An Investigation of Life Insurer Efficiency in Canada

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Introduction

• Explore efficiency of Canadian life insurers
• First determine inefficiencies
• Then effect of inefficiency and exogenous variables on ROE
• OSFI return data from 2000 thru 2004
• By entire company and by LOB
Efficiency Calculations – Sec 2.2

• Use Stochastic Frontier Analysis (SFA)
  \[ \ln y_i = \ln f(x_i, \beta) + v_i - u_i \]

• \( f(x_i, \beta) \) is the functional form

• \( \beta \) values are estimated, \( \exp(v_i) \) is noise, \( \exp(u_i) \) is inefficiency
Efficiency Calculations – Sec 3

- Use Translog function as functional form
- Basic Translog function:

\[
\ln y = \beta_0 + \sum_{1}^{N} \beta_n \ln x_n + \frac{1}{2} \sum_{1}^{N} \sum_{1}^{M} \beta_{nm} \ln x_n \ln x_m
\]
Efficiency Calculations – Sec 3

- Specific equation for profit (in)efficiency

\[
\ln \left( \frac{i}{y_{Mi} (1 + \ln A_i)} \right) + 1 = \sum_n n \ln \left( \frac{y_{ni}}{\ln A_i} + n + 1 \right) + \sum_m m \ln \left( \frac{y_{mi}}{y_{Mi}} + m + 1 \right) + \\
\frac{1}{2} \sum_n n \ln \left( \frac{x_{ni}}{\ln A_i} + n + 1 \right) + \frac{1}{2} \sum_{k=1}^{n} k \ln \left( \frac{x_{ki}}{\ln A_i} + k + 1 \right) + \\
\frac{1}{2} \sum_{m=1}^{n} m \ln \left( \frac{y_{mi}}{y_{Mi}} + m + 1 \right) + \frac{1}{2} \sum_{j=1}^{m} j \ln \left( \frac{y_{ji}}{y_{Mi}} + j + 1 \right) + \\
\frac{1}{2} \sum_{n=1}^{m} n \ln \left( \frac{x_{ni}}{\ln A_i} + n + 1 \right) + \frac{1}{2} \sum_{k=1}^{n} k \ln \left( \frac{y_{mi}}{y_{Mi}} + m + 1 \right) + v_i + u_i
\] (1)
Efficiency Calculations – Sec 3

• Profit efficiency calculated using

\[ 1 - \frac{\Pi^i}{\Pi_{\text{max}}} = 1 - \frac{\exp[f(x^i, y^i, s^i)]u^i}{\exp[f(x^\hat{i}, y^\hat{i}, s^\hat{i})]u_{\text{max}}} = 1 - \frac{\hat{u}^i}{u_{\text{max}}} \]  

\[ (2) \]

• \( \Pi \) is profit; \( f \) is functional form; \( x, y \) and \( s \) are inputs, outputs and exogenous variables; \( \text{max} \) refers to the most efficient company
Efficiency Calculations – Sec 3

• So profit efficiency is calculated such that company \( i \) is compared to most efficient company.

• Both use inputs, outputs and exogenous variables that company \( i \) uses.
Efficiency Calculations – Sec 3

• For time-varying efficiency enhance model with

\[ \sum_i \sum_t D_t w_{it} \]

• \( w_{it} \) are exogenous variables; \( D_t \) are dummy variables

• Time-varying inefficiency scores normalized to time-invariant scores
Efficiency Calculations – Sec 3

• Output – quantity company strives to produce

• Use premiums
  net investment income
  other revenue
Efficiency Calculations – Sec 3

• Inputs – keep company viable
• Use change in policy liabilities commissions interest on PH amounts on deposit other interest expense general expenses and taxes dividends and ERRs
Efficiency Calculations – Sec 3

• Inputs – claims, annuity payments, other payments may be doubtful
• So use cases both including and excluding them

• Net of reinsurance (as can be controlled by company)
• Gross of income tax (not controllable)
Efficiency Effect on ROE – Sec 3

• Now efficiency effect on ROE

• Also year (versus 2000)
  (ln of) asset size
debt ratio
percent new business written
ten year government bond yields
domestic or foreign
Efficiency Effect on ROE – Sec 3

- Use regression equation for GLS

\[ ROE_i = \beta_0 + \beta_{ineffy} PI_i + \sum_{z=2000}^{2004} \beta_z D_z + \beta_{lnasize} \ln A_i + \beta_{drat} DRat_i + \beta_{pnew} PNew_i + \beta_{yields} Yields_i + \beta_{dom} D_{dom} \]

