

# **Network-Based Price Discrimination and ‘Bill and Keep’ vs. ‘Cost-Based’ Regulation of Mobile Termination Rates**

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# Outline

Talk is based on Harbord and Pagnozzi (2008) & Harbord and Hoernig (2009)

1. Traditional approach to regulating MTRs in CPNP countries
2. Simple arguments in favour of a new approach
3. Distortions to efficiency and competition caused by high MTRs as explained by the new literature on network competition and call externalities
4. Evidence on call externalities and network effects
5. Possible solutions
6. Welfare analysis of remedies
7. International evidence on CPNP vs B&K countries

# MTRs in CPNP Countries

Under CPNP each operator is a monopolist in termination on its own network, i.e.

- controls access to its own subscribers;
- subscribers typically not sensitive to/aware of MTRs

Creates economic incentive to set high MTRs resulting in:

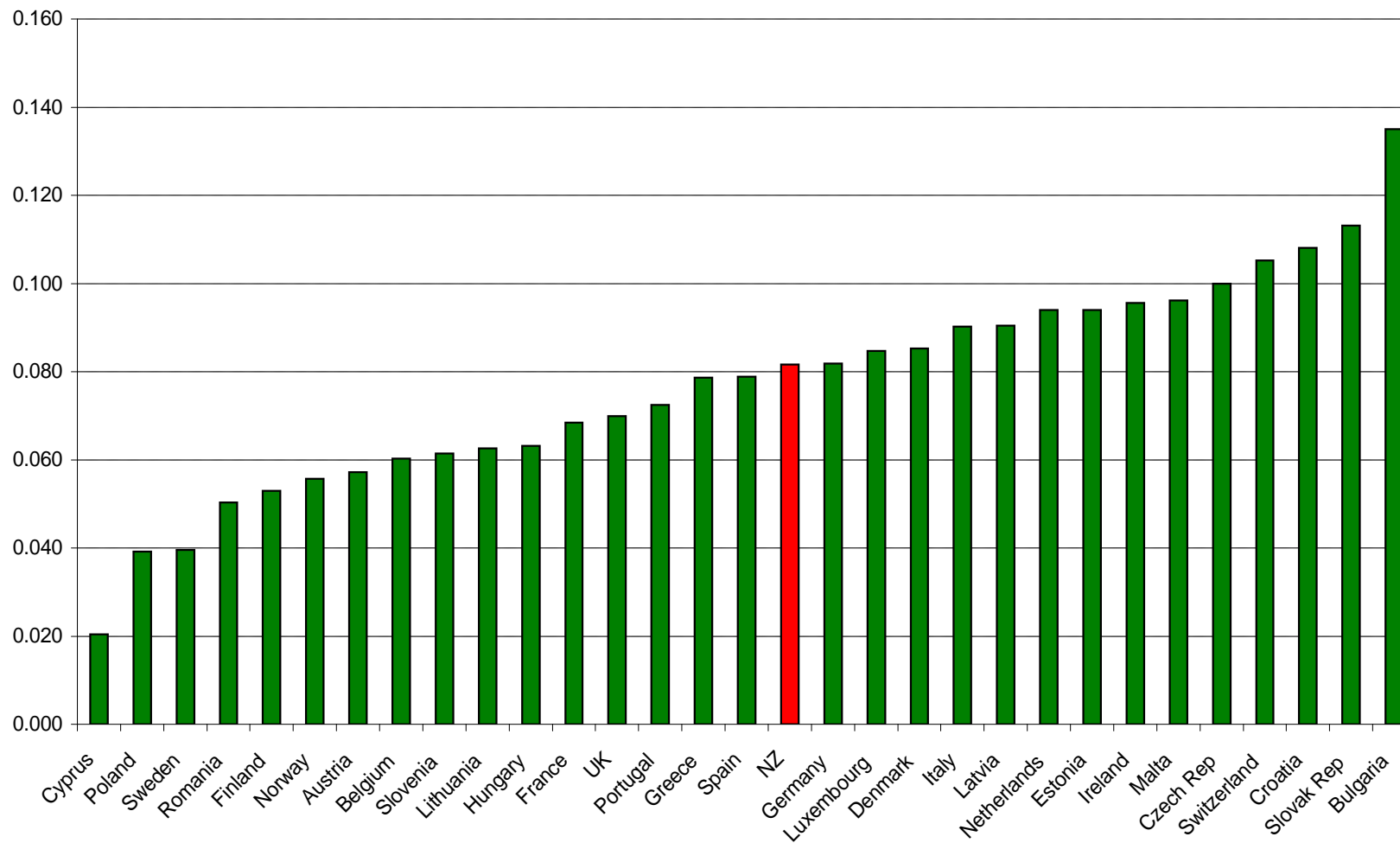
- excessive profits at wholesale level from FTM calls
- distortions in relative prices, i.e. FTM versus MTF calls
- high off-net call prices above marginal cost

Standard approach to regulating MTRs in CPNP countries is to allow for “total cost recovery”, or based on FACs. In Europe:

- MTRs vary from 2 cpm (Cyprus) to 15 cpm (in Bulgaria); average is approx. 8.5 cpm
- (FTRs range from 0.3 cpm to to 1.13 cpm)

# MTRs in CPNP Countries

Average MTR (Euro) based on a 3 minute call





# Traditional Regulatory Approach in UK

Ofcom regulates MTRs in UK based on a “LRIC +” cost model. “LRIC” is:

- “the additional cost an MNO incurs to provide termination”, or
- “the cost that the firm would avoid if it decided not to provide voice termination” :

According to Ofcom, LRIC-based charges are prices which:

- “would prevail in an effectively competitive market”, or;
- “mimic the effects of a competitive market”

But Ofcom doesn't estimate LRIC – LRIC + is just fully allocated network costs.

# Traditional Regulatory Approach in UK ...

Ofcom's main rationale for regulating MTRs is to prevent a welfare-reducing distortion in the structure of prices:

- i.e. excess profits from termination “monopoly” are used to (over-)subsidize subscriber acquisition
- leads to over-consumption of mobile retail services and under-consumption of other retail services that use mobile termination, e.g. fixed retail services
- Ofcom's estimate of welfare benefit of regulation exclusively about correcting this inefficient structure of prices, i.e. it assumes no excess profits overall, or 100% “waterbed” effect
- Waterbed effect: whereby profits earned on termination monopoly “upstream” are competed away in retail market “downstream”

# Problems with Traditional Approach I

Almost all mobile costs are fixed or common costs, i.e. not traffic sensitive. But regulated price caps turn fixed costs into cpm rates.

- results in MTRs far in excess of *marginal termination costs*
- distorts pricing incentives by making off-net calls more expensive than on-net calls
- **evidence:** MNOs often charge much lower prices for on-net calls, implying they view the relevant avoidable costs as lower than LRIC+ (in Portugal, ANACOM estimates termination costs of the order of **3.6 cpm** from on-net call prices, compared to the regulated rate of **11 cpm**)
- with strong “waterbed effects” additional revenue may not go to recovering fixed costs, but be dissipated in competition for subscribers
- Armstrong and Wright (2009a): "in such an environment, setting high termination charges purely to allow for fixed and common cost recovery would be a flawed policy."

# Capacity-Based Access Charges?

From first principles, a more efficient price structure would:

- set per-minute rates at (or near) zero, i.e. marginal cost
- allow networks to contribute to each others' network costs via capacity surcharges, i.e. *a two-part tariff*
- if capacity charges can be expected net out, then optimal regulatory policy is "bill and keep" (MTRs = 0)?

