

Public Policy and Broadband Networks

- Internet and Broadband Networks
- Long predicted; has their day finally arrived? Is Internet the vehicle?
- Now that it's here, everyone wants...*bandwidth!*
 - E-commerce
 - Entertainment, gaming,...
 - Two-way video, ...
- Public Policy Issues
 - Mandated Universal Service
 - Almost *requires* regulated monopoly
 - Can competition deliver?
 - Natural Monopoly
 - Are networks natural monopolies?
 - Can the market support more than one broadband supplier?

Universal Service Requirement

- Universal service: is competition “good enough”?
- One policy option to ensure universal service: require that any entering firm serve (say) 95% of its metro area as a condition of franchise. However, make the franchise non-exclusive, so competitive entry can occur
- Easy for DBS, difficult for fiber.
- What does this “universal service” franchise requirement do to the equilibrium?

The Point of This Paper

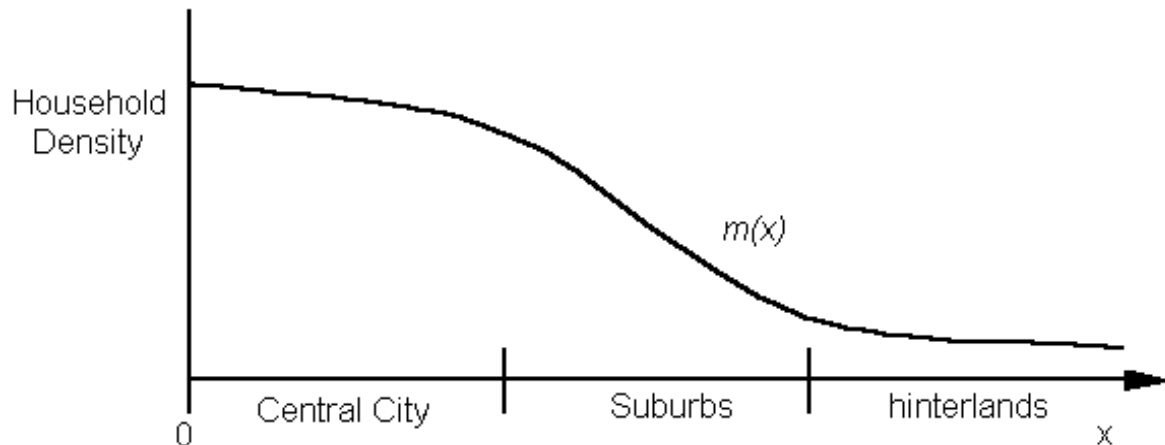
- Assess the likely outcomes of open competition in interactive broadband to determine:
 - the feasibility of competition
 - the extent to which the market provides broadband access to rural regions (universal service)
- Develop model of the intermodal broadband market: entry, networking, capacity, and price decisions
- Using current engineering estimates of costs, at what demand levels would we see fiber deployment? Fiber competition? Satellite competition?
 - Would markets serve all regions?
 - How would a universal service constraint change outcomes?

Technology of Broadband Networks

- Cost Structure
 - well-understood by engineers
 - standard network cost structure
- Demand Structure
 - functionality differs among systems
 - bandwidth in, bandwidth out
 - great uncertainty
- “Geographic” networks
 - fiber, hybrid fiber/coax.
 - physical lines must be placed near homes and businesses of potential users
- “Non-geographic” networks
 - satellite, ADSL (depends on universal telecom network)
 - “instant” coverage of all potential users

