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Comment

Monika Piazzesi, Stanford and NBER

Overview

Many empirical studies have documented that stock market proxies of Tobin's q do a poor job in explaining investment. The log-differenced investment equation says that investment growth rates should be explained by contemporaneous stock returns. In the data, however, regressions of investment growth rates on stock returns have low R^2 s and the estimated slope coefficient often has a negative sign.

This paper measures q with expected earnings over the next year instead of stock values. The expectations are from quarterly survey data of earnings forecasts by company CFOs and stock analysts. The paper finds that regressions of planned as well as actual investment growth on these survey measures of expected earnings growth have high R^2 s and the estimated slope coefficients have positive signs.

This fascinating new evidence on survey forecasts provides important further support to the idea that stock values may not be accurate measures of the value of installed capital. This idea motivated Abel and Blanchard (1986) to construct VAR forecasts of marginal profits from capital in aggregate data. Gilchrist and Himmelberg (1995) construct such VAR forecasts for individual firms. These studies find that VAR proxies of Tobin's q perform better than the more traditional measures based on stock values. Cummins, Hassett, and Oliner (2006) use survey forecasts by stock analysts instead of VAR forecasts and reach similar conclusions.

Interestingly, this paper shows that earnings expectations of CFOs and analysts are highly correlated. Moreover, the paper shows that these expectations are biased; the expectational errors made by these survey forecasts can be predicted with past variables such as lagged

GDP. The positive sign in these predictive regressions suggests that survey expectations are extrapolative: high past GDP numbers predict high errors in earnings expectations.

Below, I will discuss (a) the conventional view in finance about q theory with time-varying discount rates, (b) the recent challenge of this view by survey forecasts to which this paper adds important new facts, and (c) initial thoughts about a quantitative model with heterogeneous expectations that would be consistent with these new facts.

I think it will be crucial for the literature to take the next step and develop such a model. Existing models that feature the conventional view are quantitative and establish clean tensions with the data. To make progress, the finance literature needs to develop models that can compete on the same turf as the existing models. It helps that there is a growing number of surveys that collect microdata and also ask survey respondents to forecast certain variables. These survey data can be used to discipline the specification of beliefs in the new models.

Conventional Finance View

The conventional view in finance is that the high volatility in asset values is driven by time-varying discount rates (e.g., Cochrane's AFA presidential address [2011]). The argument starts from the definition of the return on an asset. The return is defined as the ratio of the payoff tomorrow—which consists of the dividend D_{t+1} and the resale value of the asset P_{t+1} —divided by its current value P_t :

$$R_{t+1} = \frac{P_{t+1} + D_{t+1}}{P_t} = \frac{(P_{t+1} / D_{t+1} + 1)D_{t+1}}{P_t / D_t} = \frac{(v_{t+1} + 1)g_{t+1}}{v_t}, \quad (1)$$

where v_t is the price-dividend ratio and g_{t+1} is the (gross) growth rate of dividends.

In a large variety of asset markets, we observe that price-dividend ratios v_t are highly persistent but mean reverting: when the value of assets is high relative to their fundamentals, these values are likely to subsequently decline over time, so high v_t predicts low v_{t+1} . The growth rate g_{t+1} of dividends is close to unpredictable. A regression of returns on lagged price-dividend ratios

$$R_{t+1} = \alpha + \beta v_t + \varepsilon_{t+1}$$

recovers the mean-reversion in v_t . The estimated slope coefficient is negative, $\hat{\beta} < 0$, so high asset values relative to fundamentals predict

low returns. The conclusion from these regressions is that discount rates vary over time, while expected cash flow growth is roughly constant.

Riskless real rates are roughly constant over time as well. The time variation in discount rates thus has to come from changes in required risk compensation. Any successful mechanism to generate such time variation needs to argue that investors require low compensation for risk in good times. The low discount rates drive up asset values v_t relative to fundamentals. In bad times, investors want to be highly rewarded for holding risky assets, so discount rates are high and asset values v_t are low relative to fundamentals.

By now, we have a variety of models that derive such a mechanism from ambiguity aversion, time-varying aggregate volatility, incomplete markets with time-varying idiosyncratic volatility, habit formation, and other forms of nonseparable utility (for example, with housing). There is an active literature that studies the quantitative predictions of these models and compares them with the data.

When we place q theory in an environment with time-varying discount rates, firms will choose to invest more when discount rates are low. Since low discount rates lead to high stock values relative to fundamentals, q theory predicts investment growth rates to be high when stock returns are high. This is the linear relationship that is tested in regressions of investment growth on contemporaneous stock returns.

Recent Survey Evidence on Return Forecasts

Recent work has studied survey evidence on discount rates from various asset markets. In joint work with Juliana Salomao and Martin Schneider (Piazzesi, Salomao, and Schneider 2015), we studied survey data on interest-rate forecasts. The log returns of bonds do not involve dividends D_t and so equation (1) boils down to changes in log prices:

$$\log R_{t+1} = \log P_{t+1} - \log P_t.$$

The log price is equal to (minus) the interest rate of the bond multiplied by its maturity. For example, for an n -period bond, we have

$$\log P_t = -nt_t^{(n)}.$$

To forecast the log price in $t + 1$, we thus need a measure of interest rate forecasts.

