Capital Structure and Investment in Regulated Network Utilities: Evidence from EU Telecoms

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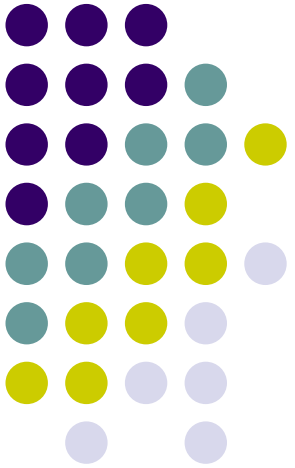


Introduction & Motivation

- 15 yrs after privatization, several regulated utilities in Europe started being *heavily leveraged*. Well known phenomenon in the US starting from 1910
- DTI and HM Treasury (2004) emphasize the "*dash for debt*" of UK utilities in water, electricity, gas, TLC, mainly to finance investment programs
- Similar concerns arise also from Energy regulators (Ofgem, 2008; and AEEG, 2008).
- Such high leverage could imply greater risks of financial distress, *transferring risk to consumers* and taxpayers and *threatening the future financeability of investment requirements*

Telecoms and Finance

- The “dash for debt” is evident also within Public Telecoms Operators (PTOs). PTOs seriously raised their financial gearing in the last decades
- At the end of 2005 (*The Financial Times):*

“the telecommunications sector is in a particularly precarious position, with a number of companies facing the threat of being downgraded to junk status. In this sector, 50 per cent of the companies have negative outlooks or are on credit watch with negative implications”

