Can Oil Prices Forecast Exchange Rates?

Domenico Ferraro, Ken Rogoff and Barbara Rossi

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- ... although we check robustness with other countries/commodity prices.

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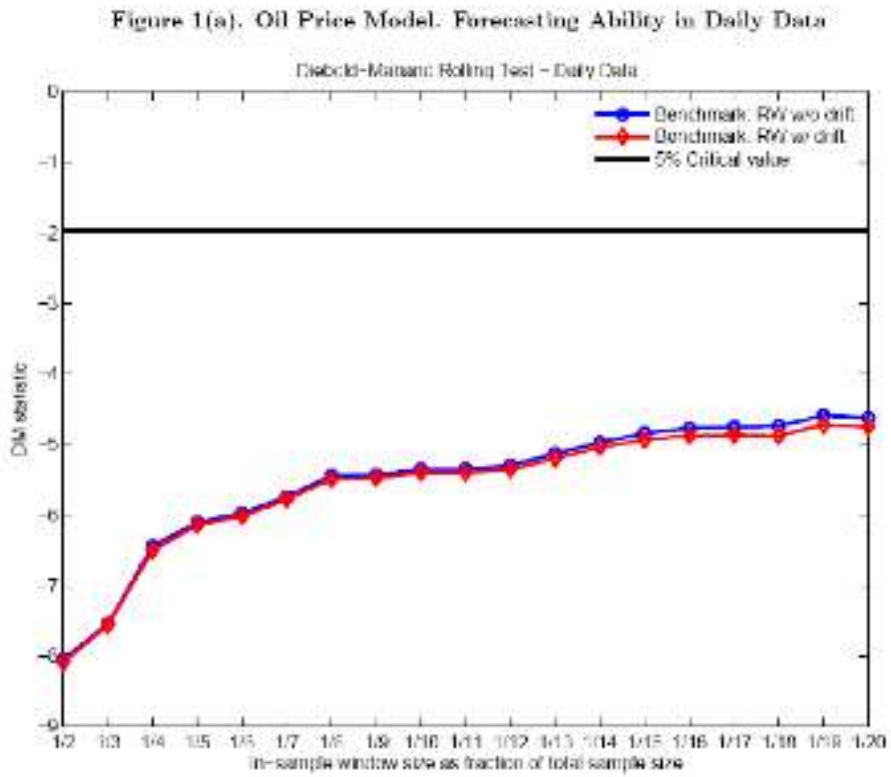
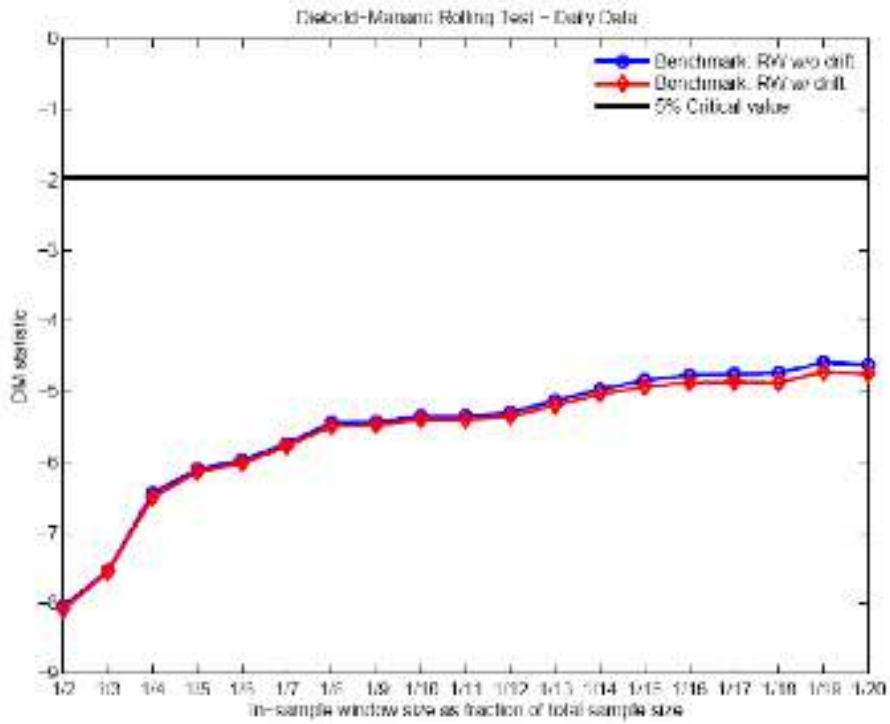


Motivation

- Can Oil Prices Forecast Exchange Rate Movements?
- In DAILY data, YES!

Figure 1(a). Oil Price Model. Forecasting Ability in Daily Data



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- On the contrary, in-sample fit is stronger in monthly and quarterly data than in daily data

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  - for the South African Rand-U.S. dollar exchange rate and gold prices we also find significance with both contemporaneous and lagged commodity prices
  - for the Australian-U.S. dollar and oil prices and the Chilean Peso-U.S. dollar exchange rate and copper prices, we find strong and significant predictive ability only with contemporaneous commodity prices as predictors.

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    - => Our results focus on **out-of-sample forecasting**, and document short-lived effect identifiable only at **high frequencies**

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- We focus on **linear models** but we check performance of **nonlinear models**: see Hamilton (2003), Kilian and Vigfusson (2011), etc. for nonlinear relationships between oil and output, and Alquist, Kilian and Vigfusson (2011) for forecasting oil prices.

Roadmap

- I. **Can Realized Oil Prices Forecast Exchange Rates?**
- II. Can Lagged Oil Prices Forecast Exchange Rates?
- III. Other Commodities/Exchange Rates
- IV. Are Non-linearities Important?

Roadmap

- I. **Can Realized Oil Prices Forecast Exchange Rates?**
  - YES!
  - Why are we able to find predictive ability?
    - Choice of Fundamental?
    - Frequency or Number of Observations?
    - Is it stable?
    - How about in-sample fit?
- II. Can Lagged Oil Prices Forecast Exchange Rates?
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Can Realized Oil Price Changes Forecast Exchange Rates?

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  - We consider three frequencies: quarterly, monthly and **daily**

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  - 12/14/1984 to 11/05/2010, end of period.

