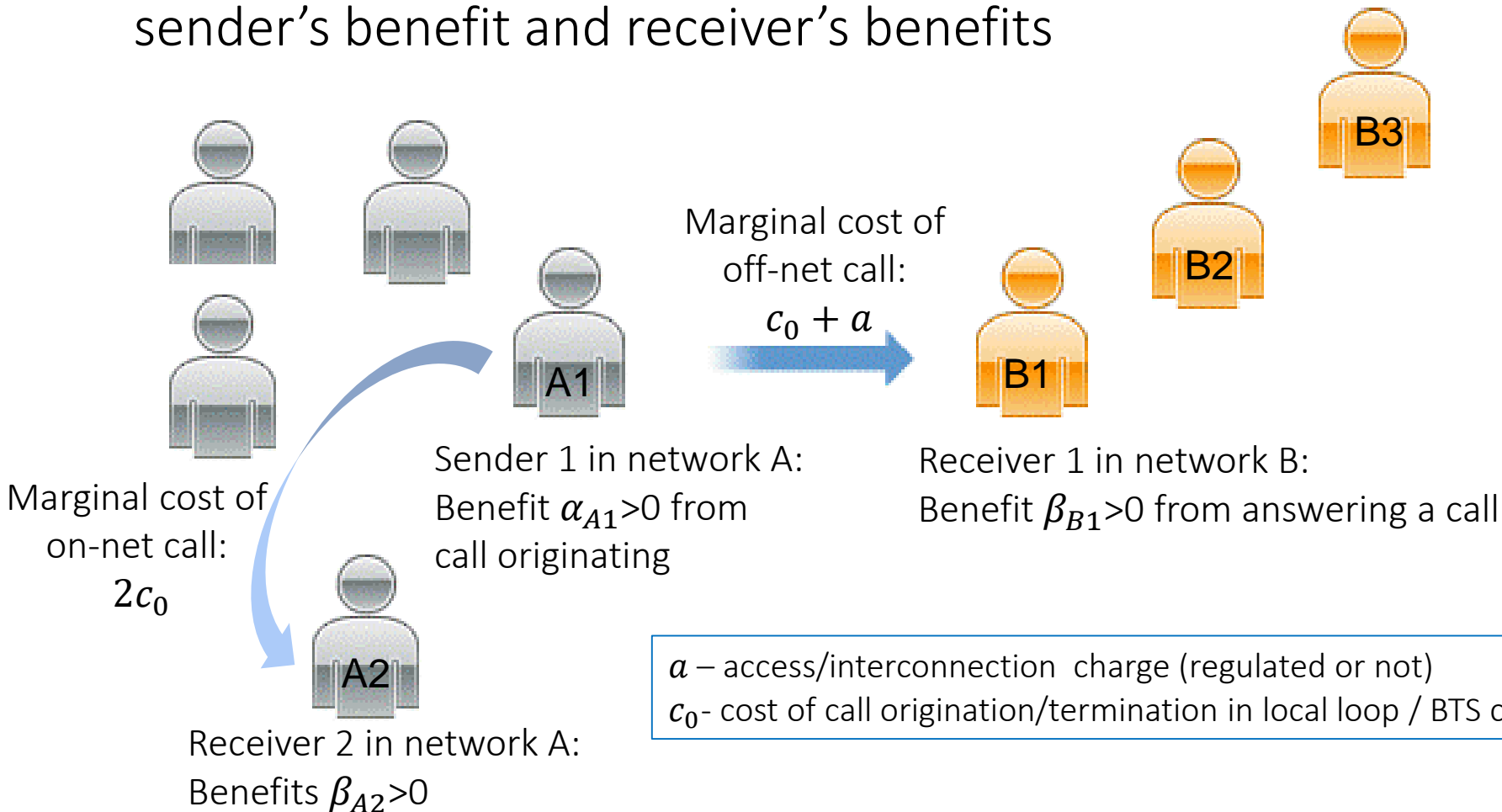# Strategic use of call externalities for entry deterrence.
The case of Polish mobile telephony market

