Medical Underwriting and Valuation in the Life Settlements Market

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Introduction

Background

- IRFS 13 and AIFMD are in force and demand that assets are held at fair value
- This can be achieved with econometric models or actuarial models
- In any case, the life expectancy (LE) of the insured is the key value driver
- Investors have to rely on LE estimates, since the “true LE” is unobservable

Motivation for this analysis

- Anecdotal evidence of systematic differences between medical underwriters
- Proper model calibration requires a better understanding of the prevailing LE landscape
Why develop a better understanding of the LE landscape?

Time series of monthly averages

Correlation: -0.7584 ➞ key value driver
AA-Partners transaction data

Multi-provider dataset

• The transaction data was collected by AA-Partners Ltd. from multiple providers

• Secondary and tertiary market transactions on a monthly basis

• Prices and important deal characteristics (e.g., life expectancy, face amount, etc.)

• The following life settlement providers were transparent at the end of December 2015:


• In addition, Carlisle and SL Investment Management Ltd. provide transaction data
Dataset: 2289 transactions between 01/2011 and 12/2015

Number of deals, LE correlations, and LE pairs

<table>
<thead>
<tr>
<th># Deals</th>
<th>All</th>
<th>21st</th>
<th>AVS</th>
<th>Fasano</th>
<th>EMSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>1884</td>
<td>1002</td>
<td>1421</td>
<td>278</td>
<td>79</td>
</tr>
<tr>
<td>Tertiary</td>
<td>405</td>
<td>531</td>
<td>600</td>
<td>66</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>2289</td>
<td>1533</td>
<td>2021</td>
<td>344</td>
<td>109</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># Pairs</th>
<th>AVS</th>
<th>Fasano</th>
<th>EMSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>21st</td>
<td>501</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>AVS</td>
<td>195</td>
<td>57</td>
<td>18</td>
</tr>
<tr>
<td>Fasano</td>
<td>48</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Correlations

- Blended: 0.9312, 0.9604, 0.9654, 0.9230
- 21st: 0.8414, 0.8516, 0.8347
- AVS: 0.9073, 0.7862
- Fasano: 0.8835

(Pairwise exclusion of missing data)

Secondary Market

<table>
<thead>
<tr>
<th># Pairs</th>
<th>AVS</th>
<th>Fasano</th>
<th>EMSI</th>
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</thead>
<tbody>
<tr>
<td>21st</td>
<td>853</td>
<td>94</td>
<td>43</td>
</tr>
<tr>
<td>AVS</td>
<td>195</td>
<td>57</td>
<td>8</td>
</tr>
<tr>
<td>Fasano</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Tertiary Market

<table>
<thead>
<tr>
<th># Pairs</th>
<th>AVS</th>
<th>Fasano</th>
<th>EMSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>21st</td>
<td>501</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>AVS</td>
<td>195</td>
<td>57</td>
<td>18</td>
</tr>
<tr>
<td>Fasano</td>
<td>48</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

thin data
Influence of the individual medical underwriters (I)

Relative market shares have changed over time

The percentage of transactions with 21st Services LEs began to decrease in 2013.
Influence of the individual medical underwriters (II)

Variation in market shares impacts the (blended) LE used for closing
Differences in the LE estimates of the medical underwriters (I)

21st Services LEs are, on average, shorter than those of other underwriters

<table>
<thead>
<tr>
<th></th>
<th>Mean ΔLE (Months)</th>
<th>AVS</th>
<th>Fasano</th>
<th>EMSI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Secondary Market</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21st</td>
<td></td>
<td>-15.56***</td>
<td>-12.39***</td>
<td>-14.31***</td>
</tr>
<tr>
<td>AVS</td>
<td></td>
<td>1.32</td>
<td>5.75*</td>
<td></td>
</tr>
<tr>
<td>Fasano</td>
<td></td>
<td></td>
<td>-3.08</td>
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</tbody>
</table>

statistically significant with p ≤ 0.001 (Wilcoxon Test)