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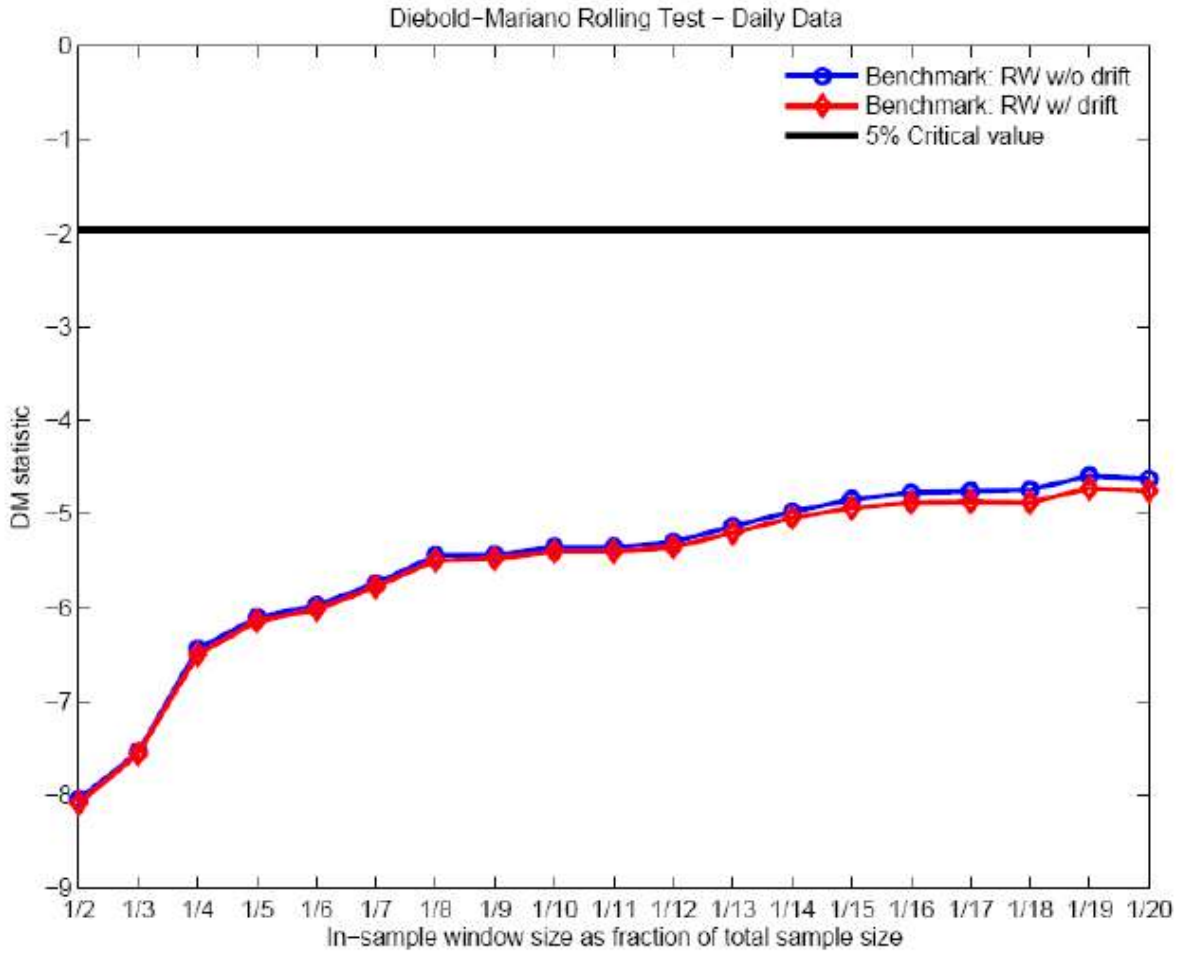
  - Predictive ability assessed by Diebold and Mariano's (1995)
  - Benchmarks are random walk without and with drift

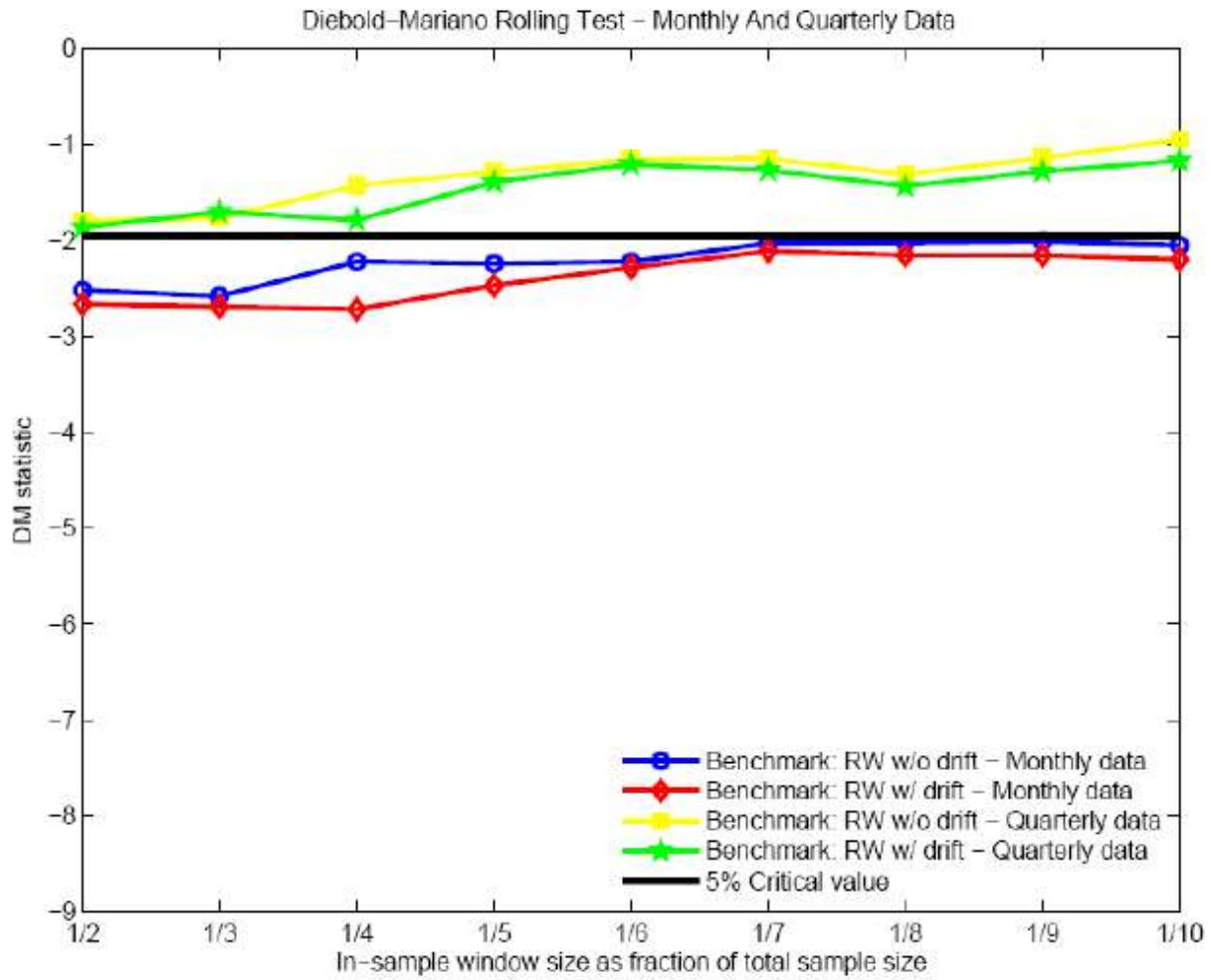
Can Realized Oil Price Changes Forecast Exchange Rates in Daily Data? YES!

Figure 1(a). Oil Price Model. Forecasting Ability in Daily Data



Can Realized Oil Price Changes Forecast Exchange Rates in Monthly/Quarterly Data? Barely...

