IPO First-Day Return and Ex Ante Equity Premium

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Abstract

This paper proposes a measure of ex ante equity premium, IPOFDR, which is the average difference between the IPO offer price and first-trading-day close price. I test the idea in three ways. First, there is a positive relation between IPOFDR and future market returns. Second, changes in IPOFDR help explain the cross-section of stock returns. Third, the predictive power of IPOFDR for stock returns reflects mainly its close relation with market variance and average idiosyncratic variance—arguably measures of systematic risk. These results cast doubt on the notion that the IPO first-day return is a measure of investor sentiment.

I. Introduction

Logue (1973), Ibbotson (1975), and others find that on average, the offer price at which the IPO (initial public offering) shares are sold to investors is substantially lower than the price at which the shares subsequently trade in the market. Numerous subsequent studies confirm that IPO underpricing is a pervasive phenomenon in both U.S. and international financial markets. Most authors measure the underpricing using the IPO first-day return—the percentage difference between the first-trading-day close price and the offer price. For example, over the 1960 to 2006 period, the equal-weighted average U.S. IPO first-day return is a stunning 17%[1].

This paper investigates systematic movements of IPO underpricing and tests its implications for asset pricing theories. In particular, I argue that the average IPO underpricing—defined as *minus* average IPO first-day return and dubbed IPOFDR—is a proxy of ex ante stock market returns. Consistent with this conjecture, I show that IPOFDR is closely related to measures of stock market risk and explains both time-series and cross-sectional stock return predictability in a coherent manner. These novel empirical findings provide support for a rational/risk-based interpretation of the information content of IPO underpricing, while they cast doubt on the notion that the IPO first-day return is a measure of investor sentiment (e.g., Baker and Wurgler (2006)).

I use two arguments to link IPOFDR to ex ante stock returns: (1) IPO underpricing mainly reflects different discount rates used by issuers and investors and (2) issuers incorporate only partially pricing information gathered during bookbuilding. Let us explain the first argument first. The present-value relation proposed by Campbell and Shiller (1988) indicates that log stock prices equal expected future log dividends minus expected future log discount rates. IPO underpricing thus reflects the fact that relative to investors, issuers either (1) underestimate future cash flows or (2) overestimate future discount rates. The first scenario is implausible for at least two reasons. First, holding back positive cash-flow

[1] The calculation is based on the IPO first-day return data constructed by Jay Ritter, which are available through his website: http://bear.cba.ufl.edu/ritter/ipodata.htm.

information is directly against issuers' interest and has other undesirable side effects. For example, it undermines investors' confidence and thus may even jeopardize the outcome of IPOs. If issuers must underprice IPO shares for a variety of reasons, they should use a higher discount rate instead. Second, there is no good reason for investors to be more optimistic about cash flows than issuers, especially because issuers—who are likely to be better informed—have incentives to exaggerate their fundamentals.

The expected value of IPOFDR is approximately constant if issuers give investors a constant discount that is invariant to business conditions. Thus, the second assumption—partial adjustment of offer prices to pricing information gathered during bookbuilding—plays a crucial role in establishing the link between IPOFDR and ex ante equity premium. The assumption is motivated by the well-documented empirical evidence, e.g., Hanley (1993). It is also a key implication of several leading explanations of IPO underpricing (e.g., Benveniste and Spindt (1989), Loughran and Ritter (2002), and Edelen and Kadlec (2005)). I show that because of partial adjustment, IPOFDR is mechanically related to *investors'* expected market returns. Many empirical studies also find that the adjustment of offer prices is more complete in cold markets than in hot markets. This stylized fact implies a stronger link between IPOFDR and ex ante equity premium in hot markets than in cold markets. Assuming that investors price IPOs rationally, I test these refutable implications in three ways using U.S. data over the 1960 to 2006 period.

First, as hypothesized, there is a positive and statistically significant relation between IPOFDR and future excess market reruns in both in-sample and out-of-sample tests, and the relation is stronger for IPOFDR in hot markets than for IPOFDR in cold markets. Second, if IPOFDR is a proxy of expected discount rates, Merton (1973) and Campbell's (1993) intertemporal capital asset pricing models (ICAPM) suggest that it should help explain the cross-section of expected stock returns. Consistent with this implication, the (unanticipated) change in IPOFDR is closely correlated with the value premium factor (HML) of the Fama and French (1996) three-factor model, for which Fama and French and many others advocate an intertemporal pricing interpretation. More importantly, the variables IPOFDR and HML have similar explanatory power for the cross-section of returns on twenty-five Fama and French portfolios sorted by size and book-to-market equity ratio. Lastly, in ICAPM, conditional equity premium is determined by the conditional variances of market returns and hedging factor(s); and Guo and Savickas (2008) argue that average idiosyncratic stock variance is a proxy for the latter. Consistent with the ICAPM implication, I find that IPOFDR correlates positively with market variance and negatively with average idiosyncratic variance. More importantly, the predictive power of IPOFDR for market returns comes mainly from its close correlation with the two variances.

A direct measure of ex ante equity premium has important implications for empirical asset pricing research. For example, by contrast with the existent empirical studies but consistent with the present-value relation, I uncover a negative relation between the dividend yield and future dividend growth after controlling for the effect of IPOFDR on future dividend growth, which is found to be significantly positive. The latter result, which suggests a positive relation between expected equity premium and expected dividend growth, is consistent with the finding by Lettau and Ludvigson (2005).

The empirical findings in this paper are consistent with the general equilibrium model of optimal IPO timing proposed by Pastor and Veronesi (2005), who argue that investors price IPOs rationally and that time-varying discount rates have significant effects on the market valuation of IPOs.[2] Their model predicts a negative relation between IPO volumes and expected discount rates, as observed in data. Because the average IPO first-day return and the number of IPOs are positively correlated (e.g., Lowry (2003)), Pastor and Veronesi's model helps understand the strong empirical link between IPOFDR and ex ante equity premium, as documented in this paper. For example, Baker and Wurgler (2000) find that the equity share in new issues forecasts stock market returns. I find that the predictive power of the equity share is related to that of IPOFDR—it becomes statistically insignificant after controlling for IPOFDR in the forecasting regression. This finding casts doubt on Baker and Wurgler's interpretation that investors price IPOs irrationally and managers issue more new equities when stocks are overvalued.

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[2] Zhang (2005) and Carlson, Fisher, and Giammarino (2006) investigate theoretically the effect of time-varying discount rates on the price of new equity issues using equilibrium models.

Baker and Wurgler (2006) construct an index using six commonly used measures of investor sentiment, including the equity share of new issues and the IPO first-day return. They show that expected returns on stocks that have highly subjective valuation and high arbitrage costs—e.g., small young growth stocks—behave differently across high and low sentiment states. Interestingly, I find that the investor sentiment index and its components are closely correlated with measures of systematic risk, i.e., market variance and average idiosyncratic variance. Moreover, ICAPM accounts for the conditional relation between investor sentiment and the cross-section of stock returns in a coherent manner. Overall, the empirical results suggest that mispricing is unlikely to be a main driver of stock market fluctuation.

Pastor, Sinha, and Swaminathan (2008) construct a measure of ex ante equity premium using implied costs of capital. These authors mainly focus on the stock market risk-return relation and do not investigate whether their measure forecasts stock market returns or explains the cross-section of stock returns. Moreover, while Pastor, Sinha, and Swaminathan find a positive relation between conditional market return and variance, the simple relation between IPOFDR and conditional market variance is found to be rather weak in this paper. Nevertheless, I am able to uncover a significantly positive risk-return tradeoff after controlling for the hedging risk factor.

The remainder of this paper proceeds as follows. I derive the theoretical relation between the IPO first-day return and expected future discount rates in Section II. I explain data in Section III. I present the main empirical results in Section IV. I compare the rational versus irrational interpretations of IPOFDR's information content in Section V. I offer some concluding remarks in Section VI.

II. IPO First-Day Return and Expected Future Discount Rates

Most of existent studies advocate for a rational pricing interpretation of IPO underpricing with three noticeable exceptions—information cascade by Welch (1992), investor sentiment by Ljungqvist, Nanda, and Singh (2004), and agency conflicts between issuers and underwriters by Loughran and Ritter

(2002).[3] Because they suggest that investors price IPO irrationally, the first two models do not explain this paper's main finding that IPO first-day return is a proxy of ex ante equity premium. Loughran and Ritter (2002) argue that (rational) underwriters deliberately lower the offer price of IPO shares in exchange for favors from institutional investors to whom offerings are allocated. By contrast, (irrational) issuers are not upset by substantial amounts of money left on the table because of mental accounting. The finding that information content of IPO underpricing reflects rational pricing is potentially consistent with Loughran and Ritter's model, in which underwriters set the offer price and investors price IPOs rationally. With this caveat in mind, for simplicity, in this section I assume that issuers, underwriters, and investors are rational and that there are no agency conflicts between issuers and underwriters.

If investors price IPO shares rationally, the market price of IPO shares equals the expected discounted future dividends. Using the present value relation, Campbell and Shiller (1988) show that the log market price equals approximately the expected future log dividends minus the expected future log discount rates

(1) $$P_{i,t} = \left(\frac{k}{1-\rho}\right)_i + E_t\left[\sum_{j=0}^{\infty} \rho^j \{(1-\rho) d_{i,t+1+j} - r_{i,t+1+j}\}\right],$$

where $\left(\frac{k}{1-\rho}\right)_i$ is a constant, E_t is the expectation operator based on investors' information set, $d_{i,t+1+j}$ is the log dividend, and $r_{i,t+1+j}$ is the log equilibrium discount rate. Campbell and Shiller's loglinearization can also be applied to the offer price ($P_{i,t}^O$) of IPO shares

(2) $$P_{i,t}^O = \left(\frac{k}{1-\rho}\right)_i^O + E_t^O\left[\sum_{j=0}^{\infty} \rho^j \{(1-\rho) d_{i,t+1+j} - r_{i,t+1+j}^O\}\right],$$

[3] Ritter and Welch (2002), Ritter (2003), and Ljungqvist (2004) provide comprehensive surveys of both empirical evidence and theoretical explanations of IPO underpricing.

where $(\frac{k}{1-\rho})_i^O$ is a constant, E_t^O is the expectation operator based on issuers' information set, and $r_{i,t+1+j}^O$ is the log discount rate adopted by issuers.

Unlike the market price of IPO shares, the offer price is not directly determined by the market equilibrium condition of supply and demand.[4] We thus can think of $r_{i,t+1+j}^O$ as an implied discount rate that equates the offer price with expected cash flows in equation (2). In particular, as I explain below, if issuers need to underprice IPO shares for some reasons, e.g., asymmetric information or legal considerations, they do so by using a discount rate, $r_{i,t+1+j}^O$, that is higher than the equilibrium discount rate, $r_{i,t+1+j}$. In other words, the difference between issuers and investors' discount rates captures various theoretical explanations of IPO underpricing.

By definition, the IPO first-day return is the difference between $P_{i,t}$ and $P_{i,t}^O$:

(3)
$$\begin{aligned} r_{i,t} = P_{i,t} - P_{i,t}^O = c_i + (E_t - E_t^O)[\sum_{j=0}^{\infty}\rho^j(1-\rho)d_{i,t+1+j}] \\ + [E_t(-\sum_{j=0}^{\infty}\rho^j r_{i,t+1+j}) - E_t^O(-\sum_{j=0}^{\infty}\rho^j r_{i,t+1+j}^O)] \end{aligned},$$

where $c_i = (\frac{k}{1-\rho})_i - (\frac{k}{1-\rho})_i^O$ is a constant. Ignoring the constant term because it does not contribute to time-series variation in IPO underpricing, equation (3) shows that the IPO first-day return is positive under two conditions. First, investors are more optimistic about the firm's cash flows than are issuers. Second, investors require lower expected discount rates than do issuers. That is, in equation (3) I decompose IPO underpricing into underpricing of fundamentals and underpricing of discount rates. Existing economic theories of IPO underpricing—e.g., asymmetric information, institution explanations, ownership and control, and behavioral explanations—do not explicitly make such a distinction between

[4] Ritter and Welch ((2002), p.1803) argue that "Thus, the solution to the underpricing puzzle has to lie in focusing on the setting of the offer price, where the normal interplay of supply and demand is suppressed by the underwriter."

fundamentals and discount rates, however. I argue below that underpricing of fundamentals is unlikely an important driver of the positive IPO first-day return for at least two reasons.