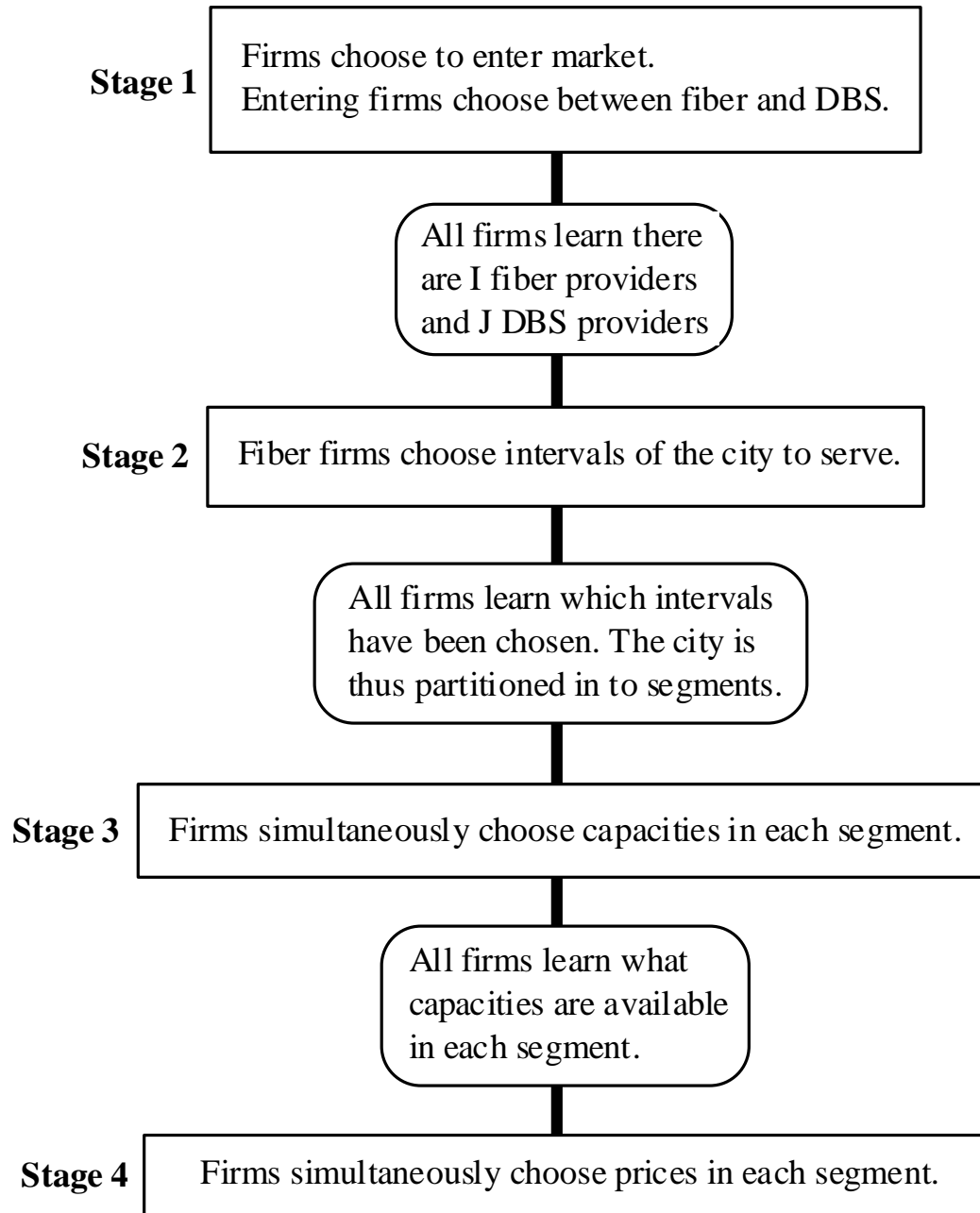
Model of Competition

- Market Geography (*linear city*):



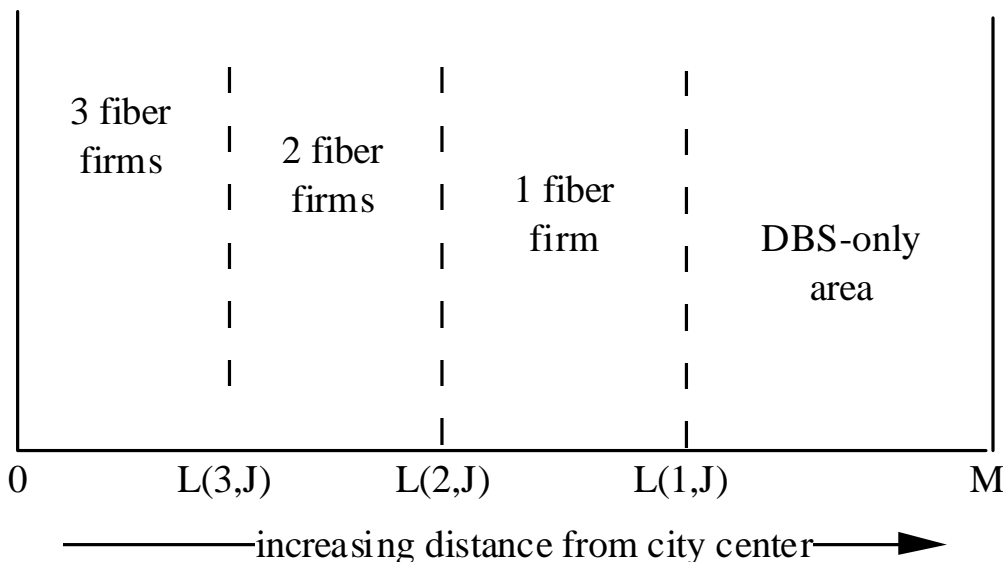
- Firm Decisions:
 - technology to use: fiber or DBS
 - what sections of the linear city to lay fiber (intervals $[h_1, H_1]$, $[h_2, H_2], \dots$)
 - how much capacity to install in each segment
 - what price to charge
- Demand:
 - fiber more valued than satellite
 - percentage of households
 - price = fixed fee (à la Internet today)

The Game



Equilibrium

- Stage 4: Bertrand in each segment
 - Stage 3: Choose capacity in each segment
- ⇒ Result is Cournot (Kreps-Scheinkman)
- Stage 2: Fiber firms select what segments to serve (asymmetric equilibrium):



- Stage 1: zero profit free entry

What is the Question?

