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*M*V Proprietary modelling

Trading the spread
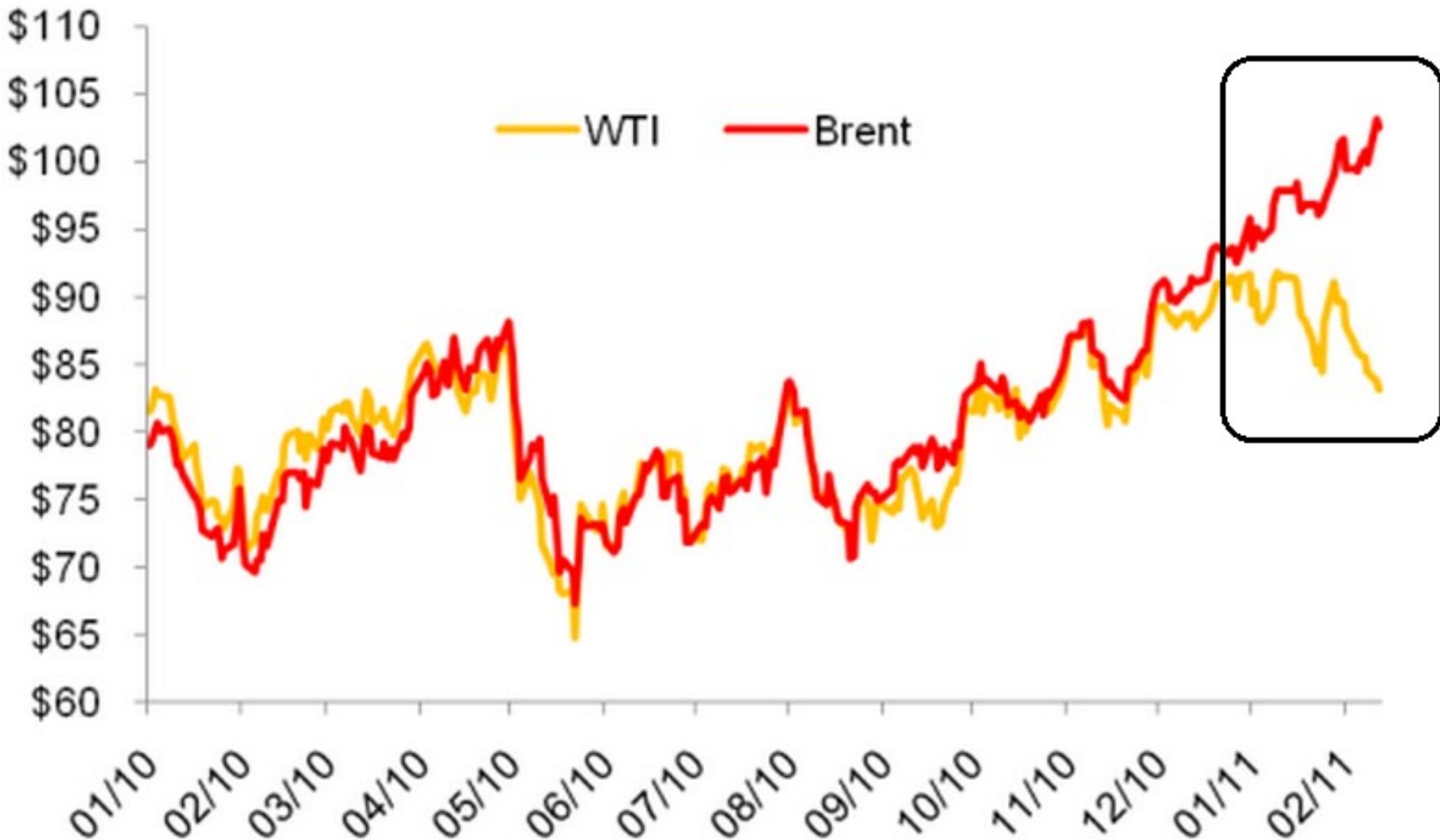Brent Crude Oil / Light Sweet Crude Oil (WTI)

BACKGROUND

The Brent-WTI spread is the difference between the prices of two types of crude oil, Brent Crude (Brent) and West Texas Intermediate (WTI) .

