Discussion:
Humpbacks in Credit Spreads

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Motivation

- Typical structural models (i.e., Merton 1974) price corporate bond as risk-free bond minus a put option:

  ⇒ Predict that shape of the spread (difference between YTM on risky and risk-free bonds) should be:

    * upward sloping for low leverage & volatility firms.
    * downward sloping (or hump-shaped) for high leverage & volatility firms.

  – N.B.: This result is entirely driven by term structure of (risk-neutral) forward default probabilities:

    * low risk firms are expected (risk-neutrally) to become less safe.
    * high risk firms, if they survive, are expected (risk-neutrally) to become less risky.
    * actually for very long maturities (in the Merton model) spreads for all firms typically tend to zero because forward probabilities vanish (due to fixed default boundary).

- First empirical investigations (Sarig and Warga 89, Fons 94) found support for this prediction:
  - average spread curve of low grade firms (less than B) is downward sloping
  - average spread curve of high grade firms (better than Baa) is upward sloping.
- However, Helwege and Turner 99 argue these studies suffer from selection bias:
  - substantial variation in credit risk within a given rating category,
  - firms with lower credit risk tend to issue longer term debt,
  - firms with higher credit risk choose shorter term debt.

  $\rightarrow$ average spread within rating category is decreasing.
- In fact, HT find evidence for this bias for two samples of B and BB bonds:
  - Average spreads are decreasing within rating category,
  - However, if consider only matched sets of new issue spreads issued by same issuer on same day, 74% BB and 82% B spreads are increasing.
  - Find similar results for Lehman Brothers data base (i.e., 70% BB and 62% B spreads are increasing).

Summary

- This raises the question:
  - Is the intuition derived from standard structural models (that slope of spread term structure is downward sloping for low credit quality issuers) incorrect?
- This paper revisits this issue:
  - Considers a different data set (Capital Access International) of secondary market transaction prices for bonds ranging from Ba to C ratings.
    * finds mostly downward sloping issuer-matched spread cruves (65% for Ba to 72% for C).
  - Argue that difference relative to HT result can be explained by difference in data:
    * HT sample contains mainly new issued bonds which trade at par.
    * AB sample contains secondary market prices which trade mostly below par.
  - and by impact of recovery assumption on par vs. discount bonds:
    * under recovery of fixed fraction of par, discount bonds *mechanically* tend to have downward sloping spread curve relative to par bonds.

Intuition?

  * Consider two zero coupon bonds by same issuer, but different maturity.
  * Suppose default becomes imminent. Then both bonds will trade at same price ($\approx$ fraction of par received upon recovery).
  * Therefore longer maturity zero-coupon bond must have lower yield to maturity.

– Use Logit to estimate the probability that slope is downward sloping as a function of price:

  * Find dichotomous behavior for discount spreads and par spreads.
  * Find that low price (i.e., discount) bonds have higher probability of downward sloping spread curve.

– Focusing on Par spreads they find:

  * Logit probability of downward sloping spread curve increases with spread level.

$\Rightarrow$ This is consistent with markets using recovery of face value as opposed to other assumptions often used in literature (RMV or RT).

Discussion: The slope of the spread curve

- What drives the slope of credit spreads:
  - Historical expected forward default probabilities,
  - Risk-premia,
  - Recovery assumption.
- Forward probability curves based on Moody's historical average cumulative default rates clearly downward sloping for low rated firms.