First, issuers have no incentive to underestimate their fundamentals because doing so will lower the offer price that they receive from investors. More importantly, because issuers need to disclose their expected cash flows in the prospectus, understating fundamentals will undermine investors' confidence and thus may even jeopardize the outcome of IPOs. If issuers must underprice their IPO shares for various reasons mentioned above, they can raise the discount rate in equation (2) instead of reporting understated cash flows in the prospectus. To summarize, because of undesirable side effects associated with understating fundamentals, it is optimal for issuers to adjust the offer price through the discount rate.

Second, if investors are rational, there are no apparent reasons why they should be more enthusiastic about cash flows than issuers. In particular, given that issuers have incentives to exaggerate fundamentals because of superior information about their own firms, doing so will likely cost investors more money to purchase IPO shares. Some authors, e.g., Ljungqvist, Nanda, and Singh (2006), argue that investors are sometimes overoptimistic about the prospective of IPO firms and investor sentiment may temporarily drive up the market price of IPO shares above the fair value.[5] By contrast with this interpretation, I find that commonly used measures of investor sentiment, including IPOFDR, are closely correlated with the determinants of ex ante equity premium, however.

Of course, I am not suggesting that investors and issuers have the same expectation about fundamentals or $(E_t - E_t^O)[\sum_{j=0}^{\infty}\rho^j(1-\rho)d_{i,t+1+j}] = 0$. Rather, if both investors and issuers are rational, the difference of their expectations is likely to be idiosyncratic and can be averaged away if N_t—the number of IPOs during period *t*—is large:

[5] Ljungqvist, Nanda, and Singh (2006) argue that their model explains the long-run underperformance of IPO stocks, as documented by Ritter (1991) and others. Lyandres, Sun, and Zhang (2008), however, show that Ritter's result may reflect time-varying risk premium.

(4) $$\frac{1}{N_t}\sum_{i}^{N_t}(E_t - E_t^O)[\sum_{j=0}^{\infty}\rho^j(1-\rho)d_{i,t+1+j}] \approx 0 \,.$$

That is, substantial amounts of money left on the table should not be a surprise to issuers; rather, they are the consequence of issuers' own actions, e.g., using a high discount rate. Otherwise, subsequent issuers will rationally bargain hard for a better offer price. This assumption is consistent with Ritter and Welch's ((2002), p.1802) argument that "simple fundamental misvaluation or asset pricing risk premia are unlikely to explain the average first-day return of 18.8%. "

Hanley (1993) finds that issuers adjust the final offer price only partially to favorable pricing information gathered during bookbuilding. Her finding is confirmed by numerous subsequent studies using both U.S. and international data. This so-called "partial adjustment" phenomenon is also an important feature of several leading explanations of IPO underpricing. In particular, Benveniste and Spindt (1989) argue that it is a form of compensation to investors for revealing their favorable private information. Alternatively, Loughran and Ritter (2002) propose that partial adjustment is mainly driven by agency conflicts between issuers and underwriters, while Edelen and Kadlec (2004) suggest that it reflects the fact that issuers trade off the proceeds from the IPO against the probability of the IPO succeeding. If underpricing of fundamentals is unlikely an important source of the positive IPO first-day return, as I argued above, partial adjustment of the offer price implies that issuers adjust their discount rates only partially to their expected investors' discount rates, $E_t^O(\sum_{j=0}^{\infty} -\rho^j r_{i,t+1+j})$:

(5) $$E_t^O(\sum_{j=0}^{\infty} -\rho^j r_{i,t+1+j}^O) = \alpha_{it} E_t^O(\sum_{j=0}^{\infty} -\rho^j r_{i,t+1+j}) - \mu_{it} \,,$$

where the coefficient, α_{it}, is less than one.[6] Some other theoretical explanations of IPO underpricing—e.g., asymmetric information among investors by Rock (1986) and legal considerations by Tinic (1988)

[6] Hanley (1993) and many other authors interpret partial adjustment as empirical support for Benveniste and Spindt's (1989) bookbuilding theory. Ritter and Welch (2002), however, are skeptical about this view by arguing that equilibrium compensation for revealing favorable information accounts for only a small fraction of the observed

and Lowry and Shu (2002)—do not involve partial adjustment of the offer price, however. I use the term μ_{it} in equation (5) to capture the effect of these factors on IPO underpricing, and assume that it is approximately stable across time

(6) $$\frac{1}{N_t}\sum_{i}^{N_t}(-\mu_{it}) \approx -\mu \, .$$

Therefore, while partial adjustment is a crucial assumption for the link between the IPO first-day return and ex ante equity premium, it is not the only explanation of IPO underpricing.

Using equation (5), I can write the underpricing of discount rats as

(7) $$\begin{aligned} &E_t(-\sum_{j=0}^{\infty}\rho^j r_{i,t+1+j}) - E_t^O(-\sum_{j=0}^{\infty}\rho^j r_{i,t+1+j}^O) = \\ &(1-\alpha_{it})E_t[\sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})] + \alpha_{it}(E_t - E_t^O)[\sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})] + \mu_{it} \end{aligned} .$$

Again, if both investors and issuers are rational, The difference of their expectations about future investors' discount rates, $(E_t - E_t^O)[\sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})]$, is an idiosyncratic random shock with zero mean. Because there is no compelling reason that $(E_t - E_t^O)[\sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})]$ and α_{it} should be correlated, their product is also a random variable with zero mean when N_t is large:

(8) $$\frac{1}{N_t}\sum_{i}^{N_t}\alpha_{it}(E_t - E_t^O)[\sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})] \approx 0 \, .$$

Using equations (3) to (8), the average IPO underpricing is

IPO underpricing. Moreover, Loughran and Ritter (2002) and Bradley and Jordan (2002) find that issuers do not incorporate fully public information in the form of pre-pricing returns on the market index. This finding casts doubt on Benveniste and Spindt' interpretation, while it is consistent with the models by Loughran and Ritter (2002) and Edelen and Kadlec (2004). Lowry and Schwert (2004), however, argue that partial adjustment to public information is economically unimportant. A formal test of these alternative hypotheses of partial adjustment is beyond the scope of this paper, and I simply interpret equation (5) as a reduced form that is motivated by empirical evidence.

(9) $$\frac{1}{N_t}\sum_{i=1}^{N_t} r_{i,t} \approx c + \mu + \frac{1}{N_t}\sum_{i=1}^{N_t}[(1-\alpha_{it})E_t \sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})],$$

where $c = \frac{1}{N_t}\sum_{i=1}^{N_t} c_i$ is a constant. I further assume that

(10) $$\alpha_{it} = \alpha_t + \eta_{it},$$

where α_t is the systematic component of the degree of the adjustment in the offer price and η_{it} is the idiosyncratic component. For example, on average, α_{it} is small (large) during hot (cold) markets because α_t is small (large). The effect of η_{it} on the offer price can be averaged away across a large number of IPOs even though it is potentially important for an individual IPO:

(11) $$\frac{1}{N_t}\sum_{i=1}^{N_t} \eta_{it} E_t \sum_{j=0}^{\infty} \rho^j r_{i,t+1+j} = 0.$$

Substituting equations (10) and (11) into equation (9), I obtain

(12) $$\frac{1}{N_t}\sum_{i=1}^{N_t} r_{i,t} \approx c + \mu + (1-\alpha_t)\frac{1}{N_t}\sum_{i=1}^{N_t}[E_t \sum_{j=0}^{\infty}(-\rho^j r_{i,t+1+j})].$$

Note that if N_t is relatively large, the cross-sectional average of expected discount rates is approximately equal to expected market returns:

(13) $$\frac{1}{N_t}\sum_{i=1}^{N_t}(E_t \sum_{j=0}^{\infty}\rho^j r_{i,t+1+j}) = E_t \sum_{j=0}^{\infty}\rho^j[\frac{1}{N_t}\sum_{i=1}^{N_t} r_{i,t+1+j}] \approx E_t \sum_{j=0}^{\infty}\rho^j r_{m,t+1+j}.$$

Given that firms going public tend to be young small growth firms, the cross-sectional average of IPO firms' discount rates is unlikely to be representative of market returns. Nevertheless, I still expect a strong correlation between the two variables because the valuation of young small growth stocks is very sensitive to changes in aggregate discount rates (e.g., Campbell and Vuolteenaho (2004)).[7] With this caveat in mind, I substitute equation (13) into equation (12) and obtain

[7] Campbell and Vuolteenaho (2004) use this argument to motivate the use of small stock value spread as a predictive variable of market returns in the estimation of ICAPM.

(14) $$\frac{1}{N_t}\sum_{i=1}^{N_t} r_{i,t} \approx c + \mu - (1-\alpha_t)E_t\sum_{j=0}^{\infty}\rho^j r_{m,t+1+j} \ .$$

Because partial adjustment implies that the coefficient α_i is less than one, Equation (14) shows that the average IPO first-day return is negatively related to the expected future market returns. For example, if the average IPO first-day return is high in the current year, one would expect a fall in market indices in the following year. To provide a direct measure of expected market returns, I define the variable IPOFDR as minus average IPO first-day return:

(15) $$\text{IPOFDR}_t = -\frac{1}{N_t}\sum_{i=1}^{N_t} r_{i,t} \approx (1-\alpha_t)E_t\sum_{j=0}^{\infty}\rho^j r_{m,t+1+j} - c - \mu,\ 0<\alpha_t < 1 .$$

In the empirical analysis, I test three refutable implications of Equation (15). First, IPOFDR forecasts the excess stock market return, ERET:

(16) $$\text{ERET}_{t+1} = \theta + \gamma * \text{IPOFDR}_t + \varepsilon_{t+1} .$$

In particular, IPOFDR is positively related to future stock market returns or the coefficient γ is positive. Moreover, because α_t is smaller in hot markets than in cold markets, the coefficient γ should be larger for IPOFDR in hot markets than for IPOFDR in cold markets. Second, Merton (1973) and Campbell's (1993) ICAPM implies that innovations in IPOFDR are a priced risk factor and help explain the cross-section of stock returns. Third, IPOFDR should correlate with measures of systematic risk that affect conditional equity premium. I present the empirical tests of these refutable implications in Section IV after I briefly discuss data next.

III. Data

I obtain data of monthly equal-weighted IPO first-day return and monthly number of IPOs over the period January 1960 to December 2006 from Jay Ritter at the University of Florida. In the empirical analysis, I convert monthly data into annual data for three reasons. First, there are no IPOs for several consecutive months, e.g., July 1974 to December 1974. There is a missing observation problem if using monthly or quarterly data. Second, Section II shows that IPOFDR is a proxy of expected market returns if it is the average of a large number of IPOs. Using annual data allows us to obtain a reliable measure of expected market returns. Third, because IPOFDR is the sum of discounted future returns over infinite horizons, it may have stronger forecasting ability for stock returns over long (e.g., annual) horizons than over short (e.g., monthly or quarterly) horizons. Nevertheless, I find that main results are qualitatively similar for semi-annual and quarterly data.

[Insert Figure 1 here]

Figure 1 plots the standardized annual IPOFDR (solid line) and the annual number of IPOs over the period 1960 to 2006. The variable IPOFDR exhibits two noteworthy patterns that are consistent with the conjecture that it is a proxy of ex ante equity premium. First, IPOFDR tends to increase sharply just before or during business recessions dated by the National Bureau of Economic Research (NBER), as indicated by shaded areas. The pattern is consistent with the conventional wisdom (e.g., Fama and French (1989) and Campbell and Cochrane (1999)) that conditional equity premium moves countercyclically across time. Second, as observed by Loughran and Ritter (2002), IPOFDR appears to have strong serial correlation. The pattern is consistent with the notion that conditional equity premium is persistent.

I use annual value-weighted S&P 500 index return obtained from Standard and Poor's as a measure of market returns, and results are qualitatively similar if using CRSP (Center for Research in Security Prices) annual value-weighted market returns. The risk-free rate is obtained from CRSP. I obtain from Kenneth French at Dartmouth College the annual Fama and French (1996) three factors and the annual returns on twenty-five Fama and French portfolios sorted on size and book-to-market equity ratio.

I obtain quarterly dividends per share from Standard and Poor's. Consumer price index (CPI) is used to convert nominal dividends into real dividends, and annual real dividends are the sum of quarterly real dividends in a year. As s robustness check, following Fama and French (1988), I use CRSP monthly total return index and price index to back out monthly dividends per share and then sum them up to obtain annual dividends. The results are qualitatively similar to those using Standard and Poor's dividends; for brevity, they are not reported here. Results are, however, different if I back out annual dividends using

CRSP annual total return index and annual price index, as in Lettau and Ludvigson (2005). In particular, because dividends are reinvested and compounded in the construction of CRSP annual total return index, the dividend growth based on annual indices is much more volatile and has substantially stronger correlation with market returns than the dividend growth calculated using monthly indices. I will return to this point when discussing the empirical evidence of forecasting dividend growth in Section IV.

