Corporate Liquidity and Asset Returns

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Abstract

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Abstract

We use an investment based asset pricing model to examine the effect of firms' investment relative to cash holdings on stock returns, assuming holding cash lowers transaction costs and helps to capitalize future investment opportunities. We find that mimicking portfolios based on investment relative to non-cash capital and investment relative to cash capital, when combined with market excess return, explain approximately 64% of the value premiums and 67% of the momentum profits. Investment relative to cash capital is significant in explaining the excess returns of growth stocks and momentum stocks.

1 Introduction

Investment-based asset pricing models that equate stock returns to returns on capital investment have received considerable attention in the finance literature.[1] Return on capital investment consists of the marginal benefit and marginal cost of investing a unit of capital. Given expected future marginal benefits, investment and future stock returns should negatively co-vary over time because, when discount rates fall, the hurdle rate on investment falls and firms increase their investments. The implication for cross-sectional asset pricing is that an investment factor emerges which Xing (2008) contended is similar to the value factor suggested by Fama and French (1992, 1993,1996). Chen and Zhang (2008) found that two neoclassical factors, the investment factor and the productivity factor, when combined with the market factor, can explain various anomalies in the financial markets.

This paper examines how stock returns are affected by firms' investment relative to their cash holdings assuming cash lowers transaction costs and helps firms to catch future investment opportunities. We study whether basing factors on investment relative to cash causes common variations in cross-sectional stock returns. We break the traditional investment factor into two components–investment relative to non-cash capital and investment relative to cash capital–because investment will vary with the availability of internal funds, rather than just with the availability of projects with positive net present value (see Fazzari, Hubbard and Petersen, 1988; Kamplan and Zingales, 1997). High levels of investment signal low future returns and, if firms do not have sufficient cash to cover transaction costs at the same time, future returns will be even lower. On the other hand, low investment, coupled with sufficient cash in the firm will reinforce future returns. Thus, investment relative to cash should be a determinant in cross-sectional

[1]A small list of related studies includes Cochrane (1991, 1996), Restroy and Rockinger (1994), Abel and Eberly (1994), Jermann (1998), Zhang (2005), Balvers and Huang (2007) and Jermann (2008)

asset returns .[2]

We first present a model that formalizes previous intuition. When profit-optimizing firms choose cash to lower transaction costs and capture good investment opportunities (Baumol, 1952; Miller and Orr, 1966; Opler, Pinkowitz, Stulz and Williamson, 1999; Bates, Kahle and Stulz, 2007), stock return is the weighted average of return on physical capital and return on cash capital. The weight on physical capital is significantly larger than that on cash capital; consequently, the stock return is driven by return on physical capital investment, and we find that holding cash increases return on physical capital.

Following Fama and French (1996), we then construct portfolios using firms' market capitalization, investment to non-cash capital(I/P ratio) and investment to cash capital(I/C ratio). All stocks are divided into three groups based on I/C and two groups based on size. Our cash investment factor (INVC) is the difference between the two low I/C portfolios and the two high I/C portfolios. The physical capital investment factor (INVP) is constructed in the same way. Because the cash investment factor (INVC) may share a common trend with the physical capital investment factor (INVP), we regress INVC on INVP to remove the possible trend. [3] We argue that, breaking traditional investment factors into physical capital investment and cash capital investment should result in better performance in cross-sectional asset pricing. We expect this improvement because we have a better measurement of q that reflects both investment demand and cash demand. In this respect, our study is complementary to Chen and Zhang (2008); however, we differ from Chen and Zhang in that we model firms' investments in both physical capital and cash capital, we allow interactions between the two types of capitals, and we show that not only traditional investment factors and expected productivity factors, but also investment relative to cash matter.

[2]In general, the investment cash flow literature has examined how investment responds to cash flows (Hubbard, 1998; Cleary; 1999, Almeida, Campello and Weisbach, 2004; Moyen, 2004). Our approach differs in that we examine how stock returns respond to such decisions in a neoclassical model.

[3]The correlation between original INVC and INVP is -0.28. Using them generates similar results for cross sectional testing.

We find that INVP and INVC, with or without the market factor, can explain approximately 67% of the variation in 25 size-value portfolios and 25 size-momentum portfolios. The performance of our models is much better than those of the CAPM (Sharpe, 1964; Linter, 1965) and is comparable to those of the Fama-French 3 factor model. Ideally, one would expect that four factors-the market, investment relative to non-cash capital, investment relative to cash, and profitability (productivity)-would price the assets in our model. As documented by Barro (1990) and Blanchard, Rhee and Summers (1993), current as well as lagged profits are strongly positively related to current investment. We find that our investment relative to the cash factor is significantly correlated with the profitability factor (-0.39), so including the profitability factor helps only marginally. Excluding the market factor does not lower the overall fit of the two investment factors but generates a higher Jensen's α.

We find growth stocks earn premiums from the INVC factor and that value stocks earn premiums from the INVP factor. This finding occurs because growth stocks, on average, have higher I/C ratios and value stocks have higher I/P ratios. We also find support for momentum stocks' earning their premiums mainly from the INVC factor; the INVC factor alone explains 19% of the variation of the size-momentum portfolios. We also find that momentum stocks tend to be those with low I/P and I/C ratios, which finding suggests that momentum stocks earn high returns not only because of low investment costs but also because of low investment costs relative to cash.

Our study sheds light on factor-based cross-sectional asset pricing through development of a model that performs well and is also theoretically motivated. Classical models such as the CAPM and the consumption-based CAPM are based on appealing intuition and show that stock returns are determined by their covariances with either market return or marginal utility of consumption (e.g., a stock is risky when it pays highly when marginal utility of wealth-consumption-is low, and this kind of stock requires a risk premium). However, the empirical performance of these two models is unimpressive. Fama and French (1996) used market excess return, return spread between small firms and big ?rms, and return spread between value and growth firms as factors in their model and found that these factors explain a substantial portion of cross-sectional stock return variations. However, their model is not derived from firms' optimization or consumers' optimization, and it is not clear what the exact underlying risks are. We show that firms' returns are driven by their investments in cash capital and physical capital. As shown in Daniel and Titman (1997) and emphasized by Liu, Whited and Zhang (2007), characteristics and covariances are two sides of the same coin and, as a result, investment relative to non-cash capital and investment relative to cash capital act as a common factor.