- If free competition is permitted, what will be the outcome?
 - number of firms (fiber and DBS)
 - fraction of households with service available (farthest reach of fiber systems)
 - prices (fiber and DBS)
 - fraction of households which take service
- How does this outcome depend upon the realized demand?
- Does this achieve “universal service”? Are the goals of public policy served?

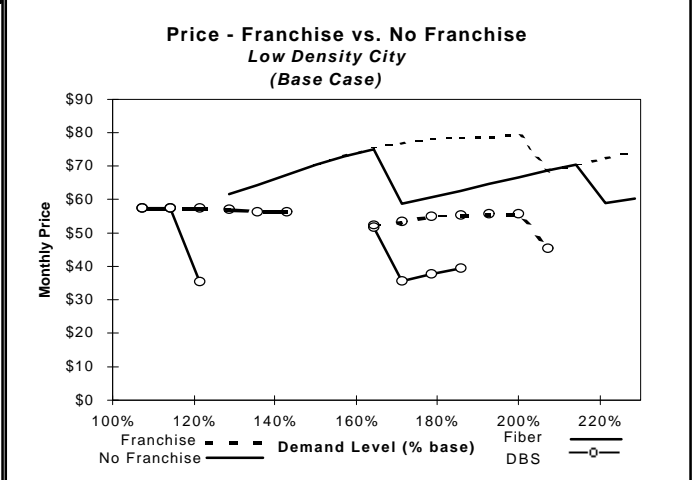
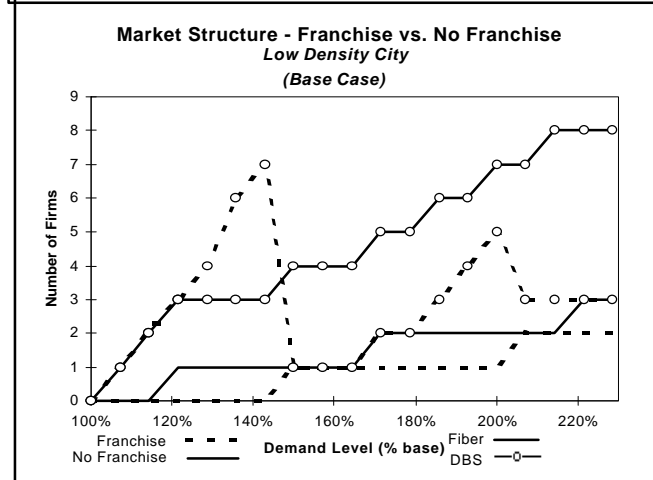
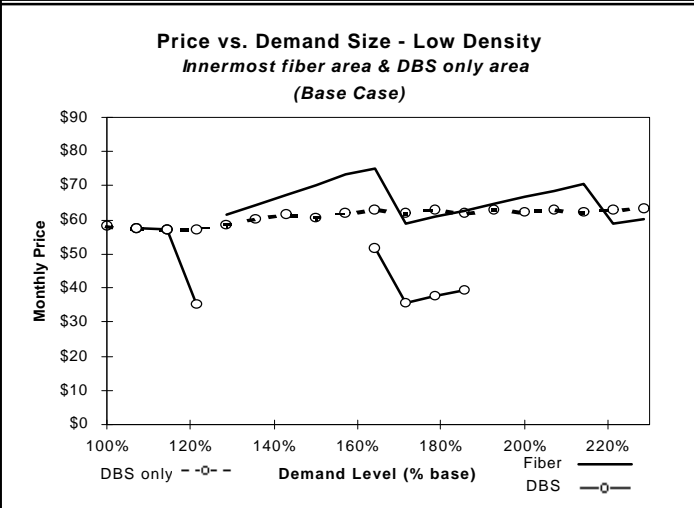
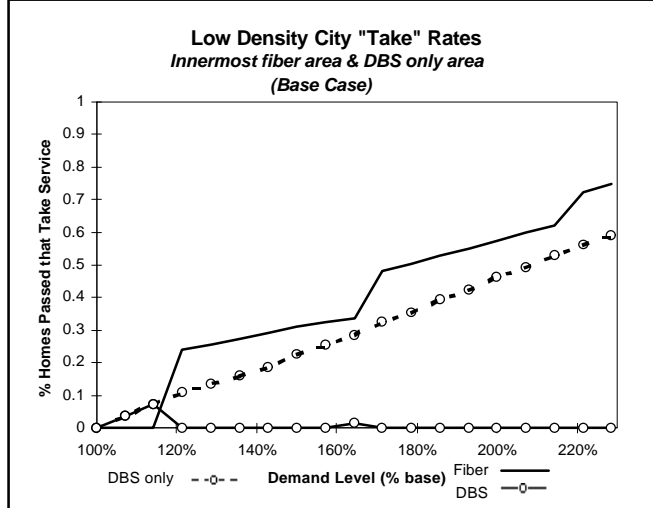
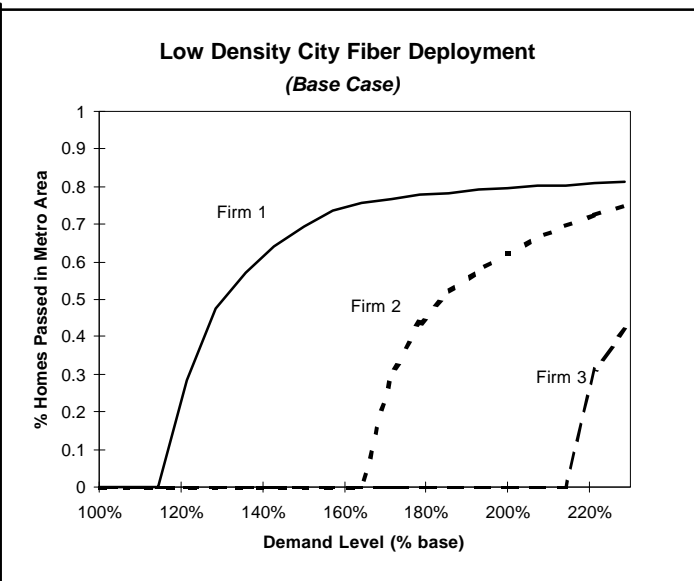
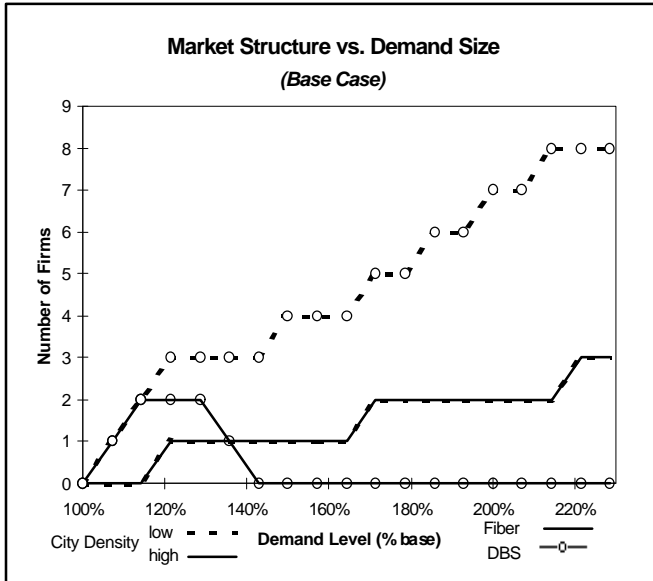
Model Calibration

