Competition and the Use of Foggy Pricing

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Do we have too many options to choose from?

- It appears that consumers encounter important deliberation costs.
  - 2003 Medicare Part D prescription drug benefit plans.
  - Retirement plans.
  - Health care providers.
  - Loans and mortgages.
  - Home, car, and life insurance.
  - Tariff choices:
    - Cable/satellite.
    - Utilities.
    - Telecommunications.

Motivating Questions

- The existence of psychological costs may lead consumers to make mistakes in their choices.
- This opens business opportunities for firms who may wish to take advantage of consumers' deliberation costs by offering ambiguous contracts.
- Fogginess refers to this ambiguity of contracts.
  - I focus on foggy tactics surrounding nonlinear pricing in a particular application where other issues, such as, hidden clauses, "small fonts" and issues alike can be ruled out or controlled for.

Quote:

"Think about pricing. What has very telco in the world done in the past? It has used confusion as its chief marketing tool. And that is fine." — Theresa Gatung, Former CEO of Telecom NZ.

Motivating Questions

How can it be "fine"?

- It is legal.
- Consumers are aware of these tactics.
- Competition erodes the ability to profit from these deceptive strategies.

Motivating Questions

- This paper addresses the issue of tariff complexity and studies whether the available evidence support one of the following two broadly defined visions:
  - Consumers encounter problems choosing the least expensive tariff options. Thus, firms will benefit by designing deceptive tariffs. Competition will only exacerbate this effect.
  - Consumers end up learning what is best for them. Using deceptive pricing will only backfire through a loss of reputation. Competition will discipline firms' pricing and tariffs will become simpler.

Free Choice *vs.* Supervising Government Control:

"If suddenly you can, as a 20-year old college student sign up for five different credit cards, if you fid yourself able on a $30,000 a year income to buy a $400,000 house with no money down, then you are much more gullible to the inducements that are out there than a generation ago. (...) [But] I think there would be a danger in goin too far if, for example, we were restricting the ability of consumers to borrow." — President Obama in support of Congress creating a new Consumer Financial Protection Agency.

Goals

- Suggest operational definitions of fogginess.
- Measure whether a competitive environment favors the use of foggy tactics more than a monopolistic market structure.
- Argue in favor or against regulation on transparency of contracts.
- Evaluate whether predictions of existing models of nonlinear pricing competition hold.

Existing Evidence

Can Tariff fogginess survive in the long run?

- It appears that consumers do not choose so poorly in the end...
  - Miravete (2002).
  - Economides, Seim, and Viard (2005).
  - Ketcham, Lucarelli, Miravete, Roebuck (2011).
- Competition increases the choices available to consumers.
  - Seim and Viard (2005).

Outline

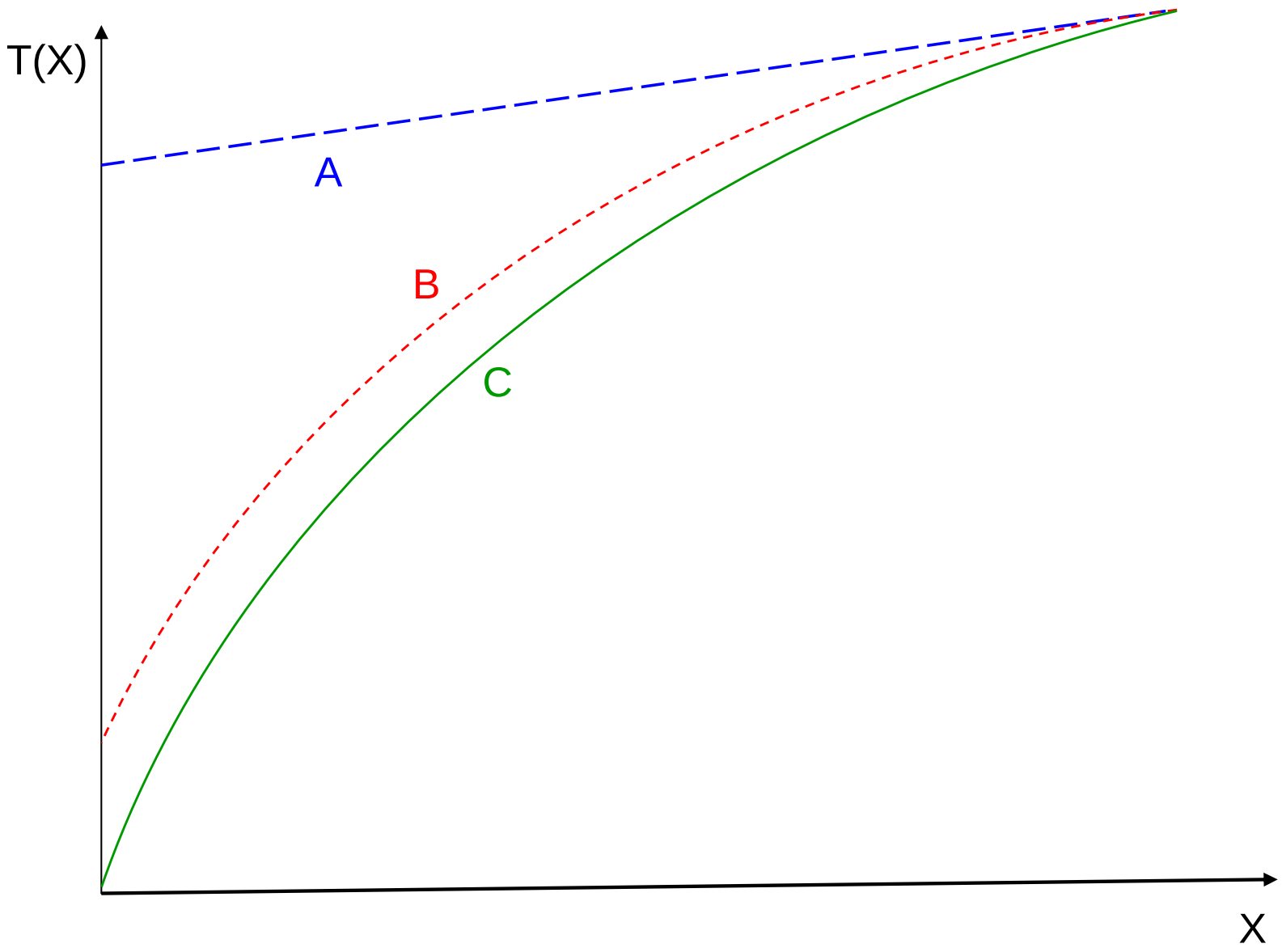
- Theory review — Nonlinear pricing.
- Suggested measures of tariff fogginess.
- Data.
- Empirical analysis — DID:
  - "Dynamic" treatments.
  - Usage uncertainty.
  - Usage heterogeneity.
  - Heterogeneity regarding usage uncertainty.

