Economics of Public WiFi

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Local governments in urban regions continue to find the idea of public or municipal WiFi attractive. This is for multiple reasons, not all of which are based on economic logic (such as city branding, vote-buying, emergency services, commercial lobbying, peak-traffic broadband off-loading). However, the purpose of this paper is to gather together the basic economic arguments for and against public provision of municipal WiFi. First, we consider what type of economic good WiFi is, and the logic for public rather than market provision. Second, we review four main economic arguments against public WiFi (capitalization; no market failure; competitive distortion; inefficiency of supply side response). Finally, we consider what may be the strongest, yet least made, case for publicly funded municipal WiFi, which is local demand discovery as an implicit subsidy for WiFi entrepreneurship and innovation.

Keywords: municipal WiFi, public economics, market failure

Introduction

WiFi (Wireless Fidelity) is the brand name of a radio-frequency-based system (using the 802.11 standard) that allows an enabled device (such as a laptop, tablet or smart phone) to exchange data or connect to the Internet over a wireless local area network (WLAN) through an access point (called hotspots or zones). These access points have a range of about 20 metres, and are therefore ideal in a home or business setting to enable multiple devices to connect to a single access point that can be public (or open) or secure (requiring a password or registration). A wireless mesh network (WMN) involving multiple radio nodes over a mesh topology can enable WiFi to provide a blanket coverage over a much larger area, such as several city blocks.

The basic economics of wireless communication (Shy 2001, Benkler 2002) coupled with rapid growth and popularity of WiFi-enabled devices and the increasing demand to be always connected to the Internet has, since the early 2000s, induced numerous cities around the world, but particularly in the US, to undertake the provision of public or municipal WiFi (Travis 2006, Jassem 2010). By about 2008 this had begun to fail in the US (Wu 2007, Fraser 2009, Economist 2013) because of the technological and regulatory challenges associated with providing seamless coverage, but also for cost and convenience factors owing to competition from next generation (3G and 4G) broadband networks (Lehr and McKnight 2003, Yaiparoj et al 2008) as well as increased coverage by private providers of WiFi.

However, new wireless mesh network technologies, along with appreciation of multiple business models that a local authority might use to own and operate a public WiFi network

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(Bar and Park 2006) have led to a resurgence of interest in municipal WiFi. This includes proposals in Singapore and Kuala Lumpur to mandate WiFi into all new businesses (such as restaurants) or make it part of new building codes. Thus despite the collapsed business case, the public provision of WiFi appears to remain attractive for city councilors, seemingly in the face of technological, regulatory and cost hurdles. This paper considers the basic economics of that choice.

What sort of economic good and market is WiFi?

Most economic analysis starts by identifying the type of good in question, classifying by properties of rivalrousness and excludability in order to determine whether a good is a private good (rivalrous and excludable), a public good (non-rivalrous, non-excludable), a club good (non-rivalrous but excludable) or a commons (rivalrous but non-excludable). A second step in the approach then considers the market for the good on a scale from competitive (free entry and marginal cost pricing) to monopolistic (entry barriers and average cost pricing). Economic analysis proceeds in this way in order to identify the prospect of market or coordination failure, and the existence and source of rents (whether these are natural consequences of the technology, or artificial consequences of regulation, the form of property rights, or imperfect competition). The purpose of this analysis is to diagnose any potential welfare gains from public provision or public intervention. A good that is essentially private in a market that is essentially competitive has no claim to improvement by public ownership or intervention. However, where market failure can be demonstrated, an economic argument for social welfare improvement through public provision can sometimes be made. But in order to reveal this, we first need to ask what type of good and market is WiFi?

First, is municipal WiFi a natural monopoly? This is the standard argument for public utilities and network goods (Shy 2001) and is based on recognition that wherever there are large fixed costs in establishing the service (say, building the network) and relatively low marginal costs in adding further clients, such that the average cost curve is everywhere downward sloping, then the most efficient number of suppliers is one. Such a natural monopoly is usually licensed to prohibit wasteful competition, but also regulated so that it cannot exploit its monopoly to price at a profit maximizing level. The combination of protection from competition and regulated pricing and service delivery invariably means that natural monopolies are not very innovative businesses, technologically stagnant, often captured by their workforces and stakeholders.

