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Investment and the weighted average cost of capital ☆

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ABSTRACT

In a standard *q*-theory model, corporate investment is negatively related to the cost of capital. Empirically, we find that the weighted average cost of capital matters for corporate investment. The form of the impact depends on how the cost of equity is measured. When the capital asset pricing model (CAPM) is used, firms with a high cost of equity invest more. When the implied cost of capital is used, firms with a high cost of equity invest less. The implied cost of capital can better reflect the time-varying required return on capital. The CAPM measure reflects forces that are outside the standard model.

1. Introduction

How does the cost of capital affect corporate investment? To government policy makers, the answer seems obvious: Keep interest rates low to stimulate corporate investment. The negative impact of the cost of capital on investment is a basic component in many academic papers that focus on other issues. And yet, perhaps surprisingly, the empirical corporate investment literature largely ignores the question of how the cost of capital affects corporate investment.

In this paper, we study how the weighted average cost of capital (WACC) affects corporate investment using U.S. firm-level data from 1955 to 2011. We use the model from Abel and Blanchard (1986) to relate optimal corporate investment to a firm's cash flow and cost of capital. The model predicts that a high cost of capital leads to low investment. We provide strong empirical evidence that the weighted average cost of capital matters for corporate investment. The form of the impact, however, is more complex than predicted by the model.

To understand the complexity of this impact, note that the weighted average cost of capital consists partly of the cost of debt and partly of the cost of equity. As predicted, firms with a high cost of debt invest less. However, the impact of the cost of equity depends on how it is measured. The cost of equity can be measured by a factor model such as the capital asset pricing model (CAPM). It can also be measured by an implied cost of capital (ICC) model. The ICC-based results match the model predictions, but the CAPM-based results do not.

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When the CAPM, or a related factor model, is used to infer the cost of equity, the WACC is significantly positively related to corporate investment.[1] This finding arises from the fact that the usual factor models produce costs of equity that are positively related to corporate investment. This positive relation overwhelms the impact of the cost of debt.

When an ICC model is used to infer the cost of equity, the weighted average cost of capital is significantly negatively related to corporate investment.[2] We find that the ICC models produce costs of equity that are negatively related to corporate investment. This negative relation complements the impact of the cost of debt.

How should these findings be interpreted? The ICC-based results are readily interpreted by the model. Pastor, Sinha, and Swaminathan (2008) provide a set of conditions under which the ICC is a perfect proxy for time-varying expected equity returns. Accordingly, Abel and Blanchard (1986) and Pastor, Sinha, and Swaminathan (2008) together provide a good theoretical foundation for the observed impact of ICC on corporate investment. The conclusion is that the cost of capital negatively affects investment and is an important force in firms' capital budgeting decisions.

Interpreting the CAPM-based result is not as straightforward. Naturally, the literature is rather critical of the CAPM. A logical conjecture, then, is that the CAPM simply provides a noisier proxy for the expected cost of equity than the ICC provides. To test this idea, we estimate investment regressions with both ICC- and CAPM-based estimates included. If the CAPM measure were simply a poor proxy, the coefficient on this variable might not be statistically significant. Empirically, however, both are statistically significant, and both have their original signs. Thus, the CAPM-based estimate provides empirically relevant information for investment that is distinct from that provided by the ICC. However, the impact of the CAPM-based cost of equity on investment is not the cost of capital effect predicted by Abel and Blanchard (1986). As in Chava and Purnanandam (2010), some other mechanism must be at work. We provide suggestive evidence on a number of possibilities that draw on the literature.

To the best of our knowledge, this paper is the first to systematically study the impact of the WACC and its components on firm-level investment. Surprisingly few studies have been done of the WACC in general. Kaplan and Ruback (1995) study a sample of high leverage transactions between 1983 and 1989, and Gilson, Hotchkiss, and Ruback (2000) study a sample of firms in bankruptcy reorganization. In both papers, the discounted cash flow analysis performs well. These studies do not focus on the components of the WACC, and they leave unclear how broadly applicable the approach could be.

A number of papers focus on the impact of investment on stock returns, such as Zhang (2005), Carlson, Fisher, and Giammarino (2004, 2006), Liu, Whited, and Zhang (2009), and Lin and Zhang (2013). Their models are generally similar to the one in Abel and Blanchard (1986) and are used to explain future stock return spreads across portfolios sorted by firm characteristics. In contrast to the investment-based asset pricing literature, this paper focuses on the impact of the cost of capital on corporate investment.

The classic implied cost of equity capital approach uses the Gordon growth model. An increasingly popular version is based on residual income accounting as proposed by Gebhardt, Lee, and Swaminathan (2001) and further studied by Pastor, Sinha, and Swaminathan (2008), Hou, van Dijk, and Zhang (2012), Lewellen (2010), and Chava and Purnanandam (2010), among others. Our paper uses both the Gordon growth model and the residual income model. They produce similar results.

Although much of the corporate investment literature has focused on q-theory, this paper is not the first to adopt the method in the work of Abel and Blanchard (1986). Their original paper examines aggregated data and does not obtain clear evidence of the role of the WACC. Using a similar approach, Gilchrist and Himmelberg (1995) attempt to use the model to construct a better measure of Tobin's q and to understand differences among firms with respect to the impact of cash flows. These studies do not use the model to examine the differing impacts of the cost of debt and the cost of equity on investment.

Philippon (2009) and Gilchrist and Zakrajšek (2007, 2012) study whether the cost of debt affects investment at the aggregate and firm levels. Our evidence on the impact of the cost of debt is similar to theirs, but none of these papers examines the impact of the cost of equity on investment. Also noteworthy is that it appears challenging to identify the impact of the cost of debt on investment in the aggregate data, as reported by Kothari, Lewellen, and Warner (2014).

Section 2 derives the model of corporate investment. The data and descriptive statistics are discussed in Section 3. Investment regression results based on the measures from the CAPM and related models are reported in Section 4. Implied cost of equity capital results are reported in Section 5. The conclusion is in Section 6.

2. Corporate investment model

In this section, we first derive a directly testable investment equation based on the model in Abel and Blanchard (1986). The optimal corporate investment is related to a firm's cash flow and cost of capital. This relation relies on assumptions about the cost of capital dynamics. Accordingly, we also discuss how relaxing these assumptions affects the key predictions.

2.1. The basic model

The model follows that in Abel and Blanchard (1986). To explain the model, we define the following variables:

[1] We examine the factors of Fama and French (1993), Carhart (1997), Kogan and Papanikolaou (2013), and Novy-Marx (2013).

[2] We examine a number of closely related methods, drawing on work by Gebhardt, Lee, and Swaminathan (2001), Pastor, Sinha, and Swaminathan (2008), Chava and Purnanandam (2010), Hou, van Dijk, and Zhang (2012), Li, Ng, and Swaminathan (2013), and Tang, Wu, and Zhang (2014).