

Market Entry, Fighting Brands and Tacit Collusion: The Case of the French Mobile Telecommunications Market

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Research questions

Incumbents often respond to new entry by introducing low-cost fighting brands (instead of only lowering prices on existing brands)

- ▶ Intel's Celeron to fight AMD
- ▶ Lufthansa's Germanwings against easyJet and Ryanair

Our analysis: French mobile telecom market

- ▶ Why do incumbents respond to new entry by introducing fighting brands?
- ▶ What are the implications for the impact of entry on consumers and welfare?

Entry of Free Mobile in France

Mobile market in France in 2011 Q4:

- ▶ Three incumbent network operators: Orange, SFR & Bouygues Telecom
- ▶ No new entry since Bouygues Telecom in 1996

Entry of Free Mobile

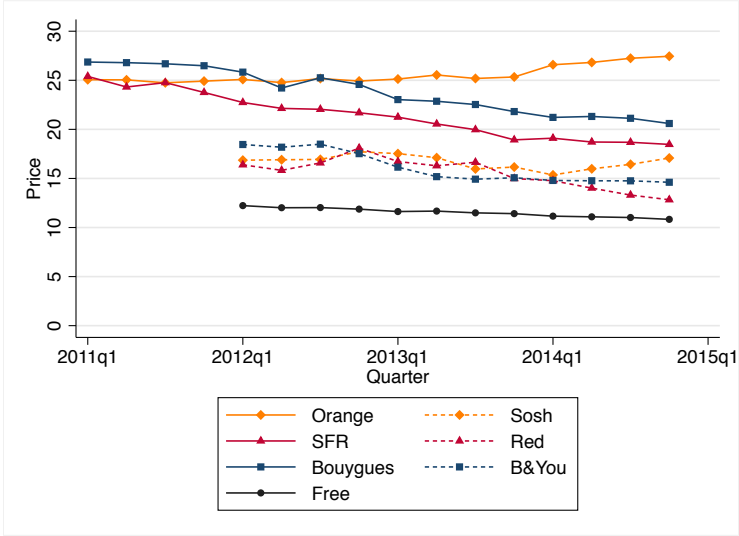
- ▶ Obtained a 3G license in 2009
- ▶ Entered in January 2012 with low tariff postpaid plan, no contractual commitment, limited customer service

Incumbents' reaction: each launched own low-cost product line

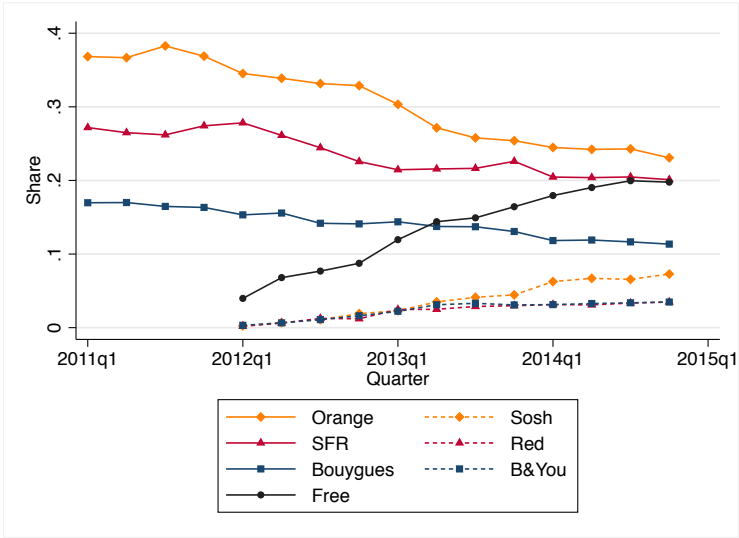
- ▶ Orange → Sosh
- ▶ SFR → Red
- ▶ Bouygues → B&You

Incumbents' market share: from 87% in 2011 to 70% in 2014.

Impact of entry on prices



Impact of entry on market shares



Free mobile's entry: a fighting brand story?

