

Ignorance and Indifference:
Decision-Making in the Lab and in the Market.
Supplement*

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Abstract

These supplemental materials include additional bibliographical and technical details on the themes brought up in the main text: the consumption-based asset pricing models, as well as the concept of shrinkage. A description of data sources is also given here.

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A Consumption-based asset pricing models

Within the universe of alternative structural consumption-based asset pricing models the current paper belongs to the literature cluster that focuses on probability distributions involved as a source of missing explanatory power.

This literature cluster hosts papers mainly dealing with consumption dynamics ($c_{t+1} - c_t$) in the SDF, whose probability distribution could be adjusted to account for heavy tails (say, basing on Bayesian updating of unknown parameters as in Weitzman, 2007), for jumps (rare disasters of Rietz, 1988; Veronesi, 2004; Barro, 2006; or rare booms of Tsai and Wachter, 2016), or to incorporate stochastic expected growth rate (long-run risk of Bansal and Yaron, 2004; Hansen et al., 2008). But it also hosts works concerned about returns r_{t+1} , whose distribution might have to be adjusted in light of capital income taxation (McGrattan and Prescott, 2003 and 2005) or upwardly biased selected sample (Dimson et al., 2003; Fama and French, 2002), and, going beyond first moment, heavier than Gaussian tails (as captured by Student's t or Lévy distribution, e.g., see classical reference Mandebrot, 1963, as well as Fama, 1963), possibly with jumps (Poisson processes).

A different literature cluster is formed by papers focusing on the SDF M_{t+1} itself and on the underlying utility function, which may be amended with features such as recursive specification (Epstein and Zin, 1989 and 1991), ambiguity aversion (Hansen and Sargent, 2007b; Hansen, 2007), habit formation (Campbell and Cochrane, 1999; Menzly et al., 2004), or an extended consumption horizon (ultimate consumption risk of Parker and Julliard, 2005).

Arguably, two clusters partitioning the literature above are fundamentally just two sides of the same coin, but this deserves a separate paper.

B Shrinkage

In the multidimensional setup, variance-covariance matrix shrinkage implies regularizing its eigenvalues by squeezing them together (reducing the largest and amplifying the smallest ones), which improves matrix conditioning and helps its inversion and hence usage in, say, portfolio optimization.

(There is an established result in random matrix theory that eigenvalues of sample variance-covariance matrixes are overdispersed: the largest sample eigenvalue asymptotically overestimates the largest population eigenvalue, and the smallest sample eigenvalue underestimates its population counterpart. This result is based on Marchenko-Pastur and Wigner’s semicircle distribution laws, for reference see Stein (1975 or 1986) and Johnstone (2001), also see Ledoit and Wolf (2013).)

In practice a regularized variance-covariance matrix is usually obtained as a convex combination between the sample variance-covariance matrix and some “well-behaved” counterpart (e.g., an identity matrix). Importantly, a matrix condition number (defined as the ratio of the largest and the smallest eigenvalues) quantifies the asymmetry, the relative spread along its principal axes and is, roughly speaking, inversely related to its distance from singularity (see, e.g., Horn and Johnson, 1985). So, improving the variance-covariance matrix conditioning by reducing this number in some sense amplifies the corresponding random variable’s dispersion.

This resonates strongly with our result on a Student’s t mixture posterior, suggesting that in this case random matrix theory-motivated eigenvalue regularization and Bayesian indifference priors are mutually consistent approaches leading in the same direction, which gives another possible reason behind the popularity and good performance of the variance-covariance matrix shrinkage in finance.

C Data

Real per capita consumption series is constructed using quarterly data on nominal seasonally adjusted at annual rates personal consumption expenditures for nondurable goods and services, corresponding seasonally adjusted price indexes, as well as population size from U.S. Bureau for Economic Analysis's NIPA tables.

Real risk-free and market returns are constructed using nominal risk-free and market returns from Fama-French online data library, converted from monthly into quarterly frequency, as well as the personal consumption expenditures for nondurable goods and services deflator applied to nominal consumption series as described above.

Real dividend series is constructed using nominal dividends for S&P500 Composite at quarterly frequency from Robert Shiller's online data collection as well as the personal consumption expenditures for nondurable goods and services deflator applied to nominal consumption series as described above.

Our data cover 1947:Q4–2014:Q4 time period.