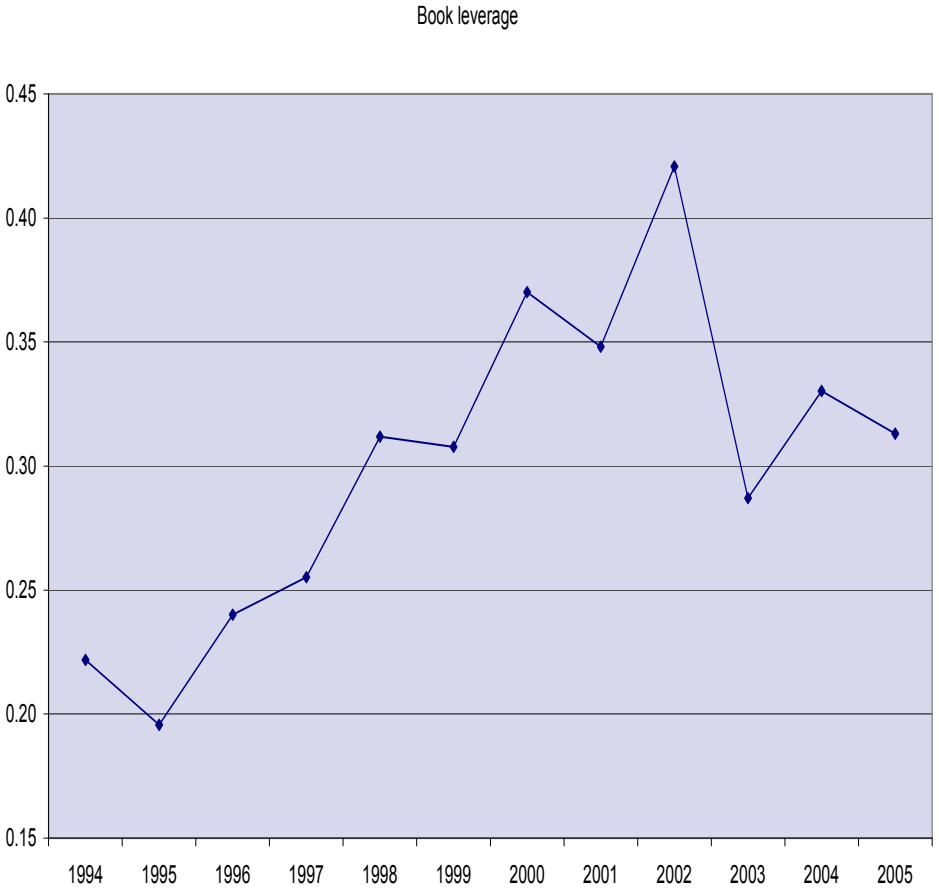
This paper

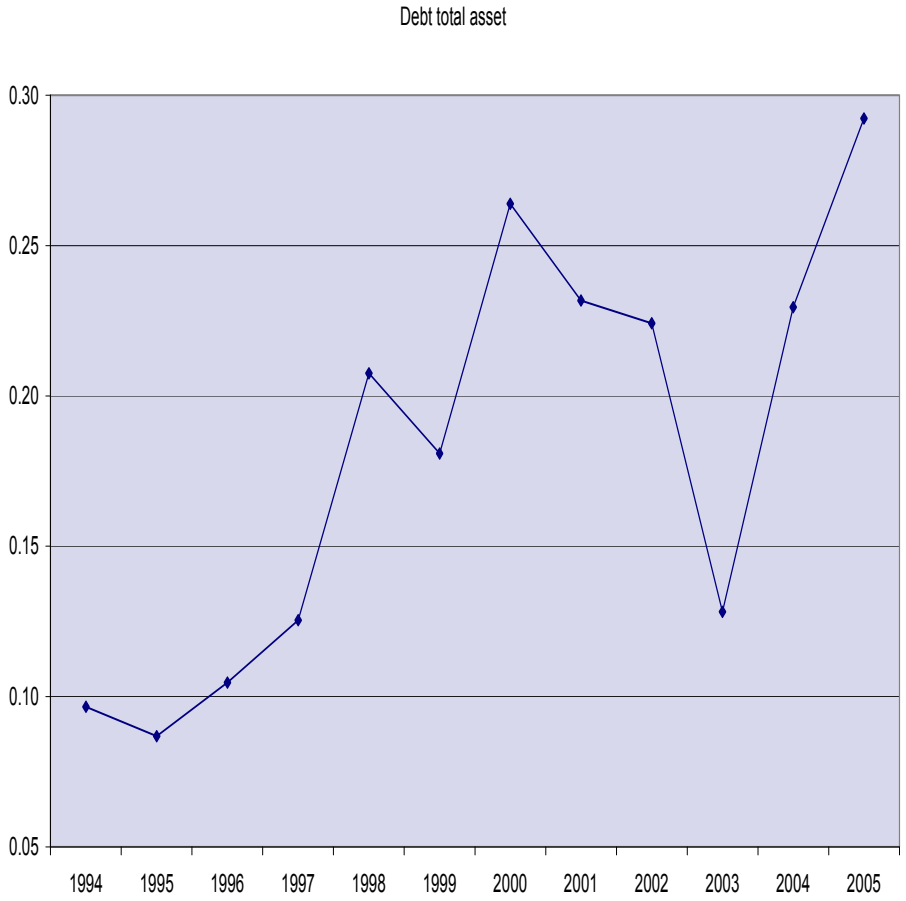
- Theoretical and empirical analysis on the relationship between wholesale regulation and firm's capital structure in a vertically related market.

- We focus on telecoms industry using a panel of 15 EU PTOs over the period 1994-2005

- Paper's main contributions: analysis of the impact of leverage on
  - wholesale and retail telecoms charges;
  - market competition (market share of incumbent and number of competitors);
  - Investment rate.

Evidence from EU 15 PTOs





Telecoms' debt exposition in selected countries (end 2008)

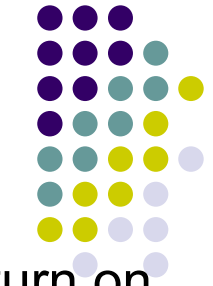
Country (2008)	Net debt (mln €)	Net debt/Ebitda
British Telecom	10.866	2.3x
Deutsche Telekom	40.664	2.1x
France Telecom	35.957	1.9x
Kpn	10.888	2.2x
Telecom Italia	34.039	3.0x
Telefonica	44.715	2.0x

Investment and Finance

- In addition, new bonds are going to be issued in the next years (2010-2011) to finance European telecoms operators' activities for an expected value of 45 billion of euros.

- What is the risk of financeability of new investment in NGANs?
- If and how capital structure decisions might affect regulatory outcomes?

