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TITLE: The importance of ICT data to measure its economic impact

Columbia Business School

The importance of ICT data to measure its economic impact

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Why is data important in measuring ICT economic impact?

- An imperfectly informed regulator is constrained in his choice of the most appropriate approaches to overseeing the ICT sector
- Governments cannot formulate correct public ICT policies
- Under conditions of limited data on ICT impact, governments in developing countries tend to imitate/copy the policy and regulatory models of developed countries
- Common cases of mis-information due to the lack of data
  - The “Solow” paradox: is broadband affecting productivity?
  - Size of the broadband supply gap in the United States: 20 million households or 10 million households?
  - Reasons explaining the broadband demand gap: why do some countries have low broadband penetration?
  - Broadband and job creation: does broadband contribute to employment?

ICT data is the required basis for conducting rigorous policy cost-benefit analysis

- Cost-benefit analysis feeding regulatory decisions requires accurate data
- Limited data introduces considerable “noise” in the analytical process
- Considering the amount of investment in ICT, and their economic impact, the amount of data and analysis leading to decisions is typically sub-optimal
- In our view, given the little data sometimes policy makers have about economic impact of ICT, this is not an issue of how “to optimize regulation under imperfect information”, but how do we gain a better understanding of these effects

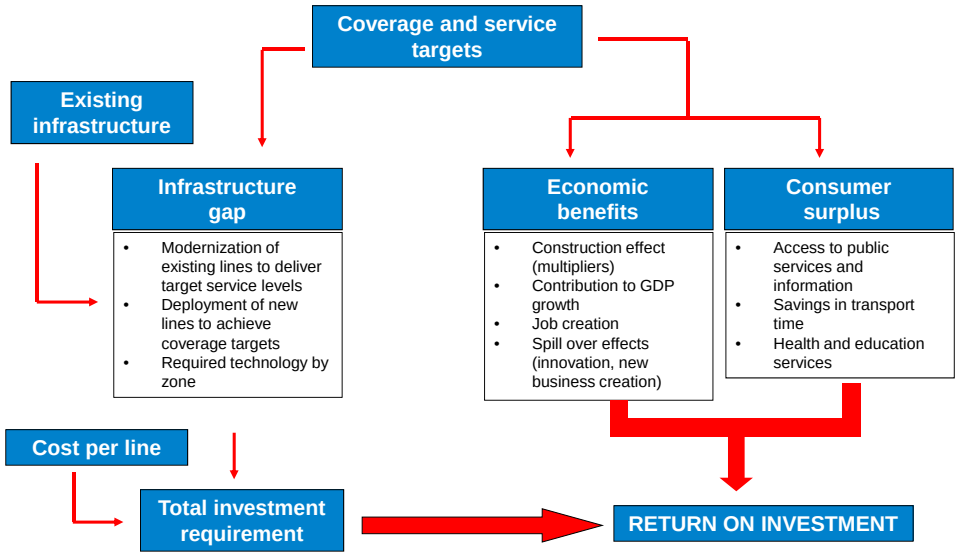
Lack of impact data results in defining policy targets without underlying rigorous analysis: example of broadband speeds

TARGETS OF COVERAGE AND DOWNLOAD SPEED FOR NATIONAL BROADBAND PLANS

COUNTRY	Coverage Targets (as a percent of households)	Speed Targets (as a percent of households)
United States	100 % (2012)	• 4 Mbps (100%) (2012) • 50 Mbps
Germany	100 % (2014)	• 1 Mbps (100%) (2014) • 50 Mbps (75%) (2014)
Singapore	100 % (2012)	• 100 Mbps (95%) (2012)
Australia	100 % (2012)	• 12 Mbps (100%) (2012)
United Kingdom	100 % (2012)	• 2 Mbps (100%) (2012)

Sources: National Broadband Plans

Coverage and service targets need to be defined on the basis of rigorous analysis of level of investment and social and economic returns



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Lack of ICT data limits governments ability to assess policy impact and fosters imitation