Figure 1(b). Oil Price Model. Forecasting Ability in Monthly and Quarterly Data



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- Canadian short-term interest rate is the daily overnight money market financing rate (Bank of Canada) and the U.S. short-term rate is the daily Federal funds effective rate

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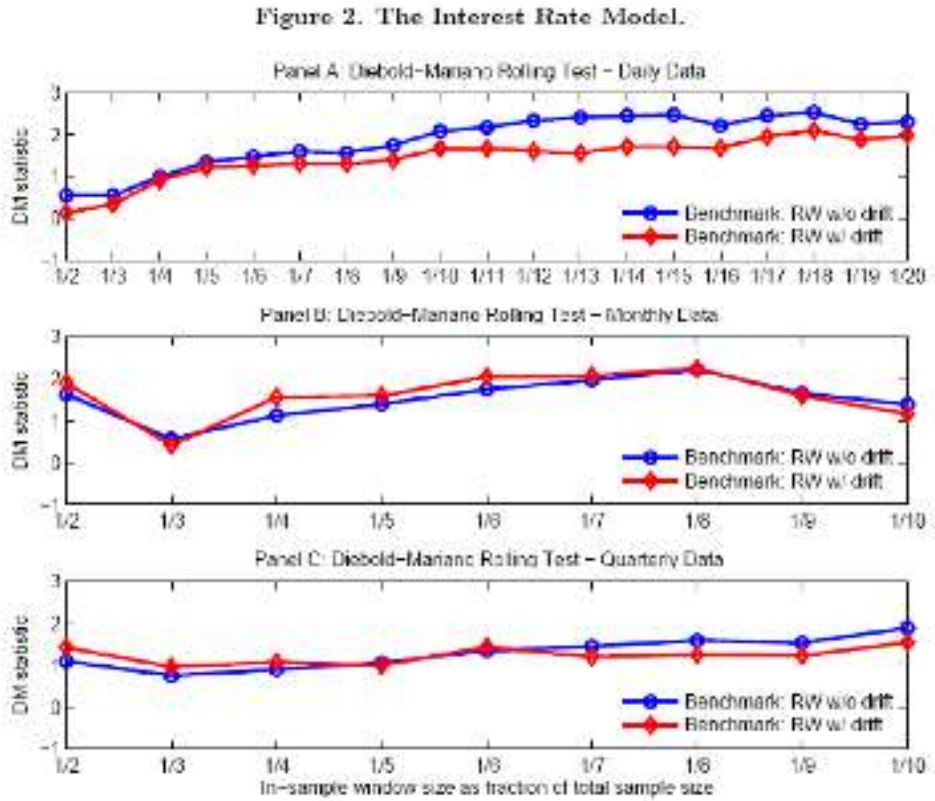
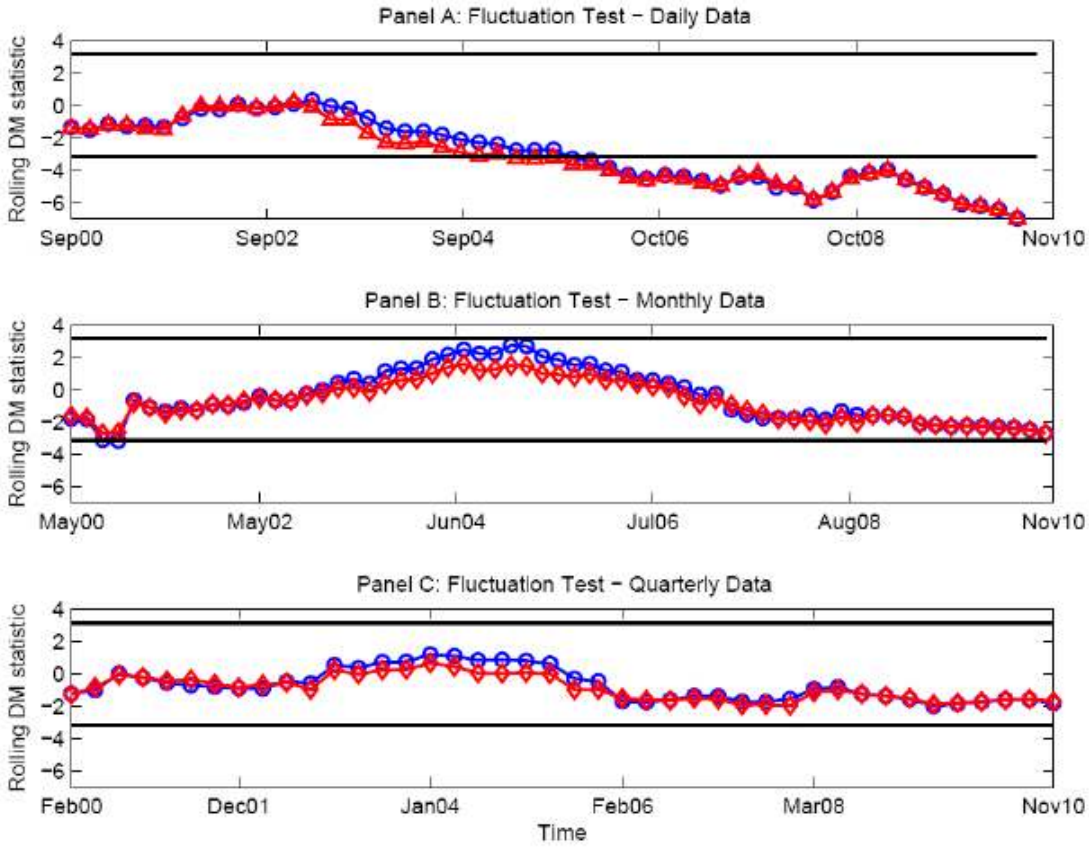


- Fundamental plays a big role: no predictive ability with interest rates!

Is the Predictive Ability Stable Over Time?

Figure 3. Fluctuation Test For the Oil Price Model



- Predictive Ability mainly after 2004 in Daily data, very little or none in Monthly/Quarterly data...

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Table 1(a). Frequency Versus Number of Observations

	RW w/o drift	RW w/ drift
	Panel A. Comparing Daily and Monthly Data	
Daily Data	-4.1829	-4.3710
	(0.0000)	(0.0000)
Monthly Data	-2.5201	-2.6630
	(0.011)	(0.007)
	Panel B. Comparing Daily and Quarterly Data	
Daily Data	-2.1160	-2.7254
	(0.0343)	(0.0064)
Quarterly Data	-1.7967	-1.8654
	(0.0724)	(0.0621)

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- It is the frequency, not the number of observations!

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	RW w/o drift	RW w/ drift
Window:		
1/2	-2.326	-2.304
	(0.020)	(0.021)
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	(0.032)	(0.028)

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Robustness: Recursive Estimation

Table A.1 Recursive Estimation for Model 1

Estimation Method	Rolling		Recursive	
Benchmark	RW w/o Drift	RW w/ Drift	RW w/o Drift	RW w/ Drift
1/2	-8.051	-8.094	-8.744	-8.760
1/3	-7.543	-7.563	-8.716	-8.735
1/4	-6.441	-6.504	-8.668	-8.720
1/5	-6.108	-6.145	-8.645	-8.691
1/6	-5.974	-6.023	-8.627	-8.682
1/7	-5.744	-5.780	-8.627	-8.675
1/8	-5.443	-5.499	-8.655	-8.703
1/9	-5.434	-5.479	-8.645	-8.688
1/10	-5.355	-5.402	-8.642	-8.687

- Results are robust to the use of a recursive window estimation procedure

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Can Lagged Oil Prices Forecast Exchange Rates?

