The Impact of Primary Bond Dealers’ Maturity Choice on Repo Market Interest Rates

Vladimir Sokolov

ICEF, Higher School of Economics

Moscow Finance, 2011
Expectation hypothesis (EH) on the term structure of very short-term repo rates provides mixed evidence. Using repo rates on treasury collateral of different tenor, Longstaff (JFE, 2000) finds that the EH holds.
Motivation

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- In order to reconcile this evidence I use predictions of Duffie (JF, 1996) and Krishnamurthy (JFE, 2002) models that show that if the supply of bonds is fixed, variation in the demand for bonds has an impact on the price of loanable funds (repo rates) against these bonds.
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- I show that the repo market term premium variation is related to variation of bond dealers’ overnight and term repo positions.
REPO term spread

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Dealer's financing

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Under repurchase (repo) transaction funds are borrowed against bonds provided as collateral. A repo rate is paid by the cash-taker (collateral-provider) to the cash-provider (collateral-taker).
Repo mechanics

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Bartolini et al. (RFS, 2011) examine the impact of the "collateral value" of different bonds such as Treasuries, agency and mortgage-backed securities provided as collateral against funding on the repo rates.

Graveline and McBrady (JFI, 2011) using interest rate spreads between bonds of different liquidity construct proxies for the bond market participants' demand to hedge interest rate risk and show that these proxies are significantly related to the overnight repo rates for "on-the-run" Treasuries.

Fleming et al. (AER, 2010) use Term Securities Lending Facility (TSLF) and demonstrate in a natural experiment set-up that shifts in the relative supply of Treasury, agency and mortgage-backed bonds had a significant impact on the repo rates charged on different bond classes.

Gorton and Metrick (NBER, 2009) study the "repo run" on Bear Sterns.
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New York Fed reports weekly averages of the total value of \textit{bonds in} under reverse repo transactions and the total value of \textit{bonds out} under repo transactions for all primary bond dealers. The value of \textit{bonds in} exceeded the value of \textit{bonds out} during most of the sample period. This implies that primary bond dealers on average were cash-providers (collateral-takers), i.e., they were net short Treasuries. Similarly as in Fleming and Adrian (2005), I determine dealers' net financing as the value of Treasury bonds out minus the value of Treasury bonds in. However, I do this separately for the overnight and term financing segments.
Primary bond dealers financing data

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Dynamics of primary bond dealers’ Net positions and Net total financing in Treasuries

Source: New York Fed

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Dynamics of primary bond dealers’ Net term and Net overnight financing of Treasuries

Source: New York Fed
Summary statistics of primary bond dealers’ financing.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std.Dev</th>
<th>Max</th>
<th>Min</th>
<th>N</th>
<th>ρ</th>
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<tbody>
<tr>
<td>Net O/N financing</td>
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<td>47170</td>
<td>167644</td>
<td>-164025</td>
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<td>22181</td>
<td>83959</td>
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<tr>
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<td>55866</td>
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<td>357</td>
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<td>ΔNet O/N financing / Net term financing</td>
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<td>0.3255</td>
<td>1.366</td>
<td>-2.401</td>
<td>357</td>
<td>-0.3582</td>
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</table>
Following Longstaff (2000), and using common terminology, I construct excess return series for repo rates:

\[ r_{x_t}^{(n)} = r_t^{(n)} - \left( \frac{1}{n} \right) \sum_{t=0}^{n} r_t^{1} \]
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\[ r_{xt}^{(n)} = r_t^{(n)} - \left( \frac{1}{n} \right) \sum_{t=0}^{n} r_t^{1} \]

Since data on primary bond dealers’ repo financing is averaged by the Fed on a weekly basis, I use weekly averages of daily excess returns in order to match both series.
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Another data series used in my empirical analysis is the slope of the repo market term-structure:

\[ r_t^{(n)} - r_t^1 \]

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std.Dev</th>
<th>Max</th>
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<td><strong>Excess returns</strong></td>
<td></td>
<td></td>
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<tr>
<td>$rx^{1\text{week}}$</td>
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<td>0.1636</td>
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<td>357</td>
<td>0.2325</td>
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<td>$r^{2\text{week}} - r^{o/n}$</td>
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<td>0.1218</td>
<td>1.1300</td>
<td>-0.5200</td>
<td>357</td>
<td>0.3545</td>
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<td>1.2140</td>
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<td>357</td>
<td>0.3967</td>
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<tr>
<td>$r^{1\text{month}} - r^{o/n}$</td>
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<td>0.1474</td>
<td>1.1900</td>
<td>-0.5360</td>
<td>357</td>
<td>0.4522</td>
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</tbody>
</table>
Dynamics of repo 1-month excess returns and ratio of Net overnight to Net term primary bond dealers’ repo financing