- Also use MLE
Efficiency Effect on ROE – Sec 3

• Do analyses for both entire companies and lines of business (LOBs)

• Ten LOBs on the OSFI returns
  OSFI 54 (Domestically owned) and
  OSFI 55 (Foreign owned)
Efficiency Effect on ROE – Sec 3

- Individual Life NonPar
- Individual Life Par
- Group Life NonPar
- Group Life Par
- Individual Annuities NonPar
- Individual Annuities Par
- Group Annuities NonPar
- Group Annuities Par
- Individual Accident & Sickness
- Group Accident & Sickness
Cases Explored for Profit (In)Efficiency – Sec 5

- Base Case:
  Inputs include Claims, Annuity Pymts & Other Pymts
  Input Numeraire = Claims
  No Companies Excluded
Cases Explored for Profit (In)Efficiency – Sec 5

• Case II:
  Exclude Claims etc. as Inputs
  Numeraire = Commissions

• Case III: Same as Case II except exclude specific companies
Profit (In)Efficiency – Sec 5.1.1.1

- GLS – Time-Invariant Base Case
- Effect on ROE of inefficiency and exogenous variables
- Table 5.4
Effect on ROE
Profit InEfficiency – GLS
Time-Invariant Base Case

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Inefficiency</td>
<td>-0.355***</td>
<td>0.060</td>
</tr>
<tr>
<td>2001</td>
<td>-0.003</td>
<td>0.018</td>
</tr>
<tr>
<td>2002</td>
<td>-0.019</td>
<td>0.023</td>
</tr>
<tr>
<td>2003</td>
<td>-0.021</td>
<td>0.038</td>
</tr>
<tr>
<td>2004</td>
<td>-0.014</td>
<td>0.045</td>
</tr>
<tr>
<td>Ln Asset Size</td>
<td>-0.003</td>
<td>0.002</td>
</tr>
<tr>
<td>Debt Ratio</td>
<td>-0.034</td>
<td>0.080</td>
</tr>
<tr>
<td>%New Bus</td>
<td>-0.016*</td>
<td>0.009</td>
</tr>
<tr>
<td>Yields</td>
<td>-0.015</td>
<td>0.033</td>
</tr>
<tr>
<td>Domestic</td>
<td>0.089***</td>
<td>0.007</td>
</tr>
<tr>
<td>Constant</td>
<td>0.228</td>
<td>0.203</td>
</tr>
</tbody>
</table>

Profit Inefficiency
Parameter % of Total Value of Parameters

| Including Average of Year Estimates | 67.4% |
| Only Parameters of Variables a Company Can Control | 87.0% |

*** = significant to a 1% level
* = significant to a 10% level

Note that 2000 is the base year so the year variables represent the change due to operating in that year versus 2000.
Profit Inefficiency - GLS - Time-Invariant Base Case – Sec 5.1.1.1

- Profit inefficiency parameter is 87.0% of sum of parameters for variables company can control
- $\beta_{ineffy}$ estimate is -0.355
- Average profit inefficiency is 6.32%
- So average decrease in ROE is 2.24%
- Current average ROE is 12.76%
- Cuts potential ROE by 15.0%
Profit Inefficiency - GLS - Time-Invariant Base Case – Sec 5.1.1.1

• Average individual company-year decrease is 16.9% of potential ROE
• 62.7% of these are more than 10%
• So effect of profit inefficiency is large
Profit Inefficiency - GLS - Time-Invariant
Case III – Sec 5.1.1.3

• Case II (Sec 5.1.1.2):
  • $\beta_{ineffy}$ estimate is statistically insignificant

• So use Case III:
  Excludes 3 most efficient companies
  So as if they did not exist
Profit Inefficiency - GLS - Time-Invariant
Case III – Sec 5.1.1.3

- Profit inefficiency parameter is 83.9% of sum of parameters for variables company can control
- $\beta_{ineffy}$ estimate is -0.282
- Average profit inefficiency is 29.93%
- So average decrease in ROE is 8.44%
- Current average ROE is 13.40%
- Cuts potential ROE by 38.6%
Profit Inefficiency - GLS - Time-Varying
Base Case – Sec 5.1.2.1

- $\beta_{ineffy}$ estimate is -0.265
- Average profit inefficiency is 6.32%
- So average decrease in ROE is 1.67%
- Current average ROE is 12.76%
- Cuts potential ROE by 11.6%
Profit Inefficiency - GLS