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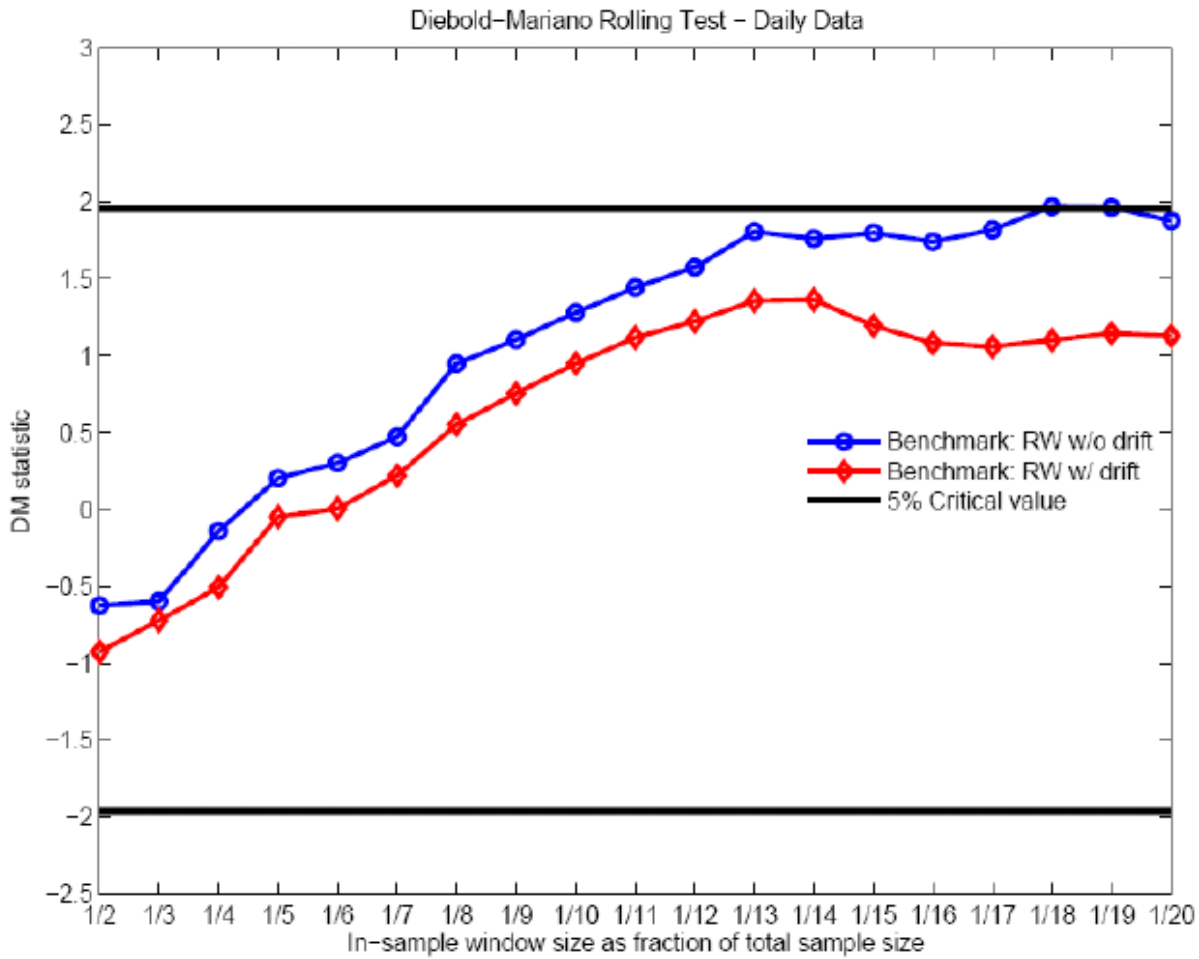
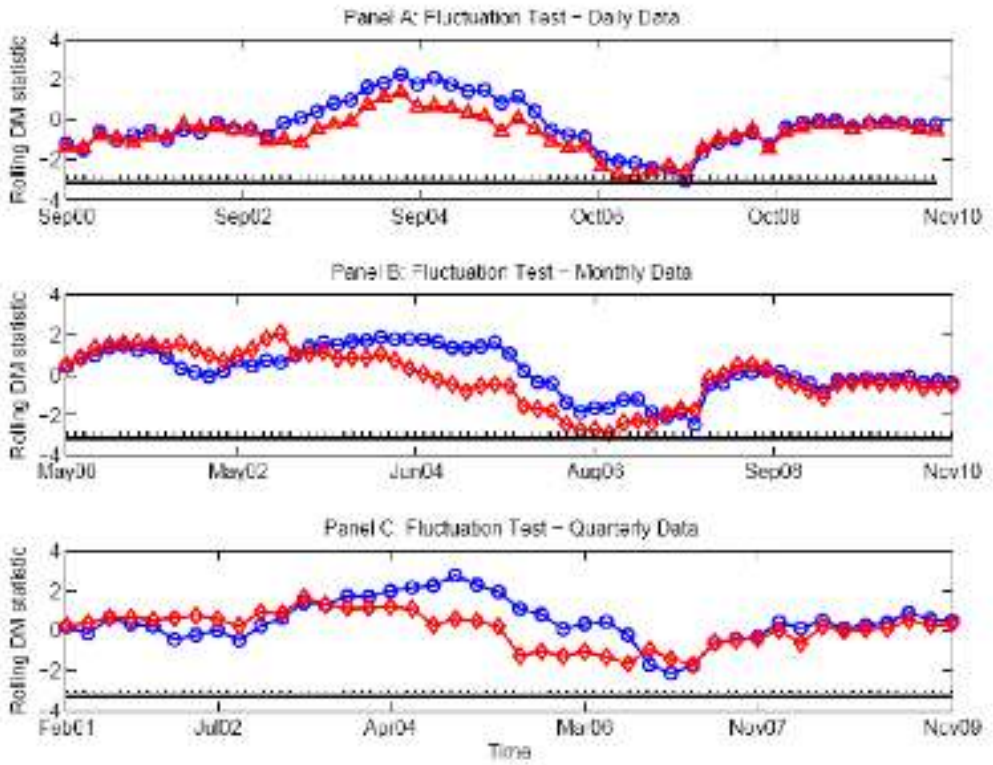
Can Lagged Oil Price Changes Forecast Exchange Rates in Daily Data?

Figure 5(a). Oil Price Model. Forecasting Ability in Daily Data



Can Lagged Oil Price Changes Forecast Exchange Rates?

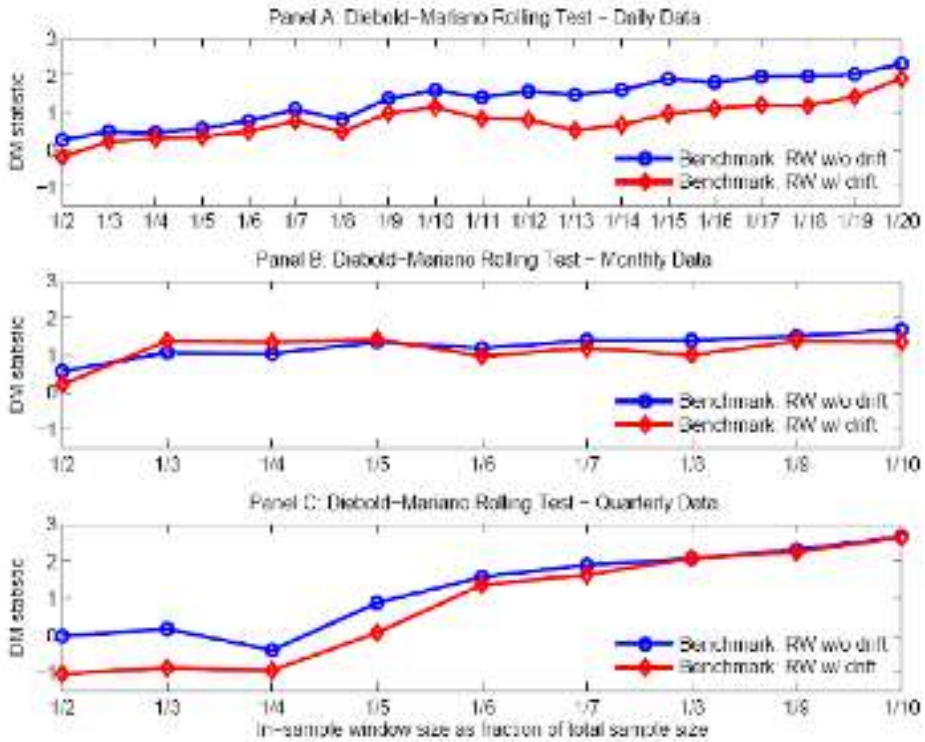
Figure 5(c). Fluctuation Test For the Oil Price Model



- Yes, after taking into account instabilities in the relative forecasting performance

Can Lagged Interest Rate Differentials Forecast Exchange Rates?

