The Partnership Decision:
Examining Municipal Wireless Broadband Networks in the U.S.

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Broadband (high-speed) access to the Internet has changed the way we communicate, transact in global marketplace, and engage in civic affairs. The FCC (2010) regards broadband as "transforming the landscape of America more rapidly and more pervasively than earlier infrastructure networks.…Broadband is *the* great infrastructure challenge of the early 21st century" (FCC 2010, p. 19). Estimates reveal that one-third of U.S. households are without broadband access.[1] Some households elect not to participate in the digital domain, but others cannot participate due to lack of broadband infrastructure or high cost of access. In response, municipalities across the U.S. have deployed municipal wireless broadband networks.

Business models to provide wireless broadband vary across municipalities. Some have partnered with private firms to share cost, risk, and administrative burden while others have chosen to provide wireless access as a public service, akin to a municipal utility supplying electricity or water. This paper focuses on the provision mechanism to address why some municipalities choose to partner with a private firm to provide wireless broadband while others choose to publicly fund and operate the service. In doing so, this study offers insight into the demographic and institutional factors that influence policymakers to pursue public-private partnerships.

Municipal wireless implementation has been primarily studied from a telecommunications policy or engineering perspective (Tapia, Kvasny and Ortiz 2011; Tahon et al., 2010; Bar and Park 2006; Gillett, Lehr, and Osario 2006; Lehr, Sirbu, and Gillett 2006; Sirbu, Lehr, and Gillett 2006). Little research has incorporated a public administration perspective (for exceptions, see Park and Lee 2010; Jain, Mandviwalla and Banker 2007; Shaffer 2007), yet there are implications for public management and policy resulting from the growth in this new public service. With nearly 170 local governments with operational wireless broadband networks in the U.S. (Vos 2010), the mere novelty and rate at which municipalities are entering the wireless broadband market is compelling. This is phenomenon is

[1] Merely estimating broadband coverage in the U.S. is problematic. The FCC has long been under fire for erroneously reporting that 99% of Americans had broadband access, arriving at this figure by claiming that at least one household in 99% of zip codes reported access to a high-speed Internet service provider (Bosworth 2008). Recognizing the perils of biased reporting, Congressed pass The Broadband Data Improvement Act of 2008 and charged the FCC with improving the quality of the data on broadband access.

perplexing, in part, because the last three decades has been marked by a contraction in public service offerings by local governments. Similarly, municipal broadband networks are likened to a public utility, and the dominant trend in public utilities has been deregulation and privatization (Bar and Park 2006). While municipalities are devolving service provision in some areas, they are expanding their portfolio by developing wireless broadband services. For municipalities entering the market to correct for disparate access, the implications for public policy and management can be profound as the Internet has arguably become an essential tool for navigating business and personal affairs, to include seeking employment, further education, and engaging in civic activities. Providing an understanding of the variation in delivery mechanisms will offer insight into the market approaches to providing this innovative public service.

MUNICIPAL WIRELESS BROADBAND NETWORKS

This section begins with a brief history of municipal broadband networks in the U.S. Next, the federal policy environment and mechanics of broadband implementation are outlined. Rationales for municipal entry into the wireless broadband market are then discussed. Finally, arguments against municipal broadband networks are identified.

Municipal wireless broadband has had a tumultuous history in the U.S. In the early 2000s, wireless broadband technologies were quickly evolving, new firms were entering the market to provide the service, and cities, counties, and states were exploring large-scale deployment plans. The promise of low-cost broadband infrastructure, compared to steep infrastructure costs for wired broadband, made wireless solutions particularly attractive.

The exponential growth in the municipal wireless market halted during the Great Recession (2007-2009). Emerging programs were among the first to be cut in public agencies and private firms scaled back development as credit markets froze. In early 2009, the U.S. Congress enacted the American Reinvestment and Recovery Act (ARRA) in an effort to stimulate the economy. ARRA included $7.2 billion in appropriations "to expand broadband access and adoption in communities across the U.S., which will increase jobs, spur investments in technology and infrastructure, and provide long-term economic benefits" (broadbandusa.gov 2012). The injection of federal funds has helped to renew interest in municipal broadband networks and revive shelved projects.

Broadband implementation was funded through ARRA investment to alleviate disparate access in U.S. communities. The FCC has long ranked broadband access among its highest priorities. FCC policy on broadband developed during the George W. Bush administration states that “All Americans should have affordable access to robust and reliable broadband products and services. Regulatory policies must promote technological neutrality, competition, investment, and innovation to ensure that broadband service providers have sufficient incentive to develop and offer such products and services” (FCC n.d.). The National Broadband Plan goes even further in justifying the need for affordable universal broadband access, noting “access to broadband is the latest challenge to equal opportunity.” (FCC 2010, p. 129).

Federal interest in broadband access is rooted in equitable access, but justified based on the benefits that high-speed access to the Internet provides.

> Like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. It is enabling entire new industries and unlocking vast new possibilities for existing ones. It is changing how we educate children, deliver health care, manage energy, ensure public safety, engage government, and access, organize and disseminate knowledge” (FCC 2010, xi).

The Pew Internet & American Life project finds that when Americans have broadband, they not only use the Internet more, but “They more actively participate in the online commons by creating and sharing content. They change the way they allocate their time and they feel better about the internet’s role in their lives” (Pew 2005, 67). Furthermore, federal policy reflects the notion that digital inclusion through broadband access is a necessity for participating in the economy of the 21st century. “Broadband can be a platform for significant economic, cultural and social transformation, overcoming distance and transcending the limitations of one’s physical surroundings… broadband can help create opportunity” (FCC 2010, p. 129).

Broadband is most commonly supplied to homes and businesses via high-speed cable modems and digital subscriber lines (DSL). During the 1990s, private firms, principally cable and telephone providers, were responsible for laying the “last mile” of fiber to the home, thereby providing the infrastructure for broadband access. The last mile represents the costly extension of fiber between the residence and the back-end infrastructure that supplies broadband service. The telecommunications market bust in 2000 decreased the rate of expansion of fiber to residential homes in the U.S. and forced a reduction in new capital investment. As a result, the U.S. currently lags behind other industrialized nations in per capita broadband penetration (OECD 2011). "[T]here's valid concern that the private sector will fail to invest in providing for next generation services or that when such services are available, they will fail to be sufficiently competitive" (Lehr, et al. 2006, 7). Arguably, it is the lack of private investment that is spurring this new wave of public action to address the deficiency in broadband access in local communities across the nation.

