
Will there be enough for everybody?

***A simulation analysis of the LNG market
in the Atlantic Basin***

Franziska Holz and Ferdinand Pavel

German Institute for Economic Research (DIW Berlin)

Agenda

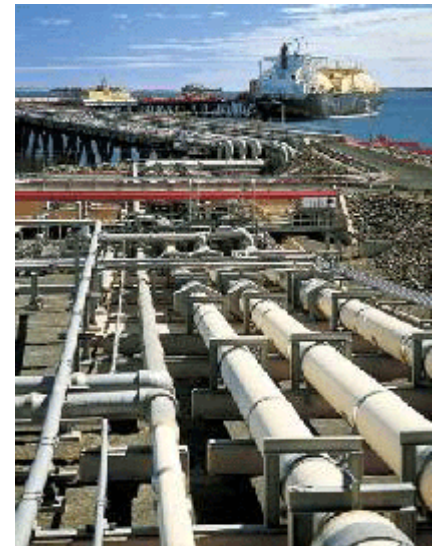
- 1. Context: The Atlantic LNG Market and the EU Natural Gas Market**
- 2. Literature: LNG**
- 3. Model**
- 4. Aggregation and Data**
- 5. Results**
- 6. Conclusions**

1. Context: The European Natural Gas Sector

- **Liberalization and Regulation by European Commission (Acceleration Directive (2003/55/EC)) have led to changes in market structure and of the institutional framework:**
 - Intensification of competition within Europe (end of „destination clause“ and of national monopolies)
 - Regulated third party access
 - Legal unbundling
- **Market expansion due to substitution of other fuels (nuclear, coal)**
- **Consequence: Increased demand and diversification of suppliers (from currently Russia, Norway, Algeria towards a larger number of exporting countries including Libya, Egypt, Middle East and overseas LNG)**

New Questions:

- Are existing LNG export and import capacities sufficient? Where will be the bottlenecks?
- What are the expectations for other relevant LNG export markets (USA)? Will this impact (or be influenced by) developments in Europe?



1. Context (cont.): LNG Trade in the Atlantic Basin

- **LNG trade has been historically located in the Pacific Basin:**
 - Main Importers: Japan, Korea
 - Main Exporters: Indonesia, Malaysia
- **Since the mid-1980s, increased demand for LNG in Europe and (more recently) in the USA have stimulated the development of an LNG market in the Atlantic basin**
 - Increasing demand in Europe (market liberalization, power generation, environmental concerns) and USA (power generation, environmental concerns)
 - Cost Reduction (mainly in liquefaction and transportation)
- **LNG exporters in the Middle East already serve as swing suppliers, but both markets are expected to remain regionally separated (Jensen, 2004)**
 - Large up-front costs for transport capacity require long-term contracts for greenfield projects
 - LNG export capacities can become serious bottleneck
 - But, there exist some flexibility for transportation within each basin.

Hence, Europe and USA will compete for available LNG capacities in the Atlantic Basin