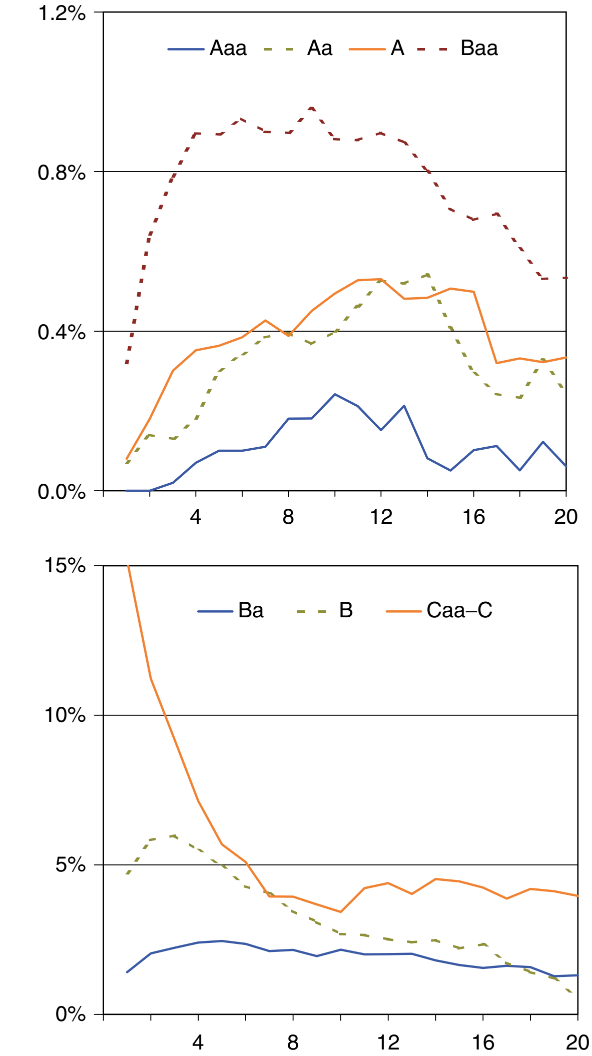

Figure 1 Empirical conditional 1-year default rates. For each year $t = 1, \ldots, 20$, the figure displays the probability of default before t conditional on survival at $t - 1$ (as in (4)), given different initial ratings. The conditional default rates are based on Moody's average cumulative default rates for the period 1920–2003, reported in Hamilton *et al.* (2004).

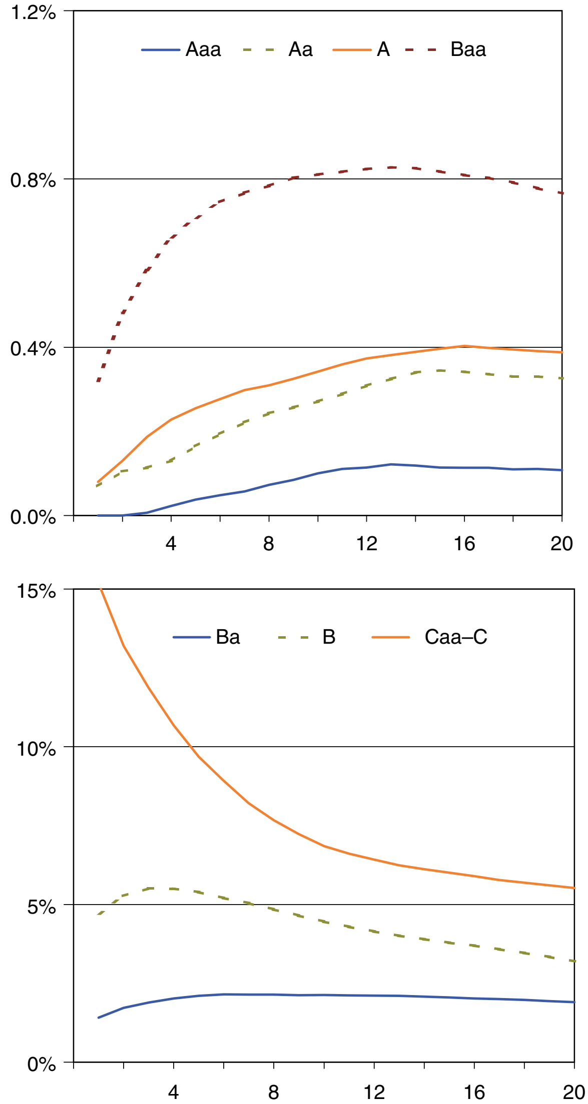

Figure 2 Average conditional 1-year default rates. For each year $t = 1, \ldots, 20$, the figure displays the average conditional 1-year default rate over the years $1, \ldots, t$ (as in (5)). Based on Moody's cumulative default rates for the period 1920–2003; cf. Hamilton *et al.* (2004).

- A generic Ba credit curve should be increasing up to the 5-year point and flat beyond the 5-year point.
- A generic B curve should be hump shaped—increasing in the short end of the curve and decreasing beyond 3–5 years.
- A generic Caa–C curve is monotonically decreasing.

The predictions may be modified by risk premia, as mentioned, and as we shall see in the next section,

- Because prices reflect risk-neutral (i.e., adjusted for risk-premia) forward default probabilities, the pattern observed in historical default rates not necessarily observed in prices.
- However, study by Lando and Mortensen (2005) of CDS spreads (which are analogous to par-bond spreads) shows that:
  - for low rating categories (less than B3) spread curves tend to be decreasing.
  - for spreads above 500 bps most curves decrease beyond three-year maturity
  - for spreads above 1000 bps most curves are decreasing even at the very short end.