Brent blend is a light crude oil (LCO), though not as light as West Texas Intermediate (WTI). It contains approximately 0.37% of sulphur, classifying it as sweet crude, yet not as sweet as WTI. Brent is suitable for production of petrol and middle distillates. It is typically refined in Northwest Europe. Brent is the leading global price benchmark for Atlantic basin crude oils. It is used to price two thirds of the world's internationally traded crude oil supplies.(1)

West Texas Intermediate (WTI), also known as Texas light sweet, is a grade of crude oil used as a benchmark in oil pricing. This grade is described as light because of its relatively low density, and sweet because of its low sulfur content. It is the underlying commodity of Chicago Mercantile Exchange's oil futures contracts. The price of WTI is often referenced in news reports on oil prices, alongside the price of Brent crude from the North Sea.(2)

As both oils are very similar, their spread has a tendency to oscillate around some average value. It is therefore possible to use deviations from the fair spread value to bet on both divergence from and convergence back to fair value. The fair spread value could be calculated via moving average, regression, neural network regression or other statistical applications.
The spread is generally mean reverting because most of the price shocks are only temporal so the spread moves back to its long term economical equilibrium and therefore it is possible to create a trading strategy based on this mean reversion.

Sometimes there is money to be made from the difference in the spread!

CME contract specifications

Product Symbol	BZ	
Venue	CME ClearPort, CME Globex, Open Outcry (New York)	
Hours (All Times are New York Time/ET)	CME Globex:	Sunday – Friday 6:00 p.m. – 5:15 p.m. (5:00 p.m. – 4:15 p.m. Chicago Time/CT) with a 45-minute break each day beginning at 5:15 p.m. (4:15 p.m. CT)
	CME ClearPort:	Sunday – Friday 6:00 p.m. – 5:15 p.m. (5:00 p.m. – 4:15 p.m. Chicago Time/CT) with a 45-minute break each day beginning at 5:15 p.m. (4:15 p.m. CT)
	Open Outcry:	Monday – Friday 9:00 AM to 2:30 PM (8:00 AM to 1:30 PM CT)
Contract Unit	1,000 barrels	
Price Quotation	U.S. Dollars and Cents per barrel	
Minimum Fluctuation	$0.01 per barrel	

(3)

Product Symbol	CL	
Venue	CME Globex, CME ClearPort, Open Outcry (New York)	
Hours (All Times are New York Time/ET)	CME Globex	Sunday - Friday 6:00 p.m. - 5:15 p.m. New York time/ET (5:00 p.m. - 4:15 p.m. Chicago Time/CT) with a 45-minute break each day beginning at 5:15 p.m. (4:15 p.m. CT)
	CME ClearPort	Sunday – Friday 6:00 p.m. – 5:15 p.m. (5:00 p.m. – 4:15 p.m. Chicago Time/CT) with a 45-minute break each day beginning at 5:15 p.m. (4:15 p.m. CT)
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(4)

Financial Market Theory

A spread is like almost all other financial market or economic time series data in that they can be classified as <u>stochastic processes</u> which are characterised as an evolution of random adding and subtracting of values(y axis) as time(x axis) progresses.

Additionally, a second important term to appreciate is <u>stochastic drift</u>, which is the change of the average value of a stochastic (random) process. But what time period do we use to calculate this average value?

This is where financial market theory, understanding and proprietary modelling becomes very valuable.

