

Will more competition at the retail level of the European natural gas industry necessarily drive down prices for final consumers?



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The views expressed in this presentation are not positions of GDF SUEZ.

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Introduction

- Additional entry \Rightarrow more competition \Rightarrow lower prices !
- Vertical industry : more competition at the retail level alleviates the double marginalisation issue.
- Excessive entry can however lead to a decrease of social welfare through the duplication of fixed costs :
 - Mankiw and Whinston (1986).
- Our approach shows how excessive competition at the retail level of a vertical industry might end up raising prices for final consumers.



Motivation for the work

- Impact of additional competition at the retail level of the European natural gas industry.
- Key features of this industry :
 - Vertical industry, homogeneous good.
 - Liberalisation of the downstream level but insufficient competition according to authorities.
 - Incumbent retailers dispose from most quantities and capacity rights in the infrastructure thanks to historical long-term contracts.
 - Wholesale market places develop but remain marginal.
 - Issue of regulated prices (*not treated in the paper*).
 - Limited competition among producers (upstream level).
 - Europe is more and more dependent on gas imports.
 - Little success of EU initiatives (Energy Charter, Nabucco...).
 - Set up of the Gas Exporting Countries Forum (GECF).



Summary

1/ An overview of the European natural gas industry.

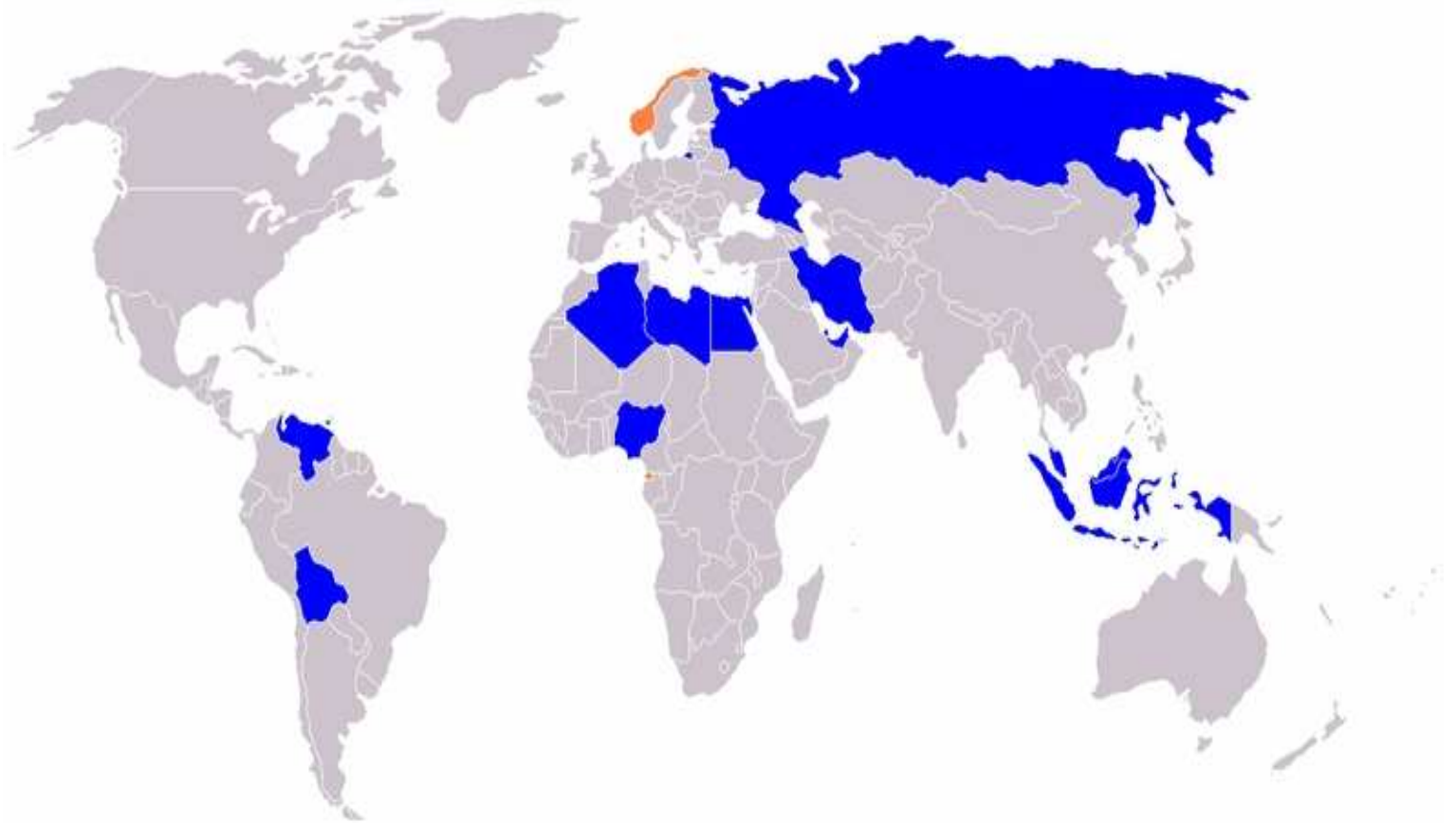
Dependency of imports towards GECF Countries.
Long-term take-or-pay contracts.

2/ Modeling the industry and the impact of increased competition at the retail level.

A basic model where an upstream monopolist (cartel) sells the good to an incumbent and new entrants.
A more realistic representation where the upstream cartel faces a competitive fringe of producers.