Table 7 Frequency (in %) of increasing/flat/decreasing CDS pairs by rating. All 10 possible pairs of CDS premia on a curve with five maturity points are considered. For each curve, the number of increasing, flat, and decreasing CDS pairs are recorded in each curve segment. For each rating and curve segment, the table reports the observed frequency of increasing/flat/decreasing pairs, across time and across entities. The dominating direction is highlighted in boldface. The frequencies are based on 226,226 observed pairs, distributed as in the upper panel of Table 6.

	1y–3y	3y–5y	5y–7y	7y–10y	1y–5y	3y–7y	5y–10y	1y–7y	3y–10y	1y–10y	Total
Aaa	**97**/1/2	**96**/1/3	**95**/1/4	**94**/2/4	**98**/0/2	**97**/0/3	**97**/1/2	**98**/0/2	**98**/0/2	**98**/0/2	**96**/1/3
Aa	**98**/1/1	**97**/1/2	**96**/1/2	**95**/2/3	**100**/0/0	**99**/0/1	**98**/1/1	**100**/0/0	**99**/0/0	**100**/0/0	**98**/1/1
A	**96**/1/3	**94**/2/4	**92**/3/6	**92**/3/5	**97**/1/3	**95**/1/4	**95**/1/4	**97**/1/2	**96**/1/3	**97**/0/2	**95**/1/4
Baa1	**94**/1/4	**91**/2/7	**88**/3/9	**89**/3/7	**95**/1/4	**92**/1/7	**93**/2/6	**95**/1/4	**94**/1/5	**95**/1/4	**92**/2/6
Baa2	**90**/2/8	**85**/3/12	**83**/3/14	**85**/3/11	**90**/2/9	**87**/1/12	**88**/2/10	**90**/1/10	**89**/1/10	**91**/1/8	**87**/2/11
Baa3	**86**/2/12	**79**/4/16	**75**/4/21	**79**/4/17	**85**/2/13	**80**/2/19	**81**/2/17	**84**/1/15	**82**/1/17	**84**/1/15	**81**/3/16
Ba1	**74**/3/23	**65**/6/29	**59**/5/36	**64**/5/31	**72**/2/26	**63**/3/34	**63**/3/34	**69**/2/29	**66**/2/32	**71**/2/27	**66**/3/30
Ba2	**63**/6/31	**53**/9/37	**54**/5/41	**54**/6/40	**59**/6/35	**56**/2/42	**54**/4/42	**59**/3/37	**54**/2/43	**57**/2/41	**56**/5/39
Ba3	**67**/5/28	**52**/9/39	**50**/8/43	**60**/6/33	**64**/3/33	**51**/5/44	**55**/5/40	**62**/3/35	**56**/3/41	**66**/1/33	**58**/5/37
B1	**71**/5/23	**51**/11/38	45/6/**49**	**48**/8/45	**67**/5/28	**51**/3/45	48/4/48	**65**/3/32	**52**/2/47	**64**/2/34	**56**/5/39
B2	**57**/8/35	**51**/16/33	**55**/10/35	**50**/14/36	**63**/6/32	**57**/3/40	**61**/7/32	**60**/2/38	**63**/4/34	**64**/3/33	**57**/8/34
B3	**52**/9/39	39/11/**50**	42/4/**54**	45/10/45	**50**/6/44	44/3/**53**	46/3/**51**	**50**/3/46	42/3/**55**	48/3/**49**	45/6/**49**
Caa–C	**54**/2/44	31/10/**59**	27/4/**68**	24/9/**66**	46/1/**53**	32/2/**66**	31/5/**64**	41/3/**57**	33/1/**66**	39/2/**60**	35/4/**60**
Total	**90**/2/8	**86**/3/11	**84**/3/13	**86**/3/11	**90**/1/8	**88**/1/11	**88**/2/10	**90**/1/9	**89**/1/10	**91**/1/8	**88**/2/10

Table 8 Frequency (in %) of increasing/flat/decreasing CDS pairs by spread level. All 10 possible pairs of CDS premia on a curve with five maturity points are considered. For each curve, the number of increasing, flat, and decreasing CDS pairs are recorded in each curve segment. For each spread level group and curve segment, the table reports the observed frequency of increasing/flat/decreasing pairs, across time and across entities. The dominating direction is highlighted in boldface. The frequencies are based on 226,226 observed pairs, distributed as in the lower panel of Table 6.