Quigley and Vogelsang (2003, p. 10):

- "capacity-based interconnection charges would be ideal, because they would correctly reflect the costs incurred by the networks"

Quigley and Vogelsang (2003, p. 5):

- "bill and keep is like a two-part tariff in access charges: the fixed fee equals the own-network costs for termination of the call generated by the other network, while the variable fee is zero."

So bill and keep looks good only if traffic between networks is "balanced"?



# Cost Causation: Who should pay whom for interconnection?

Why assume that the originating network should pay for termination on receiver's network?

- does sender cause costs by making a call? Then the terminating network should recover from the sender
- does receiver cause costs by accepting a call? Then originating network should recover from receiver
- mere conventions -- off-net calls are a *two-way* communication with benefits and costs on both networks

So should originating network buy termination or terminating network buy origination? Or both?

- **two-sided markets** – efficient usage depends on *structure* of benefits and prices on both networks

# Who should pay for interconnection?

**Berkeley economists Hermalin and Katz (2009):**

*“Consumption of communications services involves a sender and receiver, both of whom bear costs, and derive benefits.... Recognition that both sender and receiver enjoy benefits has important implications for efficient pricing. ...”*

*“In the absence of receiver benefits, the sender can be viewed as the “cost causer” and the receiver’s network should recover its costs from the sender, i.e., by levying an access charge.”*

*“In the presence of receiver benefits, this rationale for access charges makes little sense. One could just as well assert that the receiver causes the costs by accepting the message. Even the label “access charge” is misleading. Instead of viewing the originating carrier as a customer purchasing terminating access services, one could just as well think of the terminating carrier as purchasing origination services....”*

*“There are theoretical arguments for both positive and negative access charges.”*

# Simple Economic Perspective

FCC economist Patrick DeGraba (2003) argues that calls should be viewed as “public goods” jointly consumed by the sender and the receiver:

- sender of a call obtains a fraction  $\beta u$  of the total utility  $u$ , and the receiver gets a fraction  $(1-\beta)u$
- total per-minute cost of a call is  $c = c_o + c_T$
- $p_s$  = price charged to the sender; and  $p_R$  = price to the receiver.

The only prices which result in efficient consumption and add up to  $c$  are:

$$p_s = \beta c \text{ and } p_R = (1-\beta)c$$

Only when  $\beta=1$  -- i.e. no call externalities -- should sender pay entire cost of the call. Setting  $p_s = \beta c$  and  $p_R = 0$  also results in efficient consumption.

# Simple Economic Perspective ...

If competition forces networks to charge prices equal to marginal cost, then the optimal termination (access) charge is equal to:

$$a^* = (\beta - 1)c_o + \beta c_T$$

- if  $c_o = c_T$  then  $a^* = (2\beta - 1)c_T$ , which is negative if  $\beta < 1/2$

## Summary

Two problems with traditional regulatory approach:

- cpm pricing of termination turns fixed costs into marginal costs of off-net calls
- Ignores two-sided nature of communications markets and:
  - i. assumes no benefits from receiving calls
  - ii. hence sender “causes” all of the costs of calls

# Problems with Traditional Approach II

Based on an incomplete analysis of competitive interaction in mobile markets:

- focuses on one potential distortion in relative prices – i.e. the “waterbed effect”
- contributes to another welfare-reducing distortion of prices --- off-net versus on-net price differentials

On-net/off-net price differentials create “network effects” which make larger networks more attractive than smaller networks:

- when on-net calls are priced below off-net calls, *ceteris paribus*, subscribers to large networks have lower average call charges than subscribers to smaller networks, since more of their calls are made on-net
- places smaller networks at a competitive disadvantage, i.e.
  - i. if smaller networks replicate incumbents’ pricing strategies they can’t attract subscribers
  - ii. if they offer lower off-net prices, they face potentially permanent traffic/payments imbalance and reduced profits per subscriber

# Why are there off-net price differentials?

Recent economics literature highlights two principal motivations:

- high MTRs which exceed the MC of termination
- the *strategic incentive* of each network to reduce the attractiveness of, and competition from, rival networks

Strategic effects result from inclusion of *call externalities* in the analysis.

**Call externalities:** both the sender and receiver of a call receive a benefit, but under CPNP only one party pays for the call

- implies individuals will make too few (or too short) calls if price = MC
- i.e. caller doesn't take account of benefit to receiver

Existence of call externalities is beyond doubt ("*why else would anyone leave their mobile phone on to receive calls,*" A&W 2009b), but largely ignored until recently.

- they have important role in analyzing competitive interaction in mobile markets.

# Jeon, Laffont and Tirole (2004)

## Mobile-to-mobile duopoly network model:

- sender obtains  $u(\mathbf{q})$  from a call of length  $\mathbf{q}$ , and receiver gets  $\beta u(\mathbf{q})$ , where  $\beta > 0$  is a measure of the call externality
- each network charges its subscribers a fixed charge  $F$ , and per-unit call charges for on-net calls and off-net calls
- the socially optimal *on-net* and *off-net price* is equal to the **on-net** equilibrium price:

$$P_{ii}^* = \frac{c_0 + c_T}{1 + \beta}$$

where  $c_0$  is origination and  $c_T$  is termination (marginal) cost. Hence:

- networks choose the socially optimal on-net price
- on-net calls are priced below total marginal cost to 'internalize' the call externality

# Jeon, Laffont and Tirole (2004) ...

With equal-sized networks the equilibrium **off-net** price is:

$$p_{ij}^* = \begin{cases} \frac{c_0 + a}{1 - \beta}, & \text{for } 0 \leq \beta < 1, \\ +\infty, & \text{otherwise} \end{cases}$$

- where  $a$  is the reciprocal termination charge, or regulated MTR

With no call externality ( $\beta=0$ ), the on-net/off-net price differential is determined by the difference between  $c_T$  and  $a$

- i.e.  $p_{ii} = c_0 + c_T$  and  $p_{ij} = c_0 + a$
- so the difference is just  $a - c_T$

# Jeon, Laffont and Tirole (2004) ...

With receiver benefits, or call externalities, strategic considerations change this result:

- creates incentives for networks to increase off-net prices even further, in order to reduce the number of calls made to rival networks
- calls made off-net create receiver benefits (at no cost to the receiver) on rival networks
- reducing off-net calls reduces the attractiveness of joining other network
- for very large externalities ( $\beta \geq 1$ ), this can lead to "connectivity breakdown"
- in less drastic cases ( $\beta < 1$ ), competition for market share leads to "suboptimal connectivity", i.e. too few off-net calls

## Jeon, Laffont and Tirole (2004) ...

The welfare-maximizing termination rate sets off-net prices equal to on-net prices, i.e. MC adjusted for the call externality (see Berger 2005):

$$a^* = \frac{(1 - \beta)c_T - 2\beta c_0}{1 + \beta}$$

- hence welfare-maximizing access charge is always less than marginal termination cost  $c_T$
- for realistic values of  $\beta$  can be negative, e.g. for  $c_0 = c_T$

$$a^* = \frac{(1 - 3\beta)c_0}{1 + \beta}$$

- so negative for  $\beta > 1/3$

# JLT(2004) Summary

With receiver benefits, or call externalities:

- networks price on-net calls efficiently
- off-net/on-net price discrimination caused by:
  - MTRs which exceed the MC of termination
  - the *strategic incentive* of each network to reduce the attractiveness of, and competition from, rival networks
- leads to an inefficient structure of prices which results in too few off-net calls relative to on-net calls (“suboptimal connectivity”)
- in extreme cases can lead to “connectivity breakdown”

Regulators can use the MTR to address this inefficiency by setting ***a*** below marginal cost, and possibly below zero.