Johnson & Myatt (2003): incumbent introduces low cost “fighting brand” in response to low cost entrant

- ▶ Without entry, no low cost brand to avoid cannibalization
- ▶ With entry, introduce low cost brand to steal business from new entrant

French mobile telecom market

- ▶ Free mobile enters in 2012 with (very) low postpaid plan, limited service
- ▶ Three incumbents *simultaneously* introduce subsidiary brands right before entry

Research objectives

1. Empirically evaluate fighting brands theory

- ▶ Aim to rationalize the incumbents' fighting brands strategies
- ▶ Account for the presence of multiple incumbents before entry

→ Can rationalize fighting brands as breakdown of tacit collusion

→ Not inconsistent with earlier practices found by AC (information sharing; joint market share targets)

2. Measure consumer and welfare impacts of entry by sources

- ▶ Variety effect: low-cost variety of Free Mobile
- ▶ Traditional competition effect: incumbents' price responses
- ▶ Indirect competition effect: incumbents' new fighting brands

→ Consumer surplus and welfare mainly increased because of increased variety of entrant and fighting brands

Policy relevance

New licences for fourth entrant

- ▶ In 2018: Iliad Group (Free Mobile) in Italy
- ▶ Upcoming: new licences in other countries, e.g. Germany & Belgium?

Several recent 4-to-3 mergers

- ▶ From 13 to 18 countries with 3 operators in EEA
- ▶ Reversal of market structure in France again?
- ▶ Proposed merger between T-Mobile & Sprint in US, T-Mobile and Tele2 in The Netherlands

Literature

1. Market structure and tacit collusion
 - ▶ Coordinated effects from merger (Miller & Weinberg, 2017)
 - ▶ Here: semi-collusion in product lines
2. Entry and fighting brands: non-collusive theories
 - ▶ Under monopolist incumbent (Johnson & Myatt, 2003)
 - ▶ With oligopoly incumbents (Nocke & Schutz, 2018)
3. Market structure, merger & product variety
 - ▶ Strategic product positioning to deter entry (Berry & Waldfogel, 2001; Sweeting, 2010)
4. Impact of market structure in telecom markets
 - ▶ Variety (Economides, Seim & Viard, 2008)
 - ▶ Price & investment (Genakos, Valletti & Verboven, 2017)

Data overview

Demand & product characteristics

- ▶ 2011Q1–2014Q4 across 13 regions in France
- ▶ Subscribers by mobile operator's brand
- ▶ Average prices & service attributes (allowances...)
- ▶ Demographics

Network characteristics

- ▶ Mobile cellular base stations (antennas) as a measure of network quality
- ▶ Database of active cellular base stations provided by ANFR
- ▶ Technology generation, location & activation date

Other data

- ▶ Population by region from INSEE
- ▶ MVNO partnerships with MNOs from press reports

Overview of mobile services market

Network operator	Product group	Antenna stations			Price (€)	Market share
		2G	3G	4G		
Orange	Orange	1,908	1,330	243	31.71	0.289
	Sosh				16.65	0.039
SFR	SFR	1,363	1,205	86	25.99	0.229
	Red				15.53	0.024
Bouygues	Bouygues	1,421	1,119	232	30.74	0.137
	B&You				15.99	0.025
Free	Free	0	380	50	11.53	0.135
Orange	MVNO	0	0	0	17.58	0.043
SFR	MVNO	0	0	0	16.08	0.089
Bouygues	MVNO	0	0	0	17.58	0.014

Based on the dataset of 3,328 observations (mobile service products in 13 region blocks from 2011 Q4 to 2014 Q4).

Market shares are the average share of subscribers across regions.