The primary source of broadband access continues to be cable modem and DSL, but advancements in wireless technology have changed the market landscape. Wireless solutions, principally Wi-Fi, and WiMax[2] are attractive to municipalities primarily given the relative low acquisition cost and ease of implementation. Three dominant reasons are identified for achieving affordability in wireless technologies: (1) Wi-Fi[3] operates in unlicensed spectrum (WiMax operates in either licensed or unlicensed spectrum),[4] which means that there has been high participation in developing solutions in this area; (2) strong levels of interoperability through industry-led early efforts to standardize technology; and (3) low unit cost for equipment – spurred in large part through the mass integration of Wi-Fi chipsets in laptops and mobile devices (Bar and Galperin 2004).

Technology for enabling the wireless access requires a power source - such as street lights, traffic signals, and utility transformers. This is where municipalities benefit because unlike private providers, they have unfettered access to these sites and do not have to negotiate access rights (Bar and Park 2006). Wireless technologies are also easier to execute as compared to wired solutions because with wireless

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[2] WiMax operates similarly to Wi-Fi but over a wider area. Wi-Fi is a LAN with service range of 100 yards whereas WiMax covers a broader service area (3 to 30 miles), however it can be less successful than Wi-Fi for indoor use (Holcombe 2006). Municipal wireless networks are sometimes a combination of the two technologies (e.g., Houston).

[3] Wireless local area networks (LANs) are commonly referred to as Wi-Fi (Wireless Fidelity). Wi-Fi is utilized by multiple users and operates in unlicensed radio bands (FCC 2004). Not all wireless networks are Wi-Fi, however the municipal networks described in this proposal are Wi-Fi networks.

[4] Wi-Fi operates in a band of radio frequency within the electromagnetic spectrum that is unlicensed by the FCC, making it affordable and widely accessible.

implementation, disruption and repair of infrastructure (roads, sidewalks, etc) is avoided.[5] The cost of wireless implementation is primarily lower because it is driven by cost per square mile, whereas wired solutions are dependent on density, driven by the cost of installation per home.

The first homes to receive broadband access were those in high-density, high-income areas. In many cases, however, it has proven too costly to establish the high-speed infrastructure for rural locations because the financial return does not justify the significant investment. Therefore, rural and economically disadvantaged areas across the U.S. often have insufficient access to broadband technology, which hampers business development and improvement in other socioeconomic categories. “Given the increasing importance of information technology in our ever more knowledge-based and communications-intensive economy, communities that are unserved or underserved with broadband are increasingly at a competitive disadvantage” (Gillett, et al. 2003, 4). As the disparity widens between communities with broadband access and those without, the opportunities available to citizens in underserved communities becomes a persistent policy problem requiring attention from community leaders and policymakers.

There are two dominant models for municipal broadband provisioning: public-private partnership and municipal-ownership. The former is the most common approach to providing municipal wireless broadband. There are a number of existing public-private partnership models, however, the most dominant approach is a single-owner/operator that directly provides service to residents, akin to cable franchise arrangements (Bar and Park 2006). In these cases, the municipality typically provides and/or leases access to antenna sites to the private firm who then builds and operates the wireless network. The City of Cerritos, California, has adopted this model. Other municipalities, such as Minneapolis, Minnesota, have partnered with private industry to provide subscription-based services, but have also negotiated “community benefits agreement” whereby the firm provides free wireless service at various

[5] A wireless network consists of antennae mounted on powered assets (i.e. light poles, utility poles, buildings), managed by a back-end infrastructure responsible for adequate routing, security and management of the system. For example, in Chaska, Minnesota, a 14-square mile area was covered with 365 routers (antennae) and 60 backhaul points. The network is administered by a client/server architecture that manages subscribers, traffic, and security of the system (Tropos 2007).

throughout the city in an effort to mitigate the digital divide (Williams 2006). The City of Chaska, Minnesota is an example of a municipal-owned network; the city operates Chaska.net, a wireless broadband Internet provider whose goal is to provide affordable high-speed subscriptions to its residents and businesses (Tropos 2007).

Motivations to implement municipal wireless

Municipalities deploy wireless broadband networks for four primary reasons: to support their own internal operations, to promote economic development, to maintain/attract new business, and to bridge the "digital divide" by providing affordable broadband to all citizens (Bar and Park 2006; Gillett 2006; FTC 2006; Stover and Berquist 2001). Vos (2010) reports 56 municipal wireless networks designed for exclusive public safety/municipal operations in the U.S. (e.g., public safety, public utility support, network operations) and this trend is on the rise. "Public safety services have an obvious need for high-speed mobile data services to allow police, fire, and emergency personnel to access on-line data…" (Sirbu, et al. 2006, 23). The Federal Trade Commission (2006) reports a number of examples of increased efficiencies from deploying municipal-use networks, from allowing patrol officers to access vehicle records and criminal databases from their in-car laptops to automating meter reading.

A number of cities that initially developed the infrastructure to support internal operations have found that expanding the network to include service to the public was a relatively easy extension of the existing network. In Corpus Christi, Texas, implementation of a single use wireless network for meter reading was prompted after several dogs brutally attacked a city employee while attempting to read a meter. "With WiFi, meters could zap water and gas readings all the way back to computers at city hall twice a day. No trucks. No dogs. Only later did city officials realize what they'd stumbled upon. WiFi was bigger than water meters" (Swope 2007, 3). Wireless networks for exclusive government use are less common than citywide implementation projects, however, the case of Corpus Christi illustrates how a small first step can lead municipalities to the potential large-scale impact of wireless broadband.