[Insert Table 1 here]

Table 1 provides summary statistics of some selected variables. Consistent with the visual inspection of Figure 1, IPOFDR is serially correlated, with an autocorrelation coefficient of 44%. Its first difference, ΔIPOFDR, is serially uncorrelated, however. IPOFDR is negatively correlated with the excess market return, ERET, with a correlation coefficient of –16%. This result is consistent with the conventional wisdom that IPO underpricing is larger when market conditions are good than when market conditions are bad. Interestingly, there is an even stronger negative relation between ΔIPOFDR and ERET: The correlation coefficient is –48%. This new stylized fact is consistent with the conjecture that IPOFDR is a proxy of expected equity premium: French, Schwert, and Stambaugh (1987), Guo and Whitelaw (2006), and others emphasize that an unexpected increase in discount rates leads to a contemporaneous fall in stock market indices.

Table 1 also reveals a strong positive relation between ΔIPOFDR and the HML factor of the Fama and French (1996) three-factor model, with the correlation coefficient of about 49%. HML is the return difference between value and growth stocks. Because Campbell and Vuolteenaho (2004) find that prices of growth stocks are more sensitive to variation in discount rates than are prices of value stocks, HML is arguably a proxy of discount-rate shocks. Therefore, the strong positive relation between ΔIPOFDR and HML should be expected if, as I explained in Section II, IPOFDR is a proxy of ex ante equity premium.

IV. Empirical Results

A. Explaining Time-Series Variation in IPOFDR

Most of leading intertemporal asset pricing theories, e.g., Merton (1973), Campbell (1993), Campbell and Cochrane (1999), and Bansal and Yaron (2004), suggest that ceteris paribus, conditional stock market variance should be positively correlated with conditional excess stock market returns.[8] Following Merton (1980) and Andersen, Bollerslev, Diebold, and Labys (2003), I measure conditional stock market variance using realized stock market variance, MV, which is the sum of squared daily excess stock market returns in a given period. If IPOFDR is a proxy of expected stock market returns, its correlation with MV should be positive. This implication is essentially a test of the positive risk-return relation in the stock market using an ex ante measure of equity premium, as advocated by Pastor, Sinha, and Swaminathan (2008), although their measure is different from the one used in this paper.

Panel A of Table 2 reports the OLS estimation results of regressing IPOFDR on a constant and MV. Over the period 1960 to 2005, the relation is positive but statistically insignificant; and the adjusted R^2 is even negative. Overall, MV accounts for little variation in ex ante equity premium. The results are qualitatively similar for three subsamples (1960 to 1982, 1982 to 2005, and 1960 to 1995)—the effect of market variance on conditional equity premium is positive but statistically insignificant at conventional levels. As a robustness check, I repeat the above analysis using first differences instead of levels. That is, if there is a positive risk-return tradeoff, an increase in conditional market variance will raise ex ante equity premium that investors require for holding a market index. Panel B shows that the main results are

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[8] Campbell and Cochrane (1999) do not provide an analytical solution for the relation between conditional equity premium and conditional variance for their habit-formation model. Simulated data from their model show a stable relation between the two variables, however. The result reflects the fact that because there is only one state variable—i.e., the consumption surplus ratio—in the habit-formation model, conditional equity premium, conditional variance, and the dividend yield move closely to each other.

qualitatively similar to those obtained using levels—the risk-return relation is statistically insignificant at conventional levels.

[Insert Table 2 here]

To summarize, consistent with the finding by many early authors, e.g., Campbell (1987), French, Schwert, and Stambaugh (1987), Glosten, Jagannathan, and Runkle (1993), and Whitelaw (1994), there is little empirical support for a positive risk-return tradeoff in the stock market. The evidence, however, is different from that obtained by Pastor, Sinha, and Swaminathan (2008), who use the implied cost of capital as a measure of ex ante equity premium and find that it is positively and significantly related to conditional market variance. Because ex ante equity premium is not directly observable, the difference reflects measurement errors in its proxies. Before providing more stringent tests on the hypothesis that IPOFDR is a proxy of ex ante equity premium, I first try to explain why the simple relation between IPOFDR and conditional market variance is rather weak.

Failing to uncover a positive risk-return relation in the stock market may reflect an omitted variable problem. Scruggs (1998) and Guo and Whitelaw (2006) argue that ignoring the effect of the hedge component on expected excess stock market returns leads to a downward bias in the estimated risk-return relation. For example, Guo and Whitelaw uncover a positive and statistically significant risk-return tradeoff after controlling for the consumption-wealth ratio (CAY) proposed by Lettau and Ludvigson (2001) as a proxy for the hedge component. Moreover, Guo and Savickas (2008) argue that average idiosyncratic variance (IV) is a measure of investment opportunities and find that it is closely correlated with CAY and that the two variables have similar forecasting power for stock market returns.[9] Because CAY is estimated using full sample and thus may potentially have a look-ahead bias, in this paper I

[9] Cao, Simin, and Zhao (2008) provide empirical evidence that average idiosyncratic variance moves closely with standard measures of investment opportunities.

follow Guo and Savickas in the construction of the variable IV and use it as a proxy for the hedge component.[10] Figure 2 plots IV and MV over the period 1960 to 2005.

[Insert Figure 2 here]

I reinvestigate the risk-return relation using IV as a proxy for the hedge component of expected equity premium. Panel C of Table 2 reports the multivariate OLS estimation results of regressing IPOFDR on a constant, MV, and IV. Interestingly, as hypothesized, after controlling for IV, the positive relation between MV and IPOFDR becomes statistically significant at the 1% level in the full sample period 1960 to 2005. Consistent with Guo and Savickas (2008), the relation between IV and expected market returns (as measured by IPOFDR) is negative and statistically significant at the 1% level. Moreover, the adjusted R^2 increases sharply to over 30%, indicating that MV and IV jointly account for a significant portion of variation in IPOFDR. The results are qualitatively similar in three subsamples. Panel D of Table 2 shows that using the first difference in the regression produces qualitatively similar results as well. To summarize, I uncover a significantly positive relation between IPOFDR and MV after controlling for the effect of IV on conditional equity premium.

The difference between panels A and C of Table 2 reflects an omitted variable problem. Note that the effects of MV and IV on IPOFDR have opposite signs (panel C of Table 2), although the two variables are positively correlated with each other (Figure 2). Therefore, omitting the hedge component (as approximated by IV) introduces a downward bias in the slope coefficient of the regression reported in panel A. These results are also consistent with those reported by Guo and Savickas (2008), who find that MV is positively correlated with future stock market returns, while the relation is negative for IV. To summarize, IPOFDR correlates significantly with IV and MV with expected signs. This result is consistent with the conjecture that IPOFDR is a proxy of ex ante market returns.

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[10] Scruggs (1998) use returns on long-term government bonds as a measure of investment opportunities. In a subsequent study, Scruggs and Glabadanidis (2003) find that the result is sensitive to the assumption that the correlation coefficient between stock and bond returns are constant across time.

B. Forecasting One-Year-Ahead Excess Stock Market Returns

If IPOFDR is a measure of ex ante equity premium, it should forecast stock market returns. To address this issue, panel A of Table 3 reports the OLS estimation results of forecasting one-year-ahead excess stock market returns using IPOFDR. Over the full sample 1961 to 2006, IPOFDR is positively related to future market returns and the relation between the two variables is statistically significant at the 1% level. The adjusted R^2 is about 11%, indicating that IPOFDR accounts for a sizable portion of variation in market returns. In Figure 3, I plot IPOFDR along with one-year-ahead excess stock market returns. It shows that the two variables tend to move in the same direction and the result does not appear to be driven by influential observations.

[Insert Table 3 here]

[Insert Figure 3 here]

Panel A of Table 3 also shows that I obtain qualitatively similar results for three subsamples. For example, the relation between IPOFDR and future excess stock market returns is always positive in the two half samples (1961 to 1982 and 1983 to 2006) as well as in the subsample ending in 1995. However, while the relation is statistically significant at the 1% level in the second half sample, it is insignificant at the 10% level in the first half sample. Arguably the difference may be partially attributed to the lack of power because of relatively small number of annual observations used in the subsamples. For example, the relation becomes marginally significant over the period 1961 to 1995. Below I discuss two other possible explanations: (1) The relation between IPOFDR and expected returns changes across business cycles and (2) the estimation is biased because IPOFDR is a noisy measure of ex ante equity premium.

First, recall that in equation (15), α_t is larger in cold markets than in hot markets because the offer price adjusts to market information more completely in cold markets than in hot markets. Figure 1 shows that business conditions are noticeably weaker in the first half sample than in the second half sample. For example, there are four recessions in the first half sample but there are only two recessions in the second half sample. More important, if the number of IPOs is an indicator of cold or hot markets (e.g., Pastor and Veronesi (2005)), IPO markets are substantially colder in the first half sample than the second half sample. These facts help explain the evidence that the relation between IPOFDR and future stock returns is weaker in the first half sample than in the second half sample, as reported in panel A of Table 3. To investigate formally this issue, I construct a dummy variable, DUM, which equals one for the years during which the number of IPOs is less than 200 and equals zero otherwise. Panel B of Table 3 reports the OLS estimation results of the regression with the dummy variable for cold markets:

(17) $$\text{ERET}_{t+1} = \theta + \gamma \text{IPOFDR}_t + \delta \text{IPOFDR}_t * \text{DUM}_t + \eta_{t+1}.$$

In equation (17), I expect that the coefficient δ is negative or that the effect of IPOFDR on future stock returns is weaker in cold markets than in hot markets.

Panel B of Table 3 shows that, as expected, the point estimate of δ is significantly negative in the first half sample 1961 to 1983 as well as in the subsample 1961 to 1995. Interestingly, the coefficient γ, which measures the total effect of IPOFDR on future stock returns, is now positive and statistically significant at the 5% level in both subsamples. Because of few years of cold markets, the coefficient δ is imprecisely estimated for the second half sample 1984 to 2006, however. Overall, in the full sample 1961 to 2006, the coefficient δ is negative but statistically insignificant. Note that the total effect of IPOFDR in cold markets on expected stock returns, $\gamma + \delta$, is always positive, indicating that there is also partial adjustment in the offer price during cold markets. To summarize, the results confirm the finding by Hanley (1993) and others that issuers incorporate only partially market information in their offer prices.

Second, as explained in Section II, IPOFDR is only a proxy of expected stock returns and have measurement errors. To address this issue, I repeat the above analysis using the two-stage least squares (2SLS). I use IV and MV as the instrumental variables because their predictive power for market returns is similar to that of IPOFDR. (The result is omitted for brevity) In the 2SLS regressions, the relation between IPOFDR and future market returns is always statistically significant at the 1% level. Moreover, the point estimates from the 2SLS regressions are substantially larger than their OLS counterparts reported in Table 3 due to the attenuation effect of measurement errors.

As a robustness check, I investigate whether IPOFDR has significant predictive power after controlling for the forecasting variables considered in Goyal and Welch (2008). Over the period 1961 to 2006, I find that the effect of IPOFDR always remains significantly positive except when combined with CAY. Lettau and Ludvigson (2001) argue that CAY forecasts stock returns because of its close relation with expected future market returns; therefore, the evidence is again consistent with the conjecture that IPOFDR is a proxy of ex ante equity premium. Similarly, except for CAY, the other variables, however, have negligible predictive ability for stock returns after controlling for IPOFDR. For brevity, I do not report these results here but they are available on request. To summarize, the main result in this paper differs from that of Goyal and Welch because IPOFDR provides additional information about future stock returns beyond the variables that these authors consider.

C. Out-of-Sample Forecast

[Insert Table 4 here]

In this subsection, I compare the out-of-sample forecasts of the proposed forecasting variable (IPOFDR) with a benchmark model of constant expected market returns. I use three test statistics to gauge the relative performance—the mean-squared error (MSE) ratio; the encompassing test (ENC-NEW) proposed by Clark and McCracken (2001); and the equal forecast accuracy test (MSE-F) proposed by McCracken (1999). As in Lettau and Ludvigson (2001), I use the first one-third of the sample (1961 to 1977) for the initial in-sample regression and then make out-of-sample forecasts for the remainder of the sample recursively. For ENC-NEW and MSE-F tests, I report the bootstrap 5% critical values.