Price measure

Challenges

- ▶ Near continuum of tariff menus (thousands per operator)
- ▶ Bundles: voice, data sms, roaming, add-ons, handset and triple/qua play
- ▶ Heterogeneous tariffs: fixed, linear, two-part, three part
- ▶ Usage, tariff details not available

A simplified approach

- ▶ Group by 3 tariff structures: prepaid, postpaid, forfait bloqué
- ▶ Average monthly bills for package (call, data, sms)
- ▶ Average weighted by price tiers
- ▶ Offers unified measure but does not account for endogenous usage

Changes in market shares by tariff

Network operator	Product group	Market share (2011Q4)			Market share (2014Q4)		
		Prep.	Postp.	F. bl.	Prep.	Postp.	F. bl.
Orange	Orange	0.085	0.192	0.098	0.024	0.171	0.041
	Sosh					0.073	
SFR	SFR	0.036	0.185	0.057	0.011	0.170	0.023
	Red					0.035	
Bouygues	Bouygues	0.030	0.114	0.024	0.011	0.094	0.009
	B&You					0.035	
Free	Free					0.198	
Orange	MVNO	0.008	0.008	0.015	0.003	0.022	0.010
SFR	MVNO	0.027	0.064	0.024	0.012	0.064	0.007
Bouygues	MVNO	0.008	0.002	0.015	0.004	0.007	0.001

F. bl. denotes *forfait bloqué* (postpaid with fixed allowances and infinite variable price).

Demand for mobile network services

Consumer i 's utility from brand j at market t :

$$u_{ijt} = \begin{cases} \alpha \log(y_{it} - p_{jt}) + \beta'_{it} x_{jt} + \xi_{jt} + \epsilon_{ijt} & j = 1, \dots, J, \\ \alpha \log(y_{it}) + \xi_{0t} + \epsilon_{i0t} & j = 0. \end{cases}$$

- ▶ p_{jt} : total package price (subscription & usage)
- ▶ x_{jt} : antennas, allowances, operator FEs, time trend, etc.
- ▶ ξ_{jt} : unobserved mean quality

Preference parameters:

$$\beta_{it} = \beta + \pi d_t + \nu_{it}$$

- ▶ d_t : aggregate demographics
- ▶ ν_{it} : heterogeneous taste

Alternative: logit with switching costs (in progress)

Demand for mobile network services

Indirect utility of consumer i from product j at market t :

$$u_{ijt} = \delta_{jt} + \mu_{ijt} + \epsilon_{ijt},$$

where

- ▶ $\delta_{jt} = (\beta + \pi d_t)' x_{jt} + \xi_{jt}$
- ▶ $\mu_{ijt} = -\alpha_{it} p_{jt} + \nu_{it}' x_{jt}$
- ▶ $(\alpha_{it}, \nu_{it}) = (\alpha, \sigma_\nu) / y_{it} \in \mathcal{R}^K$

Market share:

$$s_{jt}(\delta_t, \alpha, \sigma_\nu) = \int \frac{\exp(\delta_{jt} + \mu_{ijt}(y_{it}; \alpha, \sigma_\nu))}{1 + \sum_{k=1}^J \exp(\delta_{kt} + \mu_{ikt}(y_{it}; \alpha, \sigma_\nu))} d\mathcal{P}_t(y_{it})$$

Estimation method

Identifying assumption

$$E[\xi_{jt}|z_{jt}] = 0$$

Optimal instruments

$$h_{jt}(z_{jt}, \theta) \equiv E\left[\frac{\partial \xi_{jt}(\theta)}{\partial \theta} \middle| z_{jt}\right]$$

Two-step GMM

$$\min_{\theta} \xi(\theta)' h(z, \hat{\theta})' h(z, \hat{\theta}) \xi(\theta)'$$

“Continuous updating” GMM

$$\min_{\theta} \xi(\theta)' h(z, \theta)' h(z, \theta) \xi(\theta)'$$

- ▶ Second (consecutive) inner loop to compute the linear parameters at the (candidate) optimal instruments
- ▶ More efficient (avoid first-stage non-optimal instruments)

Profits of network operators

Profit of MNO f :

$$\Pi_f = \sum_{l \in L_f} (p_l - c_l) D_l(\mathbf{p}) + (w_{f_0} - c_{f_0}) D_{f_0}(\mathbf{p}),$$

Profit of affiliated MVNO f_0 :

$$\Pi_{f_0} = (p_{f_0} - w_{f_0}) D_{f_0}(\mathbf{p}).$$

where $D_l(\mathbf{p})$ is national demand for product j across all markets.