- The diffusion of regulatory frameworks is similar to those of new products and ideas
  - Geographic proximity ("copy your neighbor")
  - Lateral diffusion
  - Hierarchical diffusion
- Herd behavior: the choice of a regulatory model is determined by the behavior of other countries
  - Signals of certain countries shape the behavior and beliefs of policy makers in other countries
  - When these signals lead to a convergence of large group of countries, we witness "herd" behavior
- One or more incentives for imitiative behavior can be identified
  - Reduction of uncertainty: the more countries adopt a policy, the higher the value of example
  - Promote reputation
  - **Cost of information: herding allows to short-cut the analytical work or use of rigorous data analysis leading to the formulation of a regulatory model**
  - Learning from opinion leaders: leaders that are outside the country of decision maker increase legitimacy of decision

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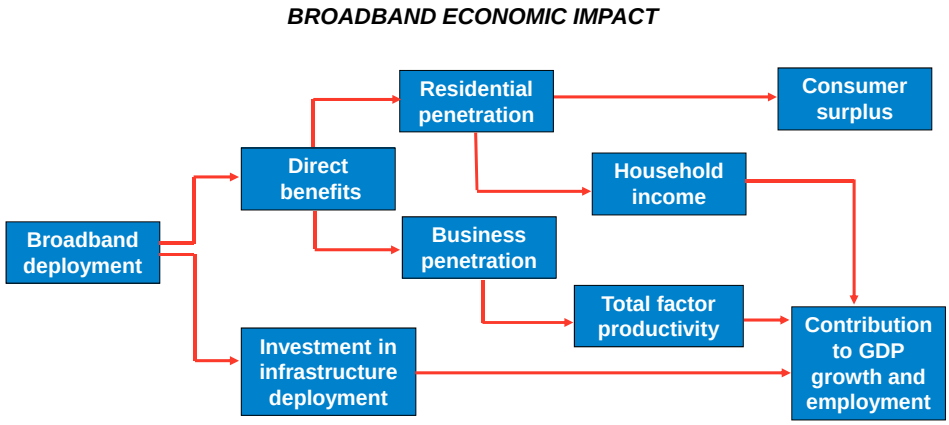
ICT Data gathering should be guided by an understanding of impact processes: the Broadband example



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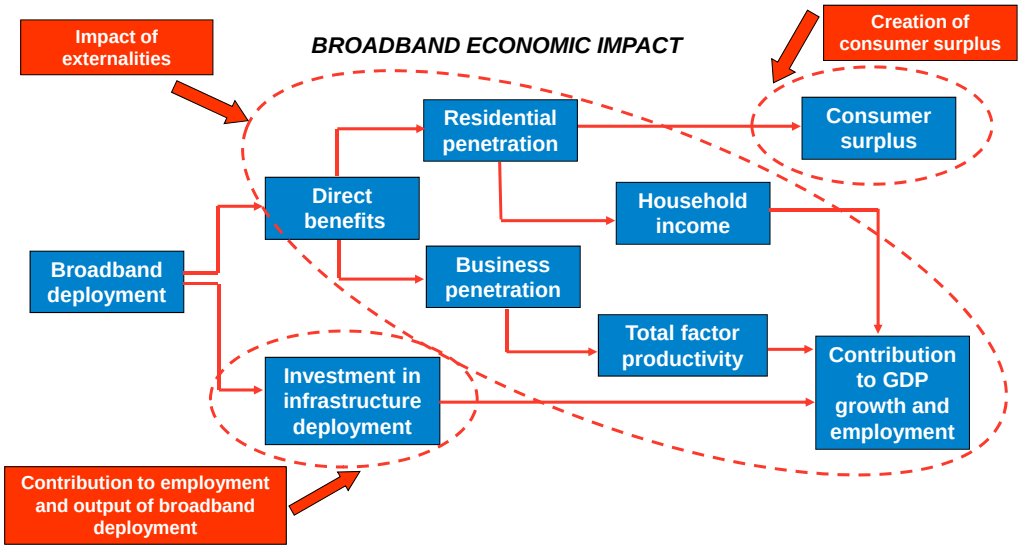
Research on the economic impact of broadband focuses on three areas



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Infrastructure effect: Three types of network construction effects exist