Results

- Competition does not foster the use of openly foggy tactics.
- Entrants use foggy tactics less frequently than incumbents.
- Incumbents do not increase the use of foggy tactics relative to the monopoly phase of the market.
- Most effects of competition are immediate.
- The tariff offered by the incumbent becomes less powerful about eighteen month after the entrance of the second carrier.
- Results are robust to the existence of uncertainty regarding future consumption and heterogeneity of usage patterns.

Mechanism Design Literature:

- The number of tariff plans is determined by the heterogeneity of consumers and the commercialization costs associated to offering an additional tariff option.
- More tariff options are needed when high valuation customers are more also more common.
- The proportion of high to low valuation customers determines how heterogeneous a customer base is.
- Under competition, tariffs tend to simplify greatly as a larger fraction of potential consumers participate in the market.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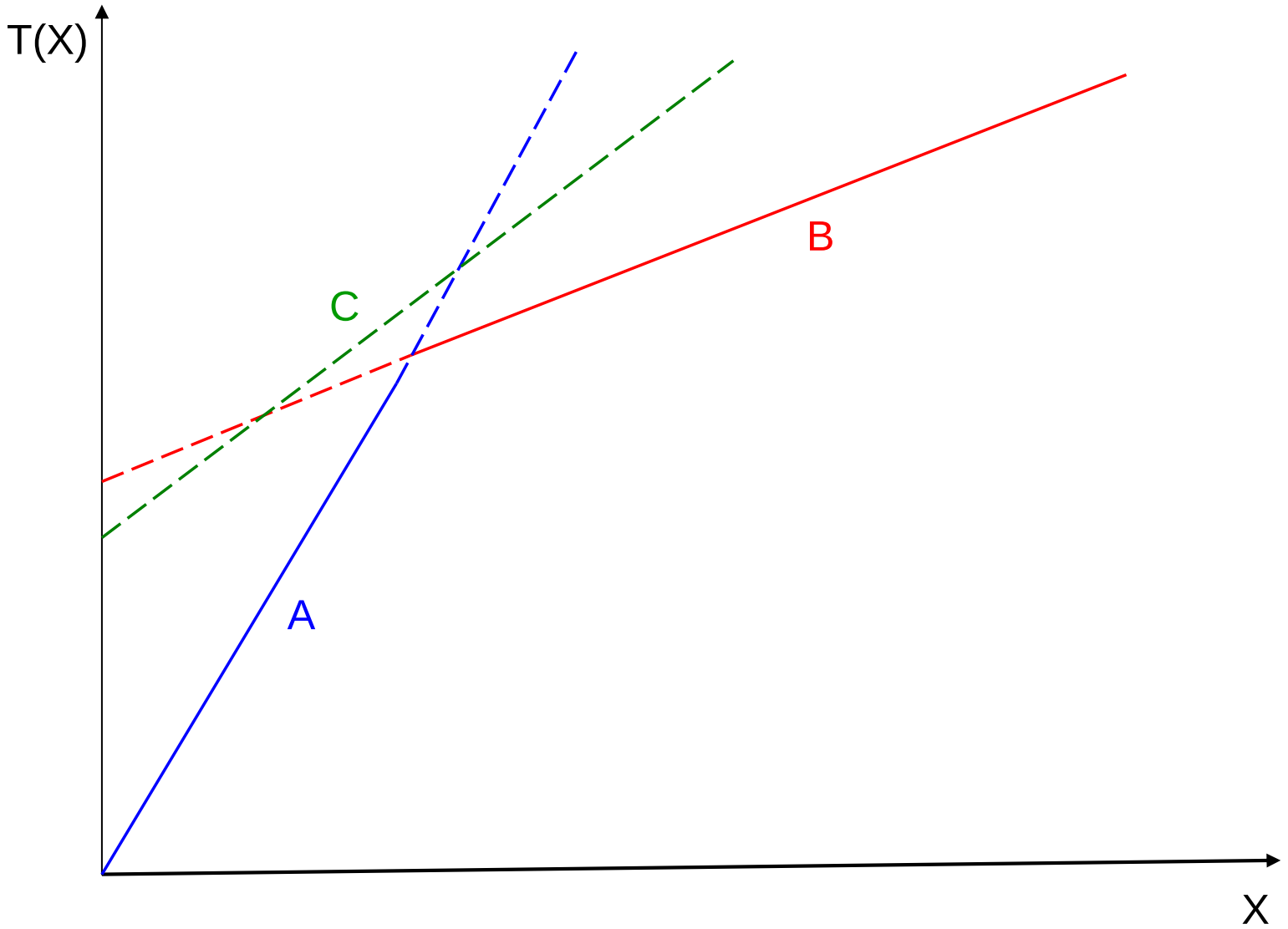
Tariff Features

- Today's tariffs distinguish among:
  - Peak and off-peak.
  - Distance.
  - Identity of the called party or her network.
  - Interconnection fees.
  - Roaming
  - Rollover of unused minutes.
- All these dimensions add to the ambiguity of the menu of tariffs. Fortunately, the tariffs of the early U.S. cellular telephone industry are much simpler.

First measure, ϕ_0

The fogginess of a menu of tariffs could be defined as the number of newly dominated or foggy options.

- The purpose of foggy options is not to address the heterogeneity of consumers regarding usage.
- More options may give the false impression that the environment is competitive and consumers have more choices (coopetition).
- Choice fatigue may lead to consumer mistakes that are profitable to firms.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Foggy Options

How do we determine if a tariff plan is foggy?

$$\phi_0 = \text{Number of Newly Dominated Options}\,.$$

- Evaluate all tariff options of a menu for any combination of peak and off-peak usage minutes that may add up to a maximum of 1,000 minutes.
- If a particular tariff option is never the least expensive one for any of these 501,501 usage patterns, then it is foggy in the sense that it is dominated by other options.
- Allowance is split proportionally to the peak and off-peak usage of each usage profile.
- Ignore options that become dominated only because of phasing-out of old tariff plans.

