Which Investors Matter for Global Equity Valuations and Expected Returns?

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Outline

- Model
- Analysis of the cross-sectional variation in market-to-book ratios (international evidence)
- Estimation of the international asset demand model

Model: Summary

- Exchange economy, two periods $t = 0, 1$
- N risky assets with terminal payoffs $D_1(n) = B_0(n)\rho(n)$
  - B_0: book equity at $t = 0$; ρ: ROE at $t = 1$, one-factor model
  - $x(n)$: a set of asset characteristics (including a constant)
- I competitive investors $i = 1, \ldots, I$ with the CARA preferences $E[-\exp(-\gamma_i A_{1i} + Z_{1i})]$ over wealth $A_{i1} = A_{0i} + Q_i'(D_1 - P)$
  - heterogeneous beliefs about $\rho(n)$: $\rho_i(n) = g_i(n) + \beta_i(n)F + \eta(n)$, $F \sim \mathcal{N}(0, 1)$, $\eta \sim \mathcal{N}(0, \sigma^2 I)$
    - $g_i(n) = \lambda_i^{g\prime} x(n) + \nu_i^g(n)$, $\beta_i(n) = \lambda_i^{\beta\prime} x(n) + \nu_i^\beta(n)$
  - outside risk factors Z_{1i}: $Z_{1i} \sim \mathcal{N}(\mu_{Zi}, \sigma_{Zi}^2)$
    - $2Cov(Z_{1i}, \rho_i(n)) = \lambda_i^{Z\prime} x(n) + \nu_i^Z(n)$
  - heterogeneous risk aversion: $\gamma_i = \gamma / A_{i0}$

Model: Implications

- Asset demand $q_i(n) = Q_i(n)B_0(n)$:

$$q_i(n) = -\frac{1}{\gamma_i\sigma^2}MB(n) + \frac{1}{\gamma_i\sigma^2}\lambda_i^{q\prime}x(n) + \frac{1}{\gamma_i\sigma^2}\nu_i^q(n)$$

  - dispersion in q_i is determined by MB and characteristics x

- Equilibrium market-to-book ratios:

$$MB(n) = \left(\frac{\sum_{i=1}^{I} A_i\lambda_i}{\sum_{i=1}^{I} A_i}\right)' x(n) + \frac{\sum_{i=1}^{I} A_i\nu_i(n)}{\sum_{i=1}^{I} A_i}$$

  - dispersion in MB is determined by characteristics x

- The model is silent about
  - how to choose the characteristics x
  - whether x reflect expected profitability (g_i) or risk (β_i, $Cov(Z_{1i}, \rho_i)$)

Model: Comments

- Standard optimization of the CARA preferences:

$$Q_i = \frac{1}{\gamma_i} Var_i(D)^{-1}(E_i(D) - P + Cov_i(D, Z_i))$$

- Renormalization: $D = B_0\rho$, $P = B_0 \times MB$, $q_i = B_0 Q_i$, $B_0 = diag(B_0(1), \ldots, B_0(N)) \Rightarrow$

$$q_i = \frac{1}{\gamma_i} Var_i(\rho)^{-1}(E_i(\rho) - MB + Cov_i(\rho, Z_i))$$

  - it is unconventional to characterize holdings by book values
  - there is nothing special about book values

- For $q_i(n) \sim MB(n)$ and $q_i(n) \sim x(n)$ it is crucial that
  - ρ has a factor structure: $\rho = g + \beta F + \eta$
  - variances of all $\eta(n)$ are identical; isn't it a restrictive assumption?

Global market-to-book ratios: Summary

- Panel data model

$$mb_t(n) = a_t + \lambda'_{mb} x_t(n) + \epsilon_t(n)$$

  - $mb_t(n)$: log market-to-book ratio
  - $x_t(n)$: log book equity, sales-to-book ratio, foreign sales share, dividend-to-book ratio, Lerner index (operating income after depreciation/sales), local market beta
  - estimated separately for the U.S., GB, Euro area, and Japan
- Main results
  - the model explains from 37% (in Japan) to 68% (in GB) of the cross-sectional variation in $mb_t(n)$
  - coefficient estimates are comparable across the regions
    - and have reasonable signs

Global market-to-book ratios: Comments

- The choice of the characteristics looks a bit ad hoc
  - other candidates: leverage, R&D, stock volatility, ...
  - how high is the R-squared expected to be ex ante?
- Can the cross-region comparison be more rigorous?
  - test that the coefficients are equal
  - hypothesize about the variation in the coefficients across the regions
- It might be interesting to compare the proposed characteristic-based explanation of mb_t with those produced by backward-looking decompositions in Daniel and Titman (2006), Fama and French (2008), and Gerakos and Linnainmaa (2018)

Asset demand system: Summary

- The most interesting and important part of the paper
- Objectives
  - explain investors' portfolio weights by firm characteristics
  - assess the importance of particular investors by assuming that they switch to holding the market portfolio and comparing
    - the actual valuations with counterfactual ones
    - the abilities of characteristics to explain actual and counterfactual valuations
- Econometric framework: nested fractional model
  - generalizes the model of Koijen and Yogo (2019) for the case of multiple countries
  - resembles a nested logit model but differs from it

