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The impact of risk and uncertainty on expected returns ☆

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ABSTRACT

We study asset pricing in economies featuring both risk and uncertainty. In our empirical analysis, we measure risk via return volatility and uncertainty via the degree of disagreement of professional forecasters, attributing different weights to each forecaster. We empirically model the typical risk-return trade-off and augment these models with our measure of uncertainty. We find stronger empirical evidence for an uncertainty-return trade-off than for the traditional risk-return trade-off. Finally, we investigate the performance of a two-factor model with risk and uncertainty in the cross section.

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1. Introduction

In this paper, we empirically investigate the relation between risk, uncertainty, and expected returns. The risk-return trade-off—one of the most empirically tested theoretical relationships in finance—states that the expected excess market return should vary positively and proportionally to market volatility. This relationship is so fundamental that it could well be described as the 'first law of finance.' Merton (1973) derived this theoretical relationship in a continuous time model, often referred to as Merton's Intertemporal Capital Asset Pricing Model (or simply the ICAPM). More recently, studies suggest that uncertainty, in addition to risk, should matter for asset pricing. The focus of this paper is to examine the risk-return trade-off and the uncertainty-return trade-off using an innovative empirical measure to capture uncertainty in the economy.

The empirical evidence for a risk-return trade-off is mixed. Many studies have implemented the linear regression:

$$\mathrm{E}_t r_{et+1} = \gamma V_t,$$

where r_{et+1} is the excess return of the market over a risk-free bond, γ is a risk aversion coefficient, and V_t is the

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conditional volatility of the market. The goal has been to find a significantly positive γ coefficient that captures the trade-off between risk and return. Baillie and DeGennaro (1990), French, Schwert, and Stambaugh (1987), and Campbell and Hentschel (1992) find a positive but mostly insignificant relation between the conditional variance and the conditional expected return. On the other hand, Campbell (1987), Nelson (1991), and Brandt and Kang (2004), among others, find a significantly negative relation. Glosten, Jagannathan, and Runkle (1993), Harvey (2001), and Turner, Startz, and Nelson (1989) find both a positive and a negative relation depending on the estimation method used. Finally, Ghysels, Santa-Clara, and Valkanov (2005) find a significant and positive relationship between the market return and conditional volatility using *Mixed Data Sampling*, or MIDAS, estimation methods.[1]

An important strand of recent research in finance contends that uncertainty, in addition to risk, should matter for asset pricing. When agents are unsure of the correct probability laws governing the market return, they demand a higher premium in order to hold the market portfolio. Following Knight (1921), Keynes (1937) described uncertainty by saying:

> By ‘uncertain’ knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know.

We adopt the position that an event is *risky* if its outcome is unknown but the distribution of its outcomes is known, and an event is *uncertain* if its outcome is unknown and the distribution of its outcomes is also unknown.

Papers by Hansen and Sargent (1995, 2001, 2003, 2005, 2007), Hansen, Sargent, and Tallarini (1999), Anderson, Hansen, and Sargent (2003), Hansen, Sargent, Turmuhambetova, and Williams (2006), Chen and Epstein (2002), Maenhout (2004, 2006), Uppal and Wang (2003), Kogan and Wang (2002), and Liu, Pan, and Wang (2005), among many others, have shown how uncertainty affects optimal decisions and asset prices. So far the literature has been mostly theoretical. The main contribution of this paper is to investigate *empirically* the performance of asset pricing models when agents face uncertainty in addition to risk. Expanding on the framework provided by Merton (1973), we show that in the presence of uncertainty the traditional risk-return regression needs to be augmented because both risk and uncertainty carry a positive premium:

$$\mathrm{E}_t r_{et+1} = \gamma V_t + \theta M_t,$$

where θ is a measure of aversion to uncertainty and M_t measures the amount of uncertainty in the economy. When there is no uncertainty, so that $M_t = 0$, or if agents are not averse to uncertainty, so that $\theta = 0$, Merton's original formulation is recovered.[2]

In the asset pricing context typically adopted by the literature and also in this paper, agents have a great deal of information about the volatility of returns but very little about mean returns. Therefore, it is assumed that the second and higher order central moments of all returns are known exactly, while there is uncertainty about mean returns. Consequently, asset returns are uncertain only because mean returns are not known.

To measure the degree of agents' uncertainty in mean returns we propose using the disagreement of professional forecasters. The predictions of forecasters are a reasonable measure of the universe of ideas to which agents in the economy are exposed. It is likely that agents, at least partly, base their beliefs on the predictions of professional forecasters. If all forecasters are in agreement about expected returns uncertainty is likely to be low. In contrast, if forecasters state very different forecasts, agents are likely to be unsure about mean returns, and uncertainty is high. Along the lines of Hansen and Sargent's work, we assume agents choose not to act like Bayesians and combine possible probability models because they are not sure which probabilities to use. Instead, agents solve a robust control problem.

The relationship between the disagreement of professional forecasters and expected returns has been discussed in many recent papers without explicit links to uncertainty. Most of the existing literature measures disagreement with the dispersion of earnings forecasts made by financial analysts of individual stocks and studies the relationship between this measure and individual stock returns.[3] Unlike prior studies, we emphasize *aggregate* measures of disagreement instead of disagreement about *individual* stocks or portfolios. Theoretically, we show that disagreement (or uncertainty) matters for individual stocks only when the divergence of opinions

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[1] When hedging demands are present additional terms affect the conditional expected value of the market. Guo and Whitelaw (2006) argue that the additional terms make the risk-return trade-off difficult to find because these additional terms can be correlated with conditional volatility.

[2] Kogan and Wang (2002) derive the same decomposition in a more restrictive setting, as discussed in Section 2.

[3] A number of authors, including Anderson, Ghysels, and Juergens (2005) and Qu, Starks, and Yan (2003) find that more disagreement, as measured by the dispersion of earnings forecasts, implies higher expected returns. In particular, Anderson, Ghysels, and Juergens (2005) observe that the dispersion factors (portfolios that are long in high dispersion stocks and are short in low dispersion stocks) are positively related to expected returns and have explanatory power beyond traditional Fama-French and momentum factors. Similarly, Qu, Starks, and Yan (2003) observe a positive relation between expected returns and a factor for disagreement, constructed from the annual volatility of a firm's earnings dispersion. Others, including Diether, Malloy, and Scherbina (2002) and Johnson (2004), find that higher dispersion stocks have lower future returns.

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