Livestock Insurance

Barry K. Goodwin
and
Ligia Vado

Presentation at Guelph, November 17, 2010
Introduction

- Overview of Livestock Insurance Programs in the World
- Livestock Insurance in the U.S.:
  - Livestock Gross Margin (LGM)
  - Livestock Risk Protection (LRP)
  - Pasture Rangeland and Forest
    - Rainfall Index (RI)
    - Normalized Difference Vegetation Index (NDVI)
    - Forage Production Index
- Discussion of general crop insurance issues (time permitting)
What’s Different About Livestock?

- Multiple, overlapping production periods
- Not a typical crop year cycle but rather continuous production
- Often focused on price risks (input and output)
- In some cases (aquaculture) measurement of output/yield is uniquely difficult
  - Examples
    - Seed clams are 5mm
    - Impossible to fully measure fishery stock in a pond
    - Mobility of stock raises animal id issues
- Risks may be highly case specific (e.g., disease, predators, etc.)
- Index vs. direct coverage—what type of index is correlated with production risks?
How Many Fish are in the Ponds?
Livestock Insurance in the World

- Livestock insurance products include:
  - Traditional animal accident and mortality
    - Canada
  - Epidemic disease
    - Germany
  - Livestock index mortality product
    - Mongolia
  - Herd Insurance
  - Price/cost margin insurance (US LRP and LGM)

- Pasture/forage Insurance products:
  - Rainfall Index
    - U.S.
  - NDVI Index
    - Canada, Spain, and the U.S.
# International Livestock Insurance

## Table 3.11 Availability of Livestock Insurance, by Development Status and Region (percent, except where otherwise indicated)

<table>
<thead>
<tr>
<th>Development status and region</th>
<th>Number of countries</th>
<th>Traditional indemnity insurance</th>
<th>Index-based insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Accident and mortality</td>
<td>Epidemic disease</td>
</tr>
<tr>
<td><strong>Development Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-income</td>
<td>22</td>
<td>77</td>
<td>55</td>
</tr>
<tr>
<td>Upper-middle-income</td>
<td>17</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>Lower-middle-income</td>
<td>20</td>
<td>55</td>
<td>30</td>
</tr>
<tr>
<td>Low-income</td>
<td>6</td>
<td>67</td>
<td>50</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>8</td>
<td>88</td>
<td>50</td>
</tr>
<tr>
<td>Asia</td>
<td>12</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Europe</td>
<td>22</td>
<td>82</td>
<td>50</td>
</tr>
<tr>
<td>Latin America and the</td>
<td>19</td>
<td>53</td>
<td>21</td>
</tr>
<tr>
<td>Caribbean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>2</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Oceania</td>
<td>2</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>All countries</td>
<td>65</td>
<td>69</td>
<td>38</td>
</tr>
</tbody>
</table>

# International Livestock Insurance

## Table D.4 Premiums, Claims, Subsidies, and Loss Ratios for Livestock Insurance, by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
<th>Total livestock premium (millions of dollars)</th>
<th>Total livestock claims (millions of dollars)</th>
<th>Loss ratio (percent)</th>
<th>Average livestock premium subsidy (percent)</th>
<th>Producer premium (millions of dollars)</th>
<th>Producer loss ratio (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Countries with Livestock Premium Subsidies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iran, Islamic Rep. of</td>
<td>2005-07</td>
<td>2,900.4</td>
<td>1,961.1</td>
<td>32.4</td>
<td>81</td>
<td>11.0</td>
<td>6801</td>
</tr>
<tr>
<td>Italy</td>
<td>2006-07</td>
<td>2.0</td>
<td>0.5</td>
<td>26</td>
<td>49</td>
<td>1.0</td>
<td>51</td>
</tr>
<tr>
<td>Japan</td>
<td>2003-05</td>
<td>1,747.6</td>
<td>1,562.7</td>
<td>48</td>
<td>34</td>
<td>10.3</td>
<td>127</td>
</tr>
<tr>
<td>Korea, Rep. of</td>
<td>2003-07</td>
<td>148.1</td>
<td>104.0</td>
<td>27</td>
<td>39</td>
<td>105.0</td>
<td>132</td>
</tr>
<tr>
<td>Mexico</td>
<td>2003-07</td>
<td>151.0</td>
<td>105.3</td>
<td>30</td>
<td>50</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Nepal</td>
<td>2003-06</td>
<td>0.7</td>
<td>0.1</td>
<td>18</td>
<td>50</td>
<td>2.0</td>
<td>36</td>
</tr>
<tr>
<td>Poland</td>
<td>2003-07</td>
<td>0.5</td>
<td>0.3</td>
<td>18</td>
<td>30</td>
<td>8.0</td>
<td>61</td>
</tr>
<tr>
<td>Spain</td>
<td>2003-07</td>
<td>1,068.8</td>
<td>941.1</td>
<td>48</td>
<td>80</td>
<td>213.4</td>
<td>441</td>
</tr>
<tr>
<td>United States (federal livestock)</td>
<td>2003-07</td>
<td>21.8</td>
<td>14.5</td>
<td>67</td>
<td>6</td>
<td>20.2</td>
<td>72</td>
</tr>
<tr>
<td><strong>Countries with No Livestock Premium Subsidies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>2003-07</td>
<td>0.1</td>
<td>0.04</td>
<td>35</td>
<td>0.1</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td>2003-06</td>
<td>5.8</td>
<td>4.4</td>
<td>75</td>
<td>5.8</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>2007</td>
<td>0.1</td>
<td>0.1</td>
<td>12</td>
<td>0.1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2003-07</td>
<td>0.1</td>
<td>0.08</td>
<td>45</td>
<td>0.1</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2003-05</td>
<td>51.7</td>
<td>25.8</td>
<td>50</td>
<td>51.7</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td>2003-07</td>
<td>1.4</td>
<td>0.9</td>
<td>62</td>
<td>1.4</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Honduras</td>
<td>2003-07</td>
<td>0.1</td>
<td>0.1</td>
<td>67</td>
<td>0.1</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>2004-07</td>
<td>111.0</td>
<td>59.3</td>
<td>61</td>
<td>111.0</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Mongolia</td>
<td>2008-07</td>
<td>0.2</td>
<td>0.2</td>
<td>115</td>
<td>0.2</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>Panama</td>
<td>2003-07</td>
<td>1.7</td>
<td>0.7</td>
<td>40</td>
<td>1.7</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

