US-Global Net Equity Flows: Profit Seeking Motives amidst Long Memory Properties

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There are Some Theoretical Explanations of Net Capital Flows, but Data’s Sparse

• There are few data sets to test our theories
  – There’s the US TIC database (30+ years of monthly data), which is what I use (also Korea, Thailand)
  – There are also some studies that use stock exchange order flows (Griffin, et al. (RESTAT 2004), and Richards (JFQA 2005); about 2 yrs. of daily data
  – Also, Froot & co-authors have proprietary data on orders from State Street Corporation (4 yrs. data)
• Also, (almost) all studies transform the flow data by dividing by stock market capitalization
  – I’d like to see if I can identify a simple model using the actual flow data
My Objective(s)

• Derive a Model of monthly Net Equity Purchases for the US viz-a-viz Rest of the World that:
  – captures some of the time series properties, if it’s denominated in a single currency (US dollars) since the data is denominated in US dollars, and there’s no good information about country origins
  – can relate the money flows to Jensen’s alpha (you don’t see models relating asset allocations to alphas, because we’re taught to think alphas = 0 in equilibrium)
    • This may not be important, but it bothered me that you always hear people say positive (negative) alphas, buy (sell) but I’ve never seen anyone show this formally
• Also, distinguish between stock or flow demands and how they relate to returns (not adjusted for risk)
  – In earlier versions, I didn’t, and then I realized I was making a mistake
What do I mean by Profits? Estimate Jensen’s Alphas with Lewellen and Nagel’s (2006) Method

Lewellen and Nagel (2006) apply the Dimson (1979) method to intra-quarterly daily data; I’ll apply it to intra-monthly, daily data to estimate the following regression to get an estimate of the alpha

\[ r_{US,t} = \alpha_{US,ROW} + \beta_{US,ROW} r_{ROW,t} + (\beta_{US,ROW})^{-1} r_{ROW,t-1} + \epsilon_{US,t} \]

I have 7645 daily rates of return for the Datastream US Index, from December 1, 1976-June 30, 2008

I have 7645 daily rates of return for the Datastream World excluding US Index, from December 1, 1976-June 30, 2008
Dimson Alphas versus Bootstrap Dimson Alphas
Intra-monthly May be Small Sample, but Bootstrapped Alphas re Similar in Magnitude

Differences between Estimated & Bootstrap Estimated Alphas, December 1976-June 2008

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Mean: 0.00025

Standard Deviation: 0.00274
A Model to do This?


Unlike Merton’s model, you choose dollar amounts not investment shares

\[ J(W_t, t) = \max_{c_t, x_{US}, x_{ROW}, b_{ROW}} E_t \left[ \int_0^\infty e^{-\rho t} u(c_t) dt + B(W(T), T) \right] \]

s.t. \[ dW = x_{US} \left( \mu_{US}(k_t) - R_{US} \right) dt + x_{ROW} \left( \mu_{ROW}(k_t) - R_{US} \right) dt + \]
\[ + W_t R_{US} dt + b_{ROW} \left( R_{ROW} - R_{US} \right) dt + y(k_t) - c_t dt + \]
\[ x_{US} \sigma_{US}(k_t) dz_{US} + x_{ROW} \sigma_{ROW}(k_t) dz_{ROW} \]

\[ W(0) = W_0 \]

\[ dk = \mu_k dt + \sigma_k dz_k \]

Global state variable shocks are assumed to be uncorrelated with asset shocks

A single global state variable drives the moments, but ...
A Model to do This?

The Associated Hamilton-Bellman-Jacobi Equation is

\[ J_t = -J_t W_t R_{US} - \max_{c_t, x_{US}, x_{ROW}, b_{ROW}} \left[ u(c_t) + J(W_t, k_t, t) + J_k \mu_k + \right. \]

\[ J_W \left[ (\mu_{US}(k_t) - R_{US}) + x_{ROW}(\mu_{ROW}(k_t) - R_{US}) + b_{ROW}(R_{ROW} - R_{US}) + W_t R_{US} + y(k_t) - c_t \right] + \]

\[ \frac{1}{2} J_{WW} \left[ \sigma_{US}^2(k_t) + x_{ROW}^2(\sigma_{ROW}^2(k_t) + 2 x_{US} x_{ROW} \sigma_{US,ROW}(k_t)) + \frac{1}{2} J_{kk} \sigma_k^2 \right] \]

The simplest single-factor model that allows moments to vary over time is obtained by assuming shocks to the global state-variable \( k \) are uncorrelated with shocks to the individual asset prices, or \( J_{Wk} E_t dWdk = 0 \)
A Model to do This?

The First Order Necessary Conditions

\[ \frac{\partial u}{\partial c_t} = J_w \]

\[ x_{US} = -\frac{J_w}{J_{WW}} \frac{\mu_{US}(k_t) - R_{US}}{\sigma^2_{US}(k_t)} - x_{ROW} \beta_{ROW,US}(k_t) \]

\[ x_{ROW} = -\frac{J_w}{J_{WW}} \frac{(\mu_{ROW}(k_t) - R_{US})}{\sigma^2_{ROW}(k_t)} - x_{US} \beta_{US,ROW}(k_t) \]

\[ R_{ROW} = R_{US} \]

After substituting each equation into the other rearranging stuff and solving for each dollar allocation yields ...
Stock Demands and Profits

