

Rethinking reversals<sup>☆</sup>Timothy C. Johnson<sup>\*</sup>

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## ABSTRACT

High-frequency reversals are an economically important characteristic of the returns to tradeable claims to the market portfolio. This paper demonstrates that short-horizon negative autocorrelation can arise in a tractable model of agents with tournament-type preferences. Intuitively, investors act as if they are averse to missing out on a trend, causing the risk premium to move strongly counter to realized returns. The model features fully rationalizing agents, complete markets, and no exogenous transaction demand. Plausible parameterizations can match the autocorrelation in the data. Supporting evidence on novel first and second moment implications is presented.

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## 1. Introduction

Returns to traded claims to stock market indexes exhibit statistically and economically significant negative autocorrelation at short horizons. While there is a long history in empirical finance studying stock market reversals in the cross-section,<sup>1</sup> the existence of a systematic time-series reversal effect has received relatively little attention.

The top panel of Fig. 1 shows the sum of the first five autoregression coefficients for daily returns of Standard & Poors 500 futures since 1982. The lower panel shows another measure of autocorrelation: the ratio of variances computed from one- and five-minute futures returns based on mid-market prices in a sample from 2006 to 2009.<sup>2</sup>

Both statistics are plotted against their bootstrapped distribution under the null of no autocorrelation. Both measures provide strong evidence that the largest and most liquid asset market – in effect, the market portfolio – features pervasive reversals at frequencies as long as a week and as short as a few minutes. Analogous evidence using other index claims is very similar. Apparently the effect is not a statistical mirage. Nor is it due to mechanical issues (like bid-ask bounce) or other problems associated with small stocks.<sup>3</sup> Nor is it an artifact of financial history that has been arbitrated away: rolling regressions plotted in Fig. 2 show some of the strongest reversal evidence in recent years.

In terms of economic magnitude, if the first-order daily autocorrelation coefficient is approximately 0.05 and the one-day standard deviation of index returns is about 0.01, then market expected return – the equity premium – may be changing by  $\pm 12.5\%$  in annual terms ( $0.0005 \times 250$ )

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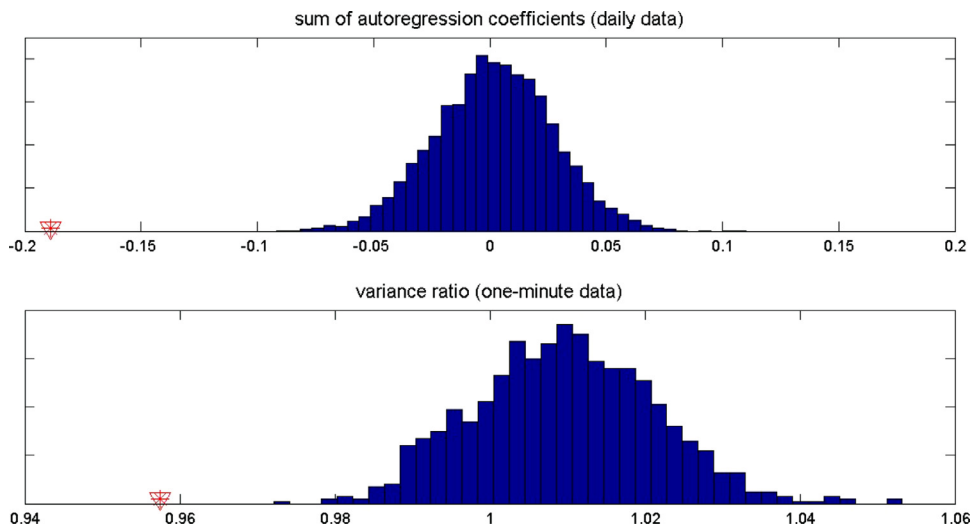
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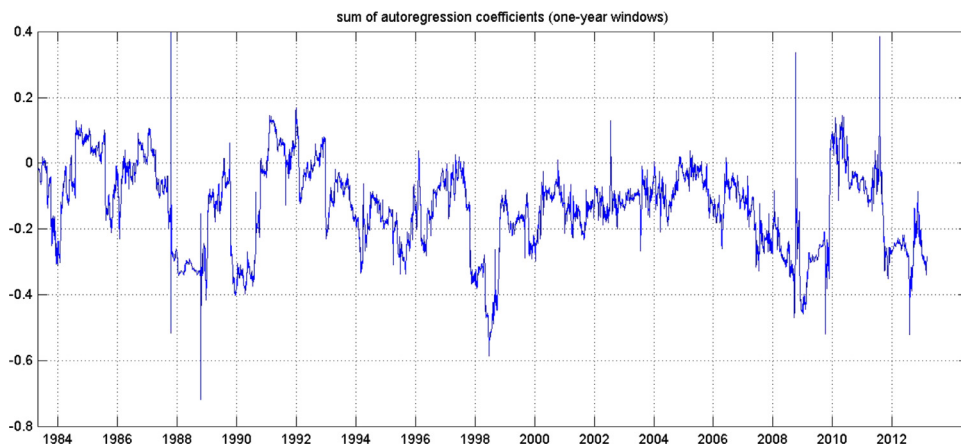
<sup>1</sup> See Lehmann (1990) and Lo and MacKinlay (1990).

<sup>2</sup> The data are described in Deuskar and Johnson (2011).

<sup>3</sup> It is also worth clarifying that the object of study is the autocorrelation of returns to traded index claims, not of changes in the cash indexes themselves, which are not realizable returns.



**Fig. 1.** S&P500 reversals. The top figure shows the bootstrapped distribution of the sum of the coefficients from a regression of daily futures returns on five of its own lags. The distribution is computed using resampled returns of the front-month S&P 500 futures contract from June 1983 to March 2013 under the i.i.d. null. The bottom panel shows the bootstrapped distribution of the average of daily ratios of the variance of the S&P 500 e-mini futures mid-market returns computed over one- and five-minute intervals for a sample from February 2006 to January 2009. In both panels, the triangle on the horizontal axis shows the actual sample value of the corresponding statistic.



**Fig. 2.** S&P500 reversals over time. The figure shows the sum of the coefficients from a regression of daily S&P 500 futures returns on five of its own lags in rolling one-year windows.

from day to day.<sup>4</sup> Systematic reversals thus appear to be a first-order feature of risky asset prices. Yet, to date, there has been almost no work that attempts to understand them as an equilibrium phenomenon, or to calibrate candidate models. This paper presents a new theoretical explanation for short-horizon negative autocorrelation, and provides supporting evidence on the model's implications.

The paper's explanation is based on status concerns. I exhibit a class of preferences that induce hedging demands among competitive agents that are sufficient to create significant transient movements in risk premia. In a nutshell, when agents care a lot about relative performance, they can act as if they are extremely averse to missing out on a

trend. Performance differences are generated in the model by heterogeneous beliefs, but the model's key implications are not dependent on any agent being wrong or irrational in a particular way. Interestingly, reversals can arise in a frictionless, full-information setting with fully optimizing behavior. Agents' positions are not constrained, and the exogenous fundamental process itself is not assumed to be mean-reverting (although it may be). While the model is necessarily stylized, I present calibrations that deliver daily negative autocorrelation of the right magnitude without obviously counterfactual implications for other observables.

Also absent from the model is any form of transaction demand. Thus, there is no sense in which reversals represent a reward to "supplying liquidity" here. A natural, and not necessarily incompatible, alternative hypothesis is that reversals are simply due to "noise traders" and "price

<sup>4</sup> The reversals are roughly symmetric in the sense that the CAPM alpha for a portfolio that is long following down days is not distinguishable from that of a portfolio that is short following up days.

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