Themes to consider:
• Markets are non-linear and have to be modelled as such
• Financial market time series data (decade+ to intra-day tick data & HFT environment)
• Stochastic processes
• Stochastic drift
• Volatility, Variance, Probability distributions
• Deviation, Mean, Non-linear dynamic upper & lower bounds, boundary creep
• Noise, Trending environment, Mean reversion, Regime switching/change
• Fractal market structure (Because markets are fractal and thus scale in-variant, a robust model should be capable of being run across any time scale and produce valuable information on market strength or weakness. This in conjunction with information on all the other selected time scales, should pinpoint tighter trade entries in the "wholesale" region of the larger stochastic drift).
• Quantity(price) is either trending away or mean reverting (but simultaneously across all time horizons, sometimes all in harmony or at varying degrees of both harmony and conflict)
• Modelling aims to find compatible time horizons where signals are produced in a complete framework that captures your specific market activities and objectives.
• Suitable tools to build a model that captures what you actually want to capture
• Past performance of signals and back testing
• News, Events and Fundamentals can give us "trade leads", but the model will always dictate whether a trade is taken and at what relative values.
• Technology infrastructure, Hardware, Software, Platforms, Order routing, Latency

Objectives

• Formulate a financial time series model that captures relative strength and weakness (at all chosen time scales) in the BRENT/WTI crude oil spread.

• The model should model the stochastic nature of the spread and produce trading signals that offer low risk trading opportunities i.e. on the "wholesale" side in same the direction of the primary stochastic drift.

• We are looking for similar repeatable market conditions and set-ups.

• The model should be robust when looking at past data (back testing(whether it be 100% systematic or semi-systematic/discretionary)) and also in any walk-forward optimization or Monte Carlo analysis.

