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Is the investment factor a proxy for time-varying investment opportunities? The US and international evidence

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ABSTRACT

Motivated from Fama's (1991) conjecture of an explicit link between the cross-sectional and time-series stock return predictability, we investigate whether the investment factor constructed from the cross-section of stocks also has time-series predictive power for stock returns within Merton's (1973) ICAPM framework. The evidence from both US and other G-7 countries (except Japan) suggests that the investment factor is a proxy for time-varying investment opportunities. We also find that the risk-return relation is positive and statistically significant after controlling for the covariance between the market factor and the investment factor.

1. Introduction

Empirical studies have widely documented a significant negative cross-sectional correlation between investment (or asset growth) and future stock returns in both US and many other markets.[1] However, researchers disagree on how to explain the investment effect. Many cite this as evidence of market inefficiency and propose several mispricing-based explanations. For example, Stein (1996), Baker and Wurgler (2002), and Baker et al. (2003) all present models in which managers are timing the market and invest when their stocks are overpriced. Therefore, the subsequent negative returns reflect a correction for the overpricing of the stocks. Titman et al. (2004) interpret the negative investment-return relation as being indicative of investors' slow reaction to overinvestment by empire building managers. Cooper et al. (2008) argue that investors overact to asset growth and a negative abnormal return follows as a result of a correction for the overreaction. Lipson et al. (2011) show that the return effect is concentrated around earnings announcements because analyst forecasts are systematically higher than realized earnings for faster growing firms.

Alternative explanations of the investment-return relation have focused on rational asset pricing, and a growing number of studies provide empirical evidence consistent with a rational investment effect. In the real options models presented by Berk et al. (1999) and Carlson et al. (2004, 2006), firms undertaking investment projects experience a fall in their systematic risk and expected returns. Cochrane (1991, 1996), Lyandres et al. (2008), Li et al. (2008) and Liu et al. (2009) argue that higher investments are often associated with lower discount rates and hence lower expected returns.[2] Building on standard Q-theory, a set of recent papers augment the capital asset pricing model (CAPM) with an investment factor, the return on a portfolio that is long on low-investment stocks and short on high-investment stocks, to explain the cross-section of average returns. The evidence shows that such an investment model helps explain the value effect (Xing, 2008), the new issues puzzle (Lyandres et al., 2008), and the accrual anomaly (Wu et al., 2010).[3]

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[1] A partial list of recent contributions includes Anderson and Garcia-Feijoo (2006), Xing (2008), Cooper et al., 2008, Watanabe et al. (2013), and Titman et al. (2013).

[2] Other recent contributions include Gomes et al. (2003); Fama and French (2006); Anderson and Garcia-Feijoo (2006); Xing (2008); Belo and Lin (2012); Lin and Zhang (2013); Watanabe et al. (2013).

[3] In an interesting study, Li et al. (2006) also show that sector-specific investment growth rates can explain the cross-section of equity returns.

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Chen et al. (2011) find that their alternative three-factor model that includes the market factor, the investment factor, and a return-on-equity factor helps understand many CAPM-related anomalies.

Nevertheless, most of these authors stop short of explicitly invoking the risk interpretation for the investment effect, probably because of the Q-theory's partial equilibrium nature. In essence, the debate about the properties of the investment effect and other accounting return anomalies is about distinguishing (1) the covariance between stock returns and a given attribute from (2) the returns attributable to the characteristic. And as Richardson et al. (2010) write concisely: "Finding evidence in support of (1) is consistent with a risk based explanation for the return relation, whereas finding (2) would suggest mispricing" (p. 430). Empirically distinguishing between these two competing hypotheses has proven to be a challenging task because characteristics are associated with covariation in returns. Recently, there are two important studies that follow this insight and directly test the risk-based explanation against the (behavioral) mispricing explanation for the investment effect.[4] By applying Daniel and Titman's (1997) methodology, Hirshleifer et al. (2012) identify variation in their accrual-related factor loadings that is independent of the accrual characteristic and test whether this independent variation in factor loadings is associated with spreads in average returns. Their findings oppose the hypothesis that the accrual anomaly represents a premium for bearing risk within a standard factor pricing model and support the behavioral mispricing explanation of the anomaly. Prombutr et al. (2012) attain similar results by also applying Daniel and Titman's (1997) method to study the investment growth anomaly. However, they show that the anomaly can be explained by a conditional Fama–French three-factor model that allows factor loadings to be time-varying and further linked to firm-level characteristics and the business cycle.

This paper extends Prombutr et al. (2012) and complements their work by directly modeling time-varying covariance risk as following a bivariate generalized autoregressive conditional heteroskedasticity (GARCH) process. More specifically, motivated by Fama's (1991) conjecture of an explicit link between the cross-sectional and time-series stock return predictability, we investigate in this paper whether return covariance with the investment factor constructed from the cross-section of stocks also has time-series predictive power for stock returns within Merton's (1973) intertemporal CAPM (ICAPM) framework. The premise here is that if the investment effect shows both cross-sectional and time-series predictive power for stock returns, it is more likely to be a reliable proxy for time-varying investment opportunities, rather than a result of spurious regressions or data mining.[5] This will provide additional evidence consistent with risk-based explanations of the investment effect.