2 A Two-Period *q* Model

2.1 The model

We model firms' investment in cash in a two-period investment-based asset pricing model (e.g., Cochrane, 1991, 1996; Restroy and Ronkinger, 1994; and Zhang,2005). At time t, firms choose investment in physical capital and in cash capital and pay convex, non-decreasing adjustment costs (Hayashi, 1982; Abel and Eberly, 1994) and transaction costs (Keynes, 1936; Baumol, 1952; Miller and Orr, 1966) to maximize current dividends and discounted future capital

$$\begin{aligned} &\underset{(i_t^p, i_t^c)}{Max}\ \pi(k_t^p, \Theta_t) - i_t^p - \Phi(i_t^p, k_t^p) - T(i_t^p, k_t^c + i_t^c) - i_t^c + \\ &E_t\ M_{t+1}\left\{[\pi(k_{t+1}^p, \Theta_{t+1}) + (1-\delta_p)k_{t+1}^p + (1-\delta_c)k_{t+1}^c\right\} \end{aligned} \tag{1}$$

subject to

$$k_{t+1}^{j} = (1 - \delta_j)k_t^j + i_t^j \qquad j = p, c \tag{2}$$

where i_t^p is investment in physical capital and i_t^c is investment in cash, k_t^p and k_t^c are the stock of physical capital and cash capital. δ_p is the depreciation rate of physical capital, δ_c is the inflation rate of cash capital; M_{t+1} is the stochastic discount factor, $\pi(k_t^p, \Theta_t)$ is a profit function that features constant elasticity of substitution and uncertainty Θ_t. Each firms' decision is different because of firm-specific productivity shocks in Θ_t .

We model the transaction cost, T, separately from the traditional adjustment cost, Φ, to emphasize the effect on firm value of hodling cash, and we assume investment in cash has an immediate effect on lowering transaction costs, such that the marginal q of cash is different from a constant over time. This approach also allows ?rms to have a precautionary motive to hold cash so that ?rm invests more in cash when it expects a bad productivity shock or tight credit market. Alternatively, one can view adjustment cost as being more physical and taking time to build, while cash is more monetary and does not take time to build. Transaction cost is linear and homogeneous and $T_1 > 0, T_{11} > 0$, that is, firms pay transaction costs for physical investment transaction costs are convex; $T_2 < 0, T_{22} > 0$, that is, cash capital reduces transaction cost with diminishing effect; and $T_{12} < 0$, that is, holding cash helps to reduce transaction cost at the margin. Essentially, holding cash makes the traditional physical capital accumulation more effective.[4]

If we let q_t^p and q_t^c be the shadow value of physical capital and cash capital, we obtain

[4] Huberman (1984) required firms to hold cash before new projects are undertaken. Kim, Mauer and Sherman (1998) used a three-period model to show firms' investments in cash are positively related to the cost of external financing.

the following first order conditions:

$$q_t^p = 1 + \Phi_1(i_t^p, k_t^p) + T_1(i_t^p, k_t^c + i_t^c) = E_t M_{t+1}[\pi_1(k_{t+1}^p, \Theta_{t+1}) + (1 - \delta_p)] \quad (3)$$

$$q_t^c = 1 + T_2(i_t^p, k_t^c + i_t^c) = E_t M_{t+1}(1 - \delta_c) \quad (4)$$

Equation (3) states that the price of one unit of physical capital and the associated adjustment and transaction costs that firms occur at time t, are equal to the present value of expected future marginal benefits, which include the expected marginal product and sale value of one unit of physical capital. Equation (4) states that the cost of investing in cash is the price of one unit of cash capital net of the transaction cost it saves. Here the return on investing in cash is simply real interest rate if one treats transaction cost as the nominal interest rate.

We define return on the two capitals as:

$$r_{t+1}^p = \frac{\pi_1(k_{t+1}^p, \Theta_{t+1}) + (1 - \delta_p)}{q_t^p} \quad (5)$$

$$r_{t+1}^c = \frac{(1 - \delta_c)}{q_t^c} \quad (6)$$

Using this definition and equations (3) and (4) we get the standard asset pricing equations for physical capital investment returns and cash capital investment returns:

$$E_t[M_{t+1} r_{t+1}^p] = 1 \quad (7)$$

$$E_t[M_{t+1} r_{t+1}^c] = 1 \quad (8)$$

The ex-dividend stock price today is:

$$\begin{aligned} p_t &= E_t M_{t+1}[\pi(k^p_{t+1}, \Theta_{t+1}) + (1-\delta_p)k^p_{t+1} + (1-\delta_c)k^c_{t+1}] \\ &= q^p_t k^p_{t+1} + q^c_t k^c_{t+1} \end{aligned} \tag{9}$$

where the second equality follows from the CES of profit function and first-order conditions. The market value of a firm consists of the market value of physical capital and the market value of cash capital. Faulkender and Wang (2006) found that the market value of cash is contingent upon whether the cash is used to pay dividends, to service debt or to decrease the amount that is needed in the credit market. They found that the marginal value of cash declines with larger cash holdings, higher leverage, and better access to capital markets, and that also declines as firms choose greater cash distribution via dividends rather than repurchases. The cum-dividend stock return is

$$\begin{aligned} r_{t+1} &= \frac{\pi(k^p_{t+1}, \Theta_{t+1}) + (1-\delta_p)k^p_{t+1} + (1-\delta_c)k^c_{t+1}}{p_t} \\ &= r^p_{t+1}\frac{q^p_t k^p_{t+1}}{p_t} + r^c_{t+1}\frac{q^c_t k^c_{t+1}}{p_t} \end{aligned} \tag{10}$$

which shows that stock return is a weighted average of return on physical capital investment and return on cash capital investment.

2.2 Intuition

This section examines how expected stock returns are affected by the return on physical capital and the return on cash capital. Taking the expectation from equation (10) gives

$$E_t[r_{t+1}] = E_t[r^p_{t+1}]\frac{q^p_t k^p_{t+1}}{p_t} + E_t[r^c_{t+1}]\frac{q^c_t k^c_{t+1}}{p_t} \tag{11}$$

where

$$E_t[r^p_{t+1}] = \frac{E_t[\pi_1(k^p_{t+1}, \Theta_{t+1})] + (1-\delta_p)}{1 + \Phi_1(i^p_t, k^p_t) + T_1(i^p_t, k^c_t + i^c_t)} \quad (12)$$

$$E_t[r^c_{t+1}] = \frac{(1-\delta_c)}{1 + T_2(i^p_t, k^c_t + i^c_t)} \quad (13)$$

Equation (11) shows that the expected stock return or discount rate is determined by four factors: expected return on physical capital investment, expected return on cash capital investment and the weights of the two types of investment. The first implication is that holding cash raises expected return on physical capital investment because cash lowers transaction costs. Meanwhile, holding cash lowers expected return on cash capital investment because of the diminishing effect of investing in cash.[5] The second implication is that we can expect the weight of cash to be much smaller than that of physical capital, so expected stock return is dominated by expected return on physical capital investment. If future discount rate arises as a result of an increase in expected return on physical capital investment, given expected future profitability, firms are likely to choose either low physical capital investment or high cash capital investment, based on the marginal q of physical capital. Thus, both low physical capital investment and high cash capital investment predict high future returns.

In our model, investment in cash is clearly related to credit market conditions or expected future productivity in our model. Anticipating a bad productivity shock and tight credit conditions, firms hold more cash and invest less in physical capital, so firms have a precautionary motive to hold cash, and the effect of having cash in our two-period model is reflected in the return on physical capital investment it can raise. On the other hand, in good times, if cash is low relative to investment in physical capital, firms may find themselves constrained by internal liquidity.

