

# The Impact of Tariff Diversity on Broadband Diffusion: An Empirical Analysis

Justus Haucap, Ulrich Heimeshoff, Mirjam R.J. Lange

Düsseldorf Institute  
for Competition Economics  
  
Heinrich Heine University of Düsseldorf

  
HEINRICH HEINE  
UNIVERSITÄT DÜSSELDORF

# Table of Contents

- ① Motivation
- ② Literature
- ③ Empirical Analysis
- ④ Results
- ⑤ Conclusion

## Motivation

- Broadband penetration key driver for economic growth
- Indirectly spurs
  - innovation,
  - productivity, and thus
  - a country's national competitiveness.
- Empirical evidence, e.g.
  - Röllner & Waverman (2001),
  - Koutroumpis (2009),
  - Qiang, Rossotto & Kimura (2009),
  - Czernich, Falck, Kretschmer & Woessmann (2011)
  - Summary: Cardona, Kretschmer & Strobel (2013)

# Motivation

- Timely deployment and uptake of broadband infrastructure has become a major policy objective
- Various action plans were launched, e.g.
  - US government's National Broadband Plan
  - European Commission's Digital Agenda for Europe
  - "Europe 2020 Strategy"

## Literature

Descry key factors that drive fixed broadband diffusion:

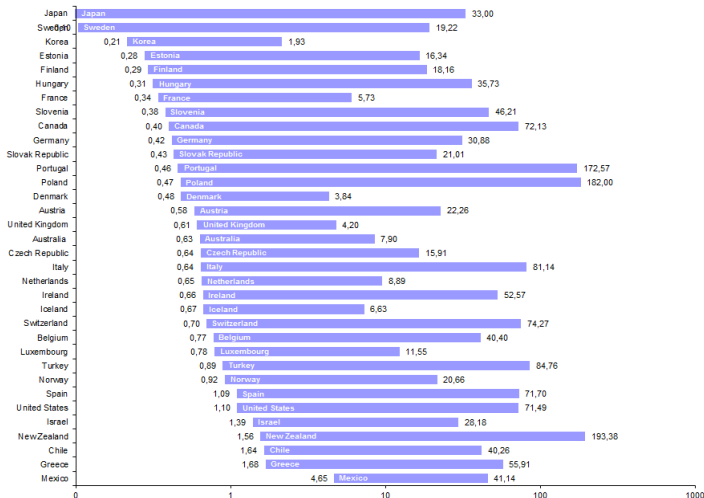
Price level	Wallsten & Hausladen (2009), Bouckaert, van Dijk & Verboven (2010), Galperin & Ruzzier (2013)
Income	Gruber & Koutroumpis (2013), Lin & Wu (2013)
Competition (inter)	[+]: Cava-Ferreruela & Alabau-Muñoz (2006), Höffer (2007), Nardotto, Valletti & Verboven (2013) [-, or none]: Briglauer, Ecker & Gugler (2013), Briglauer (2014)
Competition (intra)	[+]: Lee et al. (2011); [-, or none]: Denni & Gruber (2007), Distaso et al. (2006), Wallsten & Hausladen (2009), Bouckaert et al. (2010), Briglauer et al. (2013)
Speed	Lee & Brown (2008)
Content	Lin & Wu (2013)
Education	Trkman et al. (2008)
"predisposition"	Cava-Ferreruela & Alabau-Muñoz (2006)

## Literature

- Most studies have considered
  - (a) broadband price levels (US\$/Mbps),
  - (b) income,
  - (c) socio-demographic characteristics,
  - (d) government policy and regulation, and
  - (e) the degree of inter- and intra-platform competition.
- focus on OECD countries
  - Gruber & Koutroumpis (2013): global
  - Galperin & Ruzzier (2013): LAC vs OECD

# Tariff diversity in OECD countries

Broadband prices per megabits per second of advertised speed, Sept. 2011 - USD PPP



## Contribution

- clear that *price levels* affect broadband uptake
- effect of *price diversity* less clear
  - (i) classical industrial economics theory:  
price discrimination in final consumer markets should lead to an expansion of output  
⇒ positive relationship
  - (ii) recent theories of boundedly rational consumer:  
confusion over “too much variety” or “too many tariffs”  
backed up by the success of (simple) flat-rate tariffs  
⇒ negative relationship
- account for the degree of *tariff diversity*
- worldwide cross-sectional data set



## Data

- Google
- 91 countries (26 OECD members, 65 non-member states)
- 2012:Q3
- detailed data on tariffs
  - around 1500 broadband-only-offers, i.e., without any further bundled services
  - around 2500 mobile broadband offers
- supplemented with data by World Bank, OECD and ITU.