The strategic role of debt/1

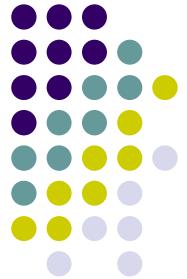


- Regulated rates are set so as to assure the firm a “fair” rate of return on its capital. A regulated firm finances its investment (sunk) with debt
- Spiegel and Spulber (1994, RAND) theoretically show that a welfare maximizing regulator has an incentive to set a high regulated *retail* price that lowers the probability that the regulated firm will become financially distressed

⇒ The firm’s leverage mitigates ex post regulatory opportunism and this in turn limits underinvestment

- The regulator allows the firm to apply discretion in choosing its financial leverage in order to commit not to engage in opportunistic behaviour
- Bortolotti, Cambini, Rondi, Spiegel (2011, JEMS) empirically show that *private* utilities tend to increase their leverage following the introduction of *independent* regulation and that leverage affects regulated retail prices and firm’s market value

The strategic role of debt/2



- Special feature of the telecoms industry:
  - Vertically integrated operators who run the existing essential facility;
  - Wholesale services represent the bulk of regulatory intervention.
- On the one hand, high financial exposition, by disciplining regulator's ex post opportunism, boosts investment incentives.
- On the other hand, by raising the regulated rates to enhance incentives to invest, the regulator may end up to negatively affect the consumer surplus and weaken market competition.
- This leaves the policy-maker with a trade-off.

An augmented model/1

- We extend Spiegel (1997, *JRE*) introducing downstream competition and regulation at wholesale level *a là* Laffont and Tirole (1994, EER).
- The regulated firm manages a network that represents an essential facility. The incumbent is also active at retail level where he faces competition from a fringe (=price takers).
- The game:
  - 1. the regulated firm chooses its investment level, *k*, and its debt level, *D*, and eventually equity
  - 2. the market value debt (and possibly equity) is determined in a competitive capital market.
  - 3. given *k* and *D*, the regulated charges (both retail and wholesale) are set by the regulator.

An augmented model/2

- The profit function of incumbent operator is:

$$\pi_I(p, a, z) = (p - c_r - c(1 - z^*))Q_I(p) + (a - c(1 - z^*))Q_E(p).$$

- $z^*(p, a, D)$ is the critical state of nature above which the regulated firm can pay debt D in full:

$$z^*(p,a,D) = \begin{cases} 0 & D + c + c_r Q_I \le pQ_I + aQ_E, \\ \dfrac{D + c - (p - c_r)Q_I - aQ_E}{c} & D + c_r Q_I \le pQ_I + aQ_E < D + c + c_r Q_I, \\ 1 & pQ_I + aQ_E < D + c_r Q_I. \end{cases}$$

- Operating profit of the alternative operators (fringe) is

$$\pi_E(p, a) = (p - a - c_r)Q_E.$$

Moreover, $p(a) = a + c_r$

An augmented model/3

- Consumers surplus is given by:

$$CS(k, p(a)) = V(k) - p(a),$$

where k is a measure of the "quality" of the firm's product or the range of its services

- The regulator maximizes (Spulber, 1989; Besanko and Spulber, 1992):

$$\underset{a}{Arg\max} = CS(k, p(a))^{\gamma}\, \pi(p(a), D)^{1-\gamma}.$$

where parameter γ captures the regulatory climate

An augmented model/4

- The social optimal access charge is given by:

$$a^* = \begin{cases} M_1(k) + c & D \le M_1(k), \\ D + c & M_1(k) < D \le M_2(k) \\ M_1(k) + c + M(D) & M_2(k) < D \le M_3(k) \\ M_1(k) + c + \gamma T & D > M_3(k). \end{cases}$$

where

$$M_1(k) \equiv (V(k) - c_r)(1-\gamma) + \gamma\frac{c}{2} - c \qquad M(D) \equiv \frac{\gamma T}{c+T}\left(D + \frac{c}{2}\right)$$

$$M_2(k) \equiv \frac{M_1(k)(c+T) + \gamma T\frac{c}{2}}{c + (1-\gamma)T} \qquad M_3(k) \equiv M_1(k) + c + \gamma T$$