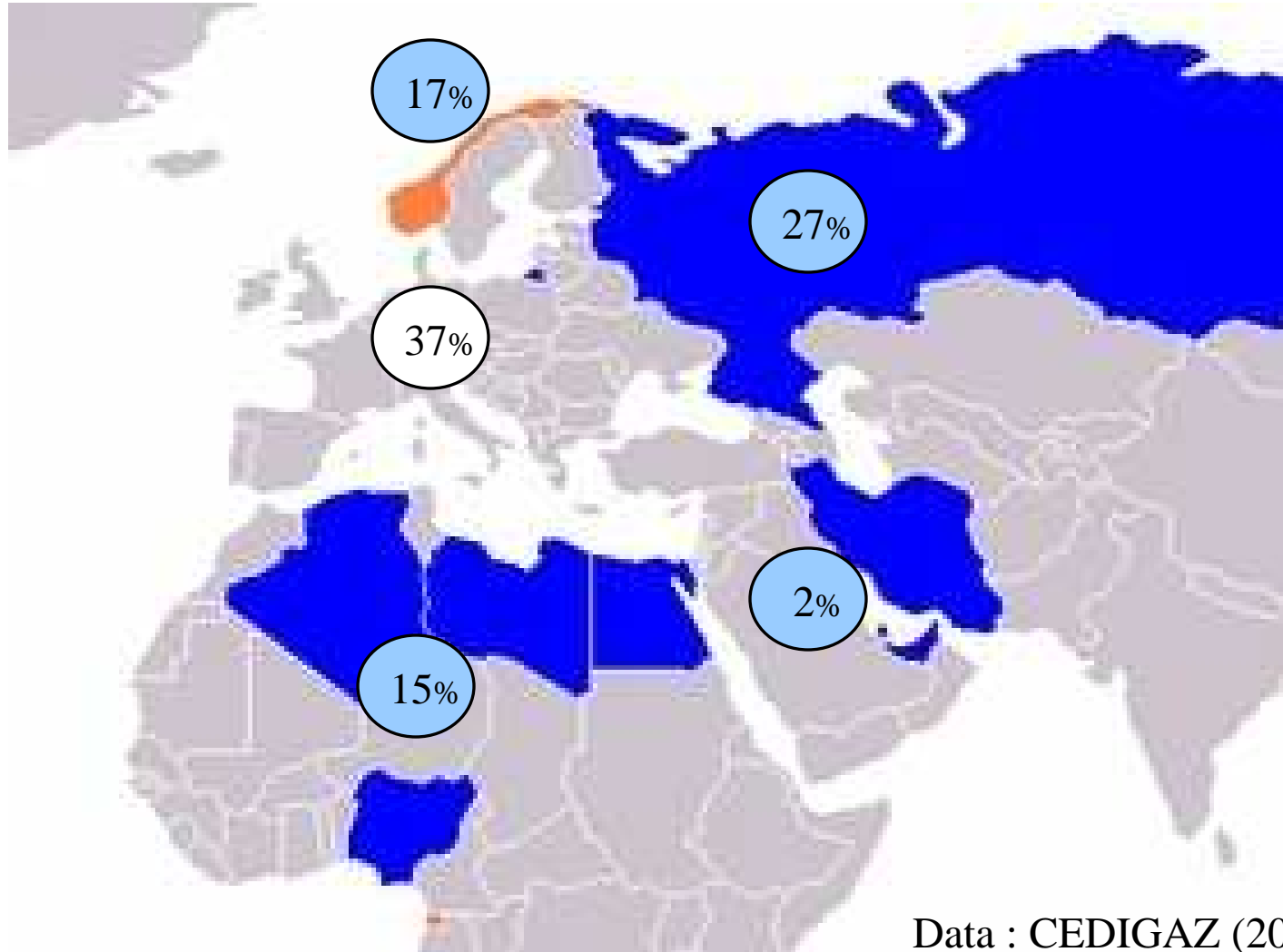
3/ Conclusion.

GECF : a « forum » of countries holding 2/3 of world gas reserves and 40% of its production.