Our model can be summarized as follows. If the investment factor is a proxy for time-varying investment opportunities, Merton's (1973) ICAPM implies that the conditional excess stock market return, $E_t(MKT_{t+1})$, is determined by its conditional variance, $\sigma^2_{M,t}$, and its conditional covariance with the investment factor (IA), $\sigma_{MI,t}$:

$$E_t(MKT_{t+1}) = \gamma_M \sigma^2_{M,t} + \gamma_I \sigma_{MI,t}, \tag{1a}$$

where γ_M can be understood as the coefficient of relative risk aversion and should be positive. The coefficient γ_I is equal to $-J_{WI}/J_W$, where $J(W_t, IA_t)$ is the indirect utility function of the representative agent with subscripts W and WI denoting the first- and second-order (partial) derivatives, W_t is the agent's wealth at time t. If IA proxies for investment opportunities and is a priced risk factor, then γ_I should also be positive. The ICAPM also implies that conditional investment factor return, $E_t(IA_{t+1})$, is determined by its conditional variance, $\sigma^2_{I,t}$, and its conditional covariance with the market factor MKT, $\sigma_{MI,t}$:

$$E_t(IA_{t+1}) = \gamma_M \sigma_{MI,t} + \gamma_I \sigma^2_{I,t}. \tag{1b}$$

For our benchmark analysis, we follow the lead of Scruggs (1998), Scruggs and Glabadanidis (2003) and Guo et al. (2009) and jointly estimate the ICAPM (1a) and (1b) as a parsimonious bivariate GARCH-in-mean model.[6] Note that Merton's (1973) theoretical model is silent about the identities of the underlying state variables that can proxy for investment opportunities. Nor does it specify the number of such variables. As robustness checks, we extend the basic model in two ways. We first include a macro variable that tracks business cycles as a predictive variable in both (1a) and (1b). The inclusion of such a state variable will directly affect the estimation of risk premiums associated with the three (co-)variance terms. It is also likely to have an impact on the estimation of the covariances themselves because they are iteratively estimated within the model. This latter flexibility allows us to model covariances as both time-varying and potentially varying with business conditions (such as in Prombutr et al. (2012). Our second modification to the model (1) is to consider a three-factor ICAPM that also includes the value factor or the return-on-equity factor in addition to the two factors MKT and IA.

It is well known that consistent and efficient estimation of model (1) and study of the risk-return tradeoff critically depend on the estimates of the unobservable conditional market variance $\sigma^2_{M,t}$, and conditional covariance $\sigma_{MI,t}$. However, empirical researchers have often found that the estimation of high-dimension GARCH-in-mean models is difficult. This underlies our choice of the simple two-factor model as the benchmark as in Scruggs (1998), Scruggs and Glabadanidis (2003) and Guo et al. (2009). As a robustness check on our benchmark GARCH estimates, we extend Ghysels et al.'s (2005) mixed data sampling (MIDAS) method of estimating conditional variance from univariate to multivariate settings. We also use the new method to estimate more parameterized ICAPM specifications.[7]

Our main findings can be summarized as follows. First, both risk price estimates, γ_M and γ_I, are positive, statistically significant, and fall in reasonable ranges. This central finding remains robust to different data frequencies, alternative estimates of the investment/asset growth effect, different methods of estimating conditional variances, different sizes of stocks, and whether or not the return-on-equity factor is included in the model. We also find that if the investment factor IA is omitted from Eq. (1a) (i.e., $\gamma_I = 0$), the risk price estimate for the market factor γ_M becomes smaller because the investment factor and the market factor are negatively correlated. One interpretation of this result is that the stock market might act as a hedge against changes in investment opportunities.

Quantitatively, the benchmark model estimates for risk prices associated with the market and the investment factors are 4.32 and 13.47, respectively. The sample average market factor premium is 0.98% on a monthly basis. The investment factor commands a negative premium of 0.43%, which is both statistically

[4] Cooper and Priestley (2011) and Wang (2013) use a different approach. Briefly, by showing that the investment factor forecasts aggregate economic activities and moves closely with variables that describe investment opportunities, they conclude that risk plays an important role in explaining the investment effect.

[5] See Daniel and Titman (2006), Lewellen et al. (2010), Nagel and Singleton (2011) for skepticism on test power in the cross-sectional asset pricing literature.

[6] In estimating ICAPM models similar to Eqs. (1a) and (1b), Scruggs, 1998; Scruggs and Glabadanidis, 2003; Guo et al., 2009 use the long-term interest rate and the value premium as proxies for investment opportunities, respectively.

[7] An alternative method to reduce dimensionality in estimating multivariate GARCH models is to specify the conditional covariance matrix to be a vector diagonal model (e.g., Abhakorn et al., 2013).