- Time-Varying Case III (Sec 5.1.2.3): Cuts potential ROE by 28.0%

- MLE Time-Invariant Base Case (Sec 5.2.1.1): Cuts potential ROE by 15.1%
Profit Inefficiency - GLS

- Time-Invariant
  
  Base Case: ROE cut by 15.0%
  
  Case III: ROE cut by 38.6%

- Time-varying
  
  Base Case: ROE cut by 11.6%
  
  Case III: ROE cut by 28.0%
Cost Inefficiency – GLS – Sec 6

• Time-Invariant
  Base Case: ROE cut by 15.7%
  Case IV: ROE cut by 20.8%

• Time-varying
  Base Case: ROE cut by 13.2%
  Case V: ROE cut by 12.7%
Profit Inefficiency – Cases & Betas

• Time-invariant (Sec 5.1.1):
  Base Case: $\beta_{ineffy} = -0.355$; Significant
  Case II: $\beta_{ineffy} = +0.006$; Not significant
  Case III: $\beta_{ineffy} = -0.282$; Significant

• Time-varying (Sec 5.1.2) similar
Cost Inefficiency – Cases & Betas

• Time-invariant (Sec 6.1.1):
  Base Case: \( \beta_{\text{ineffy}} = -0.373; \) Significant
  Case II: \( \beta_{\text{ineffy}} = +0.300; \) Not significant
  Case III (Excl most efficient companies):
    \( \beta_{\text{ineffy}} = +0.552; \) Significant
  Case IV (Incl claims etc as inputs):
    \( \beta_{\text{ineffy}} = -0.501; \) Significant
Cost Inefficiency – Cases & Betas

• Time-Varying (Sec 6.1.2):
  Base Case: $\beta_{ineffy} = -0.305$; Significant
  Case II: $\beta_{ineffy} = +0.361$; Significant
  Case IV (Incl claims etc as inputs):
    $\beta_{ineffy} = -0.253$; Not significant
  Case V (Excl most efficient companies):
    $\beta_{ineffy} = -0.386$; Significant
Cost Inefficiency – Cases & Betas

• So questions the exclusion of claims, annuity payments and other payments as inputs
• At least regarding Canadian data
• Will see for Australian and US data
LOB Profit Inefficiency – Sec 7

- Proportion of individual company-year potential ROE values cut by more than 10% range from 50.3% to 77.8%

- For the five LOBs that this can be calculated for
Discussion – Sec 8

• For Base Case & Case IV average inefficiency ranges from 6.3% to 6.6%
• These cases include claims, annuity payments & other payments as inputs
• For both profit and cost inefficiency
Discussion – Sec 8

• For Case II average inefficiency is 46% for profit and 16% for cost inefficiency
• This case excludes claims, annuity payments & other payments as inputs
• So further questions the exclusion (at least re Canadian data)
Discussion – Sec 8

• For LOBs average inefficiency ranges from 2.3% to 3.7% for 5 of 7 non-A&S
• Two average A&S scores are much higher
• Suggests fundamental difference between non-A&S and A&S business
Discussion – Sec 8

• $\beta_{ineffy}$ parameter estimate has more than 70% of influence of variables company can control
  where it has statistical significance
• Eight of ten are more than 80%
• So inefficiency is (potentially) of great importance
Profits Inefficiency GLS Time-Invariant Base Case - Sec 8.1

- Average decrease in ROE caused by inefficiency is 2.24%

- Explore actions necessary to change ROE by 1% (e.g. from 10% to 11%) or 2.24% using variables company can control
Profit Inefficiency GLS Time-Invariant
Base Case - Sec 8.1

• To increase ROE by 1% must decrease asset size by 96.0%
• Using end of 95% confidence interval gives needed decrease of 74.6%
• So clearly impossible
Profit Inefficiency GLS Time-Invariant
Base Case - Sec 8.1

• To increase ROE by 1% must decrease debt ratio by 29.5%
• Average debt ratio is only 2.56%
• Using end of 95% confidence interval gives needed decrease of 5.2%
• So clearly impossible
• Even difficult at max debt ratio = 43.0%
Profit Inefficiency GLS Time-Invariant
Base Case - Sec 8.1

• To increase ROE by 1% must decrease percent new business written by 62.4%
• Average % new business only 35.4%
• Using end of 95% confidence interval gives needed decrease of 29.2%
• So clearly impossible or difficult
Profit Inefficiency GLS Time-Invariant Base Case - Sec 8.1