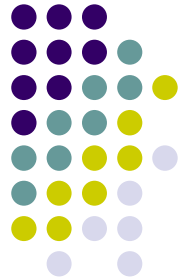
An augmented model: testable predictions

- The (standard) strategic role of leverage (Spiegel, 1997) implies:
  - *Leverage* $\uparrow \Rightarrow$ *regulated retail price* $\uparrow$
  - *Leverage* $\uparrow \Rightarrow$ *fixed capital investment* $\uparrow$
- Does leverage impact regulation at wholesale level too?
- Our theoretical results provide us additional hypothesis to test:

Leverage $\uparrow \Rightarrow$ *regulated wholesale price* $\uparrow$

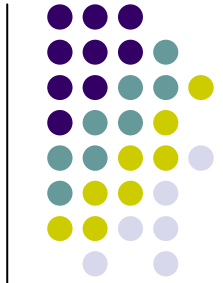
$\Rightarrow$ *Incumbent market shares* $\uparrow$ *and no. of competitors* $\downarrow$

The sample



Company Name	Country	Sample Period
Telekom Austria AG	Austria	1998 – 2005
Belgacom SA	Belgium	1994 – 2005
TeleDanmark AS	Denmark	1994 – 2005
Sonera	Finland	1997 – 2002
France Telecom	France	1994 – 2005
Deutsche Telekom AG	Germany	1994 – 2005
OTE (Hellenic Telecom Organization)	Greece	1994 – 2005
EIRCOM	Ireland	1999 – 2005
Telecom Italia SpA	Italy	1994 – 2005
Koninklijke KPN NV	Netherlands	1994 – 2005
Portugal Telecom SA	Portugal	1994 – 2005
Telefonica de Espana SA	Spain	1994 – 2005
Telia AB	Sweden	1997 – 2005
British Telecommunications PLC	UK	1994 – 2005
Kingston Communications	UK	1998 – 2005

The EU Framework



- *Retail regulation* in place at the end of 2005 (OECD, 2006) through price cap or other form of tariff approvals.
- *Wholesale regulation* always in place: access and interconnection issues were and still are the bulk of regulatory intervention
- Competition increases over time. However, at the end of 2005 MKT of PTOs was close to 77% in the national segment.
- In our time span, mainly *service competition* and not *facilities based competition* (LLU was in its starting phase). Three different methods of interconnection: local, single tandem and double tandem interconnection. At the end of 2007, ERG considered *single tandem* as the reference interconnection rate for Europe

Empirical Strategy/1

- Investment and Leverage equations with Political/Institutional/Regulatory variables:
  - Dynamic Panel estimation, one-step difference GMM
  - Fixed Effects estimate

- We then apply Granger causality tests on the relationship between:

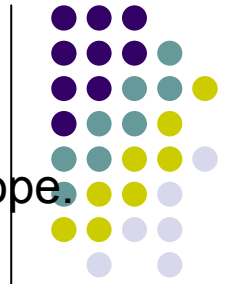
  - leverage and price (both retail and wholesale),
  - leverage and indicators of market competition
  - leverage and investment rate

- *Method*: Dynamic panel estimation – GMM (lagged variables as instruments)

Empirical Strategy/2

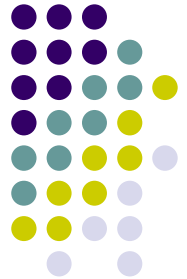
- Granger Tests have been used in recent empirical papers on *regulation/political economy of regulation*:
  - Alesina *et al.* (2005, JEEA) to analyse the relationship between regulation and investment in OECD countries
  - Edwards and Waverman (2006, JRE) to test the relationship between access regulation and regulatory independence in EU
  - Gasmi *et al* (2007, World Bank) to study the relationship between the quality of political institutions and the performance of regulation in developing countries
  - Resende (2009) to test the relationship between investment and long run debt for US telecoms
  - Bortolotti, Cambini, Rondi, Spiegel (2011 JEMS) to test the relationship between leverage and *retail* prices for a sample of EU utilities