Figure 5(d). The Interest Rate Model. Forecasting Ability in Daily, Monthly and Quarterly Data



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Other Commodities: Norwegian Krone, contemp. price

Figure 6(a). Norw. Krone and Oil. Daily Data, Contemp. Model

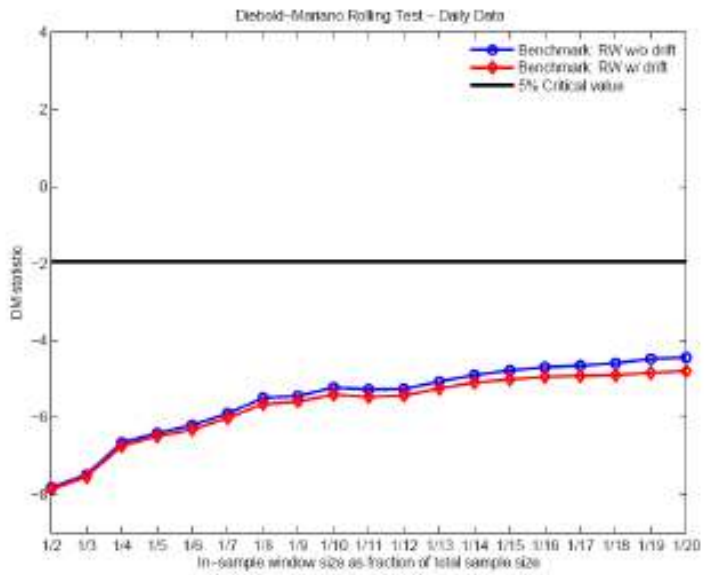
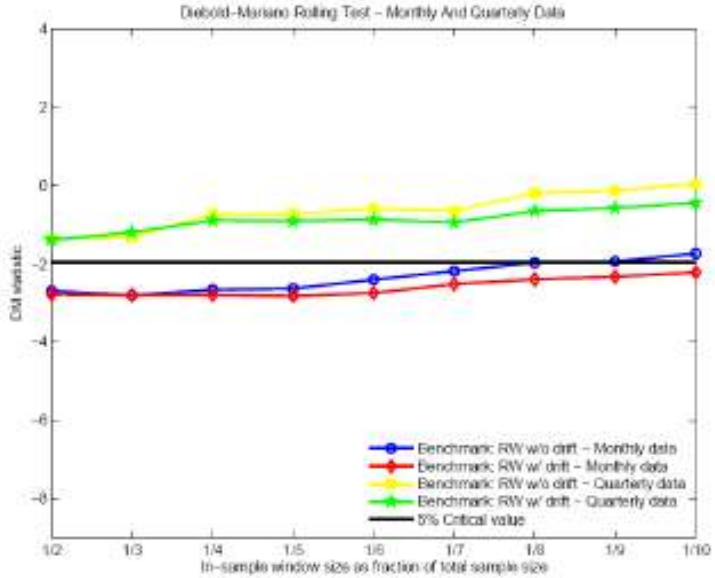


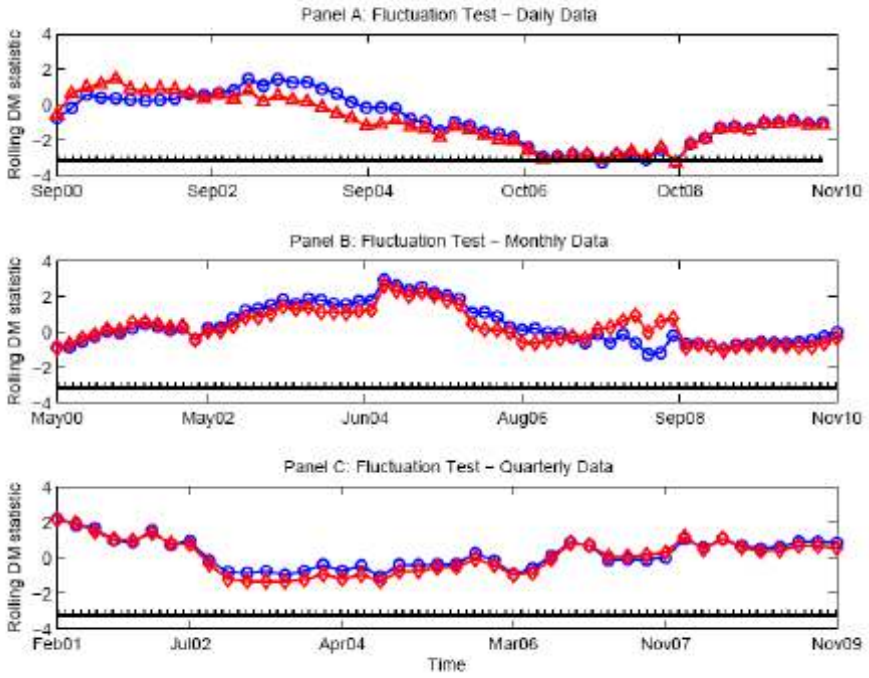
Figure 6(b). Norw. Krone and Oil. Monthly and Quarterly Contemp. Model



- Very strong predictive ability in daily data with contemp. prices

Other Commodities: Norwegian Krone, lagged price

Figure 6(f). Norw. Krone and Oil. Fluctuation Test, Lagged Model



- Predictive ability with realized fundamentals robust, with lagged p sporadic

Other Commodities: S.A. Rand and Gold, contemp.