## Historical Brent & WTI raw price data relationship
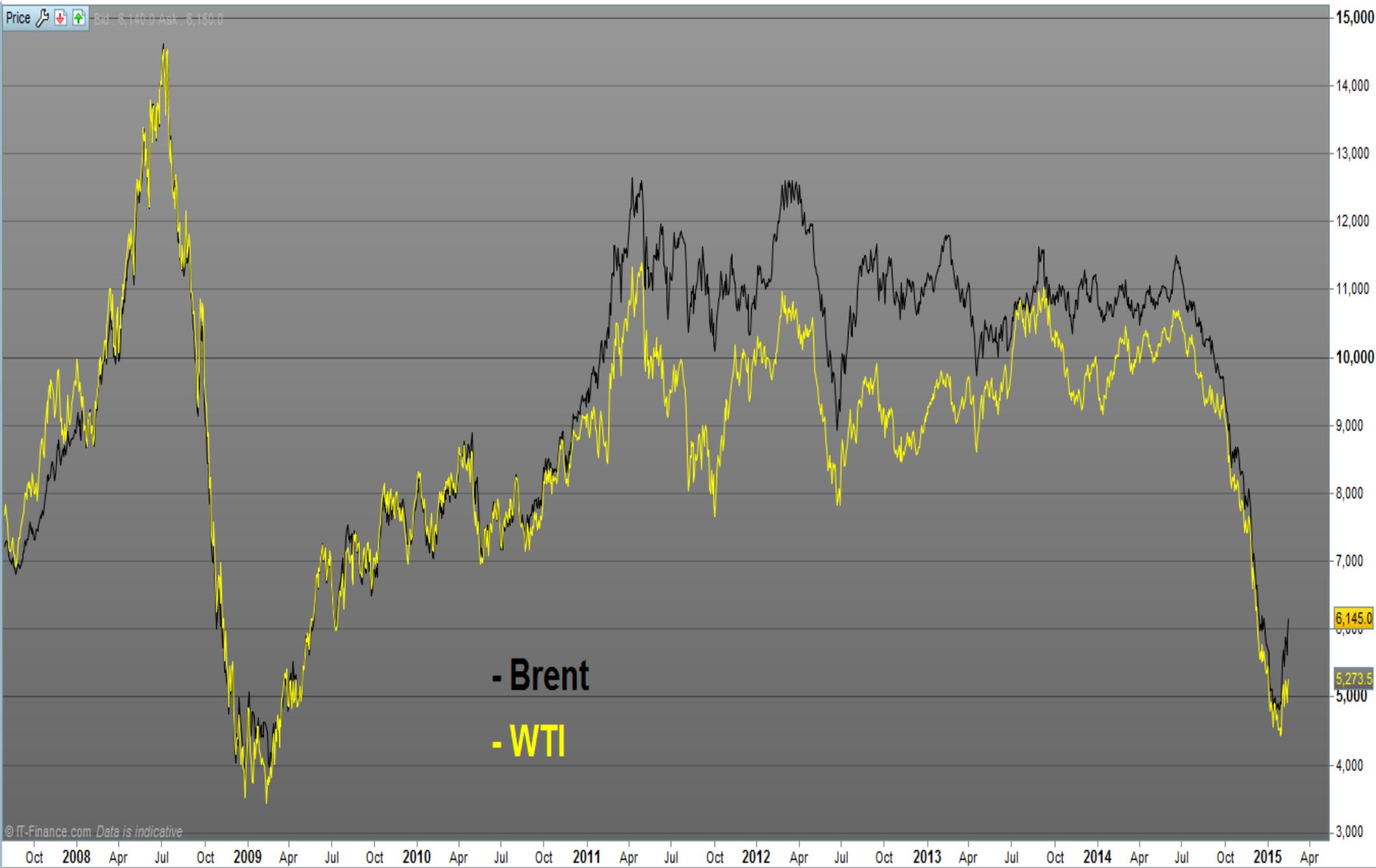
- Brent
- WTI

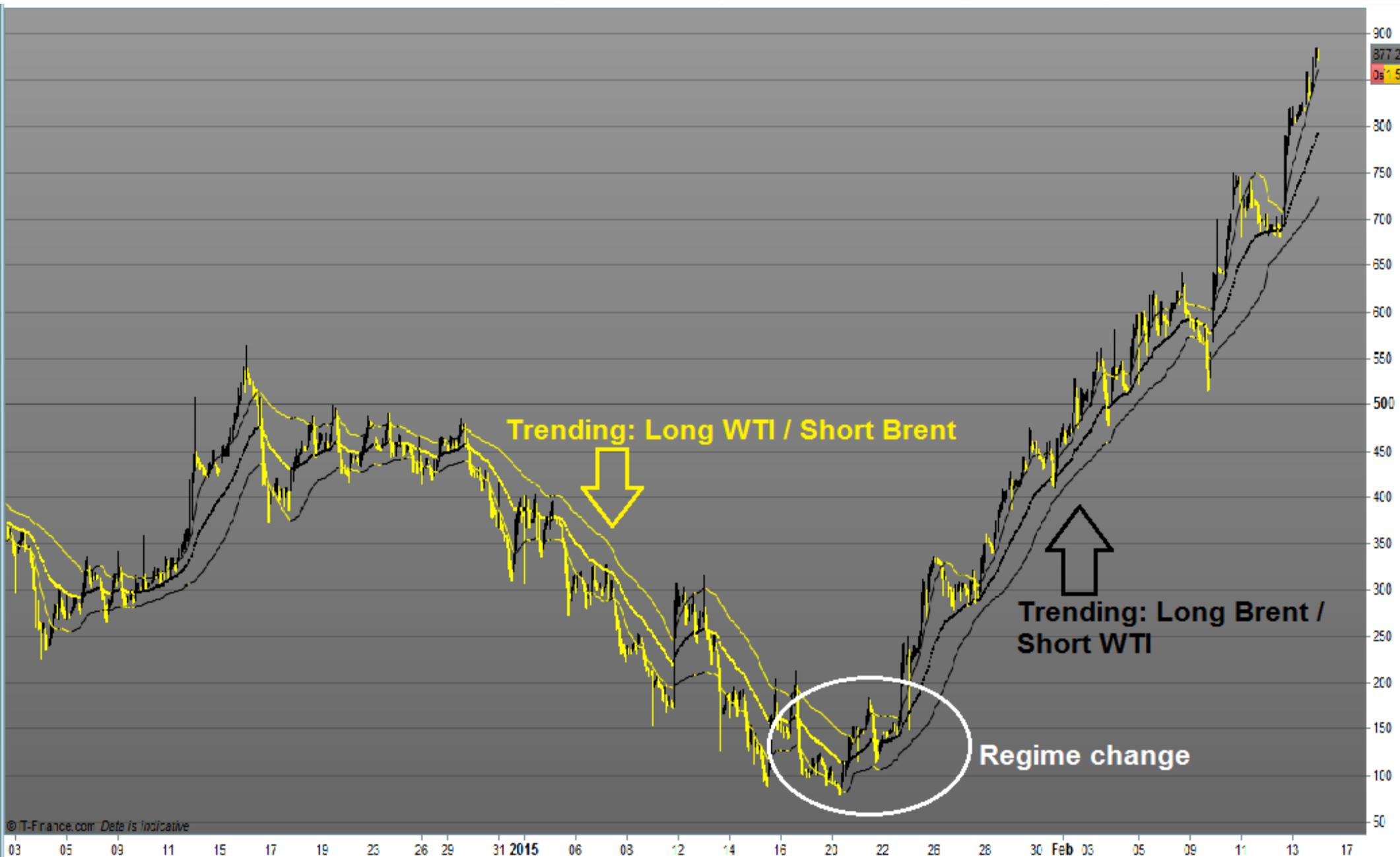The Brent / WTI spread data going back to 2008
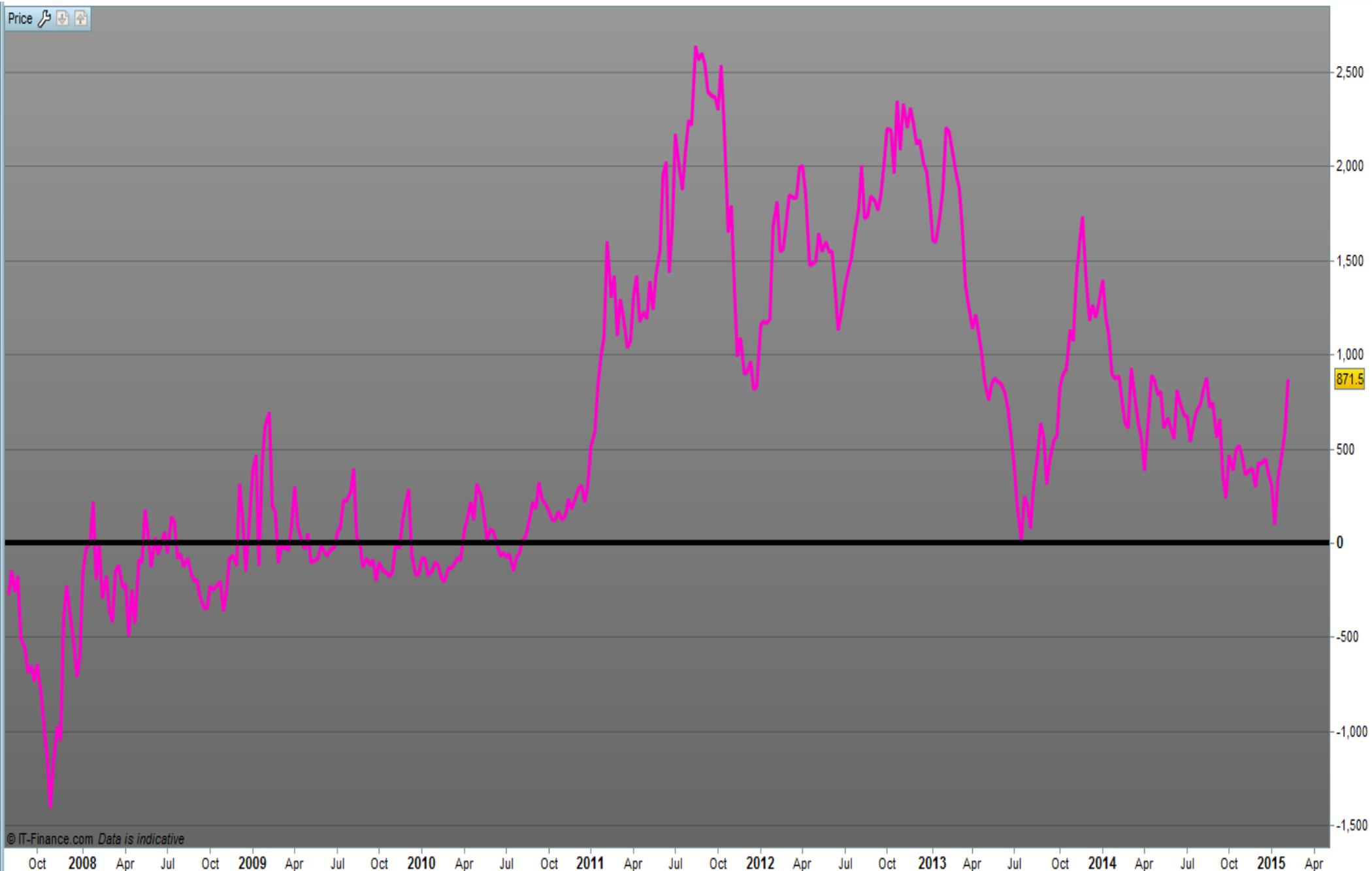