# Armstrong and Wright (2009b)

## Oligopoly model with fixed network:

- receiver of a MTM or FTM call obtains a surplus of  $bq$ , where  $b > 0$  is a measure of the call externality
- as in Jeon et al., the profit-maximizing **on-net price** for network  $i$  is equal to the social-welfare-maximizing call price, now given by:

$$p_{ii}^* = c_0 + c_T - b$$

i.e. total marginal cost less the call externality.

# Armstrong and Wright (2009b) ...

The equilibrium **off-net price** is now:

$$p_{ij}^* = c_0 + a + \frac{1}{n-1}b$$

where ***n*** is the number of mobile firms.

- equal to off-net costs --  **$c_0 + a$**  -- adjusted upwards to reduce the utility of subscribers to other networks
- for large ***n***, this strategic effect disappears
- A&W (2009b): *"this represents the chief anti-competitive motive to set high off-net call charges."*

# Armstrong and Wright (2009b) ...

The welfare-maximizing **FTM call price** is given by:

$$P^* = C + c_T - b$$

where **C** is the fixed network's origination cost.

- i.e. FTM price equals the total MC of the call less the call externality.

When the prices of FTM calls are regulated at cost, or not substitutes, the optimal FTM termination charge is given by:

$$A^* = c_T - b$$

- i.e. the mobile networks' MC of termination less the call externality

# Armstrong and Wright (2009b) ...

The welfare-maximizing MTM termination rate (i.e. which sets  $\mathbf{p}_{ij}^* = \mathbf{p}_{ij}^*$ ) is:

$$a^* = c_T - \frac{n}{n-1}b$$

- hence, the welfare-maximizing FTM termination rate exceeds the welfare-maximizing MTM rate
- the MTM termination rate is used to counteract the strategic motive for setting high off-net prices
- these strategic motives are largely absent for fixed networks, so the FTM rate simply needs to align prices with adjusted costs

# Armstrong and Wright (2007) ...

Armstrong and Wright note an anti-competitive motive for the incumbent MNOs to prefer high termination charges when facing the threat of entry:

«By setting above-cost MTM termination charges, the incumbent networks can induce network effects which make entry less attractive for the newcomer. With high charges, off-net calls will be more expensive, which particularly hurts a small network since the bulk of its subscribers' calls will be off-net. Call externalities will reinforce this effect, since when the established firms have high off-net prices, subscribers of a new (smaller) network will also receive relatively few calls.»

This issue is taken up by Hoernig (2007) & Calzada and Valletti (2007).

# Hoernig (2007)

Analyzes the model of Jeon et al. with a small and large network:

- large networks create a larger on-net/off-net differential than small networks
- hence even with a "balanced calling pattern", traffic between networks is not in balance
- smaller network will incur a permanent access deficit due to its lower off-net price

**Call externalities** are crucial for this result:

- with two-part tariffs, on-net and off-net prices are equal to cost if no call externality, i.e. the differential depends only on the access charge
- with call externalities, the differential is driven by differences in market shares and strategic considerations
- so call externalities and asymmetries in network size predict the imbalances we observe around Europe

# Entry and Dynamics: Calzada/Valletti

## Oligopoly model with network-based price discrimination:

- with no entry incumbent MNOs set access charges at or below cost to soften competition for subscribers – i.e. might adopt B&K
- but incumbents recognise that the reciprocal access charge affects ex post profitability, and thus the attractiveness of entry
- can use the uniform access charge determine the number of firms that enter the market
- for a given cost of entry, incumbents may decide to accommodate entry or to deter it, i.e. with very low entry costs, too costly to deter entry
- with higher entry costs, incumbents can increase termination charges above efficient level to deter entry of potential rivals
- with call externalities (on-net calling groups) this effect is exacerbated as entrant's subscribers make more off-net calls

# Entry and Dynamics: Calzada/Valletti

## Example of the Turkish mobile industry:

- from 1998 to 2001, a duopoly with two incumbents, Turkcell and Telsim
- agreed MTM interconnection rates of approx. 1.5 eurocents/min
- remained until March 2001, when Turkish government issued two new licences to Aria and Aycell (owned by the incumbent FNO, Turk Telekom)
- a new interconnection agreement, which was applied to all operators, increased termination charges to 20 eurocents/min
- Aria and Aycell struggled, and in 2003 merged to form Avea
- thus industry structure that was supposed to comprise four operators was reduced to three.

In 2003, the regulator negotiated access rates at 12 eurocents/min, further reduced to 8 eurocents/min in February 2006.

(Atiyas, I. and P. Dogan (2006) "When Good Intentions Are Not Enough: Sequential Entry and Competition in the Turkish Mobile Industry," mimeo, Kennedy School of Government, Harvard University).

# Entry and Dynamics: Cabral (2009)

Cabral (2007) considers a dynamic model of competition between proprietary networks:

- firms compete for new consumers by offering network entry (i.e. subscription) prices, which may be below cost.
- in each period consumers enjoy a benefit upon joining a network which is increasing in network size
- source of network effects is on-net and off-net price discrimination, i.e. utility from a given network is increasing in the number of other users on the same network
- equilibrium state in the model is generally asymmetric, since a larger network is more likely to attract new subscribers than a smaller network
- for sufficiently strong network effects, market is characterized by "increasing dominance", i.e. the larger network increases in size relative to the smaller network

# Entry and Dynamics: Cabral (2009)

Cabral (2008) shows that a mark-up on termination charges over MC induces:

- a deadweight loss from inefficient pricing; and
- implies a higher degree of increasing dominance in market share dynamics
- i.e. a greater tendency for larger networks to become even larger

High access charges also increase barriers to entry:

- i.e. tariff -mediated network effects decrease the value of an entrant (or a small network); and
- increase the average time that it takes for an entrant to achieve a given size.

# Are Call Externalities Important?

Ofcom argued (Competition Commission 2003) that:

*"it was possible that call externalities were already largely internalized as people tended to be in stable calling relationships with each other."*

*"a high percentage of calls are from known parties and there are likely to be implicit or explicit agreements to split the origination of calls."*

So perhaps call externalities don't matter, but:

- i. empirical basis for these assertions is unclear;
- ii. strategic incentive for off-net/on-net price discrimination remains even when call externalities are internalized; and
- iii. existence of imbalances is predictive of role of call externalities (in France, Portugal, UK, Austria, Italy, Sweden)

Point ii can be demonstrated in a number of ways.

# Cambini and Valletti (2007)

Model calls as «information exchange» benefitting both parties – i.e. include call externalities.

- interdependencies between calls – outgoing calls stimulate incoming calls
- “a call in one direction stimulates something like one-half to two-thirds of a call in return” (Taylor 2004)

With symmetric networks the equilibrium **off-net** price in Jeon et al. is then:

$$p_{ij}^* = \frac{(c_0 + a) - (a - c_t)x}{1 - \beta(1 - x)}$$

where  $x$  is the 'call propagation' factor.

- if no call externality ( $\beta=0$ ), off-net price equals “opportunity cost” of the call
- with full propagation ( $x=1$ ), off-net price equal to marginal cost

# Cambini and Valletti (2007)

In general, Cambini and Valletti (2007) predict lower off-net prices than those obtained by Jeon et al. (2004):

- because reducing off-net calls harms the network's own subscribers and reduces profits from termination charges
- “connectivity breakdown” less likely to occur

But strategic incentive to inefficiently increase off-net prices remains so long as  $x < 1$

- e.g. assume the MTR is equal to marginal cost ( $a = c_T$ )

Might be argued that call propagation is not the same as « internalising » the externality as intended by Ofcom? I.e.

- not really a model of « stable calling relationships » in which senders care about benefits to receivers?