The first row of Table 4 reports the results for IPOFDR. The MSE ratio between the forecasting model and the benchmark model is 0.85, suggesting that on average the forecasting model has substantially smaller squared forecasting errors than does the benchmark model. Similarly, the ENC-NEW test statistic is 4.22, which is substantially larger than the 5% bootstrap critical value of 2.50. Thus, the difference between the forecasting model and the benchmark model is statistically significant. I obtain the same conclusion using the MSE-F test. I also include the dummy variable for cold markets, and the second row of Table 4 shows that results are qualitatively similar to those reported in the first row. To summarize, IPOFDR has significant out-of-sample forecasting ability for excess market returns.

D. IPOFDR and the Cross-Section of Stock Returns

If IPOFDR is a proxy of expected discount rates, ICAPM indicates that innovations in IPOFDR are a priced risk factor and help explain the cross-section of stock returns. Because the first difference, $\triangle\text{IPOFDR}$, is serially uncorrelated (Table 1), it can be used as a proxy for innovations in IPOFDR. To be robust, I show that using alternative measures of innovations generates qualitatively similar results.

Recent authors, e.g., Campbell and Vuolteenaho (2004), Petkova (2006), and Hahn and Lee (2006), find that HML is a priced risk factor because of its close relation with the discount-rate shock. In particular, Campbell and Vuolteenaho (2004) find that growth stocks are more sensitive to the discount-rate shock than are value stocks. This is possibly because, as Lettau and Wachter (2007) illustrate in their equilibrium model, growth stocks have longer durations than do value stocks. Therefore, if IPOFDR is a proxy of conditional equity premium, its innovations should have explanatory power for the cross-section of stock returns similar to that of HML. To address this issue, I replace HML in the Fama and French (1996) three-factor model with ΔIPOFDR and use the new model to explain the cross-section of returns on twenty-five Fama and French portfolios sorted by size and book-to-market equity ratio.

Table 5 reports loadings of twenty-five Fama and French portfolios on the risk factors.[11] As expected, panel A shows that value stocks have substantially higher loadings on ΔIPOFDR than do growth stocks.[12] The pattern is similar to that of loadings on HML, as reported in Table 6.

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[11] To address the issue of potential measurement errors in IPOFDR, I also run a 2SLS estimation using changes in MV and IV as the instrumental variables because these two variables are closely related to ΔIPOFDR (Table 2), and find that results are qualitatively similar to those reported in Tables 5 and 7. In particular, value stocks have substantially higher loadings on ΔIPOFDR than do growth stocks, and ΔIPOFDR is significantly priced in the cross-section of stock returns. For brevity, these results are not reported here but are available on request.

[Insert Table 5 here]

[Insert Table 6 here]

Table 7 reports the Fama and MacBeth (1973) cross-sectional regression results. For comparison, row 1 reports the results using HML as a risk factor. Consistent with earlier studies, the risk price of HML is positive and statistically significant at the 1% level, and the Fama and French three-factor model accounts for about 83% of cross-sectional variation in expected stock returns. In row 2, I replace HML by ΔIPOFDR. As expected, ΔIPOFDR is significantly priced at the 5% level, with a R^2 of about 85%. Figures 4 and 5 present the scatter plot of expected versus realized returns with ΔIPOFDR and HML as a risk factor, respectively. They show that the two variables have similar explanatory power for the cross-section of stock returns. To address formally this issue, I first regress HML on ΔIPOFDR and then include the residual, HML^+, in the cross-sectional regression along with ΔIPOFDR. Row 3 shows that ΔIPOFDR remains marginally significant, while HML^+ provides no incremental explanatory power. Similarly, I also regress ΔIPOFDR on HML and then include the residual, ΔIPOFDR^+, in the cross-sectional regression along with HML. Again, row 4 shows that HML remains significant, while ΔIPOFDR^+ has no incremental explanatory power. As a robustness check, I construct innovations in IPOFDR by fitting an AR(1) model, and panel B shows that the results are essentially the same as those

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[12] In Table 5, I control for market returns and the size premium when estimating loadings on ΔIPOFDR. In the univariate regression (not reported here), the relation between portfolio returns and ΔIPOFDR is always negative because an increase in discount rates always leads to a contemporaneous capital loss. In the univariate regression, growth stocks have a lower loading than do value stocks because the former are more sensitive to discount-rate shocks, e.g., the capital loss is larger for growth stocks when discount rates rise. Because market returns have an average sensitivity to discount-rate shocks, controlling for market returns allows us to demean the loadings on ΔIPOFDR. That is, the result that value stocks have a positive loading while growth stocks have a negative loading in Table 5 reflects the fact that growth stocks are more sensitive to discount-rate shocks than are value stocks.

using the first difference of IPOFDR. To summarize, IPOFDR and HML have qualitatively similar explanatory power for the cross-section of stock returns.

[Insert Table 7 here]

[Insert Figure 4 here]

[Insert Figure 5 here]

E. IPOFDR and Expected Cash Flows

In the present-value relation, Campbell and Shiller (1988) show that the dividend yield equals expected future dividend growth minus expected future discount rates:

$$(18) \qquad d_t - p_t \approx -\frac{\kappa}{1-\rho} + E_t\left[\sum_{j=0}^{\infty}\rho^j[-\Delta d_{t+1+j} + r_{t+1+j}]\right].$$

Equation (18) indicates that the dividend yield is negatively related to future dividend growth; however, there is rather weak empirical support for this implication. For example, row 1 of Table 8 shows that the negative relation between the dividend yield (DP) and future dividend growth is only marginally significant and the adjusted R^2 is only 5%. One possible explanation, as suggested by Lettau and Ludvigson (2005), is that expected dividend growth and expected discount rates are positively correlated with each other. Consistent with the finding by Lettau and Ludvigson, row 3 shows that IPOFDR is positively related to future dividend growth, and the relation is statistically significant at the 1% level, with an adjusted R^2 of 14%. Figure 6 also reveals a strong comovement between IPOFDR and the one-year-ahead dividend growth.

[Insert Table 8 here]

[Insert Figure 6 here]

If there is comovement between expected returns and expected dividend growth, equation (18) indicates that both DP and measures of ex ante equity premium should be included in the forecast of the dividend growth if DP provides additional information. To address this issue, I include both DP and IPOFDR as predictive variables and report the results in row 4 of Table 8. Interestingly, after controlling for IPOFDR, I uncover a significantly negative relation between DP and future dividend growth, as stipulated in equation (18). The difference between rows 1 and 4 suggests that earlier studies fail to uncover the negative relation because of an omitted variable problem. To see this, note that DP and IPOFDR have opposite effects on expected dividend growth, although they are positively correlated with each other. To my best knowledge, this result is novel. As a robustness check, I also use the earning price ratio (EP) instead of DP and find qualitatively similar results. Lastly, panel B shows that the results are similar by using 2SLS with IV and MV as the instrumental variables for IPOFDR.

As mentioned in Section III, the results are somewhat different if I back out dividends per share using CRSP annual total return index and annual price index. In this case, IPOFDR remains a strong predictor of dividend growth; however, neither DP nor EP is statistically significant in the forecasting regression. The difference reflects mainly the fact that in the construction of CRSP annual total return index, monthly dividends are reinvested and thus compounded using market returns. As a result, the implied annual dividend growth is closely correlated with market returns, with a correlation coefficient of about 62% over the period 1960 to 2006, compared with only 21% if assuming that dividends are not reinvested (Table 1). Because IPOFDR is a proxy of expected stock market returns, using non-reinvested dividends provides a conservative estimate of the relation between expected returns and expected dividend growth. From a theoretical point of view, i.e., equation (18), it seems to be more appropriate to measure dividends without the reinvestment assumption than to measure dividends with the reinvestment assumption. This difference explains why I find a significantly negative relation between DP and the expected dividend growth using latter measure of dividends.

V. Rational versus Irrational Explanations of IPOFDR's Information Content

I have argued that investors price IPO shares rationally and IPO underpricing moves closely with ex ante equity premium because of partial adjustment. The view is in contrast with that by Baker and Wurgler (2000), who suggest that investors sometimes price IPO shares irrationally and managers try to time the market by issuing more equities when stocks are overvalued. To support this view, Baker and

Wurgler show that there is a significantly negative relation between the equity share of new issues and future market returns, even after controlling for commonly used proxies of conditional equity premium, e.g., the dividend yield and aggregate book-to-market equity ratio. Moreover, Baker and Wurgler (2006) construct a composite investor sentiment index using six commonly used measures of investor sentiment, including the equity share of new issues and the IPO first-day return. These authors document a strong conditional relation between the investor sentiment index and the cross-section of stock returns. In particular, expected returns on stocks which have highly subjective valuations and high arbitrage costs—e.g., high volatility stocks—outperform low volatility stocks when the investor sentiment index is below its sample average at the beginning of holding periods. High volatility stocks, however, have lower returns when the investor sentiment index is above its sample average at the beginning of holding periods. The evidence poses a challenge to CAPM because it requires that the market risk premium is negative in half of the sample period. In this section, I try to reconcile the two conflicting reviews of IPOFDR's information content.

A. Investor Sentiment versus Omitted Risk Factors

Investor sentiment is an elusive concept. Baker and Wurgler ((2007), p. 129) define it as "a belief about future cash flows and investment risks that is not justified by the facts at hand." This definition is susceptible to the classic joint hypothesis problem. The evidence that CAPM fails to explain the predictive ability of investor sentiment for both time-series and cross-sectional stock returns implies either (1) inefficient markets or (2) inadequacy of CAPM as an asset pricing model. That is, investor sentiment has a pervasive effect on stock returns possibly because it is a proxy of systematic risk factors omitted from commonly used asset pricing models.

In rational pricing models, e.g., Merton's (1973) ICAPM, the risk premium is determined by second moments, i.e., covariances with risk factors. By contrast, in behavioral models second moments play no role in explaining time-series and cross-sectional stock return predictability. In the preceding section, I use this difference to test the rational pricing interpretation against the behavioral interpretation of IPOFDR's information content in three ways. First, ceteris paribus, there is a significantly positive relation between IPOFDR and conditional market variance. Second, the predictive power of IPOFDR for market returns across time comes mainly from its close relation with variances of risk factors. Third, the covariance with IPOFDR helps explain the unconditional cross-section of stock returns. These empirical findings provide support for the rational pricing interpretation that IPOFDR is a proxy of expected discount rates. They, however, cannot be easily reconciled with the behavioral interpretation that IPOFDR is a measure of investor sentiment. Below, I show that other investor sentiment measures used by Baker and Wurgler (2006) also move closely with the determinants of ex ante equity premium. I also find that ICAPM helps explain Baker and Wurgler's main empirical finding of a conditional relation between investor sentiment and the cross-section of stock returns in a coherent manner.

B. Explaining Time-Series Variation in Investor Sentiment

[Insert Table 9 here]

Baker and Wurgler (2006) use six commonly used measures of investor sentiment to construct a composite index based on the first principal component. Table 9 investigates whether these measures are correlated with the determinants of equity premium—i.e., MV and IV.[13] CEFD is the close-end fund discount; TURN is the NYSE share turnover; NIPO is the number of IPOs; IPOFDR is the IPO first-day return; S is the equity share in new issues; PDND is dividend premium—the log difference of the average market-to-book equity ratio between dividend payers and nonpayers; and SENT is the composite investor sentiment index. Baker and Wurgler also construct a second index—$\text{SENT}^{\perp}$—by removing cyclical variation from each of the six investor sentiment measures prior to the principal components analysis. Because the cyclical component may be related to discount rates, Baker and Wurgler argue that $\text{SENT}^{\perp}$ is a cleaner measure of investor sentiment. Because NIPO takes only integral values, its distribution is likely to be very different from that of a normal distribution in small sample. To address this issue, I also

[13] I thank Jeffrey Wurgler for providing investor sentiment data over the 1962 to 2005 period.

use a log transformation, LNIPO, in the empirical analysis. Note that TURN, NIPO, and S are positively correlated with SENT, while the relation is negative for CEFD, IPOFDR, and PDND. Below I test the conjecture of a negative relation between investor sentiment and ex ante equity premium.

