How Much Would You Pay to Resolve Long Run Risk?

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Bansal (2007): *Several key features of asset markets are puzzling.* Among others, these include the level of equity premium, asset price volatility, and the large cross-sectional differences in average returns across equity portfolios such as value and growth portfolios. In bond and foreign exchange markets, the violations of the expectations hypothesis and the ensuing return predictability is quantitatively difficult to explain. **What risks and investor concerns can provide a unified explanation for these asset market facts? One potential explanation of all these anomalies is provided by the long-run risks (LRR) model**

Bansal and Yaron (2004) - **1600+ cites on Google Scholar

We highlight a feature of the LRR model that has been largely overlooked and that some may view as problematic

How do we judge success?

The puzzles are *quantitative*. Calibration is key

Mehra-Prescott lesson: Need not only to match moments, but to do so with parameter values that make sense, in terms of fitting other 'evidence' - both market-based and introspection

Attention is paid to elasticity of intertemporal substitution (EIS) and to the degree of relative risk aversion (RRA)

But *there is more to preference than EIS and RRA*

Utility implies that the temporal resolution of risk matters and a quantitative assessment of how much it matters should be part of the calibration process

Rules of the Game and Lexicon

Treat the representative agent as real

- there is no sensible aggregation theorem rationalizing a fictional agent

‘Introspection’ $=$ intuitively plausible

You can imagine yourself and/or others behaving in this way

Epstein-Zin ('CES') Utility

Continuation utilities $\{U_t\}$ defined recursively at each node in an infinite horizon multistage lottery/tree

$$U_t = \left\{(1-\beta)\, c_t^\rho + \beta \left[E_t(U_{t+1}^\alpha)\right]^{\rho/\alpha}\right\}^{1/\rho}, \quad \rho \neq 0$$

Interpretation: $RRA = 1 - \alpha \neq 1 - \rho = EIS^{-1}$ "separation"

In calibrations, attention is paid to evidence about RRA & EIS
But ρ and α *model more than substitution & risk aversion*
The temporal resolution of consumption risk matters *at a psychic noninstrumental level*
Early resolution preferred iff $RRA > EIS^{-1}$, which is the case in BY

Long Run Risk

$$
\begin{aligned}
\log \frac{c_{t+1}}{c_t} &= m + x_t + \sigma_t W_{c,t+1} \\
x_{t+1} &= a x_t + \varphi \sigma_t W_{x,t+1} \\
\sigma_{t+1}^2 &= \sigma^2 + \nu(\sigma_t^2 - \sigma^2) + \sigma_w W_{w,t+1}
\end{aligned}
$$

W's are standard iid Gaussian innovations, $0 < a < 1$

x_t is a persistently varying predictable component of the drift in consumption growth. Small innovations to x_t are important (even if $\varphi << 1$) because they affect consumption for the indefinite future

Volatility of consumption growth is stochastic
Empirical importance emphasized by Bansal et al (2012), Beeler and Campbell (2012)

Why this consumption (endowment) process?

Arguably difficult to reject empirically, and "it works"

The key mechanism, as described by several of the authors in this literature, is that LR *risks are not resolved until much later and are consequently treated differently than are current risks* – the preference for early resolution is central

But is the differential treatment required to match asset returns data plausible?

To address this question, we translate the BY assumption into explicit quantitative behavioral terms. This is not difficult or deep, but it clarifies what is being assumed in order to match moments

Evidence?

Not aware of any *other* market evidence or of any evidence from psychology that helps with quantitative assessment. Therefore, we suggest thought experiment & introspection as a guide (treating representative agent as real)

Thought experiments re risk aversion: Kandel and Stambaugh (1990, 1991), Rabin (2000): "how much would you pay to avoid this hypothetical gamble?"

Here: "what fraction of your consumption stream would you give up in order for all risk to resolve next period (month)?"

Subjective, not tied to data, but much better than nothing!

