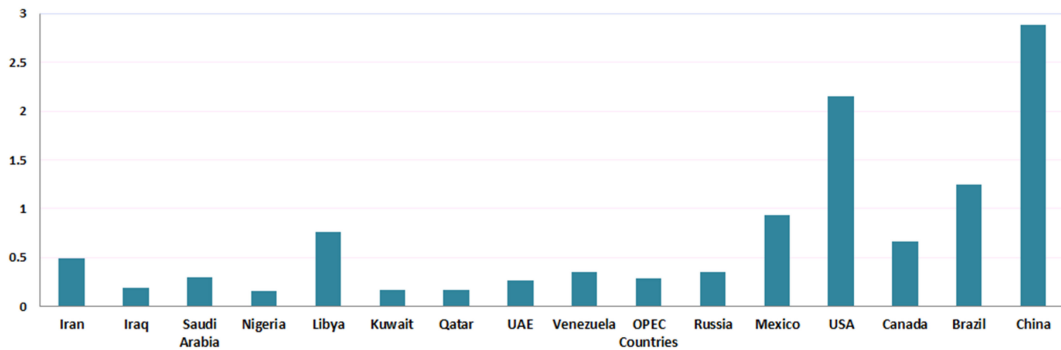


# A Risk-Hedging View to Refinery Capacity Investment in OPEC Countries

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Investing in the downstream sector to export refined products, as opposed to the export of crude oil, is an appealing and popular policy slogan in many oil-producing countries, including OPEC members. To better highlight the attraction of the slogan, Figure 1 shows the ratio of the refinery capital to oil production capacity for a set of OPEC versus non-OPEC G20 countries. One observes that the ratio is much higher for non-OPEC countries, which then grants of the question of whether OPEC countries should also invest in the oil refinery industry? This is a crucial energy policy question for such economies, on which, unfortunately, very little recent academic literature exists.

**Figure 1: Ratio of Refinery to Upstream Capacity**



Among many possible arguments in favor or against downstream investment by OPEC countries, we take a risk-hedging view to the problem. Our paper offers theoretical models for a vertical integration strategy within an oil-producing economy. The first theoretical model highlights the trade-off between return and risk-reduction features of upstream/downstream sectors. We then introduce a dynamic model that focuses on the volatility of total budgetary revenue of each sector.

Guided by our theoretical framework, we run an extensive empirical analysis using historical time-series of crude oil and refined product prices. The empirical analysis suggests that the average markup in the refining sector is significantly smaller than the profits in the upstream (see Figure 2 for the histogram of net refining margins).

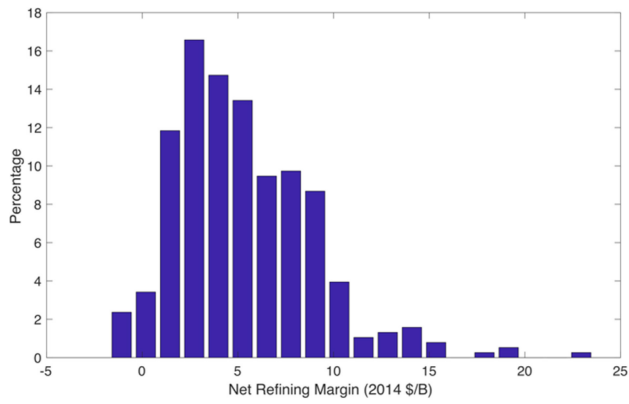
However, the near-zero correlation between changes in the upstream and downstream profits, motivates downstream investment as a hedging instrument.

Finally, the dynamic model suggests that the more stable and mean-reverting refining margins provide a partial revenue cushion when crude oil prices are low. We discuss the risk-hedging feature of the refinery industry when the crude oil market faces supply versus demand shocks.

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**Figure 2: Histogram of Refining Margins**



**Figure 3: Correlation of Changes in Upstream and Downstream Revenue**