As hypothesized, Table 9 shows that there is a strong relation between SENT and the determinants of equity premium. In particular, SENT is positively correlated with IV and is negatively correlated with MV, with an adjusted R^2 of about 20%. Thus investor sentiment tends to be high when expected equity premium is low. This result confirms that standard measures of investment sentiment do have close correlation with conditional equity premium; however, it casts doubt on the interpretation that SENT measures "belief about future cash flows and investment risks that is not justified by the facts at hand." Interestingly, the results are essentially the same for $SENT^{\perp}$, even though cyclical variation has been explicitly purged out from the variable. Table 9 also shows that most of individual measures of investor sentiment are strongly correlated with IV and MV with expected signs. Note that IPOFDR has the largest adjusted R^2 among all measures of investor sentiment, including the composite indices. This result suggests that IPOFDR has the closest relation with ex ante equity premium possibly because it is a theoretically motivated variable, as explained in Section II. Consistent with this conjecture, I show next that IPOFDR also has the strongest predictive power for stock market returns among all measures of investor sentiment considered in Baker and Wurgler (2006).

C. Investor Sentiment and Future Market Returns

[Insert Table 10 here]

This subsection investigates the information content of investor sentiment for future excess stock market returns. Panel A of Table 10 compares the predictive power of SENT, $SENT^{\perp}$, and S with that of IPOFDR. Row 1 replicates Baker and Wurgler's (2000) main finding of a negative relation between S and one-year-ahead excess market returns. As expected, SENT and $SENT^{\perp}$ correlate negatively with future market returns, although the relations are statistically insignificant (rows 2 and 3). The weak relation may reflect the fact that the investor sentiment indexes are noisy measures of ex ante equity premium. To address this issue, I use 2SLS with lagged IV and MV as the instrumental variables and find that the negative relation become statistically significant at the 1% level for both SENT and $\mathrm{SENT}^{\perp}$. For brevity, this result is not reported here but is available on request.

Table 10 shows that both one-period and two-period lagged IPOFDRs forecast market returns (rows 4 and 5). The Wald test indicates that they jointly have significant predictive power at the 1% level (row 6). Interestingly, after controlling for two lags of IPOFDR, the predictive power of S becomes statistically insignificant at the 10% level (row 7). Because IPOFDR is arguably a proxy of ex ante equity premium, this result casts doubt on Baker and Wurgler's (2000) interpretation that managers issue more new equities when stocks are overvalued. By contrast, the result is consistent with the theoretical models by Pastor and Veronesi (2005) and Zhang (2005), who argue for a close relation between IPO waves and discount rates. Similarly, after controlling for IPOFDR, the relation between SENT and future market returns becomes positive albeit statistically insignificant. I find similar results using 2SLS with lagged IV and MV as the instrumental variables (not reported). Thus, the negative relation between SENT and future market returns comes mainly from the strong comovement between SENT and ex ante equity premium. Again, row 9 shows that the result is qualitatively similar for $\mathrm{SENT}^{\perp}$.

Panel B of Table 10 shows that individually none of other investor sentiment measures has statistically significant predictive power for market returns. PDND becomes significantly negative when combined with two lags of IPOFDR; however, the negative effect is at odds with the interpretation that PDND comoves negatively with investor sentiment.

To summarize, among all measures of investment sentiment considered by Baker and Wurgler (2006), IPOFDR has the strongest predictive power for market returns.

D. Conditional Relation between Investor Sentiment and Cross-Section of Stock Returns

Baker and Wurgler (2006) find that when the beginning-of-period investor sentiment index is above its sample average, subsequent returns are lower on "risky" (e.g., small, young, high volatility, unprofitable, non-dividend-paying, extreme-growth, and distressed) stocks than on "safe" (e.g., large, old, and low volatility) stocks. The patterns, however, largely reverse when investor sentiment is below the sample average. One possible explanation, as advanced by Baker and Wurgler, is that because risky stocks tend to have highly subjective valuations and high arbitrage costs, they are more susceptible to swings in investor sentiment than are safe stocks. In particular, these authors suggest that unsophisticated investors prefer risky stocks when investor sentiment is high but demand safe stocks when investor sentiment is low. Therefore, when investor sentiment is above the sample average, risky stocks tend to have lower returns than do safe stocks in the following period because the relative demand for risky stocks decreases as investor sentiment falls eventually.[14] Conversely, when investor sentiment is below the sample average, returns on risky stocks are likely to be higher than are returns on safe stocks in the following period because the relative demand for risky stocks increases as investor sentiment rises eventually.

In subsections V.B and V.C, I document a close (negative) relation between investor sentiment and conditional equity premium. Using this relation, I argue that Baker and Wurgler's (2006) findings indicate that risky stocks are more sensitive to discount-rate shocks than are safe stocks because the former tend to have longer durations (e.g., Cornell (1999) and Dechow, Sloan, and Soliman (2004)). The

[14] When investor sentiment is above the sample average, it is more likely to fall than to rise in the following period for two reasons. First, investor sentiment is stationary and follows a mean-reverting process. Second, Baker and Wurgler (2006) sort investor sentiment using the full sample; therefore, by construction, investor sentiment is more likely to decrease than to increase in the following period when it is currently above the sample average. For example, when investor sentiment has the highest value of the whole sample, the probability that it will decrease in the following period equals one. Similarly, when investor sentiment is low, by construction, it is more likely to increase than to decrease in the following period.

main idea is as follows. When investor sentiment is high or discount rates are low, discount rates are more likely to increase than to decrease subsequently. Thus stocks are likely to have a below average return in the following period as discount rates rise; and the negative effect is more pronounced for risky stocks than for safe stocks because, as hypothesized, the former are more sensitive to discount-rate shocks. Conversely, when investor sentiment is low or discount rates are high, discount rates are more likely to fall than to rise subsequently. Thus stocks are likely to have an above average return in the following period as discount rates fall; the positive effect is again more pronounced for risky stocks than for safe stocks because the former are more sensitive to discount-rate shocks.[15]

I test this alternative hypothesis in three ways using equal-weighted returns on quintile portfolios sorted by idiosyncratic stock volatility. First, I regress the portfolio return on ΔIPOFDR, and the estimated coefficient on ΔIPOFDR is a measure of sensitivity to discount-rate shocks. The coefficient is negative for all portfolios because an increase in discount rates leads to a contemporaneous capital loss. More importantly, it decreases monotonically from the quintile of stocks with the lowest volatility (–0.22) to the quintile of stocks with the highest volatility (–1.52), indicating that, as hypothesized, high volatility stocks are more sensitive to discount-rate shocks than are low volatility stocks. As a robustness check, I also use the fitted value from the regression of excess market returns on lagged IV and MV as a measure of conditional equity premium, and find qualitatively similar results. Second, consistent with Baker and Wurgler (2006), the annual return difference between the quintiles of highest and lowest volatility stocks is –10.1% when investor sentiment is above the sample average and is 14.5% when investor sentiment is

[15] Figure 2 in Baker and Wurgler (2006) shows that for most portfolios, returns are higher when the beginning-of-period investor sentiment is below the sample average than when the beginning-of-period investor sentiment is above the sample average. While this finding is a direct implication of the conjecture that investor sentiment is negatively correlated with discount rates, it appears to be inconsistent with Baker and Wurgler's conjecture that unsophisticated investors' relative demand for safe stocks increases (decreases) when investor sentiment falls (rises). In particular, according to Baker and Wurgler's conjecture, safe stocks should have above instead of below average returns when investor sentiment is high at the beginning of holding periods.

below the sample average. I find a similar result using IPOFDR or the estimated conditional equity premium based on IV and MV as the conditioning variable. For example, the return difference is –9.1% when the estimated conditional equity premium is below the sample average and is 13.8% when the estimated conditional equity premium is above the sample average. Lastly, I regress investor sentiment on IPOFDR, IV, MV, and NIPO, and find that the residual from the regression has negligible explanatory power for the cross-section of portfolio returns.[16] The result indicates that investor sentiment explains the cross-section of stock returns mainly because of its negative correlation with conditional equity premium.

Baker and Wurgler (2006) also provide formal statistical evidence that investor sentiment forecasts returns on a hedge portfolio that is long in high volatility stocks and short in low volatility stocks. I confirm their finding by documenting a significantly negative relation between the two variables. Interestingly, IPOFDR correlates positively and significantly with future portfolio returns as well. Moreover, after I control for IPOFDR, the predictive power of investor sentiment becomes statistically insignificant. Lastly, MV and IV jointly have significant forecasting power for the portfolio return, with a positive relation for MV and a negative relation for IV.

In Merton's (1973) ICAPM, the conditional excess portfolio return depends on its conditional covariance with excess market returns if changes in the set of investment opportunities have a negligible effect on expected stock returns

(19) $$E_t(r_{i,t+1}) = \gamma \operatorname{cov}(r_{i,t+1}, r_{M,t+1}) = \gamma \beta_{i,M,t} \sigma^2_{M,t},$$

where γ is a measure of relative risk aversion and $\sigma^2_{M,t}$ is conditional market variance. As pointed out by Baker and Wurgler (2006), their results suggest that either (1) $\beta_{i,M,t}$ moves closely with investor sentiment or (2) the conditional market risk premium, $\gamma\sigma^2_{M,t}$, is negative in half of the sample period. Because Baker and Wurgler find little empirical support for time-varying $\beta_{i,M,t}$, they conclude that

[16] Pastor and Veronesi (2005), Zhang (2005), and Carson, Fisher, and Giammarino (2006) argue that time-varying discount rates are a main driver of IPO volumes.

CAPM cannot explain their main findings because $\gamma\sigma^2_{M,t}$ should be always positive. However, their results are potentially consistent with ICAPM

(20) $$E_t(r_{i,t+1}) = \gamma\beta_{i,M,t}\sigma^2_{M,t} + \lambda\beta_{i,H,t}\sigma^2_{H,t},$$

where λ is the price of risk for the hedging risk factor, $\beta_{i,H,t}$ is the loading on the hedging risk factor, and $\sigma^2_{H,t}$ is the conditional variance of the hedging risk factor. Guo and Savickas (2008) argue that MV and IV jointly forecast market returns because they are proxies of $\sigma^2_{M,t}$ and $\sigma^2_{H,t}$, respectively. Therefore, I can write an empirical specification of conditional equity premium as

(21) $$E_t(r_{M,t+1}) = \gamma \mathrm{MV}_t + \lambda\beta_{M,H}\mathrm{IV}_t = \mathrm{MV}_t(\gamma + \lambda\beta_{M,H}\frac{\mathrm{IV}_t}{\mathrm{MV}_t}).$$

For simplicity, in equation (21), I assume that loadings of market returns on the hedge factor are constant. Consistent with ICAPM, Guo and Savickas (2008) find that MV is positively correlated with future market returns. The relation, however, is negative for IV, indicating that the market serves as a hedge for changes in the set of investment opportunities. Equation (21) shows that conditional equity premium is high (low) when MV is high (low) relative to IV. Similarly, the conditional return difference between high and low volatility stocks can be written as

(22) $$\begin{aligned} &E_t(r_{5,t+1} - r_{1,t+1}) = (\beta_{5,M} - \beta_{1,M})\gamma \mathrm{MV}_t + (\beta_{5,H} - \beta_{1,H})\lambda \mathrm{IV}_t \\ &= \mathrm{MV}_t[(\beta_{5,M} - \beta_{1,M})\gamma + (\beta_{5,H} - \beta_{1,H})\lambda\frac{\mathrm{IV}_t}{\mathrm{MV}_t}] \end{aligned},$$

where $\beta_{5,M}$ ($\beta_{5,H}$) and $\beta_{1,M}$ ($\beta_{1,H}$) are loadings on market (hedge) risk for the high and low volatility stocks, respectively. As mentioned above, the return difference between high and low volatility stocks is positively correlated with MV and is negatively correlated with IV in data. That is, $(\beta_{5,M} - \beta_{1,M})\gamma$ is positive and $(\beta_{5,H} - \beta_{1,H})\lambda$ is negative. Therefore, when conditional equity premium is high or when MV is high relative to IV, high volatility stocks are likely to have higher expected returns than are low volatility stocks. Conversely, when conditional equity premium is low or when MV is low relatively to IV, high volatility stocks are likely to have lower expected returns than are low volatility stocks.

Therefore, by contrast with CAPM, to explain Baker and Wurgler's findings, ICAPM does not require either (1) that $\gamma\sigma_{M,t}^2$ is negative for half of the sample period or (2) that factor loadings change with investor sentiment across time. To illustrate formally the point, I use the fitted value from the regression of portfolio returns on lagged IV and MV as a measure of conditional portfolio returns. The average of estimated conditional equity premium is 8.5% when investor sentiment is below the sample average, compared with 2.7% when investor sentiment is above the sample average. Moreover, the average of estimated conditional returns on the portfolio that is short in low volatility stocks and long in high volatility stocks is 5.4% when investor sentiment is below the sample average, compared with –1.3% when investor sentiment is above the sample average.

