Discussion of:

“How Integrated are Corporate Bond and Stock Markets?”

by

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What is Market Integration?

- Difficult to answer, many different approaches.
- For instance, to analyze if two markets are integrated, would it better to:
  1. Adopt a structural (potentially misspecified) economic model (SPMM) with sensible factors, or
  2. Identify a fully nonparametric SDF with much weaker economic structure?
- Chen and Knez’s (CK, 1995) measure of integration:
  - Markets A and B are integrated if we find a common SDF $m$ that gives correct prices to all the payoffs (returns) $R_A, R_B$ on the joint market:
    $\mathbb{E}[m.R_A] = 1_{N_A}, \mathbb{E}[m.R_B] = 1_{N_B}$ (1)
  - What is behind this definition?
  - If markets are integrated investors should be able to trade freely in both markets and in equilibrium, no arbitrage should exist.
  - If markets are not integrated (i.e., there is no common SDF), an investor could **profit by implementing an arbitrage across markets.**
Market Integration

1. There is no SDF $m$ satisfying (1): the Law of One Price (LOP) doesn’t hold.
   - It is possible to find two portfolios in the joint market $A + B$ with the same payoff but with different prices.
   - Buy the cheap, sell the expensive to get an arbitrage.

2. We can find an SDF $m^*$ possibly negative but can’t find at least one SDF $m > 0$: The LOP is satisfied but there are still potential arbitrages to be explored.

3. There is $m > 0$: The two markets are strongly integrated. We can trade the optimal portfolio endogenously determined by the SDF.
   - Two fundamental dimensions on the problem of integrated markets:
     1. **Pricing implications** - Identification (or not) of a common SDF.
     2. **Portfolio implications** - The ability of an investor to execute an arbitrage or trade the optimal portfolio endogenous to the SDF.

   - To understand this paper’s contribution we have to analyze **pricing and portfolio** implications on traditional market integration with no frictions.
1. Pricing implications (traditional market integration)

1. We can always find a minimum variance (MV) SDF $m^*$ for the joint market $A + B$ (Hansen and Jagannathan, HJ 1991).

2. Apart from in very large cross-sections, we:
   - Can always find a non-negative MV SDF $\tilde{m}^* \geq 0$ (HJ, 1991).
   - Can estimate strictly positive SDFs $m > 0$ solving Minimum Discrepancy problems, which generalize the MV approach (Almeida and Garcia (2017))

   Thus, from a pricing perspective, we always obtain that markets are integrated under CK’s measure.

   Alternative pricing implications: Estimate the MV SDF in one market (stocks) to price the assets in the other market (bonds), and verify if pricing errors are acceptable.

   In my discussion, I mostly focus on the implications coming from the SDF from the joint markets.
2. Portfolio implications (traditional market integration)

- The MV SDF (HJ, 1991), applied to the joint market’s problem solves:

  \[
  m^* = \arg \min_m \mathbb{E}[m^2], \text{ s.t. } \mathbb{E}[m.R_{S+B}] = 1_K, \mathbb{E}[m] = \frac{1}{R_F}
  \]  

(2)

- The HJ (1991) SDF with non-negativity constraint solves:

  \[
  \tilde{m}^* = \arg \min_{m \geq 0} \mathbb{E}[m^2], \text{ s.t. } \mathbb{E}[m.R_{S+B}] = 1_K, \mathbb{E}[m] = \frac{1}{R_F}
  \]  

(3)

- Almeida & Garcia (2017) MD SDFs solve, for convex \( \phi(m) = \frac{m^{\gamma+1} - a^{\gamma+1}}{(\gamma+1)\gamma} \):

  \[
  m_{MD} = \arg \min_{m > 0} \mathbb{E}[\phi(m)], \text{ s.t. } \mathbb{E}[m.R_{S+B}] = 1_K, \mathbb{E}[m] = \frac{1}{R_F}
  \]  

(4)

- The three problems have closed form solutions:

  - \( m^* = a + W^T R_{S+B} \),
  - \( \tilde{m}^* = \max(a + \tilde{W}^T R_{S+B}, 0) \),
  - \( m_{MD} = (a + W_{MD}^T R_{S+B})^{\frac{1}{\gamma}} \).

- Portfolio implications:

  There are no restrictions on the optimal weights \( W, \tilde{W}, W_{MD} \): They can be large and also negative (short-selling).
Pricing and Portfolio implications in this paper

- Given a maximum pricing error $\epsilon > 0$, Mirela builds on Korsaye, Quaine and Trojani (2020), solving:

$$m_{fric}^* = \arg \min_{m \geq 0} \mathbb{E}[m^2], \text{ s.t. } |\mathbb{E}[mR] - 1_K| \leq \epsilon, \mathbb{E}[m] = \frac{1}{R_F}$$ (5)

- This modifies the definition of market integration that I used above considering a less binding pricing problem:

- Find the MV SDF subject to specific trading frictions, using portfolio returns from the joint markets.

- Since we can always construct different SDFs for the joint market (including $m >> 0$), there is always integration without frictions.

- From a pricing perspective, Mirela’s MV SDF with frictions is not necessary for market integration.