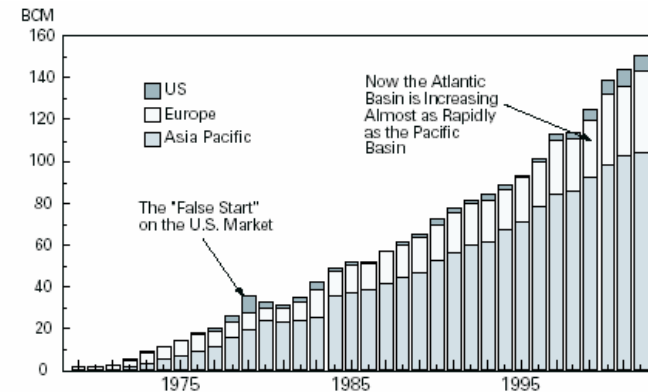


Figure 1.2: Growth of LNG Imports by Region

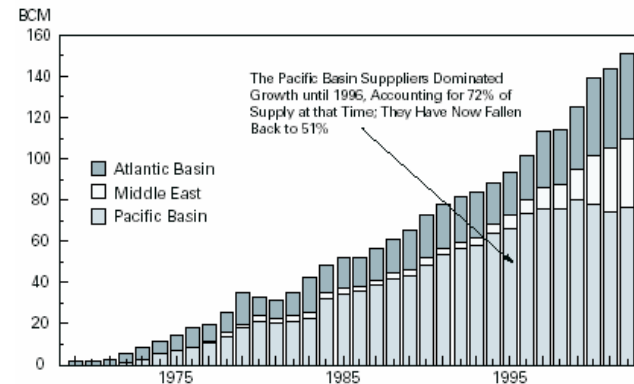


Figure 1.3: Growth of LNG Exports by Source

2. Literature: LNG

Hartley and Medlock (2005):

- General equilibrium model with a detailed representation of the natural gas sector, including LNG

Jensen (2004, 2005):

- Slow but sure development of a global spot market, which will first include the Atlantic Basin and only later Asia
- Share of spot trade has been increasing over the last years
- Decreasing costs all along the LNG value chain

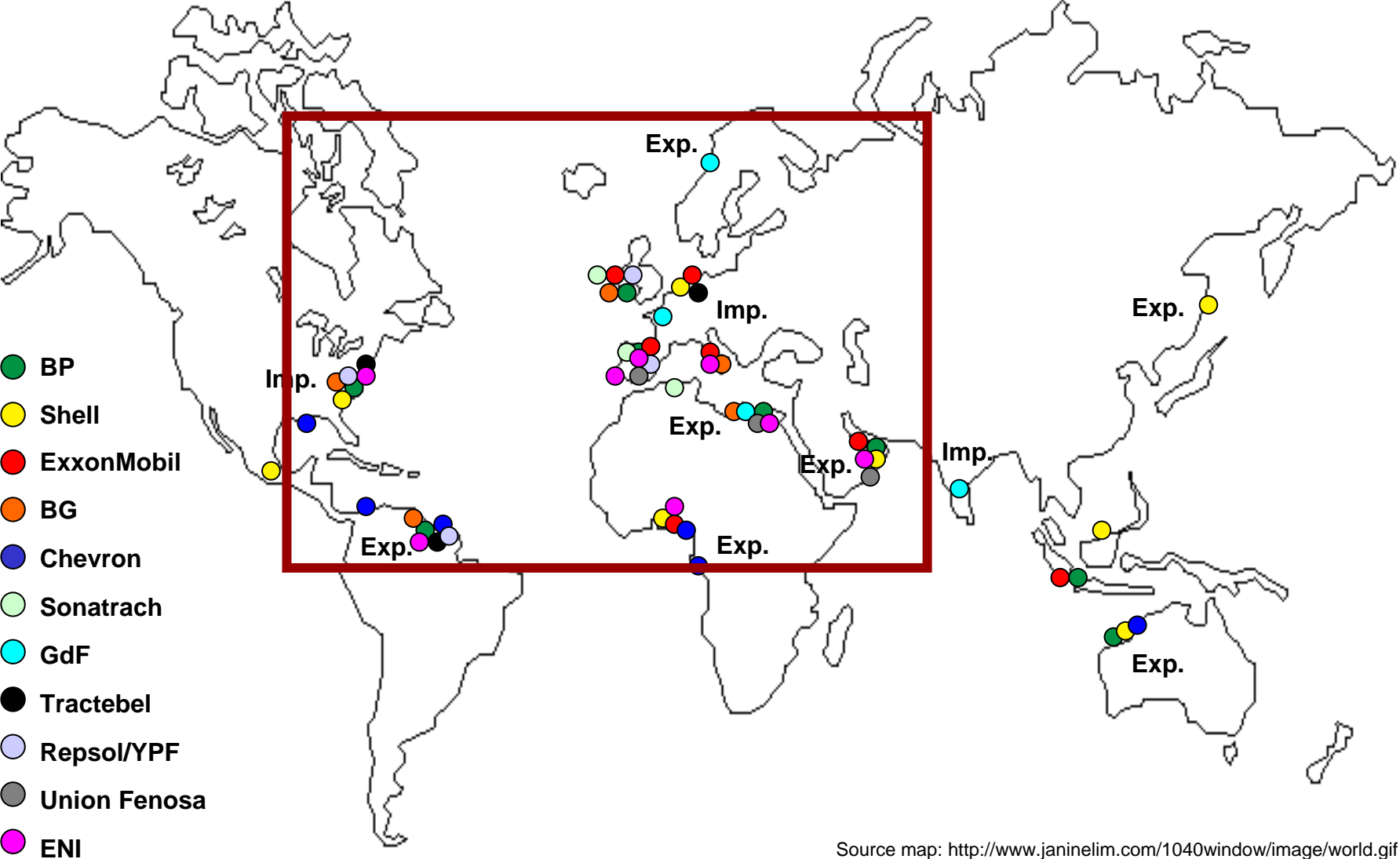
Hartley and Brito (2002):