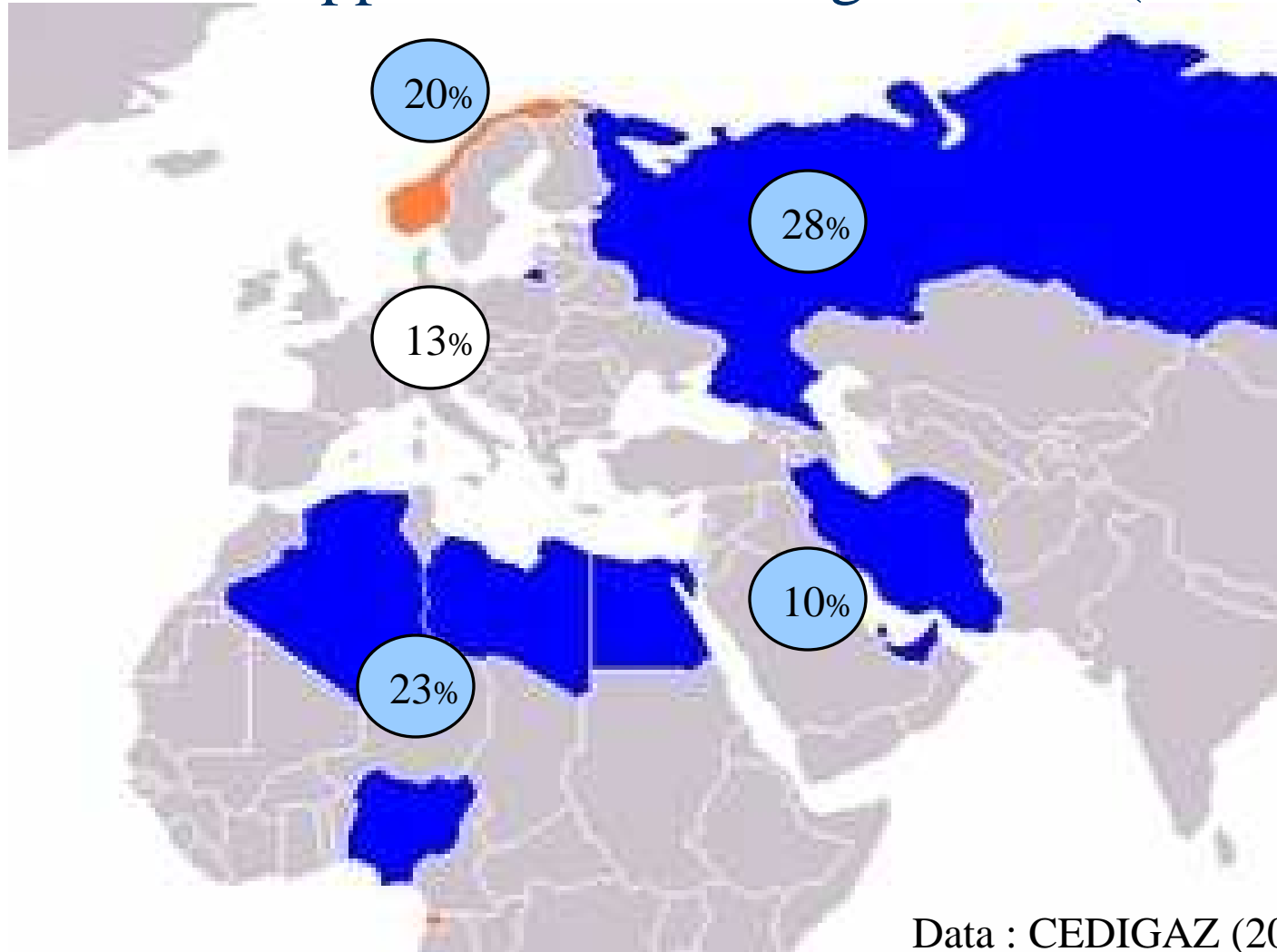


NB: Kazakhstan is an observer
Map source: Wikipedia

Almost all European imports in 2008 came from GECF countries (Gazprom, Statoilhydro and Sonatrach supplied more than 50% of EU consumption)



GECF countries dominance over European gas supply should increase (2020 projection by CEDIGAZ). Alternative suppliers will bear higher costs (distance).





The GECF : a discussion forum or the future gas-OPEC ?

- Primary mission :
 - « identify and promote measures and processes necessary to ensure that Member Countries derive the most value from their gas resources (...) »
- The aim cannot be to reduce logistics costs :
 - Massol and Tchong-Ming (2009)
- Last meeting (9 December 2009) :
 - Official set up in Doha (Qatar).
 - Nomination of a Secretary (Leonid Bokhanovsky).
 - « Ministers from Algeria, Qatar and Nigeria expressed concern that gas prices are much lower than other fuels ».



Long-term contracts in the European natural gas industry

■ Some historical elements

- First LT contracts date back to the 1960's (Groningue field).
- The architecture adopted in these first contracts has been largely used by the industry until the end of the 20th century.
- Long term contracts were entered into for very long durations (from 15 up to 30 years).

⇒ Contracts entered before the liberalisation of the industry still cover a majority of gas supplied today in the EU.

■ Quantity features of the LT contracts :

- A minimum (*yearly*) “take-or-pay” quantity.
- Minimum and maximum daily quantities (infrastructure design).
- Periodical flexibilities and/or necessary adjustments.



Long-term contracts in the European natural gas industry

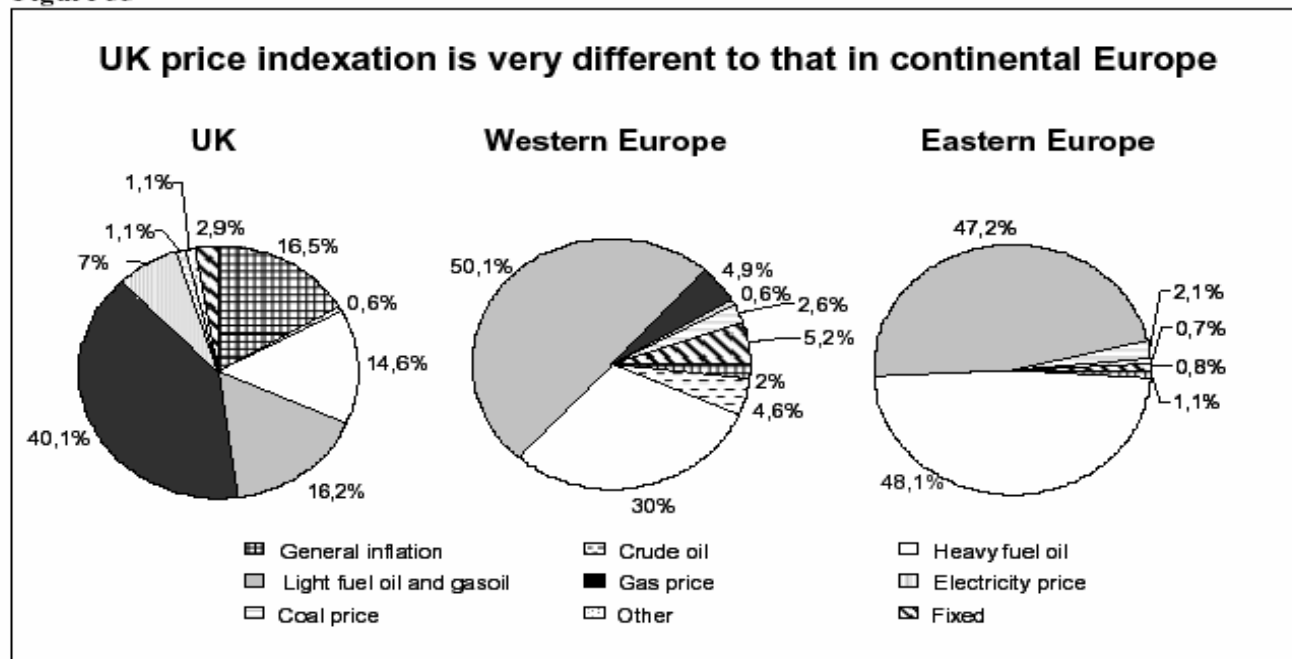
- Pricing : the netback value approach
 - Natural gas is in most of its usages in competition with other forms of energy (oil products, electricity, coal...).
 - Value of gas = the price at which a consumer is indifferent between choosing gas and the best possible alternative.
 - Indexation of price on price of competing energy sources :
 - Mainly oil and oil product prices...