Two-stage pricing game

1. MNOs set the wholesale price for their affiliated MVNOs.
2. MNOs & MVNOs set retail price.

Sensitivity analysis: vertically integrated pricing

Wholesale & retail pricing

2nd stage FOC:

$$\frac{\partial \Pi_f}{\partial p_j} = D_j + \sum_{l \in L_f} (p_l - c_l) \frac{\partial D_l}{\partial p_j} + (w_{f_0} - c_{f_0}) \frac{\partial D_{f_0}}{\partial p_j} = 0, \quad j \in L_f, \quad f \in \mathcal{F}$$

$$\frac{\partial \Pi_{f_0}}{\partial p_{f_0}} = D_{f_0} + (p_{f_0} - w_{f_0}) \frac{\partial D_{f_0}}{\partial p_{f_0}} = 0, \quad f \in \mathcal{F}.$$

1st stage FOC:

$$\begin{aligned} \frac{d\Pi_f}{dw_{f_0}} &= \frac{\partial \Pi_f}{\partial w_{f_0}} + \sum_{j \in \mathcal{J}} \frac{\partial \Pi_f}{\partial p_j} \frac{\partial p_j}{\partial w_{f_0}} \\ &= D_{f_0} + \sum_{j \in \mathcal{J} \setminus L_f} \left(\sum_{l \in L_f} (p_l - c_l) \frac{\partial D_l}{\partial p_j} + (w_{f_0} - c_{f_0}) \frac{\partial D_{f_0}}{\partial p_j} \right) \frac{\partial p_j}{\partial w_{f_0}} = 0. \end{aligned}$$

Demand parameter estimates

Estimate	Logit	IV logit	RC logit
Price/ y_{it} (α)			-4.030*** (0.485)
Forfait bloqué/ y_{it}			39.101*** (5.681)
Log 4G/ y_{it}			-3.978*** (0.711)
Price/ \bar{y}_t	-0.241** (0.104)	-6.051*** (0.848)	
Log(2G antenna)	1.097*** (0.144)	0.201 (0.361)	0.532 (0.362)
Log(2G roaming)	1.063*** (0.208)	-0.130 (0.605)	0.568 (0.556)
Log(3G antenna)	0.164 (0.108)	0.856*** (0.218)	0.662*** (0.229)
Log(3G roaming)	0.010 (0.181)	1.101** (0.557)	0.275 (0.469)
Log(4G antenna)	0.040 (0.033)	0.217*** (0.067)	0.580*** (0.134)
Log(4G roaming)	0.044 (0.038)	0.121 (0.076)	0.462*** (0.168)
Postpaid	-0.941 (1.012)	-2.651 (3.463)	-0.796 (2.228)
Forfait bloqué	2.536** (1.032)	2.486 (3.408)	2.016 (2.554)
Call allow. (1,000 min)	0.078 (0.052)	1.121*** (0.174)	0.585*** (0.126)
Data allow. (1,000 MB)	0.618*** (0.059)	0.179 (0.156)	0.520*** (0.123)

Network brand fixed effects

Estimate	Logit	IV logit	RC logit
Orange	-0.718 (1.151)	0.700 (4.336)	-0.971 (2.280)
SFR	-0.905 (1.155)	-1.358 (2.755)	-0.685 (2.812)
Bouygues	-1.004 (1.181)	0.155 (5.582)	-1.230 (2.619)
Free	0.687 (1.989)	-1.413 (4.587)	-0.185 (3.157)
Sosh	1.911 (1.933)	1.839 (4.532)	1.265 (4.229)
B&You	1.759 (1.996)	0.070 (4.468)	-1.776 (3.085)
Red	-0.904 (1.972)	-2.751 (4.298)	-4.292 (3.379)
1/Time since entry	-2.643*** (0.107)	-2.259*** (0.276)	-2.089*** (0.265)
Observations	3,328	3,328	3,328
J statistic		145.70	0.00
D.F.		13	0
Simulation draws			200
Market fixed effects	Yes	Yes	Yes

Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Demographics include age and income interacted with each product.