- Moreover, it should not be a surprise that it always exist.
Thus, sentences in the paper like “I find that it is always possible to derive a common SDF for stocks and bonds even when accounting for transaction costs...” (page 22), and “it follows that even in presence of financial frictions, there exists a common SDF” (page 23), “Overall, even when accounting for financial frictions..., there exists a common SDF pricing both...suggesting a non-trivial degree of integration...” (page 24) should be revised since there should be no surprise about the ability of finding this common SDF under frictions.
Main contribution in this paper (Portfolio)

▶ What is the central contribution of the new measure of integration with frictions?

▶ Less extreme portfolio weights in the endogenous portfolio determining the MV SDF.

▶ Market frictions imply a less volatile MV SDF, which, on its turn, implies less extreme portfolio weights, including less short-selling.

▶ Thus, it is less costly to implement the optimal endogenous portfolio in the presence of frictions.

▶ In my view, improvement on the ability of trading the optimal portfolio in the presence of frictions is the main contribution of this paper.

▶ This contribution is relatively hidden by a large discussion on less important issues.
Example with returns sorted on Profitability

- My joint market consists of 20 portfolios (10 on stocks, 10 on bonds) kindly made available by Mirela to illustrate the points discussed above.

- I present four SDFs (HJ, HJ with non-negat., HJ with frictions, and ET) and their corresponding portfolio weights.

- HJ, HJ with non-negat. and ET price the 20 portfolios with no pricing error. HJ with frictions has PEs smaller than 20bps for all assets.

- Note that one SDF has negative states (HJ) while the others not. In addition, HJ with frictions has much less variability.
Weights are much more extreme for the three SDFs without frictions. It is easier to trade the optimal portfolio with frictions.

However, the $HJ_{fric}$ is much less volatile and loads only on 4 out of the 20 original portfolios (three stocks, one bond).

Does it really measure integration of these markets? It is difficult to say.

Out-of-sample portfolio performance analysis with different endogenous portfolios could give more power to the frictions approach.
Corollary 1: Short-selling constraints

By duality theory the minimum variance SDF with frictions can be obtained via the following portfolio problem:

$$W_p^* = \arg \max_{\omega \in \mathbb{R}^N} -\frac{1}{2} \mathbb{E}[(\omega'R)^2] + \omega'1 - \varepsilon \|\omega\|_1, \text{s.t } \omega'R \geq 0$$

Corollary 1 claims that as $\varepsilon$ increases the portfolio restrictions are equivalent to imposing short-selling constraints.

This is not true. When $\varepsilon \to \infty$, the utility is maximized by minimizing $\|\omega\|_1$, which is symmetric with respect to long or short positions.

When $\varepsilon \to \infty$ both short and long positions converge to zero.

To obtain short-selling constraints we need $\sum_i \omega_i = c, \ c > 0$.

But the dual utility maximization solved in (6) doesn’t impose any restrictions to the sum of portfolio weights!
Are Pricing Errors Really Statistically Equal to Zero?

Table 6 shows cross-market pricing errors (PEs) of the type $E(M_B R_S) - 1$ and $E(M_S R_B) - 1$ sorted w.r.t the different characteristics.

Table 6. Cross-Market Pricing Errors

This table reports the average pricing errors implied by minimum variance SDFs, computed as $E[M_B R_S] - 1$ and $E[M_S R_B] - 1$, with $S$ denoting the stocks and $B$ the bonds. Pricing errors are the ones implied by the bond (stock) SDF that correctly prices the portfolios sorted on the corresponding characteristic. The pricing errors are reported in basis points (bp). The sample period is from July 2005 to September 2019. The numbers in parentheses are t-statistics calculated according to Newey and West (1987).

<table>
<thead>
<tr>
<th></th>
<th>Credit Rating</th>
<th>Duration</th>
<th>Size</th>
<th>Value</th>
<th>Leverage</th>
<th>Momentum</th>
<th>Asset Growth</th>
<th>Profitability</th>
<th>Liquidity</th>
<th>Short Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[M_B R_S] - 1$</td>
<td>9 (0.042)</td>
<td>16</td>
<td>-14</td>
<td>-8</td>
<td>25</td>
<td>-9</td>
<td>10</td>
<td>4</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>$E[M_S R_B] - 1$</td>
<td>-40 (-0.409)</td>
<td>-55</td>
<td>-30</td>
<td>-51</td>
<td>-71</td>
<td>-73</td>
<td>-26</td>
<td>-56</td>
<td>-27</td>
<td>-55</td>
</tr>
</tbody>
</table>

- It suggests PE’s are all statistically insignificant, but it sounds strange.
- For the data sorted on profitability, I calculated the average monthly risk-premium ($E[R]$) for the 10-stocks and 10-bonds portfolio returns.
- Stocks have a 77 bps average risk premium and bonds, 50 bps.
- In particular, 6 out of 10 of the pricing errors for bonds sorted wrt different characteristics are larger than the average risk premium of bond portfolios sorted w.r.t to profitability.
    - This is not compatible with PEs being statistically insignificant.
- Check how the t-statistics are obtained. I would suggest using a pair bootstrap on returns. The same issue applies to Table 7.
Conclusion

▶ Interesting and thought-provoking paper!
▶ A good step towards reconciling market integration with trading frictions.
▶ In my view, if the focus is on:

  **Pricing implications:**
  Look at a structural parametric SDF model (SPMM) or identify a nonparametric SDF in each market and test pricing both markets.

  **Portfolio implications:**
  Search for an SDF within the joint markets is more appealing.

▶ For future research: Integration with frictions should become increasingly more important in large cross-sections.

▶ I am looking forward to reading the next version!

