

Discussion of:

DO ASSET PRICES REFLECT FUNDAMENTALS?:
FRESHLY SQUEEZED EVIDENCE FROM THE FCOJ
MARKET

*by Jacob Boudoukh, Matthew Richardson, YuQing Shen and
Robert Whitelaw*

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Discussant:

Kent Daniel

Kellogg - Northwestern & NBER

MOTIVATION & FINDINGS

- In Roll's (1984) Orange Juice Futures paper, and the Roll (1988) presidential address "R-Squared", he documents the puzzling inability of direct information measures to explain contemporaneous price changes.
- In the FCOJ paper, while Roll finds that it is difficult to explain much of the futures price movements.
 - The authors note that, "With respect to temperature surprises,... he documents a statistically significant one set of Roll's regressions looking at temperature surprises yields R^2 s between 1 and 4%.
- The authors argue that this paper, as one of the "precursors of the excess volatility literature" has "become somewhat of a lightning rod for the behavioral literature."
- The authors therefore explore whether the results in Roll's paper are a result of misspecification:

"... these regressions, and for that matter the majority of the aforementioned excess volatility studies, are performed in a linear framework. In contrast, agricultural theory tells us that temperature surprises will only have a significant impact on orange production around freezing temperatures....The regression is misspecified; therefore, a low R^2 provides little or no evidence against market inefficiency."
- They find that:

"When we are confident that we can identify the fundamental information from theory (i.e., temperatures near or below freezing) *we show that the weather has a highly nonlinear and substantial effect on futures prices.*"

WHY ORANGE JUICE?

The basic idea here is that, since:

$$P_t = E[\tilde{m}_{t,\tau} \tilde{Y}_\tau | \Omega_t]$$

In simple markets, there should be a relatively simple mapping between some small set of "fundamental information" ($\mathbf{x}_t \in \Omega_t$) and the expected payoffs. Assuming m and Y are uncorrelated:

$$P_t = \frac{1}{R(t, \tau)} E[\tilde{Y}_\tau | \Omega_t] = f(\mathbf{x}_t)$$

and over short time periods:

$$\begin{aligned} P_t - P_{t-1} &= f(\mathbf{x}_t) - f(\mathbf{x}_{t-1}) \\ &\approx \nabla f(\mathbf{x}_t) \cdot \Delta \mathbf{x}_t \end{aligned}$$

we should be able to link price movements directly to the arrival of new information.

Conclusion generally drawn from this paper is that, no matter how much fundamental information you throw in, you can't explain that large a fraction of the fundamental price movements.

- What could this mean?:
 1. "animal spirits" are moving the price around.
 2. We aren't seeing the fundamental information (the \mathbf{x}) that is changing $E[Y]$ and moving the price around
 3. We haven't searched hard enough to find the right $f(\cdot)$.
- The authors here argue that 3. is the culprit.

WHY ORANGE JUICE?

Roll argues that the FCOJ market is a good market to look at because this mapping should be relatively straightforward (or as straightforward as it gets!)

1. Geographical Concentration:

- 98% of US production is (was) in central Florida, around Orlando.

2. Stable Commodity:

- "national income and taste probably do not fluctuate enough to explain a significant part of the daily OJ price movement."

3. Other Effects should be minimal:

- For example, "Oranges grow on trees that require five to 15 years to mature."

4. Also, at some level, we perhaps expect the traders in these contracts to be pretty rational.

Roll argues that high frequency price movements should be almost exclusively a result of supply shocks, which should mostly result from unexpected changes in the temperature in Orlando.

ROLL'S FINDINGS ON FSOJ FUTURES

1. Monday effect and January effects in mean returns (as in French (1980) and Keim (1983)).
2. Weekend variance lower than weekday variance:
 - "The ratio of Monday's to the average of the other days' variances is about 1.54." (Should be 3 – as in French and Roll (1986)).
 - Post-holiday returns are also low.
3. Lagged futures return is a statistically significant predictor of the *error* in the weather forecast the minimum temperature later that evening.
4. There is substantial return volatility even on days when there is apparently no news.
5. The majority of the variability appears unexplained, for returns or squared-returns.
6. Equity data return suggest that supply shocks, not demand shocks drive movements in future prices:
 - Stock returns of OJ producers (and orange growers) not statistically related to futures returns (or negatively, for Tropicana).
 - Stock returns of substitute producers positively covary with futures returns.
 - Norton Simon (complement?).

ROLL'S FINDINGS ON FSOJ R^2 S

- Roll's Table 10 shows the R^2 achievable in forecasting FSOJ returns and squared-returns:

TABLE 10— T -STATISTICS OF EXPLANATORY FACTORS FOR OJ RETURNS, NO CONSIDERATION OF LIMIT MOVES, DAILY DATA, OCTOBER 1975–DECEMBER 1981

Explanatory Variable	Dependent Variable	
	OJ Return	Squared OJ Return
Max ($32 - T_{-1}, 0$) ^a	5.40	7.99
Max ($32 - T_{-0}, 0$)	3.69	8.09
(Oil Stock Return) ₋₁ ^b	-.618	.385 ^g
(Oil Stock Return) ₀	.624	2.11 ^g
(VW Market Return) ₋₁ ^c	.525	-1.05 ^g
(VW Market Return) ₀	-.120	-1.53 ^g
(Δ CDN exch. Rate) ₋₁ ^d	-.417	-.759 ^g
(Δ CDN exch. Rate) ₀	.577	.938 ^g
Monday ^e	-2.18	4.23
Weather-Related News Story ^f	–	9.36
Crop Forecast News Story ^f	–	3.35
Supplies or Int'l News Story ^f	–	-.563
Miscellaneous News Story ^f	–	-1.47
Multiple Adjusted R^2	.0668	.268
F -Statistic for Regression	13.4	45.0
Durbin-Watson	1.81	1.39
Number of Observations	1,559	1,559

^a T_t is the minimum temperature at Orlando on day t .