We decompose expected returns as follows. We write the expected value of the log return measured from the predictive regression as an

expectational difference—the difference between the OLS predicted log price and a subjective expectation of the log price—plus the subjective expectation of the log return. The subjective expectation is indicated with a star *:

$$E_t(\log R_{t+1}) = E_t(\log P_{t+1}) - E_t^*(\log P_{t+1}) + E_t^*(\log R_{t+1}). \quad (2)$$

We measure subjective interest-rate forecasts for many maturities using the Bluechip survey. To forecast the log price of a bond with current maturity $n + 1$, we use survey forecasts of the n -period interest rate

$$E_t^*(\log P_{t+1}) = E_t^*(-ni_{t+1}^{(n)}).$$

We measure expected returns on bonds $E_t(\log R_{t+1})$ with predictive regressions on lagged interest rates, following Cochrane and Piazzesi (2005).

Figure 1 shows the left-hand side $E_t(\log R_{t+1})$ of equation (2) as a solid line together with the first term on the right-hand side, the expectational difference $E_t(\log P_{t+1}) - E_t^*(\log P_{t+1})$ as a dashed line. The units are percent returns per year. The figure uses the 11-year bond, so that we are forecasting the 10-year rate $i_{t+1}^{(10)}$ one year from now. The gray bars in figure 1 are NBER recessions.

Two patterns are clear from a look at figure 1. First, predictive regressions recover expected returns on bonds that are strongly countercyclical. The fluctuations are big; the solid line OLS fitted values range from 15% expected bond returns per year to -7% per year. This pattern in OLS-expected returns is well known (see, for example, figure 6 in Cochrane and Piazzesi [2005]). It is precisely the kind of empirical pattern behind the conventional view in finance.

Second, the dashed line forecast differences share the cyclical fluctuations in the solid line OLS-fitted values and are almost comparable in magnitude. This means that subjective expectations of bond returns, $E_t^*(\log R_{t+1})$ on the right-hand side of equation (2), are not as cyclical as OLS-fitted values of return predictions. If survey forecasts provide a measure of expectations, these patterns suggest that discount rates may not fluctuate as much as predictive regressions document. Instead, asset values may be volatile because beliefs systematically differ from these OLS regressions; the difference is cyclical.

Figure 1 is based on Bluechip surveys that started in the mid-1980s. In our paper, we go beyond this short sample using data from previous surveys. Based on these data, we estimate subjective expectations of bond returns during the entire postwar sample. The message from the

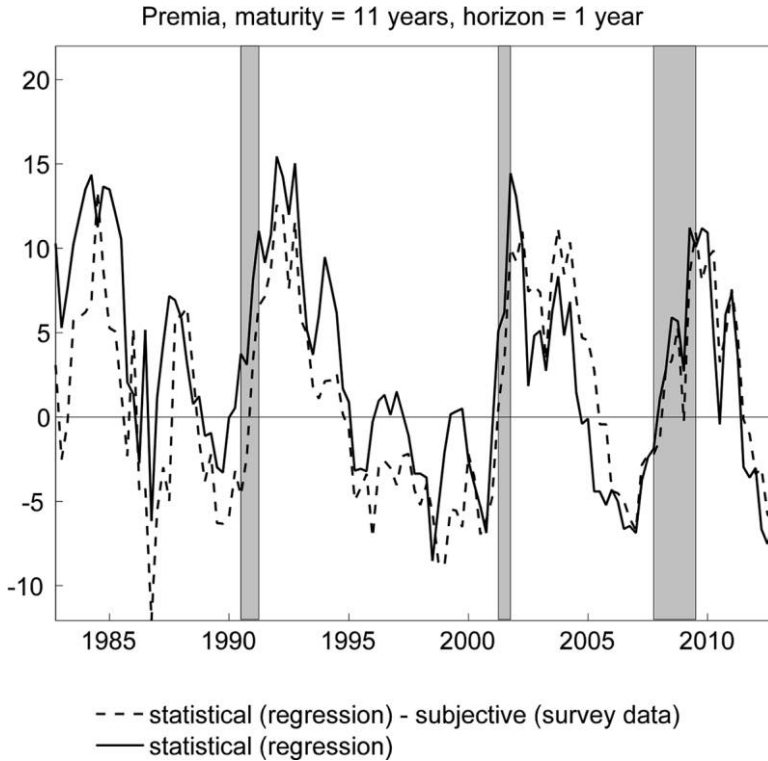


Fig. 1.

longer sample is that subjective expected returns are not flat, as it may appear from figure 1. The movements in subjective risk compensations are still not cyclical; they move at lower frequencies. Interestingly, subjective expectations of bond returns were particularly high in the late 1970s and early 1980s.