⇒ The price of natural gas does not reflect the balance between offer and demand for that form of energy !
- An alternative : the development of wholesale gas markets where natural gas is priced as a commodity.
 - Sourcing for new entrants on the retail market.
 - Change of price indexation in the historical long-term contracts.

Long-term contracts in the European natural gas industry

- **So far**, price signals indicated by wholesale markets have played a secondary role on the Continent compared to oil prices, due to the indexation of historical long term contracts :

Figure 33



Source: Energy Sector Inquiry 2005/2006

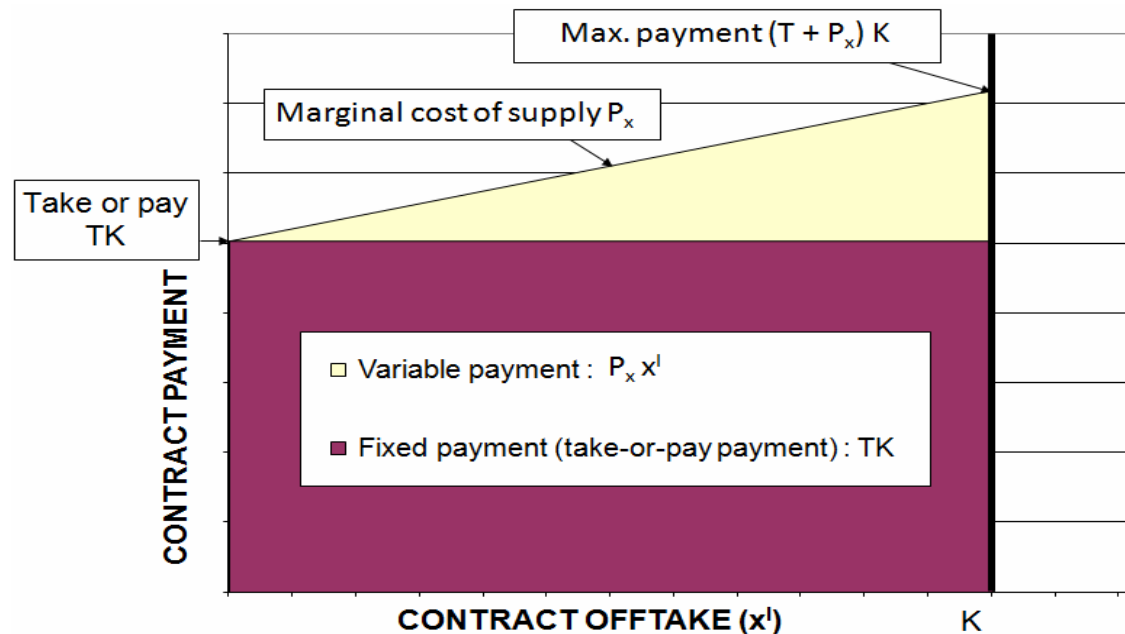


Our model – main assumptions

- Industrial organisation approach
 - Imperfect competition among firms.
- Homogenous good delivered in a vertical industry
 - Upstream level :
 - A dominant producer (or a cartel of producers) with a constant marginal cost of production (zero).
 - A competitive fringe with higher production costs (quadratic).
 - Downstream level :
 - An incumbent firm holding long-term take-or-pay contracts with the firms of the upstream cartel (exogenous price).
 - New entrants supplying themselves on wholesale markets (these firms bear a fixed cost of entry).
 - Constant marginal cost of distribution (neglected).
 - Linear demand from final consumers.

Our model – main assumptions

■ Representation of long-term contracts :



- Long-term take-or-pay contracts are then considered as two-part tariffs, with a cap on the quantity that can be offtaken.
- We assume a large take-or-pay commitment TK ; the marginal supply cost P_x under the contracts will therefore be low.