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Mobile & Externalities

▶ (Tele)communications generates two-sided benefits: sender's benefit and receiver's benefits

Marginal cost of off-net call:
$$c_0 + a$$

Marginal cost of on-net call:
$$2c_0$$

Sender 1 in network A: Benefit $\alpha_{A1}>0$ from call originating

Receiver 1 in network B: Benefit $\beta_{B1}>0$ from answering a call

Receiver 2 in network A: Benefits $\beta_{A2}>0$

a – access/interconnection charge (regulated or not)
c_0 - cost of call origination/termination in local loop / BTS cell

Literature – network effects

‣ Network externalities extensively studied in economics since (Katz and Shapiro, 1985).

‣ In telecommunications:

  ‣ Are induced by termination based discrimination (Laffont et al., 1998)

  ‣ Are not homogenous across all members of the network (Maicas and Sese, 2011)

  ‣ Are localized among family and friends (Corrocher and Zirulia, 2009)

  ‣ Have diminishing marginal value and tend to exist even without on-net price discount (Czajkowski and Sobolewski, 2011)

  ‣ Drive consumer choices (Maicas et al. 2009b; Sobolewski and Czajkowski 2012)

  ‣ Impact network competition by creating lock-in (Doganoglu and Grzybowski 2007 ; Grajek 2010)

Problem set-up: call externalities

- ▸ The key insight from Jeon, Laffont, Tirole (2004):
  - ▸ A sender obtains a gross surplus $u(q)$ from a call of length q, while the receiver obtains a surplus of $\hat{u}(q) = \beta u(q)$ where $(\beta > 0)$.
  - ▸ Under calling-party-pays regime (CPP), duopoly competition with network-based discriminating networks i, j yields the following Nash equilibrium:

  $$p_{ii} = \frac{2c_0}{(1+\beta)}$$

  $$p_{ij} = \frac{(1-s_i)(c_0+a)}{1-(1+\beta)s_i} \text{ for } s_i < \frac{1}{1+\beta}; \ +\infty \text{ otherwise.}$$

  - ▸ On-net price is decreasing in receiver benefits (β) and set at social optimum
  - ▸ Off-net price set above the social optimum; increasing in (β) and market share of call originating network (s_i)

Problem set-up: call externalities

▶ What are the implications?

  ▸ (Armstrong and Wright 2009 ; Hoernig, 2007; Calzada and Valletti 2008; Berger 2005).

▶ Under CPP, receiver benefits remain under control of originating network ➔ call externality.

▶ Distortionary effect on price differential. Overpricing effect has a negative impact on smaller networks, causing access deficit and connectivity breakdown (if $\beta > 1$).

▶ In the presence of receiver benefits and CPP, large network can put smaller ones into competitive disadvantage by reducing the volume of outgoing calls and lowering attractiveness of rival network.

▶ ‚Bill and keep' ($a = 0$) is welfare enhancing than $a = c_0$.

Empirical evidence

▸ Rojas (2017, IEPOL):

  ▸ Implement a DCE study on Ecuador subscribers;

  ▸ 42 choice tasks (!); each with two four-attribute alternatives (paid incoming calls) + opt out option;