Second measure, ϕ_1

The fogginess of a menu of non-dominated options could also be defined as the ratio of newly dominated to non-dominated options.

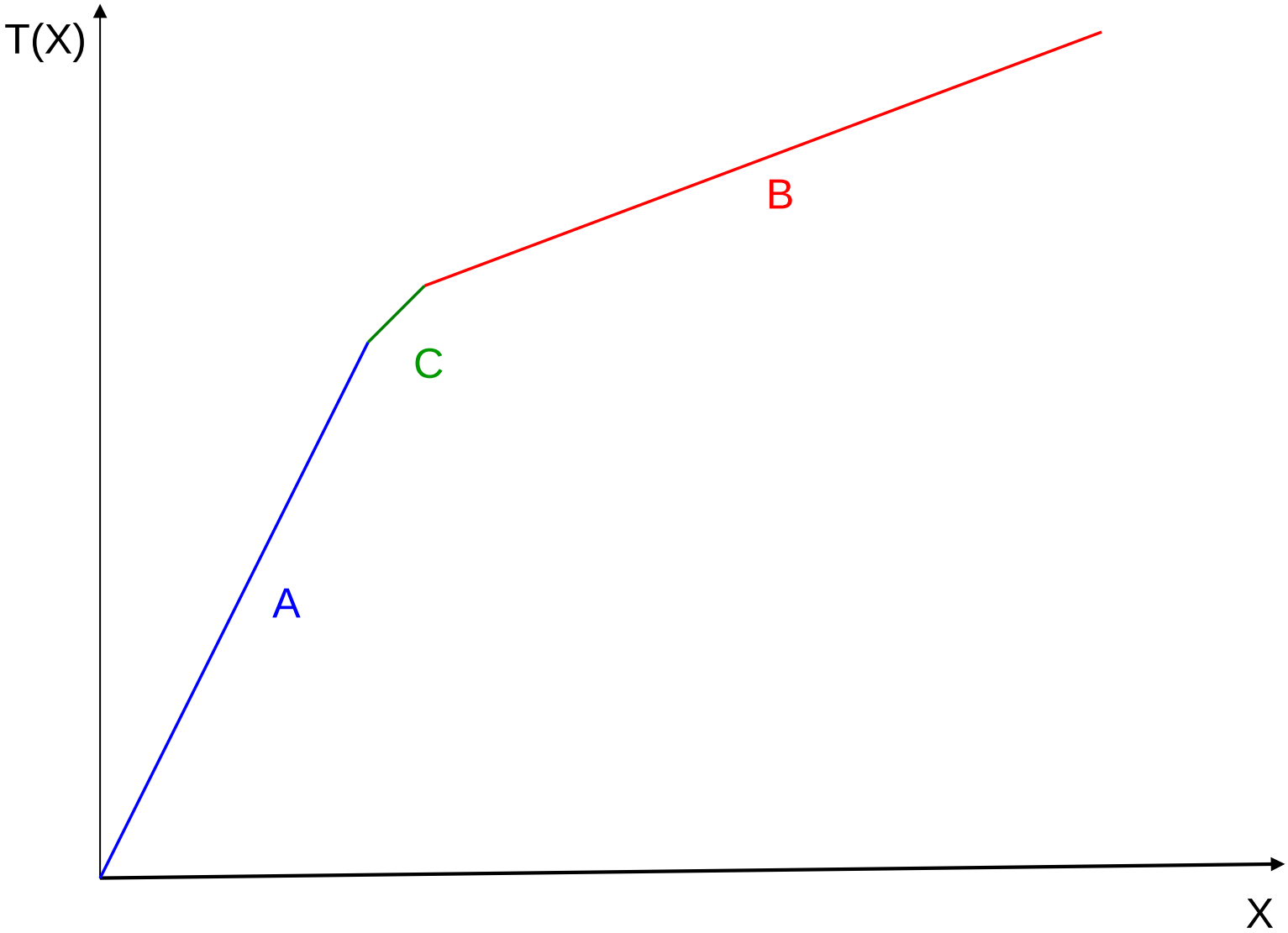
$$\phi_1 = \ln\left(\frac{\text{Number of Newly Dominated Options}}{\text{Number of Non}-\text{Dominated Options}} + 0.1\right).$$

- It is directly related to the probability of making a wrong choice when the choice of tariff plan is completely random.
- It takes care of phasing-out of old non-dominated options.
- It measures the importance of deception as guiding the design of the tariff menu.

Complexity *vs.* Fogginess

Nonlinear pricing is a tool to extract consumer surplus while inducing customers to self-select according to their preferences and avoiding arbitrage.

- Tariffs would be as complex as needed depending on how heterogeneous consumers are.
- The least expensive it is to implement tariffs the more options will be offered.
- A menu of non-foggy tariff options according to the previous two measures may still generate additional revenues due to consumers' mistakes in the presence of uncertainty.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Measure of Complexity, ϕ_2

Define the fogginess of a menu of non-dominated options as:

$$\phi_2 = \ln\left[\theta + 0.1\right] = \ln\left[(n \cdot HHI - 1) + 0.1\right] .$$

- It characterizes the complexity rather than the fogginess of the lower envelope of the tariff.
- For balanced tariffs $\phi_2 = 1$ regardless of the number of tariff options of the menu (if usage is uniformly distributed).
- The index of fogginess ϕ_2 is increasing with the asymmetry in the distribution of usage patterns for which tariff options are the least expensive ones.