Economic development is another strong rationale for promoting wireless broadband initiatives as findings suggest the economic effect of broadband access on a community is significant. A study conducted of communities with broadband access from 1998 to 2002 concluded that these areas "experienced more rapid growth in employment, the number of businesses overall, and businesses in IT-intensive sectors, relative to comparable communities without broadband at that time" (Gillett, Lehr, Osorio and Sirbu 2006, p. 3). On average, the economic effect was a one percent (1%) increase in economic growth for communities with broadband access. The authors find this is significant because overall growth in the municipalities studied during this same period was approximately five percent (5%). Nadiri and Nandi's (2003) analysis of the broader effect of telecommunications infrastructure on the U.S. economy from 1950 to 1990 is also compelling.

> [T]his study suggests a strong positive relationship between the growth of telecommunications infrastructure capital, [and] the growth of output and productivity….The evidence clearly shows that increases in size and modernization of telecommunications networks are cost reducing in all industries of the national economy….At the aggregate level the total marginal benefit from this infrastructure capital is also rather sizable, about 30 to 40 per cent (sic) (Nadiri and Nandi 2003, 309).

Ford and Koutsky (2005) also find positive economic growth effects from broadband access in their empirical case study of Lake County, Florida. In 2001, the county established a wired fiber optic broadband network. When the county's economic growth rate was compared to those of other counties with similar demographics but lacking municipal-wide broadband infrastructures, Lake County was shown to have grown at twice the rate of its peers while controlling for population and other economic factors. Furthermore, in their analysis of wireless technology and spectrum rights, Hazlett and Spitzer (2006) suggest that "the lack of wireless broadband thwarts economic development," noting that greater use of wireless broadband "could provide economic stimulus and expand consumer choices" (600). Thus, the rationale for municipalities with insufficient access to broadband to provide high-speed Internet is justified by the potential for accelerated economic growth and the positive externalities associated with economic gain.

Perhaps most importantly, municipalities seek to establish wireless networks to bridge the "digital divide" – the disparity between those who regularly access the Internet and those who do not. While access to the Internet is increasing for all Americans, it is increasing at a slower rate for minorities, those in lower income households, those with fewer years of education, and those in rural communities (van Dijk 2005; Gabe and Abel 2002; NTIA 2001). Mossberger, et al. (2003)[6] find that income, education, race, and ethnicity[7] represent the four most significant determinants of Internet access:

- Individuals with a college degree are 21 percent more likely to have access to the Internet than those with a high school diploma;
- Individuals with incomes above $30,000 are 24 percent more likely to have Internet access than those with incomes below $30,000;
- Whites are 17 percent more likely to have Internet access than African Americans; and
- Whites are 13 percent more likely to have Internet access than Latinos (35).

There is also a significant age gap associated with the Internet, but this is largely explained by a lack of interest from older Americans and is less of a systemic equity issue.[8]

In addition to the other demographic factors, research also suggests the digital divide that exists in rural America is closing at a rate slower than those of all other demographic categories (Prieger 2003; Horrigan 2006). "…[W]ireless technologies frequently are a more cost effective solution for serving areas of the country with less dense populations, and provide rural and remote regions new ways to connect to critical health, safety, and educational services" (FCC 2005, 13).

Rural communities have a long history with self-correcting technological market failures and involving government actors.

> There is a long-standing rural tradition of local people organizing themselves as a last resort method to obtain services not otherwise available. One good example is the western tradition of rural cooperatives bringing power to rural communities that no private sector power company wished to serve. Rural telephone cooperatives have become the telephone service provider in many rural communities for the same reason: no for-profit company was willing to make the investment (Parker 2000, 285-286).

[6] While there are a number of reports on the digital divide, including the National Telecommunications and Information Association and the Pew Internet & American Life Project, few report statistically controlled results. Mossberger et al (2003) conduct a national survey and use multivariate regression to determine access disparities. The trends, in terms of what variables are significant, are consistent with the other studies.

[7] A once prevalent gender gap has closed; Mossberger et al (2003) find the relationship between gender and Internet access is no longer significant.

[8] However, there is a correlation between age and rural living – a recent study from the Pew Internet and American Life Project (2006) cites that rural America is "older" than metropolitan counterparts (43% of rural Americans are over 50 whereas 37% of non-rural Americans are over 50).

As rural residents once addressed shortcomings in telephone access, so too are they creating innovative solutions to their broadband problems. Consider the town of Thomaston, Maine, population: 3,748. Thomaston entered a public-private partnership with a local startup firm, RedZone, to provide municipal wireless access. RedZone's mission is to bring wireless broadband solutions to towns with small populations (between 3,500 and 50,000) that are underserved by affordable broadband. RedZone CEO and new Thomaston resident Jim McKenna explains

> For Mainers, who are still buying dial-up at $9.95, $19.95 is a stretch (sic). I decided that high-speed Internet here was either unavailable or unaffordable – unavailable meaning your only option is dial-up, and unaffordable meaning $50 or more per month for slow DSL or some local wireless ISP… The idea [with RedZone] was to serve the underserved and make it affordable (Graychase 2006).

Municipalities also seek to bridge the digital divide by not only providing access to the Internet, but also aiming to offer affordable options to increase broadband adoption – across both rural and urban areas. In Minnesota, Cable or DSL monthly subscriptions are on average $49.46/month (Connect Minnesota 2011), whereas Chaska.net, the Chaska, Minnesota municipal-owned wireless network, offers broadband at a rate of $19.99/month.

The manner in which citizens use the Internet and its impact on daily life also underscores the need for ensuring equal access. The Pew Internet & American Life Project (2005) finds Internet use contributes to increased social interaction, civic participation, and even improved perceptions of government (through access to e-Government services). The Internet is also successful at minimizing information asymmetries. "As a medium, the Internet is brilliantly efficient at shifting information from the hands of those who have it into the hands of those who do not" (Levitt and Dubner 2005, 68). While minimizing asymmetries while shopping for an automobile is relevant from a consumer perspective, minimizing information asymmetries in the civic arena holds promise for the democratic process. Mossberger, et al. (2003) identify a "democratic divide" citing findings from their research that "…individuals with higher education and income are more supportive of digital democracy and e-government, and are more likely to participate in politics online, than are the poor and those with lower education" (109). While some scholars view the Internet as the "most important ingredient for fueling a participator revolution...[o]thers, however, contend that information technology will promote further inequality in democratic participation….Disparities in access to the Internet based on income, education, race and ethnicity mean that politics may therefore amplify the voice of the affluent and well educated, further marginalizing the underprivileged" (Mossberger, et al. 2003, 89). Thus, the incentives for local governments to ensure equal access are profound.