- As the LNG-market becomes more mature, there is a tendency away from long-term contracts towards shorter-term trading
- A liquid (spot) market with many players reduces the need for long term contracts, partnering after the investment possible

→ **There is evidence of a spot LNG market evolving, at least for a fraction of the LNG trade (~ 15-20%)**

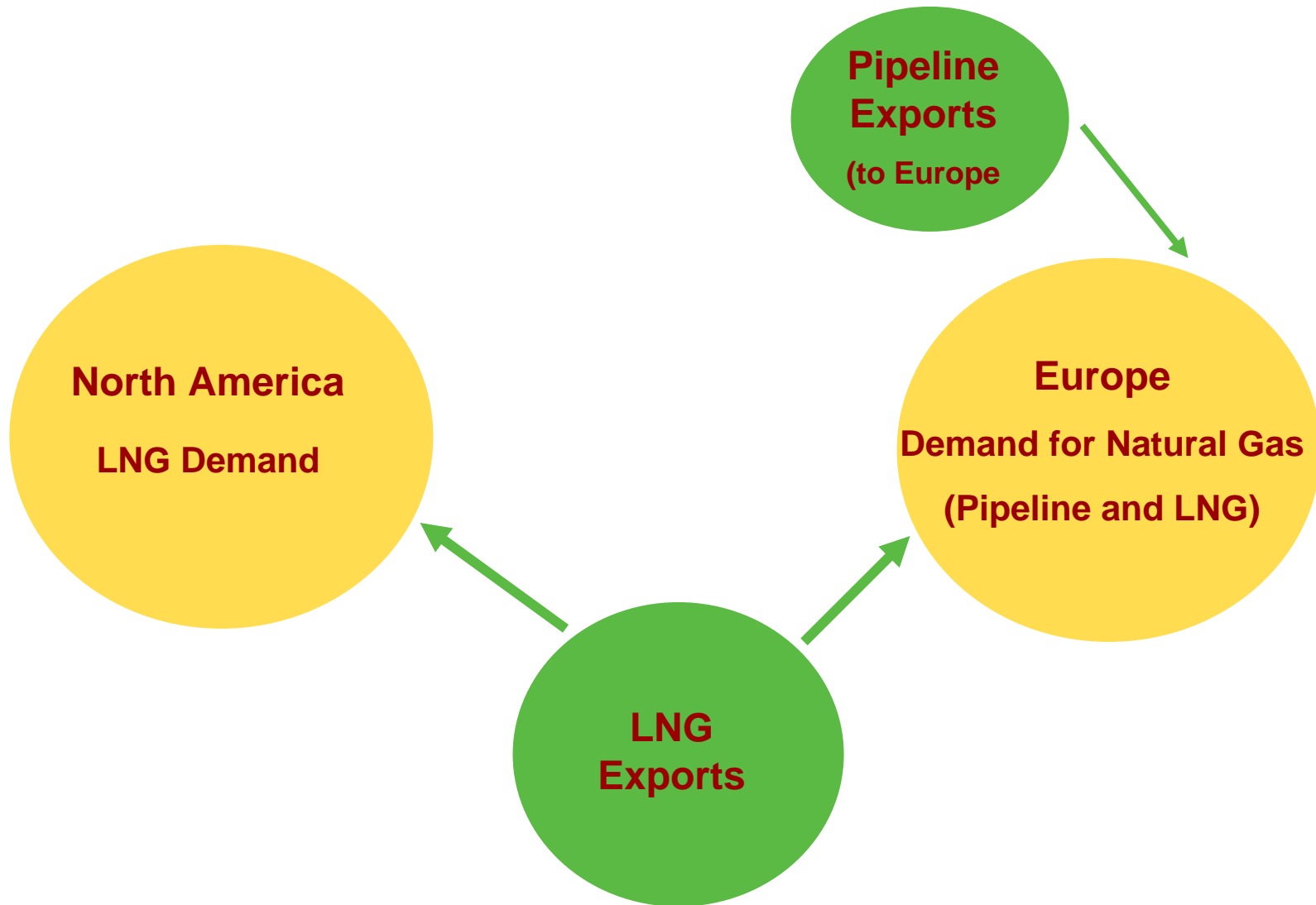
→ **Few of the literature until today has considered the possible influence of European market developments on the American market and vice versa.**

