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The influence of the Panama Canal on global gas trade

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ABSTRACT

An increasing growth of unconventional gas production in the U.S. has gradually turned it into a potential gas exporter. In near future, increasing LNG exports from the U.S. coupled with the capacity of the Panama Canal will change the LNG market. The Panama Canal expansion is the key to the change because the route via this canal reduces the voyage by 7000 nautical miles to Japan from the Gulf of Mexico. Applying the World Gas Model from the University of Maryland, this paper investigates the potential effects of varying Panama Canal tolls on the LNG markets via six scenarios of possible Panama Canal tariffs. Results are compared and examined with the focus on prices, LNG flows, and supply displacement. We find a significant LNG volume tradeoff between Asian and European gas markets. The U.S. and Trinidad & Tobago are key players due to their LNG exports displacing to some extent, flows from the Middle East, Africa, and other Asian suppliers to the Japanese and South Korean markets. Japanese & South Korean prices are significantly reduced when the Panama Canal tariff is low due to more supplies from the Atlantic Basin. As the toll increases, the U.S. and Trinidad &Tobago switch their exports to Europe rather than these markets in East Asia. European prices are improved when that region gets more LNG from the Atlantic basin.

1. Introduction

The global natural gas market has undergone a number of changes recently due to new unconventional resources such as shale gas. This has been at roughly the same time as the rise in consumption in liquefied natural gas (LNG) especially in Asian markets. LNG is an attractive alternative to gas transported by pipelines and helps consuming countries to diversify their supply portfolio (Wood, 2012). LNG is also a key option to compensate for domestic resources that are depleting for example in Europe. Over the last decade, LNG market has been dominated by a few exporters. For example, 83% of the global LNG trade in 2012 was supplied by eight countries. Qatar was the largest exporter followed by Malaysia and Indonesia (GIGNL, 2013). However, in near future the global LNG market will undergo rapid changes as it welcomes the entry of new exporters from the U.S. and increased supplies from Australia (Leather et al., 2013). In the past, LNG trade has been divided into two basins, the Pacific and Atlantic Basins, and most LNG trade is confined within one basin (GIGNL, 2013). LNG trade between basins is unprofitable due to high shipping costs and a small price gap between these two basins. Recently, the price difference between the basins has increased since mid-2010 due to strong demand in Asia. Therefore, trading LNG between basins became profitable depending on the shipping costs. Thus, while LNG markets previously were separate due to financial disadvantage, the rise of LNG in Asia and elsewhere, coupled with an expanded Panama Canal, are increasing the competitiveness of global LNG markets. For instance, U.S. LNG exports can compete with Australian and Middle Eastern LNG exports in the Japanese and South Korean markets or for other high demand areas in Asia.

The expansion of the Panama Canal is scheduled to be completed in June 2015. The route via the Panama Canal will shorten voyages by more than 7500 nautical miles (8500 miles) from the East Coast of North America to Asia. With shorter distances, the cost of U.S. LNG from the East Coast going to Asia will be very competitive compared to the cost of LNG from the Gulf countries. For example, taking a Henry Hub reference price of $3/MMbtu, a liquefaction and storage cost of $3/MMbtu, the MMbtu cost aboard an LNG carrier out of the Gulf of Mexico, Texas or Louisiana, will be $6/MMbtu. The shipping cost to East Asia without the Panama Canal can be estimated at between $2.5/MMbtu and $3/MMbtu. This gives an LNG delivered price of about $9/MMbtu

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($3 + $3 + $3) to East Asia; a very competitive price for the Asian buyers when compared to the spot price which oscillates around the $15–17/MMbtu mark (BP, 2013). Although using the Panama Canal can save time (approximately 14 days to Asia from the U.S. East Coast) and transportation costs, the canal fee is still uncertain, and it may be costly. LNG experts expect the canal tariff will around 30 cents per MMBtu based on a $1 million round-trip fee for a medium-sized LNG tanker (Reuters, 2013). After the completion of the Panama Canal, several possible outcomes are possible. First, how will the Panama Canal tariffs affect the decision of LNG exporters and LNG shippers? Second, will more U.S. gas go to Asia given a shorter distance or go to Europe? Therefore, the aim of this paper is to address these questions using the University of Maryland's World Gas Model (WGM) (Gabriel et al., 2012); see Section 2 for more details. We assume the Panama Canal route is available for LNG shipping with tariffs differing by scenarios. However, we assume that the Panama Canal has unlimited capacity and is never congested which is a best-case scenario but useful in providing guidance.