Arguments against municipal wireless

Not all municipalities have the choice to provide wireless service to their residents. A number of states have passed laws limiting or banning municipal communications networks (Tapia and Ortiz 2006; Gillett, et al. 2006). Tapia and Ortiz (2006) note that two-thirds of U.S. states and both chambers of the U.S. Congress have considered municipal broadband initiatives. These initiatives, largely initiated at the behest of large telecommunications providers, claim city wireless deployment projects amount to unfair competition and pose a threat to private investment (Dyck and Van Wart 2010; Bar and Park 2006; Tapia and Ortiz 2006). Private firms argue that because municipalities can use public assets to mount wireless infrastructure (e.g., street lights, buildings, and in some cases utility poles), they have an unfair pricing advantage.

In addition to raising concerns about unfair competition, governments can distort the market for wireless broadband technology by choosing winners and losers in technology and among firms in the market (Bar and Park 2006). Further, since broadband technology is not a core competency of local governments officials, an associated danger is that municipalities run the risk of selecting (and thus promoting) inappropriate technology solutions (Bar and Park 2006).

It bears mentioning that while on one hand the telecommunications industry is lobbying state legislatures and Capitol Hill, on the other hand they are starting to embrace the "if you can't beat 'em, join 'em" strategy. Telecommunications firms are increasingly partnering with municipalities to enter the wireless market. "AT&T…isn't anxious to offer a cut-rate or free service that could siphon off some of its DSL broadband customers, analysts say, but would rather cannibalize its own business than watch someone else snatch it away" (Sharma 2006).

Those opposing municipal wireless initiatives also cite fiscal transparency as a major concern – for both partnership and municipal-ownership (namely when a municipal utility is the service provider). For example, "off the books" intergovernmental loans (from municipal utility to general services, or from partner to government) are one way policymakers are reducing transparency and not being forthright about the true cost of wireless partnerships (Arrison 2007).

Opponents maintain that there are alternatives to government entry into the market. Governments can revisit existing regulatory policies or reevaluate franchise agreements to provide for lower-cost options and wider coverage commitments if cost is a barrier to adoption. Alternatively, public officials can create subsidies to increase access for low-income households in lieu of competing with the private sector. When deciding whether to enter the municipal broadband market, policymakers must weigh availability of these options and broader concerns about market distortions against the need to create an alternative route to broadband access.

MARKET-BASED PUBLIC SERVICE DELIVERY

This section provides an overview of the literature on public-private partnerships. Consideration is given to the broader literature on privatization and market-based public service delivery, to include contracting. The scholarship presented here, coupled with the research presented on municipal broadband networks, establishes the framework used to analyze the determinants of municipal wireless partnerships.

Public-private partnerships are part of the broader market-based toolset available to policymakers for providing goods and services. The marketization of public services stem from the rise in New Public Management (NPM), which emphasizes smaller government and shifts away from public service provision and toward privatization (Hood 1991). For these reasons, there has been substantial growth in public-private partnerships around the world (Boviard 2004). Public-private partnerships are generally defined as a long-term contract between a government entity and a private firm for "some combination of services, construction, or financing in return for some combination of public funds, public assets, or user fees" (Bloomfield 2006). Partnerships inherently require cooperation and synergy among collaborators toward the development and/or delivery of a project or service (McQuaid 2000).

While NPM serves as the theoretical justification for public-private partnerships, it's the budgetary benefit of partnerships – costs paid through user fees, extended amortizations, or other non-tax arrangements – that serves as the practical force behind the use of the partnership mechanism (Yescombe 2007). The increasing need for information technologies among government agencies, as Boviard (2004) maintains, is also a strong partnership driver as these projects require intense capital investment as well as access to technical expertise.

Partnership for large capital outlays features opportunities for shared risk, relaxed regulation and legal constraints, shared up-front investments in capital infrastructure, and creative financing (Bloomfield 2006; Daniels and Trebilcock 1996; Hirsch 1991). Many municipalities are simply not able to fund large-scale capital projects and partnerships are the only option for many policymakers (Tapia, et al. 2006). Moreover, states limit the ability of local governments to raise funds, affecting their ability to pursue capital investment.[9] As a result of this constraint, local governments increasingly rely on public-private partnerships for capital-intensive initiatives.

In addition to the financial benefits, partnerships also provide advantages in terms of efficiency, expertise, and innovation. Partnerships allow the exchange of skills and/or develop of expertise in an area that is not a core competency. For instance, private sector skills tend to be stronger in project management capability and technical expertise (McQuaid 2010). Shared experiences in developing new initiatives can also lead to innovation as the private sector is challenged to work in a unique environment and produce new solutions (Yescombe 2007). Finally, partnerships can yield enhanced efficiencies and cost savings through the cooperation of public and private entities by eliminating duplication and creating stability in the operating environment (McQuaid 2000). The introduction of a profit-maximizing partner can also enhance efficiency for the public-private operation (Yescombe 2007).

One of the most important features of public-private partnerships is shared risk. There are a variety of risks associated with public-private partnerships, to include financial risk, construction risk,

[9] Mullins and Pagano (2005) note 46 states passed legislation limiting revenue generation and expenditures.

usage risk, performance risks, and operating risk (Yescombe 2007). Sharing or transferring some of these risks with private industry is one of the motivations behind entering a public-private partnership. The private partner may be able to find and use creative sources for project funding that would otherwise not be available to the public agency. Partnerships inherently presume that both the public and private partner have a financial stake in the success of the project.