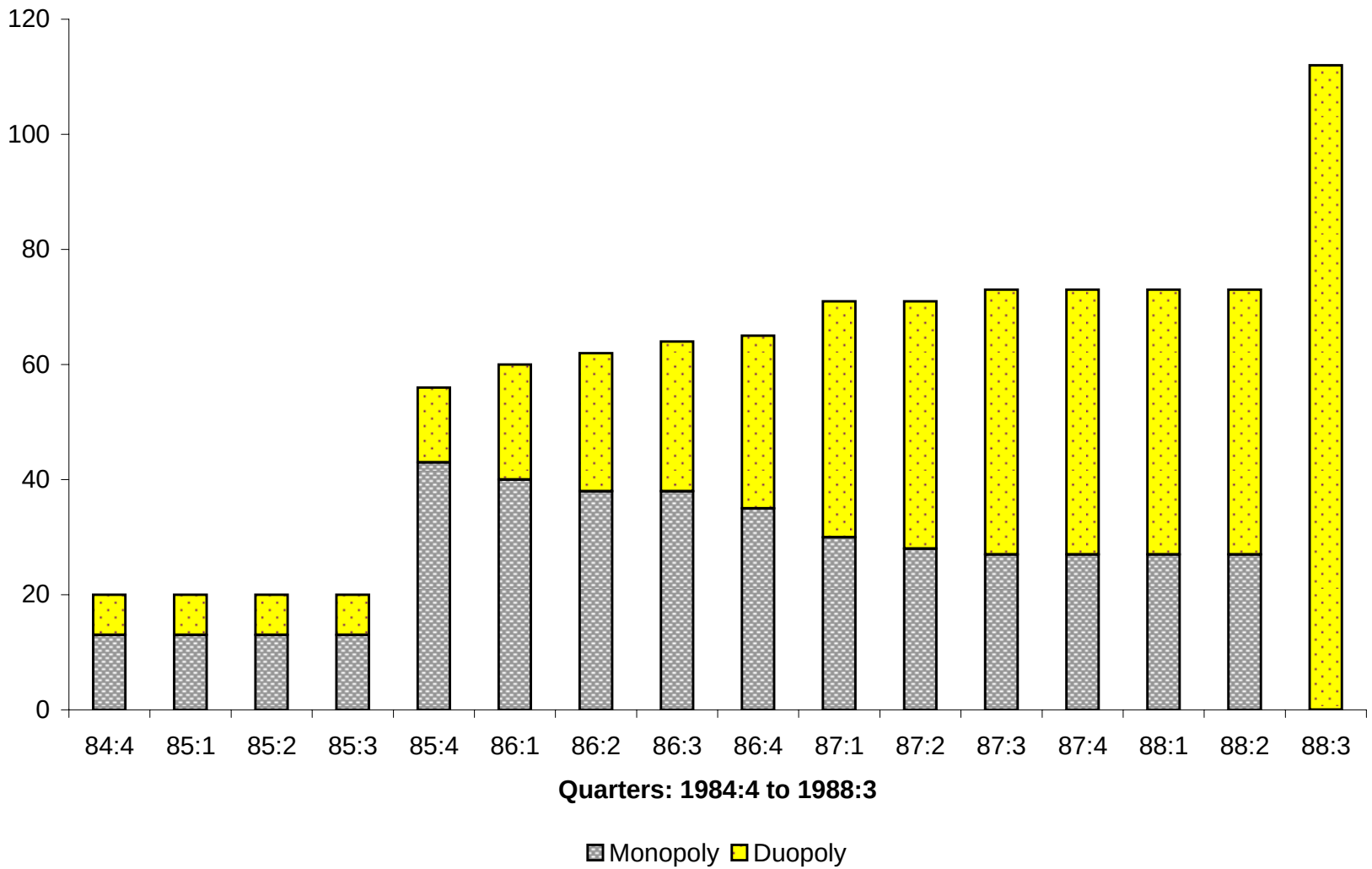
Qualifications, ϕ_2

Other relevant issues related to the third measure of fogginess:

- The existence of sweet spots invalidates any deceptive intent.
- This is indeed a "fogginess-free" measure of tariff complexity.
- More options may be completely non-foggy if consumers are heterogeneous and firms are able to screen them at a profit (once commercialization costs are taken into account).
- Usage profiles are weighted according to a $\beta(4\kappa/21, \kappa)$ distribution for $\kappa = \{1, 2, 3, 4, 5\}$ so that the average monthly telephone usage is 160 minutes (while the variance always decreases with κ).

Early U.S. Cellular Industry

- About 100 U.S. local cellular carriers (1984-1988 & 1992).
- Temporary monopoly of the wireline (incumbent) carrier in many markets.
- Exogenous entry of the nonwireline (entrant) operator.
- Largest SMSA markets.
- Complete description of all tariff plans offered by the incumbent and the entrant:
  - Allowance.
  - Fixed monthly fee.
  - Rate per minute during peak and off-peak time.
- Individual consumption data is however not available.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Quarters: 1984:4 to 1988:3
Monopoly
Duopoly

Table 1: Tariffs Offered in Cleveland in 1992

	Incumbent: GTE Mobilnet				
Plan Name	Allowance	Monthly Fee	Peak Rate	Off-Peak Rate	Usage Share
Convenience	20	24.95	0.65	0.10	96.40
Business	20	24.95	0.48	0.48	0.00
Basic Value	75	49.95	0.39	0.20	0.88
Business Saver	220	99.95	0.36	0.20	2.73
Business Advantage	400	149.95	0.28	0.28	0.06
	Entrant: Celluar One of Cleveland (McCaw)				
Plan Name	Allowance	Monthly Fee	Peak Rate	Off-Peak Rate	Usage Share
Advantage	20	24.95	0.60	0.20	57.72
Advantage Plus	20	29.95	0.60	0.20	0.00
Basic	0	34.95	0.35	0.20	21.00
Communication II	90	55.95	0.35	0.20	7.60
Communication III	180	84.95	0.34	0.19	13.77

The allowance is measured in minutes per month. All tariff related variables are measured in dollars. The column "Usage Share" indicates the percentage of usage profiles for which each tariff plan is the least expensive option. The allocation of GTE's "Convenience" plan includes peak minutes only and its "Business" plan does not include a $4.95 charge for phone rental.

Table 2: Frequency Distributions of the Number of Tariff Options (1984-1988)

	Monopoly		*Duopoly*			
	Incumbent		*Incumbent*		*Entrant*	
Total Opt.	Frequency	Rel.Freq.	Frequency	Rel.Freq.	Frequency	Rel.Freq.
1	134	0.3252	14	0.0269	48	0.0949
2	87	0.2112	71	0.1363	75	0.1482
3	73	0.1772	198	0.3800	118	0.2332
4	76	0.1845	128	0.2457	157	0.3103
5	28	0.0680	63	0.1209	54	0.1067
6	14	0.0340	47	0.0902	54	0.1067
Mean/(Var.)	2.5607	(2.0863)	3.5681	(1.4651)	3.5059	(1.9732)
Foggy Opt.	Frequency	Rel.Freq.	Frequency	Rel.Freq.	Frequency	Rel.Freq.
0	195	0.4733	96	0.1843	127	0.2510
1	92	0.2233	151	0.2898	144	0.2846
2	83	0.2015	180	0.3455	136	0.2688
3	28	0.0680	75	0.1440	56	0.1107
4	14	0.0340	17	0.0326	36	0.0711
5			2	0.0038	7	0.0138
Mean/(Var.)	1.4879	(0.4986)	1.5624	(1.1466)	1.5079	(1.5692)

Absolute and relative frequency distribution of the number of actual and non-dominated tariff options offered by each active firm in each market-quarter combination.