3. Global LNG business – Focus on the Atlantic Basin



Source map: <http://www.janinelim.com/1040window/image/world.gif>

3. Model Structure



3. Model Structure (cont.)

- **LNG exporter serve both, US and EU markets**
- **Representation of the European market (“GASMOD”)**
 - Two successive markets: upstream and downstream market
 - Upstream market is served by pipeline and LNG exporters
 - Traders on EU downstream market can buy domestically produced gas, ‘pipeline gas’ and LNG
 - On all stages of transaction, infrastructure capacities are limited
 - Pipeline and LNG Exporters are oligopolists (Cournot)
 - In EU, double marginalization since traders are also oligopolists
 - Characteristics of double marginalization: overall welfare reducing, penalizing the upstream producer by further reducing their sales and hence their profits
 - Elasticity of final gas demand in Europe = -0.8
 - Assumptions:
 - Producers know the final demand addressed to the wholesale traders
 - Traders are price takers of the import price set on the upstream market
- **Representation of the North American market:**
 - LNG-Import demand modeled by iso-elastic demand function, reference year 2003
 - Elasticity of LNG import demand in USA = -1

4. Aggregation and Data

- **Large number of exporting and European importing countries / regions (including domestic production of each European country)**
 - LNG Exporters: Algeria, Libya, Egypt, Middle East (Qatar, Oman, UAE, Yemen), Nigeria, Trinidad, Venezuela
 - Pipeline Exporters: Algeria, Libya, Iran, FSU, Norway, Netherlands, UK
 - Importers: USA and Europe (separated in 17 sub-regions)
- **Capacity data from GTE, OME (2001), IEA (2005)**
- **Production and transport cost data (Long-Run Marginal Cost) to the EU by OME (2001)**
- **Trade data (flows, prices) by IEA and BP for 2003**

5. Scenarios

Scenario	Europe	North America
(A) Benchmark	Oligopolistic Traders	LNG reference demand of 15 bcm
(B) EU Liberalization	Traders' market in perfect competition	LNG reference demand of 15 bcm
(C) Demand Expansion	Higher gas demand: +30%	Higher gas demand: +30%
(D) More Export Capacity	Increased Pipeline Export Capacity: +50 bcm	
	Increased LNG Export Capacity: + 175 bcm	

-Three main questions to be answered:

- What is the Impact of EU Gas Market liberalization on LNG trade in the Atlantic basin?
- Are existing LNG export and import capacities sufficient? Where will be the bottlenecks?
- Who will benefit from higher LNG export capacities in the Atlantic basin, the EU or US market?

5. Results

EU market liberalization has only small impacts on the transatlantic LNG market, on the contrary of demand and capacity expansion

		Benchmark	EU Liberalization	Demand Expansion	More Export Capacity
		(A)	(B)	(C)	(D)
Imports into: (in bcm)	- EU (pipeline)	458	514	548	576
	- EU (LNG)	99	103	63	207
	- USA (LNG)	15	11	49	71
Import Prices: (in USD/tcm)	- Germany	160	180	283	219
	- France	131	171	288	197
	- UK	197	196	318	263
	- Italy	116	180	283	211
	- USA (LNG only)	175	233	380	236
Retail prices: (in USD/tcm)	- Germany	259	182	285	221
	- France	225	173	290	199
	- UK	199	198	320	265
	- Italy	227	182	285	213

5. Results (cont.):

High price levels due to largely congested export capacities!