Thought experiment

You are given the LRR consumption process. In particular, the riskiness of consumption resolves only gradually over time (c_t and x_t are realized only at time t). You are offered the option of having all risk resolved at time 1. The cost is that you would have to relinquish the fraction π of both current consumption and of the consumption that is realized subsequently for every later period. What is the maximum value π^* for which you would be willing to accept this offer? Call π^* the *timing premium*

$$((1-\pi^*)\,c, \text{early}) \;\sim\; (c,\ \text{late})$$

'Compensating variation' of the change to early resolution of the given risk

Timing premia for LRR

We take parameter values from BY (2004)

a	ν	φ	σ	σ_w^2	β
.9790	.987	.044	.0078	$.23 \times 10^{-5}$	.998

$$EIS = 1.5$$

Then

$RRA =$	7.5	10
$\pi^* =$	24%	31%

DISCUSSION

- Why pay a premium?
- Is introspection possible/useful?
- How related to total welfare cost of risk (Lucas, 1987)?
- What about a different endowment process: iid? disasters?
- What to do now??

Why pay a premium?

At issue is consumption risk, not income or return risk

Anxiety? But arguably would lead to violation of stationarity and thus is not a valid interpretation of recursive utility
(Grant-Kajii-Polak (2000), Caplin-Leahy (2001), Epstein (2008))
To extent that introspection is derived in part from considerations of anxiety, stated timing premia exceed premia that are consistent with LRR

Hidden unmodeled planning problem (Kreps & Porteus, 1978): How to make this concrete/quantitative? Can it make plausible a timing premium of 25%?

Plausibility in theory vs in quantitative/empirical applications
Applied papers have accepted timing nonindifference uncritically

Is introspection possible/useful?

Artificial/unfamiliar situation: But starkness arguably helps introspection
One might feel "*why should I give up 25% ... just to know earlier, when I can't use that information?*"

Arguably easier to introspect than if allowed to use the information, in which case self assessment of premium would involve introspection about all of substitutability, risk aversion *and* early resolution, as well as about all consumption processes in an expected budget set

Introspection is at best a matter of opinion: inherently subjective
We are not arguing that a concensus is possible. But exercise may help *some* people understand the LRR model more fully

Alternative is to leave completely undisciplined

How related to total cost of risk?

Are the timing premia large only because the cost of risk is large?
Or are they large also in relative terms?

Lucas-style calculation: Consider the deterministic consumption process $\overline{c} = (\overline{c}_t)$ where $\overline{c}_t = E_0 c_t$, starting with $x_0 = 0$, $\sigma_0 = \sigma$

Compute $\overline{U}_0$ and risk premium $\overline{\pi}$

$$(1 - \overline{\pi})\, \overline{U}_0 = U_0$$

Then

$RRA =$	7.5	10
$\pi^* =$	24%	31%
$\overline{\pi} =$	48%	57%

IID endowment process

$\beta = .998$, $\log\left(c_{t+1}/c_t\right)$ is $N\left(.0015,\ .00007\right)$, matching annual moments

$RRA \setminus EIS$	1.5	1	.2	.1
10	$\mathbf{9.6\%}$	7.9%	$\mathbf{1.1\%}$	0.0%
7.5	6.9%	5.6%	0.4%	-0.5%
5	4.3%	3.4%	0.0%	-0.8%
2	1.2%	0.8%	-0.9%	-1.1%
1	1.0%	0.0%	-1.0%	-1.2%

Premia smaller than for LRR process: 9.6% vs 31%

Low values for EIS argued by Hall (1988), Campbell (2003)

Premium small for $(10, 0.2)$, which is still "far" from expected utility

Disasters

EZ utility but change in endowment process – small probability of large drop in consumption growth

Premia computed for annual frequency

Prob = probability of disaster

	EIS	RRA	Prob	π^*	$\overline{\pi}$
Barro 2009	2	4	iid	18%	29%
Wachter 2013	1	3	persistent	42%	65%

As in LRR, persistence leads to large timing premia

CONCLUDE

"Don't Bansal and Yaron show that the timing premium implicit in asset markets is large? Why bother with introspection?"
The same could be said about risk aversion in the equity premium context. Want a model that is consistent with a broad range of 'facts.' Our objective is to remind readers that this principle has not been applied as consistently as it should be

Not saying that LRR should be abandoned–timing premium is only 1 dimension
Our objective is to inject the subject into the discussion of the quantitative properties of LRR & related models

How might we improve models?
(i) Different specification of preference parameters and endowment process?
(ii) A more general model of preference that yields a three-way separation?

Another competing model: Campbell-Cochrane (1999) – external habits
Plausibility of the specified habit process has been judged solely by how it matches asset market data–an exception is Uhlig and Ljungqvist (2014)

A final word:

It may be difficult to find market evidence about the timing premium and about the habit formation process. But these should not become free parameters