Our proprietary model run across weekly data showing examples of trading signals. Broadly speaking, **BLACK** represents Brent strength and corresponding WTI weakness. Whereas YELLOW represents WTI strength and corresponding Brent weakness. The central dotted line is the stochastic drift of the model. Dynamic trending Upper and Lower "bounds" then complete the "stochastic zone". A complete week of trading data is complied into a single proprietary weekly range bar that in a series accumulates to form trends or reversals as per the parameters of the model.
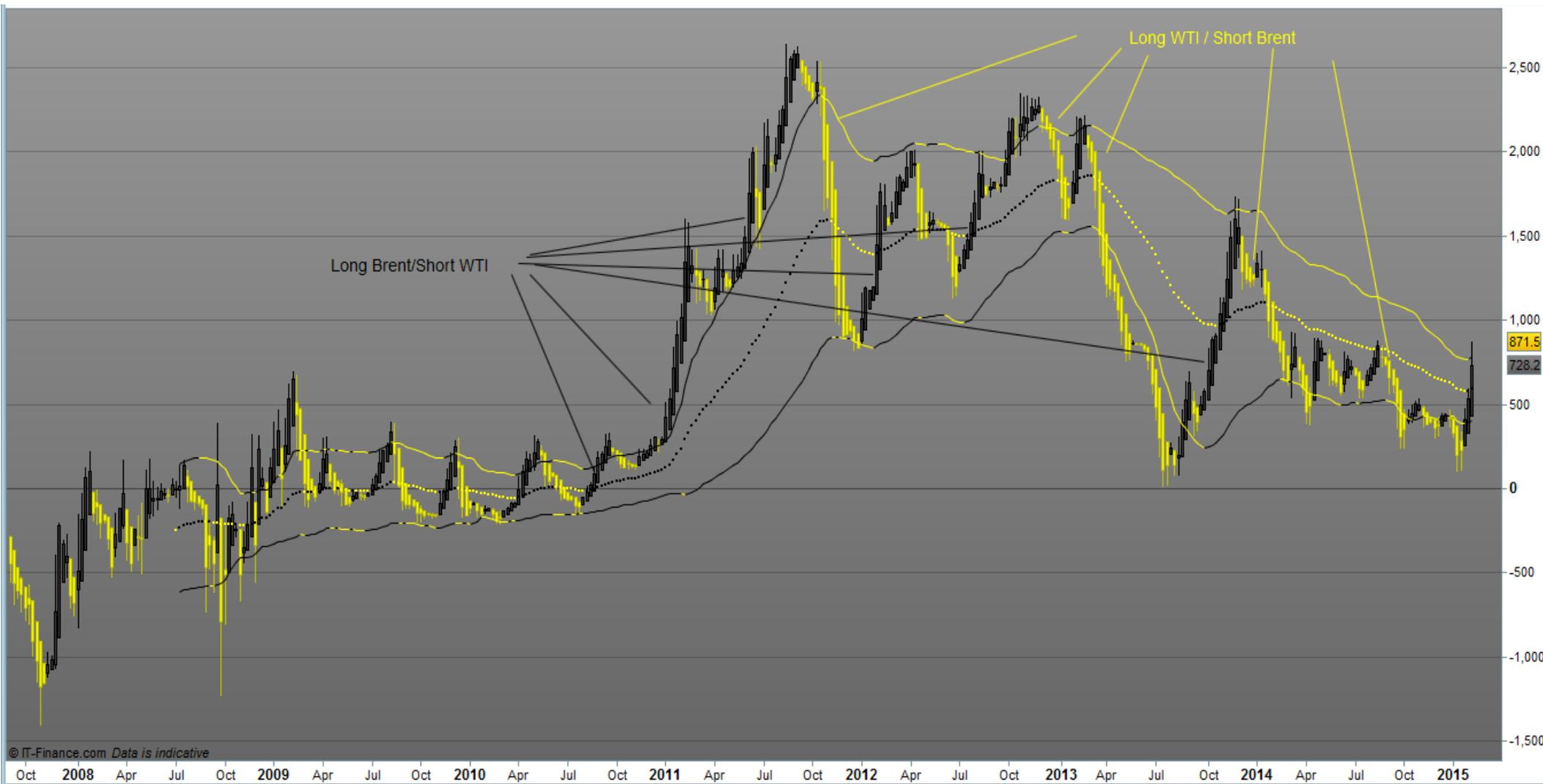
Because of the fractal nature of financial time series data, the same model should be able to, and in this case is, run across lower time scales: here- daily data and examples of trading signals.