[5]Specifically, $\frac{\partial r^p_{t+1}}{\partial i^c_t} = -\frac{T_{12}}{(q^p_t)^2}[\pi_1 + (1-\delta_p)] > 0$ and $\frac{\partial r^c_{t+1}}{\partial i^c_t} = -\frac{T_{22}}{(q^c_t)^2}(1-\delta_c) < 0$;

2.3 Factor Pricing

Cochrane (1996) showed that stock returns or investment returns drive cross-sectional asset returns while, in our model, stock return is the weighted average of return on physical capital and return on cash capital. Let

$$\Phi_t = \frac{a_1}{2}(\frac{i_t^p}{k_t^p})^2 k_t^p \tag{14}$$

$$T_t = \frac{a_2}{2}(\frac{i_t^p}{k_t^c + i_t^c})^2 (k_t^c + i_t^c) \tag{15}$$

where a_1 and a_2 are positive parameters. Equation (12) and (13) now become

$$E_t[r_{t+1}^p] = \frac{E_t[\pi_1(k_{t+1}^p, \Theta_{t+1})] + (1 - \delta_p)}{1 + a_1 \frac{i_t^p}{k_t^p} + a_2 \frac{i_t^p}{k_t^c + i_t^c}} \tag{16}$$

$$E_t[r_{t+1}^c] = \frac{(1 - \delta_c)}{1 - \frac{a_2}{2}(\frac{i_t^p}{k_t^c + i_t^c})^2} \tag{17}$$

The numerator in equation (16) can be treated as expected productivity. Xing (2008) used sales-to-asset-ratio as proxy and found that, after controlling for expected productivity, stock returns are related to physical capital investment. Chen and Zhang (2008) found that using current return on assets as proxy can explain the momentum profits among stocks. In our study, we focus on firms' investment relative to cash holdings; as we discuss below, investment relative to cash is still significant in explaining cross-sectional asset returns when a proxy for expected future productivity is included, and excluding investment relative to cash significantly worsens the pricing results. When firms expect bad productivity shocks, they hold more cash and invest less as a precautionary motive and to ensure that they have cash to support good projects that may arise. Thus, investment relative to cash and investment relative to non-cash capital capture, at least to a degree, expected future profitability.

Equation (16) shows that the expected return on physical investment is affected by $\frac{i_t^p}{k_t^p}$, the ratio of physical capital investment to non-cash capital(I/P), and $\frac{i_t^p}{k_t^c+i_t^c}$, the ratio of physical capital investment to cash capital(I/C). Equation (17) shows that the expected return on cash capital is determined by the I/C ratio. We measure all variables using data up to time t.

Because stock return is derived in a partial equilibrium setting (Chen and Zhang, 2008), we include market return as an additional factor to capture average return of stock; thus, we test the following 3-factor model as our benchmark speci?cation:[6]

$$E[R^i_{t+1}] = \beta_{im}E[MKT] + \beta_{ip}E[INVP] + \beta_{ic}E[INVC] \tag{18}$$

where E[R_i] is expected excess return of stock i ; E[MKT], E[INVP] and E[INVC] are expected premiums on market excess return, the factors constructed using firms' I/P ratio and I/C ratio; and β_{im}, β_{ip}, and β_{ic} are factor loadings estimated from the following time series regressions

$$R^i_{t+1} = \alpha_i + \beta_{im}MKT_{t+1} + \beta_{ip}INVP_{t+1} + \beta_{ic}INVC_{t+1} + \epsilon_{i,t+1} \tag{19}$$

We also test multi-factor models in which proxies for expected future profitability are added and the market return is excluded for comparison and for robustness of the factor based on investments relative to cash.

[6]The widely cited Fama French (1996) 3-factor model also has a market factor; our model is similar in that it is a characteristics-based model.

3 Empirical Results

3.1 Data

We obtained monthly stock returns from January 1964 to December 2006 from CRSP, and the annual characteristics data from COMPUSTAT. To construct INVC, we independently sorted firms by size and investment-to-non-cash assets (I/C). We used the 50% size breakpoints for NYSE stocks to split all stocks into two groups in June of each year (t); following Fama and French (1996), we also split all stocks into three I/C groups based on the 30% and 70% breakpoints for NYSE stocks. We then formed 6 portfolios from the intersection of the two size groups and the three I/C groups, computed monthly returns for all portfolios from July of year t to June of year t+1, and rebalanced the portfolios in June of year t+1. The INVC is the difference between the average return of two low-I/C porfolios and two high-I/C portfolios. INVP is constructed in a similar way using investment-to-cash (I/C). We regressed INVC on INVP to remove the trending component in INVC that is due to INVP and use the residual for further study.

Our main testing assets are 25 size- and value-sorted portfolios, 30 industrial portfolios and 25 momentum portfolios. We also obtained the three Fama-French factors and the momentum factor for later comparison.[7]

[7] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french. Cash includes bank drafts, cash, checks (cashiers or certified), demand certificates of deposit, demand deposits, letters of credit, money orders, government and other marketable securities and time deposits. Firm size is measured by stock price times the total shares outstanding. The book-to-market equity ratio (BE/ME) at time t is calculated by dividing book equity (BE) at the fiscal end of year t-1 by market equity (ME) in December of year t-1. There is a lag of at least a 6 month between accounting data and market data. Following Cohen, Polk and Vuolteenaho (2003) and Fama and French (2008), book equity is defined as the stockholders' equity, plus balance sheet deferred taxes (Compustat item #74) and investment tax credit (Compustat item #208), plus post-retirement benefit liabilities (Compustat item #330), less the book value of preferred stock. Depending on availability, we measure the book value of preferred stock by the order of redemption (Compustat item #56), liquidation (Compustat item #10), or par value (Compustat item #130). Stockholders' equity is measured by Compustat item #216 or the book value of common equity (Compustat item #60), plus the par value of preferred stock or the book value of assets (Compustat item #6), less total liabilities (Compustat item #181).

3.2 Portfolio Return Formed on I/P and I/C

Panel A of Table 1 reports descriptive statistics. INVP had a mean of 0.26%, which is negatively correlated with market excess return and means that firms invest more when the future discount rate is low. The negative relationship between INVP and SMB suggests that small firms require the future discount rate to be even lower to invest, and the positive relationship between INVP and HML signals similar situation for growth firms. On the other hand, INVC is negatively related to HML and positively related to market excess return, SMB and the momentum factor. A high level of cash increases return on physical capital through reduced transaction costs, which is more likely to happen with small stocks, growth stocks and momentum stocks. It is negatively correlated with market excess return and it means that firms invest more when future discount rate is low. The negative relation between INVP and SMB suggests that small firms require future discount rate to be even lower to invest and the positive relation between INVP and HML signals similar situation for growth firms. On the other hand, INVC is negatively related to HML and positively related to market excess return, SMB and momentum factor. High level of cash increases return on physical capital through reduced transaction cost and it is more likely to happen for small stocks, growth stocks and momentum stocks.

Panel B of Table 1 reports the average excess returns of six portfolios formed on I/P and I/C. The returns of the two low I/P portfolios are 0.96% and 0.58%, and the returns on high I/P portfolios are 0.62% and 0.45%. This is consistent with earlier findings that stocks with low investment-to-asset ratios have higher returns; this finding holds even when we form portfolios using investment scaled by non-cash assets, rather than total assets. The returns of the two low I/C portfolios are 0.93% and 0.53%, and the returns of the two high low I/C portfolios are 0.64% and 0.38%.