Diversion ratios from postpaid products

Network operator	Product group	Orange		SFR		Bouygues		Free
		Postpaid	Sosh	Postpaid	Red	Postpaid	B&You	Postpaid
Orange	Prepaid	5.15	5.70	5.58	5.54	4.69	5.62	7.98
	Postpaid	-100.00	11.80	24.58	9.91	26.05	10.90	6.83
	Forfait bloqué	7.02	8.36	7.72	8.40	6.23	8.11	12.78
	Sosh	3.99	-100.00	4.31	3.50	3.65	3.73	4.14
SFR	Prepaid	1.91	2.31	2.19	2.65	1.79	2.32	3.54
	Postpaid	28.32	15.05	-100.00	13.22	24.59	14.14	10.20
	Forfait bloqué	2.51	4.14	2.98	4.71	2.29	4.35	10.88
Bouygues	Red	2.45	2.77	2.85	-100.00	2.38	2.82	4.03
	Prepaid	2.03	2.21	2.19	2.16	1.88	2.31	3.17
	Postpaid	18.39	7.71	15.10	6.63	-100.00	7.58	4.74
	Forfait bloqué	1.28	1.88	1.48	2.11	1.21	2.06	4.30
Free	B&You	3.13	3.40	3.53	3.23	3.10	-100.00	4.29
	Postpaid	12.54	20.78	15.95	23.45	12.41	23.03	-100.00

Percentage of sales diverted toward products (rows) due to price increase (columns). Columns limited to postpaid products.

- ▶ Premium brands mainly compete with other premium brands
- ▶ Fighting brands mainly compete with Free

Estimated retail margins: MNOs

Network operator	Product group	Retail price			Retail markup		
		Prep.	Postp.	F. bl.	Prep.	Postp.	F. bl.
Orange	Orange	13.56	39.04	22.56	7.73	13.55	7.39
	Sosh		16.67			9.04	
SFR	SFR	13.33	28.86	18.62	6.83	11.05	5.01
	Red		15.54			7.86	
Bouygues	Bouygues	13.53	35.12	19.89	5.77	10.51	4.36
	B&You		16.07			6.92	
Free	Free		11.54			5.59	
Orange	MVNO	9.27	19.05	18.26	3.55	6.61	3.38
SFR	MVNO	6.36	18.90	17.29	2.99	6.52	3.20
Bouygues	MVNO	4.40	32.93	19.79	2.35	8.42	3.56

Average retail prices and margins of mobile services across times and regions (in euro).

F. bloqué denotes forfait bloqué service.

Estimated wholesale prices & margins: MVNOs and hosts

Upstream network	Downstream network	Wholesale price			Wholesale markup		
		Prep.	Postp.	F. bl.	Prep.	Postp.	F. bl.
Orange	MVNO	5.72	12.43	14.88	4.81	9.38	4.64
SFR	MVNO	3.37	12.37	14.09	4.08	8.63	4.37
Bouygues	MVNO	2.05	24.51	12.48	2.44	9.91	3.31

Average prices and margins in the wholesale market across times and regions.

Incentives to introduce fighting brands: overview

Compute counterfactual profits under 16 possible market structures:

- ▶ Entry of each of the three fighting brands
- ▶ Entry of Free Mobile

Establish whether a non-empty range of fixed costs can rationalize no FB before entry, FB after entry

- ▶ Joint incentives: increase
- ▶ Unilateral incentives: always there, already before entry
- ▶ Collusion in restricting product lines

(1) Joint incentives to introduce fighting brands

Network	Entry of Free Mobile	
	No	Yes
Orange	-265	-33
SFR	-345	-129
Bouygues	131	156
Total incumbents	-479	-6
Free	0	-264

Profit changes from joint FB (in mill. €).

