Auctioning Corporate Bonds: A uniform-price auction under investment mandates

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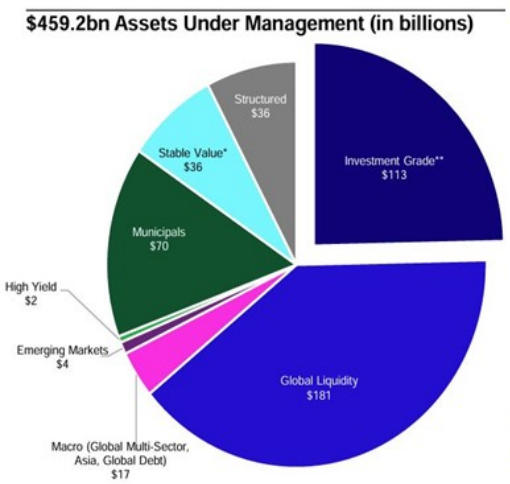
What is an investment mandate?



Invesco Global Investment Grade Corporate Bond Fund
Fund facts

Fund name	Invesco Global Investment Grade Corporate Bond Fund
Fund objectives	The Fund intends to achieve, in the medium to long term, a competitive overall investment return with relative security of capital in comparison to equities. The Fund will invest at least two thirds of its total assets in investment grade corporate bonds. Up to one third of the total assets of the Fund may be invested in cash, cash equivalent securities and other debt securities[1]
Launch date	1 September 2009
Domicile	Luxembourg
Legal structure	Luxembourg SICAV with UCITS status
Base currency	USD
Unit type	Accumulation and distribution
Reference benchmark	Bloomberg Global Aggregate Corporate Index USD-Hedged (Total Return)

Share class	Unit type	Share class ccy	Annual management fee	Minimum investment	ISIN codes
Z	Acc	USD	0.38%	USD 1,500	LU1642784927

There may be additional share classes[2] registered for sale in individual jurisdictions.

1 For the full objectives and investment policy please consult the current prospectus.

2 For information on fund and fund's shares registrations, please refer to the appropriate internet site or your local Invesco office. Not all share classes are the same nor do they necessarily suit every investor. There may be differences in fee structures, in minimum investment amounts, etc. Please check the fund prospectus for additional information.

Costs may increase or decrease as result of currency and exchange rate fluctuations. Consult the legal documents for further information on costs.

The investment concerns the acquisition of units in an actively managed fund and not in a given underlying asset.