To demonstrate that I/C provides additional information beyond that contained in

I/P, we construct nine portfolios using I/P and I/C, with all stocks allocated into three I/P groups and three I/C groups independently, using 30% and 70% breakpoints. Using the intersections, we report median values for all nine portfolios. As shown in Table 2, low I/C stocks have higher returns than high I/C stocks for all I/P groups. The excess returns of the three low-I/C portfolios are 0.69%, 0.78% and 0.41% the excess returns of three high-I/C portfolios are 0.44%, 0.39% and 0.39%. Coincidentally, low I/C stocks have low I/P ratios and low I/A (investment-to-asset) ratios and vice versa , suggesting that investment plays a dominant role. However, we find that low I/P stocks have high C/A (cash-to-asset) ratios in all three I/P groups, confirming that low I/C ratios are due to both low investment and high cash, rather than only to low investment.

3.3 Value vs. Growth Portfolios

We examined the pricing results of our model, comparing them to the Fama-French 3-factor model and the classical CAPM. We relied on the Fama-Macbeth (1973) two-pass regression to study the betas of the 25 portfolios sorted by size and book-to-market ratio, and we followed Cochrane (2001) in adjusting the t-values to account for bias in generated regressors (Shanken, 1992) and autocorrelation and heteroscedasticity (Jagannathan and Wang, 2002). We report both GLS R-squared and adjusted OLS R-squared following Kandel and Stambaugh (1995) and Lewellen and Shanken (2006), since GLS R-squared measures the maximum mean return a mean-variance investor can achieve if implied mean returns from a particular model are used as inputs for portfolio optimizations.

The CAPM does not perform well in terms of either OLS R-squared or GLS R-squared, yielding yielding 12% in both cases; it also has the wrong sign on market risk premiums. In our model, the risk premiums on market, INVP and INVC are 0.07%, 0.97% and 1.12% per month, respectively. The premiums on INVP and INVC factors are both significant, and our model shows a positive sign on market excess return, even though it is still insignificant. The Jensen's α of our 3-factor model is only 0.51% with t-value of 1.29 , which is economically and statistically less than 1.31% (t-value of 4.02) of the Fama-French 3-factor model and economically and statistically less than 1.25% (t-value of 3.18) of the CAPM. Although our model's OLS R-squared is 10% lower than that of the Fama French 3 factor model, but only 1% lower in terms of the GLS R-squared. Excluding the market factor does not lower the overall fit but the Jensen's α increases to a significant 1.23% when the market factor is excluded.

We break INVA into two components: the value component and the growth component arising from the ?rm's optimal decision in holding cash. Low I/P stocks have higher future returns because ?rms invest less when the future discount rate is higher. Low IC stocks also have higher future returns because high cash holdings lower transaction costs and facilitate building of physical capital. Meanwhile, investing in cash at time t allows ?rms to play it safe so they can respond to good investment opportunities when they are available, without resorting to sometimes expensive external ?nancing. Thus, cash holdings increase return on physical capital at time $t + 1$.

Table 4 provides the betas and t-values of the market excess return, INVP and INVC for the 25 portfolios, sorted by size and book-to-market ratio. Almost all betas are significant and 11 alphas from the first pass are significant. Value firms have higher betas on INVP, and growth firms have higher betas on INVC. The INVP and INVC betas of small value stocks are 0.40 and 0.13, respectively, but they are -0.84 and 0.79, respectively, for small growth stocks. As a result, growth firms earn higher premiums on the INVC component and value firms earn higher premiums on the INVP component. Figure 1 plots the median I/P and I/C for value stocks and growth stocks for small- and large-size stocks over time. Value stocks have lower I/P and higher I/C in general,[8] the only exception being the small capitalization category, where the I/C of value stocks is lower. Overall, lower I/P and higher I/C give value stocks higher INVP betas and lower

[8]Value stocks have higher I/C in the other three omitted size groups

INVC betas.

In our model, a firm has low market-to-book ratio when the weighted average of the two q's are low.[9] On average, value firms have a lower marginal q on physical capital since they usually have abundant physical capital, and the shadow value of that capital is low. On the other hand, value firms have higher marginal q on cash capital because they hold relatively less cash, and the value of additional cash is high.

The marginal q effect on physical capital dominates if the cash capital proportion of total capital is not too large; in our model, value firms have higher returns because of higher return on physical investment. This is consistent with conventional wisdom, but we provide an additional dimension of variation in the value premium, which is that growth firms earn their return premiums mainly from our INVC factor.

3.4 Size-Momentum Portfolios

Lewellen, Nagel and Shanken (2006) pointed out that size-value-sorted portfolios contain a factor structure, so one should examine whether certain factors still perform well if portfolios with less structure are used as testing assets. We use 25 portfolios sized by size and momentum as alternative testing assets, given that momentum is difficult to explain. The 25 portfolios are constructed monthly and are the intersections of five portfolios formed on size and five momentum portfolios formed on cumulative return from month j-12 to j-2 (skipping month j-1), where j is the month of the predicted return. We use the NYSE stock market equity and the prior 2-12 months' cumulative return quintiles as the monthly size and momentum breakpoints, respectively.

Table 5 shows that, when the 25 portfolios sorted by size and momentum are used as the testing assets, all models have high alphas; but our alpha is insignificant, and

[9] In our model, the market-to-book ratio is $\frac{M}{B} = \frac{q_t^p k_{t+1}^p}{k_{t+1}^p + k_{t+1}^c} + \frac{q_t^c k_{t+1}^c}{k_{t+1}^p + k_{t+1}^c}$.

INVP and INVC carry significant risk premiums that are comparable to those achieved when size-value portfolios are used as testing assets. Our model also has the highest GLS R-Squared and OLS R-squared, at 67% and 23%, respectively. The latter is, surprisingly, twice that of the Fama-French 3 factor model. Figure 2 plots the time series median of the I/Ps and I/Cs of winner and loser stocks for the three size groups, illustrating that winner stocks have lower I/C and I/P ratios and higher returns. When the market factor is excluded, the Jensen's α becomes significant at 1.51% with similar performance in terms of overall fit. When return on asset (ROA), a proxy for expected future profitability, is included and our INVC factor is dropped, we find that the overall fit is only 15.8%, less than the 19.8% achieved by a single-factor model consisting of only INVC.

3.5 Industry Portfolios

As a further robustness check, we also use 55 testing assets, consisting of 25 assets sorted by size and value and 30 industry portfolios. Table 6 shows that none of the models perform as well as they do for the 25 assets sorted by size and value. The ?ts of the models are substantially lower, ranging from 1% to 34.9% in terms of OLS R-squared and 1.4% to 11.9% in terms of GLS R-squared. Both the CAPM and the Fama-French 3-factor model have the wrong sign on the market, and our model is the only one that has an insignificant alpha (0.47% with t-value of 1.66). Our model has GLS R-squared of 10%, which is slightly lower than that of the Fama-French 3-factor model.