(continued)

## Table D.4 Premiums, Claims, Subsidies, and Loss Ratios for Livestock Insurance, by Country (continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
<th>Total livestock premium (millions of dollars)</th>
<th>Total livestock claims (millions of dollars)</th>
<th>Loss ratio (percent)</th>
<th>Average livestock premium subsidy (percent)</th>
<th>Producer premium (millions of dollars)</th>
<th>Producer loss ratio (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philippines</td>
<td>2003-07</td>
<td>0.3</td>
<td>0.2</td>
<td>57</td>
<td>0.3</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>2006-07</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
<td>27</td>
<td>&lt; 0.1</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>2003-07</td>
<td>1.4</td>
<td>0.4</td>
<td>31</td>
<td>1.4</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>2003-07</td>
<td>41.9</td>
<td>20.0</td>
<td>48</td>
<td>41.9</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td>2003-07</td>
<td>12.1</td>
<td>1.7</td>
<td>14</td>
<td>12.1</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

Canadian Livestock Insurance

- Accident and Mortality Insurance
  - Mortality/Asset Loss (Due to named diseases)
  - Income/Yield Losses (Due to Death)
  - Products: Cattle, hogs, and poultry
  - Voluntary
  - Delivery channel: producers associations, cooperatives, insurers’ agent networks

- Aquaculture Insurance

- Livestock Insurance products under development

- Funding for livestock administration costs will start in 2009 with intro of new programs
Saskatchewan Weather Insurance

- Options include:
  - Forage Rainfall Insurance Program, the
  - Annual Crop Weather Based Insurance Program
  - Corn Heat Unit Pilot Program

- Area-wide and coverage and indemnities are based on a network of 131 weather stations throughout the province and in neighboring provinces.
- Areas eligible for coverage are within 40 kilometers of a weather station.
- Precipitation and temperature measurements during the growing season are the basis for coverage.
- Claims are based on a lack of precipitation or early frost and insuring agents must select a weather station within 100 kilometers for their coverage over each quarter-section of land.
Alberta Livestock and Weather Insurance

- **Cattle Price Insurance Program (CPIP)**
  - Covers price, basis, and currency risks
  - Pay a premium and receive a floor price on the insured cattle

- **Range of weather insurance options**
  - Soil moisture level with and without precipitation
  - Corn Heat Unit (CHU) insurance plan, which provides coverage against conditions of insufficient heat for producing irrigated corn silage or grain
  - NDVI Index with short-season and a long-season options
Livestock Gross Margin (LGM)

- Protects the loss of gross margin (Difference between market value and the feed cost)
  - Market value of insured animals
  - Feed cost: cost of corn and soybean meal.
- Insurable Products:
  - Cattle, Dairy, Swine
- Eligibility:
  - Selected states for cattle and swine producers;
  - All 48 states for milk producers
- Indemnity paid if
  - Insured gross margin > actual gross margin
- Gross Margin Guarantee:
  - Based on producer’s target marketing and future prices
- 100 % Coverage
Livestock Gross Margin (LGM)

