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Risk-return trade-off and serial correlation: Do volume and volatility matter? ☆

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ABSTRACT

I investigate a relation between the conditional mean and variance of the aggregate stock return using a model that allows the relevance of the risk-return trade-off and autocorrelation to change over time. The model detects a positive risk-return relation, but the importance of the risk-return relation fluctuates with the level of information flow, measured by volatility. During low-volatility periods, market-wide persistence in returns increases, leading to a failure of the pure risk-return explanation for expected returns. This offers an explanation as to why detection of a positive risk-return trade-off has been challenging, while autocorrelation has been a robust finding.

1. Introduction

The intertemporal capital asset pricing model (ICAPM) of Merton (1973) implies a positive relation between the expected market return and its conditional variance, yet the empirical evidence on the sign of the risk-return trade-off is conflicting. These mixed results can have several explanations, but the role of autocorrelation has received less attention than others. In the following, I estimate an empirical model in which the relevance of the risk-return trade-off and autocorrelation can change

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over time. The model allows controlling for one of the most robust findings in empirical finance: stock returns exhibit serial dependence. I find a positive risk-return relation, but the importance of the risk-return explanation fluctuates with the level of information flow, measured by volatility.

Researchers have had difficulties documenting a positive risk-return relation. Often they detect a negative or insignificant relation between the conditional mean and variance of the aggregate return [for an overview, see Brandt and Wang (2010) and Nyberg (2012)]. These mixed results are related to an omitted-variable problem or differences in how the conditional mean and variance are modeled. The former may result if the hedging component of the ICAPM is omitted from an empirical specification (Scruggs, 1998; Guo and Whitelaw, 2006). The latter arises from the fact that neither of the conditional moments is directly observable, so modeling assumptions shape the results (Brandt and Wang, 2010).

The simultaneous role of autocorrelation has attracted less interest. In empirical work, a risk-return specification is often augmented by a first-order autoregressive term that is included to account for nonsynchronous trading (Nelson, 1991; De Santis and Imrohoroglu, 1997) or test whether the lagged return helps explain the expected return (Bollerslev, Engle, and Wooldridge, 1988; Ghysels, Santa-Clara, and Valkanov, 2005). Although the autoregressive component is usually found to be significant, its effect on the mixed risk-return results remains unexplored. If the degree of autocorrelation is constant over time, the standard approach (a conditional risk-return trade-off augmented by a time-invariant first-order autoregressive term) controls for autocorrelation in returns. However, no previous study considers whether the relative contribution of the risk-return trade-off and autocorrelation in explaining the aggregate return changes over time.

I investigate the risk-return trade-off using an empirical model that builds on the ICAPM, while inspired by a view that the relevance of the risk-return explanation and autocorrelation may fluctuate with the level of information flow, approximated in empirical work by volatility and volume (e.g., Andersen, 1996). The changing relevance of the risk-return explanation and autocorrelation is economically motivated by the adaptive markets hypothesis (AMH) of Lo (2004).

The AMH builds on the concept of bounded rationality (Simon, 1955) and evolutionary principles. Lo (2004) argues that market participants adapt to a constantly changing market environment with satisfactory (as opposed to optimal) behavior attained via heuristics and an evolutionary process. Natural selection ultimately determines the number and composition of the market participants and trading strategies. Under the AMH, prices reflect both information and the prevailing market ecology. The AMH implies that the degree of market efficiency is dynamic and context dependent; it can change in cyclical fashion with market conditions.

The AMH treats market conditions as a multidimensional and complex construct, leaving it to the researcher to determine which features should be the focus of empirical modeling. Here, I assume the key market condition is the level of new information. This interpretation agrees with the AMH motivation: changing market conditions are closely linked to the type and amount of available pricing information and how market participants process and use this information. It seems natural, for example, to assume that the survival of market participants and trading strategies that rely on past prices depends on the level of new information needed to be subsumed in prices. The same is particularly true for investors incapable of processing new information. While I do not try to specify an exact formal mechanism behind the changing relevance of the risk-return trade-off, the economic intuition behind the tested model is appealing: the contribution of the risk-return trade-off (efficient pricing) and autocorrelation (inefficient pricing) can depend on the level of new information (market condition).

While Kim, Shamsuddin, and Kian-Ping (2011) find support for the AMH and a number of studies indicate that market efficiency varies over time [see survey of Lim and Brooks (2011)], autocorrelation may partly reflect time-varying risk premia (Anderson, 2011) or nonsynchronous trading (Lo and MacKinlay, 1990).[1] In other words, even if the financial market is efficient, we may obtain significant autocorrelation if our pricing model is incorrect or infrequent trading is a significant source of

[1] It is worth noting that return predictability using past prices does not necessarily indicate market inefficiency as it may not be economically exploitable due to transaction costs.