A basic model

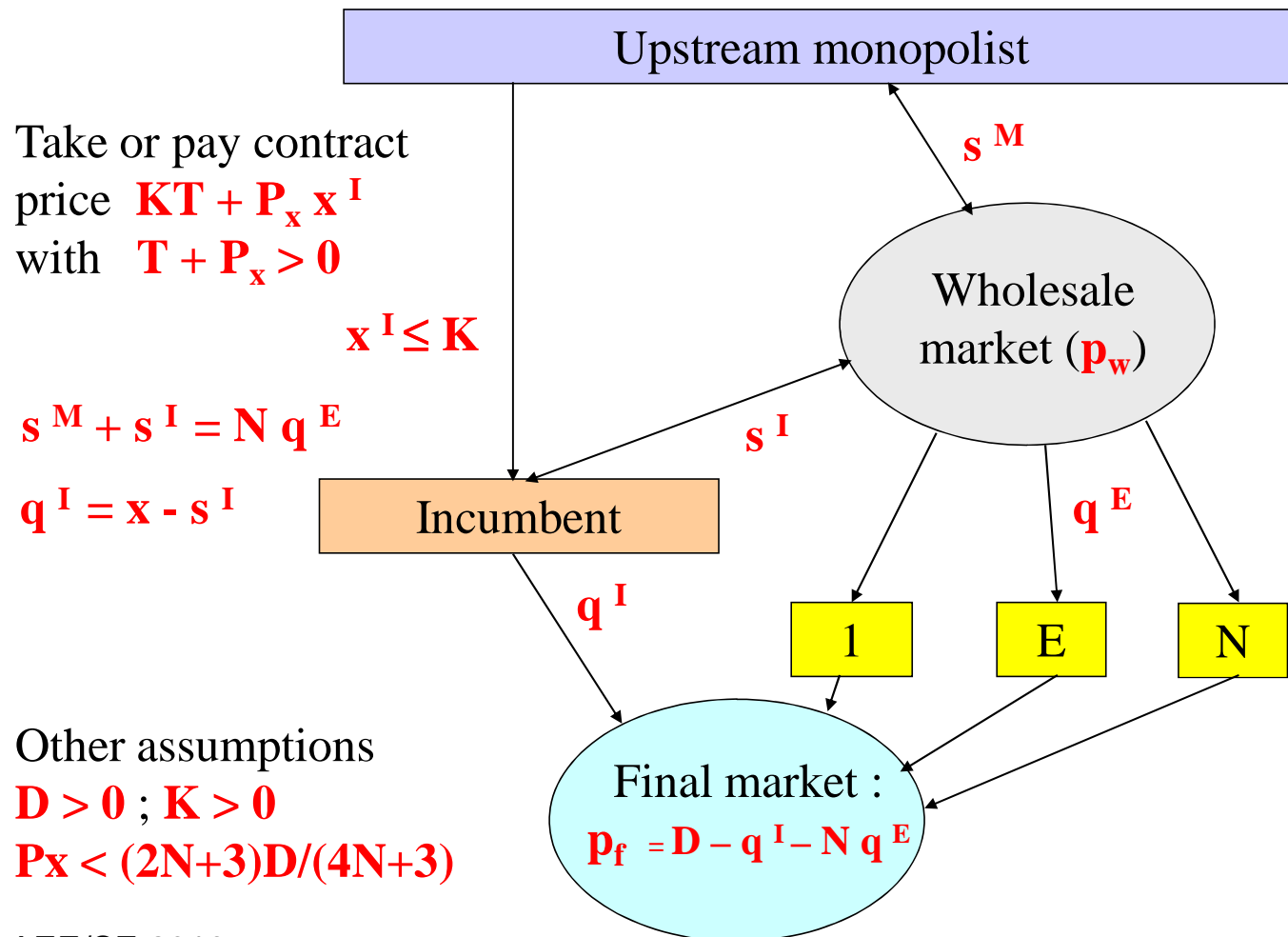
- We use simplified assumptions to introduce the mechanisms at stake in our vertical industry :
 - Upstream monopolist.
 - Exogenous number of entrants at the retail level.
 - Failure to renegotiate the long-term contracts induces the termination of the contracts.
- The timing of our game is as follows :
 - Date t_1 : the retail market is liberalised, a wholesale market develops and N firms enter to compete with the incumbent retailer (“entry stage”).
 - Date t_2 : the upstream monopolist and the incumbent retailer observe N and renegotiate their long-term contracts (“renegotiation stage”).
 - Date t_3 : competition among the firms (“competition stage”).



Basic model – competition stage (t_3)

- If at t_2 parties fail to agree, the cartel sells the good to $N+1$ symmetric retailers on the wholesale market :
 - classical « double marginalisation » framework. 
 - Perfect competition at the retail level for $N \rightarrow +\infty$.
- If contracts are renegotiated, we model a two-stage game inspired by Neumann, Fell, Reichel (2005) :
 - The incumbent is a leader on the retail market and plays before the entrants (\neq Gaudet and Van Long (1996)).
 - At the 1st stage of the game, the incumbent plays together with the upstream monopolist (quantity competition).
 - At the 2nd stage of the game, entrants compete in quantity on the residual share of the final market (and can be foreclosed).
 - Need to take care of incumbent contractual constraint ($x \leq K$).

Competition stage (t_3): assumptions and notations when long term contracts are kept





Solution of the competition stage (t_3) when long-term contracts are kept

- Profits of the various firms write down :
 - $\Pi^M = TK + P_x x^I + p_w s^M$
 - $\Pi^I = -TK + (p_f - P_x) x^I - (p_f - p_w) s^I$
 - $\Pi^E = (p_f - p_w) q^E$
- Before writing down first order conditions, we check that foreclosure of entrants cannot be sustained :
 - The incumbent would need to propose a retail price below the marginal production cost of the monopolist in order to have that firm not selling on the wholesale market.
 - But even if $P_x < 0$, the incumbent would get a negative profit. We would verify indeed $\Pi^I < -(T + P_x) K < 0$.