3.6 SDF Estimation

While the two-pass approach allows us to focus on betas, the one-stage Generalized Method of Moments (GMM) estimation (Hansen, 1982) can test whether certain factors help to explain the variation of the pricing kernel. We focus on the one-stage estimation because, as Lettau and Ludvigson (2001) and Cochrane (2001) recommended, the optimal weighing matrix is poorly estimated when the cross-section is large, as is the case in our sample. Jagannathan and Wang (2002) showed that the stochastic discount factor approach is as efficient as the expected-return-beta approach and that it has higher power in detecting model mis-specifications. Furthermore, using identity as the weighting matrix allows us to examine economically interesting portfolios. To evaluate the overall statistical significance of the model, we rely on the JT statistic. The stochastic discount factor can be written as:

$$m_{t+1} = 1 + b' f_{t+1} \tag{20}$$

where f_{t+1} is factors and b is a vector of coefficients. The pricing error is

$$g_T = E_T m r^e \tag{21}$$

where $r^{i,e}_{t+1}$ is excess stock return. GMM estimation minimizes weighted average of pricing errors such that:

$$\underset{b}{Min}\, g_T^{'} W g_T \tag{22}$$

If the factors are the true factors, we expect b to be significant and joint pricing errors (JT) to be insignificant.

Table 7 shows the estimation results for various model specifications using 80 portfolios, including 25 size-value portfolios, 30 industry portfolios and 25 size-momentum portfolios as testing assets. Consistent with our model, INVP and INVC are significant in explaining the variation of the stochastic discount factor with and without market excess return. The coefficients of market excess return, INVP, and INVC are -0.34, -4.95, and

-4.39, respectively, and the t-values of market excess return, INVP, and INVC are -0.44, -2.55 and -3.31, respectively. The negative signs suggest that increases in risk premiums of INVP and INVC lower the value of the stochastic discount factor much as in the case where, when marginal utility of wealth is the stochastic discount factor and wealth growth is the factor, we expect the sign to be negative. Stocks correlate negatively with the stochastic discount factor and positively with the factors; in our sample, the market factor, INVP and INVC are risky and, thus, require a high rate of return.

In addition, we find that the market factor is insignificant and, by itself, has the wrong sign. A factor constructed using two by three independent sorts on size and Investment/Assets (the traditional investment factor) is significant when combined with the market return. The size and value factors are both insignificant because our testing assets include 30 industry portfolios and 25 momentum portfolios in addition to the often-tested 25 size-value sorted portfolios. Adding value or momentum to our model reduces the sensitivity of the stochastic discount factor on our factors, but our factors remain significant. The value factor is insignificant in the presence of our factors, but the momentum factor still remains significant. Finally, adding portfolios formed on return on assets (ROA), which is a proxy for expected future productivity or profitability, does not reduce the significance of the INVP and INVC factors.

According to the JT value in Table 8, joint pricing errors of all models are significant, even though our model has the third-lowest JT value. We also compute the root mean squared errors separately for the 25 size-value portfolios, the 30 industry portfolios and the 25 size-momentum portfolios and find our formulation (Model-4) has the lowest root mean squared error (0.78% for 25 size-value portfolios), which is better than the 1.23% of the CAPM(Model-1) and 0.84% of the Fama French 3-factor model(Model-3). The investment-based model does not price industry return well; for the 25 size-momentum portfolios, our model has a mean squared error of 1.60%, which is better than that of the

CAPM and the Fama-French 3 factor model. Adding the momentum factor (Model-6) reduces the errors considerably, but adding ROA (Model-8) does not.

3.7 Cross Section Regressions at Firm Level

A standard question is whether the anomalies can predict future equity returns on the margin. To address this issue, we take an approach similar to the Fama-Macbeth approach adopted in Fama and French (2008). A cross-section regression is estimated for each month to predict monthly returns from July of year t to June of year $t+1$. Independent variables include common anomaly variables such as market cap, book-to-market equity and momentum, as well as our INVP and INVC measures. Explanatory variables are assumed to be observable in June of year t or earlier and are measured only once a year with the exception of momentum, which is calculated monthly. We decided not to include estimated market betas in the cross-section regressions for the same reasons That Fama and French decided not to include them.[10]

Table 9 shows results from monthly cross-section regressions to predict stock returns. Consistent with previous literature, average regression slopes are highly significant-negative for market cap and positive for book-to-market equity and momentum. Furthermore, for all four models, our estimated average regression slopes for market capitalization, book-to-market equity, and momentum are very close to the estimation of Fama and French. The coefficient of I/A is strong and negative (-0.63, t= -19.17), which confirms the predictions of the investment-based models that firms with high investments tend to have low expected stock returns. In the investigation of the impact of cash holdings on the future stock returns, the C/A ratio is included in the cross-section regression in

[10]Fama and French (2008) argued that the betas of the three-factor model tend to be much less dispersed than the CAPM betas: The premium for the three-factor beta is smaller than the average market excess return, individual firm betas are unlikely to be correlated with the anomaly variables, and estimates for individual firm betas are imprecise. The authors concluded that omitting market beta in the cross-section regression should have little impact.

addition to the three common anomaly variables: ME, BEME and Momentum. The average regression slope on C/A is 0.81, and the t statistic is 7.58.

Our results support the view that, on average, cash holding can increase equity returns by reducing the transaction cost when firms need to raise external capital. Next, a breakdown of the investment into investment relative to the non-cash capital factor and investment relative to the cash factor leads to the inclusion of two separate, independent variables, I/P and I/C, in the monthly cross-section regressions. Average coefficients of both variables are negative and highly significant. Firms with higher I/P and I/C ratios tend to yield lower stock returns, which can be interpreted to mean that firms that make smaller investments in physical assets and hold larger amounts of cash generate higher future returns. Model 4 determines whether the coefficient of C/A is still significant when the two components of I/A are also included in the regression; it turns out that the explanatory power of cash holdings is not reduced at all.

4 Concluding Remarks

Traditional investment- or production-based asset pricing models argue that investments should negatively covary with future equity returns over time because firms will invest more when they expect future discount rates to fall. Recent work has used investments and profitability as a pricing factor that can explain the cross-sectional variations of stock returns. This paper examines the impact of firms' investments relative to cash holdings on expected equity returns. It is important that firms consider the role of cash when making investment decisions because abundant internal funds can reduce transaction costs and make room for future investment opportunities, thereby boosting future stock returns.

We first present a two-period investment-based asset pricing model, where firms make decisions on cash holdings and investments to maximize value, and transactions costs are separated from traditional adjustment costs to strengthen the effect that cash holdings can have on a firm's value. Cash holdings enhance a company's value by saving transaction costs and facilitating the ability to building physical assets when pro?table investment opportunities occur. Our model suggests that future stock returns should be determined by a weighted average of return on physical capital and return on cash capital.

