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Risk-adjusting the returns of private equity using the CAPM and multi-factor extensions

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ABSTRACT

This paper develops a novel Public Market Equivalent (PME) measure to evaluate the risk-adjusted performance of private equity investments using the standard CAPM and multi-factor extensions. Using a comprehensive sample of 7732 fully realized venture capital investments, the paper estimates PMEs using the standard CAPM, the Fama–French three-factor model, and a four-factor model that also includes the Pastor–Stambaugh traded liquidity factor. The results highlight that venture capital investments substantially outperform traded stocks and that their returns resemble those of small growth stocks. Additionally, the results show that the exposure of venture capital returns to the traded liquidity factor is negligible.

1. Introduction

Estimating the performance of private equity is particularly challenging due to the illiquid nature of the asset class. Since neither the interests in a private equity fund, nor its portfolio companies are typically traded, regular valuations are not available and, hence, the performance must be evaluated from observable cash flows alone. Currently, the most widely used measures of performance are the internal rate of return (IRR), total value to paid-in capital (TVPI), and the Public Market Equivalent (PME) measure developed by Kaplan and Schoar (2005).[1] IRR and TVPI are problematic as they are measures of absolute returns that do neither account for risk nor for the time value of money in the case of TVPI. While

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[1] While the Kaplan and Schoar PME is the most widely used measure, there are several variations of the PME in the literature. For a summary and discussion of the different approaches, refer to Gredil et al. (2014).

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Kaplan and Schoar (2005) provide only a heuristic motivation of the PME, recent research by Korteweg and Nagel (2015) and Sorensen and Jagannathan (2015) shows that it is a valid measure of risk-adjusted performance that can be derived from the Rubinstein (1976) CAPM under the assumption that investors have log-utility. However, the method still suffers from two deficiencies. First, Korteweg and Nagel (2015) show that the standard PME can lead to biased performance estimates because of the underlying assumption of log-utility. Second, the standard PME cannot easily be augmented with additional risk factors other than the market return.

The innovation of this paper is to present a method that allows estimating PMEs using the standard CAPM, which is the most widely used asset pricing model. Another major advantage of the method is that the PME calculation can easily be extended to incorporate additional risk factors, such as the Fama and French (1993) factors or traded liquidity factors. The estimation method is based on the certainty equivalent form of the CAPM, which allows deriving PME measures without explicitly calculating any betas or even knowing the risk of the underlying investments. Similar to the Kaplan and Schoar PME, the estimation can be done using a stream of observable investment cash flows and requires no market valuations.

The developed method is applied to a unique and comprehensive dataset containing the exact monthly gross of fee cash flows generated by a large number of portfolio company investments from venture capital funds. Overall, the data contains 7732 fully liquidated venture capital investments. Using this sample, the paper starts by estimating the PME of venture capital using the standard CAPM. Then, recognizing that venture capital investments tend to be made predominantly in small growth companies, we consider the Fama and French (1993) three-factor model. Finally, we augment the three-factor model with the Pastor and Stambaugh (2003) traded liquidity factor. The results highlight that venture capital investments substantially outperform traded stocks before fees and carried interest payments. Relative to small growth stocks, there is still outperformance, but it is markedly lower, which implies that venture capital returns resemble those of small growth stocks. In addition, the results show that the exposure of venture capital returns to the traded liquidity factor is negligible.

The remainder of this paper is organized as follows. Section 2 develops the estimation approach. Section 3 describes the venture capital data used for the empirical analysis and presents the estimation results. The paper concludes with Section 4.

2. Estimation methodology

The PME measure can be defined as the present value of a private equity investment's cash outflows (i.e., the capital received from a private equity fund or portfolio company) divided by the present value of all cash inflows (i.e., the capital paid into a private equity fund or portfolio company):

$$PME = \frac{PV_{D,0}}{PV_{I,0}}, \tag{1}$$

where $PV_{D,0}$ denotes the present value of the outflows and $PV_{I,0}$ denotes the present value of the inflows at time 0. Intuitively, the PME measure minus one equals the present-valued return on invested capital, that is, the excess value created for each dollar invested. This means that $1 invested in private equity is worth the PME in present value terms. Consequently, the interpretation of this measure is that an investment with a PME greater (less) than one has outperformed (underperformed) on a risk-adjusted basis. Eq. (1) shows that calculating PMEs reduces to calculating present values of private equity cash flows. The following illustrates how this can be done using the standard CAPM and multi-factor extensions.

Note that the estimation methodology developed in the following can be applied to both, investments in private equity funds by institutional investors, as well as investments in portfolio companies by the funds themselves. In the following, we use the term *investment* and note that this can refer likewise to a private equity *fund* or *portfolio company* investment.

2.1. CAPM public market equivalent

Let T denote the total lifetime of a private equity investment and let X_t denote its cash flow at time t. The cash flow X_t includes inflows I_t paid into a fund or portfolio company at time t and outflows D_t received from a fund or portfolio company at time t, i.e., $X_t = D_t - I_t$.

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