Solution of the competition stage (t_3) when long-term contracts are kept

- Equilibrium quantities and prices are given by :

\square	$0 < K \leq K_{\lim}$	$K_{\lim} \leq K$
x^I	K	K_{\lim}
s^I	$\frac{-N}{4N+3}(D - K)$	$\frac{-N}{4N+3}(D - K_{\lim})$
s^M	$\frac{2N}{4N+3}(D - K)$	$\frac{2N}{4N+3}(D - K_{\lim})$
q^E	$\frac{1}{4N+3}(D - K)$	$\frac{1}{4N+3}(D - K_{\lim})$
q	$\frac{2N}{4N+3}D + \frac{2N+3}{4N+3}K$	$\frac{2N}{4N+3}D + \frac{2N+3}{4N+3}K_{\lim}$
p_f	$\frac{2N+3}{4N+3}(D - K)$	$\frac{2N+3}{4N+3}(D - K_{\lim})$
p_w	$2\frac{N+1}{4N+3}(D - K)$	$2\frac{N+1}{4N+3}(D - K_{\lim})$

with $K_{\lim} = \frac{1}{6(N+1)}((2N+3)D - (4N+3)P_x)$

- Our results illustrate the pro-competitive effect of forward contracts when firms compete in quantities (Allaz and Vila). This effect is however capped for $K > K_{\lim}$



Renegotiation stage (t_2)

- The joint profit of the incumbent and the monopolist is :
 - Constant in K for $K \geq K_{lim}$.
 - Concave in K for $K \leq K_{lim}$; it is maximised for $K^* = \frac{1}{2} \frac{8N+9}{(4N+9)(N+1)} D > 0$ and we verify $0 < K^* \leq K_{lim}$ for $P_x \leq \frac{2N}{4N+9} D$
- It is optimal for the parties to agree on the quantity K^* and to pick a value of P_x sufficiently low.
- The choice of T depends on the bargaining position of the incumbent and the monopolist (rent sharing) :
 - The monopolist wants the highest possible T , provided the incumbent gains at least its reservation profit given by the double marginalisation game (and vice versa).
 - There exist a range of T where an agreement benefits both.

Equilibrium of the basic game

- The upstream cartel and the incumbent successfully renegotiate their long-term contracts :
 - Contractual quantity will be set equal to K^* .
 - Contract price will be within a certain range (multiple eq.).
- At equilibrium, we have :

\square	<i>Equilibrium result</i>	$\frac{\partial(\cdot)}{\partial N}$
$p_f - p_w$	$\frac{1}{2} \frac{2N+3}{(4N+9)(N+1)} D$	-
p_w	$\frac{2N+3}{4N+9} D$	+
p_f	$\frac{1}{2} \frac{(2N+3)^2}{(4N+9)(N+1)} D$	<i>sign of</i> $(2N - 3)$
Π^M	$K^*(T + P_x)_{eq} + \frac{N}{N+1} \frac{(2N+3)^2}{(4N+9)^2} D^2$	+
Π^I	$-K^*(T + P_x)_{eq} + \frac{9}{4} \frac{(2N+3)^2}{(N+1)(4N+9)^2} D^2$	-
Π^E	$\frac{1}{4} \frac{(2N+3)^2}{(N+1)^2(4N+9)^2} D^2$	-
$\Pi^M + \Pi^I + N\Pi^E$	$\frac{1}{4} \left(1 - \frac{N^2}{(4N+9)^2(N+1)^2}\right) D^2$	<i>sign of</i> $(2N - 3)$
W	$\frac{1}{8} \frac{48N^4 + 320N^3 + 748N^2 + 720N + 243}{(4N+9)^2(N+1)^2} D^2$	<i>sign of</i> $(3 - 2N)$



Impact of additional entry

- Additional entry has two countervailing effects :
 - More entry drives down the margin of all retailers...
 - ... but contracting firms react to a more intense competition downstream by reducing the size of their long-term contracts, which in turn reduces their pro-competitive effect.
 - More entry induces a higher wholesale market price.
- On the retail market this second effect dominates for $N \geq 2$:
 - Final consumers pay the lowest price when $N = 2$.
 - The retail price is however always below the vertically integrated monopoly price (pro-competitive effect of long-term contracts).
- Trade-off between limiting the market power of :
 - downstream incumbent by increasing retail competition.
 - upstream producers through long-term contracts.

Prop. 1 : excessive entry of retailers raises final market price and reduces social welfare.



The model

- Three assumptions are changed :
 - Existence of a competitive fringe with higher costs of production (quadratic cost $0.5 \times C_f \times (s^F)^2$) supplying the wholesale market.
 - Endogenous number of entrants n at the retail level with a fixed cost of entry defined as a fraction F of the vertically integrated monopoly profit : $F \times (0.5 \times D)^2$.
 - Long-term contracts remain unchanged if contracting parties fail to renegotiate, which can induce the exit of the incumbent.
- We consider that the initial set of long-term contracts were optimal for the firms (vertically integrated monopoly profit) :
 - Contracted quantity equal to monopoly quantity ($K_i = 0.5 \times D$).
 - Marginal price equal to marginal cost of production ($P_{xi} = 0$) to avoid double marginalisation.
 - Sharing of the rent through the fixed payment ($T_i = \alpha \times 0.5 \times D$) with $\alpha\%$ for the producers and $(1 - \alpha)\%$ for the incumbent.
- The timing of the game is unchanged.