Table 3: Actual vs. Foggy Number of Tariff Options (1984-1988)

Monopoly	0	1	2	3	4	5
1	32.52					
2	8.01	13.11				
3	6.31	4.85	6.55			
4	0.49	4.37	7.77	5.83		
5	0.00	0.00	5.83	0.97		
6	0.00	0.00	0.00	0.00	3.40	0.00
Duopoly — Incumbent 0	1	2	3	4	5	
1	2.69					
2	9.79	3.84				
3	5.76	20.35	11.90			
4	0.00	4.80	16.89	2.88		
5	0.19	0.00	3.84	8.06	0.00	
6	0.00	0.00	1.92	3.45	3.26	0.38
Duopoly — Entrant 0	1	2	3	4	5	
1	9.49					
2	8.70	6.13				
3	3.75	7.91	11.66			
4	1.19	13.04	10.47	6.32		
5	1.98	1.38	4.55	2.77		
6	0.00	0.00	0.20	1.98	7.11	1.38

Percentage of total cases for each tariff combination. Rows denote the number of total options while columns are the number of non-dominated tariff options. Kendall's τ measures of the correlation among the count numbers of effective and foggy options offered by each firm are: 0.7579 for the monopoly sample, 0.7467 for the incumbent in duopoly, and 0.6282 for the entrant in duopoly. The corresponding t-statistics are (22.98), (25.48), and (21.13), respectively.

Table 4: Descriptive Statistics (1984-1988)

	Monopoly		*Duopoly*			
	Incumbent		*Incumbent*		*Entrant*	
Variables	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
PLANS	2.5607	1.4444	3.5681	1.2104	3.5059	1.4047
EFFPLANS	1.5850	0.7642	1.9789	0.7082	2.0099	0.9408
FOGGY (ϕ_0)	0.9757	1.1159	1.5893	1.0526	1.4960	1.2336
SHARE-FOGGY (ϕ_1)	0.2739	0.2768	0.4078	0.2219	0.3722	0.2633
COMPLEXITY (ϕ_2)	0.3680	0.5451	0.6886	0.5704	0.5894	0.5968
WIRELINE	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000
DUOPOLY	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000
AP_{peak}	0.0911	0.5363	0.2603	0.3132	0.0919	1.9176
$AP_{off-peak}$	0.5845	3.2887	-11.2009	99.4176	1.0395	45.7270
AVGjLEADj	0.0000	0.0000	2.3455	2.2544	2.3702	2.2583
AVGjSHFj	0.0000	0.0000	0.2595	0.2134	0.2622	0.2135
AVGjHHFj	0.0000	0.0000	0.4204	0.3658	0.4215	0.3628
Observations	412		521		506	

All variables are defined in the text.

Estimation

Simple Econometrics:

- OLS and PMLE.
- DID approach.
- Time and market fixed effects.
- Separate analysis for incumbent and entrant to isolate strategic pricing issues.
- Average and "dynamic" treatments to evaluate the effect of competition.
- Curvature of tariffs (potentially endogenous), which is related to the heterogeneity of potential customers.

Table 5: Fogginess – Average Treatment Effects

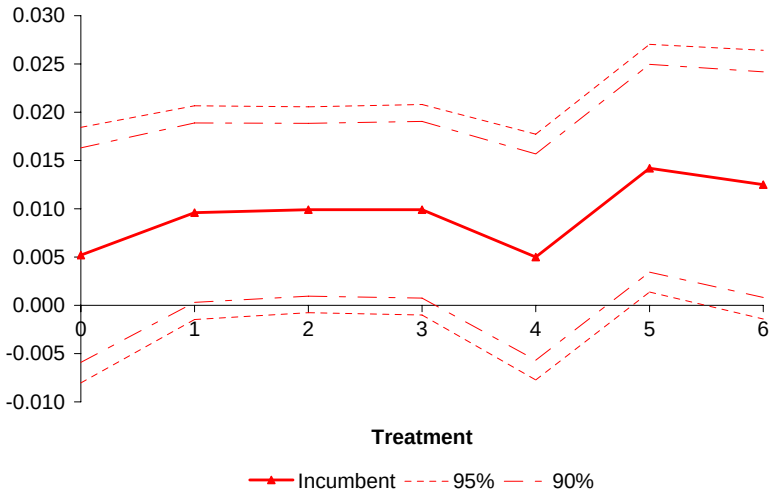
INCUMBENT	ϕ_0 $(PMLE)$		ϕ_1 (OLS)		ϕ_2 (OLS)	
YEAR92	0.0183	(1.84)	0.0304	(0.76)	0.0634	(0.74)
DUOPOLY	0.0069	(1.42)	0.0437	(2.25)	0.1159	(3.42)
AP_{peak}	0.0091	(1.86)	0.0080	(0.20)	0.0180	(0.31)
$AP_{off-peak}$	0.0000	(1.04)	0.0000	(0.10)	−0.0004	(3.44)
$DPLRI/\ Adj.\ R^2$	0.5964		0.6808		0.6806	
LM(Joint Test)	2.9383	[0.2301]	0.2988	[0.5847]	0.0063	[0.9370]
ENTRANT	ϕ_0 $(PMLE)$		ϕ_1 (OLS)		ϕ_2 (OLS)	
YEAR92	−0.0007	(0.17)	−0.0095	(0.28)	0.4117	(4.76)
DUOPOLY	−0.0006	(0.27)	−0.0440	(2.12)	0.0261	(0.72)
AP_{peak}	−0.0016	(3.51)	−0.0144	(2.56)	0.0126	(2.00)
$AP_{off-peak}$	−0.0000	(0.96)	−0.0001	(0.03)	0.0003	(0.03)
$DPLRI/\ Adj.\ R^2$	0.6401		0.6958		0.6576	
LM(Joint Test)	3.8424	[0.1464]	1.4979	[0.2210]	4.5913	[0.0321]

Marginal effects evaluated at the sample mean of regressors and absolute, heteroskedastic-consistent t-statistics are reported between parentheses. $DPLRI$ is the Poisson-deviance pseudo-R^2 of Cameron and Windmeijer (1996). LM is the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1997) for the case of the *Poisson PMLE* and the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1995) for linear regressions. LM is asymptotically distributed as a χ^2 with 2 degrees of freedom under the null hypothesis of joint exogeneity. The corresponding p-values are shown between brackets. Sample includes 1,004 observations for the incumbent and 989 for the entrant.