<table>
<thead>
<tr>
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<th>Fasano</th>
<th>EMSI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tertiary Market</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21st</td>
<td></td>
<td>-11.40***</td>
<td>-20.15***</td>
<td>-16.46</td>
</tr>
<tr>
<td>AVS</td>
<td></td>
<td>-7.21*</td>
<td>1.22</td>
<td></td>
</tr>
<tr>
<td>Fasano</td>
<td></td>
<td></td>
<td>6.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: analysis based on transactions with LE pairs

![Relative Frequency Chart](chart.png)

![Relative Frequency Chart](chart2.png)
Differences in the LE estimates of the medical underwriters (II)

The difference persists across age brackets and markets

Note: analysis based on all transactions for each underwriter
Differences in the LE estimates of the medical underwriters (III)

Time variation in the 21st-AVS difference

The difference seems to be decreasing as of late.
Differences between the secondary and the tertiary market

 Corrections of the standard LE over time

A) On average, standard LEs seem to have been corrected more strongly in the secondary market

B) 21st LEs were, on average, shorter than AVS LEs in both the secondary and tertiary market

LE - Standard LE (months)


21st second 21st tertiary AVS second AVS tertiary
Differences in the (implied) IRRs

21st Services IRRs are, on average, higher than those of other underwriters

Mean: 0.09

Mean: 0.16

Mean: 0.15

Mean: -0.01
What are potential reasons for these differences?

Diverging incentives and consequences

- **Sell side** has incentives to pick medical underwriters with shorter LEs
- **Investors** have a strong interest in accurate LEs (to limit longevity risk)
- Hence, **medical underwriters** can compete on accuracy or through “shorter average LEs”
- The latter strategy remains viable as long as the market does not demand A/E-ratios

Potential solutions? Increase transparency!

- Establish a **ranking system** (based on market data) that signals longevity risk to investors
- Underwriters with consistently shorter LEs and no A/E ratios would receive a lower rank
Why should investors be aware of the differences?

Market-consistent valuation crucially depends on the correct usage of model inputs

- **Econometric models**: LEs used for calibration and application need to be consistent

  \[ P_0 = \alpha + \beta \cdot LE + \gamma \cdot X + \epsilon \]

  - **Example**: must not insert a 21st Services LE when beta has been derived based on AVS LEs
  - **Reason**: beta estimates for AVS LEs are more negative (because AVS LEs tend to exhibit higher values)
  - If the model is calibrated with blended LEs, their time varying composition may be taken into account

- **Probabilistic models**: discount rate needs to be consistent with LE (mortality rates)

  \[ P_0 = \sum_{t=0}^{\infty} \frac{tp_x \cdot q_{x+t} \cdot DB}{(1 + r)^{t+1}} - \sum_{t=0}^{\infty} \frac{tp_x \cdot \pi_t}{(1 + r)^t} \]

  - **Example**: must not employ a 21st Services LE when the IRR has been derived based on an AVS LE
  - **Reason**: average IRR for 21st LEs (46%) is higher than for AVS LEs (33%) (as the former LEs tend to be shorter)
Econometric models

A graphical illustration

- Linear: Transaction Price/Face Amount vs. Life Expectancy (months)
- Polynomial: Transaction Price/Face Amount vs. Life Expectancy (months)
- Linear-Log: Transaction Price/Face Amount vs. Log(Life Expectancy (months))
- Power: Transaction Price/Face Amount vs. Life Expectancy (months)
What do we know about the true LE?

Principal components analysis allows the derivation of an underlying factor score

- **Problem**: missing values (incomplete correlation matrix)
  - **Solution**: imputation by regression (assumes functional relationship between known and unknown LEs)
  - When relying on the blended LE, time variation in the regression betas could be taken into account to increase precision
Summary and conclusion

Main findings

• Market shares and thus composition of the LE used for closing are not stable over time
• LE estimates of 21st Services are (still) systematically shorter than those of competitors
• LE differences are mirrored by IRRs: this needs to be taken into account for valuation

Consequences

• Sellers (and fund managers) have incentives to pick underwriters with shorter LEs
• Systematically distorted LEs imply a heightened degree of longevity risk for investors
• The absence of A/E-ratios conceals these issues but could be mitigated through rankings
Thank you for your attention!