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Volatility Spillover Effects and Cross Hedging in the U.S. Oil Market and the Energy Pipeline Sector Index

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Objectives

- > Examine the mean and volatility spillover effects between the U.S. oil, overall stocks markets and the U.S. energy pipeline market.
- > Study the impact of the liquidity crisis in the financial market on the volatility spillovers.
- Evaluate the new cross-hedging strategy to manage the risk on the oil market by including the Dow Jones U.S. Pipeline Index (DJUSPL).

Background

ENERGY PIPELINE INDUSTRY includes energy pipeline companies, which are the

operators of pipelines carrying oil, gas or other forms of fuel for distribution instead of direct sales to end users that are not solely focused on production.

The energy pipeline industry plays an important role in the growth and stabilization of U.S. economy, which heavily depends on the oil (Elyasiani, Mansur, & Odusami, 2011).



The U.S. energy pipeline network assists the distribution of the energy to support the operation of other industries, to meet the basic needs of the consumers, and to reduce the impact of the energy price hikes. From 2004 to 2013 the energy pipeline mileage increased 15.4 percent, and the crude oil delivered by U.S. energy pipeline rose 19.4 percent.

Linkages between the U.S. energy pipeline industry and the U.S. economy and the oil market are interesting to investigate with recent, increased investment in the sub-sector pipeline industry.



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- Conditional Variance: BEKK-VAGARCH(1,1) $H_{t} = CC' + A'\varepsilon_{t-1}\varepsilon_{t-1}'A + B'H_{t-1}B + D'v_{t-1}v_{t-1}'D$
- U.S. Energy Pipeline Market Conditional mean: AR(2)

 $\delta_{DJUSPL,t-1}r_{WTI,t-1} + \gamma_{DJUSPL,t-1}r_{ST,t-1} + \varepsilon_{DJUSPL,t}$

• Conditional variance: AGARCH(1,1) $\varepsilon_{DJUSPL,t} = e_{DJUSPL,t} + \psi_{DJUSPL,t-1}e_{WTI,t} + \phi_{DJUSPL,t-1}e_{ST,t}$

 $\sigma_{DJUSPL,t}^{2} = c_{DJUSPL} + a_{DJUSPL} e_{DJUSPL,t-1}^{2} + b_{DJUSPL} \sigma_{DJUSPL,t-1}^{2} + d_{DJUSPL} v_{DJUSPL,t-1}$

- Spillover Parametrization Let $\Omega_{DJUSPL,t} = \{\delta_{DJUSPL,t}, \gamma_{DJUSPL,t}, \psi_{DJUSPL,t}, \phi_{DJUSPL,t}\}$
 - Constant Spillover Model $\Omega_{DJUSPL,t} = \Omega_{DJUSPL}$
 - Event-dummy Spillover Model $\Omega_{DJUSPL,t} = \Omega_{DJUSPL,0} + \Omega_{DJUSPL,1}D_t,$
 - Time-varying Spillover Model

Results

Constant Spillover and Event-dummy Spillover Models

Constant Spillover Model					
Spillover	DJIA as	S&P500 as			
Coefficients	Proxy	Proxy			
Mean					
δ_{DJUSPL}	0.04***	0.03***			
γ _{djuspl}	-0.03	-0.01			
Variance					
ψ_{DJUSPL}	0.14***	0.12***			
ϕ_{DJUSPL}	0.62***	1.02***			

,* Significant at the five and one percent level, respectively P-LB-Q (30) indicates that there is no autocorrelation P-ML (30) indicates that there is no ARCH effect.



approach. Energy Economics, 50, 1-12

Economics, 33(5), 966-974.

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 An increase in the volatility spillover ratio of the WTI to the DJUSPL during the illiquid periods identified by the interbank liquidity spread. (Increased by 67.7%)

Increasing volatility spillover ratio of the DJIA during the illiquid period identified by the liquidity spread. (Increased by 7%)

• Oil-stock hedge Ratio (Salisu and Oloko, 2015; Basher&Sadorsky, 2016):

$$\beta_{ST} = \frac{H_{ST,WTI}}{H_{ST}}$$

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	In-sample		Out-of-sample	
	Var	HE	Var	HE
	5.42		4.70	
ed	5.42	0.10%	4.52	3.80%
nedged	5.03	7.31%	4.05	13.94%
	5.43		4.70	
ed	5.43	0.04%	4.50	4.41%
nedged	5.03	7.40%	4.19	10.81%

Concluding Remarks

Both WTI and DJIA/S&P500 have statistically significant volatility-spillover effect on

The raising illiquidity in the financial market is associated with the statistically significant increase in the volatility transmission from the U.S. oil and overall stock

The new cross-hedging strategy for managing oil price risk using DJUSPL improves the

Basher, S. A., & Sadorsky, P. (2016). Hedging emerging market stock prices with oil, gold, VIX, and bonds: A comparison between DCC, ADCC and GO-GARCH. *Energy Economics*, 54, 235-247 • Elyasiani, E., Mansur, I., & Odusami, B. (2011). Oil price shocks and industry stock returns. *Energy*

Salisu, A. A., & Oloko, T. F. (2015). Modeling oil price–US stock nexus: A VARMA–BEKK–AGARCH