Discussion of:

# "Fuel is Pumping Premiums: A Consumption-based Explanation of the Value Anomaly"

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# The paper in a nutshell

**Theory:**

- Utility à la Epstein-Zin (1989), but with period "consumption" flow

$$u_t = \left[\sum_i^M a_i B_{i,t}^{1-\eta^{-1}}\right]^{\frac{1}{1-\eta^{-1}}} \quad \text{where} \quad B_{i,t} = \sum_{j \in S_i} C_{j,t}$$

i.e.: i) <u>constant</u> elasticity of substitution ($\eta$) across bundles; ii) goods in the same bundle ($S_i$) are perfect substitute ($\eta \to \infty$);

Recall: at optimum, ratio of marginal utilities = ratio of prices.

- Thanks to homogeneity of EZ, (log) relative consumption of bundles, and relative prices of goods in them, are perfectly correlated

$$b_{j,t} - b_{k \neq j,t} = \eta \left(p_{i \in S_j,t} - p_{m \notin S_j j,t}\right) + k_{S_j, S_{k \neq j}},$$

and for goods in the same bundle relative prices are constant.

⇒ criteria for i) identify bundles ii) (over) identify $\eta$ in the data.

**Empirics:**

1. Select the "best" number bundles (using 6 "goods") and estimates $\eta$
2. linearize (!) SDF and do x-sectional AP ⇒: energy/fuel consumption is priced, and related to value premium.

# Itch #1: model selection

To choose the consumption bundles, the authors, for each possible model:

1. estimate GMM for (log) bundles/prices relations (Dynamic OLS).

$$\#\text{moments} = \binom{N}{2} \times 9, \quad \#\text{parameters} = \binom{N}{2} \times 8 + 1 \qquad (1)$$

2. select model with lowest variance of residual errors (Q-LIKE or RMSE) of (log) bundles/prices relations.

But:

$$\#\text{ over-identifying restrictions} = \binom{N}{2} - 1$$

**!** selection biased toward selecting smaller $N$ (harder to fit bundles/prices whit more moments to fit cf. $R^2$ vs. $\bar{R}^2$).

$\Rightarrow$ model selection should reward fit & penalize using fewer moments.

Example: Andrews (1999) moment selection criteria (BIC, AIC etc.) for GMM (applicable to your setting!)

# Itch #2: GMM moment function

- Estimation based on time series moments ⇒ GMM (as used in the paper) requires large T (i.e. $T \to \infty$) relative to # moments.
- Ideally, $\frac{\#mom}{\sqrt{T}} \to 0$.

$T =$ 280 Quarters, 70 Years

$N = 6 \to \#mom = 135, \frac{\#mom}{\sqrt{T}} = 8.06 - 16.1$

$N = 5 \to \#mom = 90, \frac{\#mom}{\sqrt{T}} = 5.37 - 10.75$

$N = 4 \to \#mom = 54, \frac{\#mom}{\sqrt{T}} = 3.32 - 6.45$

$N = 3 \to \#mom = 27, \frac{\#mom}{\sqrt{T}} = 1.16 - 3.22$

$N = 2 \to \#mom = 9, \frac{\#mom}{\sqrt{T}} = 0.53 - 1.07$

... and degree of over-identification (that also increases in $N$) worsen reliability further (e.g. Hall (2004)).

But: you don't need so many moments! Your theory implies just $\binom{N}{2} \times 2$ moments, i.e. 30-2 moments only! (the OLS ones, with same degree of over-identification)

- Do results still hold just with the theoretical moments? If not...

# Itch #3: linearized SDF

- They have a nice model with clearcut inter-temporal Euler equation for cross-sectional asset pricing...

But instead estimate a linearized SDF without parameter restrictions.

$\Rightarrow$ makes results unconvincing, and opens the floodgates of weak/spurious factor inference.

Note: energy betas violate monotonicity in Value and Size sorting 7 out of 10 times... yet *seems* priced even alone... but no robust estimator...

But: straightforward to estimate the non-linear Euler equation by either:

1. replacing the return on wealth with the market return – that's what you do anyway in the linearized version!
2. since you assume anyway complete markets, linearizing the budget constraint $W_{t+1} = R^w_{t+1}(W_t - C_t)$ to get

$$r^w_{t+1} = k_0 - \Delta cay_{t+1} + \Delta c_{t+1} + k_1 cay_t$$

3. using fancier econometrics (change of measure + GEL à la Ghosh, Julliard & Taylor (2016), latent variable non-linear filtering etc.)

Also: should also perform bundles selection using the asset pricing (non-linear) Euler equation, and show that the results are consistent $\Rightarrow$ i) validation, ii) asset returns help a lot in learning about consumption (adapted to same wealth shocks, e.g. Bryzgalova-Julliard (2018))

# Other itches

- #4 to explain the mechanism you say:
  *"[...] negative oil [price] supply shocks such as the 1973-74 oil crisis hit households and firms simultaneously. Households have high marginal utility in these periods, since they cannot substitute energy consumption by other forms of consumption."*
- But: Chen, Roll and Ross (1986) did test that hypothesis and concluded:
  *"[...] The oil betas were insignificant for pricing in the overall period [...] The risk associated with oil price changes was not priced in the stock market during the critical 1968-77 subperiod, when the OPEC cartel became important (or in later subperiods)"*
- # 5 Standard errors of cross-sectional asset pricing are mechanically wrong, since they don't include the uncertainty coming from the selection of the consumption bundles.
- # 6 Weighting matrix matters for over-identified GMM, but you never said what you use! (if efficient, #2 gets even worse)
- # 7 how did you come up with 3 leads/ 3 lags in the Dynamic OLS specification? Sensitivity?

# In summary

I like the paper quite a bit, and I'm very sympathetic to the research question (but I'm a biased reader).

Scorecard:

(+) Taking seriously that canonical "consumption" is a linear aggregate, and that that makes sense only under prefect substitutability.

(+) Elegant formalization: good tradeoff between tractability and realism (albeit constant $\eta$... but better than statu quo)

(-) I need more convincing wrt to the selection/estimation of bundles.

(-) Nice model, but they do not estimate it, nor use its restrictions $\Rightarrow$ not sure whether the evidence really supports the model, and have concerns about weak/spurious factor type results.

(-) empirics need polishing; bundles selection, and elasticity estimates, should be confirmed when using asset pricing Euler equation.

(+) I like the results based on textual analysis, but again it's only very indirect evidence in support of the consumption framework.

$\Rightarrow$ sympathetic, but tough, R&R