# Internalizing Call Externalities

Suppose instead that individuals in “stable calling relationships” fully internalize the call externality, as hypothesized by Ofcom:

- i.e. senders act as if they receive the total call utility,  $u(\mathbf{q}) + \beta u(\mathbf{q})$ , in Jeon et al.
- then networks would set on-net prices equal to marginal cost, and off-net prices to:

$$p_{ij}^* = \begin{cases} \frac{(1 - \alpha_i)(c_0 + a)}{1 - \alpha_i \left(1 + \frac{\beta}{1 + \beta}\right)}, & \text{for } \alpha_i < \frac{1}{1 + \frac{\beta}{1 + \beta}} \\ +\infty, & \text{otherwise} \end{cases}$$

- so strategic motive to increase off-net prices above MC remains
- with asymmetric market shares, “connectivity breakdown” can still occur
- a large network still has an incentive to create higher on-net/off-net price differentials than a smaller network

# Internalizing Call Externalities ...

What if individuals in “stable calling relationships” act to minimise the total costs of their communication?

- *ceteris paribus*, a small increase in network  $i$ 's off-net price results in an increase in incoming off-net calls from network  $j$
- can increase network  $i$ 's profits whenever  $a > c_T$ , without reducing the utility of network  $i$ 's subscribers
- an additional motive for high off-net prices when subscribers to different networks act as a **team**

In summary, the degree to which the internalization of call externalities, or call propagation effects, reduce networks' strategic incentives to engage in on-net/off-net price discrimination is far from being resolved.

**But:**

- *existence of imbalances is predictive of important role of call externalities!*

# Empirical Evidence on Call Externalities

We should observe price differentials larger than  $a - c_T$ , i.e. MTR less MC of termination

## In the UK:

- termination charges currently **4.7 ppm** for Vodafone and O2, and **4.8 ppm** for Orange and T-Mobile
- T-Mobile (22% market share) offers on-net calls for **8 ppm**, compared with an off-net MTM rate of **25 ppm**
- O2 (28% market share) offers **5 ppm** for on-net calls (after 3 minutes/day) and **25 ppm** off-net
- Price differentials exceed MTRs by a lot! Why?
- Ofcom reported average prices for off-net calls of **22.6 ppm** versus **5.1 ppm** on-net in 2002 (**8.9 ppm** and versus **3.5 ppm** in 2006)

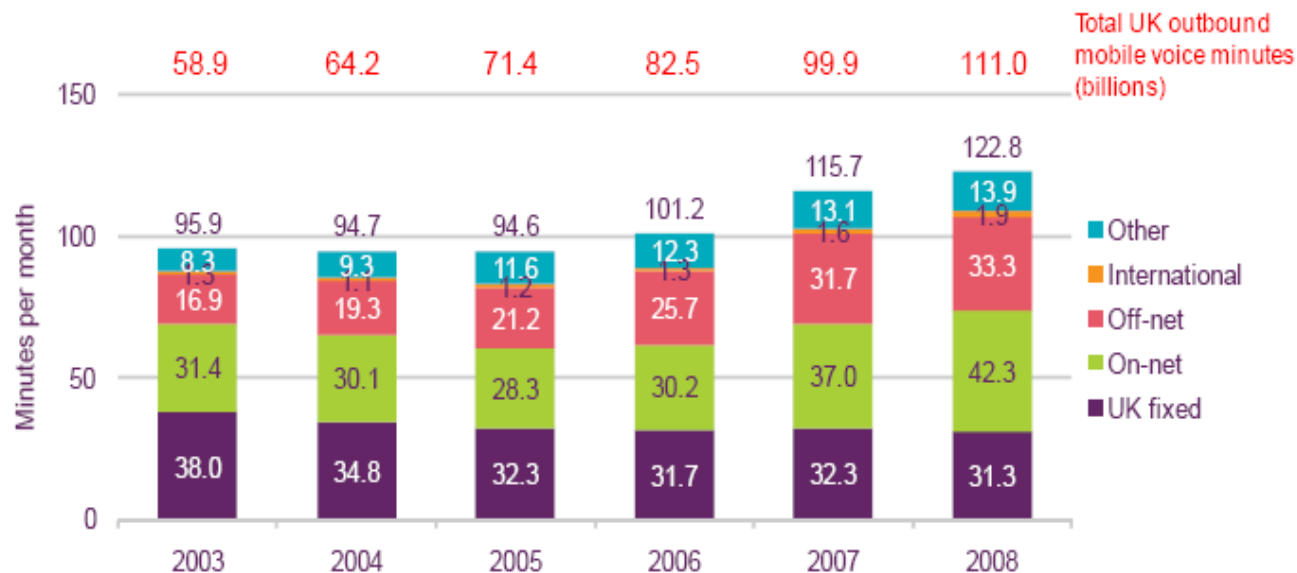
## In Spain:

- largest mobile operator, Telefonica, offers on-net calls at **3.3 cpm**, compared with an off-net call rate of **39.9 cpm**

# Empirical Evidence on Network Effects

With “balanced calling pattern” and four symmetric networks, would expect off-net traffic to be approximately three times greater than on-net traffic.

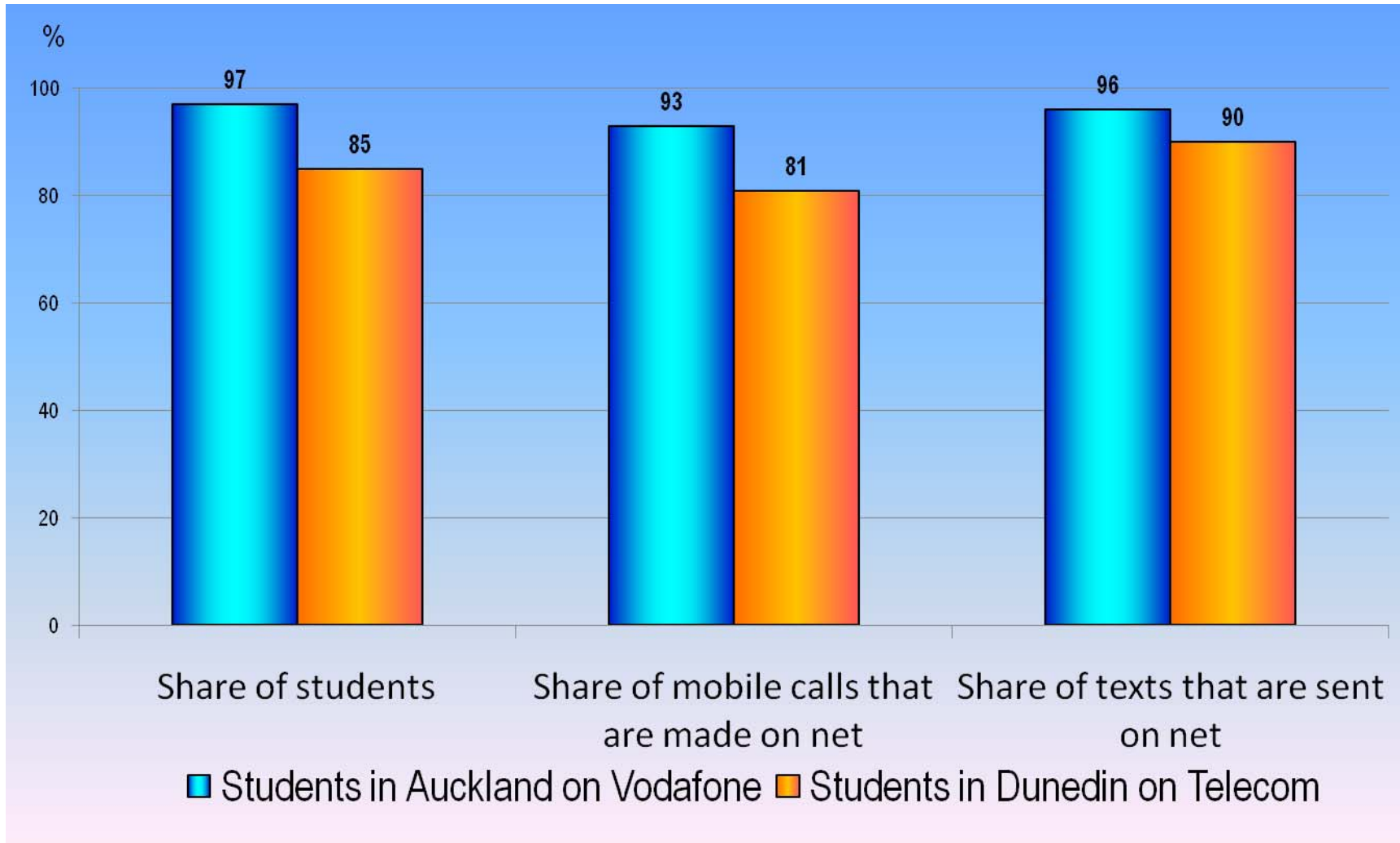
Figure 4.71 Average monthly outbound voice minutes per mobile connection