Asset demand system: Details

- Portfolio weights: $\omega_{i,t}(n,c) = \omega_{i,t}(n|c)\omega_{i,t}(c)$, $c = \{US, GB\}$
- Determinants of country allocations:

  $\delta_{i,t}(US) = \exp(\psi_{0,i} + \epsilon^{\psi}_{i,t})$, $\delta_{i,t}(GB) = 1$ (normalization)
- Determinants of asset allocations:

  $\delta_{i,t}(n|c) = \exp(b_{0,i,c,t} + \beta_{0,i,c} mb_t(n) + \beta'_{1,i,c} x_t(n) + \epsilon_{i,c,t}(n))$
  - outside asset: $\delta_{i,t}(0|c) = 1$ (normalization)
- Portfolio weights within country c:

$$\omega_{i,t}(n|c) = \frac{\delta_{i,t}(n|c)}{\sum_{m \in \mathcal{N}_{i,c,t}} \delta_{i,t}(m|c)}$$

- Portfolio weight of country c:

$$\omega_{i,t}(c) = \frac{\left(\sum_{m \in \mathcal{N}_{i,c,t}} \delta_{i,t}(m|c)\right)^{\psi_{1,i}} \delta_{i,t}(c)}{\sum_{c=\{US,GB\}} \left(\sum_{m \in \mathcal{N}_{i,c,t}} \delta_{i,t}(m|c)\right)^{\psi_{1,i}} \delta_{i,t}(c)}$$

Asset demand system: Estimation

- Separate estimation of within- and cross-country demands using holdings of institutional investors in the U.S and GB
  - investment advisors, mutual funds, long-term investors, hedge funds, private banking, brokers
  - household sector holdings are constructed as residuals
- Within-country demands:

$$\log\left(\frac{\omega_{i,t}(n)}{\omega_{i,t}(0)}\right) = b_{0,i,t} + \beta_{0,i} mb_t(n) + \beta_{1,i}' x_t(n) + \epsilon_{i,t}(n)$$

  - estimated for individual investors
- Cross-country demands:

$$\log\left(\frac{\omega_{i,t}(US)}{\omega_{i,t}(GB)}\right) = \psi_{0,i} - \psi_{1,i} \log\left(\frac{\omega_{i,t}(0|US)}{\omega_{i,t}(0|GB)}\right) + \epsilon_{i,t}^{\psi}$$

  - estimated for investor types

Asset demand system: Estimation

- Two challenges:
  - latent demand is correlated with prices
  - many investors hold concentrated portfolios
- Solutions:
  - 2SLS estimation with the instruments

$$z_{i,t}(n) = \log\left(\sum_{j\neq i,HH} A_{j,t}\frac{1_j(n)}{1+|\mathcal{N}_j|}\right)$$

    - as in Koijen and Yogo (2019)
    - variation in the instruments captures the exogenous variation in investment mandates
  - ridge-type regression in the second stage of 2SLS
    - shrinkage toward the aggregate demand function
    - regularization parameters are obtained by cross-validation

Asset demand system: Empirical results

- Investors disagree on the importance of dividend-to-book ratio, log book equity, and foreign sales
- The elasticity of substitution across countries ψ_1 varies from 0.1 (for broker-dealers) to 0.32 (for investment advisors)
- Investment advisors have the largest impact on valuations
  - primarily because of their size
- Hedge funds have the largest impact per dollar
- Insurance companies and pension funds have the smallest impact per dollar
- The results hold unconditionally and conditionally on characteristics

Asset demand system: Comments

- What is achieved by estimating demands of individual investors?
  - main results are reported for institutional types
  - additional problems:
    - concentrated portfolios; small cross-section of weights
    - the variation in the instrument is more likely to reflect choices of individual investors rather than investment mandates
- Why not to consider separately the impacts of the U.S. and GB investors?
  - currently, the counterfactuals are computed assuming that particular investors in both the U.S. and GB switch to the market portfolio

Asset demand system: Comments

- The 2SLS shrinkage estimator is interesting and innovative
- What are its econometric properties?
    - ridge regression reduces the variance but increases the bias
        - 2SLS is biased itself
    - are the regularization parameters sensitive to splitting the sample into training and validation samples?
    - it might be useful to illustrate the properties of the 2SLS shrinkage estimator using simulations
- What are the standard errors of the coefficient estimates?
    - needed for conducting formal tests
    - is it possible to use bootstrap to get them?

Asset demand system: Comments

- The counterfactual market equity of asset n is computed as

$$ME_t^{CF}(n) = \sum_i \omega_{it}^{CF}(n, ME_t^{CF}(n))A_{it}$$

  - wealth A_{it}, which depends on ME of all assets, stays the same
- However, by affecting ME, switching of a group of investors to the market portfolio also changes
  - the wealth of all investors
  - the demand functions of all investors
    - in the theoretical part, $c_i = (\beta_i' \beta + \sigma^2)^{-1} \beta_i' (g_i - MB + z_i)$
- What are the consequences of ignoring those facts?

Conclusion

- Interesting and ambitious paper with numerous results
  - both methodological and empirical
- Suggestions
  - emphasize more the estimation of the asset demand system focusing on international results
  - better develop the 2SLS shrinkage estimator
  - try to address the indicated issues