Main Variables



- Leverage: (LT+ST Fin Debt)/(LT+ST Fin Debt + Equity) from Worldscope. We also control for Debt-to-asset
- Retail Price: Country Specific Price Index from Eurostat and OECD
- Wholesale Rates: Country Specific Wholesale Rates in €cents/min (Local Rate and Single transit – reference interconnection mode in 2005 – ERG, 2007) from European Commission
- Investment Rate: Gross investment flow/capital stock at replacement value
- Regulatory Environment: index of regulatory independence based on the information contained in the European Union Regulatory Institutions (EURI) database (Edwards and Waverman, 2006); index of regulatory intensity (Plaut Economics, 2007); index of market liberalization (OECD, 2007)
- Political orientation: index ranging from 0 (extreme left wing → pro-consumer) to 10 (extreme right wing → firm) (Bortolotti and Faccio, 2008)
- Company controls: Size, Tangibility, Profitability, Non-debt tax shields, Cash-flow (source: Worldscope)
- Years and Firms dummies

Results on the determinats



- *Leverage*: *Fixed effect estimation*. Positive impact of regulatory intensity (Plaunt Index but no OECD and EURI) but negative impact of political variables (if govn't is pro firm less need to rely on debt to "affect" regulatory decision; moreover, more developed capital market)

- *Investment*: *Dynamic Panel estimation, GMM* (with firm and time dummies). Impact of cash flow (+), sales (+), and political variables (pro firm; +); degree of market liberalization (more entry; +) but not reg intensity (still -)

Quantitative analysis

- *Leverage*: If the *Plaut index* increases from the minimum value, 0.289, to the mean value, 0.510, the expected leverage increase would be of 13.1 percentage points. Given that the sample leverage is 31.7% on average, this would imply an increase to 44.8%.
- *Investment*: In the long run, the investment rate increases by more than one percent ($\alpha_6/(1-\alpha_1)$=-0.0124). Since the average investment rate is 15.7% this implies an increase to 17%. If the *Market Entry index* decreases from its third quartile value (3.1) to the first quartile value (zero), then the investment increase would be of 3.84.

Test 1: Price-Leverage relation

$$P_{i,t} = \alpha_1 P_{i,t-1} + \alpha_2 P_{i,t-2} + \beta_1 Lev_{i,t-1} + \beta_2 Lev_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{i,t},$$

$$Lev_{i,t} = \delta_1 Lev_{i,t-1} + \delta_2 Lev_{i,t-2} + \gamma_1 P_{i,t-1} + \gamma_2 P_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \nu_{i,t},$$

- *P = Retail price, local rate, single and double transit charges*
- *Lev = Leverage*

Results 1: Price-Leverage relation

Dependent variable: Regulated Price	*(1)* *Single Transit*	*(2)* *Local Transit*	*(3)* *Retail Price*
α_1 Regulated Price$_{t-1}$	0.900*** *(0.078)*	0.743** *(0.083)*	0.390** *(0.168)*
α_2 Regulated Price$_{t-2}$	0.009 *(0.058)*	0.044 *(0.023)*	0.421* *(0.228)*
β_1 Leverage$_{t-1}$	-0.054 *(0.045)*	-0.048 *(0.046)*	7.932** *(3.344)*
β_2 Leverage$_{t-2}$	0.109** *(0.052)*	0.082' *(0.057)*	10.250** *(3.914)*
P-value test on H_0: $\beta_1 = \beta_2 = 0$	5.15 (0.076)*	2.11 (0.34)	4.35 (0.03)**
P-value test on H_0: $\beta_1 + \beta_2 = 0$	3.21(0.073)*	0.99 (0.32)	8.68 (0.01)***
Arellano-Bond test for AR(1) *(p-value)*	0.005	0.063	0.914
Arellano-Bond test for AR(2) *(p-value)*	0.193	0.513	0.062
Sargan-Hansen test *(p-value)*	1.000	1.000	0.998
N. Firms [N. Obs.]	15 [83]	15 [83]	15 [88]

- p value = 0.14

Quantitative effects of leverage on regulated prices

- The long run coefficient of 0.714 (calculated as $\beta_1+\beta_2/(1-\alpha_1-\alpha_2)$
- Thus, after a 10% increases in leverage, the *single transit* charge would increase – net of the efficiency gains due to the technological trend - by 0.0714 €cents per minute, which corresponds to a 6% increase with respect to the mean tariff rate (1.184 €cents/min).
- Moreover, the same increases causes an increase in the retail price index 9.62 percentage points. Since the mean retail index is 110.32, this amounts to an increase by 8.72% (9.62/110.32) of the average consumers' bill.