  ▸ Estimating utilities from incoming and outgoing calls.
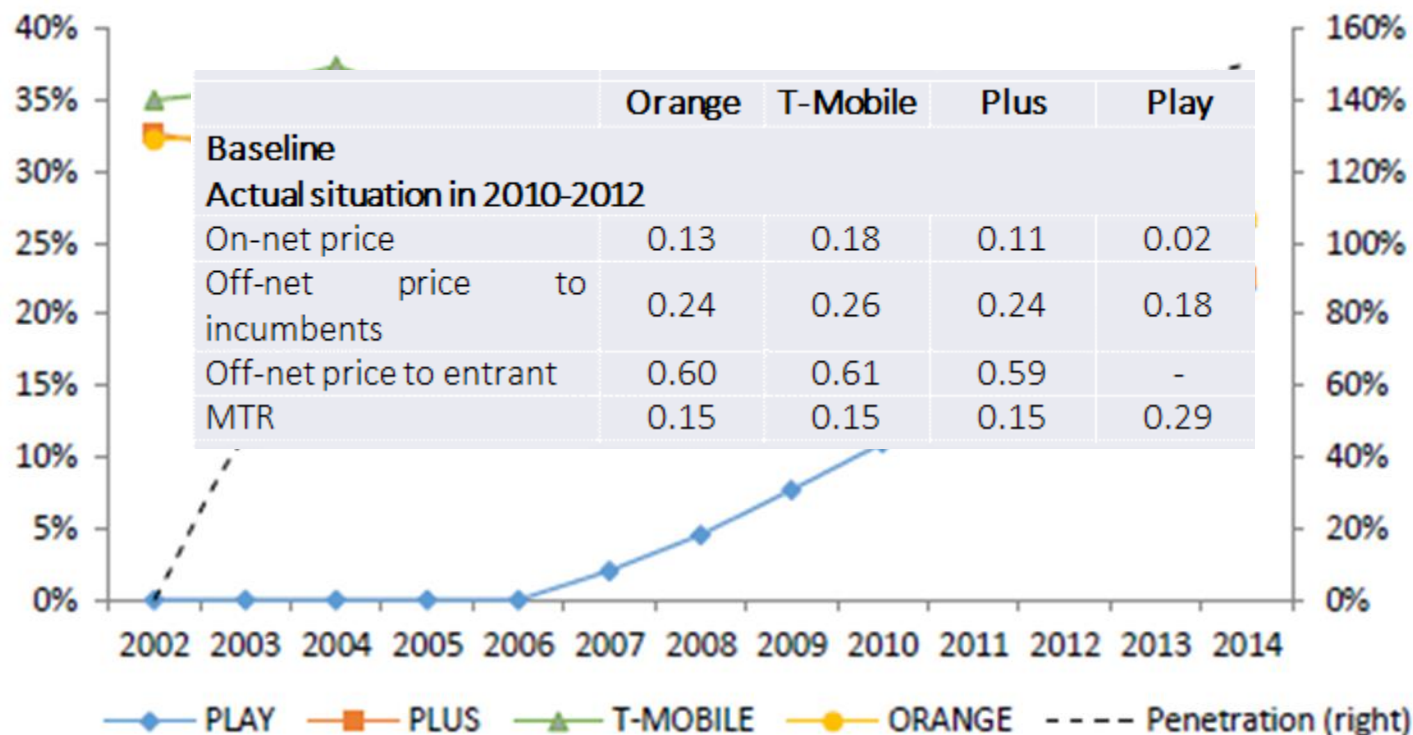
  ▸ Call externality coeffcienct: $\beta = \left[\dfrac{\partial U}{\partial p_{ij\_inc}} \right] / \dfrac{\partial U}{\partial p_{ij\_out}}$

  ▸ $\beta = 0{,}67$ for on-net calls
  ▸ $\beta = 0{,}41$ for of-net calls
  ▸ $\beta = 0{,}79$ for on-net calls pre-paid
  ▸ $\beta = 0{,}27$ for on-net calls post-paid

Market evidence - Poland

▶ Slow catching-up by late entrant (Play)

Figure 2. Penetration and the operators' market shares in the mobile telephony market in Poland

	Orange	T-Mobile	Plus	Play
Baseline				
Actual situation in 2010-2012				
On-net price	0.13	0.18	0.11	0.02
Off-net price to incumbents	0.24	0.26	0.24	0.18
Off-net price to entrant	0.60	0.61	0.59	-
MTR	0.15	0.15	0.15	0.29

Source: annual reviews of the telecommunications market in Poland provided by the Office of Electronic Communications.

Objectives

▸ (1) To test the importance of CE and NE for the choice of mobile operator

  ▸ DCE to model subscription choices of pre- and post-paid users

▸ (2) To assess the impact of call externalities on the market share distribution

  ▸ Policy exercise: simulation of market share stealing effect experienced by the late entrant, under two counterfactual scenarios assuming reduced off-net price asymmetry between incumbent networks and late entrant.

