LNG PRICING DIFFERENCES ACROSS THE ATLANTIC - A COMPARISON BETWEEN THE UNITED STATES AND EUROPE

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1 OVERVIEW

Projections and future developments in energy markets are of major importance to economists and policy makers worldwide. Each of the World Energy Outlook (IEA), the International Energy Outlook (EIA) and the Energy Outlook (BP), emphasize the strong increase in energy demand over the following decades driven by a steep population rise especially in emerging economies such as India, Brazil, China, etc. The worldwide increase in primary energy consumption places our attention on natural gas. Although substantial changes in the worldwide fossil fuel mix are less realistic in such a close time horizon, and given the lack of new energy sources, mild changes on the relevance of the constitution of the energy mix are possible.

According to the IEO (EIA), renewables provide the biggest growth in the 2040 energy mix. Fossil fuels, on the one side, are affected by stricter climate policies which causes a reduction in the shares of coal and oil liquids in the energy mix. On the other hand natural gas is the only fossil fuel that increases its share as a primary source of energy, given its low environmental impact and the availability of unconventional gas. During this period of time, natural gas becomes the world's fastest-growing fossil fuel and its importance increases in the world's energy mix of 2040 reflecting an approximate equal share as coal and oil. A similar development is observed in BP's Energy Outlook, where natural gas is the fastest growing fossil fuel and its worldwide consumption increases at an annual rate of 2%. This common general trend (the share of natural gas in the world's primary energy mix increases while that of other fossil fuels decrease) is what highlights the relevance of natural gas in international energy markets. It is in this context of special significance for emerging and import dependent countries that natural gas markets and their pricing mechanisms are well understood.

Contrary to the oil market, natural gas markets have not gained as much attention from research. Historically, coal and oil have played a bigger role in the energy mix. The linkage between oil and economic growth is a well-studied one throughout the energy economics literature (see Mork et al. [1994], Papapetrou [2001], Barsky and Kilian [2004], Jiménez-Rodríguez and Sánchez [2005], Lardic and Mignon [2008] as well as the factors altering the oil price Hamilton [2003], Hamilton [2009], Breitenfellner et al. [2009], ECB [2008], OECD [2004], etc.). The main variables for determining oil prices in the studies above are proxies for market fundamentals and can be clustered in: supply, demand and financial markets.

Acknowledging the increasing relevance of natural gas over the future decades and the importance of energy as a source of economic growth[1], we focus on understanding how prices of natural gas are determined in different world regions. Therefore we will analyze the Unites States and the European Union markets. Our approach is based on the literature for oil price determinants (see references above) due to the lack of empirical analysis in the determinants of natural gas prices.

2 METHODS

In order to explain what leads to the differences in liquefied natural gas import prices (LNG) worldwide, we estimate the influence of different determinants on LNG natural gas prices in the United States and in Europe. For modeling the dependencies between the LNG import price we implement a structural vector autoregressive (SVAR) model. Therefore, for both regions a SVAR analysis is equally conducted. The results of the SVAR model are interpreted in impulse response functions and are compared to another to explain differences in the LNG import price between Europe and the US. In order to compare the influence of determinants on the European and US LNG import price, at first the time series data has to be controlled for covariance stationarity to fulfill the SVAR requirement. Testing for each implemented determinant for unit roots is necessary to make sure that the data is in the end stationary and lead to correct results.

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[1]A vast number of studies concentrate on the linkage between economic activity/growth and energy. Some of the latest references are: Belke et al. [2009], Lee [2005], Lee and Chang [2008], Narayan and Smyth [2008], and Apergis and Payne [2009].

Whilst in the oil market typical determinants are oil demand (divided in OECD and non-OECD members), oil supply, storages, refineries, capacities and OPEC-influence we will adapt those to the natural gas sector as shown in Table 1. Basing our approach on the existing oil pricing literature, we assume that the natural gas import price ($PLNG_t EU/USA$) in either region is determined by a mixture of market mechanism and speculation in the financial markets as well as seasonal dependent factors. Therefore we define four groups of variables that explain LNG natural gas prices: Supply ($S_{t,i}$); Demand ($D_{t,i}$), Financial Markets ($FM_{t,i}$) and climate related variables($SE_{t,i}$) (see Table 1 for a detailed list of determinants). The general econometric model is therefore defined as:

$$PLNG_t = \alpha + \beta_1 S_{t,i} + \beta_2 D_{t,i} + \beta_3 FM_{t,i} + \beta_4 SE_{t,i} + \epsilon_t \tag{1}$$

Table 1: Determinants

Variable	Description	Source	Periodicity	Expected Impact	Unit of measurement
Dependent Variable: LNG Import Price					
$PLNG_{t,i}$	Liquefied Natural Gas Import Price	IEA; IEA	monthly		US$/MMBTU
Covariates: Supply ($S_{t,i}$)					
$Prod_{t,i}$	Production: Natural Gas Gross Withdrawals	EIA; IEA	monthly	−	MMcm
$Storage_{t,i}$	Natural Gas Working Underground Storage	EIA; -	monthly	−	Bcf
Demand ($D_{t,i}$)					
$Cons_{t,i}$	Natural Gas Total Consumption	IEA; IEA	monthly	+	MMcm
$IP_{t,i}$	Industrial Production Index (IP/PPI)	FRED ; Eurostat	monthly	+	Index
Financial Market ($FM_{t,i}$)					
SP_{USA}	Henry Hub Natural Gas Spot Price	EIA	monthly	+	US$/MMBTU
SP_{EU}	Average European Natural Gas Spot Price (NBP, ZEE, TTF) (1 month ahead)	EIA	monthly	+	US$/MMBTU
WTI	Western Texas Intermediate Spot Price FOB	EIA	monthly	+	US$/barrel
$Brent$	European Brent Spot Price FOB	EIA	monthly	+	US$/barrel
Seasonality ($SE_{t,i}$)					
$HDDus$	Heating Degree Days	NCDC	monthly	+	days
$HDDeu$	Heating Degree Days	Eurostat	monthly	+	days

3 RESULTS

After conducting the structural vector autoregressive analysis on both sides of the Atlantic our results imply the following: the determinants reflect the previously expected behavior based on economic theory. In comparison, the LNG import prices respond different in both regions to short-term shocks of the demand determinants. In the US, both variables react for a longer time period, namely nine months. On the other side of the Atlantic the impact of these variables is shorter but more intense.

Considering the price mechanisms in Europe (long-term oil indexed contracts) we had expected a higher impact of oil prices in LNG than in the US, even though we only considered short-term shocks to LNG import prices.

4 CONCLUSION

We have analyzed the impact of different determinants on LNG import prices for the European and the US market, applying a structural VAR model which allows for short-term restrictions. We have used publicly available data in order to estimate the impulse response functions and have come to the conclusion that the price differences across the regions can be explained by the diverse impact of the proposed determinants. Specially in Europe the inclusion of political events could be of further interest i.e. the current Ukraine-Crimea crisis.

Finally, we have gained additional insight into the LNG natural gas market and took a step forward understanding regional import price differences.