Long WTI/Short Brent

Long Brent/Short WTI

© IT-Finance.com *Data is indicative*
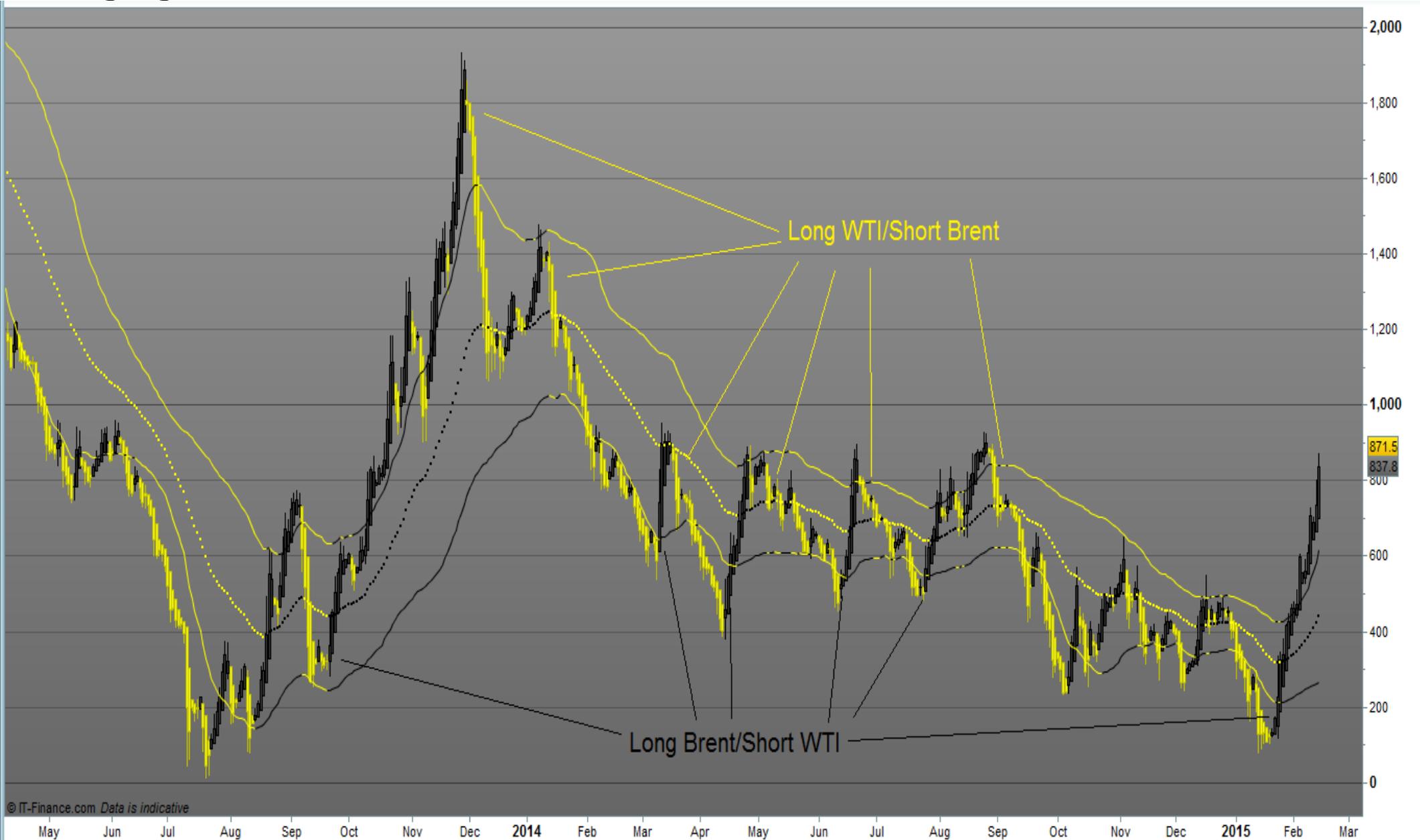
Again, the same model ran across hourly data. This really shows how the model can capture trends in the spread and also the occurrence of high probability rotation areas(regime change).

Trending: Long WTI / Short Brent

Trending: Long Brent / Short WTI

Regime change

For actual trade entries on the hourly data.

Entries:
Wait for the spread to pull back into the lower "Wholesale" zone and go long in the direction of the stochastic drift. In these examples initiate a long position in Brent and a short one in WTI.

This shows the fractal nature of stochastic process modelling and how the same model works across multiple time-horizons, and in union provides complimenting signals to take a trade or conflicting signals to not take the trade. In this example, all time horizons are in agreement of Long Brent/Short WTI.

Final thoughts..

• This proprietary model has been designed as a semi-systematic, but ultimately discretionary trading model that aims to capture large chunks of the movement in the Brent/WTI Crude oil spread.

• The model can be used to trade on a weekly, daily, hourly or tick basis. Therefore multi-month or intra-day positioning is completely viable.

• Because of the robust nature of this model, it could be run across various other spreads in different markets with very positive results.

• A model and it's signal producing capabilities are not enough on their own. A robust capital and risk managing trading structure is required for each trade and overall account management.

• This must also take into account commissions, margin and any financing requirements.

• Model performance should be constantly monitored, analysed, evaluated and refined where possible.

• Volume and Order flow has not been included in this model but can easily be added as an additional filter.

This particular Proprietary model was devised using ProRealTime v10.2

We also model using Bloomberg, Reuters, Matlab, Excel
and all models can be configured within them.

Appendix.

(1) http://en.wikipedia.org/wiki/Brent_Crude
(2) http://en.wikipedia.org/wiki/West_Texas_Intermediate
(3) http://www.cmegroup.com/trading/energy/crude-oil/brent-crude-oil-last-day_contract_specifications.html
(4) http://www.cmegroup.com/trading/energy/crude-oil/light-sweetcrude_contract_specifications.html

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