Based on the theoretical model, we then propose a Fama-French-type three-factor model that includes a market factor, a factor based on investment relative to non-cash capital (INVP), and a factor based on investment relative to cash capital (INVC) to test whether coefficients of INVP, INVC and the market factor are significant. For this purpose, we use 25 size-value portfolios, 25 size-momentum portfolios and 30 industry portfolios. Empirical evidence shows that value firms have higher loadings on INVP, and growth firms have higher loadings on INVC. We also ?nd that momentum stocks earn higher premiums on the INVC factor.

Next, we perform monthly cross-section regressions to predict stock returns, where the investment-to-asset ratio is decomposed into two separate variables, I/P and I/C. Average coefficients of both variables are significantly negative. Firms with higher I/P and I/C ratios tend to see lower future stock returns. This finding supports the strength of our model, in which firms that invest less in physical capital and hold larger amounts of cash yield higher future stock returns.

Finally, we use the one-stage Generalized Method of Moments to test whether our proposed INVP and INVC factors can help explain variations in the stochastic discount factor. The results show that our factors play a significant role in explaining the variation of the pricing kernel, even when size, value and momentum factors are included in the model. Specifically, an increase in risk premiums of INVP and INVC will reduce the value of the stochastic discount factor.

This paper sheds light on the factor-based cross-sectional asset pricing model because it presents a theoretically motivated model that also works well empirically. Our study shows that stock returns are driven by firms' investment in physical capital as wells as cash capital. Cash holdings help reduce transaction costs at the margin and facilitate accumulation of physical capital, which is particularly essential to growth stocks and momentum stocks.

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Table 1: Summary Statistics: 07/1964-12/2006

The cash investment factor (INVC) is formed as follows: At the end June of each year, all stocks (from NYSE, AMEX and NASDAQ) are allocated into two size groups (Small and Big) based on whether their June market capitalization is above or below the median market value for NYSE stocks. All firms are allocated independently into three Investment/Cash Asset (I/C) groups based on the values of 30% and 70% breakpoints of I/C for NYSE stocks. Six size-I/C portfolios are formed as the intersections of two size groups and three I/C groups. Value weighted monthly returns are calculated for each portfolio from July to the following June. INVC is the difference, each month, between the average returns of two low I/C portfolios and two high I/C portfolios. INVP is constructed using Investment/Non-cash Assets (I/P) following the same approach. We regress INVC on INVP to remove the trend and take the residual as INVC.

Investment is defined as the annual change in fixed assets and inventories for firms in COMPUSTAT. Only firms with ordinary common equity classified by CRSP are included in the test and we exclude financial firms.

Panel A reports the means, standard deviations of INVP, INVC, the three factors of Fama and French (1996), MKT, SMB and HML, and the Momentum factor from French's website. Panel B reports the correlations. Panel C reports average excess returns of the six size-I/P and the six size-I/C portfolios.

Panel A

	INVP	INVC	MKT	SMB	HML	MOM
Mean	0.2547	0.0000	0.4592	0.2747	0.4440	0.8157
Std.	1.9134	2.1877	4.4224	3.2728	2.9412	4.0419

Panel B

	MKT	SMB	HML	MOM
INVP	-0.4023	-0.2702	0.6979	-0.0110
INVC	0.1232	0.2881	-0.3812	0.1687

Panel C

	Small	Big		Small	Big
IP-Low	0.9593	0.5778	IC-Low	0.9254	0.5249
IP-Medium	0.8946	0.3913	IC-Medium	0.8107	0.4004
IP-High	0.6240	0.4535	IC-High	0.6425	0.3834

Table 2: Portfolios Characteristics: I/P and I/C

Stocks are allocated into three I/P groups (Investment/Non-cash Asset) and three I/C groups (Investment/Cash) independently using 30% and 70% breakpoints of all firms from 7/1964 to 12/2006. Nine I/P-I/C portfolios are formed as the intersections of I/P and I/C portfolios We report the average excess return (Return) and median values for investment/total asset (I/A), investment/non-cash asset (I/P), investment/cash asset (I/C) and cash/total asset (C/A).

I/P	Low			Medium			High		
I/C	Low	Medium	High	Low	Medium	High	Low	Medium	High
Return	0.6939	0.5619	0.4410	0.7841	0.4863	0.3892	0.4057	0.3466	0.3898
I/A	-0.0251	0.0207	0.0265	0.0385	0.0683	0.0922	0.0932	0.1808	0.2679
I/P	-0.0299	0.0215	0.0270	0.0589	0.0782	0.0953	0.2578	0.2494	0.2903
I/C	-0.3265	0.5421	4.9376	0.1462	0.8099	5.1642	0.1774	1.0048	7.3515
C/A	0.0949	0.0579	0.0056	0.3854	0.0978	0.0169	0.6177	0.2057	0.0322

Table 3: Two-pass Regression: Size-Value Portfolios

Risk premiums estimates from Fama-Macbeth (1973) two-pass estimation. We provide two sets of t-values: Shanken's (1992) t-value (t-value) and GMM t-value (GMM-t) that adjusts for generated regressors, autocorrelation and heteroscadasticity. The MKT, SMB and HML are the Fama- French 3 factors and they are from French's website. INVP and INVC are constructed using six portfolios sorted on size and Investment/Non-cash Asset and Investment/Cash respectively. We remove the INVP component in INVC by regressing INVC on INVP. Data are from 7/1964-12/2006.

	Const.	MKT	SMB	HML	INVP	INVC	OLSR2	GLSR2
risk premium	0.0125	-0.0049					0.1220	0.1172
Gmm-t	3.1838	-1.0821						
risk premium	0.0131	-0.0081	0.0022	0.0047			0.7816	0.3201
Gmm-t	4.0189	-2.3822	1.4340	3.0693				
risk premium	0.0123				0.0092	0.0116	0.6364	0.2997
Gmm-t	3.8708				3.1595	2.2715		
risk premium	0.0051	0.0007			0.0097	0.0112	0.6764	0.3100
Gmm-t	1.2892	0.1514			3.2196	2.3949		

Table 4: Betas: Size-Value Portfolios

Betas from Fama-Macbeth two pass regression. MKT is the market excess return and it is from French's website. INVP and INVC are constructed using six portfolios sorted on size and Investment/Non-cash Asset and Investment/Cash respectively. We remove the INVP component in INVC by regressing INVC on INVP. Data are from 7/1964-12/2006