Test 2: Leverage - competition relationship

$$C_{i,t} = \alpha_1 C_{i,t-1} + \alpha_2 C_{i,t-2} + \beta_1 Lev_{i,t-1} + \beta_2 Lev_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{i,t},$$

$$Lev_{i,t} = \delta_1 Lev_{i,t-1} + \delta_2 Lev_{i,t-2} + \gamma_1 NC_{i,t-1} + \gamma_2 NC_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{i,t},$$

- *C = a) No. of operators that along with the incumbent operator have a combined market share of at least 90% on the global voice telephony market (European Commission Indicator); b) Incumbent Market share in the national segment (long distance)*
- *Lev = Leverage*

Results 2: Leverage-competition relationship

Dependent variable: *Competition Measure*	*(1)* *Number of Competitors*	*(2)* *Market Share of the Incumbent*
α_1 Competition Measure$_{t-1}$	0.717*** *(0.180)*	0.972*** *(0.088)*
α_2 Competition Measure$_{t-2}$	0.246 *(0.211)*	-0.006 *(0.104)*
β_1 Leverage$_{t-1}$	1.722 *(1.028)*	5.364** *(2.388)*
β_2 Leverage$_{t-2}$	-3.567*** *(1.206)*	4.468 *(6.465)*
P-value test on H_0: $\beta_1 = \beta_2 = 0$	4.41 (0.03)**	7.98 (0.02)**
P-value test on H_0: $\beta_1 + \beta_2 = 0$	3.64(0.07)*	2.73 (0.09)*
Arellano-Bond test for AR(1) *(p-value)*	0.014	0.031
Arellano-Bond test for AR(2) *(p-value)*	0.779	0.362
Sargan-Hansen test of over identifying restrictions *(p-value)*	1.000	1.000
N. Firms [N. Obs.]	15 [95]	15 [90]

Test 3: Investment and Leverage

$$IK_{i,t} = \alpha_1 IK_{i,t-1} + \alpha_2 IK_{i,t-2} + \beta_1 Lev_{i,t-1} + \beta_2 Lev_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{i,t},$$

$$Lev_{i,t} = \delta_1 Lev_{i,t-1} + \delta_2 Lev_{i,t-2} + \gamma_1 IK_{i,t-1} + \gamma_2 IK_{i,t-2} +$$

$$+ \sum_i \mu_i Firm_i + \sum_t \lambda_t Year_t + \varepsilon_{i,t},$$

- *IK = Fixed Investment to Capital Stock*
- *Lev = Book leverage; Debt to Sales ratio; Debt to Asset ratio*

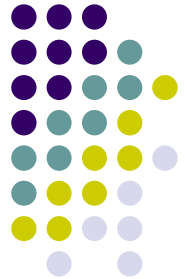
Results 3: Investment & Leverage

Dependent variable: Investment rate	*(1)* *Leverage Debt/(Debt+Equity)*	*(2)* *Debt-to-Total Asset*	*(3)* *Debt-to-Sales Ratio*
α_1 Investment rate$_{t-1}$	-0.122	-0.280	-0.208
	(0.235)	*(0.289)*	*(0.285)*
α_2 Investment rate$_{t-2}$	0.061	-0.607*	-0.599**
	(0.112)	*(0.297)*	*(0.267)*
β_1 Leverage$_{t-1}$ or Debt-to-Assets$_{t-1}$ or Debt-to-Sales$_{t-1}$	-0.026	0.280**	0.085**
	(0.063)	*(0.125)*	*(0.035)*
β_2 Leverage$_{t-2}$ or Debt-to-Assets$_{t-2}$ or Debt-to-Sales$_{t-2}$	0.518***	0.388**	0.118***
	(0.180)	*(0.174)*	*(0.043)*
P-value test on H_0 $\beta_1 = \beta_2 = 0$	9.79 (0.007)***	3.07 (0.07)*	3.85***(0.043)*
P-value test on H_0 $\beta_1 + \beta_2 = 0$	5.63 (0.017)**	6.10(0.025)**	7.58(0.014)***
Arellano-Bond test for AR(1) *(p-value)*	0.091	0.041	*0.035*
Arellano-Bond test for AR(2) *(p-value)*	0.497	0.323	*0.817*
Sargan-Hansen test *(p-value)*	0.931	0.773	*0.880*
N. Firms [N. Obs.]	16 [76]	16 [76]	15 [76]