Figure 7(a). S.A. Rand and Gold. Daily Data, Contemp. Model

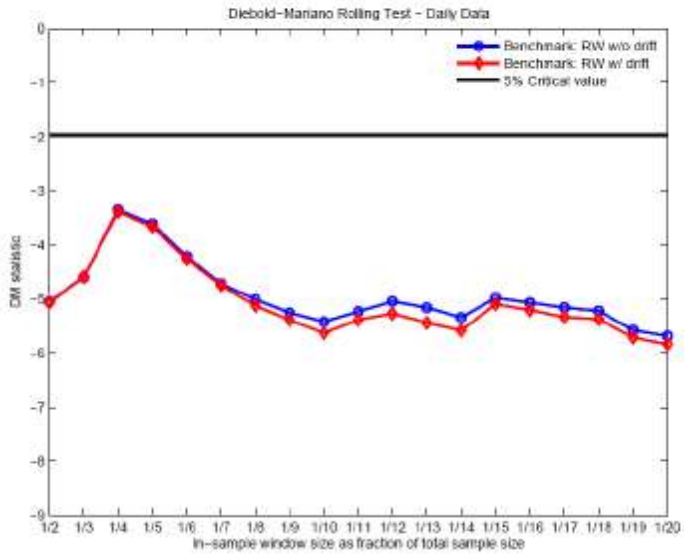
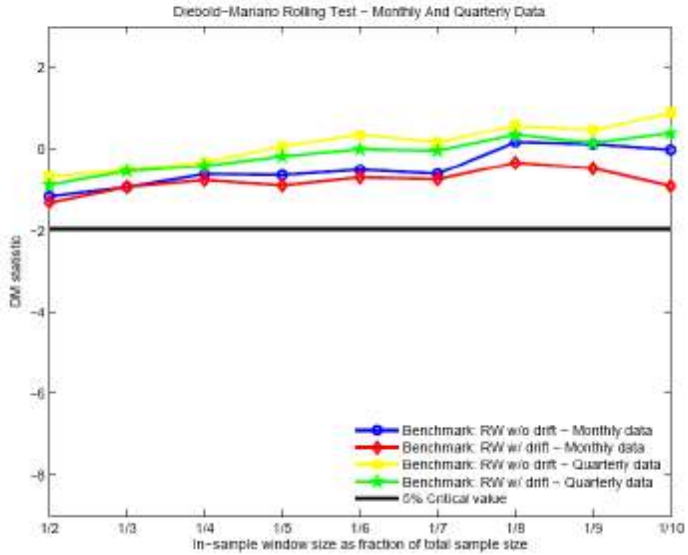


Figure 7(b). S.A. Rand and Gold. Monthly and Quarterly Contemp. Model



- Very strong predictive ability in daily data with contemp. prices

Other Commodities: S.A. Rand and Gold, lagged p

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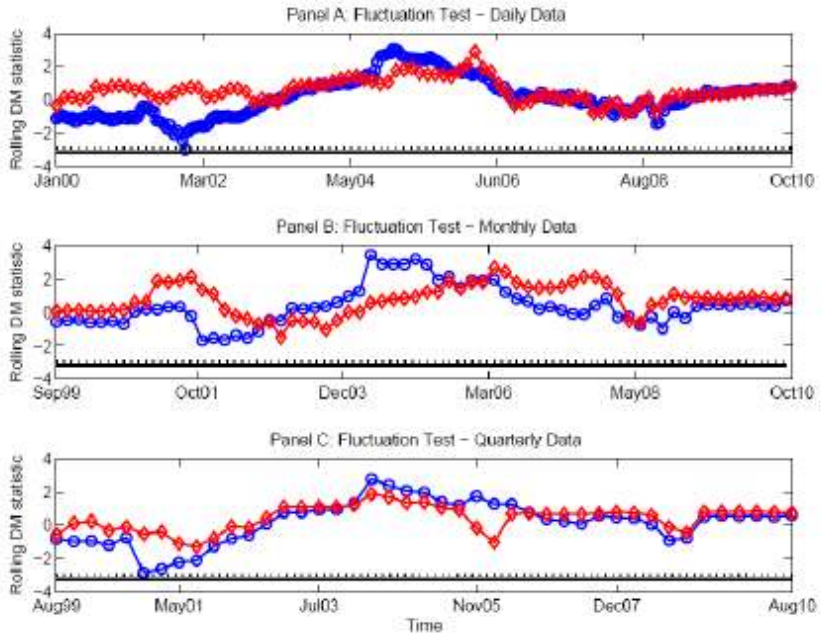

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Other Commodities: Chilean Peso and Copper, contemp.

Figure 8(a). Chilean Peso and Copper. Daily Data, Contemp. Model

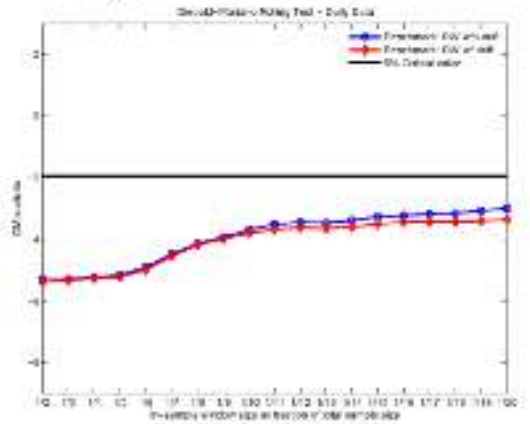
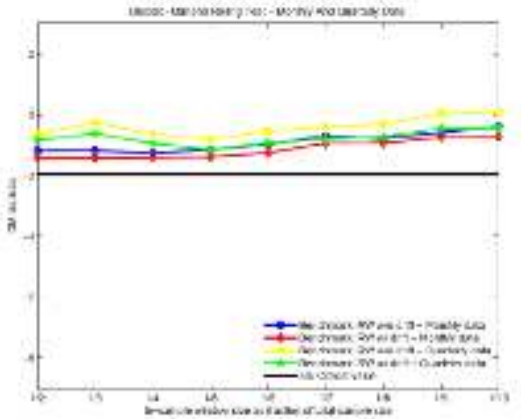


Figure 8(b). Chilean Peso and Copper. Monthly and Quarterly Contemp. Model



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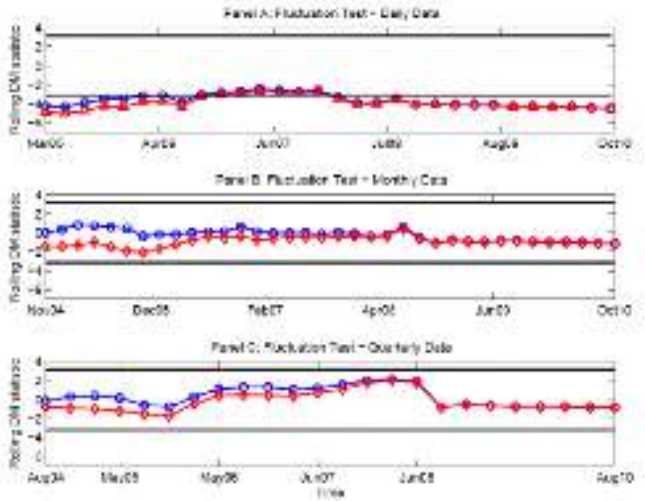
Other Commodities: Chilean Peso and Copper, contemp.

Figure 8(e). Chilean Peso and Copper. Fluctuation Test, Contemp. Model



- Only predictive ability with realized fundamentals

Other Commodities: Australian $ and Oil, contemp.

