

A Quantitative Model of the Oil Tanker Market in the Arabian Gulf

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The market for oil tankers is an important component of the supply chain for crude oil, yet this market has remained poorly understood, owing to the paucity of time series data and the absence of an empirical framework for studying its determinants. Our work advances this literature in several ways. First, we construct a new data set of key economic indicators for the market for very large crude carriers (VLCCs) from the Arabian Gulf to East Asia for January 1991 through October 2019.

Second, we develop a structural vector autoregressive framework for this market that allows us to quantify the determinants of these indicators. This is a major advance in that existing studies of oil tanker markets to date have focused on documenting lead-lag relationships and reduced-form correlations without addressing the underlying identification problem.

Third, using state-of-the-art econometric methods, we quantify the causal effects of tanker cost, utilization, tanker supply and tanker demand shocks on the volume of oil exports from the Arabian Gulf, bunker fuel prices, one-year VLCC time charter rates, round-trip VLCC voyage rates from the Arabian Gulf to East Asia, and the profits of owners of VLCCs chartered for round-trip voyages on this route. Our estimates are informative, economically intuitive, and relevant for understanding today's oil tanker market.

We show that a positive tanker cost shock has a negligible effect on the real time charter rate, but higher voyage costs are associated with a decline in the demand for time charters because charterers' profits are reduced by higher operating costs. This helps explain the decline in the overall volume of oil exports from the Arabian Gulf. The magnitude of this response is small, consistent with the view that the demand for shipping is fairly inelastic with respect to changes in freight costs. Moreover, real voyage profits decline in response to positive cost shocks, suggesting that cost shocks are only partially passed on to round-trip voyage rates. This finding is consistent with the fact that real roundtrip rates increase in response to positive cost shocks only with a delay. Positive utilization shocks are associated with higher profits, an increase in time charter rates and lower fuel prices and oil export volumes. Tanker supply and tanker demand shocks have persistent effects on time charter rates as well as on the volume of oil exports and the bunker fuel price with the expected sign. Lower tanker supply and higher tanker demand are reflected in persistently higher voyage profits for vessel owners as well as higher round-trip voyage rates.

Whereas the variability of the real voyage profits of ship owners and round-trip voyage rates depends mainly on utilization shocks and tanker demand shocks, that of time-charter rates depends first and foremost on tanker demand and supply shocks. The variability of bunker fuel prices mainly depends on tanker demand and supply shocks, followed by tanker cost shocks, with utilization shocks playing only a small role. The main determinants of the variability of the volume of oil exports are tanker demand, tanker cost shocks and utilization shocks.

Our analysis also allows us to quantify the extent to which the historical evolution of oil exports, bunker fuel prices, time charter rates, round-trip voyage rates and shipowner profits is

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explained by each of the structural shocks. The results are reasonably robust across model specifications. We find that, until 2008, the volume of oil exports from the Arabian Gulf was largely determined by tanker demand shocks, consistent with conventional wisdom. Since then cost shocks have been the main determinant. Interestingly, there is robust evidence of a tanker-demand driven spike in oil export volumes (as well as in both tanker rates) associated with the temporary détente in U.S. trade policy in 2018/19, confirming that trade disputes have real effects on industrial commodity markets.

Cost shocks have only minor effects on the evolution of real time charter rates. The demand-driven cycle in time charter rates largely mirrors that found in oil export volumes and voyage profits. Between 2010 and 2015 (and again between 2016 and 2019), there is evidence of a trough in real time charter rates caused by the cumulative effects of tanker supply shocks, consistent with the delivery of many newly built vessels during this period. Finally, the results for the real round-trip voyage rate from the Arabian Gulf to East Asia and for the real vessel owners' profits from these round-trip voyages are qualitatively similar. The historical evolution of these variables is more sensitive to utilization and tanker demand shocks than tanker supply or cost shocks.