Invesco

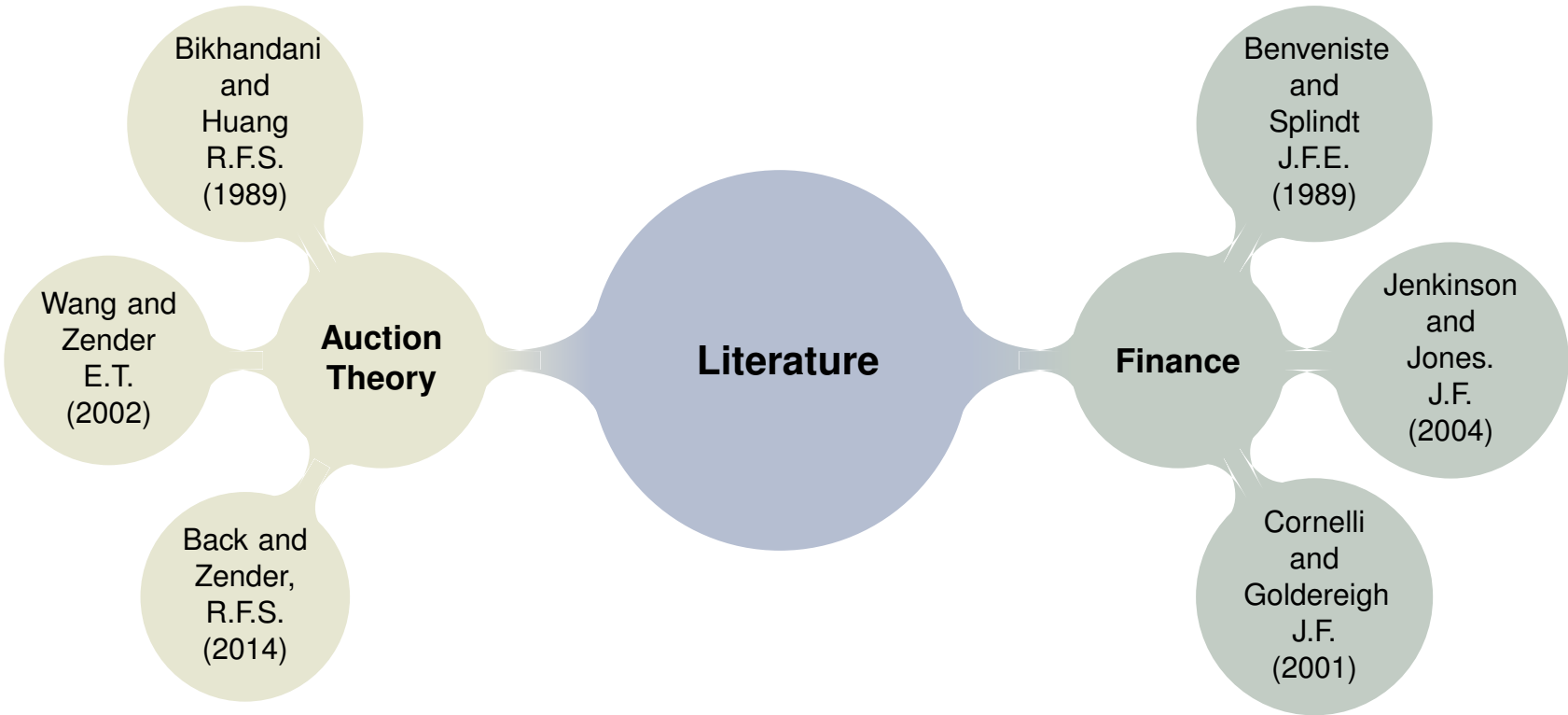
Challenges

- **Market inefficiencies** in the current post-pricing selling process on corporate bond markets leading to:
  - Underpricing of bonds.
  - Inefficient allocation of bonds

- Investment funds often resell bonds in the secondary market to achieve their **benchmark returns**:
  - Underpricing reduces return margins, especially under tight budget constraints.

Contribution

- Apply the uniform pricing rule to the issuance of corporate bonds, considering the existence of a resale market.
- Integrate two key parameters from investment mandates —*budget* and *risk limits*—into the bidding strategies for corporate bonds.
- Prove the existence of (non-unique) symmetric Bayesian Nash equilibrium.
- Analyze how investment mandates influence bidding behavior during corporate bond issuance -risk limits set a boundary in underpricing.


Bikhandani and Huang R.F.S. (1989)
Wang and Zender E.T. (2002)
Auction Theory
Back and Zender, R.F.S. (2014)
Literature
Benveniste and Splindt J.F.E. (1989)
Finance
Jenkinson and Jones. J.F. (2004)
Cornelli and Goldereigh J.F. (2001)

Basic Setup

- A set of competitive risk-neutral bidders $\mathcal{I}=\{1,2,3\ldots n\}$, with $n \geq 3$
  - The type of bidder i is $\tau = (c_i, \ell^*)$, with only the budget limit c_i being private information, while ℓ^* is common knowledge risk limit.
  - $f(c,\ell^*) \approx f(c)$ common knowledge distribution.
- Bidding strategy (demand function):

$$b_i(r|c_i) : [\underline{r}, \bar{r}] \rightarrow [0,1)$$

- The total demand at any interest rate r is $D(b) = \sum_{i=1}^{n} b_i(r|\tau_i)$.

Issuance Yield and Allocation

- The *issuance yield* (inverse demand function) is determined as:

$$y = \sup\{r \in [\underline{r}, \bar{r}] \mid D(b) \geq 1\}$$

Assume a linear yield rule:

$$y = \begin{cases} \Theta - \theta D(b) & \text{, if } D(b) \geq 1, \text{ with } b > 0,\ \theta < \Theta,\ \theta D(b) < \Theta \\ 0 & \text{, otherwise} \end{cases}$$

where Θ: maximum risk limit and θ:an exogenous sensitivity factor.

- The *allocation* rule maps bid schedules to non-negative allocations $\alpha \in (0,1)$, ensuring $D(b) = 1$.