Necessary Changes (as % of Current Value) to Increase ROE by 1% (e.g. from 10% to 11%) or by Average Change of ROE Due to Profit Inefficiency

GLS - Time-Invariant Base Case

<table>
<thead>
<tr>
<th>Variable</th>
<th>Method</th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Size</td>
<td>Using Parameter Estimate</td>
<td>96.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value</td>
<td>74.6%</td>
<td></td>
</tr>
<tr>
<td>Debt Ratio Max</td>
<td>Using Parameter Estimate</td>
<td>68.5%</td>
<td>Impossible</td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value</td>
<td>12.1%</td>
<td>27.2%</td>
</tr>
<tr>
<td>Debt Ratio Ave</td>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>%New Bus Ave</td>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value</td>
<td>82.5%</td>
<td>Impossible</td>
</tr>
</tbody>
</table>
Profit Inefficiency GLS Time-Invariant Base Case - Sec 8.1

• For government bond yields need change of 0.677% to increase ROE by 1%

• Average in five years is 0.270%
Profit Inefficiency GLS Time-Invariant Base Case - Sec 8.1

- Recall Equation (2) shows we are comparing efficiencies when companies have identical inputs, outputs and exogenous variables
- To increase ROE by 1% need to decrease inefficiency by 2.8%
- Average inefficiency is 6.3%
Profit Inefficiency GLS Time-Invariant Base Case - Sec 8.1

• So changing inefficiency is easiest and quite possibly only way to increase ROE
Necessary Changes (as % of Current Value)
to Increase ROE by 1% (e.g. from 10% to 11%)
or by Average Change of ROE Due to Profit Inefficiency
GLS - Time-Invariant Case III

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>99.1%</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>78.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>78.1%</td>
<td>Impossible</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>12.2%</td>
<td>Impossible</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>68.5%</td>
<td>Impossible</td>
</tr>
</tbody>
</table>
Profit Inefficiency GLS Time-Invariant
Case III - Sec 8.2

- To increase ROE by 1% need to decrease inefficiency by 3.5%
- Average inefficiency is 29.9%
Profit Inefficiency GLS Time-Varying
Base Case - Sec 8.3

Necessary Changes (as % of Current Value)
to Increase ROE by 1% (e.g. from 10% to 11%)
or by Average Change of ROE Due to Profit Inefficiency
GLS – Time-Varying Base Case

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>97.2%</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>75.9%</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>65.1%</td>
<td>Impossible</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>12.0%</td>
<td>20.1%</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>81.6%</td>
<td>Impossible</td>
</tr>
</tbody>
</table>
Profit Inefficiency GLS Time-Varying
Base Case - Sec 8.3

• To increase ROE by 1% need to decrease inefficiency by 3.8%
• Average inefficiency is 6.3%
Necessary Changes (as % of Current Value)
to Increase ROE by 1% (e.g. from 10% to 11%)
or by Average Change of ROE Due to Profit Inefficiency
GLS – Time-Varying Case III

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to Inefficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>99.99%</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>83.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>49.6%</td>
<td>Impossible</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>11.1%</td>
<td>58.0%</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>63.5%</td>
<td>Impossible</td>
</tr>
</tbody>
</table>
Profit Inefficiency GLS Time-Varying
Case III - Sec 8.3

• To increase ROE by 1% need to decrease inefficiency by 5.7%
• Average inefficiency is 29.9%
Profit Inefficiency MLE Time-Invariant Base Case - Sec 8.4

Necessary Changes (as % of Current Value) to Increase ROE by 1% (e.g. from 10% to 11%) or by Average Change of ROE Due to Profit Inefficiency MLE - Time-Invariant Base Case

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td>Using Parameter Estimate 99.95%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value 85.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td>Using Parameter Estimate 54.5%</td>
<td>Impossible</td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value 11.5%</td>
<td>26.8%</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td>Using Parameter Estimate Impossible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value Impossible</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td>Using Parameter Estimate Impossible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using end of 95% CI Value 64.8% Impossible</td>
<td></td>
</tr>
</tbody>
</table>
Profit Inefficiency MLE Time-Invariant Base Case - Sec 8.4

- To increase ROE by 1% need to decrease inefficiency by 6.5%
- Average inefficiency is 14.9%
Cost Inefficiency GLS Time-Invariant Base Case & Case IV - Sec 8.5

Necessary Changes (as % of Current Value) to Increase ROE by 1% (e.g. from 10% to 11%) or by Average Change of ROE Due to Cost Inefficiency
GLS – Time-Invariant Base Case (Case IV)

