



# The Growing and Multiple Costs of Network (Broadband) Exclusion

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## Network Effects Mean Others Matter

- Metcalfe's Law is the most famous of many formulations
  - Suited to pair-wise connections, e.g., telephones
  - You need other people to call
  - ...so the value of the network is proportional to the square of the number of people in the network ( $\propto n^2$ )
- Other "Laws" correct for structure and type of network
  - Broadcast=linear, groups=exponential, real-world=logarithmic, etc.



## How Do We Measure Disparity?

- All network values show increasing *total* value with network growth
  - What about excluded *individuals*?
- ALL previous Network Laws are based on membership in the network
- Conventional wisdom
  - Disparity is value inside (membership) vs. those outside (assumed zero)
- But surely disparity depends on the number of people OUTSIDE the network?

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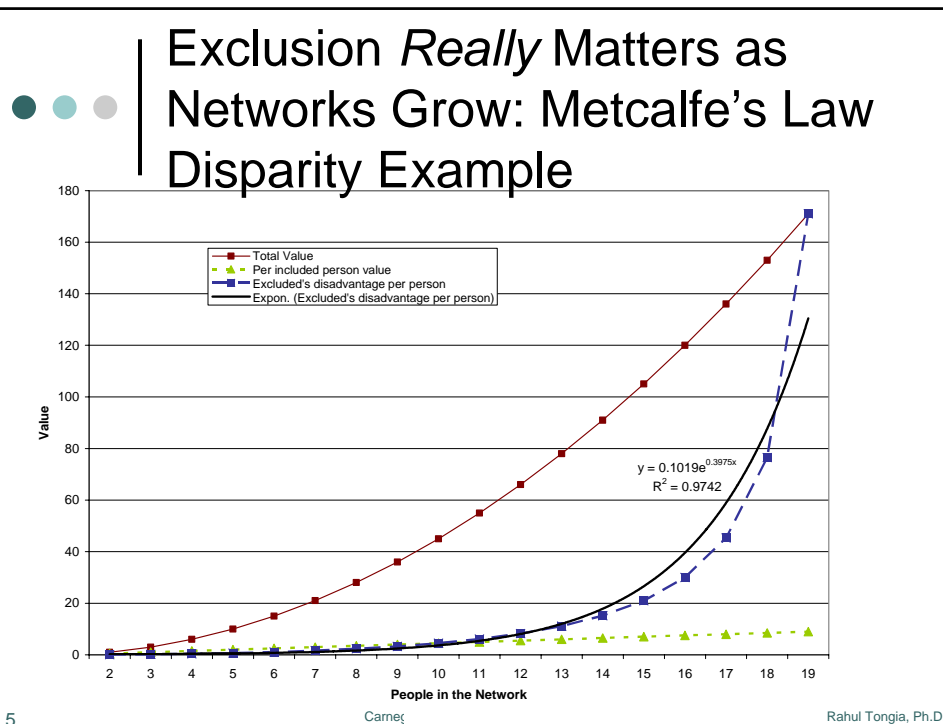
## Exclusion-based Framing

- The number of people inside the network matter
  - The included network may be inherently superior (broadband, immunized, etc.)
  - Included send signals to complementary networks
    - Content, OS, software, etc.
    - E.g., webpages are getting bigger with more people on broadband
      - Dial-up users suffer even if the number of people on dial-up weren't to decrease
- Proposed exclusion-based framing captures both of these effects

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- ## Exclusion has Societal Costs as well
- Those excluded from a network often resort to parallel/alternative networks
    - Such networks and their interconnections are poorly studied or even captured
  - The costs of exclusion are borne not only by the excluded but by society overall
    - Factors include overhead, subsidy requirements, need to maintain alternative/parallel networks, externalities etc.
      - Classic example is Emergency Rooms and the uninsured
      - In broadband/telephony, examples include pulse/touchtone dialing, unpatched older software being responsible for many Internet attacks, etc.
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## Additional Slides

- (used in Q&A / Comments)

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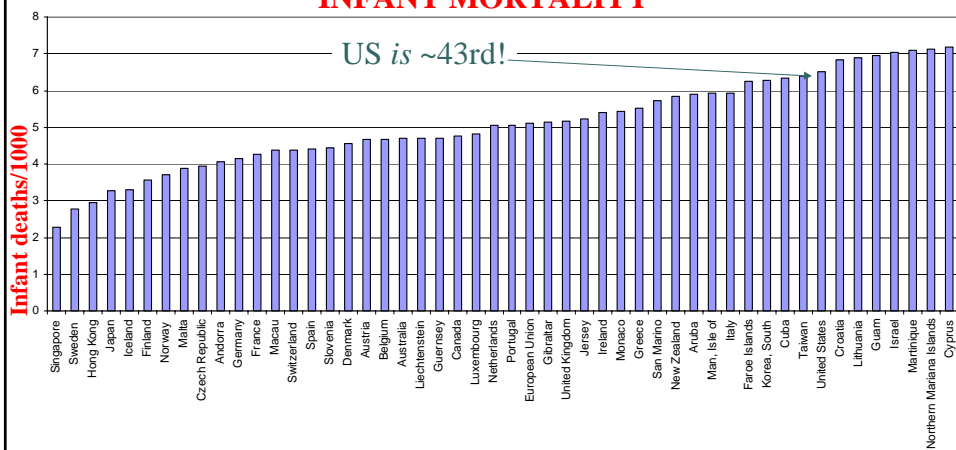
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## Here's a Ranking...

### INFANT MORTALITY



8

Mostly 2005 estimates; CIA World Factbook university

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## Rethinking the “Normal” Distribution: Healthcare and Broadband in the US

- Average numbers appear to mask a *bimodal* distribution
  - Healthcare is really good or really bad
    - US Broadband ranking is perhaps 25<sup>th</sup> (19<sup>th</sup> in OECD)
- Implications
  - Waiting for solutions to “trickle down” will either fail or take a really long time
  - Might need specialized solutions for the underserved
    - How did poorer countries manage superior infant mortality?
      - Specialized in-home visits by paramedics/midwives for every expectant mother
    - We might do the same for rural or underserved areas
      - Technology – Increase wireless emission limits, use white spaces, etc.
      - Policy – Open Access, Rights of Way, Sharing, etc.