		Betas					t-values				
		Small		Medium		Big	Small		Medium		Big
Alpha	Growth	-0.0013	0.0002	0.0008	0.0018	0.0004	-0.6101	0.1158	0.6053	2.0189	0.4909
		0.0044	0.0018	0.0018	-0.0009	-0.0009	2.3306	1.3265	1.6959	-1.0974	-1.4109
	Blend	0.0039	0.0037	0.0012	0.0010	-0.0006	2.3968	2.9562	1.2457	1.3054	-0.8041
		0.0058	0.0040	0.0023	0.0019	-0.0003	3.7232	3.2531	2.3533	2.1394	-0.3622
	Value	0.0059	0.0037	0.0033	0.0012	-0.0003	3.4976	2.5652	2.6555	1.1443	-0.2298
MKT	Growth	1.2806	1.2985	1.2183	1.1331	0.9448	25.3495	34.3402	40.2814	52.4251	52.8084
		1.1384	1.1652	1.1558	1.1556	1.0359	24.8106	34.6904	45.2678	58.9433	64.4726
	Blend	1.0755	1.0944	1.0797	1.1015	0.9517	27.1586	35.9202	46.2585	56.2873	48.4744
		1.0337	1.0646	1.0374	1.0424	0.9388	27.1822	35.5908	43.6736	48.4985	47.8539
	Value	1.0992	1.1580	1.1452	1.1734	0.9802	26.6950	32.9086	37.7041	44.3976	32.6952
INVP	Growth	-0.8385	-0.7551	-0.7415	-0.6285	-0.3264	-7.2365	-8.7060	-10.6893	-12.6787	-7.9526
		-0.4434	-0.0770	0.1541	0.3420	0.3780	-4.2130	-0.9998	2.6319	7.6052	10.2564
	Blend	-0.0134	0.2519	0.4703	0.5515	0.4725	-0.1471	3.6048	8.7849	12.2877	10.4928
		0.1967	0.4034	0.5921	0.6175	0.6753	2.2550	5.8795	10.8677	12.5264	15.0085
	Value	0.4038	0.5388	0.7353	0.8704	0.7267	4.2757	6.6758	10.5546	14.3592	10.5691
INVC	Growth	0.7891	0.4758	0.4308	0.3513	0.0751	8.4398	6.7989	7.6968	8.7833	2.2668
		0.5885	0.0921	-0.1123	-0.2556	-0.2727	6.9301	1.4821	-2.3754	-7.0442	-9.1693
	Blend	0.2636	-0.1208	-0.3021	-0.3848	-0.3000	3.5959	-2.1421	-6.9942	-10.6261	-8.2556
		0.1584	-0.1226	-0.3339	-0.3015	-0.5153	2.2509	-2.2143	-7.5955	-7.5786	-14.1921
	Value	0.1274	-0.0948	-0.2761	-0.4435	-0.4359	1.6712	-1.4551	-4.9123	-9.0670	-7.8556

Table 5: Two-pass Regression: Size-Momentum Portfolios

We use 25 Size-Momentum sorted portfolios as our testing assets. The 25 Size-Momentum portfolios, which are constructed monthly, are the intersections of 5 portfolios formed on size and 5 momentum portfolios formed on cumulative return from month j-12 to j-2, where j is the month of the predicted return. The monthly size breakpoints are the NYSE market equity quintiles. The monthly prior 2-12 months' cumulative return breakpoints are NYSE quintiles. We report both OLS R-squared and GLS R-squared. MKT SMB and HML are the Fama- French 3 factors and they are from French's website. INVP, INVC, ROA are constructed using six portfolios sorted on size and Investment/Non-cash Asset, Investment/Cash and return on asset respectively. We remove the INVP component in INVC by regressing INVC on INVP. Data are from 7/1964-12/2006.

	Const.	MKT	SMB	HML	INVP	INVC	ROA	OLSR2	GLSR2
risk premium	0.0110	-0.0041						0.0218	0.0214
Gmm-t	3.7260	-1.0990							
risk premium	0.0369	-0.0284	0.0039	-0.0101				0.6380	0.1114
Gmm-t	3.0806	-2.4579	2.0797	-1.8458					
risk premium	0.0050					0.0070		0.1978	0.0166
Gmm-t	2.1142					2.3204			
risk premium	0.0151				0.0147	0.0220		0.6675	0.2106
Gmm-t	3.9906				2.5660	2.6848			
risk premium	0.0185	-0.0111			0.0131	0.0212		0.6706	0.2264
Gmm-t	1.4517	-0.8888			2.0659	2.6000			
risk premium	0.0351	-0.0256			-0.0063		0.0011	0.1581	0.0672
Gmm-t	2.3039	-1.8559			-1.4508		0.2961		

Table 6: Two-pass Regression: Industry Portfolios

We used 55 portfolios consisting of 25 Size-Value sorted portfolios and 30 industry portfolios as our testing assets and we report both OLS R-squared and GLS R-squared. MKT SMB and HML are the Fama- French 3 factors and they are from French's website. INVP and INVC are constructed using six portfolios sorted on size and Investment/Non-cash Asset and Investment/Cash respectively. We remove the INVP component in INVC by regressing INVC on INVP. Data are from 7/1964-12/2006.

	Const.	MKT	INVP	INVC	SMB	HML	OLS-R2	GLS-R2
	25 Size-Value Portfolios and 30 Industry Portfolios							
risk-premium	0.0076	-0.0011					0.0086	0.0139
t-value	2.7667	-0.3117						
GMM-t	2.6085	-0.2857						
risk-premium	0.0081	-0.0028			0.0020	0.0028	0.3487	0.1185
t-value	3.1013	-0.8602			1.3268	2.0526		
GMM-t	3.4618	-0.9327			1.2639	1.7865		
risk-premium	0.0047	0.0013	0.0040	0.0037			0.1746	0.1096
t-value	1.8107	0.3881	2.5051	1.7269				
GMM-t	1.6578	0.3370	2.1393	1.7374				

Table 7: SDF Estimation: All Portfolios

Estimation results for different factor models using the Generalized Method of Moments. For each model we report the coefficients (b), t-value and implied risk premiums and t-values. JT is the weighted average of pricing errors. MKT SMB HML and MOM are the Fama- French 3 factors and momentum factor and they are from French's website. INVP, INVC, INVA, ROA are constructed using six portfolios sorted on size and Investment/Non-cash Asset, Investment/Cash, Investment/Asset, Net Income/Asset respectively. We remove the INVP component in INVC by regressing INVC on INVP. Errors are adjusted for heteroskedasticity and autocorrelation and data are from 7/1964-12/2006.

	Const.	MKT	INVA	SMB	HML	INVP	INVC	MOM	ROA
b	0.9868	1.0122							
t-value	97.4869	0.5519							
risk-premium		-0.2000							
t-value		-0.5427							
b	0.5483	-2.6656	-12.7490						
t-value	21.5334	-1.6437	-2.9091						
risk-premium		0.3508	0.5582						
t-value		0.8134	3.6149						
b	0.3276	1.8090		-1.4814	-0.0170				
t-value	43.4387	2.9397		-2.5813	-0.0207				
risk-premium		-0.8723		0.2350	0.1767				
t-value		-2.8732		1.4047	1.0618				
b	0.2636	-0.3358				-4.9454	-4.3913		
t-value	22.6648	-0.4370				-2.5532	-3.3120		
risk-premium		-0.2025				0.6813	0.8600		
t-value		-0.4616				3.5363	3.6790		
b	0.2119	-0.3632			0.7355	-5.4307	-3.5219		
t-value	21.0620	-0.5721			0.5710	-1.8962	-3.2241		
risk-premium		-0.1616			0.2191	0.7907	0.9579		
t-value		-0.3554			1.0955	2.9885	3.2691		
b	0.1863	-0.8432				-3.4385	-1.6786	-0.8633	
t-value	24.9369	-1.7025				-2.8088	-1.8172	-3.3007	
risk-premium		0.3489				0.5802	0.6210	0.9238	
t-value		0.8636				3.2800	2.6686	4.3127	
b	0.1489					-2.4402	-2.4728		
t-value	33.3329					-3.3506	-3.2694		
risk-premium						0.6275	0.8311		
t-value						3.6369	3.5543		
b	0.1339	-0.3367				-2.9062	-2.6021		-0.3807
t-value	21.4296	-0.8947				-2.7418	-2.9124		-0.6659
risk-premium		-0.0676				0.7490	0.9755		-0.3673
t-value		-0.1650				3.6271	3.6664		-2.0947

Table 8: Root Mean Squared Errors for Different Models

We compute root mean squared error for 8 models and break 80 portfolios into three groups, 25 size-value portfolios, 30 industry portfolios and 25 size-momentum portfolios. JT is the weighted average of pricing errors.