Agenda

- Data and Methodology

- Results

- Conclusions

Data and Methodology

‣ Discrete choice experiment on two representative samples of prepaid (n = 1001) and postpaid (n = 1029) subscribers in June 2005 (IPSOS)

‣ Hypothetical choice scenario:
  ‣ Imagine new law is introduced at the EU level that does not allow to use 'unlimited' mobile phone plans (stimulate price competition, people use mobile phones less than they think making average price per minute relatively high)
  ‣ Which offer would you choose?
  ‣ Ignore liabilities resulting from current contracts
  ‣ Assume alternatives are the same with respect to all other attributes

‣ Experimental design
  ‣ 4 labelled alternatives corresponding to the 4 main operators
  ‣ On-net price, off-net price, price for off-net incoming calls paid by originating party, 'family and friends' in the same network, 'others' in the same network
  ‣ 12 choice tasks per respondent; 3 blocks of choice tasks.
  ‣ Bayesian efficient design, based on priors from pretest phase

Data and Methodology

▸ We control for the following ‚usuall' drivers of choice:

  ▸ On-net prices

  ▸ Off-net prices

  ▸ Brand effects

  ▸ Personal network effects (utility increases with larger share of frequently called people subscribing to the same network as respondent)

  ▸ Switching costs (people are reluctant to change current operator – status quo inertia)

▸ Receiver benefits are controlled indirectly with the third price attribute: average price level for incoming off-net calls paid by people who originate a call from other networks to a given network → CPP setup

  ▸ If a person cares about the prices other have to pay when calling her or him in a given network then that person is sensitive to receiver benefits.

  ▸ Negative coefficient for incoming off-net price implies that respondent recognizes that this price negatively affect the traffic intensity of calls originated by others to him and hence reduces his or her receiver benefits.

Choice attributes and levels

Table 1. List of attributes and attribute levels used to describe choice alternatives.

Brand of the operator	• Orange • T-Mobile • Plus • Play
On-net price (PLN per minute)	• 0.10 • 0.20 • 0.30
Off-net price (PLN per minute)	• 0.20 • 0.30 • 0.50
Price of call incoming from other networks, paid by person originating connection (PLN per minute)	• 0.20 • 0.30 • 0.50
% of 'family and friends' in the same network	• 25% • 50% • 75%
% of 'others' in the same network	• 25% • 50% • 75%

Example of a choice card

Which of the following mobile phone operators' offers would you consider the best for yourself?

Operator	ORANGE	T-MOBILE	PLUS	PLAY
On-net price per minute (PLN)	0.2	0.1	0.3	0.2
Off-net price per minute (PLN)	0.2	0.5	0.5	0.2
Price of incoming off-net call, per minute (PLN)	0.3	0.3	0.3	0.3
'Family and Friends' in the same network	25%	25%	75%	75%
'Others' in the same network	50%	50%	25%	75%
Your choice	☐	☐	☐	☐

Results – MXL model (correlated parameters)