EFFECT	DESCRIPTION	EMPLOYMENT EXAMPLES
Direct jobs and output	• Employment and economic production generated in the short term in the course of deployment of network facilities	• Telecommunications technicians • Construction workers • Civil and RF engineers
Indirect jobs and output	• Employment and production generated by indirect spending (or businesses buying and selling to each other in support of direct spending)	• Metal products workers • Electrical equipment workers • Professional Services

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Infrastructure effect: Estimates from several countries indicate that network construction effects and multipliers are significant

NETWORK CONSTRUCTION EFFECTS OF BROADBAND

COUNTRY	RESEARCHER / INSTITUTION	STIMULUS INVEST. (US$ million)	NETWORK DEPLOYMENT JOBS ESTIMATE				MULTIPLIERS	
			DIRECT	INDIRECT	INDUCED	TOTAL	TYPE I (*)	TYPE II (**)
UNITED STATES	Katz (Columbia)	$ 6,390	37,300	31,000	59,500	127,800	1.83	3.42
	Atkinson (ITIF)	$ 10,000	63,660	165,815		229,475	2.58	3.60
SWITZERLAND	Katz (Columbia)	~$ 10,000	~80,000	~30,000	N.A.	~110,000	1.38	N.A.
GERMANY	Katz (Columbia)	$ 47,660	281,000	126,000	135,000	542,000	1.45	1.94

Sources: Katz, R. and Suter, S. (2009). *Estimating the economic impact of the US broadband stimulus plan, Columbia Institute for Tele-Information working paper;* Katz, R., P. Zenhäusern, S. Suter, P. Mahler and S. Vaterlaus (2008). *Economic Modeling of the Investment in FTTH* in Switzerland, unpublished report; *Libenau, J., Atkinson, R. (2009) The UK's digital road to recovery. LSE and ITIF; Australian government.* Katz, R., S. Vaterlaus, P. Zenhäusern, S. Suter and P. Mahler (2009). *The Impact of Broadband on Jobs and the German Economy*; Columbia Institute for Tele-Information working paper

(*) (Direct + indirect)/direct
(**) (Direct + indirect + induced)/direct

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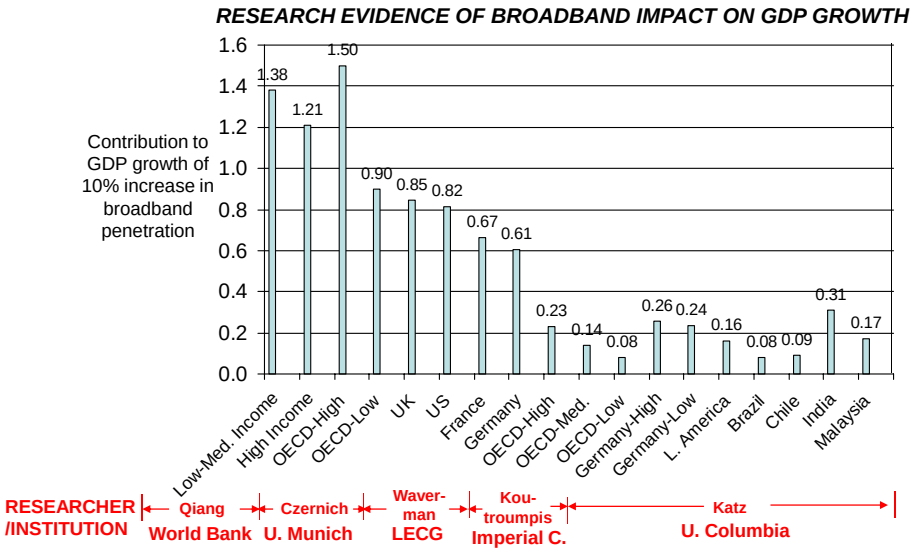
Network effects: The externalities derived from broadband are significantly higher

EFFECT	DESCRIPTION	EMPLOYMENT EXAMPLES
Productivity	• Improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband	• Marketing of excess inventories • Optimization of supply chains
Innovation	• Acceleration of innovation resulting from the introduction of new broadband-enabled applications and services	• New applications and services (telemedicine, Internet search, e-commerce, online education, VOD and social networking) • New forms of commerce and financial intermediation

Network effects: Research to date confirms the contribution to GDP growth but the amount of impact varies widely