Partners differ in their perceptions of risk. Public partners have a need to ensure transparency, hedge against private discontinuity such as bankruptcy, and protect the public interest (Ham and Koopenjan 2001). Private partners risk uncertainty with long-term commitment, cash flow constraints, and political discontinuity such as elections (Van Ham and Koopenjan 2001). Furthermore, determining which partner assumes the greater part of the various types of risk affects the nature of the project cost (Ghere 2001).

Managing political risks are also important in public-private partnerships – for both the private partner and public entity (Klijn and Teisman 2003; Ham and Koopenjan 2001). "Private companies often consider the public partner to be a multi-headed monster with contradicting strategies" (Koopenjan 2005, p. 141). Thus, maintaining political support for the partnership, particularly when there is a leadership change, is a key concern. "Unless there is a strong political will on the public-sector side of the table, and the ability to communicate the case for pursing PPPs clearly and fairly, political winds can easily blow the process off course and a PPP programme will struggle for success" (Yescombe 2007, p. 27). As a result, Koppenjan (2005) finds that partnerships are more likely when private firms perceive stability through political-administrative commitment. In addition to the risks inherent in partnership arrangements, there are also opportunities for goal conflict among partners, challenges with accountability in the partnership, as well as concerns regarding community interest and participation (McQuaid 2010).

Marketization Preferences

While there is also some debate in the field on the type of local government that is more likely to prefer market-based approaches, evidence suggests suburban governments are more likely to privatize services (Warner 2006; Warner and Hefetz 2002; Greene 2002; 2006). In part because suburban areas are less likely to have an entrenched institutional structure compared to more established American cities. Institutional strength is a determinant of contracting (Brown and Potoski 2003), namely the presence of strong labor unions, which decreases the likelihood of privatizing public services (Lopez-de-Silanes and Vishny 1997).

Cities that are in fiscal distress, or have lower fiscal capacity are also likely to pursue market-based solutions (Joassart-Marcelli and Musso 2005; Fernandez, et al. 2008) as they have less flexibility to increase the scale and scope of publicly provided services. When deciding whether to contract or provide the service in-house, local governments weigh the impact of tax revenue as well as expenditures. Unlike public entities, private firms are required to pay taxes, thereby creating a revenue stream for the municipality that did not previously exist. For example, in the electric utility market, franchise fees and taxes can constitute significant revenue for a municipality (Hirsch 1991). Privatizing services that will increase revenue is an attractive solution for local governments with low fiscal capacity.

Experience with market-based approaches can influence the decision to enter a public-private partnership. Essentially, the costs associated with creating a partnership agreement will be lower if the municipality is skilled in this arena. As Bloofield (2006) notes "The unique challenges posed by long-term contracts further complicate the tasks of fostering meaningful competition, crafting contracts that equitably allocate project risks and guarantee contractor performance, and ensuring appropriate transparency" (p. 406). Public agencies able to draw on extensive contracting experience are better equipped to navigate these complex partnership arrangements.

DATA AND METHODS

To determine the factors that increase the likelihood that a municipality will choose to partner with a nongovernmental entity to provide municipal broadband wireless, data is collected from numerous industry and government sources. Data on municipal wireless broadband providers is collected from an industry report (Vos 2007) and further validated by crosschecking each municipality with external sources (primarily municipal and industry websites).[10] Observations are limited to U.S. cities with fully operational or in-process deployments to ensure a common unit of analysis (N=108).[11] Municipalities are captured in 2007 because municipalities are observed at the height of interest in municipal broadband deployments and in doing so best represent partnership status before broader economic effects slowed growth in this area.

Two statistical models are presented in the following sections. The first is a multivariate logistic regression model that analyzes whether municipal broadband is provisioned by public-private partnership. Due to concerns with selection bias – that is, there may be something altogether unique about cities that provide municipal wireless, regardless of the mechanism they use to offer the service – a selection model is also presented. The Heckman selection model incorporates a random sample of 55 cities that do not provide municipal wireless broadband; the outcome in the selection model is also partnership status. Ideally this analysis would use the population of U.S. cities, not a random sample, to correct for potential selection bias,[12] but data limitations impeded this approach.

Partnership Model

Dependent variable

The dependent variable is a binary indicator reflecting the partnership status of a municipality providing wireless Internet access. The *partnership* variable is coded 0 if the municipality does not partner (n=36 or 33.33% of observations) and 1 if the municipality partners with a nongovernmental entity (n=72 or 66.67% of observations).

Explanatory variables

Marketization orientation: Three measures of marketization orientation are included: percent of

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[10] Data on the partnership status of Wi-Fi implementation was also collected from a variety of municipal and industry resources in 2007. Demographic data collected from the U.S. Census Bureau, 2000 Census and 2002 Census of Governments, U.S. Department of Agriculture 2003 Rural-Urban Continuum identification.

[11] 140 cities met the criteria but 32 were dropped due to missing data because they failed to complete the U.S. Census Bureau's 2002 Local Government Directory Survey. The response rate for the survey is 70.3%; the response rate among the cities providing municipal wireless technology is 77.1%.

[12] Given the small number of cities that provide municipal wireless, a selection model with the full population of U.S. cities would likely dwarf the sample. A propensity score matching technique would allow analysis of relevant factors not included in the match on provision choice and account for potential selection bias.

public services the municipality contracts out, metropolitan/suburban/rural status of the municipality, and government expenditures per capita. The U.S. Census Bureau's 2002 Local Government Directory Survey is used to identify the *percent of services a municipality contracts*. The measure includes contracting status for nine public services: electric, gas, and water utilities, fire protection, law enforcement, parks/recreation, streets/bridges, sewerage services and solid waste management. Municipalities with higher levels of contracting out have a lower marginal cost of contracting than cities with few contracted public services. Thus, the more services contracted, the greater the likelihood the municipality will choose to partner due to their experience with market-based service delivery.

Suburban areas are more likely to favor market-based approaches compared to urban or rural areas. Urban cities tend to have an institutional bureaucracy that opposes privatization efforts whereas wealthier suburban cities are more likely to oppose redistributive efforts and prefer to curb bureaucratic expansion (Greene 2002). Rural areas are less likely to have experience with market-based approaches as they have fewer available private vendors to provide public services compared to urban or suburban areas. (Warner 2006; Warner and Hefetz 2003). The 2003 U.S. Department of Agriculture (USDA) Rural-Urban Continuum Code is used to create three dummy variables indicating whether the municipality is *metropolitan, suburban, or rural*.[13] It is expected that suburban areas are more likely to enter public-private partnerships than metropolitan and rural areas.