Table 6: Fogginess – Dynamic Treatment Effects

INCUMBENT	ϕ_0 $(PMLE)$		ϕ_1 (OLS)		ϕ_2 (OLS)	
YEAR92	0.0099	(0.82)	−0.0042	(0.08)	0.1888	(2.13)
TREAT(0)	0.0052	(0.77)	0.0358	(1.38)	0.1425	(3.51)
TREAT(+1)	0.0096	(1.70)	0.0503	(1.77)	0.0955	(2.19)
TREAT(+2)	0.0099	(1.82)	0.0621	(2.25)	0.0733	(1.83)
TREAT(+3)	0.0099	(1.78)	0.0493	(1.97)	0.0817	(1.98)
TREAT(+4)	0.0050	(0.77)	0.0394	(1.29)	0.0761	(1.60)
TREAT(+5)	0.0142	(2.17)	0.0788	(2.48)	0.0385	(0.93)
TREAT(≥+6)	0.0125	(1.76)	0.0675	(2.15)	0.0289	(0.62)
AP_{peak}	0.0090	(1.84)	0.0077	(0.19)	0.0192	(0.34)
$AP_{off-peak}$	0.0000	(1.05)	0.0000	(0.16)	−0.0004	(3.29)
$DPLRI$/ $Adj.R^2$	0.5974		0.6802		0.6833	
LM(Joint Test)	3.6038	[0.1650]	0.4290	[0.5125]	0.0001	[0.9918]
ENTRANT	ϕ_0 $(PMLE)$		ϕ_1 (OLS)		ϕ_2 (OLS)	
YEAR92	−0.0066	(1.27)	−0.0534	(1.22)	0.4073	(4.12)
TREAT(0)	0.0005	(0.18)	−0.0486	(1.88)	0.0469	(1.21)
TREAT(+1)	−0.0001	(0.05)	−0.0365	(1.17)	−0.0030	(0.06)
TREAT(+2)	0.0006	(0.20)	−0.0276	(0.97)	−0.0026	(0.05)
TREAT(+3)	0.0004	(0.14)	−0.0285	(1.01)	0.0110	(0.24)
TREAT(+4)	−0.0012	(0.39)	−0.0474	(1.64)	0.0625	(1.26)
TREAT(+5)	0.0018	(0.59)	−0.0291	(1.13)	0.0657	(1.27)
TREAT(≥+6)	0.0044	(1.32)	−0.0112	(0.38)	0.0359	(0.60)
AP_{peak}	−0.0015	(3.35)	−0.0141	(2.50)	0.0137	(2.10)
$AP_{off-peak}$	−0.0000	(0.89)	−0.0001	(0.03)	0.0003	(0.03)
$DPLRI$/ $Adj.R^2$	0.6419		0.6951		0.6575	
LM(Joint Test)	2.0338	[0.3617]	2.0295	[0.1543]	1.5502	[0.2131]