[Insert Table 11 here]

Baker and Wurgler (2006) use equal-weighted portfolio returns in their empirical analysis. As a robustness check, I show in Table 11 that results are qualitatively similar using value-weighted portfolio returns. I first replicate Baker and Wurgler's main finding that SENT forecasts IVF—the return difference between stocks with high and low volatility (row 1).[17] In particular, the relation is negative, indicating that stocks with high volatility tend to have relatively low returns when investor sentiment is high at the beginning of holding periods. Row 2 shows that IPOFDR—a measure of ex ante equity premium—has significant explanatory power for IVF as well. Similarly, IV and MV jointly forecast IVF; in particular, while IV is negatively related to one-year-ahead IVF, the relation is positive for MV (row 3). These results confirm that high volatility stocks have relatively low returns when discount rates are low at the beginning of holding periods.

Pastor and Veronesi (2003) show that stocks with high volatility tend to be small young growth stocks. These stocks are likely to be more sensitive to changes in discount rates than are stocks with low volatility because the former tend to have longer durations. Therefore, if ΔIPOFDR is a measure of

[17] I find qualitatively similar results for portfolios sorted by dividends and earnings. For brevity, these results are not reported here but are available on request.

discount rate shocks, it should be negatively correlated with IVF. I confirm this conjecture in row 4 of Table 11. In rows 5 to 7, I investigate whether predictors of market returns forecast residuals from the regression in row 4. In particular, Baker and Wurgler (2006) suggest that SENT should forecast the residual that are uncorrected with systematic risk. After controlling for IVF's comovement with ΔIPOFDR as well as other risk factors, the predictive power of SENT for one-year-ahead IVF becomes statistically insignificant at the 5% level (row 5), and the adjusted R^2 decreases sharply to less than 4% from 23% in row 1. The results are qualitatively similar for IPOFDR (row 6) and IV and MV (row 7). Therefore, by contrast with Baker and Wurgler's conjecture, the predictive power of investor sentiment reflects mainly systematic risk.

Lastly, Baker and Wurgler (2006) find that the return difference between high and low investor sentiment states is a U-shaped function of B/M. These authors argue that stocks with extreme values of B/M are more susceptible to swings in investor sentiment than are stocks with median B/M. Alternatively, the finding may suggest that stocks with extreme values of B/M are more sensitive to discount-rate shocks than are stocks with median B/M. Again, I test this alternative hypothesis using equal-weighted returns on quintile portfolios sorted by B/M. First, I regress the portfolio returns on ΔIPOFDR and find that the coefficient is negative for all portfolios. Interestingly, the coefficient is also a U-shaped function of B/M: It equals –1.03 for extreme growth stocks, –0.55 for stocks with median B/M, and –0.64 for stressed stocks.[18] Second, using either IPOFDR or the estimated conditional equity premium based on IV and MV as the conditioning variable, I find that the return difference between high and low conditional

[18] The pattern is somewhat different from that reported in Table 5, which shows that loadings on ΔIPOFDR tend to increase monotonically with B/M within each size quintile. There are three explanations for the difference. First, in Table 5, the portfolios are constructed using two independent sorts—by size and by B/M. Second, in Table 5, I use value-weighted portfolio returns instead of equal-weighted portfolio returns. Third, in Table 5, I control for market risk and the size premium when estimating loadings on ΔIPOFDR. Nevertheless, for equal-weighted quintile portfolios sorted by B/M, loadings of extreme growth stocks on discount-rate shocks are substantially smaller than are those of stressed stocks, and the difference is statistically significant at the 10% level.

equity premium states is a U-shaped function of B/M as well. Third, if I regress investor sentiment on IPOFDR, IV, MV, and NIPO, the residual has negligible explanatory power for the cross-section of stock returns. Lastly, I replicate Baker and Wurgler's findings that investor sentiment is negatively correlated with future return difference between extreme growth stocks (or distressed stocks) and stocks with median B/M; its predictive power, however, becomes negligible after controlling for IPOFDR in the forecasting regression. Therefore, both extreme growth and distressed firms' stock returns are high relative to their unconditional average when sentiment is low because these stocks are more sensitive to discount-rate shocks than are stocks with median B/M.

To summarize, because of the close relation between investor sentiment and conditional equity premium, ICAPM explains Baker and Wurgler's (2006) main findings of a conditional relation between investor sentiment and the cross-section of stock returns in a coherent manner.

VI. Conclusion

In this paper, I propose a new forecasting variable of stock market returns, IPOFDR, which is constructed using the average IPO first-day return. Unlike other predictive variables considered in the existing literature, I argue that IPOFDR is a direct measure of ex ante equity premium. Consistent with this conjecture, IPOFDR is closely correlated with measures of stock market risk; has significant predictive ability for stock market returns in sample and out of sample; and helps explain the cross-section of stock returns. These results suggest that conditional equity premium does change across time and the hedging demand for time-varying equity premium has significant effects on stock prices.

The empirical findings in this paper shed light on two important questions about efficient markets hypothesis. The first question is whether stock market returns are predictable across time. Financial economists have long believed that expected market returns are constant. In the past two decades, inspired by seminar works of Campbell and Shiller (1988) and Fama and French (1989), researchers have found that many variables appear to have significant predictive ability for market returns. However, Goyal and

Welch (2008) comprehensively reexamine the existing empirical studies and find no reliable evidence of stock return predictability, especially in the out-of-sample context. Cochrane (2008), Campbell (2008), and Pastor and Stambaugh (2009) argue that stock returns are predictable by using more powerful tests. In this paper, I propose a theoretically motivated variable and show that it forecasts stock market returns in and out of sample. The result confirms that stock market returns are predictable.

The second question is whether stock return predictability poses a challenge to efficient markets hypothesis. Fama and French (1989) and many other argue that conditional equity premium moves countercyclically across business cycles. Moreover, Campbell and Cochrane (1999) and Bansal and Yaron (2004), among others, develop equilibrium models to explain the countercyclical variation in conditional equity premium. Some other authors, however, argue that stock return predictability mainly reflects mispricing or investor sentiment. For example, Baker and Wurgler (2000) argue that the equity share of new issues forecasts market returns because managers try to time the market by issuing more new equities when stocks are overvalued. I cast doubt on this interpretation by showing that the equity share of new issues forecasts stock returns mainly because of its close correlation with IPOFDR—a proxy of ex ante equity premium. Moreover, I find that commonly used measures of investor sentiment move closely with the determinants of conditional equity premium. These results suggest that mispricing is unlikely to be an important driver of stock return predictability.

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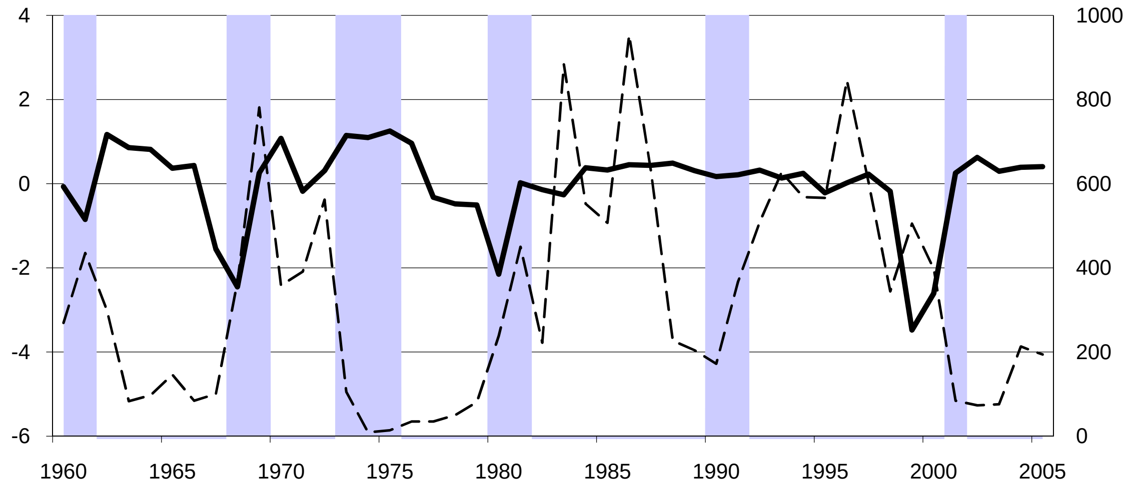

Figure 1
Standardized IPOFDR (Solid Line) and Number of IPOs

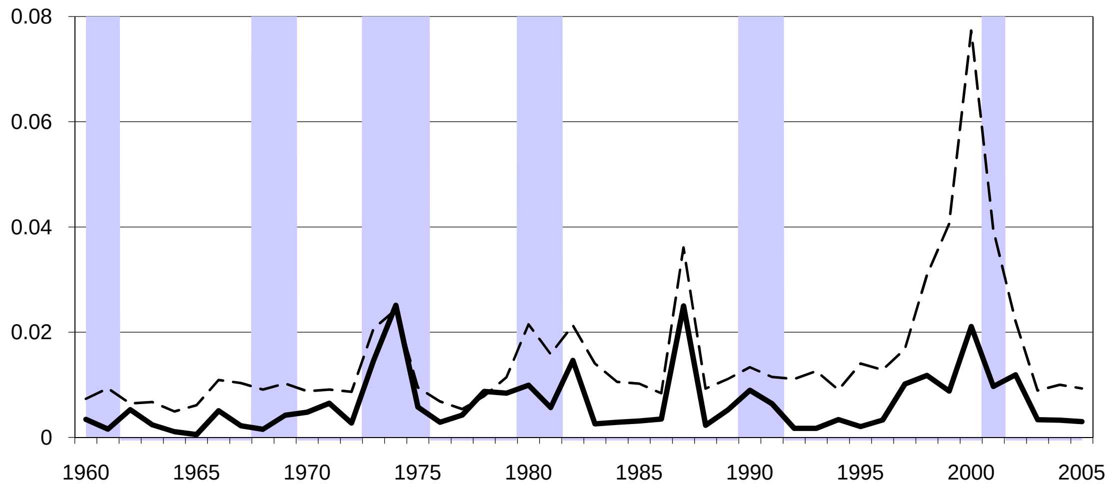

Figure 2
Realized Market Variance (Solid Line) and Average Idiosyncratic Variance

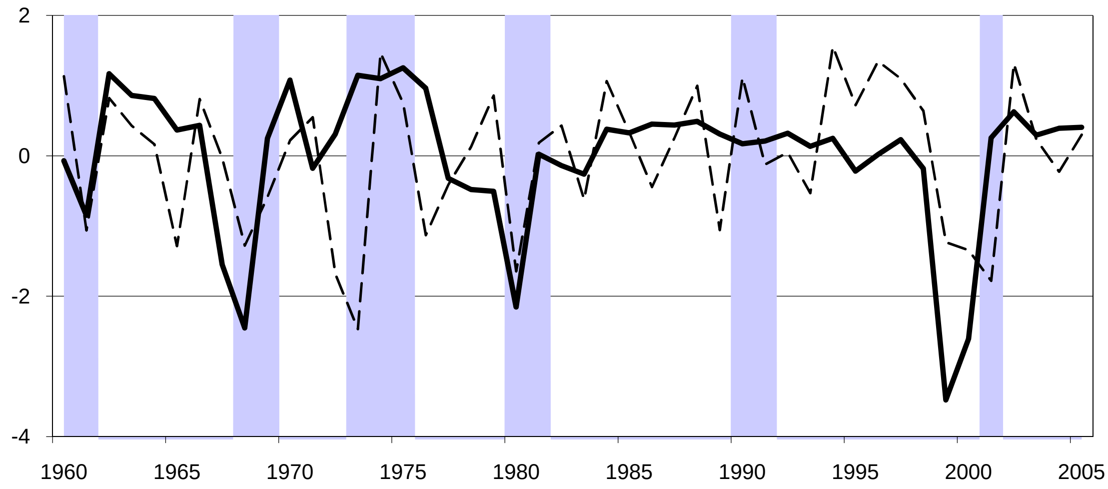

Figure 3
Standardized IPOFDR (Solid Line) and Standardized One-Year-Ahead Excess Market Returns