The rest of this paper is organized as follows: Section 2 provides details for the University of Maryland's World Gas Model. Section 3 proposes scenarios involving the Base Case and the Panama Canal toll. Section 4 presents the results and the analysis, and Section 5 provides conclusions.

2. The World Gas Model

The WGM (2012 version) is a large-scale, market equilibrium model based on a mixed complementarity problem (MCP) system (Gabriel et al., 2013). This MCP comprises profit-maximizing optimization problems for the various market agents such as: producers, traders (who controls LNG), an integrated pipeline operator and a storage operator as well as demand functions for describing three consumption sectors (residential/commercial, industrial, and electric power). The WGM then takes the Karush–Kuhn–Tucker (KKT) optimality conditions of these various players along with market-clearing conditions to form the overall MCP (Gabriel et al., 2013). In the modeling framework, the traders are modeled as having market power (depending the country) in order to withhold gas supplies to increase overall prices. For some countries, such as the U.S., such market power is not consistent with market realities and thus traders in the U.S. are modeled via perfect competition. For other countries such as the Former Soviet Union, the traders see a weighted combination of both the perfect competition prices as well as ones derived from inverse demand functions. Such an approach allows for partial market power and has been used successfully for a number of private and public sector projects (e.g., Gabriel et al., 2012). The WGM goes beyond a number of previous and current gas models (Rice, 2005; Holz et al., 2008; Lochner, 2011; Aune et al., 2009; Abada et al., 2012; Huntington, 2010, 2013) by allowing for nearly global coverage combined with market power, multiple seasons, as well as coverage of conventional and unconventional gas production with separate shale gas production nodes.

Table 1
Base Case references.

	Regions	References
Consumption	North America	(EIA, 2013)
	Europe	(EDF/Enerdata (POLES), 2013; AIE, 2013a,b)
	China[a]	(EDF/Enerdata (POLES), 2013; OIES, 2011, 2012)
	The rest of the world	(EDF/Enerdata (POLES), 2013)
Production	North America	(EIA, 2013)
	Europe	(DECC, 2013; AIE, 2013a,b)
	China	(WEO, 2013; OIES, 2012)
	The rest of the world	(WEO, 2013)
Price reference	USA	(EIA, 2013)
	The rest of the world	(IGU, 2013)
	Norway	(AIE, 2013a,b)
Contract data base	The rest of the world	(GIGNL, 2013)
	USA	www.freeportlng.com (Macalister, 2013)
Liquefaction cost	All regions	(WEO, 2013; AIE, 2013a,b)
Regasification cost	All regions	(WEO, 2013)
LNG shipping cost	All regions	(Petroleum Economist, 2011)

[a] China node includes more than one country i.e., Thailand, China, and Taiwan. More details for regional definitions can be found in Appendix 1.

Table 2
North America LNG Export terminal, capacities, and contracts.

Terminals	Upper bound capacity (BCM)	Lower bound LTC with destination (BCM)	Destination (BCM)
U.S. West	8.25	N/A	
U.S. East	8	6.32	USA–Japan/S. Korea (3.16) USA–India (3.16)
U.S. Gulf	72	13.22	USA–Japan/S. Korea (13.22)
Canada West	6.98	1.65	Canada–Japan/S. Korea (1.65)
Canada East	0.96	N/A	

3. Description of scenarios

This section describes the scenarios examined as well as hypotheses about how the various case assumptions could impact the model outcomes. First, we define the Base Case as a benchmark for the other scenarios. The Base Case was calibrated to match recent global natural gas market trends and incorporates natural gas market projections from multiple sources. Table 1 provides details of the references for the WGM calibration. The Base Case assumed that there was no Panama Canal route. Thus, the Base Case assumes the longer distances from LNG export nodes to regasification.

In terms of the Liquefied Natural Gas (LNG) exports from North America, the Base Case assumes the North America LNG exports begin in 2020 and these LNG export capacities are exogenously realized by the model in 2020. Further, five potential aggregated

Table 3
Panama Canal toll scenarios.

Scenarios	Abbreviation	Description
Scenario 1	Zero_toll	"Zero toll": tariff = $0/MMBtu
Scenario 2	Regular_toll	"Regular toll": tariff = $0.35/MMBtu
Scenario 3	Double_toll	"Double toll": tariff is regular toll times 2 = $0.70/MMBtu
Scenario 4	Threefold_toll	"Threefold toll": tariff is regular toll times 3 = $1.05/MMBtu
Scenario 5	Fivefold_toll	"Fivefold toll": tariff is regular toll times 5 = $1.75/MMBtu
Scenario 6	Inf_toll	"Infinite toll": tariff is regular toll is high $9999/MMBtu