Forecasting, Risk, and Valuation: Accounting for the Future

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Two Aspects of Valuation

For a one-period payoff,

$$P_t = \frac{E_t(X_{t+1}) - Cov_t(X_{t+1}, y_{t+1})}{1 + r_f}$$

$$P_t = \frac{E_t(X_{t+1})}{1 + r}$$

1. Forecasting payoffs
2. Discounting for risk

Two Points in the Paper

- Forecasting is a matter of accounting

- Risk is a matter of accounting

Three Features that Link Accounting to Forecasting

1. Accounting links to cash flows

$$X_{t+\tau} = Earnings_{t+\tau} - \Delta(B_{t+\tau})$$

2. Accounting allocates to periods

$$\sum Earnings = \sum X$$

3. Accounting builds to earnings and book value from more basic elements according to fixed structural relations

Accounting Feature 1: Accounting Links to Cash Flows

No-arbitrage price (with constant discount rate):

$$P_t = \sum_{\tau=1}^{\infty} \frac{d_{t+\tau}}{(1+r)^{\tau}}$$

Account such that $d_{t+\tau} = Earnings_{t+\tau} - (B_{t+\tau} - B_{t+\tau-1})$,

$$P_t = B_t + \sum_{\tau=1}^{\infty} \frac{Earnings_{t+\tau} - rB_{t+\tau-1}}{(1+r)^{\tau}}$$

Implications

- Accounting is not just a matter of supplying the information to forecast future cash flows, but also the numbers to be forecasted
- For infinite-horizon forecasting, accounting does not matter
- Practical forecasting and valuation is done over finite horizons; the accounting then defines the forecasting

Finite Horizon Forecasting

$$P_t = \sum_{\tau=1}^{T} \frac{d_{t+\tau}}{(1+r)^{\tau}} + \frac{P_{t+T}}{(1+r)^{T}}$$

$$P_t = B_t + \sum_{\tau=1}^{T} \frac{Earnings_{t+\tau} - rB_{t+\tau-1}}{(1+r)^{\tau}} + \frac{P_{t+T} - B_{t+T}}{(1+r)^{T}}$$

Error = $P_{t+T} - B_{t+T}$

Compare cash accounting with accrual accounting
Compare mark-to-market accounting with historical cost accounting

Balance Sheet and Income Statement Error

Given no-arbitrage,

$$P_{t+T} = \frac{P_{t+T+1} + d_{t+T+1} - P_{t+T}}{r}$$

With $d_{t+T+1} = Earnings_{t+T-1} - (B_{t+T+1} - B_{t+T})$,

$$P_{t+T} = \frac{Earnings_{t+T+1} + P_{t+T+1} - B_{t+T+1} - (P_{t+T} - B_{t+T})}{r}$$

If change in balance sheet error = 0,

$$P_{t+T} = \frac{Earnings_{t+T+1}}{r}$$

Implications

1. Omissions from the balance sheet are not necessarily error: the income statement recovers the error
2. Forecasting error is not merely error in the given forecasting technique, but valuation error from the accounting used in the forecasting.
3. Relevance and reliability fall into place: minimize valuation forecast error
4. Earnings forecasting is done by forecasting the income statement and balance sheet in the future

Note: one can accommodate constant expected change in premiums (Penman 1998):

$$P_{t+T+1} - B_{t+T+1} = g(P_{t+T} - B_{t+T})$$

Accounting Feature 2: Accounting Allocates to Periods

Accounting determines the transition from the present to the future; $\beta_1, \beta_2,$ and β_3 are accounting parameters:

$$Earn_{t+1} = \beta_1 Earn_t + \beta_2 B_t + \beta_3 d_t + \varepsilon_{t+1}$$

Special cases:

$\beta_1 = 0 \quad \beta_2 = r$, and $\beta_3 = 0 \quad \leftrightarrow \quad P_t = B_t$

$\beta_1 = 1+r \quad \beta_2 = 0$, and $\beta_3 = -r \quad \leftrightarrow \quad P_t = \dfrac{(1+r)Earnings_t}{r} - d_t$

Ohlson (1995) shows that the general case is a weighted average of these two cases, with the M&M consistent weights determined by the accounting.

Accounting Feature 3: Accounting structure dictates forecast structure

Fixed accounting relations build the forecasts of earnings and book values. For example,

Earnings = Revenues – Expenses

= Δ Assets – ΔLiabilities + Net dividend

- Forecasts are build from more elementary components

Implications

- Forecasting cannot go out of income statement and balance sheet bounds, nor the bounds of the components
  - disciplining speculation
  - check on statistical forecasts
- Ball and Watts martingale → Financial Statement Analysis
- Accounting modeling first, statistics modeling second
- Components connect to the business (Feng Li)
- Ability to model value implications of alternative paths
- Ability to model extreme outcomes (Sugihara, Meyer, Einmahl, Posner)

Accounting and Risk

- Asset pricing sees risk and required return in terms of price variation

$$\text{eg., } Beta = Cov(R_{it}, R_{mt})$$

- Valuation sees risk in terms of accounting outcomes differing from expectation: the distribution of forecast error

Incorporating Accounting: "Cash flow betas"

Replace $Cov(R_{it}, R_{mt})$ with $Cov(Earn_{it}, Earn_{mt})$

Problem: The Accounting!

Only works for the two special cases:

1. $P_t = B_t$
2. $P_t = \frac{(1+r)Earnings_t}{r} - d_t$

4. Another Accounting Feature

- Accounting defers earnings recognition under uncertainty
- Deferred earnings creates earnings growth

Conservative Accounting!

Can we think of risk (and the required return, *r*) in terms of expected earnings being at risk, but also in terms of earnings growth?

Returns to Buying Earnings and Book Values

For 1963-2006:

		E/P Portfolio				
		1	2	3	4	5
	1	4.3%	10.9%	14.2%	17.1%	19.7%
B/P	2	8.8%	9.1%	13.0%	16.0%	22.1%
Port-	3	14.4%	8.5%	12.1%	17.0%	21.6%
folio	4	15.5%	13.4%	14.7%	18.0%	24.3%
	5	26.4%	20.1%	20.2%	22.6%	30.0%

- The additional returns to E/P are explained by B/P indicating risky growth
- A property of the accounting: conservative accounting depress earnings relative to book value when there is growth. Risk does not add to price. So, B/P is higher for a given E/P.

S. Penman and F. Reggiani, "Buying Earnings and Book Value: Accounting for Risk and Growth"

A Conjecture

- If I forecast earnings, maybe I have accommodated risk?

$$P_t = \frac{E_t(X_{t+1}) - Cov_t(X_{t+1}, y_{t+1})}{1 + r_f}$$

- But it depends on the accounting!
- Develop asset pricing models where earnings and earnings and earnings growth are at risk, but the accounting is accommodated. At a minimum, earnings and book value must come into it.