The Payoff Function

$$\mathbb{E}_{b_{-i}}[\pi_i(b_i)] = \mathbb{E}_{b_{-i}(\cdot|c_{-i})}\left[\left(y(b_i, b_{-i}) - \mathbb{E}[s]\right) \cdot \alpha_i(b_i, b_{-i})\right]$$

exogenous expectation for secondary market

issuance yield

final allocation over the issuance

- Inverse relationship between bond prices and yields is fundamental in bond pricing (yield $\uparrow$ price $\downarrow$).
- Each bidder anticipates gaining a positive spread over the issuance ($y \geq \mathbb{E}[s]$) - nonnegative payoff.

Market Design

Lemma: *For each bidder, i, truthfully revealing the budget limit c_i is a dominant strategy incentive compatible.*

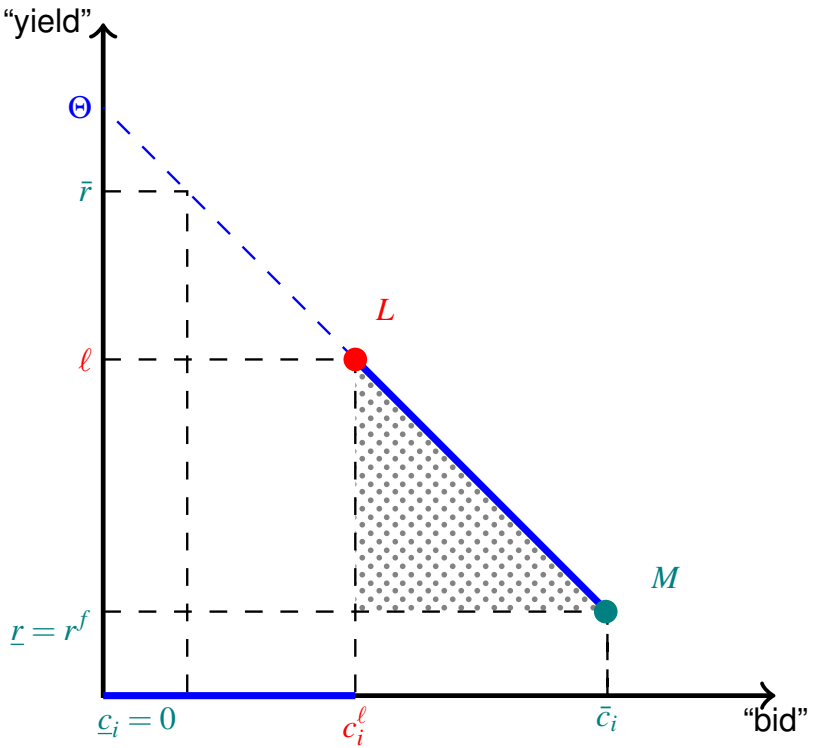
Example:

If $b_i(r|\tau_i) = c_i(1 - \frac{r}{\ell^*})$ and $\mathbb{E}[s]$=100 bps for a truthful c_i

Bidder	1 (AA)	2 (AA)	3 (AA)
c_i	0.5	0.4	0.6
ℓ^*	500	500	500
r	160	200	150
$b(r\|\tau)$	0.34	0.24	0.42

when D(b)=1 then $y = 200bps$, and $\alpha_i = b_i$. If bidder 1 misreports a $c_1 = 0.8$, D(b)=1.2, then $\tilde{y} = 140bps$ with $\tilde{\alpha}_1 = \tilde{b} = 0.54$.
Payoffs: $(\tilde{y} - \mathbb{E}[s])\tilde{\alpha}$=0.0022 and $(y - \mathbb{E}[s])\alpha$=0.0034.

How do investment mandates affect demand?



Bidder i:

- Supremum risk of the investment mandate $\ell \in [r^f, \bar{r}]$
- Budget limit $c_i \in [0, \bar{c}]$, with c^ℓ infimum bid associated with ℓ
- Mandate: At least c^ℓ for an acceptable risk level ℓ (e.g. AA credit rating)

