Is Fixed-Mobile Substitution Strong Enough To De-regulate Fixed Voice Telephony? Evidence From The Austrian Markets

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Outline

- motivation
- related literature
- conceptual framework of market definition
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- estimation and results
- conclusions

Motivation

- until recently, most fixed network retail markets in Austria were regulated
  - access for residential as well as business users: regulated
  - national calls of residential users: regulated
  - international calls of residential users: not regulated
  - national as well as international calls of business users: regulated
- mobile telephony was not considered to be part of the same market
- competitive pressure from mobile telephony seems to have increased
- not for all markets in the same way
  - little empirical evidence on fixed-mobile substitution on level of particular retail markets (access/calls, national/international, business/residential)
- in which markets is fixed-mobile substitution strong enough?

European regulation

- every few years the European Commission publishes a list of relevant markets concerning the ex ante regulation of communications markets
- the so called "Recommendation on Relevant Markets" has to be considered by each national regulatory authority and is the starting point of any market analyses process
- in 2007 the old recommendation was replaced
  - markets for national and international calls should no longer be subject to ex ante regulation
  - due to the increasing importance of broadband connections and associated technological innovations (most notably, IP-based telephony) and (in part only recently) imposed regulatory instruments on the wholesale level (such as unbundling, naked DSL, wholesale line rental, carrier selection)

Consequences for national markets

- it is not a-priori clear whether these "intramodal" developments justify any changes of the recommendation
- on the other hand, in many member states the mobile sector is increasingly exerting competitive pressure ("intermodal") on fixed voice telephony markets ("Fixed-to-Mobile Substitution").
- the Austrian telephone market
  - mobile competition in Austria is advanced
  - about 75% of voice traffic originated from mobile networks in 2007
  - Austria among the countries with the highest mobile broadband penetration (European Commission 2009)

Development over time
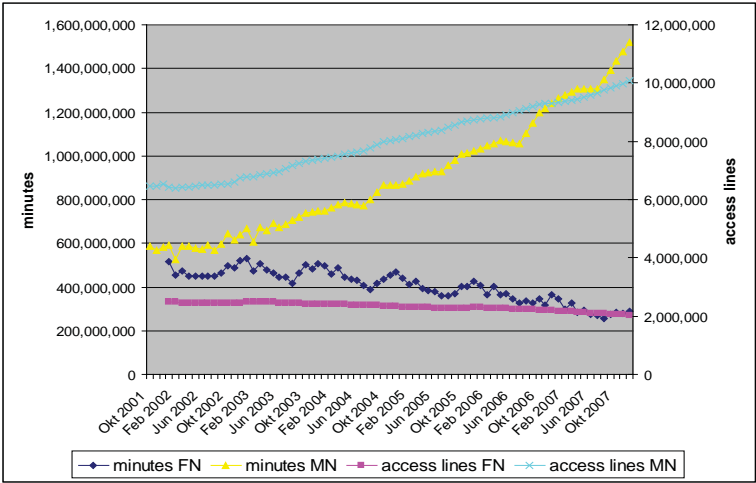
Objective of the study

- is the competitive pressure from mobile telephony large enough to de-regulate fixed telephone lines in Austria?
- to test whether fixed-mobile substitution is strong enough, a hypothetical monopolist test is conducted
  - test asks whether a small but significant non-transitory price increase is profitable for a hypothetical monopolist
- estimation of demand elasticity
  - quantity = f(own price, substitute price, income)
  - times series data, error correction model
- along three dimensions
  - access vs. calls
  - national calls vs. international calls
  - residential vs. non-residential consumers

Related literature

- estimation of fixed mobile substitution
  - demand for fixed access and usage is estimated to be inelastic during 1980s-1990s (New Zealand Commerce Commission, 2003)
  - newer studies find some evidence for fixed mobile substitution, not all are using price data
  - in a review Vogelsang (2009) concludes that fixed and mobile access as well as call services appear to be substitutes
    - own price elasticities of fixed network services are usually estimated to be inelastic, access is much more inelastic than calls
    - only few studies with recent data
- econometric model
  - Steen and Salvanes (1999) proposed a dynamic formulation of an oligopoly model within an error correction model an applied it to the French market for fresh salmon
  - based on the models by Bresnahan (1982) and Lau (1982)

Conceptual framework of market definition

- hypothetical monopolist test
  - is a small but significant non-transitory price increase profitable?
  - small but significant is interpreted as 5-10% in practice
  - non-transitory is interpreted as a period of 1-2 years
- elasticity of residual demand summarizes a firm's market power
  - its ability to raise prices above competitive levels
  - the higher the elasticity of residual demand the lower market power
- for market definition purposes we refer to a (hypothetical) monopolistic supplier of the product in question