Source: Bloomberg, New York Fed
Testable hypothesis

- A growth of $\Delta \frac{\text{Net O/N financing}}{\text{Net term financing}}$ occurs when primary dealers establish relatively more short positions for the overnight horizon, which results in that the overnight segment of the repo market becomes more "special" than the term segment. This can be expected to press down the overnight repo rate in relation to the term repo rate and, thus, positively impact repo market excess returns.
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I formulate the following hypothesis:

1. Growth in the ratio of primary dealers' overnight repo financing in relation to their term repo financing $\Delta \frac{\text{Net O/N financing}}{\text{Net term financing}}$ is positively associated with repo market excess returns $r_x(t)$
2. Growth in the ratio of primary bond dealers' overnight repo financing in relation to their term repo financing $\Delta \frac{\text{Net O/N financing}}{\text{Net term financing}}$ is positively associated with an increase in the slope of the repo market term-structure $r_1(t)$.
A growth of $\Delta \frac{\text{Net O/N financing}}{\text{Net term financing}}$ occurs when primary dealers establish relatively more short positions for the overnight horizon, which results in that the overnight segment of the repo market becomes more "special" than the term segment. This can be expected to press down the overnight repo rate in relation to the term repo rate and, thus, positively impact repo market excess returns.

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  1. Growth in the ratio of primary dealers’ overnight repo financing in relation to their term repo financing \[ \Delta \frac{\text{Net O/N financing}}{\text{Net term financing}} \] is positively associated with repo market excess returns \( r_{xt}^{(n)} \)
  2. Growth in the ratio of primary bond dealers’ overnight repo financing in relation to their term repo financing \[ \Delta \frac{\text{Net O/N financing}}{\text{Net term financing}} \] is positively associated with an increase in the slope of the repo market term-structure \( r_{t}^{(n)} - r_{t}^{1} \)
Similarly to specifications used by Piazzesi and Swanson (2008) for the fed funds futures market and by Greenwood and Vayanos (2010) for the bond market I run:

\[ r_{X_t}^{(n)} = \alpha + \beta X_t + \gamma Z_t + u_{t+n} \]

\[ r_{t}^{(n)} - r_{t}^{1} = \alpha + \beta X_t + \gamma Z_t + u_t \]
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\[ rx_t^{(n)} = \alpha + \beta X_t + \gamma Z_t + u_{t+n} \]

\[ r_t^{(n)} - r_t^1 = \alpha + \beta X_t + \gamma Z_t + u_t \]

where \( X_t \) is the ratio \( \frac{\Delta \text{Net O/N financing}}{\text{Net term financing}} \).
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- where \( Z_t \) represents a vector of control variables
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1. Cochrane-Piazzesi factor
Empirical specification

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2. Price change of the nearby fed funds futures contract
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- Similarly to specifications used by Piazzesi and Swanson (2008) for the fed funds futures market and by Greenwood and Vayanos (2010) for the bond market I run:

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1. Cochrane-Piazzesi factor
2. Price change of the nearby fed funds futures contract
3. Merill Lynch MOVE Bond volatility index
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where \( X_t \) is the ratio \( \frac{\Delta \text{Net O/N financing}}{\text{Net term financing}} \)

where \( Z_t \) represents a vector of control variables

1. Cochrane-Piazzesi factor
2. Price change of the nearby fed funds futures contract
3. Merill Lynch MOVE Bond volatility index
4. A measure of primary dealers’ overbidding during Fed open market operations (OMO) \( \frac{\text{OMO O/N overbid}}{\text{OMO Term overbid}} \)
Control variables

- I construct the Cochrane-Piazzesi factor from the data on zero-coupon bonds compiled by Gurkaynak *et al.* (2006)
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Merill Lynch MOVE Bond volatility index is analogous to the CBOE stock market volatility index (VIX)
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Repo excess returns and maturity of dealers’ financing

\[ r(x_{t+n}) = \alpha + \beta X_t + \gamma Z_t + u_{t+n} \]

\( X_t \) is the growth of ratio of dealers’ net financing in the overnight repo segment relative to the term repo segment \( \Delta \frac{\text{Net O/N financing}}{\text{Net term financing}} \)