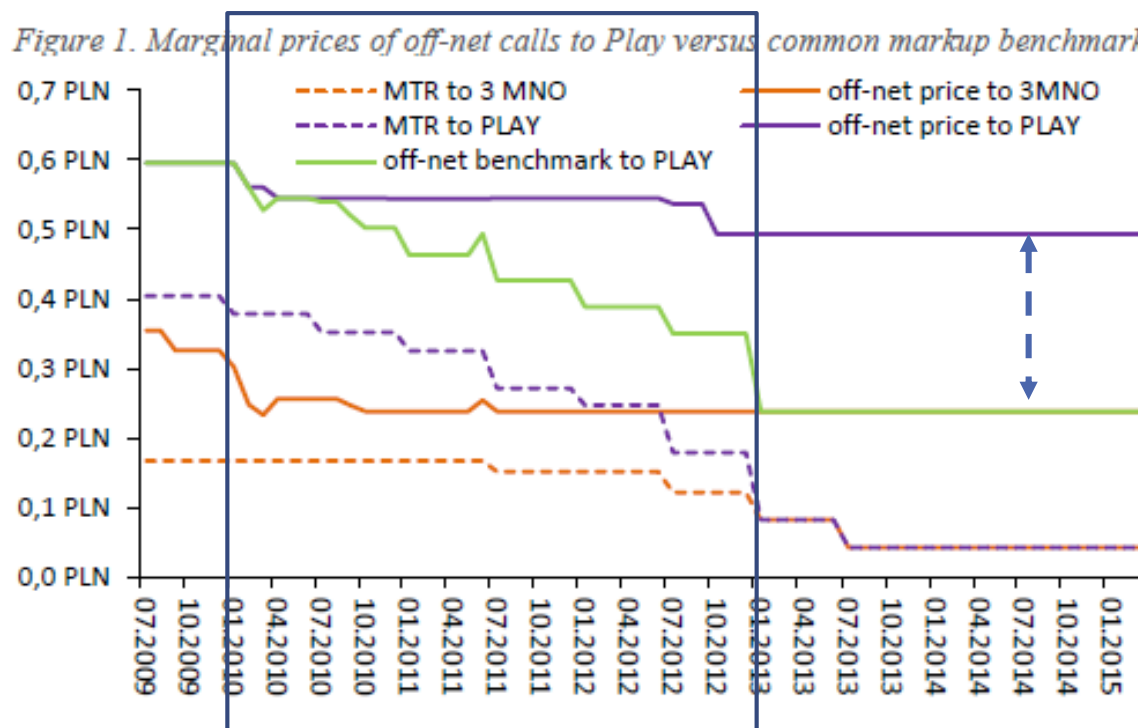|	Distribution	Postpaid		Prepaid	
		Mean	St. Dev.	Mean	St. Dev.
Status quo inertia	Lognormal	0.21***	1.56***	0.32***	1.46***
Orange vs. Play (operator-specific constant)	Normal	-0.27***	1.50***	-0.33**	1.59***
T-Mobile vs. Play (operator-specific constant)	Normal	-0.43***	1.52***	-0.56***	1.79***
Plus vs. Play (operator-specific constant)	Normal	-0.26***	1.42***	-0.31***	1.56***
On-net calls price per minute	- Lognormal	2.18***	1.14***	2.17***	1.31***
Off-net calls price per minute	- Lognormal	1.59***	1.43***	1.48***	1.69***
Incoming off-net calls price per minute	- Lognormal	0.51***	1.48***	0.36***	1.64***
Share of friends and family using the same operator (%)	Normal	0.97***	4.13***	0.57***	3.89***
Share of other people using the same operator (%)	Normal	-0.01	2.27***	-0.17	2.13***

Switching costs, Call externalities, Personal network effects are all significant drivers of subscriber choices for both pre- and post-paid users. $\mathrm{P}ostpaid\ \beta \approx 0{,}32; prepaid\ \beta \approx 0{,}24$

Market evidence - Poland

▶ excessive overpricing?

▶ Markup benchmark: prices for off-net calls to Play (green line) should have been on average 29% lower throughout the period 04.2010-03.2015 compared to actual levels of off-net prices set by the 3 incumbents in that period (violet line).

Figure 1. Marginal prices of off-net calls to Play versus common markup benchmark (postpaid).

Legend:
- - - - - MTR to 3 MNO
- - - - - MTR to PLAY
───── off-net benchmark to PLAY
───── off-net price to 3MNO
───── off-net price to PLAY

source: Market monitoring provided by Audytel SA.