Source: Ofcom / operators

Note: 'Other calls' include roaming, premium rate calls, WAP calls and all other call types

# Pheonix Research Data





# Summary

Recent literature highlights two motivations for on-net/off-net pricing:

- high MTRs which exceed the MC of termination
- the *strategic incentive* of each network to reduce the attractiveness of, and competition from, rival networks

Results in:

- welfare losses from an inefficient pricing structure;
- barriers to entry and growth for smaller networks; and
- traffic/termination revenue imbalances for small networks

# Solutions?

## **Ban price discrimination (e.g. Turkey)?**

- Force on-net prices to exceed MTRs?
- Helps alleviate network effects
- Forces on-net prices up so presumably worsens pricing inefficiency

## **Higher MTRs for small networks (e.g. Portugal, France)?**

- Worsens price discrimination problem (but only a little for small networks)
- Helps with imbalance problem
- Some evidence it intensifies competition and is good for small networks and consumers (Peitz 2005; de Bijl and Peitz 2002; Cabral 2009)

## **B&K (e.g. USA, Hong Kong, Singapore)?**

- Eliminates monopoly pricing problem by eliminating MTRs!
- Eliminates price discrimination (almost) and associated network effects
- Levels playing field for small networks
- Lower call prices lead to more efficient usage of networks

# Welfare Analysis of Remedies - Hoernig

Hoernig (2008) considers solutions for on-net/off-net price discrimination to remedy:

- i. inefficiency from off-net prices above cost, which reduces the length of calls
- ii. disadvantage for small networks from tariff-mediated network externalities

Considers reduce/eliminate tariff differentials; or lower termination fees

In each case there is a trade-off between efficiency and networks' profits versus consumer surplus:

- decreasing on-net/off-net differentials reduces “network” effects which reduces intensity of competition for new subscribers
- hence MNOs increase fixed tariffs – welfare and efficiency improve, but consumer surplus can decrease
- potential trade-off between more efficient price structure and the split between consumers and firms

But Hoernig's analysis ignores FTM calls, and hence increased welfare of fixed network subscribers (also dynamic effects of entry/growth).



# Harbord and Hoernig Welfare Model

**We constructed welfare model to consider the consequences of:**

- setting MTRs equal to LRIC/MC
- adopting reciprocal rates for both MTM and FTM calls based on fixed network termination rates
- setting MTRs at zero - or “bill and keep” - for both MTM calls and FTM calls

**The key ingredients required for such a model are:**

- equilibrium theory of the determination of MTM retail call charges to capture imperfect competition between a number of asymmetrically-sized MNOs;
- estimates of MC (or avoidable) costs of call origination and termination; and
- allowance for the effects of call externalities, which are crucial determinants of competition between mobile networks and economic welfare.



# Welfare Model Specification

We assume:

- Jeon et al. formulae for on-net and off-net call prices charged by five MNOs with different market shares
- valid so long as no inter-network price discrimination
- one small operator (H3G) with an 6% market share and four larger operators with realistic market shares (Vod: 23%; O2: 28%; Orange 21%; T-Mob: 22%)
- a single fixed operator which does not price strategically (as in Armstrong and Wright 2009b)
- a “balanced calling pattern” i.e. each subscriber calls every other subscriber with equal probability
- linear call demand curves calibrated using data provided by Ofcom

# Welfare Model Assumptions

- equilibrium fixed charges: these affect the division of total surplus between consumer surplus and firms' profits, and not the level of aggregate welfare *for fixed market shares*
- no fixed network and subscriber costs: these effect aggregate welfare calculations only, and not the welfare comparisons between alternative scenarios
- no network externalities: most European markets are effectively saturated, and there is little/no evidence that network penetration depends upon termination rates
- (in any event, including network externality implies MTRs slightly above MC, not FAC)

A range of assumptions on the level of call externality are been considered:

- from  $\beta = 0$ , i.e. no receiver benefits
- To  $\beta = 1$ , i.e. receivers and callers benefit equally



# Welfare Model Cost Assumptions

## Network cost assumptions:

- LRMC/LRIC of origination & termination = 1 ppm on mobile networks
- LRMC/LRIC of origination & termination = 0.2 ppm approx. on fixed network
- Fixed termination rate = 0.207 ppm
- Fixed retention = 6.2 ppm

We then consider a move from Ofcom's regulated rates in 2010/11 to variants of B&K.

# Welfare Model Results

- I. Moving from regulated MTRs in 2010/11 to: (A) MC/LRIC pricing; (B) reciprocal rates with fixed network; or (C) B&K results in an overall welfare gain of:
  - approx £0.36 billion per annum when call externalities are entirely absent (i.e.  $\beta = 0$ )
  - approx £2.4 billion per annum when call externalities are significant ( $\beta = 1$ )
- II. The estimated welfare gains from (A), (B) or (C) are broadly similar under a wide variety of assumptions on the marginal costs of termination.
- III. OFCOM's own welfare analysis estimated welfare gains from regulation of £0.4 billion in 2010/11 moving from an unregulated rate of 14.5 ppm to regulated rates of 5.9 ppm and 5.1 ppm respectively for small and large networks. The EC estimated welfare gains of approx. £1 billion from 2007-2012 for the entire European Union for its own proposals to reduce MTRs to LRIC.

# Welfare Model Results (H&H 2009)

**Table 5.1 Change in Welfare Over "LRIC+" Pricing**

	$\beta = 0$	$\beta = 0.25$	$\beta = 0.5$	$\beta = 0.75$	$\beta = 1$
LRMC Pricing	367	648	1022	1535	2266
Reciprocal with Fixed	366	675	1086	1649	2452
Bill and Keep	360	674	1091	1663	2478

**Table 5.2 Change in Consumer Surplus Over "LRIC+" Pricing**

	$\beta = 0$	$\beta = 0.25$	$\beta = 0.5$	$\beta = 0.75$	$\beta = 1$
LRMC Pricing	30	218	465	800	1274
Reciprocal with Fixed	-30	175	444	809	1326
Bill and Keep	-50	157	430	800	1323

**Table 5.3 Change in Profits Over "LRIC+" Pricing**

	$\beta = 0$	$\beta = 0.25$	$\beta = 0.5$	$\beta = 0.75$	$\beta = 1$
LRMC Pricing	337	430	557	735	993
Reciprocal with Fixed	396	501	642	839	1126
Bill and Keep	411	517	661	862	1155



# International Experience

**USA and Canada** - "calling party network pays" (CPNP) for calls to fixed incumbent operators, and effectively B&K for mobile-to-mobile calls