Quantitative analysis

- We calculate the long-run coefficient as $\beta_1+\beta_2/(1-\alpha_1-\alpha_2) = 0.464$
- Thus, a 10% increase of the leverage would lead to an increase of 4.64 percentage points in the investment rate.
- As the average investment rate is 15.7%, this would imply a sizeable increase, to 20.3%.

Conclusion



- Our results show that an increase in leverage granger-causes:
  - ⇒ An increase in retail and wholesale prices
  - ⇒ An increse in the Incumbent market share and a decrese in the number of competitors
  - ⇒ An increase in the Investment
- Mixed welfare effects of leverage: good for investment but bad for competition
- These results are in line with the predictions on the strategic use of debt.
- The strategic use probably is still in place for the more recent wholesale access services (WLR, LLU, bitstream …) … but this needs to be verified!

Investment equation

Fixed Investment to Capital Stock	**(1)**	**(2)**	**(3)**	**(4)**
Fixed Investment to Capital Stock $_{t-1}$	-0.213	-0.145	-0.210	-0.202
	(0.201)	*(0.203)*	*(0.183)*	*(0.267)*
Sales Growth $_{t}$	0.625***	0.585***	0.632***	0.550**
	(0.174)	*(0.194)*	*(0.172)*	*(0.263)*
Sales Growth$_{t-1}$	0.049	0.019	0.060	0.023
	(0.157)	*(0.174)*	*(0.144)*	*(0.208)*
Cash Flow to Capital Stock $_{t}$	0.064	0.030	0.030	0.050
	(0.149)	*(0.148)*	*(0.146)*	*(0.205)*
Cash Flow to Capital Stock $_{t-1}$	0.525***	0.541***	0.536***	0.562**
	(0.169)	*(0.175)*	*(0.164)*	*(0.256)*
Political Orientation	-	0.023**	0.028**	0.024*
	-	*(0.010)*	*(0.012)*	*(0.013)*
OECD entry	-	-	-0.015**	-
	-	-	*(0.007)*	-
Plaut Index of Regulatory Intensity	-	-	-	-0.209
	-	-	-	*(0.646)*
Arellano-Bond test for AR(1) *(p-value)*	0.034	0.021	0.010	0.055
Arellano-Bond test for AR(2) *(p-value)*	0.254	0.129	0.114	0.184
Sargan-Hansen test *(p-value)*	0.326	0.530	0.821	0.481
N. Firms [N. obs.]	16 [79]	16 [79]	16 [79]	15 [69]

Leverage equation

Leverage	**(1)**	**(2)**	**(3)**	**(4)**
Log of real total assets	0.122**	0.146**	0.141**	0.110[a]
	(0.062)	*(0.064)*	*(0.065)*	*(0.072)*
Fixed-to-Total Assets	-0.489***	-0.432***	-0.448***	-0.412**
	(0.143)	*(0.148)*	*(0.146)*	*(0.189)*
EBIT-to-Total Assets	0.086	0.110	0.112	0.091
	(0.128)	*(0.124)*	*(0.127)*	*(0.145)*
Non-Debt Tax Shield	-0.007	-0.006	-0.006	-0.011**
	(0.006)	*(0.006)*	*(0.006)*	*(0.004)*
Political Orientation	-	-0.023**	-0.023**	-0.037**
	-	*(0.011)*	*(0.011)*	*(0.014)*
OECD Index – Market entry	-	-	0.006	-
	-	-	*(0.011)*	-
Plaut Index of Regulatory Intensity	-	-	-	0.595*
	-	-	-	*(0.332)*
Firm Dummies	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes
R squared within	0.405	0.405	0.422	0.297
N. Firms [N. Obs.]	16 [154]	16 [154]	16 [154]	16 [126]