The Zero-Beta Interest Rate

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Question

- What is the correct intertemporal price of consumption?
  - What nominal riskless rate would you require to postpone your upcoming vacation to next year?
  - Would 5% do it?
  - How about 12%?

What this paper wants to do

1. Estimate asset betas

$$R_{it+1} - R_{0t} = \alpha_i + \sum_{j=1}^{K} \beta_{ij} F_{jt+1} + \varepsilon_{it+1}$$

2. Choose a zero-beta portfolio p with weights w that sum to one

$$w'\beta = 0$$

3. Estimate the zero-beta rate as a linear function of instruments Z_t

$$\underbrace{w'R_{t+1}}_{R_{pt+1}} = \underbrace{\gamma' Z_t}_{R_{0t}} + u_{t+1}$$

- A challenge is this is circular

What this paper does

- GMM estimator to simultaneously solve for factor loadings α, β and zero-beta rate coefficients γ

$$g_{t+1}(\alpha, \beta, \gamma) = \begin{bmatrix} [R_{t+1} - \alpha - (1 - \beta_1)\gamma' Z_t - \beta_1 R_{m,t+1} - \beta'_{2..K} F_{t+1}] \otimes F_{t+1} \\ [I_N - \beta\beta^+](R_{t+1} - \iota\gamma' Z_t) \otimes Z_t \end{bmatrix}$$

- Use a carefully chosen GMM weight matrix that makes an exactly identified system that guarantees

$$\text{Zero-beta portfoilo} = \text{Minimum variance unit-investment portfolio}$$

- Take to data on standard portfolios of stocks and factors
- Intuitive instruments Z_t: T-bill yield, inflation rate, term spread, excess bond premium, and unemployment rate
  - Nests the usual assumption that the T-bill yield is the zero-beta portfolio

Main findings

1. Zero-beta rate is high and volatile
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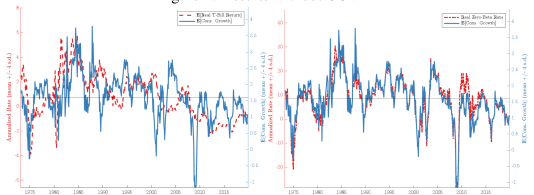
2. Zero-beta rate fits the aggregate consumption Euler equation with an IES$\in [0, 0.5]$

$$E_t\left[\Delta c_{t+1}\right] \approx \sigma^{-1} \log \delta + \sigma^{-1}\left(r_{0,t} - E_t\left[\Delta P_{t+1}\right]\right)$$

Figure 2: Results without COVID

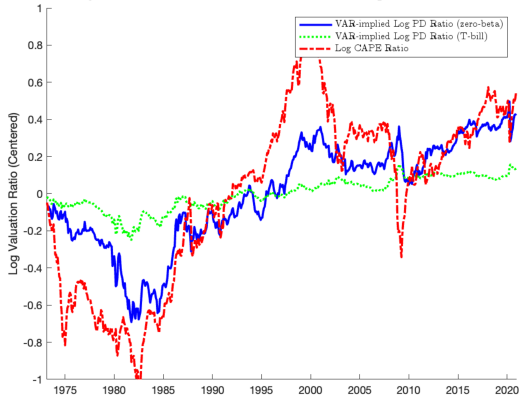


Main findings

1. Zero-beta rate is high and volatile ($8.3\% \pm 9.3\%$ per year)
2. Zero-beta rate fits the aggregate consumption Euler equation with an IES$\in [0, 0.5]$
3. Zero-beta rate is volatile and persistent enough to explain market returns and P/D volatility even without a risk premium

$$E_t\left[pd_t\right] \approx \left(\sigma^{-1} - 1\right) \gamma_0' \left(I - \rho\Phi\right)^{-1} Z_t + cons.$$

Figure 6: Predicted Valuation Ratio of a Consumption Claim



Contribution

- Zero-beta portfolio fix dates back to Black (1972)
- Equity-premium puzzle has long been understood to be simultaneously a Risk-free rate puzzle (e.g, Cochrane, 2005, Ch. 21)
- Current paper:
  - provides a time-series of the zero-beta rate
  - shows it fits the aggregate consumption Euler equation
  - zero-beta rate is volatile and persistent enough to explain market returns and P/D volatility even without a risk premium

Suggestion 1: Which frictions?

- Paper avoids saying much about which friction generates the treasury convenience yield
- Provides an example model where treasuries and money are mispriced, but stocks and consumption are priced as usual
- But more generally, frictions can generate

$$E_t \left[M_{t+1} R^e_{t+1} \right] = \lambda$$

- If the treasury specialness comes from intermediary constraints like bank regulation, can you still thread the needle?
- Black (1972) suggested treasury-based leverage is at a corner

Suggestion 2: Zero-beta portfolio

- There are many zero-beta portfolios
- Paper focuses on one with weights that sum to one
- $w'\beta = 0$, $w'\iota = 1$
- Questions:
  1. Is it a feasible portfolio? Are the weights reasonable?
  2. Is a zero-beta portfolio constructed at time t, actually zero-beta out-of-sample?[1]

[1] Keloharju-Linnainmaa-Nyberg-Mikael (2021 JFE) find discount rates do not vary across firms. Dessaint-Olivier-Otto-Thesmar (2021 RFS) find similar result for firm projects.

Suggestion 3: Formal tests for γ

Table 1: Constructing the Zero-Beta Rate

	(1) GMM	(2) OLS (inf.)
RF	2.747	2.747
	(0.706)	(0.686)
UMP	0.0629	0.0629
	(0.0820)	(0.0818)
EBP	-0.993	-0.993
	(0.256)	(0.238)
TSP	0.297	0.297
	(0.0966)	(0.0958)
CPI_Rolling	-2.196	-2.196
	(0.909)	(0.875)
Constant	1.002	1.002
	(0.112)	(0.111)
Wald/F	35.74	8.125
p-value	1.1e-06	2.0e-07
RMSE		2.671
Observations	574	574

Standard errors in parentheses

- Neat that the traditional t-bill = zero-beta rate model is nested

$$R_{0,t} = \gamma_0 + \gamma_1 R_{treasury} + \boldsymbol{\gamma}'_{other} Z_t$$

- Why not test the hypothesis that $\boldsymbol{\gamma} = 0$?
- Maybe show the model with $\boldsymbol{\gamma} = 0$ too

Suggestion 4: What about risk premia?

- Risk prices ω_j are not identified by the GMM moments included
- Perhaps that belongs in another paper, but to me that one is somewhat more interesting
- Cochrane (2005, Ch 11.6), advocates estimating on one group of moments, testing on another
- Paper already does this, when testing the Euler equation for the Zero-beta rate
- But why not use the Euler equation for risky asset excess returns?
  - Is there an improvement in pricing errors?
  - Does the EIS admissible region change?

My Take

- Fundamental textbook-worthy contribution
- Shows that an empiricist armed with strong instruments can better measure the riskless rate that is relevant for equity holders
- Subsequent literature should study excess returns relative to the zero-beta rate (data is homepage worthy)

Appendix / Minor Comments

- Choice of ρ and σ for Figure 6 could be better disciplined with data.
- Perhaps explain which moments are targeted, give non-rejection ranges, and do some robustness within them.
- Can you interpret the $\gamma_0' \left(I - \rho\Phi\right)^{-1} Z_t$ term in (19) as a long-term expected zero-beta rate? If not, giving it a name would help the exposition.