3MNO – incumbent operators: Plus, Orange, T-Mobile

MTR – mobile termination rate = interconnection access charge

Simulated policy scenarios

▸ We simulate we simulate operator choice probabilities under:

1. The baseline, excessive off-net price discrimination

2. Assuming reduced asymmetry (reflecting asymmetry in MTRs)

3. Assuming full symmetry in off-net prices between large and small networks

▸ Simulation approach:

▸ We used respondents' estimated utility function parameters and their individual-specific characteristics (such as the share of friends and family using the same operator or their current subscription)

▸ We simulated how operator choice probabilities would change if one of the counterfactual scenarios took place

Characteristics of the simulated policy scenarios

	Postpaid				Prepaid			
	Orange	T-Mobile	Plus	Play	Orange	T-Mobile	Plus	Play
Baseline **Actual situation in 2010-2012**								
On-net price	0.13	0.18	0.11	0.02	0.07	0.01	0.05	0.01
Off-net price to incumbents	0.24	0.26	0.24	0.18	0.21	0.21	0.27	0.21
Off-net price to entrant	0.60	0.61	0.59	-	0.56	0.52	0.65	-
MTR	0.15	0.15	0.15	0.29	0.15	0.15	0.15	0.29
Scenario 1 **No excessive off-net price asymmetry**								
On-net price	0.13	0.18	0.11	0.02	0.07	0.01	0.05	0.01
Off-net price to incumbents	0.24	0.26	0.24	0.18	0.21	0.21	0.27	0.21
Off-net price to entrant	0.45	0.50	0.46	-	0.39	0.39	0.52	-
MTR	0.15	0.15	0.15	0.29	0.15	0.15	0.15	0.29
Scenario 2 **Fully symmetrical MTR and off-net prices**								
On-net price	0.13	0.18	0.11	0.02	0.07	0.01	0.05	0.01
Off-net price	0.24	0.26	0.24	0.18	0.21	0.21	0.27	0.21
MTR	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Manipulation of off-net prices to entrant (in green rectangles) implies changes in the level of incoming off-net price attribute for late entrant (Play).

Operator choice probability differentials
Scenario 1 (no excessive off-net price asymmetry) vs. the baseline

		Postpaid					Prepaid				
		Orange subscribes	T-Mobile subscribes	Plus subscribes	Play subscribes	Overall	Orange subscribes	T-Mobile subscribes	Plus subscribes	Play subscribes	Overall
Orange	ΔP s.e.	1.34*** (0.21)	0.64*** (0.12)	0.52*** (0.09)	0.77*** (0.14)	0.82*** (0.13)	0.11 (0.11)	0.17*** (0.07)	0.14** (0.07)	0.32*** (0.08)	0.16** (0.08)
	95% c.i.	(0.96;1.78)	(0.43;0.91)	(0.36;0.72)	(0.55;1.10)	(0.59;1.11)	(-0.10;0.34)	(0.05;0.32)	(0.01;0.28)	(0.17;0.50)	(0.02;0.33)
T-Mobile	ΔP s.e.	0.36*** (0.05)	1.10*** (0.13)	0.34*** (0.05)	0.48*** (0.07)	0.58*** (0.06)	1.07*** (0.14)	1.01*** (0.18)	0.93*** (0.15)	1.57*** (0.19)	1.09*** (0.15)
	95% c.i.	(0.28;0.46)	(0.87;1.38)	(0.26;0.44)	(0.36;0.62)	(0.47;0.71)	(0.79;1.36)	(0.65;1.37)	(0.64;1.24)	(1.24;1.95)	(0.80;1.4)
Plus	ΔP s.e.	1.08*** (0.14)	1.32*** (0.17)	1.86*** (0.23)	1.42*** (0.19)	1.43*** (0.17)	0.40*** (0.06)	0.37*** (0.05)	0.64*** (0.09)	0.52*** (0.08)	0.47*** (0.06)
	95% c.i.	(0.83;1.37)	(1.01;1.69)	(1.45;2.35)	(1.07;1.83)	(1.12;1.8)	(0.31;0.52)	(0.28;0.49)	(0.47;0.83)	(0.39;0.69)	(0.36;0.61)
Play	ΔP s.e.	-2.77*** (0.32)	-3.06*** (0.36)	-2.72*** (0.31)	-2.67*** (0.31)	-2.83*** (0.32)	-1.58*** (0.27)	-1.56*** (0.26)	-1.70*** (0.27)	-2.42*** (0.30)	-1.72*** (0.26)
	95% c.i.	(-3.45;-2.20)	(-3.82;-2.43)	(-3.38;-2.16)	(-3.36;-2.14)	(-3.51;-2.26)	(-2.14;-1.09)	(-2.10;-1.08)	(-2.27;-1.20)	(-3.05;-1.89)	(-2.28;-1.24)

The magnitude of harm to the late entrant in terms of market share loss is moderate under actual regulatory policy (asymmetric interconnection charges).