**Hong Kong** - bill and keep for mobile-to-mobile calls whereas mobile networks pay to both send and receive calls from fixed networks

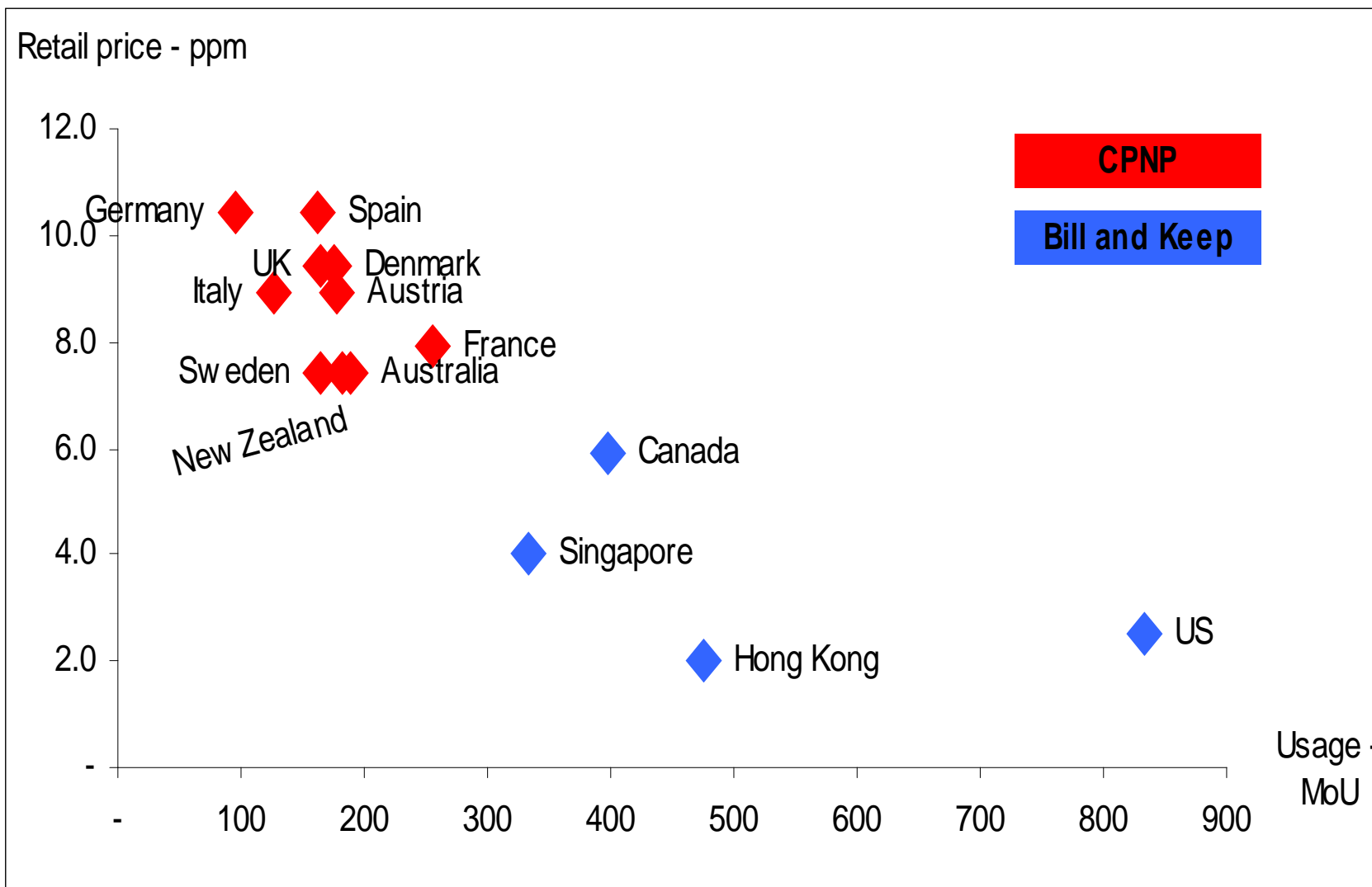
**Singapore** – nearly bill and keep for calls terminating on the mobile network, but CPNP for calls terminating on the fixed network

**Compared with CPNP, bill and keep appears to lead to:**

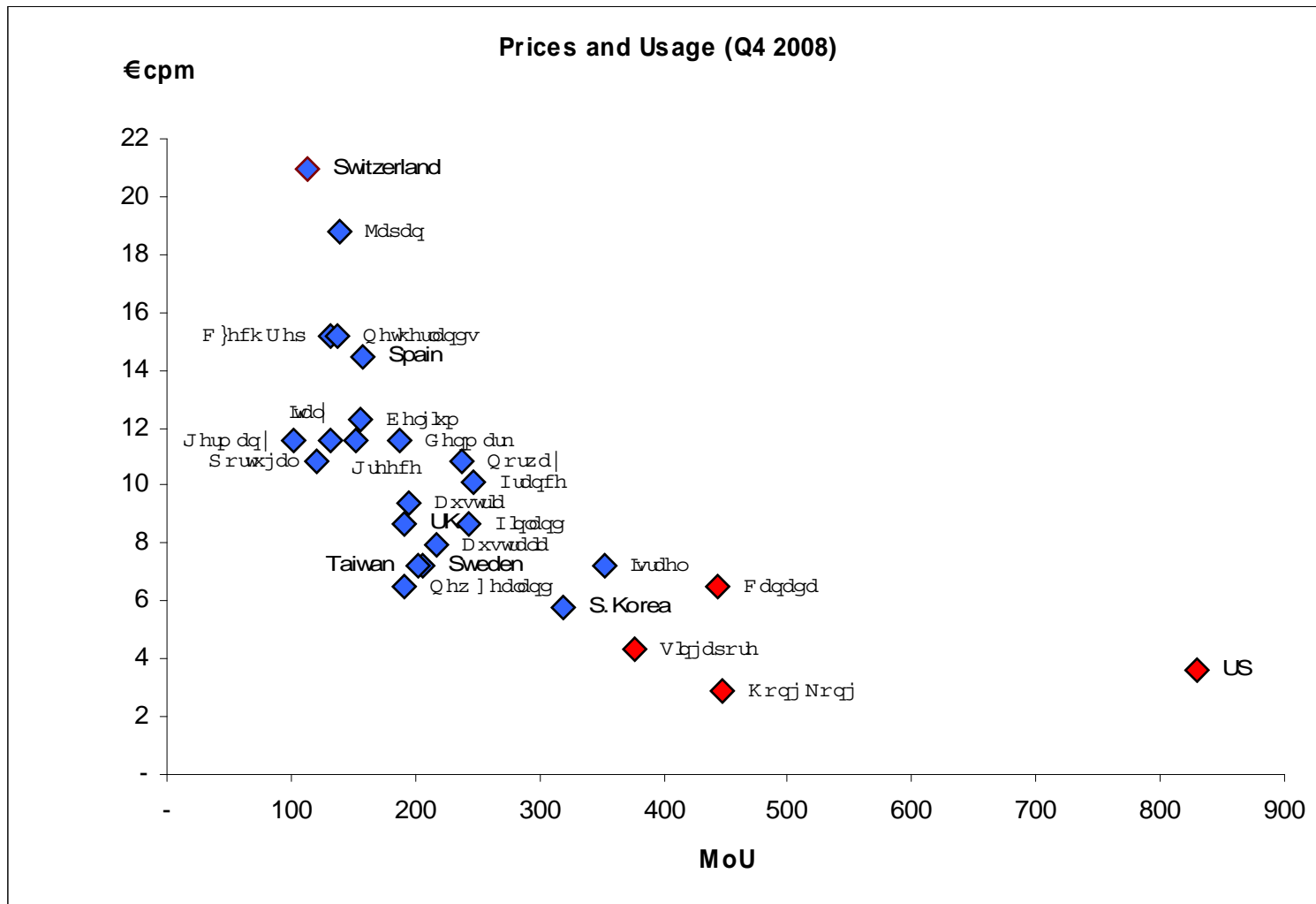
- low retail prices
- high mobile utilization rates
- little or no significant effect on mobile take up (penetration rates)

# Average Prices and Usage

June 2007



# Average Prices and Usage





# Mobile Penetration

Incumbent MNOs argue that high MTRs result in high levels of mobile take up, or penetration, via the “waterbed effect”

- i.e. excess profits earned on termination are used to subsidise handsets and lower fixed charges
- hence lowering MTRs will hurt low usage/low income consumers

Are they right?

