Variance Risk in Aggregate Stock Returns & Time-varying Return Predictability

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Introduction

Contributions
1. New Out-of-Sample Prediction of Monthly Market Returns
   Determine the risk premium of an asset by the beta representation. Use the price of variance risk (the variance risk premium, VRP), the variance risk exposure – measured using variance innovations of the market index – to compute the risk premium. The out-of-sample $R^2$ is higher than 8% and is statistically significant.

2. Time-Varying Predictive Relation
   As the variance risk exposure, known as the leverage effect, varies over time, so does the predictive relation. By estimating the risk exposure at a given point of time, we can determine the predictive relation.

3. The Key is the Relation to Variance Risk - Cross-sectional Applications
   The beta representation holds for every asset, and as long as an asset is exposed to market variance risk, its future returns are predictable. Assets with no correlation with market variance are not predictable.

Motivation

A. The Beta Representation

The Variance Risk Premium ($\beta_v$)

- Option-Implied Variance (VIX)
- Realized Variance (RV) of S&P500 Index

Risk Premium From Variance Risk

Risk Premium From Orthogonal Risk

B. The Variance Risk Premium

The Variance Risk Premium (VRP)

- $E_t[R_{m+1}] = \beta_{PR} + \beta_v R_v + \epsilon_t$

C. The Leverage Effect

Market Index

Market Variance

Move in the Opposite Direction

$\beta_m < 0$

D. The Predictive Relation

(Bollerslev, Tauchen and Zhou, 2009)

1. The predictive beta, $\beta_p$, in the predictive regression, may be very close to the variance risk exposure, $\beta_v$, of the contemporaneous return-variance regression in C, that comes from the leverage effect.

2. The predictive power of the predictive regression in D, the $R^2$, strongly depends on the proportion of market returns explained by variance risk.

$R^2$ of C $\approx R^2$ of D

Out-of-sample Prediction Methodology

The Traditional Approach of Forecast

The Contemporaneous Beta (New) Approach

How to estimate the orthogonal premium ($\beta_v$):

- The VRP may be related to the price of orthogonal risk (since they are both functions of risk aversion). Let the risk premium from variance risk be determined by the variance beta and VRP, and estimate the orthogonal premium in the traditional manner, i.e., using rolling predictive regression.

- The VRP is much different from other common predictors (e.g., cash, dividend yield, or term premium) since VRP performs well in predicting short-term returns. Moreover, standard predictors perform well during recessions; the VRP works well when the leverage effect is strong.

Thus we can use our common predictors to determine the orthogonal premium.

Out-of-sample Results

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2. The predictive power of the predictive regression in D, the $R^2$, strongly depends on the proportion of market returns explained by variance risk.

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Summary & Conclusion

1. Market risk premium and the VRP related in a particular way
   - Market's exposure to variance risk is close to the predictive beta.
   - Monthly market returns predictable in a statistically and economically significant manner.

2. Cross-sectional application to exchange rates
   - Some currency returns are predictable using the VRP, but those are substantially exposed to U.S. equity variance risk.
   - The contemporaneous beta approach outperforms the UIP relation for those currencies even out of sample.

Whether, when or which returns predictable by the VRP determine ex ante — by variance risk exposure

References


