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# Fundamental factors and extrapolation in stock-market expectations: The central role of structural change<sup>☆</sup>

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## ABSTRACT

Rational expectations and behavioral-finance models are widely interpreted as representing two distinct conceptions of decision-making: rational and irrational, respectively. Using survey data, this paper presents econometric evidence that both fundamental factors and extrapolation drive participants' expectations of stock returns, but that they do so in ways that vary over time. Although both the REH and behavioral-finance approaches offer relevant insights for understanding participants' expectations, neither of these distinct model classes is consistent with time-series data. The paper's findings also suggest that structural change gives rise to ambiguity about the correct quantitative model driving outcomes. This ambiguity, faced by economists and market participants alike, is the key to according both fundamental and behavioral factors a role in *rational* forecasting.

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## 1. Introduction

Rational expectations and behavioral-finance models are widely interpreted as representing two distinct conceptions of decision-making: rational and irrational, respectively. The rational expectations hypothesis (REH) represents how rational participants forecast stock returns in terms of fundamental factors, such as company earnings and interest rates. By design, REH models rule out the relevance of extrapolation of past returns, or optimism (pessimism) concerning the course of prices, in driving participants' expectations of future returns. In contrast, behavioral-finance models assume that such considerations are a primary driver of stock-market expectations. For example, evidence that participants' expectations are at least in part extrapolative is considered to be a symptom of market participants' "less than full rationality".<sup>1</sup>

Using survey data, this paper presents econometric evidence that both fundamental factors and extrapolation drive participants' expectations of stock returns, but that they do so in ways that vary over time. As in any econometric investigation, our findings are conditioned on the empirical specification of the model for investors' expectations. Although our specifica-

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<sup>1</sup> For extensive surveys of the behavioral-finance approach, see [Shleifer \(2000\)](#), [Barberis and Thaler \(2003\)](#), and references therein.

tion includes a set of commonly used fundamentals and proxies for extrapolation, it is possible that inclusion of additional variables might alter the findings on structural breaks. Importantly, these breaks may be capturing the effect of prevailing narratives about the future course of stock prices (Shiller, 2017).<sup>2</sup> Nonetheless, our findings suggest that, although both the REH and behavioral-finance approaches offer relevant insights for understanding stock-market expectations, neither of these distinct classes of models is consistent with empirical evidence.

Our finding that fundamentals are a major driver of participants' expectations is the key insight formalized by REH models. However, a typical REH model constrains its structure – the set of explanatory variables and their parameters – to be time-invariant. This makes the model inconsistent with structural breaks in how fundamentals drive stock-price expectations.

REH models sometimes allow for structural change. But when they do, they represent it with a probabilistic rule, such as Markov switching. In a number of papers, David Hendry has not only demonstrated the empirical relevance of structural change in a variety of contexts, but has also shown that such change is often triggered by historical events that are, at least in part, unique. This implies that the timing and the magnitude of these structural shifts could not have been foreseen with a probabilistic rule, thereby invalidating REH models.<sup>3</sup>

Moreover, the apparent significance of extrapolation that we find is inconsistent with REH models, *regardless* of whether they allow for structural change. At the same time, while extrapolation plays an important role in behavioral-finance models' accounts of asset-price swings, these models typically assume that its effect is time-invariant. In contrast, we find that the effect of extrapolation, like that of fundamentals, varies over time.

Although consistent with neither REH nor typical behavioral-finance models, our finding of structural change suggests a way to build on the insights of both approaches. As we discuss in the concluding remarks, recognizing that participants rely on fundamental and behavioral factors in ways that vary over time is the key to accounting for the role of both sets of factors in *rational* forecasting.

By contrast, the previous studies of participants' expectations using survey data, like much theoretical and econometric modeling, constrain the structure of the empirical specification to remain unchanging over time. These studies have concluded that participants' expectations are largely extrapolative, while fundamental factors play a negligible role. Such studies are generally interpreted as supportive of the behavioral-finance approach.<sup>4</sup> But by relying on time-invariant specifications, these studies may have obscured the variation in the impact of fundamentals that might arise from participants' revisions of their forecasting strategies. Likewise, the impact on expectations of behavioral considerations such as extrapolation may change over time.

Indeed, long-standing, largely overlooked arguments suggest that we should expect models that include such behavioral factors to be structurally unstable. Behavioral-finance theorists have formalized their effect with representations that are inconsistent with the predictions of an economist's model. As Lucas (2001, p. 13) argued, such non-REH representations presume that participants are grossly irrational, in the sense that they ignore systematic forecast errors in perpetuity. We would expect that, faced with such errors, participants would revise their forecasting strategies. Moreover, beyond responding to forecast errors, participants may also alter the way they interpret fundamentals in response to changes in monetary regimes (Lucas, 1976), evolving technologies, political institutions, and a multitude of other factors (Frydman and Goldberg, 2011). Akerlof and Snower (2016) argue that participants' interpretation of the process driving outcomes is to a significant extent influenced by their shared narrative accounts of the determinants of this process and how it might change over time. They argue that these narratives “play a role in understanding the environment, ... predicting events, ... [and] motivating actions (p. 59).” Participants' reliance on narratives may lead them to alter the weights that they attach to various factors in forming their expectations.

Thus, if both fundamental and behavioral variables are relevant for understanding participants' expectations, we would expect structural breaks in the parameters of both sets of factors. And this is precisely what we find: the parameters of fundamentals, extrapolation, and all other factors in our specification of participants' expectations undergo intermittent breaks during the sample period.

The myriad potential sources of change in how fundamental and behavioral considerations might affect investors' expectations would seem to preclude a theoretical account that could predict when and how investors might revise their forecasting strategies. In the absence of such a theory, we use the multiplicative indicator saturation (MIS) procedure, which does not require that we specify in advance the mechanism behind and timing of structural breaks.

The MIS procedure, proposed by Ericsson (2012), extends the automated model selection (Autometrics) algorithm of Hendry and Krolzig (2005) and Doornik (2009). The superior properties of this approach relative to other approaches to model selection have been documented in that literature.<sup>5</sup>

In contrast to other procedures, such as Bai and Perron (1998), MIS does not constrain the breaks in the parameters of each variable to occur at the same time. This is important because we have no reason to suppose that structural breaks

<sup>2</sup> Frydman et al. (2018) examine structural change in stock-market expectations using the proxies extracted from narrative market reports. They provide evidence that the time-varying effects of fundamentals are associated with variation in market sentiment: participants' optimism (pessimism) about future stock returns.

<sup>3</sup> See Hendry (2017) and references therein.

<sup>4</sup> For recent studies using stock-market survey data, and references to earlier literature, see Williams (2013) and Greenwood and Shleifer (2014).

<sup>5</sup> For an in-depth treatment of the automatic model-selection procedures, see Hendry and Doornik (2014).

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