Dynamic treatment effects estimator of Laporte and Windmeijer (2005). Marginal effects evaluated at the sample mean of regressors and absolute, heteroskedastic-consistent t-statistics are reported between parentheses. $DPLRI$ is the Poisson-deviance pseudo-R^2 of Cameron and Windmeijer (1996). LM is the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1997) for the case of the *Poisson PMLE* and the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1995) for linear regressions. LM is asymptotically distributed as a χ^2 with 2 degrees of freedom under the null hypothesis of joint exogeneity. The corresponding p-values are shown between brackets. Sample includes 1,004 observations for the incumbent and 989 for the entrant.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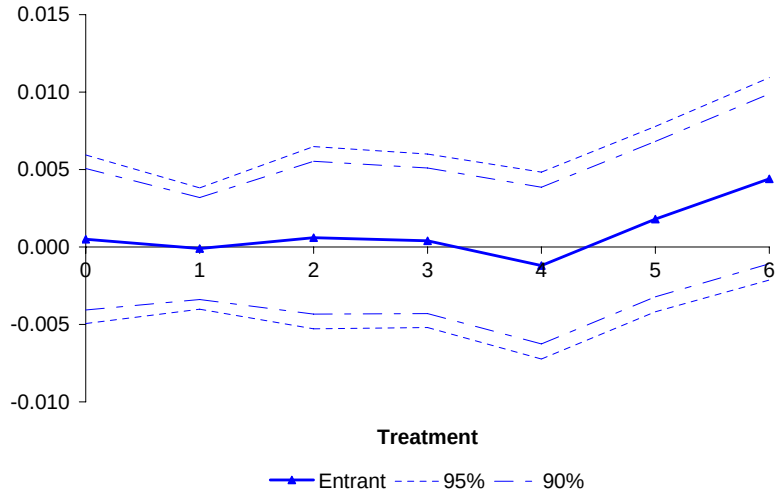
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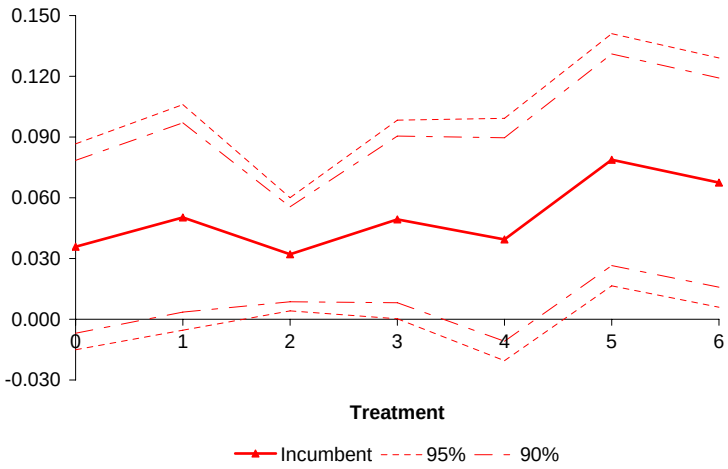
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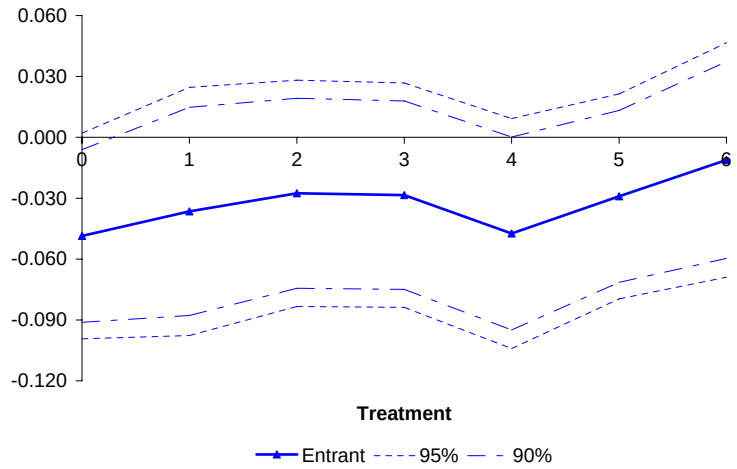
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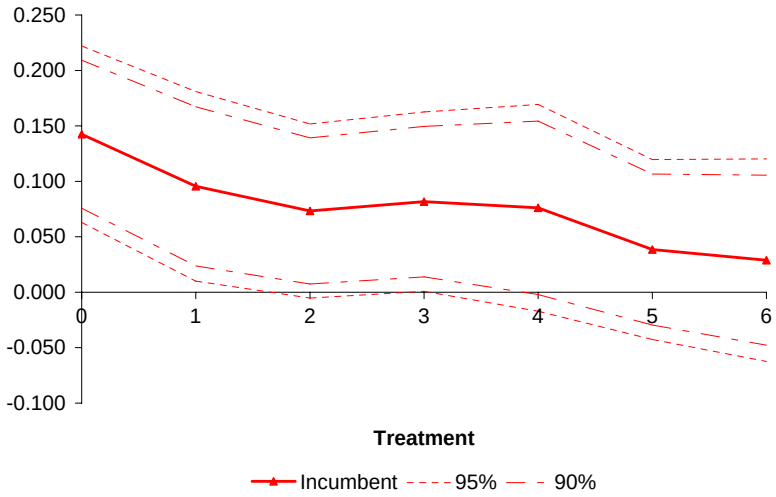
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Incumbent
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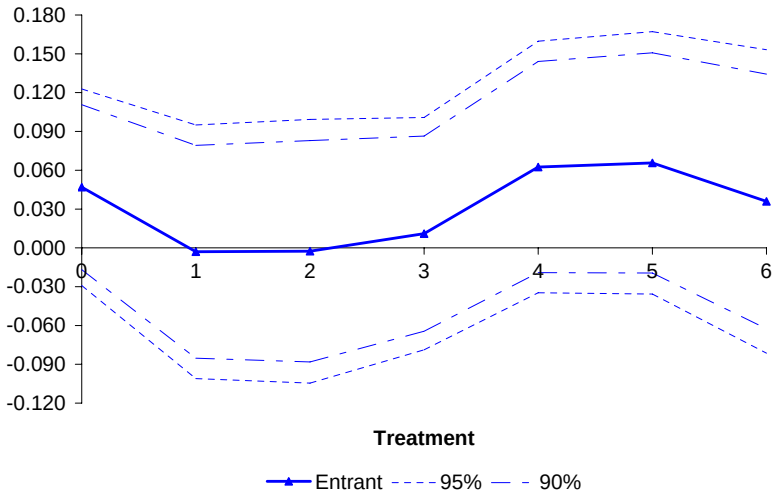
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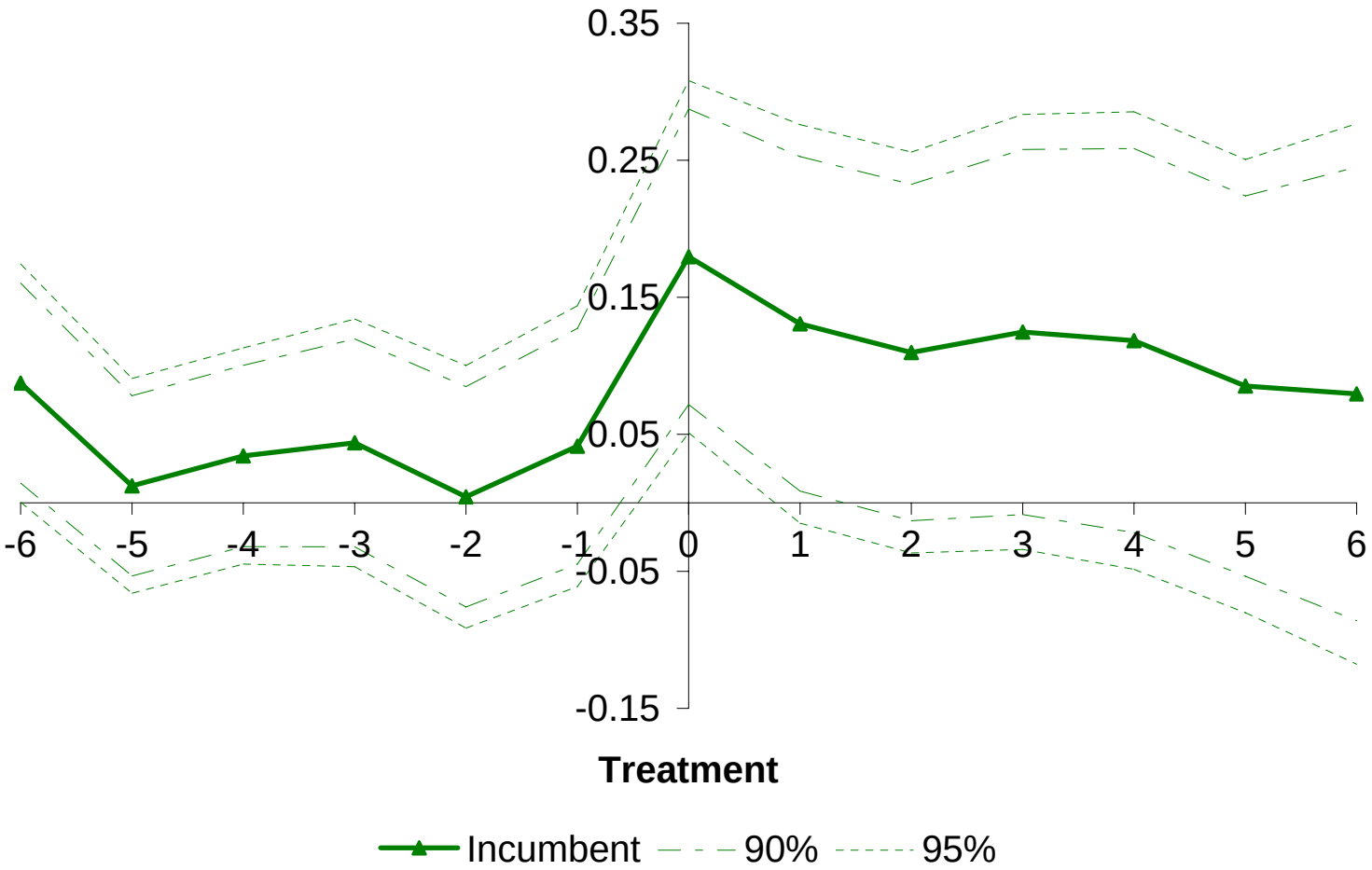
Treatment
Entrant
95%
90%