- ▶ Before entry: large joint profit losses from FB
 - ▶ After entry: negligible profit losses from FB
(Under vert. int. pricing, some profit gains from FB after entry)
- ⇒ Business stealing from Free, but not necessarily enough to counteract cannibalization

(2) Unilateral incentives

No unilateral incentive to deviate if

$$\Pi_j^{noFB,N} \geq \Pi_j^{FB,N} - f_j$$

$$\Pi_j^{FB,E} - f_j \geq \Pi_j^{noFB,E}$$

i.e. if:

$$\Pi_j^{FB,N} - \Pi_j^{noFB,N} \leq f_j \leq -(\Pi_j^{noFB,E} - \Pi_j^{FB,E})$$

Network	No entry: no FB	Entry; FB
	$\Pi_j^{FB,N} - \Pi_j^{noFB,N}$	$\Pi_j^{noFB,E} - \Pi_j^{FB,E}$
Orange	416	-341
SFR	287	-222
Bouygues	395	-303

Profit changes from unilateral deviations from candidate equilibrium: “no FB” without entry, “FB with entry (in mill. €).

(2) Unilateral incentives

- ▶ Before entry, require sufficiently large fixed costs to rationalize no *FB*
- ▶ After entry, require sufficiently small fixed costs to rationalize *FB*
- ⇒ No range of fixed costs rationalizes *no FB* without entry, and *FB* with entry
- ⇒ Intuition: both with and without entry incentive to *FB* because of business stealing from both Free and rival incumbents

(3) Collusion on restricting product lines

Question 1.

Is no-FB sustainable as collusive equilibrium before entry?

- Yes if

$$\frac{\pi_j^{C,N}}{1 - \delta_j} \geq \pi_j^{D,N} - f_j + \frac{\delta_j}{1 - \delta_j} (\pi_j^{N,N} - f_j)$$

or

$$\delta_j \geq \underline{\delta}_i^N(f_i) \equiv \frac{\pi_i^{D,N} - \pi_i^{C,N} - f_i}{\pi_i^{D,N} - \pi_i^{N,N}}$$

- ▶ Colluding enables to save fixed costs of FB
- ▶ Deviating gives one-shot gain due to business stealing, but long-term punishment loss due to cannibalization when all do FB.

(3) Collusion on restricting product lines

Question 2.

Do incentives to collude on no-FB decrease after entry?

- Yes if

$$\underline{\delta}_i^E(f_i) > \underline{\delta}_i^N(f_i)$$

- ▶ Entry reduces collusive payoff \Rightarrow harder to collude
- ▶ Entry reduces deviation and punishment payoffs \Rightarrow easier to collude

Collusion on restricting product lines

Operator	\underline{f}_j^N (collusion)	\bar{f}_j^N (punishment)	$\bar{\bar{f}}_j$ (breakdown)
(O)range	-265	374	285
(S)FR	-345	259	166
(B)ouygues	131	361	198

Lower and upper bounds on fixed costs for which collusion is sustainable before entry, and upper bounds for which collusion becomes more difficult to sustain after entry (in mill. €).

- ⇒ For each operator, there is a range of fixed costs that sustains no-FB as an equilibrium before entry.
- ⇒ For each operator, there is a range of fixed costs that rationalizes decreased incentive to collude on no-FB after entry.

Sources of surplus gains

Source	Consumer	Producer	Total
Free's entry	3,144	-1,959	1,185
Variety	2,340	-1,200	1,140
Price	804	-759	45
Fight brands	1,417	-378	1,039
Total	4,561	-2,337	2,224

Impact of entry on consumers and welfare (in mill. €).

Consumers

- ▶ Mainly gain from variety effect of Free (50% and incumbents' FB (30%))
- ▶ Smaller gains from price response (20%)

Gross welfare

- ▶ Equal welfare effects from variety of Free and incumbents' FB
- ▶ Negligible welfare effects from price response

Remark: maybe net welfare losses due to fixed costs

Conclusions

Fighting brands

- ▶ Joint incentives to collude on no FB in absence of entry
- ▶ Decreased incentives to collude on no-FB after entry

⇒ Market structure may affect collusion in restricting product lines, not just prices

Welfare gains from entry

- ▶ Consumer surplus and welfare improve from variety by Free and incumbents' product line responses
- ▶ Limited gains from price responses

These are gross welfare gains, no account of incentives to invest.