WiFi certainly has fixed-cost network-like properties. But there is no economic basis to claim that the most efficient number of providers is one. Rather, this only makes sense when we

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speak of seamless roaming and passage from one WiFi zone to another, but that is a matter of interoperability standards (i.e. a coordination and contracting problem, not a supply problem). Yet while such standards can benefit from public imposition, there is no essential reason why they need to be. It is plausible that they more efficiently arise from voluntary associations through commons mechanisms. The Internet exchanges are an example of a highly effective voluntary association in this area (http://www.ausix.net/).

WiFi is clearly not a public good for the simple reason that access can be easily excluded through encryption keys. This is sometimes called a quasi-public good (a public good where exclusion is possible) but really it is a 'club good' instead (Buchanan 1965), the economics of which implies that the most efficient provision solution is through price-discrimination in the market. The relevant question then concerns the optimal size and sorting of WiFi clubs – given technological constraints in supply and business models in payments – and the extent to which that is distorted by regulation.

The language of quasi-public good is sometimes used in relation to WiFi when considering the limits to service obligations of commercial broadband networks. On the one hand, some parts of a market may be unprofitable and underserved by commercial networks, and public WiFi can fill that gap (this will rarely be the most efficient solution, compared to subsidizing extended broadband coverage, either on the demand or supply side). On the other hand, some parts of the broadband network can become congested at peak-load, and private providers may seek to off-load some of that data traffic onto WiFi networks (Qiu et al 2013). This can be efficient because it reduces overinvestment in broadband peak-load capacity. However, this outcome is usually a consequence of competition regulations prohibiting joint contracting of supply (sharing networks) in which different suppliers compete on some traffic and cooperate on others. This problem is widespread in public utilities and network goods such as rail transport and airline routes. The solution here is usually de-regulation to allow firms to organize among themselves, including new entrants, the most efficient mixture of pricing and bundling (as for example airlines now do with codesharing). This is the solution to the problem of discovery of optimal size and sorting of WiFi clubs.

Another claim made about WiFi is that it has properties that add value to existing public assets and utilities. WiFi is thus a 'bundled good' that can be added to existing or new assets such as public transport, and public utilities such as airports and public spaces, or bundled into all new buildings (through the building code). Economic efficiency usually comes from unbundling goods, or from the process of producers experimenting with different bundles to meet particular segments of market demand. Furthermore, the bundling argument applies equally to private providers of WiFi as a public good. For example, Microsoft and Yahoo, US

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technology companies, have both offered free WiFi in select municipal locations in order to direct traffic to their search engines.

These arguments suggest that public WiFi may be less of an economic good than a political good (as analyzed in public choice theory, Olson 1971), in that it is something that can be offered to a particular group as a transfer from others (ratepayers within the council area) in order to secure the political support of that group.

Four basic economic objections to public WiFi

These initial considerations of what type of good and market WiFi is, despite the various degrees of boosterism from different lobby groups and consultancies (Cohen 2007), suggests that the case for public provision is neither obvious nor strong. This is plainly true of a lot of public sector activities, and is certainly not unique to WiFi. However, it will be useful to set out the main benchmark objections that a standard (neoclassical) line in economic reasoning would level against public provision of municipal WiFi.

#1 Capitalisation of 'free' WiFi in land value

The basic economic objection to public WiFi is that it is a pure rent transfer that will be capitalized in increased property values (Caplan 2001). The argument is simply that to the extent that the 'free WiFi' adds value to a location, that will increase the marginal product of the location, and thus its value to or 'willingness to pay' of existing and potential tenants, which at the margin will bid up land and building prices, which will at the margin flow through to rents. There may be redistribution if the WiFi is funded from a wide pool of ratepayers but the benefit is delivered to a narrow group.

Any benefit to particular consumers, say tourists passing through or local residents who lease (rather than own), that accrues to the free WiFi will be compensated by higher rents (owing to higher debt costs or higher rates from land valuations) and prices for local services (such as cafes and short-stay accommodation). For this reason the target population of the free WiFi policy – which is presumably a coalition of voters on lower incomes, renters, visitors, or those who benefit from a flow of visitors – may yet experience no net benefit once the general equilibrium effects have washed through. The main beneficiary would be landlords in the area serviced by free WiFi. Yet benefiting existing landlords is not usually argued to be the main purpose of public municipal WiFi.