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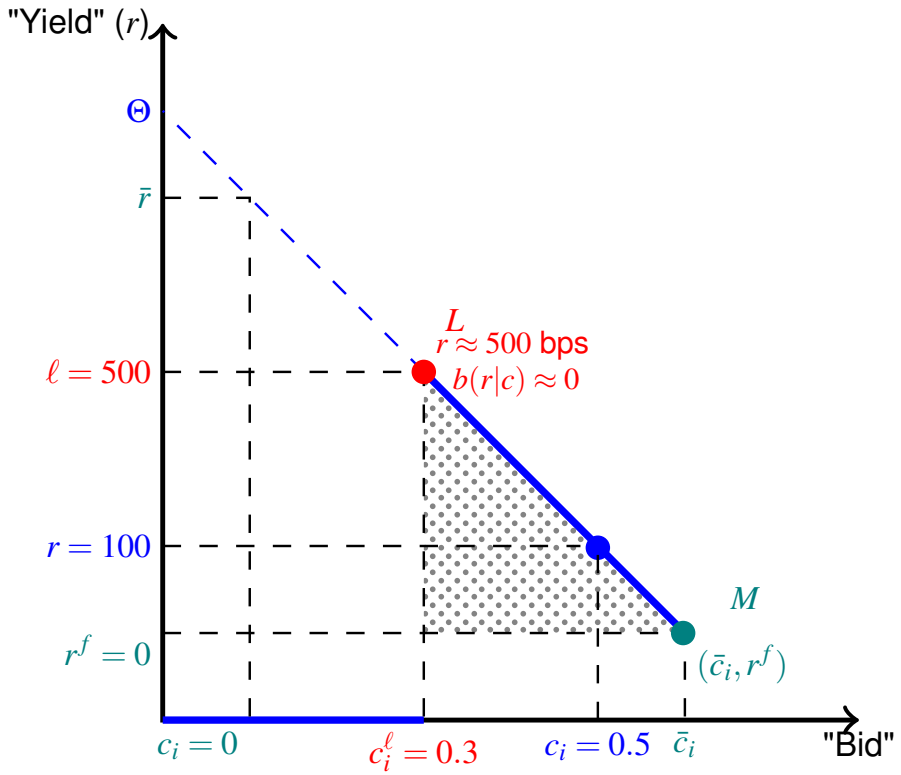

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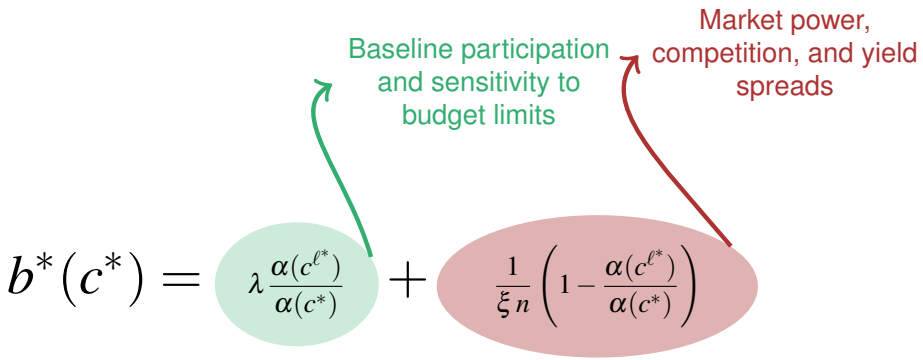
Symmetric Bayesian Nash Equilibrium

Theorem



$$b^*(c^*) = \lambda \frac{\alpha(c^{\ell^*})}{\alpha(c^*)} + \frac{1}{\xi n}\left(1 - \frac{\alpha(c^{\ell^*})}{\alpha(c^*)}\right)$$

$$\text{and } \xi = \frac{\theta}{(\Theta - \mathbb{E}[r^s])} \text{ and } \xi < \frac{1}{\lambda n}.$$

- minimum bid $b(c^\ell) = \lambda$ corresponding to $\alpha(c^\ell)$
- All bidders share the same type c^*.
- $b_i = b_j = b^*$: the symmetric bidding strategy.
- $\alpha_i = \alpha_j = \alpha^*$: the symmetric allocation.

Equilibrium Analysis

- Inverse relationship between the number of bidders and equilibrium strategy (Cournot oligopoly).
- The equilibrium is not unique, a common characteristic in uniform auctions [Ausubel, 2014].
- Asset managers with low-risk acceptance provide stronger market power (endogenous), leading to lower bids (**Corollary 1**).
- The risk limit sets a boundary in demand protecting against underpricing (**Corollary 2**).

Conclusion

- This study develops a symmetric Bayesian Nash equilibrium model for pricing corporate bonds.
- Risk limits can effectively reduce the risk of underpricing, which is common in uniform auctions and the book-building process.
- Future research could explore potential correlations among bidders' types and asymmetric risk limits.