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>83.8% (100%)</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>67.3% (92.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>70.9% (34.9%)</td>
<td>166.9% (Impossible)</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>13.1% (10.2%)</td>
<td>30.9% (33.7%)</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible (Imp)</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>Impossible (Imp)</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>Impossible (Imp)</td>
<td></td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>78.2% (67.5%)</td>
<td>Impossible (Impossible)</td>
</tr>
</tbody>
</table>
Cost Inefficiency GLS Time-Invariant Base Case & Case IV - Sec 8.5

• Base Case: to increase ROE by 1% need to decrease inefficiency by 2.7%
• Average inefficiency is 6.3%
• Case IV: to increase ROE by 1% need to decrease inefficiency by 2.0%
• Average inefficiency is 6.6%
Cost Inefficiency GLS Time-Varying Base Case & Case V - Sec 8.5

Necessary Changes (as % of Current Value)
to Increase ROE by 1% (e.g. from 10% to 11%)
or by Average Change of ROE Due to Cost Inefficiency
GLS – Time-Varying Base Case (Case V)

<table>
<thead>
<tr>
<th></th>
<th>Using Parameter Estimate</th>
<th>Increase ROE by 1%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td>Using end of 95% CI Value</td>
<td>66.8% (88.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>Debt Ratio Max</strong></td>
<td>Using Parameter Estimate</td>
<td>103.2% (41.4%)</td>
<td>199.0% (74.9%)</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td>Using end of 95% CI Value</td>
<td>14.0% (10.8%)</td>
<td>27.0% (19.5%)</td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td>Using Parameter Estimate</td>
<td>Impossible (Imp)</td>
<td></td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td>Using end of 95% CI Value</td>
<td>Impossible (Imp)</td>
<td></td>
</tr>
</tbody>
</table>
Cost Inefficiency GLS Time-Varying
Base Case & Case V - Sec 8.5

• Base Case: to increase ROE by 1% need to decrease inefficiency by 3.3%
• Average inefficiency is 6.3%
• Case V: to increase ROE by 1% need to decrease inefficiency by 2.6%
• Average inefficiency is 4.7%
Profit Inefficiency GLS Time-Invariant Individual Life NonPar - Sec 8.6

Necessary Changes (as % of Current Value) to Increase ROE by 10%
or by Average Change of ROE Due to Profit Inefficiency
GLS - Time-Invariant Base Case

<table>
<thead>
<tr>
<th></th>
<th>Increase ROE by 10%</th>
<th>Increase ROE by Amt Due to InEfficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>11.0%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>6.0%</td>
<td>18.4%</td>
</tr>
<tr>
<td><strong>Debt Ratio Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>10.0%</td>
<td>32.5%</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>6.8%</td>
<td>22.2%</td>
</tr>
<tr>
<td><strong>%New Bus Ave</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Parameter Estimate</td>
<td>9.1%</td>
<td>29.7%</td>
</tr>
<tr>
<td>Using end of 95% CI Value</td>
<td>5.0%</td>
<td>16.2%</td>
</tr>
</tbody>
</table>
Profit Inefficiency GLS Time-Invariant Individual Life NonPar - Sec 8.6

- To increase ROE by 10% need to decrease inefficiency by 0.25%
- Average inefficiency is 3.66
Conclusions – Sec 9

- Inefficiency has decreased the ROE of life insurers by between 11% and 38% of its potential
- Large percentages of the individual company-year ROEs are decreased by more than 10% of their potential
Conclusions – Sec 9

• To change ROE by even 1% a life insurer has to change its business radically
• Or else is impossible
• But changing inefficiency is easier to the extent that it is easiest and possibly only way to do so
Conclusions – Sec 9

- This research adds to

  Information concerning expenses and efficiency in life insurance

  Knowledge of regulating life insurance and determining warning signs concerning viability
Conclusions – Sec 9

• Efficiency is considered to be more accurate to consider than (items similar to) expense ratios

• So efficiency can be an improvement of existing methods as it is more accurate than simply using expenses or expense ratios
Conclusions

• May be possible to determine the best inputs and outputs to use for future studies regarding life insurer efficiency
• Also help insurers learn which areas to concentrate on when making management decisions regarding expenses, efficiency, and similar concepts
Conclusions – Sec 9

• Bowie et al. (1996): “difficulty with the computational tool is not a good reason to dismiss the model”
• So including efficiency in an analysis of life insurance may be a better way
• Therefore this can be deemed both desirable and necessary
Questions? / Comments