A variation on this is capitalization in private companies that would benefit from increased Internet use, such as for example Google, Yahoo or Microsoft. The economic logic is that 'free' WiFi is a subsidy to Internet use, thus leading to increased consumer demand. In a monopolistically competitive industry, this increases the economic rents that accrue to

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companies that sell goods that are complementary with increased Internet use (such as search technologies, devices or hardware). We would thus expect that the coalition of lobbyists seeking to promote public municipal WiFi would be composed of at least local property owners and Internet technology companies.

#2 There is no market failure

The theoretical case for public provision of a good or service requires evidence of some form of market failure that is causing an inefficient allocation. This can be due to a pervasive externality, asymmetric information, principal-agent problems, imperfect competition or public goods leading to a systematic under-investment in private provision of WiFi compared to the theoretical welfare maximizing optima.

It is difficult to make this claim. There have been numerous consultancy-driven reports extolling the benefits of public WiFi (Cohen 2007, for instance) but few serious attempts to estimate the costs, in terms of destroyed existing private infrastructure and business models, or the crowding-out effects on private provision. It is probably still too soon to tell. But analysing this from first principles there is no strong basis to suspect market failure in the direction argued by proponents of public municipal WiFi.

The externality argument is actually strongest in private WiFi networks and would suggest some kind of club good (for example eduroam, which is a global academic WiFi network). The existence of wide-spread private WiFi networks in cafes and most private businesses for instance suggests there are few barriers to entry and thus no market power to exclude at work. If there is a profitable opportunity to provide WiFi, we can expect it to be provided. This means that non-provision is probably due to it not being profitable to do so, which in turn gives us an indication of local consumers' willingness to pay at that point. There is no information asymmetry involved here (where buyer and seller have very different or hidden information, which can cause some markets to fail, such as insurance).

The upshot is that none of the standard market failure-based arguments for public provision seem to apply here. In consequence, public provision in such a situation is likely to lead to crowding out and an inefficient allocation through rent and wealth transfers. There will certainly be winners and losers from this, but not necessarily in a way that increases overall social welfare.

#3 Unfair competition to existing providers

This market failure consideration extends outward from an unnecessary distortion (or misallocation) to the risk of harm to two specific classes of agents: existing and potential private providers, and ratepayers.

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It matters whether public provision is a complement to existing providers, or a substitute. If it is a complement, then we can claim that municipal WiFi is a positive externality that benefits private providers. But if it is a substitute, then it is in competition. This is an empirical question, and it depends upon consumer and citizen behaviour but, to the extent that existing consumers' decisions about which café or hotel to choose depends upon their provision of WiFi, then public WiFi is in competition with those that already do provide it, and a subsidy for those that already do not. This will be distortionary, harming those who have already invested in the service, but benefiting those who have not. Furthermore, this will reduce the positive externality from the private provision of that service. Public WiFi could run into problems with competition policy, and indeed has in North America and Europe in particular.

Second, municipal WiFi networks involve substantial upfront and ongoing maintenance costs. Ratepayers are at risk of these cost overruns, and also to a raft of unforeseen consequences stemming from public access to the Internet. The immunity provisions for ISPs through unlawful acts (copyright infringement, objectionable content, and so forth) by third parties do not necessarily extend to WiFi hotspots, placing providers at risk of criminal liability. The economic point here is that there is substantial uncertainty associated with these risks, and without the private protection of limited liability.

#4 Public good doesn't necessarily mean public provision

A fourth stock objection flowing from standard economic theory to the prospect of public WiFi is that even if we can establish a natural monopoly, a positive externality or a market failure argument, and show that there is no crowding out or destruction of private capital, it does not follow that public provision (or intervention on the supply side) is necessarily the best option. We may still have a case for public payment through ratepayer fees, poll-taxes (or some manner of citizen levy), or property taxes, without then arriving at the conclusion that these need to be publicly supplied, operated or contracted. This point seems to have been missed in most of the public analysis, even when an ownership/operation distinction is made (e.g. Bar and Park 2006).

