

*Sophia Rüster and Anne Neumann*

## **ECONOMICS OF THE LNG VALUE CHAIN AND CORPORATE STRATEGIES. AN EMPIRICAL ANALYSIS OF THE DETERMINANTS OF VERTICAL INTEGRATION**

Dresden University of Technology, Department of Business and Economics  
Chair of Energy Economics and Public Sector Management, D-01069 Dresden  
E-mail: sophia.ruester@mailbox.tu-dresden.de

### **Overview**

This paper analyzes corporate strategies in the emerging global LNG market. In particular, we provide an empirical analysis of the determinants that push companies towards increasing vertical integration; this trend has been observed recently in a large number of cases (see for example Iniss, 2004).

Transporting liquefied natural gas (LNG) from (remote) producing to consuming regions in Europe, North America and Asia is a viable option to diversify the portfolio of energy sources as well as suppliers and thus increase security of supply. Therefore, bulky investments in asset specific infrastructure remain a crucial issue. During the last five years 46 billion cubic meters (bcm) regasification capacity started operation worldwide (11.3% of today's capacity), until 2010 another 140 bcm will come on stream.

### **Methods**

A large number of empirical case studies examine firms' motivations to choose alternative institutions of governance and determinants of vertical integration in different industries, such as Klein (1988), Monteverde and Teece (1982), and Masten (1984). The work of Joskow (1985), discussing coal fired power plants in the US, distinguishes between different situations leading to procurement of coal on spot markets, based on long-term contracts or through vertical integration. Neumann and Hirschhausen (2005) show that liberalization leads to shorter contract duration and more short term trading. Dailami and Hauswald (2005) find that the financing structure for LNG liquefaction projects is closely related to the downstream contract structure.

We place ourselves in the continuation of this literature by analyzing the determinants of vertical integration in the LNG industry from the perspective of transaction cost economics. Our hypothesis is that increasing transaction costs along the LNG value chain lead to a higher degree of vertical integration. We derive proxy variables by using explicit project data on 85 LNG projects – both, importing and exporting – worldwide. To measure asset specificity we use a dummy variable indicating export projects which, in contrast to LNG import facilities, are characterized by investments in highly specific infrastructure. The political country risk is defined as proxy variable to measure the level of uncertainty. The cumulated liquefaction-/regasification capacity owned by a firm expresses the frequency of transactions of this player in the industry. Furthermore, we use the Herfindahl-Hirschman Index of importing countries relating to the small number bargaining problem and resulting transaction costs faced by LNG suppliers. Our analysis also includes a dummy variable for start up dates of projects before 2002 to consider changes in the European LNG industry induced by liberalization. Control variables cover firm characteristics and regional differences.

The degree of vertical integration of a player along an actual LNG value chain is defined as a continuous measure computed as the enumeration of the stages in which a player is active, over the whole number of the value chain's stages. We test the hypothesis that higher transac-

tion costs have a positive impact on the degree of vertical integration using standard Tobit regressions.

## Results

Our preliminary findings suggest that vertical integration of players from the export project side exceeds the degree of vertical integration of those coming from the import project side. On the one hand, this is due to higher investment costs and resulting higher asset specificity as well as the larger degree of uncertainty in exporting (in many cases developing) countries. On the other hand, the ambition of upstream players which went downstream as a result of the liberalization process to benefit from marginal rents in the LNG industry is a driving factor. The extent of vertical integration increased significantly with start up dates of projects since 2002 (changes of corporate behavior resulting from liberalization in Continental Europe). We can show that exporting and importing players control the mid-stream stage transportation to a similar extent: both, oil and gas majors as well as original distributors, own and operate ships. Furthermore, private companies' degree of vertical integration exceeds the degree of vertical integration of state entities. With raising firm size (measured through assets value) players tend to be higher integrated, which can be explained by the increasing capability of financing integration. Figure 1 summarizes the influence of certain project and firm characteristics on the degree of vertical integration:

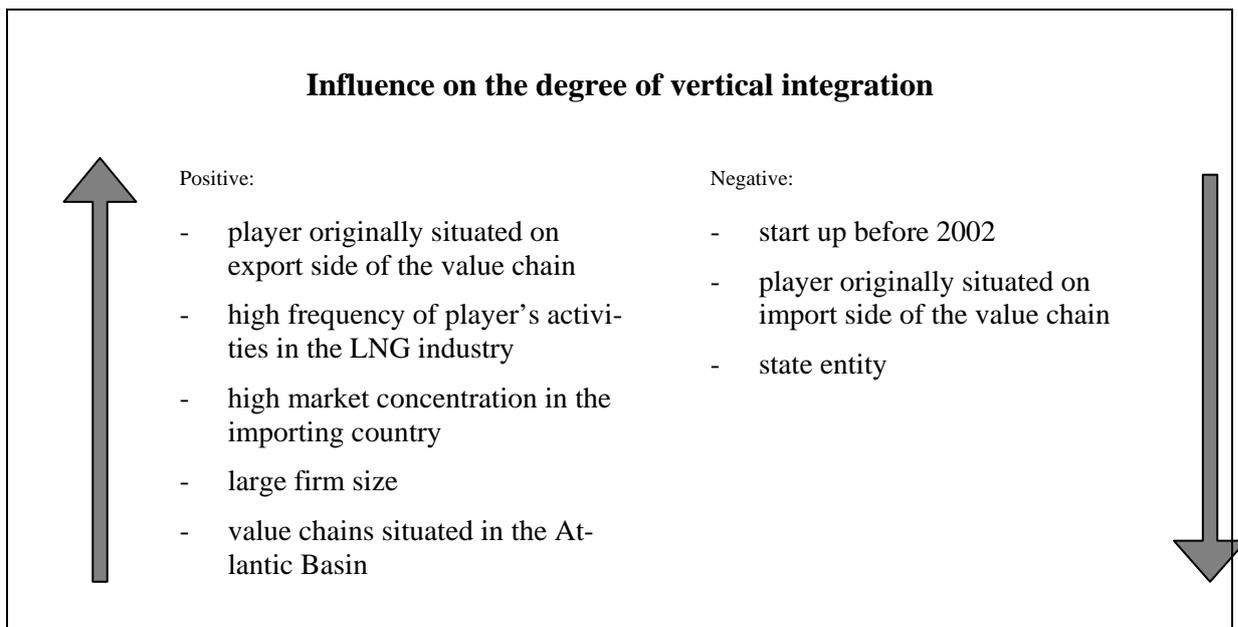


Figure 1: Influence on the degree of vertical integration

## Conclusions

Increasing natural gas demand and the ongoing process of liberalization and deregulation in Continental Europe lead to fundamental changes in corporate behavior. Global oil and gas majors as well as original distributors engage in all stages of the LNG value chain. Vertical integration and strategic partnerships become a common form of organization to face the changing market characteristics, mainly for private companies which tend to be more integrated than state entities. We show that players active in LNG export projects are characterized by a higher degree of vertical integration than those situated on the importing side of the value chain. LNG short-term trade will continue to grow combined with increasing flexibility inherent in contracts. In addition, players order uncommitted vessels thereby creating uncommitted transport capacities which will be the key to exploit arbitraging profits from price differences between regions.