Operator choice probability differentials
Scenario 2 (fully symmetrical MTRs and off-net prices) vs. the baseline

		Postpaid					Prepaid				
		Orange subscribes	T-Mobile subscribes	Plus subscribes	Play subscribes	Overall	Orange subscribes	T-Mobile subscribes	Plus subscribes	Play subscribes	Overall
Orange	ΔP s.e.	4.78*** (0.64)	2.15*** (0.35)	1.70*** (0.28)	2.13*** (0.36)	2.77*** (0.38)	1.66*** (0.34)	1.16*** (0.22)	1.16*** (0.22)	1.45*** (0.25)	1.35*** (0.25)
	95% c.i.	(3.68;6.18)	(1.55;2.93)	(1.22;2.3)	(1.54;2.93)	(2.12;3.61)	(1.04;2.37)	(0.77;1.63)	(0.77;1.62)	(1.00;1.98)	(0.90;1.88)
T-Mobile	ΔP s.e.	0.99*** (0.17)	3.25*** (0.41)	0.94*** (0.17)	1.22*** (0.21)	1.65*** (0.20)	3.55*** (0.54)	3.7*** (0.61)	3.68*** (0.56)	4.91*** (0.60)	3.82*** (0.54)
	95% c.i.	(0.7;1.36)	(2.54;4.14)	(0.66;1.31)	(0.85;1.69)	(1.29;2.08)	(2.53;4.64)	(2.46;4.9)	(2.63;4.8)	(3.81;6.16)	(2.81;4.95)
Plus	ΔP s.e.	2.93*** (0.42)	3.63*** (0.48)	5.87*** (0.68)	3.38*** (0.52)	4.10*** (0.49)	0.81*** (0.17)	0.79*** (0.17)	1.19*** (0.29)	1.13*** (0.21)	0.95*** (0.19)
	95% c.i.	(2.19;3.81)	(2.76;4.65)	(4.67;7.35)	(2.46;4.49)	(3.23;5.14)	(0.52;1.17)	(0.50;1.15)	(0.67;1.79)	(0.76;1.58)	(0.60;1.35)
Play	ΔP s.e.	-8.70*** (0.92)	-9.03*** (0.99)	-8.51*** (0.90)	-6.73*** (0.84)	-8.53*** (0.90)	-6.02*** (0.88)	-5.66*** (0.84)	-6.03*** (0.89)	-7.48*** (0.85)	-6.12*** (0.85)
	95% c.i.	(-10.66;-7.06)	(-11.17;-7.3)	(-10.43;-6.91)	(-8.54;-5.23)	(-10.48;-6.93)	(-7.82;-4.39)	(-7.38;-4.06)	(-7.88;-4.37)	(-9.29;-5.93)	(-7.89;-4.56)

The magnitude of harm to the late entrant in terms of market share loss is substantial under alternative regulatory policy (symmetric interconnection charges).

Conclusions

▶ Call externalities are among important drivers of mobile operator choice for both prepaid and postpaid subscribers, next to price effects, switching costs, network effects and brand effects.

▶ Consumers are discouraged to subscribe to networks for which incoming calls are higher.

▶ Above benchamark asymmetry in off-net calls between 3 incumbent MNO and new entrant had negative, albeit moderate, impact on market share of NE.

▸ In reduced asymmetry scenario, under a common markup benchmark NE would gain 2.8 p.p in market share in postpaid segment (1.7 in prepaid)

▶ Under full symmetry NE would gain 8.5 p.p (6.1 in prepaid)

▸ Assymetric MTRs are costly for its beneficiaries. This has largely been overlooked in practical considerations.

Thank you for your time

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