Competition and renegotiation stages

- Solution of the competition stage at t_3 more complex due to the presence of the fringe, but qualitative results similar :
 - Given n , there exists a contract quantity $K^{*'} > 0$ that maximises contracting firms joint profit, with $K^{*'} < K'_{lim}$ for P_x low enough.
- New issue in the renegotiation stage at t_2 is the possible exclusion of the incumbent :
 - Threshold value $\alpha_{lim} = \frac{n(4n+9)C_f + 9(n+1)}{9(n+1)(nC_f + n+1)}$
 - For $\alpha \leq \alpha_{lim}$ the profit of the incumbent is positive with the initial contracts : same reasoning as in the basic model.
 - When $\alpha > \alpha_{lim}$ the cartel can induce the exit of the incumbent by sticking to original contracts, in which case we have to consider a double marginalisation game with m retailers :
 - One shows that $n \leq m \leq 2n + 2,5$.
 - Upstream cartel profit is higher with optimal long-term contracts.

Prop. 2 : it is optimal for the cartel to renegotiate the contracts even if it could force the incumbent to exit.

Entry game at date t_1

- Would-be entrants correctly anticipate that contracting firms will later on agree on the quantity K^* (or index a quantity K_i - K^* on the wholesale market price with 100% take-or-pay commitment)

- The number of entrants is the integer number immediately below the real number n that solves :

$$\frac{n(2n+3)C_f^2 + 3(n+1)(2n+3)C_f + 4(n+1)^2}{(n+1)(nC_f + n+1)((4n+9)C_f + 4n+4)} = \sqrt{F}$$

- Two extreme cases

- The competitive fringe is as efficient as the cartel ($C_f = 0$) :

- $p_w(K^*; C_f = 0; n(C_f = 0)) = 0$

- $p_f(K^*; C_f = 0; n(C_f = 0)) = \frac{1}{2} \sqrt{F} D$

- Final consumers benefit from a higher number of retailers (low F).

- No competitive fringe ($C_f \rightarrow +\infty$)

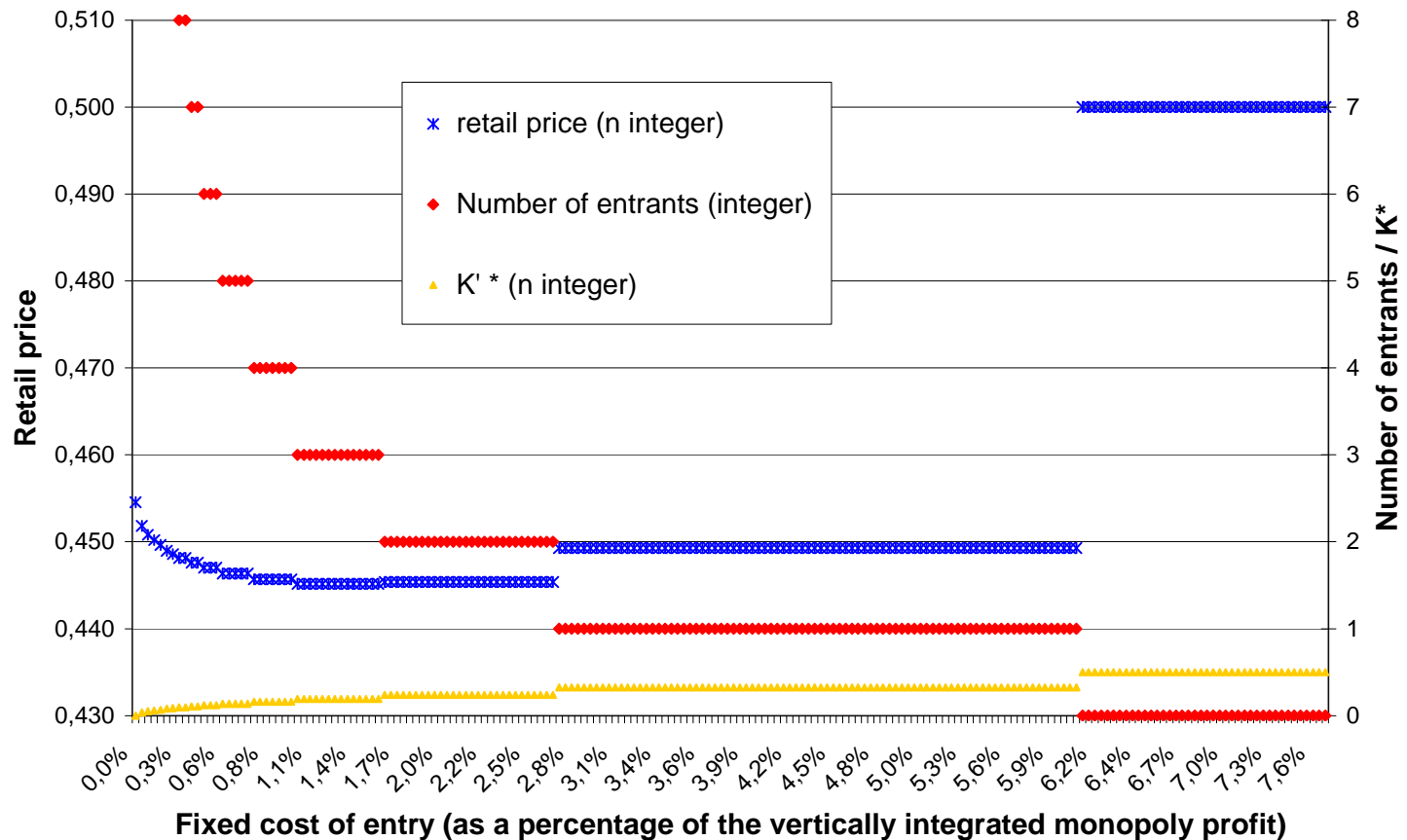
- Wholesale market price decreases with F (increases in n).