- Does it make sense to distort prices to subsidise mobile take up?
- Low usage results from high call charges, driven in part by high MTRs
- Is there any relationship between MTRs and penetration rates?

# Mobile Take Up using SIM Penetration

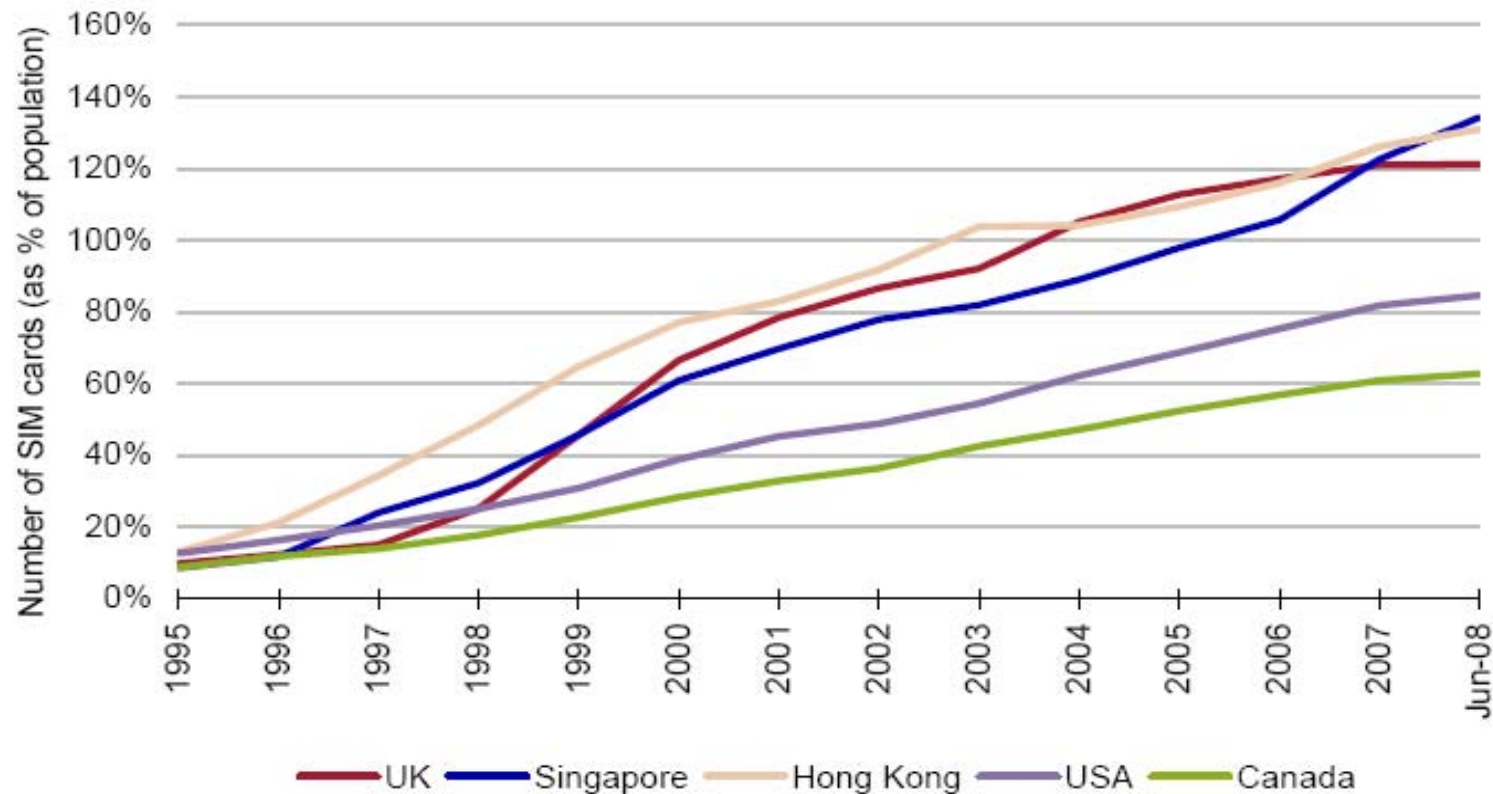


Figure 1.2: SIM penetration (as % of population) [Source: GlobalComms, ITU]



# Mobile Take Up: SIMs versus Ownership

Ofcom (2009):

Mobile penetration measured as the number of SIM cards or subscriptions overestimates take-up in CPNP countries as many consumers may have more than one subscription.

Ownership - the proportion of population that makes use of a mobile phone - is a better measure.

The difference is significant in CPNP countries.

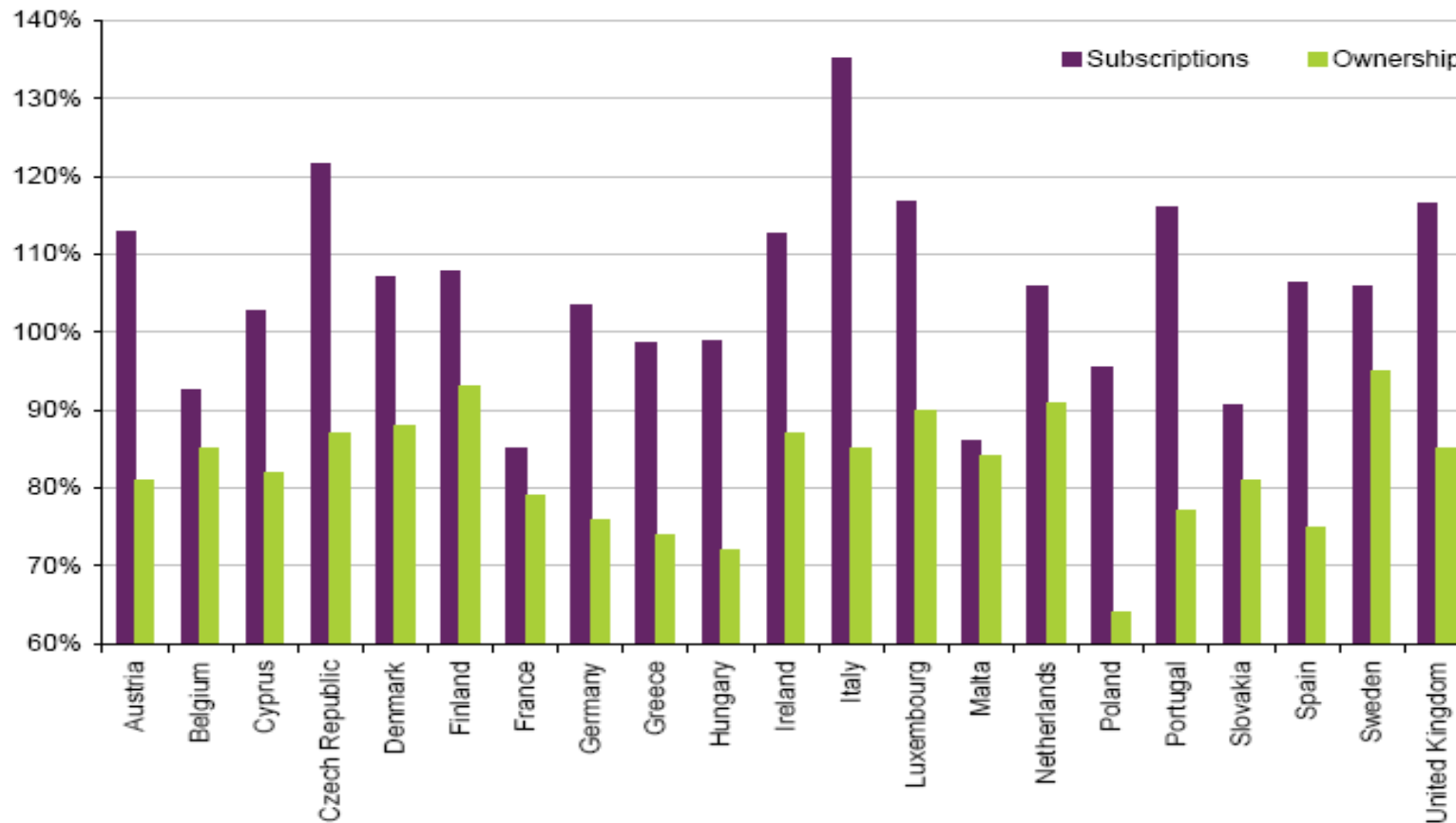
According to the Analysys/Mason (2008) report (p. 9):