Table 7: Fogginess – Incumbent: Preemption

	ϕ_0 $(PMLE)$		ϕ_1 (OLS)		ϕ_2 (OLS)	
YEAR92	0.0075	(0.49)	−0.0218	(0.29)	0.1560	(1.32)
TREAT(−6)	−0.0004	(0.07)	0.0179	(0.74)	0.0874	(1.97)
TREAT(−5)	0.0066	(1.01)	0.0314	(1.14)	0.0124	(0.31)
TREAT(−4)	0.0029	(0.44)	0.0255	(0.81)	0.0342	(0.85)
TREAT(−3)	−0.0001	(0.01)	0.0062	(0.20)	0.0438	(0.95)
TREAT(−2)	0.0045	(0.60)	0.0216	(0.59)	0.0044	(0.09)
TREAT(−1)	0.0007	(0.10)	0.0063	(0.18)	0.0413	(0.79)
TREAT(0)	0.0075	(0.77)	0.0533	(1.26)	0.1796	(2.74)
TREAT(+1)	0.0125	(1.36)	0.0696	(1.47)	0.1306	(1.76)
TREAT(+2)	0.0126	(1.32)	0.0822	(1.66)	0.1097	(1.47)
TREAT(+3)	0.0124	(1.24)	0.0685	(1.40)	0.1247	(1.54)
TREAT(+4)	0.0081	(0.75)	0.0614	(1.10)	0.1184	(1.39)
TREAT(+5)	0.0172	(1.53)	0.1018	(1.73)	0.0852	(1.01)
TREAT(≥+6)	0.0159	(1.22)	0.0929	(1.38)	0.0795	(0.79)
AP_{peak}	0.0091	(1.87)	0.0084	(0.21)	0.0175	(0.32)
$\text{AP}_{\text{off-peak}}$	0.0000	(1.04)	0.0000	(0.14)	−0.0004	(3.28)
$DPLRI$/ $Adj.\,R^2$	0.5977		0.6788		0.6830	
LM(Joint Test)	1.6425	[0.4399]	1.0007	[0.3171]	0.0181	[0.8929]

Marginal effects evaluated at the sample mean of regressors and absolute, heteroskedastic-consistent t-statistics are reported between parentheses. $DPLRI$ is the Poisson-deviance pseudo-R^2 of Cameron and Windmeijer (1996). LM is the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1997) for the case of the *Poisson PMLE* and the regression-based, heteroskedastic-robust, Lagrange multiplier test of endogeneity of Wooldridge (1995) for linear regressions. LM is asymptotically distributed as a χ^2 with 2 degrees of freedom under the null hypothesis of exogeneity. The corresponding p-values are shown between brackets. Sample includes 1004 observations.


0.35
0.25
0.15
0.05
-0.05
-0.15
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
Treatment
Incumbent
90%
95%

Robustness 1

Numerical methods replace the lack of information regarding individual usage:

- Heterogeneous usage: The analysis is repeated for different distributions of usage with mean monthly usage at 160 minutes but decreasing variance with κ s.t. usage is distributed as a $\beta(4\kappa/21, \kappa)$ with $\kappa = \{1, 2, 3, 4, 5\}$.

- See Table 9: Incumbent and entrant follow opposite strategies with regard to fogginess and complexity of the tariff with the incumbent offering more foggy options and complex schedules upon the entry of the second carrier.

Robustness 2

Numerical methods replace the lack of information regarding individuals' uncertainty with respect to future usage at the time of choosing tariff options:

- Heterogeneous uncertainty regarding future usage: Fogginess is now defined on expected usage rather than on usage known with certainty. Consumption of each individual is distributed according to a bivariate normal with means (μ_i, μ_j) s.t. $\mu_i + \mu_j \leq 1000$ and variances equal to $\sigma_i = \lambda\mu_i$ and $\sigma_j = \lambda\mu_j$, respectively. Fifty random draws for each of the 501,501 usage profiles are used to compute this expectation.
- Heterogeneity regarding uncertainty: I also consider the possibility that individuals are randomized from distributions with different dispersion.
- See Table 10: Incumbents still increase the fogginess of their tariffs upon entry of the second carrier but results become slightly less significant the more uncertain customers are regarding future consumption. Entrants still offer less foggy tariffs but results become less significant with individual uncertainty.

Summary

- Main results:
  - Competition does not make matters worse.
  - It takes a substantial amount of time for tariffs to become more transparent under competition.
  - Entrants adopt far less foggy tactics than incumbents.
  - Results are robust heterogeneity regarding usage and usage uncertainty.

- Caveat: Consumer choice data will allow to evaluate how effective foggy pricing really is.