This evidence suggests that quantitative models may not need to generate much cyclical movements in risk compensation or discount rates. The one episode in which subjective bond premia were high was the time during and after the Great Inflation. This suggests that models of bond values need to take a stand on inflation expectations and compensation for inflation risk during a unique episode: a new Fed chairman, Paul Volcker, came into office and was trying hard to get inflation down.

I look at this evidence and conclude that we need more theoretical work about belief formation. This work can be guided as well as disciplined by the survey data. The discipline will be useful to avoid the

famous “wilderness” of such models that Chris Sims warned about. The empirical work in this paper takes an important step toward documenting the relationship between the optimal choices that should be implied by such a model (here, optimal investment) and survey expectations. The poor regression results from investment growth on stock returns suggest that the subjective expectations of managers may not be reflected in stock returns. This should further guide the modeling, an issue that I turn to next.

Model with Heterogeneous Expectations

How could we specify a model of investment that would be quantitatively consistent with the evidence documented in this paper? The paper documents that survey expectations by managers—firm insiders—are similar to survey expectations by stock analysts—outsiders to the firm—and both are biased. Thus, I want to first proceed under the simple assumption that q theory holds, but expectations are subjective. In this first setup, expectations are not heterogeneous. The star * will denote these common subjective expectations.

Firms use constant-returns-to-scale production functions and have quadratic adjustment costs. They pay dividends

$$D(K_t, I_t) = A_t K_t^\alpha L(K_t)^{1-\alpha} - w_t L(K_t) - p_t I_t - \frac{a}{2} \left(\frac{I_t}{K_t} \right)^2 K_t$$

where K_t is capital, I_t is investment, $L(K_t)$ is optimal labor demand, w_t is the wage, p_t is the price of investment goods and $a > 0$ is an adjustment cost parameter. The technology A_t is affected by shocks

$$\log A_{t+1} = \rho \log A_t + \varepsilon_{t+1}.$$

Managers of this firm maximize shareholder value. For simplicity, suppose that shareholders are risk neutral. The problem of the managers is to invest

$$\max_{\{I_{t+s}\}} E_t^* \left[\sum_{s>0} \beta^s D(K_{t+s}, I_{t+s}) \right]$$

$$\text{s.t. } K_t = (1 - \delta)K_{t-1} + I_t$$

$$K_0 \text{ given.}$$

The setup implies the classic equation for optimal investment

$$\frac{I_t}{K_t} = \frac{1}{a}(q_t - p_t)$$

where q_t is the shadow price of installed capital. It involves the following expectation of the present value of future marginal profits

$$q_t = E_t^* \left[\sum_{s>0} (1 - \delta)^{s-1} \beta^s D_K(K_{t+s}, I_{t+s}) \right].$$

Here, managers and shareholders agree; they have the same expectation E^* . In this case, it is fine to measure q_t with stock values. The setup predicts that the regression of investment growth on stock returns works well. This setup with common subjective expectations is thus not consistent with the empirical evidence presented in this paper that stock returns do not explain investment.

The paper documents, however, that the correlation between managerial forecasts and forecasts by stock analysts is not perfect. Thus, there is room for differences in opinion between managers and stock holders. Suppose next that E^* is the subjective expectation by managers, while shareholders have a different expectation E^{**} . There are surveys on both, so we can discipline both E^* and E^{**} . Again, the evidence suggests that both are biased.

How would managers in this model make decisions? Would they maximize shareholder values computed with E^{**} ? In this case, we are back to square one. The model again implies an equation that relates investment growth rates to stock returns.

Instead, suppose managers compute their own expected future profits with E^* . In this case, the model predicts that regressions of investment growth on stock returns do not work, because stock values reflect expectations by outside investors E^{**} . However, the model does predict that investment growth should be related to managers' earnings growth forecasts. The data confirm this implication. This setup would predict that expected earnings growth by stock holders should not explain investment growth, or not as well. The findings in the paper confirm this prediction.

In my mind, the key question is whether we can write down a model that makes quantitative sense of both regressions of investment growth on (a) stock returns and (b) analyst forecasts of earnings growth. The first regression should be a disaster with a negative coefficient, while the second regression should work okay (but not as well as managerial forecasts).

In my own work, I found that a tractable way to set up a model with heterogeneous expectations is to apply the temporary equilibrium con-

cept by Grandmont (1982). It allows the researcher to compute optimal decisions based on some beliefs about the future and then to solve for time- t market-clearing prices. With this approach, beliefs can directly be specified to be consistent with data.

An application of this approach is my paper with Martin Schneider (Piazzesi and Schneider 2013) where we study bond, stock, and house valuations during the Great Inflation. During that episode, household inflation forecasts differed across generations in the Michigan Survey. In particular, older households had lower inflation forecasts than younger households. We use these survey data to discipline the beliefs of different generations in an OLG model and study its quantitative implications for asset valuation and household portfolios.

Endnote

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