*“SIM penetration measures in the USA and Canada are likely to be closer to the actual user penetration levels given the very low incidence of prepaid subscriptions. Additionally very large bundles of minutes and equal pricing for on-net and off-net pricing also minimise the incentive to maintain multiple subscriptions.”*

So actual take up levels are similar between CPNP and B&K countries.

# Mobile Take Up: SIMs versus Ownership

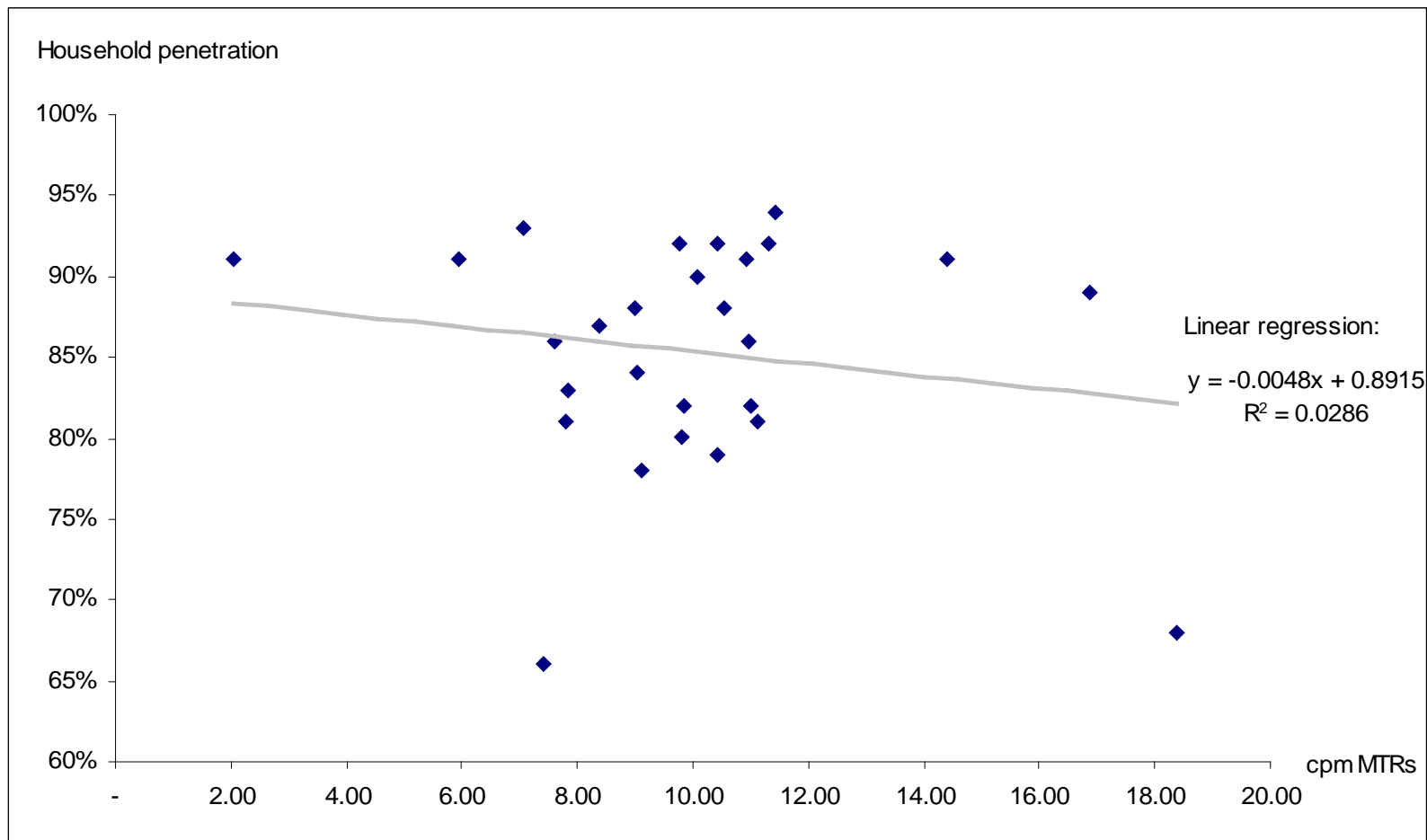
Figure 3: Subscriptions and ownership (2006)



Source: Subscriptions – Merrill Lynch dataset; Ownership – Eurobarometer, European Commission, 2006

# Do lower MTRs drive lower penetration?

## EU evidence



# EC Recommendation

Reduce MTRs to costs of an efficient operator using a long-run incremental cost model (LRIC).

- could result in a decrease in average MTRs in Europe from above 8 cpm to 2.5 cpm or lower by 2012
- MTRs should (normally) be symmetric - traffic imbalances may be caused by asymmetric MTRs, as well as by an on-net/off-net retail price differentiation
- LRIC is conceptually between SRMC and SAC – allows for some fixed cost recovery
- but two-sided nature of calls markets means there are efficient mechanisms available for the recovery of joint and common costs, i.e.

*“Given the two-sided nature of call termination, not all related termination costs must necessarily be recovered from the wholesale charge levied on the originating operator. Even if wholesale termination rates were set at zero, terminating operators would still have the ability to recover their costs from non-regulated retail services. Rather it is a question of how these financial transfers are distributed across operators in a way that best promotes economic efficiency to the benefit of consumers. ...”*

# EC Recommendation: Conclusions

- regulation of MTRs in the EU under CPNP assumes that the calling party causes all of the costs
- however, both calling and called parties jointly benefit from a call, and jointly cause costs
- call termination differs from other markets where the creation of costs and attribution of benefits can be ascribed to one side
- consideration of call externalities raises issues about how costs ought to be recovered
- *“call termination services are two-sided, with the network(s) being the platform and the caller and receiver being on either side of that platform. The structure of prices impacts on the levels of consumption; therefore, it often plays a crucial role in bringing the two sides of the market together”*
- Bill and Keep takes account of the call externality
- (and Ms. Reding has indicated that B&K may be long-run goal)

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