- Available data: engineering estimates of cost, virtually nothing on demand
- Assume linear demand functions for fiber and DBS
 - Baseline demand: at \$56/mo (fiber) and \$33/mo (satellite), HH penetration = 15% (= current US ISP penetration)
- Fiber fixed costs (=\$15 M)
- Satellite fixed costs (=\$15M + \$25M first transponder cost)
- Fiber network costs:
 - requires population density function; we parameterize with θ = % of city population > 400/sq mile
- Fiber & satellite per subscriber capacity cost (= ISP costs = \$20/mo)

The Scenarios

- Four Scenarios:
 - A high-density city in which 75% of the households live in regions with 400 HH/mi², and a low-density city in which 50% of households live in such regions.
 - Two policy scenarios: open competition and the universal service non-exclusive franchise requirement.
- For each scenario, the game was solved for demand levels varying from 100% of baseline (“today’s demand”) to 230% of baseline
- *Not Growth Scenarios!*

Simulation Results-Base Case



Model Conclusions

- Fiber deployment awaits an increase in demand, but not by much
- Two or even three fiber firms can coexist at “take” rates similar to cable TV; monopoly at lower levels
- Satellite a niche technology for dense cities, but important for sparse cities
- For dense cities, the franchise requirement makes little difference; for sparse cities, reduces competition and raises prices, but not by all that much
- The market can do universal service
- Need to resist the urge to regulate in monopoly stage
 - universal service requirement not awful; could be a political compromise to avoid regulation.