Natural Gas Exports:

Pipeline to EU	Algeria Reg1:	Libya Reg2:	Iran Reg5:	FSU Reg7:	Norway Reg8:	Netherlands Reg9:	UK Reg10:
Benchmark	22.0	11.0	10.0	119.3	86.0	90.0	120.0
EU Liberalization	35.0	11.0	10.0	161.6	86.0	90.0	120.0
Demand Expansion	35.0	11.0	10.0	196.0	86.0	90.0	120.0
More Export Capacity	36.4	12.4	10.0	220.8	86.0	90.0	120.0

LNG Exports (total)	Egypt Reg3:	Middle East Reg6:	Nigeria Reg11	Trinidad Reg12	Venezuela Reg13	Algeria Reg14	Libya Reg15
Benchmark	11.9	26.6	22.7	18.7	0.0	31.0	3.5
EU Liberalization	11.9	26.6	22.7	18.7	0.0	31.0	3.5
Demand Expansion	11.9	26.6	22.7	18.7	0.0	31.0	3.5
More Export Capacity	35.0	50.0	40.0	40.0	15.0	65.0	45.0

5. Results (cont.)

European market absorbs bigger part of LNG exports!

Capacities remain congested, prices remain high!

LNG Exports (total)	Egypt Reg3:	Middle East Reg6:	Nigeria Reg11	Trinidad Reg12	Venezuela Reg13	Algeria Reg14	Libya Reg15
Benchmark	11.9	26.6	22.7	18.7	0.0	31.0	3.5
EU Liberalization	11.9	26.6	22.7	18.7	0.0	31.0	3.5
Demand Expansion	11.9	26.6	22.7	18.7	0.0	31.0	3.5
More Export Capacity	35.0	50.0	40.0	40.0	15.0	65.0	45.0
LNG Exports to EU:							
Benchmark	10.8	22.5	18.4	13.3	0.0	31.0	3.5
EU Liberalization	10.7	23.8	19.7	15.0	0.0	30.5	3.5
Demand Expansion	5.6	15.0	10.8	5.8	0.0	24.6	1.1
More Export Capacity	27.3	33.4	24.7	19.3	4.5	60.1	37.8
LNG Exports to USA:							
Benchmark	1.1	4.1	4.3	5.4	0.0	0.0	0.0
EU Liberalization	1.2	2.8	3.0	3.7	0.0	0.5	0.0
Demand Expansion	6.3	11.6	11.9	12.9	0.0	6.4	2.4
More Export Capacity	7.7	16.6	15.3	20.7	10.5	4.9	7.2

6. Conclusions

Preliminary Conclusions:

- Expected demand increases in Europe together with congested capacities (pipeline and LNG) will drive up prices!
- Since US market competes with Europe for LNG imports, also US prices will rise. This effect will be even stronger if demand on both markets will expand as expected.
- Additional export capacities alone are unlikely to ease the situation, capacities will remain congested.

Open questions (future research):

- Impact of infrastructure bottlenecks within EU (e.g. between UK and mainland Europe) ?
- Impact of increasing LNG prices on US demand?

Will there be enough for everybody?

Yes, but at higher prices than expected today!

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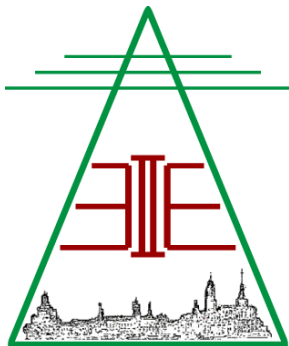
Globalization of Natural Gas Markets

Research Program “Global Gas”:

<http://www.tu-dresden.de/wwbwleeg/projekte/gg/gg.html>

fholz@diw.de

fpavel@diw.de



DIW Berlin

German Institute
for Economic Research