Model 1: MKT;
Model 2: MKT+INVA;
Model 3: MKT+SMB+HML;
Model 4: MKT+INVP+INVC;
Model 5: MKT+HML+INVP+INVC;
Model 6: MKT+INVP+INVC+MOM;
Model 7: INVP+INVC;
Model 8: MKT+INVP+INVC+ROA;

MKt SMB and HML are the three Fama-French factors and MOM is the momentum factor from French's website. INVP, INVC, INVA, ROA are constructed using six portfolios sorted on size and Investment/Non-cash Asset, Investment/Cash, Investment/Asset, Net Income/Asset respectively. We remove the INVP component in INVC by regressing INVC on INVP. Data are from 7/1964-12/2006. All values are significant.

Model	Value	Industry	Momen.	JT
1	1.2343	0.993	2.0529	710.2
2	0.7913	1.2208	1.8103	524.5
3	0.8406	1.1228	1.7771	664.2
4	0.7809	1.3897	1.6007	454.8
5	0.8251	1.4169	1.5356	440.3
6	0.8280	1.0813	0.9569	471.1
7	0.8114	1.3973	1.5874	467.1
8	0.8094	1.4278	1.5215	448.4

Table 9: Average Slopes and t-statistics from Monthly Cross-Section Regressions

The table shows average slopes and their t-statistics from monthly cross-section regressions to predict stock returns. The independent variables used to predict equity returns for July of year t to June of year t+1 include: ME, the natural log of market cap in June of year t (in millions of dollars); BEME, the natural log of the book to market equity ratio, where book equity is derived at the fiscal year end in t-1 and market equity is calculated at December of t-1; Mom is momentum for month j, which is calculated as the cumulative return from month j-12 to j-2; I/A is investment over total assets, where investment is defined as the annual change in fixed assets and inventories; C/A is cash over total assets ratio; I/P is investment over physical assets, which is calculated as total assets minus cash and cash equivalents; I/C is investment over cash ratio. ΔX represents change in variable X. Const. is the average regression intercept and OLS-R2 is the average regression R2 adjusted for degrees of freedom. The t-statistics for the average regression slopes are calculated using the time-series standard deviations of the monthly cross-section regression slopes.

Model		Int	logME	logBEME	Mom	I/A	I/P	I/C	C/A	R2
1	Average	1.9308	-0.1846	0.3784	0.4969	-0.6347				0.0182
	t-statistic	22.15	-10.93	15.40	8.49	-19.17				
2	Average	1.8392	-0.1814	0.4160	0.5024				0.8074	0.0193
	t-statistic	21.54	-10.85	17.68	8.64				7.58	
3	Average	1.9058	-0.1855	0.3831	0.5003		-0.2731	-0.0049		0.0176
	t-statistic	31.61	-15.53	22.08	12.09		-17.2	-11.51		
4	Average	1.8430	-0.1806	0.4058	0.4940		-0.2709	-0.0047	0.7629	0.0189
	t-statistic	44.64	-21.64	34.64	17.00		-24.45	-14.99	14.30	

Figure 1. We plot the median I/P, I/C for value stocks and growth stocks for small, medium and large sizes (size 1, 3 and 5) for period 07/1964-12/2006.

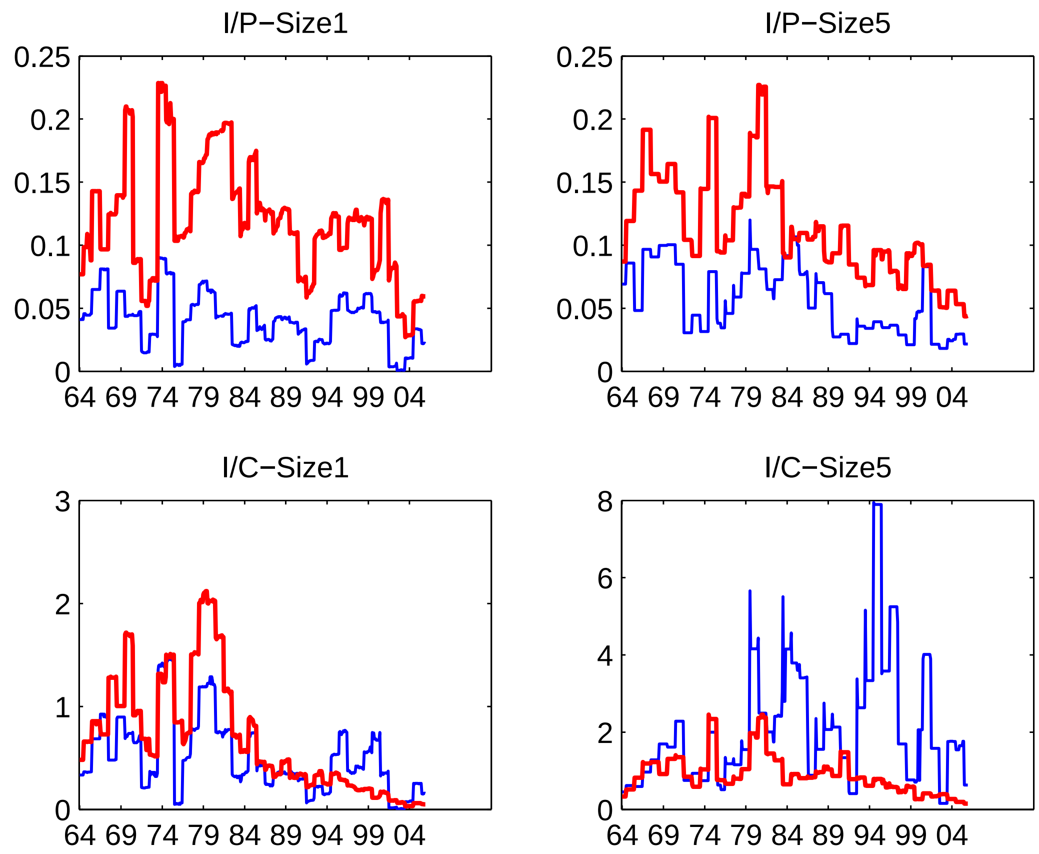

Figure 2. We plot the median I/P, I/C for winner stocks and loser stocks for small, medium and large sizes (size 1, 3 and 5) for period 07/1964-12/2006.