployment at a given download speed by a given provider within the county. To focus on the impact of high-speed connections on employment, I omitted observations where the advertised download speeds were less than 10 megabits per second (Mbps).

Next, I categorized a provider-county pair as muni- or privately owned networks based on the name of the provider. For this exercise, I treated any ISP as muni-owned if the provider name in the NTIA data contained any of the following names: "city," "EPB Chat," "Intergovernmental," "North Dakota," or "Tullahoma." The list is potentially under-inclusive, but to the extent that some muni networks are inappropriately categorized as a privately owned network, any differences in the employment effects should be harder to detect. The resulting database yielded 43 provider-county pairs served by a muni-owed ISP and 5817 counties served by a privately owned ISP, respectively, with download speeds in excess of 10 Mbps. Table 15.3 shows the results, broken down by network type and by download speed.

Table 15.3 Number of provider-county pairs by ownership type, by download speed (December 2010)

Download speeds	Muni networks	Private networks
Greater than 10 Mbps and less than 25 Mbps (7)	9	3896
Greater than 25 Mbps and less than 50 Mbps (8)	2	525
Greater than 50 Mbps and less than 100 Mbps (9)	4	806
Greater than 100 Mbps and less than 1 Gbps (10)	18	233
Greater than 1 Gbps (11)	10	357

Notes Numbers is parenthesis correspond to NTIA speed classifications

As of December 2010, there were only ten counties that were served by muni networks capable of reaching 1 gigabit per second (Gbps) download speeds; by comparison, 357 counties enjoyed such speeds from privately owned ISPs. Nearly 3900 counties were served by a privately owned ISPs with speeds between 10 and 25 Mbps.

Finally, I merged this county-level 2010 deployment data with county-level nonfarm private-employment data in 2010 and 2013 from the Bureau of Economic Analysis (BEA 2013). For each county, I computed the cumulative average growth rate (CAGR) in private-sector employment from 2010 to 2013. Table 15.4 shows the results for the sample of privately owned networks.

For these private-sector deployments, one cannot detect any economically significant divergence from the sample average CAGR in private employment growth (1.17%) until the network reaches download speeds of 50 Mbps (9–10 bin); in those counties, private-employment grew at 1.34%. The Gigabit counties (11+bin) appear to enjoy faster job growth relative to the average (1.28%), but not noticeably different from counties served by 50 Mbps. The observed positive correlation between privately owned network speeds and private-sector employment growth does not imply that deployment causes job creation. Causation could be going in the other direction—that is, ISPs may be choosing to deploy a fast network in a city based on an informed guess of future employment growth. Teasing out the direction of causality is beyond the scope of this chapter, but could involve a two-stage regression model in which an instrument is used to predict broadband deployment in stage one.

Table 15.5 replicates the above analysis for counties served by muni networks as of December 2010. Because there were only 34 such counties with access to speeds above 25 Mbps, I combine speed categories before computing the average CAGR; else the average CAGR for a given category would be based on too few observations. Unlike the results for private-sector deployment in Table 15.4, one cannot detect any economically significant

Table 15.4 2010–2013 private-sector employment growth for counties served by a privately owned network provider in 2010

Low speed	High speed	CAGR (%)
7	8	1.12
8	9	1.25
9	10	1.34
10	11	1.27
11	+	1.28
ALL		1.17

Table 15.5 2010–2013 private-sector employment growth for counties served by a muni-owned network provider in 2010

Low speed	High speed	CAGR (%)
8	11	0.96
9	11	0.96
10	11	1.00
ALL		1.17

lift, relative to the sample average of 1.17%, in trailing nonfarm-private employment in these counties. Indeed, trailing private-sector employment growth in muni-served counties appears to underperform the sample average CAGR. Once again, discerning causation is difficult. Hard-hit municipalities (say, with high unemployment) could be selecting public deployments to spur job creation, which would create the false impression that muni networks undermine job growth in a simple correlation analysis. But by using the same metric to gauge employment effects, Tables 15.4 and 15.5 combined lend support to the crowding-out hypothesis. Clearly, more econometric inquiry is needed.

15.4 Policy Implications

The sizable total-employment and spillover effects estimated in the literature suggest that the broadband industry should be nurtured and encouraged. Rather than subjecting ISPs to "light-touch" common-carrier regulation, which raises the specter of rate regulation and unbundling and thereby potentially discourages investment, regulation should be truly light-touch; episodes of discriminatory conduct should be assessed on a case-by-case basis, while bans on new business models and non-discriminatory pricing strategies should be avoided.

Relative to the socially optimal level of broadband investment, the private sector will likely underinvest in the presence of positive externalities, as implied by the significant spillovers. Accordingly, a subsidy on buildout costs (for example, a tax credit for fiber) or a demand-based subsidy (for example, covering the expense of broadband for low-income households) is in order. Barring ISPs from participating in the value created for edge providers, by setting the price of interconnection and paid priority to zero, perversely exacerbates underinvestment caused by externalities.

With respect to the wisdom of government ownership, because muni networks do not appear to generate the same private-sector employment effects as privately owned networks, municipalities cannot cite private employment gains as a benefit of government provision. The finding here is consistent with prior findings in the literature, and consistent with the crowding-out hypothesis that muni networks, which by construction are not profit-maximizing, discourage privately owned networks.

This is not to say that there are no benefits of muni networks. In the absence of any network, a muni network could stimulate economic development and permit residents to develop valuable skills. And there is evidence that muni networks stimulate public employment; some public employment is better than no public employment. Yet public employment can also be stimulated through roads and bridges. Thus, the relevant policy question is how best to spend public resources. Economics counsels that public resources should be allocated to, among other things, *public goods*, such as national defense or lighthouses, which will be under-provided by private parties due to their non-excludable nature. But because broadband (like satellite television) is excludable via a pricing mechanism, including congestion pricing, broadband is closer to a *club good*, which can be profitably provided albeit at significant markups over marginal cost (to cover the large upfront costs). Again, a subsidy that moves broadband adoption toward the socially optimal level (accounting for the positive externalities) is the best course under these circumstances.

Finally, statewide obstacles to funding muni networks could serve as a way for cities to temper their demand for new networks, in the same way that states would prefer that cities temper their demand for new sports stadiums. Muni-broadband should be a last resort for municipalities that cannot be served profitably by private ISPs.

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