- Now we see how stock demands relate to profits (Merton recognizes these are stocks, & stock demands relate to returns)

\[
\begin{pmatrix}
    x_{US} \\
    x_{ROW}
\end{pmatrix} = - \frac{J_W}{J_{WW}} \begin{pmatrix}
    \frac{\alpha_{US,ROW}(k_t)}{\sigma^2_{US}(k_t)(1 - \beta_{US,ROW}(k_t)\beta_{ROW,US}(k_t))} \\
    \frac{\alpha_{ROW,US}(k_t)}{\sigma^2_{ROW}(k_t)(1 - \beta_{ROW,US}(k_t)\beta_{US,ROW}(k_t))}
\end{pmatrix}
\]

- therefore ...
Flow Demands Relate to Changes in Profits

• It may seem obvious, but it wasn’t to me.
• Flow demands relate to the differential between changes in US and global profit-total risk ratios.

\[
dx_{US} - dx_{ROW} = -\frac{J_W}{J_{WW}} \left[ \frac{d\alpha_{US,ROW}}{\alpha_{US,ROW}} - \frac{d\sigma^2_{US}}{\sigma^2_{US}} \right] - \frac{d\alpha_{ROW,US}}{\alpha_{ROW,US}} + \frac{d\sigma^2_{ROW}}{\sigma^2_{ROW}}
\]

Net purchases
Of US equities
Changes in the
US “profit to
total risk” ratio
Changes in the Rest of
the World’s “profit to total
risk” ratio

I’ll be estimating these, which can be thought of as inverse CARA’s.
Estimating the Previous Equation

The conditional mean follows Grangers’s \( \text{ARFIMAX}(1, d_M, 1) \) where he \( d_M \) captures long memory

\[
(1 - \rho L)(1 - L)^{d_M} [y_t - \gamma_0 - \gamma' x_t] = (1 + \eta L)e_{US,t}
\]

\[
y_t = \frac{net_{US,t}}{cpi_{US,2000,t}}
\]

The conditional volatility follows Chung’s \( \text{FIGARCH}(1, d_V, 1) \) where the \( d_V \) captures long memory in volatility

\[
\sigma_t^2 = \omega_0 + \left[1 - (1 - \omega_2 L)^{-1}(1 - \omega_1 L - \omega_2 L)(1 - L)^{d_V}\right] \left(e_t^2 - \omega_0\right)
\]

\[
e_t | \Omega_{t-1} = t(df, H)
\]

\[
\gamma' x_t = \sum_{i=1}^{19} \gamma_i \left[ \frac{\alpha_{US,ROW,t-i+7}}{\sigma_{US,t-i+7}^2 (1 - \beta_{US,ROW,t-i+7} \beta_{ROW,US,t-i+7})} - \frac{\alpha_{US,ROW,t-i+6}}{\sigma_{US,t-i+6}^2 (1 - \beta_{US,ROW,t-i+6} \beta_{ROW,US,t-i+6})} \right] - \sum_{i=1}^{19} \gamma_i \left[ \frac{\alpha_{ROW,US,t-i+7}}{\sigma_{ROW,t-i+7}^2 (1 - \beta_{US,ROW,t-i+7} \beta_{ROW,US,t-i+7})} - \frac{\alpha_{ROW,US,t-i+6}}{\sigma_{ROW,t-i+6}^2 (1 - \beta_{US,ROW,t-i+6} \beta_{ROW,US,t-i+6})} \right]
\]

Term-Structure of Changes in the US-Rest of the World risk-weighted performance differentials
Stylized Facts

• Net Equity Flow-Profits Linkages
  – There’s what I’ll call a term-structure associating profits and flows
  – The sensitivities rise during the post-May 1984 sample, when European markets began liberalizing
  – I could describe it verbally, but I think inter-ocular trauma (hitting you right between the eyes) is better ...
Term Structure of Private Sector, Official and Total Net Equity Inflow Dollar Sensitivities to Changes in Risk-Weighted Performance Differentials for the **Full January 1978 – December 2007** Sample. Points are taken from the Table 2, and the 95% confidence interval is generated by multiplying the coefficient standard errors by +/- 1.96. Breaks in the lines imply that the coefficient was eliminated from the specification as the associated p-value was above 0.4.
Term Structure of Private Sector, Official and Total Net Equity Inflow Dollar Sensitivities to Changes in Risk-Weighted Performance Differentials for the May 1984 – December 2007 Sample. Points are taken from the Table 3, and the 95% confidence interval is generated by multiplying the coefficient standard errors by +/-1.96. Breaks in the lines imply that the coefficient was eliminated from the specification as the associated p-value was above 0.4.
Stylized Facts

• Net Equity Flows: Statistical Properties
  – For the full sample, all series exhibit negative serial correlation, but the signs switch for private and total flows in the post-May 1984 sample
  – The distributions get fatter tailed since the markets have liberalized as private sector, official and total flow $t$-distributions go from having degrees of freedom of $(6, 3, 7)$ to $(4, 3, 5)$ [this means moments that exist start to drop out of sight, from $(5, 2, 6)$ to $(3, 2, 4)$]
  – There’s short memory ($0 < d < 0.5$) for conditional means but long memory ($0.5 < d < 1$) for conditional volatility
Some Final Remarks

• I think the more important set of findings relate to private sector flows chasing profits, while official flows do not.

• There also appears to be a behavioral aspect of the investment flows:
  – Money flows in, in response to realized profits, but with some delay, (2-7 months later), Froot suggests the behavioral explanation may be that it takes time to unwind a trade.

• Also, there is long memory in the conditional mean and volatility of net equity flows.