^bReturn on an equally weighted portfolio of oil stocks listed on the NYSE and the AMEX, consisting of up to 45 firms. The sample consisted of all listed oil firms covered in the 1982 *Value Line* service.

^cValue-weighted index of all NYSE and AMEX stocks.

^dPercentage change in the Canadian/U.S. dollar exchange rate.

^eDummy variable; 1 if Monday, 0 otherwise.

^fDummy variable; 1 if news story in this category in the *Wall Street Journal* on day t or $t + 1$, zero otherwise.

^g T -statistic for the squared explanatory variable.

About this Table, Roll says: "Finally, notice that only 27% of the variability in squared OJ returns is explained by all of these variables combined. Most of the variability remains unexplained."

RETURN VARIANCE ON NO-NEWS DAYS

- Roll's Table 9 argues that, while big price variability results from weather, and some price variability results from news, there is still substantial variability on no-news days.

TABLE 9—VARIABILITY OF OJ FUTURES RETURNS ON DAYS WITH NEWS ABOUT ORANGE JUICE IN THE *WALL STREET JOURNAL*, OCTOBER 1975–DECEMBER 1981

	No News (1)	Weather (2)	Crop Forecast (3)	Supplies, Antitrust, International (4)	Miscellaneous (5)
Standard Deviation of Returns	1.53 (1361)	2.86 (64)	2.01 (60)	1.97 (34)	1.37 (34)
Levene's Test for Equal Variances ^a	<u>Comparisons Among</u>			<u>F-Statistic</u>	<u>Tail Probability</u>
	Cols. (1)–(5)			22.5	0.0000
	Cols. (1), (3), (4), (5)			9.83	.0018
	Cols. (2), (3), (4)			8.99	.0033

Notes: Standard deviation of returns are shown in percent per day, with sample size shown in parentheses; returns on an equally weighted index of the second and third from the shortest maturity contracts on the day of the news story and on the two preceding trading days.

Sample sizes are smaller than the number of possible days because of overlapping dates among articles. For overlapping dates, returns were assigned hierarchically to category (2) (Weather) first, then to categories (3), (4), and (5), respectively.

^aSee Brown and Forsythe.

FROM THE CONCLUSION

"In our opinion, it was the apparent lack of a strong link, as suggested by a low R^2 , that made the FCOJ market such a prominently cited example of excess volatility. Now that we have successfully addressed this issue, it will be tempting for behavioral economists to argue that the real volatility puzzle for FCOJ returns is volatility during times other than freezes. Of course, all assets – other commodities, equities, and bonds, among others – exhibit some volatility throughout the year...

...it is not surprising, at least to us, that equity return cannot be explained, even using ex post information. In our opinion, the literature has been too fast to embrace market irrationality as an explanation for perceived excess volatility

At the very least, we hope we have made the point that the case for irrationality needs to involve much more than an examination of results from linear regressions.

OTHER POSSIBLE TESTS

- In general, what we care about is whether agents are optimizing.
- Asset pricing models are the FOCs from optimization problems. If the predictions of a *correctly specified* asset pricing model is violated, this means that agents aren’t optimizing.
- Contrary to what is implied in this paper’s Introduction, this result is not “lightning rod” driving all interest in behavioral finance:
 - To my mind, the key thing we need to explain is the Sharpe Ratios of various portfolio strategies:¹

Port.	MKT	SMB	HML	MOM	LIQ ^V	Sharpe Ratio
1	100.00	—	—	—	—	0.12
2	35.08	5.83	59.10	—	—	0.22
3	20.05	16.07	43.03	20.85	—	0.33
4	17.70	20.62	34.23	11.86	15.59	0.37

- Using Hansen and Jagannathan (1991) like arguments, this implies really volatile pricing kernels:

$$\frac{\sigma_{m,t}}{E_t[\tilde{m}]} = \frac{1}{\rho_{m,r,t}} \frac{E_t[(\tilde{r}_i - r_f)]}{\sigma_{r,t}}$$

$$\frac{\sigma_{m,t}}{E_t[\tilde{m}]} \geq \frac{E_t[(\tilde{r}_i - r_f)]}{\sigma_{r,t}}$$

¹Taken from Pastor and Stambaugh, 2001, Table 10-A.

OTHER POSSIBLE TESTS

- The only reason we care if there is excess volatility is because true "excess" volatility implies return predictability.
 - See Cochrane (1991).
- Assuming this predictability is not related to risk, this in turn implies the existence of a trading rule that generates abnormal returns, and high Sharpe ratios.
- If the unexplained volatility here really is unrelated to fundamentals, it implies that price movements are predictable.
 - If the unexplained price movements don't reflect changes in the expected future spot price will be reversed.
 - However, if the unexplained price movements *do* reflect real information, then the price changes will be permanent.
- An interesting avenue to explore would be to see whether the price movements which can't be linked to fundamentals are indeed reversed.
- One issue here will be test power:
 - Can either of the two nulls be rejected?:
 1. the unexplained movement is all permanent
 2. the unexplained movement is all temporary.

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