Conceptual framework of market definition continued

- iterative procedure
  - cross-price elasticities constitute method of ranking closest substitutes
  - for fixed networks mobile services are most obvious candidate
- compare estimated elasticity of demand with a critical elasticity
  - smaller elasticities imply that the price increase will increase overall profits
  - greater elasticities imply that the price increase will reduce overall profits and the next best substitute has to be included in the market

Estimation of demand

- quantity = f(own price, substitute price, income)
- estimations focus on private users
  - ► more homogenous
  - ► more likely to consider mobile as substitute
- estimations are done for
  - ► national calls
  - ► access
- relation between access and calls
  - ► fixed and mobile operators tend to set two-part tariffs for their services
  - ► fixed fee and a per-minute calls price
- fixed mobile substitution
  - ► long-run vs. short considerations: change of usage behavior and subscription decision
  - ► fixed network access price, mobile network prices, fixed network per minute price and mobile network per minute price

Econometric model

- error correction model (ECM)
  - allows for short-run departures from long-run equilibrium
  - not only statistical problems can be addressed, but also dynamic factors as habit formation of consumers and adjustment costs of producers can be incorporated
- statistical issues
  - tests show that quantity, prices, and income variable have a unit root
  - first differences are stationary
  - cointegrating relation allows to use data in levels

Empirical specification

- we specify the following error correction model in logs
  - $\Delta Q_t = \beta_0 + \beta_1 \Delta P_t + \beta_2 \Delta W_t + \beta_3 \Delta Y_t + \beta_4 D_1 + \beta_5 D_2 + \gamma(Q_{t-1} - \alpha_1 P_t - \alpha_2 W_t - \alpha_3 Y_t - \alpha_4 \text{trend}) + \epsilon_t$ (*)
- it is estimated in a two-step procedure (Bardsen 1989)
  - first, equation (*) is estimated to obtain a consistent estimate of γ
  - then, we construct $\Delta Q_t - \gamma Q_{t-1}$ and regress it on the remaining variables in (*)
  - instruments are used for endogenous variables on the RHS
- residuals have to be checked to be stationary
- if γ is significantly different from zero, it describes the speed of adjustment to the long-run relation after a shock
- β's describe short-run elasticities, α's long-run elasticities

Data

- quantities
  - number of access lines held by private users (fixed and mobile)
  - number of minutes from private users (fixed and mobile)
- prices
  - average prices: revenues divided by quantities
- instruments
  - for the fixed network calls prices:
    - basket of fixed and mobile termination charges
    - number of fixed access lines
  - for the fixed network access prices:
    - number of broadband lines
    - number of voice over broadband lines
- all data are available on a monthly basis from Jan 02 to Dec 07
  - exception: data for mobile only on quarterly basis from Jul 03 to Dec 07 $\rightarrow$ interpolated

Estimated models, methods and results

- calls
  - one model with four prices (p_fn_use, p_fn_acc, p_mn_use, p_mn_acc) and one with calls prices only (p_fn_use, p_mn_use)
  - OLS, TSLS
  - standard errors are calculated using the delta method
  - critical t-value is adjusted in the case of interpolated data
  - we find a co-integrated relation, i.e. γ is significantly different from zero and residuals are stationary
  - $\hat{\gamma}$ is around -0.4 , i.e. demand bounces back to the long-run equilibrium path within two and a half months after a shock had occurred
  - long-term and short-term elasticities fulfill theoretical properties

- access
  - one model with four prices (p_fn_acc, p_fn_use, p_mn_acc, p_mn_use) and one with calls prices only (p_fn_acc, p_mn_acc)
  - we do not find a co-integrating relation $\rightarrow$ estimation in first differences accounting for autocorrelation

Estimation results for calls

	Model 1 OLS	Model 2 OLS	Model 1 TSLS	Model 2 TSLS
Constant	4.524***	5.142***	0.940	4.423***
	(3.96)	(5.62)	(0.33)	(3.84)
Long run elasticities				
p_fn_use(t-1)	-2.093***	-1.953***	-3.473***	-2.052***
	(-6.76)	(-6.75)	(-2.85)	(-3.58)
p_fn_acc(t-1)	0.244		0.723	
	(0.75)		(1.37)	
p_mn_use(t-1)	0.341***	0.461***	0.042	0.451***
	(2.83)	(5.20)	(0.16)	(6.21)
p_mn_acc(t-1)	0.238		0.691	
	(1.14)		(1.37)	
prod(t)	0.687	0.631	1.301*	0.773*
	(1.46)	(1.33)	(1.85)	(1.76)

