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Uncertainty and Valuations: A Comment

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ABSTRACT

Cremers and Yan (2016) aim to provide "an additional litmus test for the uncertainty-convexity argument in Pástor and Veronesi (2003)." We challenge this view, as well as the authors' related thoughts on the technology "bubble" of the late 1990s. Nonetheless, we agree with Cremers and Yan that our profession needs to think harder about the measurement of parameter uncertainty.

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Cremers and Yan, hereafter referred to as CY, aim to provide "an additional litmus test for the uncertainty-convexity argument in Pástor and Veronesi (2003)." This "uncertainty-convexity argument" recognizes the simple mathematical fact that future earnings are a convex function of the earnings growth rate, as a result of which expected future earnings are higher when the growth rate is more uncertain. To illustrate this argument, consider the well-known Gordon growth formula:

$$P = \frac{D}{r-g}, \tag{1}$$

where P is the stock price, D is next period's dividend, r is the discount rate, and g is a constant growth rate of dividends. Since P is convex in g, uncertainty about g increases P through Jensen's inequality, ceteris paribus. In Pástor and Veronesi (2003, 2006), we also argue that both young firms and technology firms tend to have more uncertain growth rates. Such firms should therefore tend to have higher stock market valuations, and we find that they indeed do.

CY begin with a simplified version of our model, which features an all-equity firm, and extend this model by adding bond financing. Their model preserves our prediction that uncertainty about future growth increases stock valuations, but it also adds the prediction that this uncertainty decreases bond valuations, as well as predictions about interactions of uncertainty with leverage. When CY test their model empirically, they find support for the prediction that is common to both their model and ours (that uncertainty about g increases stock valuations), but they mostly reject the bond predictions that are unique to their model. Most notably, they find that higher uncertainty is associated with *higher* bond prices (i.e., *lower* credit spreads), contrary to their model.

CY's rejection of these bond predictions has no implications for the validity of our all-equity model, or the associated uncertainty-convexity argument. Recall that CY begin with an all-equity model, extend it by adding bonds, and then empirically reject their model's bond predictions. In general, an empirical rejection of a model's extension does not invalidate the original model, especially if the rejected predictions are driven by an economic mechanism that is distinct from the mechanism underlying the original model. As we explain next, the mechanism that drives the bond predictions of the CY model is indeed different from the mechanism driving the uncertainty-convexity argument.

1 Two Kinds of Convexity

The CY model features two different kinds of convexity. The first kind is the convexity of P in g in equation (1). This is the convexity underlying our uncertainty-convexity argument. The second kind is the well-known convexity of option payoffs. In the presence of leverage, equity is a call option on the firm's assets whereas bonds represent a short position in a put option.

The main new prediction of the CY model, that uncertainty decreases bond valuations, is driven solely by the second convexity. CY's empirical rejection of this prediction is thus relevant for judging the importance of the second convexity in bond pricing. This evidence has no relevance for the uncertainty-convexity argument, which relies on the first convexity.

2 The Puzzling Empirical Result

As noted earlier, CY find empirically that higher uncertainty is associated with higher bond valuations (that is, lower credit spreads). While this result has nothing to do with our uncertainty-convexity argument (as explained above), it is puzzling as it contradicts the well-established idea that a corporate bond is effectively a short put option on the firm's assets (see, for example, Black and Scholes, 1973, and Merton, 1974). Since option value increases in uncertainty about the underlying asset's value, higher uncertainty should reduce the bond price, which is contrary to CY's empirical result.

One potential explanation for this puzzling result is poor measurement of uncertainty about the firm's growth rate. CY clearly recognize this possibility, and they consider multiple proxies for uncertainty. Their main proxy is firm age, and the puzzling result is a positive relation between credit spreads and firm age. This finding is intriguing though we do not find it intuitive. It also contradicts the results of Datta *et al.* (1999), Lu *et al.* (2010), and Mansi *et al.* (2004), all of whom find that corporate bond spreads are significantly *negatively* related to firm age. These studies use different datasets and different controls, and we do not attempt to reconcile their differences here.

3 What If Return Volatility Were Used As Proxy for Uncertainty?

In addition to firm age, CY analyze the proxies for uncertainty used by Pástor *et al.* (2009), Korteweg and Polson (2009), and Guntay and Hackbarth (2010), for a total of eight different proxies. However, one natural proxy that is not included in this set is the volatility of the firm's stock returns. As one might expect, and as we emphasize in our prior work, more uncertainty about future growth makes stock returns more volatile.

If volatility were used to proxy for uncertainty, CY's puzzling result would disappear. Specifically, their Table 4 shows that a higher standard deviation of stock returns is associated with higher credit spreads, and thus lower bond prices, with t-statistics in excess of seven in each specification. In addition, Table 2 shows that a higher standard deviation is associated with higher stock valuations, again with t-statistics above seven. Therefore, both of the model's key predictions—that uncertainty increases stock valuations but decreases bond valuations—are strongly supported if return volatility is viewed as a proxy for uncertainty.

Instead of using volatility as a proxy for uncertainty, CY use it as a control in their regressions. However, after controlling for one measure of uncertainty, it is not clear how the other proxies for the same quantity should enter. If the volatility control soaks up most of the price-relevant variation in uncertainty, we would not expect CY's proxies for uncertainty to exhibit any residual power in explaining asset valuations. CY effectively analyze only the component of uncertainty that is present in their eight proxies while being orthogonal to return volatility.

4 The Technology "Bubble"

CY argue in their introduction that their leverage-based results offer "an opportunity to distinguish the two competing viewpoints on the technology 'bubble'" (Shiller (2000) versus Pástor and Veronesi (2006, 2009)). We are not convinced, however, for three reasons. First, CY do not test Shiller's optimism story; they only focus on our uncertainty story. That is understandable as our model offers multiple clear testable predictions whereas Shiller's story seems difficult to test.

Second, our story for the "bubble" rests on two pillars, neither of which is tested by CY. The first pillar is the positive relation between a firm's stock price and uncertainty about the firm's average future growth rate. This relation derives from the convexity of P in g in equation (1), whereas CY's results derive from a different kind of convexity, as explained earlier. The second pillar of our story is the interplay between valuation and volatility. Specifically, in our 2006 paper, we show that technology stocks with the highest valuation ratios in the late 1990s tended to have the most volatile returns, which is consistent with the notion that these firms had the most uncertain growth rates. CY do not analyze the volatility implications of their model, or ours.

Finally, most technology stocks in the late 1990s had little to no leverage. It therefore seems more natural to analyze their values in an all-equity model such as ours than in the leverage-based model of CY. Moreover, any evidence based on bond data applies only to a small subset of technology firms, namely, those with a substantial amount of bond financing.

5 Conclusion

We applaud Cremers and Yan for developing and testing new implications of parameter uncertainty for asset prices. We do not think that their evidence has much to say about our uncertainty-convexity argument, or about the technology "bubble" of the late 1990s. Nonetheless, we fully agree with CY's message that our profession needs to think harder about the measurement of parameter uncertainty.

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