	1y–3y	3y–5y	5y–7y	7y–10y	1y–5y	3y–7y	5y–10y	1y–7y	3y–10y	1y–10y	Total
1	**97**/1/2	**95**/2/3	**94**/3/4	**94**/3/4	**98**/1/1	**97**/1/2	**97**/1/2	**98**/1/1	**98**/1/1	**99**/0/1	**97**/1/2
2	**93**/2/5	**89**/3/8	**86**/4/11	**88**/4/8	**94**/1/5	**91**/1/8	**91**/2/7	**94**/1/4	**93**/1/6	**96**/1/4	**91**/2/7
3	**84**/4/12	**71**/7/23	**66**/5/29	**71**/7/23	**83**/3/14	**71**/3/26	**72**/5/23	**81**/2/16	**75**/2/23	**83**/2/15	**75**/4/21
4	**70**/5/25	**55**/8/36	**48**/6/46	**51**/9/40	**65**/4/30	**53**/3/43	**52**/4/44	**63**/3/34	**54**/2/43	**62**/2/36	**57**/5/38
5	**59**/4/37	**46**/9/45	41/5/**54**	46/7/**47**	**56**/4/40	43/3/**53**	43/4/**53**	**51**/2/47	44/3/**53**	**52**/3/45	**48**/5/47
6	**55**/5/40	41/9/**50**	38/4/**58**	47/4/**48**	**50**/4/46	39/3/**58**	43/3/**54**	47/3/**50**	41/3/**56**	48/3/**49**	45/4/**51**
7	**48**/5/47	39/10/**52**	33/5/**62**	36/6/**58**	43/4/**53**	36/2/**62**	32/2/**65**	38/2/**61**	33/2/**65**	39/2/**60**	37/4/**58**
8	**51**/3/45	44/7/**49**	47/2/**51**	48/1/**51**	**52**/3/45	42/2/**55**	46/2/**53**	48/2/**50**	43/1/**57**	48/1/**52**	47/3/**51**
9	**53**/2/45	38/8/**53**	38/1/**61**	39/1/**60**	46/2/**52**	41/1/**59**	39/1/**60**	39/0/**61**	40/0/**60**	43/0/**57**	41/2/**57**
10	**55**/2/43	43/4/**52**	39/2/**59**	37/2/**61**	**51**/1/48	41/2/**57**	41/0/**59**	48/2/**50**	43/0/**57**	50/0/50	45/2/**54**
11	48/4/**49**	26/9/**64**	27/1/**72**	35/2/**63**	34/2/**64**	29/0/**71**	33/0/**67**	34/1/**65**	30/0/**70**	33/0/**67**	33/2/**65**
12	47/1/**52**	23/5/**72**	15/0/**85**	17/2/**80**	34/0/**66**	15/0/**85**	15/1/**84**	21/0/**79**	16/0/**84**	18/0/**82**	22/1/**77**
13	27/2/**71**	12/7/**81**	5/6/**89**	11/8/**81**	20/1/**78**	6/1/**93**	7/6/**87**	12/1/**87**	6/1/**93**	14/1/**85**	12/4/**85**
Total	**90**/2/8	**86**/3/11	**84**/3/13	**86**/3/11	**90**/1/8	**88**/1/11	**88**/2/10	**90**/1/9	**89**/1/10	**91**/1/8	**88**/2/10

- It seems plausible that both historical and risk-neutral forward default probabilities become decreasing for low enough credit quality.

⇒ We should expect spreads to be decreasing even absent any technical recovery assumption for low enough credit quality.

Discussion: The Recovery assumption

- How important is the assumption of recovery of face value (which seems to be the market standard) relative to the term structure of forward default probabilities in generating downward sloping spread curves?
  - Conditioning on price does not really discriminate between the two alternatives.
  - Perhaps, could condition on price and coupon (or spread level) to distinguish:
    * firm with low credit risk trading below par because of a low coupon,
    * firm with standard coupon trading below par because of high credit risk.
  - Seems useful to investigate as it provides evidence for the recovery assumption used by market.

- Why might there not be a clear link between observed leverage, rating, EDF, and shape of the spread curve?
  - Dynamic capital structure changes expected by market will affect shape of conditional default probabilities.
  - Rating 'through the cycle' introduces cross-sectional variation in default risk within rating groups.
  - Risk-premia may introduce a wedge between the expected conditional default probabilities and prices (in general, tend to make price implied probabilities more increasing).
- But overall, evidence suggest that for sufficiently low credit quality (e.g., less than Caa or spreads greater than 1000bps) credit curves become downward sloping.
- A few suggestions for future research:
  - Use term structure of EDFs in conjunction with spreads to investigate role of risk-premia and recovery.
  - Investigate characteristics of firms with up/downward sloping spread curves to validate predictive power of structural models.
  - Are new issue prices different from secondary market prices (and could therefore explain HT's results)?