Governments with lower fiscal capacity are more likely to seek market-based approaches to public service delivery (Greene 2002; Schneider 1989). Furthermore, fiscally strained municipalities do not have the capacity to expand public service provision, increasing likelihood of partnership. Fiscal capacity is measured by *government expenditure per capita* (Greene 2002; Hefetz and Warner 2004; Fernandez, et al. 2008). The measure is logged to normalize distribution.

Political-administrative commitment: Firms seek to minimize risk in large-scale partnerships - what may have been a high priority for one administration may be eliminated with the next. The form of

[13] The USDA uses a nine-point scale, but given the number of observations in the model, some of the categories required collapsing due to insufficient variance and in an effort to preserve degrees of freedom. In the statistical models, suburban area is the omitted comparison category.

municipal government measures *political-administrative commitment*. This is a dummy variable coded 1 if the municipality is a council-manager structure. City managers tend to have a high degree of autonomy in policymaking (Selden, et al. 1999), considerable budgetary influence (Ammons 2008), and authority in partnership arrangements (Walzer and York 1998). As a result, council-manager municipalities, where city managers have more administrate authority, may be more attractive to private partners concerned with ongoing political-administrative commitment to the project.

Control variables

Municipalities that are wealthier are more likely to prefer privatization efforts (Greene 2002). Likewise, resident income may also have an effect on a community's ability to attract a private partner - that is, firms will calculate willingness to pay for service. *Median income* of municipal residents from the 2000 census captures this affect. Similarly, *population* from the 2000 census is used to control for population effects because communities with higher populations might be more attractive to private business (i.e., greater potential for subscribers) thus affecting the likelihood a municipality partners.[14] The log of municipal population and log of median household income is used in the model to normalize the distribution of these two variables.

Table 1 provides a summation of hypotheses.

[table 1 about here]

Selection Model

A two-stage Heckman selection model is used to estimate the likelihood of a municipality partnering for municipal wireless provision while also accounting for the probability a municipality will provide the service (Dubin and Rivers 1990; Heckman 1979). This technique is in response to the concern that the logistic regression presented is derived from a nonrandom sample of municipalities and may have produced biased coefficients. Probit estimation is used for the first-stage selection equation (likelihood of *providing* wireless broadband) and for the second-stage outcome equation (likelihood of

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[14] Factor analysis reveals population and the metropolitan/suburban/rural indicators are not measuring the same underlying factor; metropolitan/suburban/rural is measuring density of the surrounding area where population is only measuring the number of residents in a city.

partnering to provide wireless broadband). The outcome equation is identical to the logistic regression specified in the preceding section. The selection equation is specified in the following subsections.

Dependent variable

The latent dependent variable in the selection equation measures the underlying likelihood a municipality provides municipal wireless broadband.

Independent variables

State regulations affect the ability of local governments to provide wireless broadband, influencing their decision to partner. The variable *state-level legislative limitations* controls for the presence of state legislation restricting municipal entry into broadband markets. States without restrictive legislation are coded 0 and states with restrictive legislation are coded 1. It is expected that municipalities with restrictive state laws are less likely to provide the service.[15]

Mossberger, et al. (2003) find that socioeconomic factors, income and education, respectively, are the two greatest determinants of access to the Internet. Municipalities with lower socioeconomic indicators may be more interested in providing municipal wireless broadband due to a lack of private investment. An index variable to capture the presence of the digital divide, *socioeconomic effects*, includes an averaged assessment of the poverty rate and percent of residents with a bachelor degree.[16]

Municipalities that provide their own electricity are more likely to pursue municipal communications (Gillett, et al., 2006). This increases the likelihood of providing municipal broadband because if a municipality owns utility poles they have more physical locations to set up antennae (without having to negotiate with a separate private utility for access). Municipalities that own an electrical utility also have experience managing billing, customer service, and the other administrative tasks associated with providing a fee-for-service product. *Municipal electric utility* is coded 1 if the municipality owns their own electrical utility and 0 if the municipality does not.

Dummy variables indicating whether the municipality is *metropolitan, suburban, or rural* are also

[15] Although if a state has passed a legislative measure, it's generally a signal that municipalities are interested in a municipal wireless project, (otherwise the legislature would not be generating legislation).
[16] Tests for multicollinearly reveal relatively low correlation (0.18) between the two variables.

included. As the need for municipal wireless broadband may be higher in underserved areas, namely metropolitan and rural, propensity to provide the service may be higher in these locations.

Governments with lower financial capacity would be less inclined to provide new public services; therefore, municipalities with higher *government expenditures per capita* might be more likely to provide municipal wireless broadband.

Descriptive statistics for independent variables in both models are presented in table 2.

[table 2 about here]

RESULTS

Table 3 reports the regression results for the partnership status logit model with robust standard errors. Two of the three measures included for marketization orientation are statistically significant: rural area and government expenditures per capita. Rural area is statistically significant at the 5% level, suggesting that rural areas are more likely to partner for municipal wireless than suburban areas. Predicted probabilities presented in table 4 illustrate that while holding all other variables at their mean, rural communities are likely to partner 97% of the time whereas suburban areas are only 67% likely to partner. This finding is of interest because the direction of the effect is opposite expectations given the findings in the privatization literature that suburban areas are most likely to prefer market-based solutions. Metropolitan area is not statistically significant in this model.

As anticipated, government expenditures per capita is statistically significant at the 1% level in the expected direction. The likelihood of partnership at the 25th percentile is 82% and the likelihood of partnership at the 75th percentile is 68%.

Two remaining explanatory variables, percent of services contracted and political-administrative commitment do not reach statistical thresholds for significance. Of the control variables, population is significant at the 1% level and median income is significant at the 5% level - both effects are in the expected direction.