## Demand

$$\log(\text{BP}_{it}^d) = \beta_0 + \beta_1 \text{PFIX}_{it} + \beta_2 \text{PMOB}_{it} + \beta_3 \text{DIVERSITY}_{it} \\ + \beta_4 \text{INCOME}_{it-1} + \beta_5 \text{COMP}_{it} + \beta_6 \text{OECD}_{it} + \epsilon_{it}^d,$$

where  $i = 1, \dots, 91$  indicates each market (or country).

- Identification problem: cost shifters
  - share of urban population,
  - Index of Economic Freedom

Variable	Description	Sign	Source
BP	Fixed broadband subscriptions per 100 inhabitants.		ITU, 2012
PFIX	Fixed broadband tariffs' monthly price standardized by download speed (in US\$ PPP/Mbps).	-	Google, 2012
PMOB	Mobile broadband tariffs' monthly price until data cap is reached (in US\$ PPP/Gbps).	+	Google, 2012
DIVERSITY	Tariff diversity (standard deviation of PFIX).	+	Google, 2012
INCOME	Annual GDP per capita (US\$ PPP).	+	World Bank, 2011
COMP	1 if there is inter-platform competition, 0 else	+	Google, 2012
OECD	1 if country is OECD member, 0 else	+	
URBANPOP	Urban population per 100 inhabitants.	+	World Bank, 2012
FREEDOM	Index measuring economic freedom, the freest country is assigned the first rank out of 1-186.	-	The Heritage Foundation, 2011

## Results

Dependent variable: $\log(BP)$						
Variable	OLS			2SLS		
	(1)	(2)	(3)	(1)	(2)	(3)
PFIX	-0.0031*** (0.0012)	-0.0024* (0.0012)	-0.0023* (0.0012)	-0.0102** (0.0041)	-0.0058** (0.0028)	-0.0061** (0.0029)
PMOB			-0.0039 (0.0107)			0.0108 (0.0129)
DIVERSITY		0.0008* (0.0004)	0.0008* (0.0004)		0.0024** (0.0011)	0.0025** (0.0011)
INCOME		0.0001*** (0.0000)	0.0001*** (0.0000)		0.0001*** (0.0000)	0.0001*** (0.0000)
COMP			0.1882 (0.4662)			0.2384 (0.5147)
OECD			0.6356 (0.419)			0.6579** (0.3162)
Intercept	1.3753***	-0.6316** (0.2937)	-0.6947 (0.4801)	2.3868*** (0.4347)	-0.0580 (0.4188)	-0.0939 (0.3155)
N	91	91	85	91	91	85
R <sup>2</sup>	0.2236	0.6664	0.6669	0.7141	0.5174	0.5024
F	7.58	51.14	35.67	5.30	46.52	32.11
Prob>F	0.0072	0.0000	0.0000	0.0239	0.0000	0.0000
Hausman $\chi^2$				15.28	8.31	11.31
Sargan $\chi^2$				1.385	1.472	1.241

Significance levels : \* : 10% \*\* : 5% \*\*\* : 1%.

Robust standard errors are reported in parentheses.

Variance inflation factors are reported in curly brackets.

## Results - Elasticities

Variable	Total sample	non-OECD
PFIX	-0.95**	-1.26**
DIVERSITY	0.37*	0.48**
INCOME	1.22***	0.75***
OECD	0.20**	

Significance levels : \* : 10% \*\* : 5% \*\*\* : 1%.

(i) fixed broadband price (-)

(ii) tariff diversity (+)

⇒ As suggested by traditional economic theory:

Possibility of price discrimination seems to enlarge output and demand by serving consumers with a low WTP without restraining the price charged for consumers with a higher valuation.

(iii) income (+)

(iv) OECD membership (+)

(v) mobile broadband price and  
inter-platform competition

(expected positive signs, statistically not significant)

## Conclusion

- *Tariff diversity* enhances demand
- Reduced prices and increased tariff diversity are more important than increased inter-platform competition  
⇒ Policy makers should be lenient towards price discrimination in broadband markets
- Price discrimination allows suppliers with a high proportion of fixed costs to expand their output  
⇒ Prohibiting price discrimination would prevent efficient recovery of fixed costs and would, in the long run, have a negative impact on investments.
- Model works well for cross-section of heterogeneous countries (majority of non-OECD member states)  
⇒ Results may be especially true for emerging markets

Thank you for your attention!