Consumer surplus: utility gain of broadband that can be purchased at a price lower than what consumers are willing to pay

Benefits that broadband technology (DSL, cable modem, Fttx) yields in relation to dial-up

Benefits derived from increased broadband penetration (access to new services and information)

Price declines as a result of competition, technology trends, and productivity gains

Consumer surplus
=
Willingness to Pay
-
Price of service

Consumer surplus: this approach can be used either historically or forward-looking

HISTORICAL STUDIES	FORWARD-LOOKING
Greenstein and McDevitt (2009) analysis of broadband bonus in the United States	Crandall and Jackson (2001) analysis of consumer surplus generated by broadband adoption in the United States
Greenstein and McDevitt (2010) comparative analysis of consumer value generated by broadband diffusion in China, Mexico, Spain, Canada and the United Kingdom: **scale of value creation is proportionate to deployment**	Katz et al. (2008) comparative analysis of consumer surplus to be generated in Switzerland by alternative fiber deployment strategies: **consumer surplus is maximized in competitive models that promote infrastructure based competition**

Infrastructure effect: data to support a quantification of investment (input) and the I-O matrices are required to estimate this

DATA UTILIZED IN INPUT-OUTPUT STUDIES

DATA	REMARKS	AVAILABILITY	RATIONALE
Investment in broadband program	Breakdown of investment by sectors (i.e. manufacturing of electronic equipment, construction, telecommunication)	To be calculated based on benchmarks	This is the investment input that will trigger growth in output and/or jobs
Input-output-table	Requires reformatting to estimate employment effects	To be supplied by government statistical units and/or Central Banks	Required to understand inter-sectoral relationships

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Network effects: data requirements for econometric analysis include both ICT and economic

DATA UTILIZED IN ECONOMETRIC STUDIES

DEPENDENT VARIABLES	INDEPENDENT VARIABLES	CONTROL VARIABLES
•Annual or quarterly rate of change of GDP •Annual or quarterly rate of change of employment •Annual or quarterly rate of change of unemployment •Annual number of SME's	•Annual or quarterly rate of change of broadband penetration	•GDP at starting time of period •Level of education: Percent of population with tertiary degrees; Illiteracy rate; Years of schooling; participation rate in secondary school •Regional Investment as percentage of regional GDP •Percent of households with electricity or running water •Number of projects and added value of construction projects financed by the state •Number of hospitals per inhabitant; number of beds in hospitals per pop. •Access to financial services: Number of banking offices and bank credit p.c. •Industry concentration: Contribution of financial services, commerce and manufacturing sectors to regional GDP •Importance of tourism in the region (number of domestic tourism trips) •Cost index for interstate trade costs •Cost to create new business •Regional Gini Coefficient •Percentage of people living in urban centers •Total road length per hundred sq. Km by area; Road development index •Population growth rate •Globalization Index; Globalization Index per region

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Advantages and disadvantages of each methodology

	ADVANTAGES	DISADVANTAGES
Input-output analysis	• Easy to communicate • Based on proven interlinks	• Static models • Numerous caveats on induced effects • Dependent on up to date I-O matrices
Econometric analysis	• Ability to link projections of broadband penetration to growth	• Length of data sets • Data disaggregation
Consumer Surplus	• Useful to calculate economic impact not captured GDP numbers • Results are quite valid in the short run because the analysis assumes stable demand	• Analysis could be conservative because it excludes gains to early consumers, shifts in demand due to GDP growth, falling prices of PCs, etc.

To sum up, data requirements for assessing broadband economic impact range from aggregate macro to the micro-data data

- Disaggregated data for ICT, broadband and economic indicators
  - Increase the number of observations
  - Deal with fixed effects
- Quarterly data
  - Gain better understanding of timing of effects
  - Ability to conduct analysis for monitoring of effects
- Data on broadband download speeds
  - Understand return to broadband speed
  - Frame investment and broadband target requirements
- Data on wireless internet access
  - Capture a growing trend and shift in broadband platform
- Broadband coverage data
  - Understand uptake trends
  - Gain more evidence to support formulation of demand gap policies
- Variables to control income endogeneity (prices, competition, government, investment)
  - Gain better understanding of causality