<table>
<thead>
<tr>
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<th>No crisis sample (July 2001 - August 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( r(x^{1\text{week}}) )</td>
</tr>
<tr>
<td>( \Delta \frac{\text{O/N Financing}}{\text{Term Financing}} )</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
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<tr>
<td>( CP ) factor</td>
<td>0.171</td>
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<tr>
<td></td>
<td>(0.152)</td>
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<tr>
<td>( \Delta \text{FF Futures} )</td>
<td>-0.675***</td>
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<tr>
<td></td>
<td>(0.175)</td>
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<tr>
<td>( \Delta \text{MOVE Vol} )</td>
<td>-0.062</td>
</tr>
<tr>
<td></td>
<td>(0.104)</td>
</tr>
<tr>
<td>( OMO ) ( O/N ) overbid</td>
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<tr>
<td>( OMO ) ( \text{Term overbid} )</td>
<td>(0.003)</td>
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<td>305</td>
</tr>
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<td>( R^2 )</td>
<td>0.081</td>
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</table>

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Repo excess returns and maturity of dealers’ financing

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<table>
<thead>
<tr>
<th>The whole sample (July 2001 - Sept. 2008)</th>
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<tbody>
<tr>
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<tr>
<td>( \Delta \frac{\text{O/N Financing}}{\text{Term Financing}} )</td>
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<td>( CP \text{ factor} )</td>
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<td>( \Delta FF \text{ Futures} )</td>
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<td>( \Delta MOVE \text{ Vol} )</td>
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<tr>
<td>( \frac{OMO \text{ O/N overbid}}{OMO \text{ Term overbid}} )</td>
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<tr>
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</tr>
<tr>
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<tr>
<td>( R^2 )</td>
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</table>
Term-structure slope and maturity of dealers’ financing

\[ r_t^{(n)} - r_t^1 = \alpha + \beta X_t + \gamma Z_t + u_t \]

\( X_t \) is the growth of ratio of dealers’ net financing in the overnight repo segment relative to the term repo segment \( \Delta \frac{\text{Net O/N financing}}{\text{Net term financing}} \)

### The whole sample (July 2001 - Sept. 2008)

<table>
<thead>
<tr>
<th></th>
<th>( \text{Slope}^{1\text{week}} )</th>
<th>( \text{Slope}^{2\text{week}} )</th>
<th>( \text{Slope}^{3\text{week}} )</th>
<th>( \text{Slope}^{1\text{month}} )</th>
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<tr>
<td>( \Delta \frac{O/N \text{ Financing}}{\text{Term Financing}} )</td>
<td>0.001</td>
<td>0.008</td>
<td>0.059</td>
<td>0.050</td>
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<td></td>
<td>(0.014)</td>
<td>(0.029)</td>
<td>(0.037)</td>
<td>(0.061)</td>
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<tr>
<td>( \Delta \text{CP factor} )</td>
<td>0.058</td>
<td>0.372</td>
<td>0.657</td>
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<td></td>
<td>(0.161)</td>
<td>(0.249)</td>
<td>(0.257)</td>
<td>(0.469)</td>
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<td>(0.254)</td>
<td>(0.351)</td>
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<tr>
<td>( \Delta \text{MOVE Vol} )</td>
<td>-0.299***</td>
<td>-0.445***</td>
<td>-0.397**</td>
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<td>( \frac{\text{OMO O/N overbid}}{\text{OMO Term overbid}} )</td>
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<td>0.005</td>
<td>0.012**</td>
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<td></td>
<td>(0.002)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Num.obs.</td>
<td>357</td>
<td>356</td>
<td>353</td>
<td>349</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.027</td>
<td>0.034</td>
<td>0.048</td>
<td>0.075</td>
</tr>
</tbody>
</table>
Conclusions

I organized my empirical investigation around a theoretical model formulated by Duffie (1996) and Krishnamurthy (2002) on the relative “specialness” of bonds.
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I hypothesized that “specialness” mechanism also works across different maturities of repo contracts. As primary bond dealers were consistently short Treasuries during the period of investigation, their choice of holding short positions for either an overnight or a term horizon created a relative excess demand/supply pressure in the repo market at the corresponding horizons.
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- I construct a factor measuring primary dealers’ net financing in the overnight repo segment relative to the term repo segment and demonstrate that this variable is significantly associated with repo market excess returns in the whole 2001-2008 period.