Figure 9(a). Austr. $ and Oil.
Daily Data, Contemp. Model

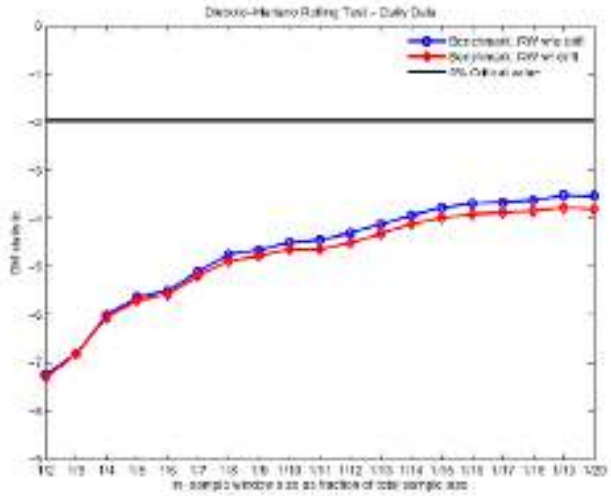


Figure 9(b). Austr. $ and Oil.
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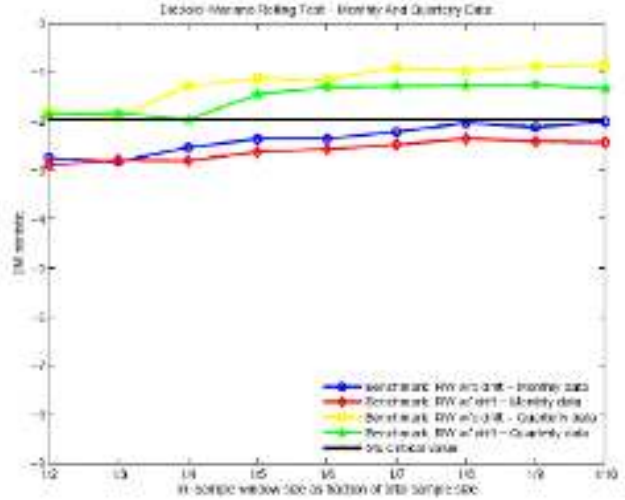

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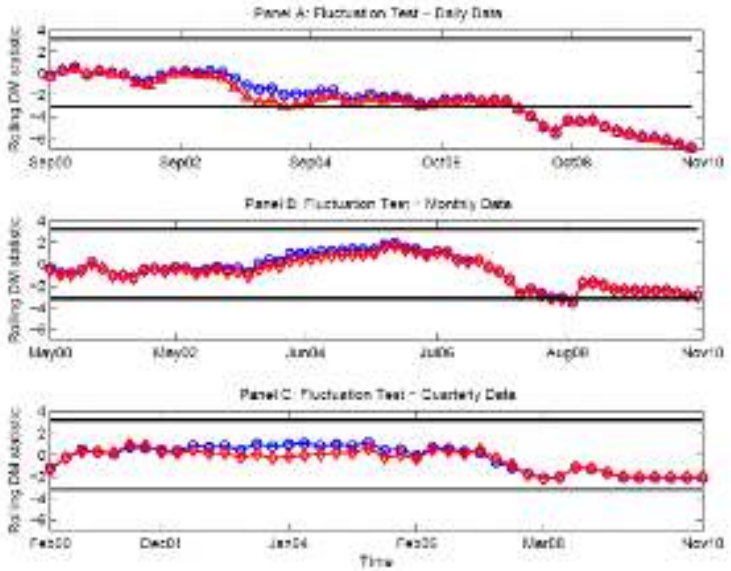

- Only predictive ability with realized fundamentals

Roadmap

- I. Can Realized Oil Prices Forecast Exchange Rates?
- II. Can Lagged Oil Prices Forecast Exchange Rates?
- III. Other Commodities/Exchange Rates
- IV. **Are Non-linearities Important?**

Are Non-linearities Important?

- Consider a model with **Asymmetries** (Kilian and Vigfusson (2009), Alquist, Kilian and Vigfusson (2011))

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- The exchange rate response is asymmetric in oil price increases and decreases:

$$\Delta s_t = \alpha_+ + \beta_+ \Delta p_t + \gamma_+ \Delta p_t^+ + u_t \tag{1}$$

where $\Delta p_t^+ = \begin{cases} \Delta p_t \text{ if } \Delta p_t > 0 \\ 0 \text{ otherwise.} \end{cases}$.

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Are Non-linearities Important?

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- "large" changes in oil prices have additional predictive power for the nominal exchange rate:

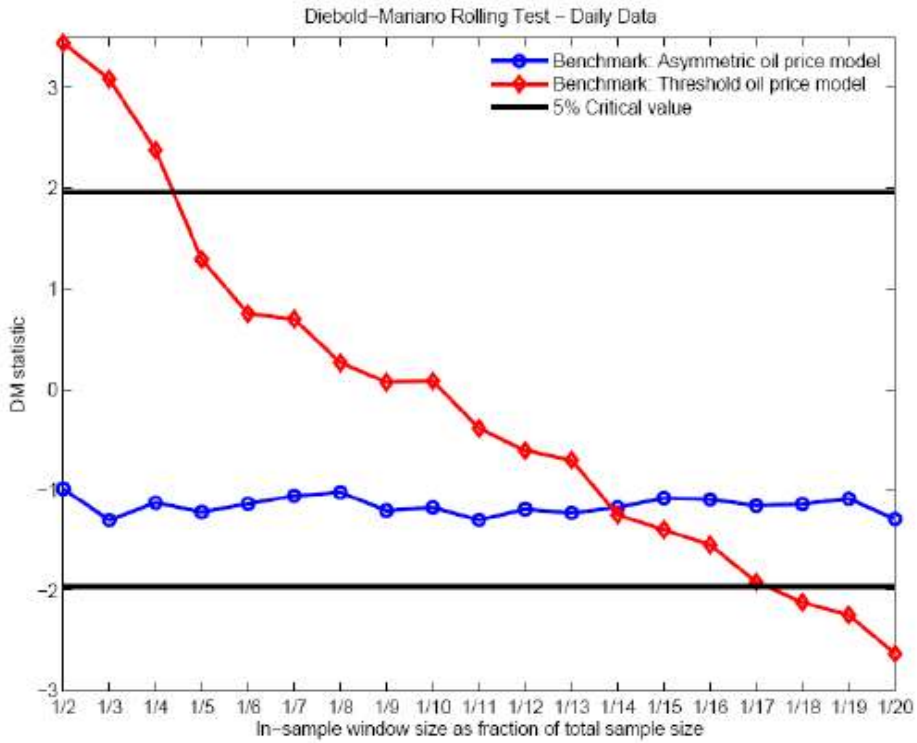
$$\Delta s_t = \alpha_q + \beta_q \Delta p_t + \gamma_q \Delta p_t^q + u_t$$

where

$$\Delta p_t^q = \begin{cases} \Delta p_t \text{ if } \Delta p_t > 80th \text{ quantile of } \Delta p_t \text{ or } < 20th \text{ quantile} \\ 0 \text{ otherwise.} \end{cases}$$