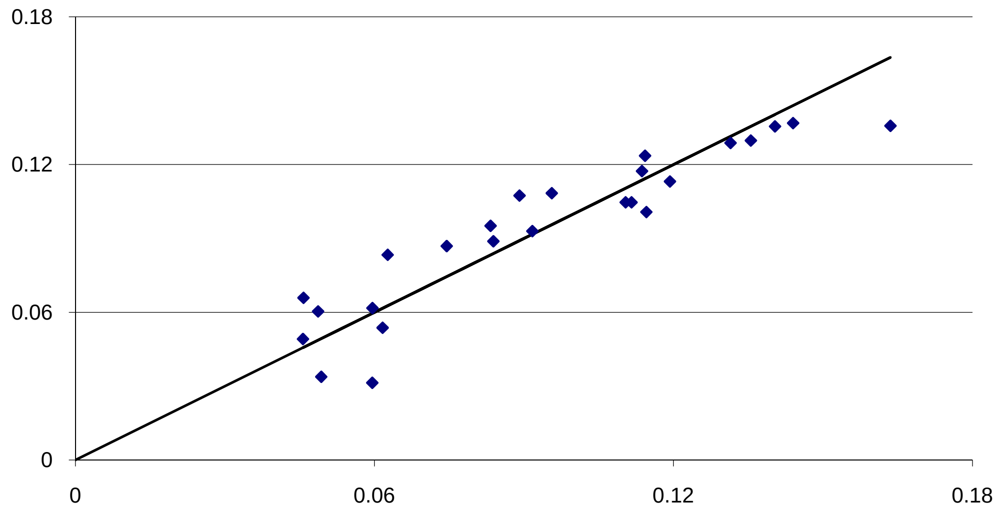

Figure 4
Expected (Vertical Axis) versus Realized (Horizontal Axis) Returns with IPOFDR as a Risk Factor

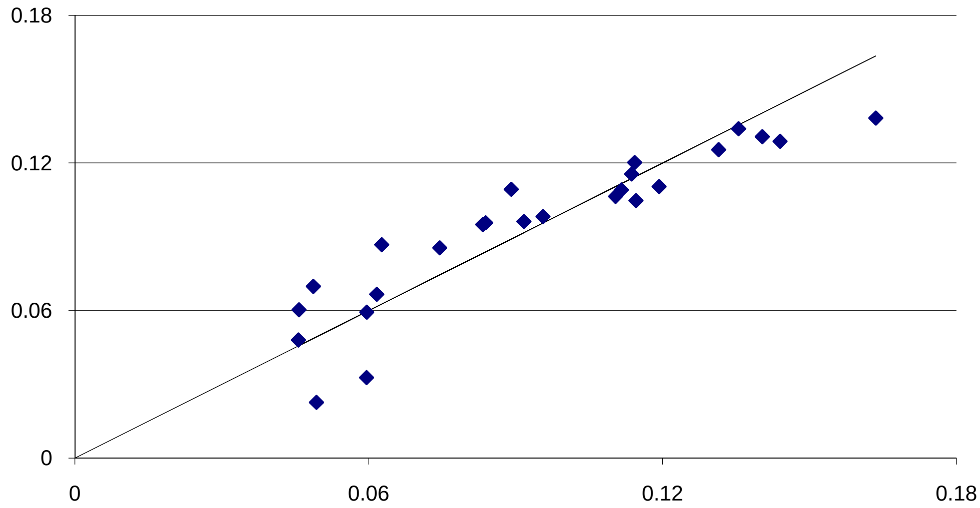

Figure 5
Expected (Vertical Axis) versus Realized (Horizontal Axis) Returns with HML as a Risk Factor

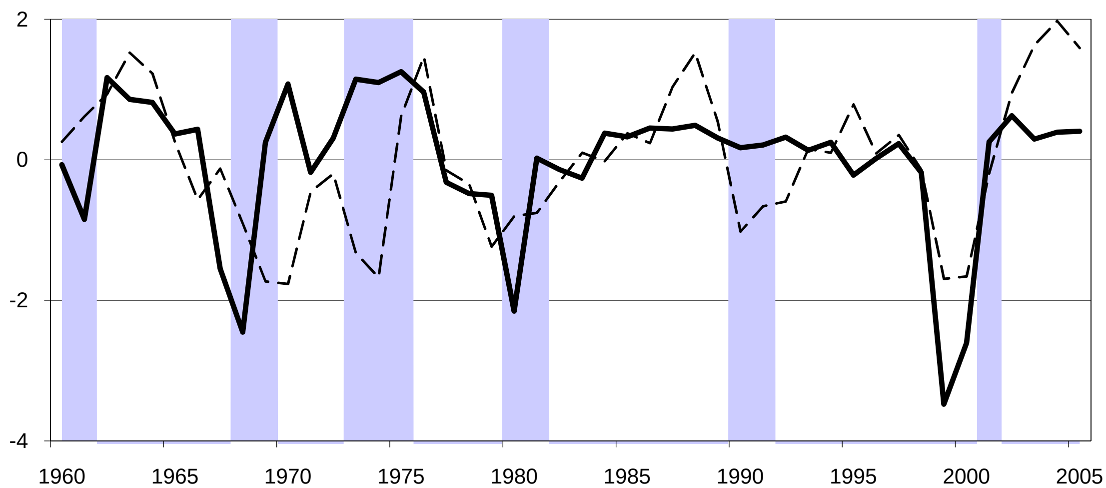

Figure 6
Standardized IPOFDR (Solid Line) and Standardized One-Year-Ahead Dividend Growth

Table 1

Summary Statistics

	IPOFDR	ERET	∆DIV	HML	∆IPOFDR
Panel A Univariate Statistics					
Mean	-0.170	0.059	0.014	0.066	0.002
Standard Deviation	0.151	0.165	0.044	0.138	0.160
Autocorrelation	0.442	-0.041	0.658	-0.089	-0.076
Panel B Cross Correlation					
IPOFDR	1.000				
ERET	-0.156	1.000			
∆DIV	0.209	0.209	1.000		
HML	0.316	-0.294	-0.016	1.000	
∆IPOFDR	0.531	-0.484	-0.178	0.490	1.000

Note: The table provides summary statistics of some selected variables used in this paper. IPOFDR is minus average IPO first-day return; ERET is excess stock market returns; ∆DIV is the growth rate of dividends per share; HML is the high-minus-low factor in the Fama and French (1996) three-factor model; and ∆IPOFDR is the first difference of IPOFDR. The annual data span the 1960 to 2006 period.

Table 2

Explaining Time-Series Variation in IPOFDR

	IV	MV	Wald Test (p-value)	$\overline{R}^2$
Panel A $\text{IPOFDR}_{t+1} = \theta + \gamma \text{MV}_{t+1} + \eta_{t+1}$				
1960-2005		2.349		-0.016
		(2.338)		
1960-1982		2.094		-0.045
		(3.486)		
1983-2005		2.543		-0.036
		(2.883)		
1960-1995		1.156		-0.028
		(1.991)		
Panel B $\Delta\text{IPOFDR}_{t+1} = \theta + \gamma \Delta\text{MV}_{t+1} + \eta_{t+1}$				
1960-2005		0.258		-0.023
		(2.506)		
1960-1982		2.207		-0.044
		(3.599)		
1983-2005		-0.730		-0.046
		(3.207)		
1960-1995		0.859		-0.028
		(1.481)		
Panel C $\text{IPOFDR}_{t+1} = \theta + \gamma \text{MV}_{t+1} + \delta \text{IV}_{t+1} + \eta_{t+1}$				
1960-2005	-10.083**	13.508**	17.084	0.330
	(2.441)	(3.913)	(0.000)	
1960-1982	-24.730*	25.925*	6.621	0.176
	(11.213)	(10.216)	(0.037)	
1983-2005	-10.887**	14.783**	30.414	0.615
	(2.943)	(5.168)	(0.000)	
1960-1995	-13.519*	15.677*	6.310	0.091
	(6.856)	(6.438)	(0.043)	
Panel D $\Delta\text{IPOFDR}_{t+1} = \theta + \gamma \Delta\text{MV}_{t+1} + \delta \Delta\text{IV}_{t+1} + \eta_{t+1}$				
1960-2005	-9.396*	11.296*	5.689	0.149
	(4.528)	(4.738)	(0.058)	
1960-1982	-24.280**	19.108**	7.923	0.097
	(8.936)	(7.136)	(0.019)	
1983-2005	-8.658	11.609*	4.010	0.236
	(4.990)	(5.820)	(0.135)	
1960-1995	-13.739*	13.701*	6.362	0.074
	(5.447)	(5.756)	(0.042)	

Note: The table reports the OLS estimation results of regressing IPOFDR on stock market variance (MV) and average idiosyncratic variance (IV). Panels A and C use levels and Panels B and D use the first difference. IPOFDR is minus average IPO first-day returns. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 3

Forecasting One-Year-Ahead Excess Stock Market Returns: OLS Regressions

	IPOFDR	IPOFDR*DUM	$\gamma+\delta$	$\overline{R^2}$
Panel A $\text{ERET}_{t+1} = \theta + \gamma \text{IPOFDR}_t + \eta_{t+1}$				
1961-2006	0.392**			0.108
	(0.119)			
1961-1982	0.317			0.038
	(0.201)			
1983-2006	0.501**			0.187
	(0.087)			
1961-1995	0.355			0.051
	(0.194)			
Panel B $\text{ERET}_{t+1} = \theta + \gamma \text{IPOFDR}_t + \delta \text{IPOFDR}_t\text{*DUM}_t + \eta_{t+1}$				
1961-2006	0.407**	-0.177	0.230	0.096
	(0.114)	(0.182)	(0.211)	
1961-1982	0.412*	-0.403*	0.009	0.053
	(0.171)	(0.182)	(0.247)	
1983-2006	0.524**	0.327	0.850	0.160
	(0.092)	(0.743)	(0.779)	
1961-1995	0.442*	-0.347*	0.095	0.061
	(0.177)	(0.171)	(0.209)	

Note: The table reports the OLS estimation results of forecasting one-year ahead excess market returns (ERET). IPOFDR is minus average IPO first-day returns and DUM is a dummy variable, which equals one for the years during which the number of IPOs is less than 200 and equals zero otherwise. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 4

Tests of Out-of-Sample Forecast Performance

	Models	MSE_A / MSE_B	ENC-NEW		MSE-F	
			Statistic	BS. CV	Statistic	BS. CV
1	C+IPOFDR vs. C	0.852	4.220	2.503	5.197	1.625
2	C+IPOFDR+IPOFDR*DUM vs. C	0.862	5.132	3.551	4.876	1.622

Note: Expected excess stock market returns are constant in the benchmark model. I augment the benchmark model with IPOFDR in row 1 and with IPOFDR and IPOFDR*DUM in row 2. IPOFDR is minus average IPO first-day returns and DUM is a dummy variable, which equals one for the years during which the number of IPOs is less than 200 and equals zero otherwise. I report three out-of-sample forecast tests: (1) the mean-squared forecasting error (MSE) ratio of the augmented model to the benchmark model, MSE_A / MSE_B, (2) the encompassing test ENC-NEW developed by Clark and McCracken (2001); and (3) the equal forecast accuracy test MSE-F developed by McCracken (1999). I use observations over the period 1961 to 1977 for the initial in-sample estimation and then generate forecasts recursively for stock returns over the period 1978 to 2006. The BS. CV column reports the empirical 95 percent critical values obtained from the bootstrapping, as in Lettau and Ludvigson (2001). In particular, I first estimate a VAR (1) process of excess stock market returns and its forecasting variables with the restrictions under the null hypothesis. I then feed the saved residuals with replacements to the estimated VAR system, of which I set the initial values to their unconditional means. The ENC-NEW and MSE-F statistics are calculated using the simulated data and the whole process is repeated 10,000 times.

Table 5

Loadings of Portfolios Sorted on Size and Book-to-Market on Changes in IPOFDR

	1 (low B/M)	2	3	4	5 (high B/M)	5-1
Panel A Loadings on ΔIPOFDR						
1 (small cap)	-0.340	0.012	0.138	0.296	0.278	0.618
2	-0.159	0.080	0.193	0.353	0.401	0.559
3	-0.197	0.108	0.236	0.356	0.352	0.548
4	-0.262	0.135	0.317	0.286	0.253	0.515
5 (large cap)	-0.064	0.097	0.009	0.265	0.292	0.355
5-1	0.276	0.085	-0.130	-0.031	0.014	
Panel B Loadings on ERET						
1 (small cap)	1.092	1.064	0.898	0.906	0.992	-0.099
2	1.078	0.924	0.941	0.970	1.003	-0.075
3	1.009	0.920	0.856	0.982	0.865	-0.144
4	0.928	0.907	0.963	0.966	0.994	0.066
5 (large cap)	1.064	0.995	0.833	0.954	1.017	-0.047
5-1	-0.028	-0.069	-0.065	0.048	0.025	
Panel C Loadings on SMB						
1 (small cap)	1.607	1.585	1.385	1.381	1.470	-0.137
2	1.110	0.985	1.100	0.994	1.034	-0.076
3	0.728	0.821	0.731	0.845	0.955	0.227
4	0.406	0.447	0.540	0.549	0.573	0.167
5 (large cap)	-0.138	0.030	0.011	0.116	0.118	0.256
5-1	-1.745	-1.555	-1.374	-1.264	-1.352	

Note: The table reports loadings of twenty-five Fama and French (1996) portfolios on risk factors:

$$R^{p}_{i,t+1} = \alpha + \beta_1 \Delta\text{IPOFDR}_{t+1} + \beta_2 \text{MKT}_{t+1} + \beta_3 \text{SMB}_{t+1} + \eta_{t+1},$$

where ΔIPOFDR is the first difference of IPOFDR; ERET is the excess stock market return; and SMB is the small-minus-big factor. The annual data span the period 1960 to 2006.