[Insert tables 3 and 4 about here]

Table 5 presents the results from the Heckman selection model. The results of the outcome model are generally consistent with the results of the logistic results. The findings from this model suggest that governments in both rural and metro areas are more likely to partner to provide municipal wireless broadband than suburban municipalities. Government expenditures per capita reaches only marginal statistical thresholds in this model. Directional effects of the variables remain consistent across the models.

While the results of the selection equation –provide municipal wireless broadband – are not relevant to the hypotheses, it does produce interesting findings. As expected, municipalities are more likely to provide municipal wireless if they already operate an electric utility, have higher government expenditure per capita, and are in metropolitan areas. State restrictions on municipal networks decrease the likelihood of providing the service. Thresholds for rural designation do not reach statistical significance. Socioeconomic effects have a positive effect on the likelihood of offering the service. This is consistent with expectations regarding broadband use, but does not support the notion that municipal networks seek to bridge the digital divide by providing broadband access to reach those who cannot otherwise afford the service.

[insert table 5 about here]

DISCUSSION

This section addresses the significance of these findings with an eye toward rural communities. Limitations of this research are defined and opportunities for future research are then discussed.

While it was expected that economic attributes would drive the partnership decision – resident income, population, and government expenditures – it was surprising to find that rural areas were most likely to partner to provide municipal wireless broadband networks. There are a number of possible explanations for these findings. Although rural areas have not been attractive to private industry for wired broadband services, the result of this analysis indicates these communities have become more economically viable for less expensive wireless solutions. As implementation costs are largely driven by size (in terms of square miles), it is more feasible for a small town to become financially attractive and thus lend itself to finding a business partner.

The type of partner that a rural community attracts might be different than those in suburban and metropolitan areas, and thus increase the likelihood of partnership. In contracting arrangements, larger firms tend to dominate larger municipalities while smaller firms are more prevalent in less populated local governments (Bel and Fageda 2011). RedZone Wireless is one such example of a small private firm that provides localized broadband service to the community in which the owners live.

The findings may also suggest that rural communities are reaping the benefits of broadband technology because local government officials are taking an active role in resolving disparate access issues. That is, policymakers in rural communities may be more aggressively pursuing partners because of disparate access and take a more participatory role in the partnership. This comports with empirical findings that rural communities are more likely to pay increased attention to civic concerns and participate in the service delivery process (Warner 2009).

As resident income and population are also significant drivers of the partnership decision, these results are likely less relevant for the poorest and remotest rural areas. That is, while rural communities are finding viable ways into the market, partnership opportunities also depend on economic factors – the very issues the drive the digital divide. Questions remain for the most disadvantaged rural areas; whether, as Warner (2006) discusses, they will be able to compete in the new marketized public service environment.

The findings of this study are tentative given the limitations of the model. The primary concern with the analysis presented in this study is the self-selection of municipalities to provide wireless broadband. The results presented across the two models in this study are consistent, however, as the methodological technique did not account for the population of U.S. cities, and thus did not fully control for potential selection bias, the results remain preliminary.

Two additional concerns with the estimated models relate to the small size of the municipal wireless population. First, a Heckman selection model can be unreliable when analyzing small datasets. Second, despite the small size of the population, 20% of the municipalities were dropped from this analysis due to missing data, tempering generalizability. There is an opportunity to further test these hypotheses in a larger environment as the number of municipal wireless broadband implementations increase.

This study raises a number of possibilities for future research. Municipal wireless broadband implementations have experienced a number of successes and failures early in their life cycle. Evaluating implementations and comparing attributes of success and/or failure may provide insight into the factors that contribute to effective partnership agreements. Examining attributes at the partnership level – partner analysis of varied risks, behavioral and relational factors such as trust – which were not included in this analysis, may yield interesting results on the dynamics of partnerships and their potential for success.

Examining risk factors are warranted as recent developments in the municipal wireless broadband landscape indicate the calculation of risk has changed over time. For example, Philadelphia partnered with Earthlink in 2005, an early mover in municipal wireless implementation. At that time, the city's Chief Information Officer, Dianah Neff characterized the partnership as virtually risk-free. "The biggest contribution the city will make to the network will be in providing access to city infrastructure, such as utility poles…a private company will operate the network once it starts running…and taxpayers won't be on the hook if business doesn't live up to expectations" (Gomes 2005, B1). Earthlink eventually deemed their partnership model unviable (Keen 2007) and later divested of their many municipal wireless initiatives nationwide. Earthlink CEO Rolla Huff explained "We will not devote any new capital to the old municipal Wi-Fi model that has us taking all the risk…That model is simply unworkable" (Keen 2007). One might argue that in negotiating free wireless broadband for city residents, Philadelphia failed to appropriately consider their partner's risks in the decision. Failed partnerships can not only result in loss of taxpayer funds, but as importantly unmet expectations and political fallout as evidenced by recent partnership failures.

Despite previous empirical findings, administrative-political commitment is not a significant driver of the partnership decision for municipal wireless initiatives. By their very nature, long-term contracts make it difficult to account for the future governing environment (Greve and Hodge 2010), adding uncertainty to already complex partnership arrangements. The nonfinding in this analysis may be due to measurement issues. Alternatively, it could be indicative of miscalculation on the part of the private partner – not unlike the risk oversight in the illustrative Philadelphia case – or lack of experience in public-private partnerships. Additional research on the assessment of administrative-political commitment in partnerships is merited given the nonfinding in this study.

Another area for future research is an evaluation of the type of partner a municipality pursues. There is limited variance in partnership models across the population of cases in the sample as only seven municipalities have partnered with a nonprofits or cooperatives to provide the service (all others have partnered with for-profit firms). However, a means test reveals there are statistically significant differences in the percent of services contracted and median income of residents. Further exploration of these factors, coupled with the rationale public officials employ in selecting a partner, can provide insight on sectoral differences as the variance in partner type increases across deployments.

This research is unique in that it represents an intersection of both telecommunications and information technology. The combination of these factors, and the rapid pace with which the technologies are changing, may be exceptions to other marketized services, presenting an alternative explanation for the lack of significance in the percent of services contracted variable, one of the marketization measures.[17] Further investigation into the relevance of contract management experience to development of partnerships is also deserved.