Non-linearities: Contemporaneous Price Model – Daily data

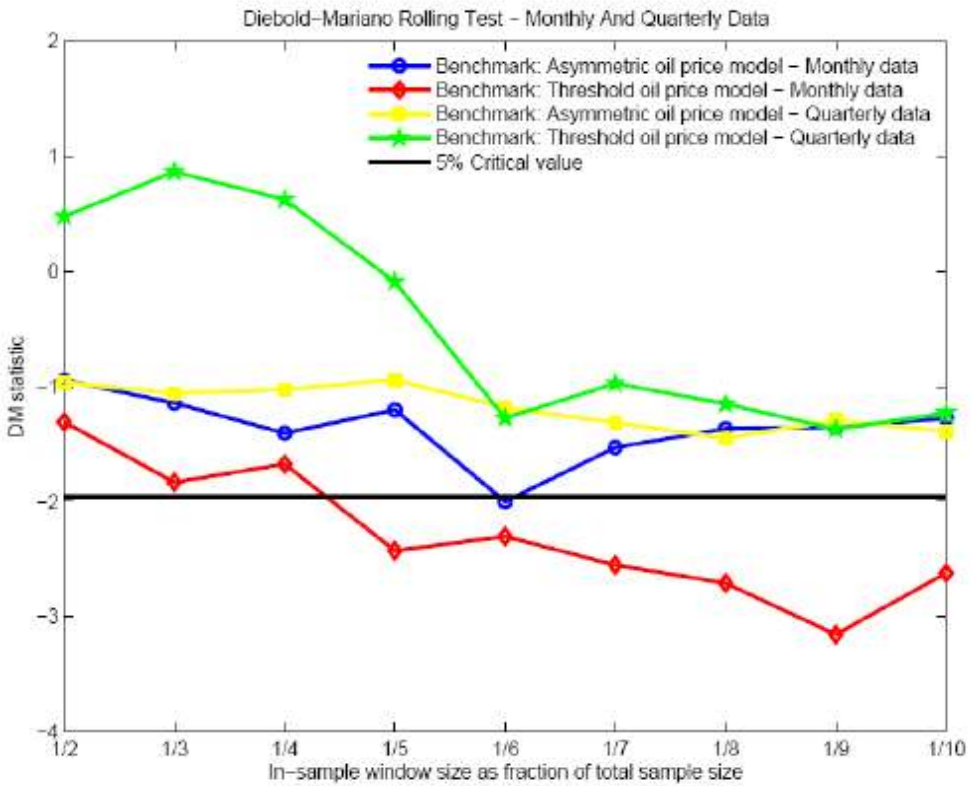
Figure 10(a). Asymmetric and Threshold Models. Forecasting Ability in Daily Data



- Some predictability in Threshold models but only for very large window sizes

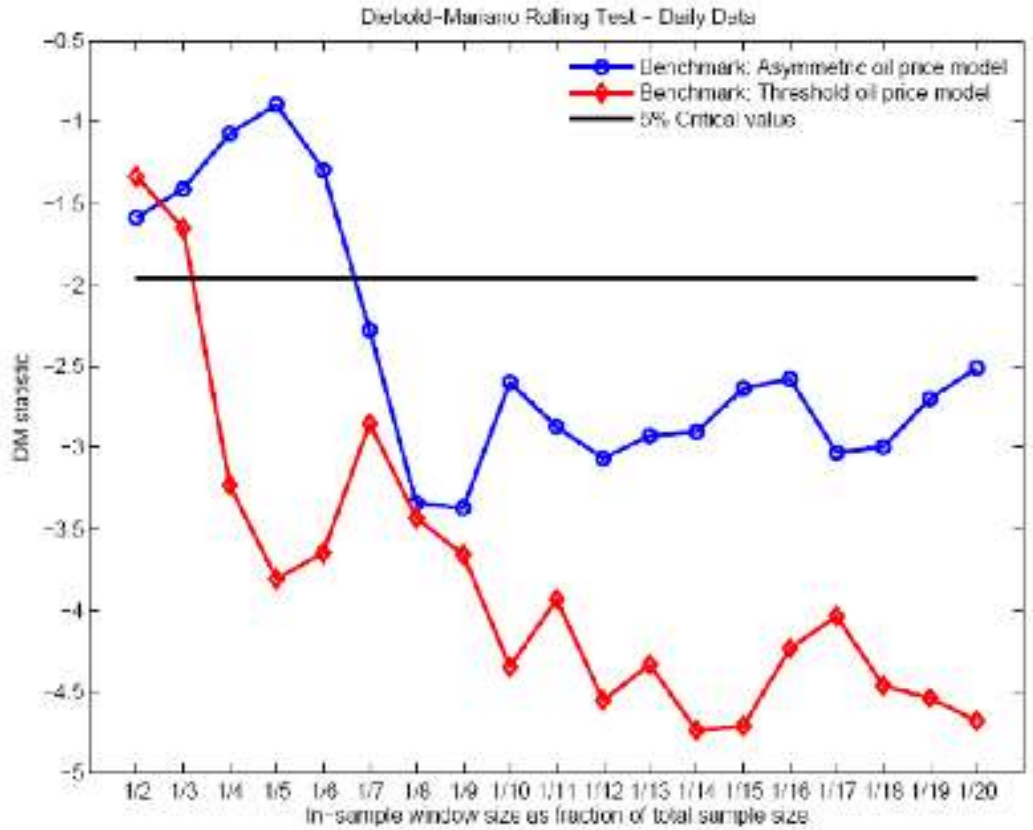
Non-linearities: Contemp. Price Model, Monthly a& Quarterly data

Figure 10(b). Asymmetric and Threshold Models. Forecasting Ability in Monthly and Quarterly Data



- Non-linear models are never better and sometimes signif. worse

Non-linearities: Lagged Price Model – Daily data



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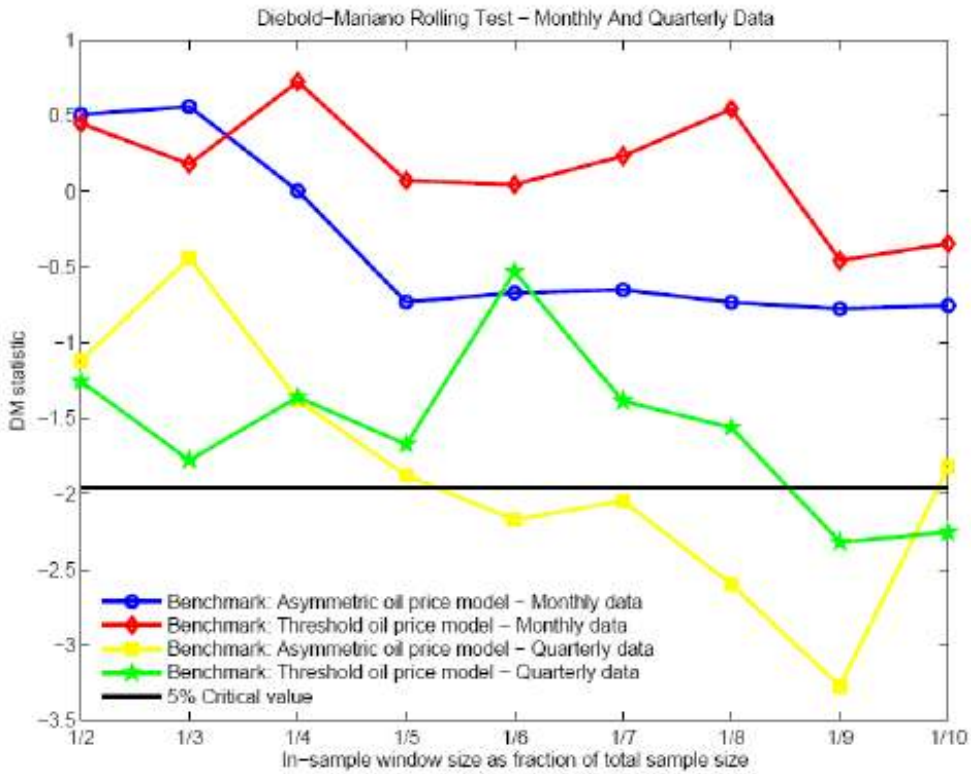
Non-linearities: Lagged Price Model – Monthly and Quarterly data

Figure 10(d). Asymmetric and Threshold Models. Forecasting Ability in Monthly and Quarterly Data, Lagged Model



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- Both out-of-sample and in-sample analyses suggest that **frequency of the data is important** to detect the predictive ability of oil prices

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- We leave these issues for future research.