

# Price relationship between US natural gas, LPG and oil

## The effect of shale gas

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### (1) Overview

Liquefied petroleum gases (LPG) are light hydrocarbon gases, primarily propane and butane. Natural gas liquids and liquefied petroleum gases have played an important role in the current shale gas boom. The depressed gas price has made pure natural gas operations less profitable. The result is that liquids components in gas production have become increasingly important in ensuring the profitability of shale gas operations. Low natural gas prices have shifted the focus of producers towards “wet” gas areas containing more liquids. The result has been an increase in the supply of liquefied petroleum gases. Thus, the high liquids prices, connected to the high oil price, have contributed to keeping natural gas prices low. Natural gas prices might drop below marginal production costs as long as associated liquids sufficiently inflate the marginal revenue from the shale gas operations. In terms of the relationship between natural gas and oil in the US (Erdős, 2012; Neumann, 2009; Parsons and Ramberg, 2012; Villar and Joutz, 2006) the high liquids prices have likely contributed to separating natural gas and oil prices, and provides an additional explanation as to why US natural gas and oil markets are no longer integrated. In this paper we investigate whether the shale gas revolution has affected the historically strong price relationship between LPG and the oil prices. Even though the oil price has been a major determinant for LPG prices, the new supply of LPG from shale gas operations might have been sufficient to move LPG prices away from the historical long run relationship with oil into a new regime. The shale gas boom provides a natural experiment to evaluate the effect of a significant and persistent supply shock on the historically stable LPG/oil relationship.

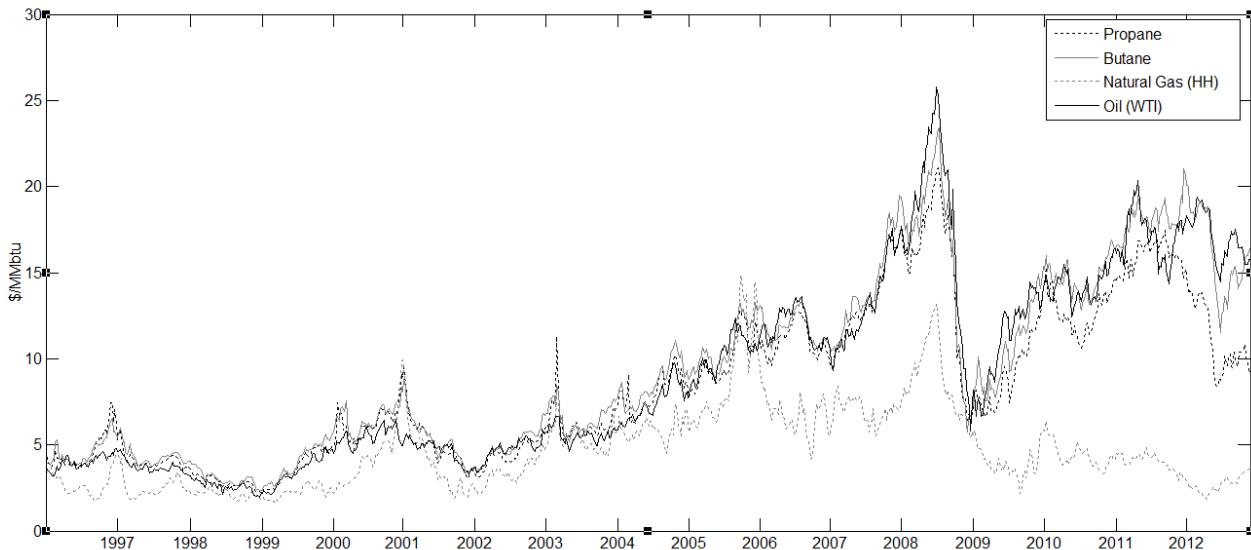
### (2) Methods

To test the degree of cointegration between series<sup>c</sup> and the structure of the relationship across the sample we use the cointegration testing approach of Hansen(2003).

### (3) Results

The figure indicates that the Propane and Butane prices closely track the WTI oil price, with a somewhat larger spread towards the end of the sample. The natural gas price shows an increasing spread relative to oil, with price trends moving in opposite direction after 2008.

The cointegration rank analysis indicates that propane/butane and oil are cointegrated, sharing a stochastic trend across the sample. However, applying a structural change model, we find that the relatively strong cointegration relationship between propane/butane and oil prior to January 2009 is significantly weakened in recent years. We find no evidence for cointegration towards natural gas across the full sample.



**Figure:** US prices of Propane, Butane, Natural Gas and Oil, January 1996 to December 2012, all prices on an equivalent energy basis (\$/MMbtu). LPG prices consist of propane and butane spot prices from Mont Belvieu, TX, hub. The oil price is the Crude oil WTI spot Cushing price, and the natural gas price is the Henry Hub spot price. Prices are collected from DataStream.

#### (4) Conclusions

The shale gas boom provides a natural experiment to evaluate the effect of a significant and persistent supply shock on the historically stable LPG/oil relationship. Even though the oil price has been a major determinant for LPG prices, the new supply of LPG from shale gas operations have been sufficient to move LPG prices away from the historical long run relationship with oil into a new regime. Reduced income from liquids may further reduce profitability from shale gas wells, thus reducing the spread between natural gas and oil.

#### References

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