- Final market price equals the vertically integrated monopoly price for $F = 0$ (perfect retail competition) or for $F > (5/26)^2$ (no entry).

- Intermediate values of F induce lower price (p_f minimum for $n = 2$).

An intermediate case

Numerical illustration for $D = 1$ and $C_f = 10$





Impact of additional entry

- Additional entry has two countervailing effects :
 - More entry drives down the margin of all retailers...
 - ... but contracting firms react to a more intense competition downstream by reducing the size of their long-term contracts, which in turn reduces their pro-competitive effect.
 - More entry induces a higher wholesale market price.
- Compared to the basic model, the presence of a competitive fringe limits the wholesale market price increase :
 - When this fringe is efficient enough (low C_f), more entry at the retail level always benefits final consumers.
 - But when production costs of the fringe are substantially higher than cartel ones then excessive entry raises final market price.

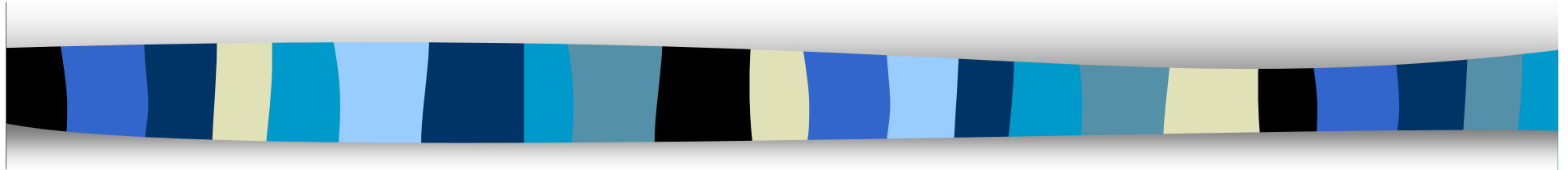
Prop. 3 : excessive entry of retailers raises final market price, provided costs of the fringe are substantially higher than those of the cartel.



Conclusion

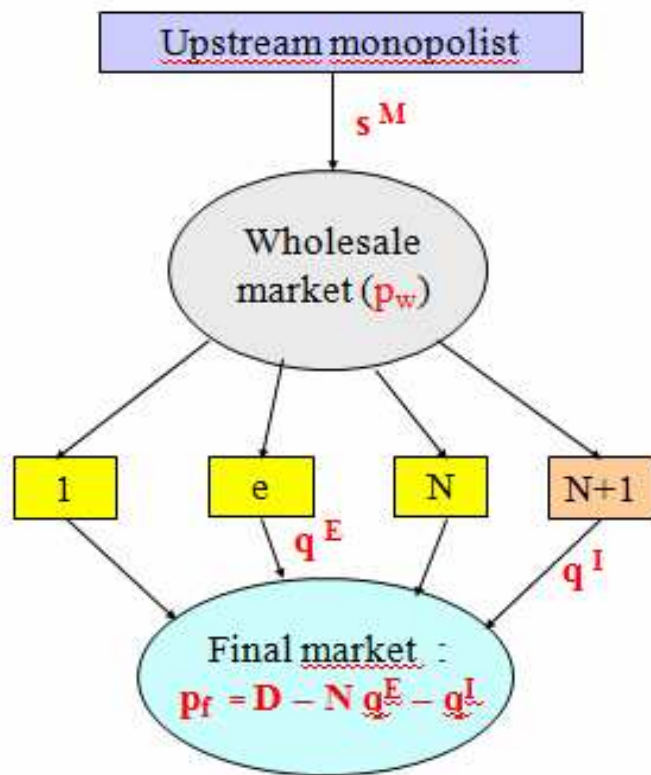
- Too much competition at the retail level of a vertical industry can raise the price paid by final consumers.
 - Excessive entry of retailers can harm both final consumers and retailers, for the sole benefit of upstream firms.
 - Conversely, more competition at the upstream level of our industry decreases both final and wholesale market prices, provided there is some competition on the retail market.
- In the European natural gas industry, long-term contracts bring final consumers more than “security of supply” :
 - They limit the market power of upstream producers on the wholesale market (*provided their prices are exogenous*).
 - If large upstream producers were to cartelise, contracts would induce lower prices than perfect competition at the retail level.
- Given the industry structure, EU authorities should view more favorably long-term contracts and other items that counterbalance the market power of upstream firms.

Will more competition at the retail level of the European natural gas industry necessarily drive down prices for final consumers?



Not necessarily...

Competition game (t_3): double marginalisation framework



\square	<i>Equilibrium result</i>	$\frac{\partial(\cdot)}{\partial N}$
$q = s^M$	$\frac{1}{2} \frac{N+1}{N+2} D$	+
q^I	$\frac{1}{2} \frac{1}{N+2} D$	-
q^E	$\frac{1}{2} \frac{1}{N+2} D$	-
p_f	$\frac{1}{2} \frac{N+3}{N+2} D$	-
p_w	$\frac{1}{2} D$	0
Π^M	$\frac{1}{4} \frac{N+1}{N+2} D^2$	+
$\Pi^I = \Pi^E$	$\frac{1}{4} \frac{1}{(N+2)^2} D^2$	-
$\Pi^M + \Pi^I + \Pi^E$	$\frac{1}{4} \frac{N^2+4N+3}{N^2+4N+4} D^2$	+
W	$\frac{1}{8} \frac{3N^2+10N+7}{(N+2)^2} D^2$	+

Vertically integrated monopoly price

Reservation profits

An intermediate case

Numerical illustration for $D = 1$ and $C_f = 1$