Estimation results for calls continued

	Model 1 OLS	Model 2 OLS	Model 1 TSLS	Model 2 TSLS
Short run elasticities				
Δp_fn_use(t)	-0.842***	-0.741***	-1.776**	-0.926**
	(-5.00)	(-5.15)	(-2.21)	(-2.15)
Δp_fn_acc(t)	0.360		1.354	
	(1.44)		(1.36)	
Δp_mn_use(t)	0.150	0.146	0.273	0.171
	(0.63)	(0.79)	(0.80)	(0.69)
Δp_mn_acc(t)	0.164		0.189	
	(1.03)		(0.79)	
Δprod(t)	0.498***	0.464***	0.663***	0.495***
	(2.94)	(3.07)	(2.93)	(2.93)

Estimation results for calls continued

	Model 1 OLS	Model 2 OLS	Model 1 TSLS	Model 2 TSLS
Other variables				
Time trend	-0.009***	-0.007***	-0.019**	-0.008***
	(-4.01)	(-4.11)	(-2.32)	(-2.81)
D(1)	-0.116***	-0.118***	-0.111***	-0.114***
	(-14.31)	(-13.82)	(-6.37)	(-8.19)
D(2)	-0.060***	-0.062***	-0.045***	-0.059***
	(-7.16)	(-7.61)	(-2.98)	(-5.59)
$\hat{\gamma}$ (first step)	-0.406***	-0.397***	-0.399**	-0.367**
	(-3.83)	(-4.14)	(-2.19)	(-2.44)
Sargan n* R^2 test (p-value)	-	-	0.75	0.23
Number of observations	69	69	68	68
adj. R^2	0.92	0.92	0.88	0.91

Estimation results for access

	Model 1 OLS	Model 2 OLS	Model 1 TSLS	Model 2 TSLS
Constant	-0.003***	-0.003***	-0.003***	-0.003***
	(-3.55)	(-4.20)	(-3.38)	(-4.14)
Short run elasticities				
Δp_fn_use(t)	-0.003		-0.001	
	(-0.92)		(-0.13)	
Δp_fn_acc(t)	-0.058***	-0.058***	-0.085***	-0.102***
	(-4.22)	(-4.73)	(-3.71)	(-4.69)
Δp_mn_use(t)	0.003		0.009	
	(-0.19)		(0.54)	
Δp_mn_acc(t)	-0.001	-0.002	-0.002	-0.003
	(-0.12)	(-0.21)	(-0.21)	(-0.24)
Δprod(t)	-0.028***	-0.028***	-0.026***	-0.026***
	(-3.80)	(-4.19)	(-3.69)	(-4.14)
AR(1)	0.159*	0.175*	0.166*	0.185**
	(1.69)	(1.82)	(1.75)	(2.01)
AR(2)	0.534***	0.522***	0.513***	0.506***
	(4.86)	(5.08)	(4.56)	(4.91)
Long run elasticities				
Δp_fn_acc(t)	-0.15	-0.15	-0.21	-0.25
Sargan $n*R^2$ test (p-value)	-	-	0.89	0.69
Number of observations	69	69	69	69
adj. R^2	0.33	0.35	0.30	0.28

Critical elasticity

- long-run elasticities are compared to the critical elasticity
- $\epsilon_c = \frac{\log(PMC+t)-\log(PMC)}{\log(1+t)}$
    - with PCM the competitive price-cost margin prior to the price increase t (Werden 2002)
    - elasticities less than ϵ_c imply that the price increase will increase overall profits
    - elasticities greater than ϵ_c imply that the price increase will reduce overall profits and the next best substitute has to be included in the market
- access: smallest value of $\epsilon_c = 0.91$ ($PCM = 1$ and $t = 10\%$)
- national calls: $-1.31 \leq \epsilon_c \leq -1.31$ ($PCM = 0.75$ and $t = 5$ or 10%)
    - variable cost for calls (e.g. interconnection capacity, off-net termination, dab debt) is estimated to be 25% at the maximum for network operators

Summary and conclusions

- national calls for private users seem to be elastic, cross price elasticity to mobile positive
- estimated elasticity larger than critical elasticity for HM-test (1.2)
  - assumptions: 25% variable costs, 10% price increase, linear demand
- fixed and mobile are likely to be part of the same market for national calls of private users
  - $\rightarrow$ market has been deregulated
- access for private users is more inelastic, cross price elasticity to mobile small/insignificant
  - $\rightarrow$ mobile unlikely to be part of the same market for private users

Conclusions for other markets

- business customers / international calls
  - ▶ consumer surveys / market data show that fixed-mobile substitution is less pronounced in the business segment
    - ⋆ → mobile unlikely to be part of the same market
  - ▶ same goes for international calls (still large price differences)
- other countries
  - ▶ Austria is relatively advanced concerning fixed-mobile substitution
    - ⋆ highest share of mobile compared to fixed revenues (OECD)
    - ⋆ highest penetration of mobile broadband (14th Implementation Report)
  - ▶ → questionable, whether fixed mobile substitution is strong enough in other countries