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Macroeconomic uncertainty and the cross-section of option returns ☆

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ABSTRACT

I empirically investigate whether macroeconomic uncertainty is a priced risk factor in the cross-section of equity and index option returns. The analysis employs a non-linear factor model, estimated with the Fama-MacBeth methodology, where the macroeconomic uncertainty factor is the return on a long/short portfolio of equity options, built on the basis of how implied volatilities change around macroeconomic announcements. I find that macroeconomic uncertainty is priced in the cross-section of option returns, even after controlling for a number of relevant factors. The results are robust to alternative ways of measuring option returns, and to the non-random pattern of missing returns.

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1. Introduction

In this paper, I study whether time-varying uncertainty about the current value of macroeconomic variables is a priced risk factor in the cross-section of equity and index option returns. Building on the results of Beber and Brandt (2009), I rely on the behavior of equity option implied volatilities around selected scheduled macroeconomic announcements to form a long/short factor mimicking portfolio

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that proxies for unobservable macroeconomic uncertainty. The factor peaks during periods of economic turmoil, it has a large negative average return, and it explains the cross-section of option returns over the 1996–2010 sample. The results, which are based on the Fama and MacBeth (1973) methodology, account for the non-linearity of option returns relative to returns on the underlying, and are robust to a large set of additional relevant factors, to the non-random pattern of missing option returns, and to alternative ways of measuring returns and building the macroeconomic uncertainty factor.

Researchers typically study the drivers of option returns by comparing the properties of option-implied and objective return distributions (e.g., Bakshi, Cao, and Chen, 1997; Bates, 2003; Broadie, Chernov, and Johannes, 2007). Reduced-form option pricing models consist of assumptions about the distribution of the underlying asset's returns, the specification of the sources of uncertainty that carry a risk premium, and the estimation of objective/risk-neutral distributions of returns that have different parameter values for the priced sources of uncertainty. Risk premia effectively act as degrees of freedom that reconcile the discrepancies between the objective and risk-neutral distributions, which means that misspecification can appear as a risk premium, and that specification tests are of primary importance (Broadie, Chernov, and Johannes, 2007).

A reduced-form approach to option pricing also poses questions in terms of economic interpretation, because, first, the preferences of investors are implied by the pricing kernel that reconciles the objective and risk-neutral distributions, and, second, the economic mechanisms that drive the sources of uncertainty are not fully specified. In his 2003 retrospective study of empirical option pricing, Bates (2003, p. 399) explicitly emphasized the desirability of a sharper focus on the economic fundamentals behind the differences between objective and risk-neutral distributions: "To blithely attribute divergences between objective and risk-neutral probability measures to the free 'risk premium' parameters within an affine model is to abdicate one's responsibilities as a financial economist."

The literature has indeed grown along the lines suggested by Bates (2003). It now includes a number of contributions that link stylized option pricing facts to fundamental economic mechanisms. For instance, the implied volatility skew has been explained in terms of demand pressure and the unhedgeable risks borne by market makers (Bollen and Whaley, 2004; Gârleanu, Pedersen, and Poteshman, 2009); in terms of heterogeneous beliefs (Buraschi and Jiltsov, 2006); in terms of learning about the process that drives returns (Benzoni, Collin-Dufresne, and Goldstein, 2011); and in terms of Knightian model uncertainty (Drechsler, 2013).

This paper focuses on the implications that the uncertainty surrounding macroeconomic announcements has for the cross-section of returns on equity and index options. The macroeconomic uncertainty factor is the return on a long/short portfolio of equity options, which are bought and sold according to the ranking, during the preceding quarter, of their implied volatility changes around macroeconomic announcements. The sorting builds upon studies showing that the implied volatilities of bond options react strongly to macroeconomic announcements (Ederington and Lee, 1996; Beber and Brandt, 2006), and that the reduction in bond implied volatilities after a scheduled announcement is proportional to the level of macroeconomic uncertainty, as measured by the implied volatilities of "Economic Derivatives," a type of options on macroeconomic variables that were marketed between 2002 and 2007 (Beber and Brandt, 2009). By narrowing the focus on events that are associated with larger changes in uncertainty, the ranking based on changes in implied volatility provides a cleaner proxy for the sensitivity of each option to the unobserved macroeconomic uncertainty factor. Savor and Wilson (2014), for instance, find that market betas, as estimated on announcement days, have a stronger relation with asset returns than market betas estimated on days without announcements.

The literature provides ample evidence that the price impact of scheduled releases is not limited to bond options, but can be found in stocks (Jain, 1988; McQueen and Roley, 1993; Flannery and Protopapadakis, 2002; Lee, 2012), bonds (Ederington and Lee, 1993, 1995; Fleming and Remolona, 1999; Balduzzi, Elton, and Green, 2001; De Goeij and Marquering, 2006), exchange rates (Andersen and Bollerslev, 1998; Andersen, Bollerslev, Diebold, and Vega, 2003, 2007; Faust, Rogers, Wang, and Wright, 2007), and co-movements across asset classes (Brenner, Pasquariello, and Subrahmanyam, 2009).