Table 6

Loadings of Portfolios Sorted on Size and Book-to-Market on HML

	1 (low B/M)	2	3	4	5 (high B/M)	5-1
Panel A Loadings on HML						
1 (small cap)	-0.625	0.005	0.217	0.452	0.592	1.217
2	-0.485	0.121	0.322	0.656	0.736	1.221
3	-0.490	0.240	0.493	0.663	0.781	1.271
4	-0.588	0.302	0.467	0.645	0.568	1.157
5 (large cap)	-0.368	0.126	0.193	0.504	0.702	1.071
5-1	0.257	0.121	-0.024	0.052	0.110	
Panel B Loadings on ERET						
1 (small cap)	1.080	1.060	0.894	0.893	1.021	-0.059
2	1.025	0.920	0.939	0.984	1.016	-0.010
3	0.971	0.933	0.878	0.996	0.909	-0.061
4	0.893	0.925	0.945	1.005	1.028	0.134
5 (large cap)	1.000	0.985	0.877	0.967	1.067	0.067
5-1	-0.187	-0.135	0.052	0.112	0.006	
Panel C Loadings on SMB						
1 (small cap)	1.722	1.581	1.338	1.281	1.375	-0.347
2	1.165	0.958	1.034	0.875	0.898	-0.267
3	0.796	0.784	0.651	0.724	0.835	0.039
4	0.496	0.401	0.434	0.452	0.487	-0.009
5 (large cap)	-0.115	-0.002	0.007	0.027	0.018	0.133
5-1	-1.837	-1.583	-1.331	-1.255	-1.358	0.480

Note: The table reports loadings of twenty-five Fama and French (1996) portfolios on risk factors:

$$R^{p}_{i,t+1} = \alpha + \beta_1 \mathrm{HML}_{t+1} + \beta_2 \mathrm{MKT}_{t+1} + \beta_3 \mathrm{SMB}_{t+1} + \eta_{t+1},$$

where HML is the high-minus-low factor; ERET is the excess stock market return; and SMB is the small-minus-big factor. The annual data span the period 1960 to 2006.

Table 7

Cross-Sectional Regressions with Fama and French 25 Portfolios

	Constant	ERET	SMB	HML	ΔIPOFDR	HML$^+$	ΔIPOFDR$^+$	R^2
Panel A ΔIPOFDR from First Difference								
1	0.075	-0.024	0.036	0.065**				0.834
	[1.659]	[-0.466]	[1.661]	[3.161]				
	<1.455>	<-0.420>	<1.656>	<3.145>				
2	0.072	-0.024	0.036		0.126*			0.854
	[1.770]	[-0.501]	[1.648]		[2.968]			
	<1.240>	<-0.378>	<1.629>		<2.263>			
3	0.068	-0.019	0.036		0.112	0.016		0.855
	[1.523]	[-0.374]	[1.648]		[2.302]	[0.681]		
	<1.118>	<-0.290>	<1.632>		<1.790>	<0.578>		
4	0.068	-0.019	0.036	0.063**			0.076	0.855
	[1.523]	[-0.374]	[1.648]	[3.085]			[1.641]	
	<1.118>	<-0.290>	<1.632>	<3.050>			<1.264>	
Panel B ΔIPOFDR from AR(1) Model								
5	0.120*	-0.071	0.037		0.097*			0.847
	[2.925]	[-1.488]	[1.695]		[2.823]			
	<2.103>	<-1.144>	<1.678>		<2.218>			
6	0.105	-0.055	0.036		0.079*	0.027		0.848
	[2.228]	[-1.027]	[1.687]		[2.399]	[1.299]		
	<1.723>	<-0.828>	<1.675>		<2.010>	<1.196>		
7	0.105	-0.055	0.036	0.064**			0.051	0.848
	[2.228]	[-1.027]	[1.687]	[3.088]			[1.631]	
	<1.723>	<-0.828>	<1.675>	<3.058>			<1.354>	

Note: The table reports the Fama and MacBeth (1973) cross-sectional regression results. The annual data span the 1960 to 2006 period. ERET is the excess stock market return; HML and SMB are the value premium and the size premium, respectively, of the Fama and French (1996) 3-factor model; ΔIPOFDR is the first difference of IPOFDR; HML$^+$ is the residual from the regression of HML on ΔIPOFDR , and ΔIPOFDR$^+$ is the residual from the regression of ΔIPOFDR on HML. Fama and MacBeth t-statistics are reported in squared brackets and Shanken (1992) corrected t-statistics are reported in angled brackets. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 8

Forecasting One-Year-Ahead Dividend Growth

	DP	EP	IPOFDR	IPOFDR*DUM	$\overline{R}^2$
Panel A OLS Regressions					
1	-0.836				0.045
	(0.561)				
2		-0.316			0.024
		(0.187)			
3			0.116**		0.140
			(0.033)		
4	-1.238**		0.134**		0.237
	(0.404)		(0.036)		
5		-0.374*	0.123**		0.186
		(0.170)	(0.034)		
6	-1.314**		0.139**	-0.022	0.231
	(0.419)		(0.036)	(0.043)	
Panel B 2SLS Regressions					
7			0.148**		0.140
			(0.038)		
8	-1.105**		0.222**		0.213
	(0.368)		(0.040)		
9		-0.223	0.168**		0.165
		(0.152)	(0.039)		
10	-1.217**		0.218**	-0.064	0.209
	(0.388)		(0.041)	(0.047)	

Note: The table reports the OLS estimation results of forecasting annual dividend growth. The annual data span the 1961 to 2006 period. DP is the dividend yield; EP is the earning-price ratio; IPOFDR is minus average IPO first-day returns; and DUM is a dummy variable, which equals one for the years during which the number of IPOs is less than 200 and equals zero otherwise. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 9

Explaining Time-Series Variation in Investor Sentiment: 1962 to 2005

	IV	MV	$\overline{R}^2$
CEFD	-1.825*	6.088**	0.081
	(0.691)	(1.754)	
TURN	5.692*	-7.415	0.045
	(2.604)	(8.239)	
NIPO	6.717*	-16.408	0.029
	(3.010)	(9.173)	
LNIPO	4.340*	-1.059*	0.124
	(1.631)	(0.514)	
IPOFDR	-10.042**	13.539**	0.328
	(2.435)	(3.906)	
S	-1.617	3.009	-0.018
	(0.836)	(2.912)	
PDND	-8.818**	14.521**	0.150
	(3.063)	(5.167)	
SENT	52.413**	-82.814**	0.189
	(8.680)	(25.069)	
$SENT^{\perp}$	50.436**	-52.991**	0.195
	(7.431)	(18.136)	

Note: The table reports the OLS estimation results of regressing Baker and Wurgler's (2006) measures of investor sentiment on contemporaneous market variance (MV) and average idiosyncratic variance (IV) over the period 1962 to 2005. CEFD is the close-end fund discount; TURN is the NYSE share turnover; NIPO is the number of IPOs; LNIPO is the log transformation of NIPO; IPOFDR is the IPO first-day return; S is the equity share in new issues; PDND is dividend premium—the log difference of the average market-to-book equity ratio between dividend payers and nonpayers; and SENT is the composite sentiment index. Baker and Wurgler (2006) also construct a second index—$SENT^{\perp}$—by removing business-cycle variation from each of the six investor sentiment measures prior to the principal components analysis. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 10

Investor Sentiment and One-Year Ahead Excess Market Returns: 1963 to 2006

Panel A Equity Share and Composite Investor Sentiment

	S(-1)	SENT(-1)	$SENT^{\perp}$(-1)	IPOFDR(-1)	IPOFDR(-2)	Wald Test	$\overline{R^2}$
1	-0.563*						0.069
	(0.269)						
2		-0.026					0.003
		(0.022)					
3			-0.025				0.001
			(0.022)				
4				0.379**			0.103
				(0.119)			
5					0.337**		0.078
					(0.119)		
6				0.319*	0.181	0.500**	0.113
				(0.136)	(0.144)	(0.138)	
7	-0.480			0.310*	0.151	0.462**	0.169
	(0.296)			(0.132)	(0.186)	(0.153)	
8		0.040		0.315*	0.394	0.709**	0.119
		(0.033)		(0.129)	(0.209)	(0.194)	
9			0.054	0.330*	0.467*	0.797**	0.134
			(0.033)	(0.143)	(0.210)	(0.226)	

Panel B Other Components of Investor Sentiment Index

	PDND(-1)	CEFD(-1)	NIPO(-1)	TURN(-1)	IPOFDR(-1)	IPOFDR(-2)	Wald Test	$\overline{R^2}$
10	0.000							-0.021
	(0.002)							
11		0.002						-0.017
		(0.003)						
12			0.063					-0.024
			(0.923)					
13				0.035				-0.020
				(0.093)				
14	-0.004*				0.608**	0.273	0.881**	0.199
	(0.002)				(0.144)	(0.152)	(0.197)	
15		-0.001			0.285*	0.231	0.516**	0.094
		(0.003)			(0.136)	(0.152)	(0.131)	
16			0.690		0.287*	0.243	0.531**	0.104
			(0.956)		(0.134)	(0.141)	(0.134)	
17				0.091	0.303*	0.237	0.540**	0.116
				(0.074)	(0.142)	(0.153)	(0.127)	

Note: The table reports the OLS estimation results of forecasting annual excess market returns using Baker and Wurgler's (2006) measures of investor sentiment. CEFD is the close-end fund discount; TURN is the NYSE share turnover; NIPO is the number of IPOs; LNIPO is the log transformation of NIPO; IPOFDR is minus average IPO first-day return; S is the equity share in new issues; PDND is dividend premium—the log difference of the average market-to-book equity ratio between dividend payers and nonpayers; and SENT is the composite sentiment index. Baker and Wurgler also construct an alternative index—$SENT^{\perp}$—by removing business-cycle variation from each of the six investor sentiment measures prior to the principal components analysis. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.

Table 11

Forecasting One-Year-Ahead Returns on Portfolios Sorted on Volatility

	SENT(-1)	IPOFDR(-1)	IV(-1)	MV(-1)	ERET	SMB	ΔIPODFR	$\overline{R^2}$
Panel A: Returns Difference between High and Low IV Stocks								
1	-0.128**							0.232
	(0.021)							
2		0.637**						0.123
		(0.167)						
3			-11.694**	23.421**				0.146
			(2.883)	(6.570)				
Panel B: Returns Difference between High and Low IV Stocks: Controlling for ERET, SMB, and ΔIPODFR								
4					0.271	0.665**	-0.631*	0.471
					(0.224)	(0.208)	(0.256)	
5	-0.044							0.037
	(0.025)							
6		0.193						0.003
		(0.219)						
7			-5.642*	11.356*				0.043
			(2.293)	(5.575)				

Note: The table reports in rows 1 to 3 the OLS estimation results of forecasting annual returns on the portfolio that is long in stocks with high idiosyncratic volatility and short in stocks with low idiosyncratic volatility over the period 1963 to 2006. Row 4 reports the OLS estimation results of regressing the portfolio return on contemporaneous risk factors. Rows 5 to 7 report the OLS estimation results of forecasting the residual from the regression reported in row 4. SENT is Baker and Wurgler's (2006) investor sentiment index; IPOFDR is minus average IPO first-day returns; IV is average idiosyncratic variance; MV is stock market variance; ERET is excess stock market return; SMB is the return difference between small and big stocks; and ΔIPOFDR is the first difference of IPOFDR. White-corrected standard errors are reported in parentheses. Asterisks * or ** indicate significance at the 5% and 1% levels, respectively.