The real choice is not between the different models of public ownership, operation and delivery (public utility, hosted service, public overlay, wholesale, franchise, wholesale open platform, common carrier, organic mesh, etc.) but rather between whether this intervention takes place on the supply side or the demand side of the market. The case advanced by most proponents of municipal WiFi is predicated on a supply-side intervention, but standard economic theory suggests that it would be better done on the demand side. This would be WiFi vouchers, allocated to citizens or denizens or those travelling through. The analogous concept is school vouchers.

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Demand side funding has two major advantages. First, it minimizes distortions to the existing market by enabling consumers to choose themselves what particular bundles and configurations they want. This should also maximize consumer surplus. The second benefit is that it furnishes incentives for producers to provide consumers what they want, thus leading to efficient maintenance and bundling without harming innovation and adoption of new technologies. None of these benefits accrue to the supply side model, which will require significant oversight reporting to ensure accountability and transparency, and will be prone to cost blow-outs (as is common in any model where capital and operations are paid for by a third-party, not the consumer). In short, the supply-side model of provision (whether by operation or third-party contracting) loses all the benefits of a market mechanism.

The economic case for public WiFi: demand uncertainty

So, those are the basic economic reasons to be skeptical of municipal public WiFi. However, there is at least one good reason to support public WiFi, in the sense of a genuine market failure/public good, but it is an argument that so far as I am aware has not been made.

In essence, it is that WiFi is an experimental technology in each municipal location with substantial entrepreneurial uncertainties. This, specifically, is the market failure, and it accrues not to consumers (most consumers know how to use WiFi, or understand how they benefit for specific uses), nor on the technology side (engineers mostly know what to expect, and what capabilities the technology has) but to entrepreneurs in figuring out new applications of WiFi to create new businesses or business models. This is demand uncertainty, and it is a genuine market failure that is not associated with the technology in general but with its application in a particular municipal location in the context of the mix of other businesses, resources and markets.

The market failure is in figuring out entrepreneurial opportunities, market demand, business models, and so forth that are niche and contingent to particular places and times (Rodrik 2004, Bakhshi et al 2011). These are a market failure because, in a competitive market, firms will not have the rents (supernormal profits created by imperfect competition) to explore and discover where these opportunities lie, but worse, what they do discover is easily copied and appropriated by imitators who do not carry the costs associated with that experimentation. There is therefore a legitimate role for public sector support for an experimental test bed in discovering these opportunities.

The implication however is that public provision of municipal WiFi is not about providing an ongoing utility (or something sufficiently permanent that it will impact on rents and property prices, see objection #1) but a temporary underwriting of an experiment to test consumer behaviour and investment in innovative new uses or opportunities that might then be

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subsequently taken up by private businesses. This is also not about adding value to public enterprises (such as airports and public transport, or even city branding) but about underwriting a discovery process that yields market information about entrepreneurial opportunities as a public good.

Conclusion

There are many reasons to support public provision of municipal WiFi, but few of these are found in basic economic analysis. Municipal WiFi is not a natural monopoly, it is not subject to market failure; public provision would likely distort existing markets and devalue existing investments. Furthermore, a better solution to proceed with public WiFi is to intervene on the demand side (through vouchers, for instance).

However, a case can be made for clear market failure resolved through public provision of WiFi in terms of demand uncertainty affecting entrepreneurs. The reason is that this information about opportunities is actually a pure public good, and its provision is likely to be welfare enhancing in maximizing the rate and scope of innovation in relation to the WiFi technology in the particular municipal location. (This includes information about what is unlikely to work, and thus minimizing wasted investments.)

Putting these arguments together, one can discern two main justifications for public WiFi provision, depending on the particular circumstances of the municipality involved:

1. Where there is already, or is likely to be, adequate wireless access available from competitive sources, then an intervention to stimulate WiFi use by a municipality, if justified, should be on the supply side: that is, temporary vouchers to make WiFi affordable. This is likely to be the best practice municipal WiFi intervention in many cases.

2. Where there is a likelihood that the provision of public WiFi would lead to entrepreneurial activity that will identify value-enhancing opportunities in the municipality, then a case can be made for demand-side intervention: that is, the provision of classical public WiFi networks.

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