There is also an opportunity to study positive externalities associated with municipal-owned networks versus private networks. In a quasi-experiment of two cities, Oxendine, et al. (2007) found that civic involvement was higher in the city with a community-based network versus a market-based network. Expanding the research to focus on municipal wireless networks may provide insight into the phenomenon described by Mossberger, et al. (2003). They find a growing "democratic divide" among citizens who have access and the skill to use the Internet. Examining issues related to political and civic

[17] The U.S. Census Bureau's 2002 Local Government Directory Survey does not include contracting data on information technology functions.

participation can have implications for policymakers, such as the need to create more outlets for low-cost or free broadband access, to mitigate the effects this growing disparity.

CONCLUSION

Location and demographic factors appear most significant in determining whether a community partners for municipal wireless broadband. Public-private partnerships are dependent on the economic viability of a community and the practical need for governments with lower fiscal capacity to attract a partner. The results are promising for some underserved areas, revealing that rural communities are more likely to enter public-private partnerships to provide the service.

Public-private partnerships allow municipalities to avoid or minimize debt financing, to work around regulatory limitations, and to balance risks associated with a capital investment. As budgetary pressures increase, there will be an ongoing need for creative solutions and cross-sector participation. O'Leary and Van Slyke (2010) predict "There will be a greater role for the public, a greater need for collaborative governance, and a greater appreciation for deliberative democracy. Clearly, partnerships are at the heart of the future of public administration in 2020" (s10). This study illustrates that there are some communities better positioned to take advantage of those partnerships. "The city must be realistic about its financial expectations and the certainty of technological evolution. The world of the cable industry municipal franchising is long since dead. Greater sophistication and patience is needed on both the public and private sides to make public/private partnerships work when deemed to be appropriate" (Dyck and Van Wart 2010, p. 447).

Beyond the partnership decision, larger issues remain for the future of municipal broadband networks. The recent decline in deployments may be a temporary victim the Great Recession or they may be an example of a failed attempt by local governments to enter a complex market. The way in which services are provided may help to answer the sustainability question. While Philadelphia's broadband network has languished after Earthlink's exit from the market, Houston, also a former Earthlink partner has been successful in modifying their business model and deploying a municipal-owned network. For many locales, perhaps most, municipal provision is not option. As Yescombe (2007) states "the realistic choice, given budgetary constraints, is generally not between a PPP and public-sector procurement…but between a PPP and no investment at all" (p. 17).

Whether partnership is the most appropriate mechanism to provide municipal broadband service remain normative and empirical questions. Utilizing private partners might address access issues, but equity issues might also persist unless the government structures the partnership agreement with these values in mind. As Kettl (1997) notes, "In a democracy, its [the government's] fundamental job is pursuing the public interest. It promotes critical values of fairness, justice, equity, and due process. Government exists, and has always existed, precisely because the private market, and market-style management does a terrible job in pursuing goals such as these that go beyond efficiency" (p. 459). In the case of municipal wireless broadband, partnerships that fail to address underlying public values likely do little to meet broader policy goals for digital inclusion.

Tables

Table 1: Summary of Hypotheses

Hypotheses	**Partnership model**
Marketization orientation, as measured by:	
a) Percent of services contracted	+
b) Suburban governments	+
c) Fiscal capacity	-
Political-administrative commitment	+

Table 2: Descriptive Statistics

Independent Variable	**N**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Marketization orientation					
Percent of services contracted	163	0.192	0.214	0	0.875
Government expenditures per capita (log)	163	7.257	0.461	6.423	9.030
Metro area	163	0.663	0.474	0	1
Rural area	163	0.141	0.349	0	1
Suburban area	163	0.196	0.398	0	1
Political-administrative commitment	163	0.497	0.502	0	1
Median income (log)	163	10.689	0.314	9.882	11.821
Population (log)	163	9.152	2.446	3.611	15.896
Municipal electric utility	163	0.227	0.420	0	1
State-level legislative limitations	163	0.350	0.478	0	1
Socioeconomic effects	163	0.468	0.035	0.3705	0.574

Table 3: Logit Estimation

Independent variable	**Coef.**	**Robust std. err.**
Explanatory variables		
Marketization orientation		
Percent of services contracted	-0.653	1.376
Government expenditures per capita (log)	-1.536***	0.507
Metro area	0.398	0.873
Rural area	2.685**	1.329
Political-administrative commitment	0.319	0.558
Control variables		
Median income (log)	1.961**	0.962
Population (log)	0.862***	0.207
Constant	-18.470*	10.697

Adj. count R^2 = 0.25
N = 108 cities
*** p<.01 **p<.05 * p<.10, two-tailed tests

Table 4: Predicted Probabilities by Partnership Status for Explanatory Variables

Independent Variables	**Partner**	**Not Partner**
Rural Area	96.76%	3.24%
Suburban Area	67.08%	32.56%
Government expenditure per capita logged (25th percentile = 6.978)	81.92%	18.08%
Government expenditure per capita logged (75th percentile = 7.477)	67.08%	32.92%

Table 5: Heckman Selection Probit Estimation

Independent variables	**Coef.**	**Std. Err.**
Outcome equation - partner		
Explanatory variables		
Marketization orientation		
Percent of services contracted	-0.394	0.557
Government expenditures per capita (log)	-0.295^	0.245
Metro area	0.908***	0.360
Rural area	1.368***	0.445
Political-administrative commitment	0.122	0.245
Control variables		
Population (log)	0.363***	0.076
Median income (log)	0.779**	0.362
Constant	-10.770	3.936
Selection equation – provide		
Municipal electric utility	1.026***	0.264
State-level legislative limitations	-0.302*	0.167
Metro area	1.287***	0.276
Rural area	-0.194	0.332
Socioeconomic effects	4.378^	3.258
Government expenditures per capita (log)	0.692***	0.276
Constant	-7.459	2.174

LR test Chi^2= 5.97***
N = 163 cities
*** p<.01 **p<.05 *p<.10 ^p<.20, two-tailed tests

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