- Producer’s target marketing and feed:
  - # cattle, swine head, or hundredweight of milk to be insured
  - Cattle and swine: Default animal head weight and feed per head
  - Dairy producers have two options:
    - Default # of corn and soybean meal to be fed during the insurance period
    - Producer’s choice on # tons of soybeans and corn meal per month per hundredweight of milk (Caps applicable)
- Producer choose level of deductibles
- Premium subsidies only if target market more than 2 months in an insurance period
  - increases as deductible increases
- Twelve insurance period each calendar year
- No coverage limit on # of head insured
Livestock Risk Protection (LRP):

- Provides protection against price declines below coverage price

- Insurable products:
  - Cattle (feeder and fed), swine, and lamb

- Insurance Period: Variable 13–52 weeks (lower for lambs & swine)

- Coverage price: prices insured by producer, change daily and posted by RMA (weakly for lamb).
  - Prices and rates based on CME contracts

- Coverage Levels: 70%–100% (80%–95% lambs)

- Coverage Limit: feeder 2000 head; fed 4000, lamb 28,000;

- Target weight: Default weights or ranges
LGM/LRP and Private Options

- This protection has long been available in private options markets
- Why should the government be involved?
  - Basis risks?
  - Contracts do not fit individual risks?
- LGM premium is not subsidized but A&O is
- LRP has 13% premium subsidy and A&O
- LGM is equivalent to an Asian Option (a bundle of overlapping options)
- Raises a number of technical issues relating to modeling of correlations across overlapping contracts
Livestock Risk Calculator Tool

- Developed by NCSU, RMA, and KSU partnership
- http://www.naiber.org/cattleriskanalyzer/
Recently Added 7 Risk Management Options, Including LRP

Expected Profit Per Head: $324.01

Expected Cash Profit Per Head: $324.01
  Lower and Upper two-thirds distribution: $144.96 and $504.85

Expected Cattle Hedged Profit Per Head: $324.84
  Lower and Upper two-thirds distribution: $230.58 and $422.96

Expected Cattle and Corn Hedged Profit Per Head: $324.96
  Lower and Upper two-thirds distribution: $287.79 and $362.26

Expected Cattle At-Money-Put Option Profit Per Head: $348.72
  Lower and Upper two-thirds distribution: $221.02 and $476.26

Expected Cattle and Corn At-Money Options Profit Per Head: $386.06
  Lower and Upper two-thirds distribution: $286.29 and $487.66

Expected Livestock Revenue Protection Profit Per Head: $331.08
  Lower and Upper two-thirds distribution: $185.14 and $484.62

Click on the links below to Compare Risk Management Strategies by Graphs.

Expected Cash Profit Per Head:
Expected Cattle Hedged Profit Per Head:
Expected Cattle and Corn Hedged Profit Per Head:
Expected Cattle At-Money-Put Option Profit Per Head:
Expected Cattle and Corn At-Money Options Profit Per Head:
Expected Livestock Revenue Protection Profit Per Head:
LRP Feeder Cattle Example

- # Insured heads = 100
- Feeder cattle target weight = 7.5 cwt/head
- 100% insured share
- Expected ending value = $78.95/cwt
- Coverage price = $75/cwt
- Premium rate = 1.3990%
- Premium subsidy = 13%
- Insured Value = (100 * 7.5 * 75 * 1) = $56,250
- Producer Paid Premium = (0.03990) * ($56,250) * (1 - 0.13) = $685
- Actual price = $70/cwt
- Indemnity = (100 * 7.5) * (75 - 70) * 1 = $3,750
Three programs to cover pasture and rangeland

- 588 million acres of pasture and rangeland in US.
- 61.5 million acres of hay land
- Three programs
  - Pasture, Rangeland, Forage (PRF) – Rainfall Index (RI)
  - Pasture, Rangeland, Forage (PRF) – Vegetation Index (NDVI)
  - Forage Production Index
- Programs initially available in 6 regions to test indexes in different climates, soils and weather conditions
PRF–RI and NDVI Availability 2011

- Rainfall Index Pilot Area
- Vegetation Index Pilot Area
Pasture, Rangeland, Forage Rainfall Index (PRF–RI)

- **Crops:** Pasture, Rangeland, Forage
- **Crop Types:** Grazing land, Hay land
  - Established acreage of perennial forage
  - Intended for grazing by livestock or haying
  - Acreage must be suitable for grazing/haying
  - Covers all types of grazing and haying forage
- **GRP program:**
  - Geographical Unit: 12 m x 12 m Grids
    - Grid size reduces basis risk vs. county size
    - Allows for closer correlation to individual experience
Index Intervals

- Multiple intervals offered per year: Six 2-month intervals for each grid
- These Intervals act as ‘mini-insurance periods’
- Ability for producers to manage appropriate timing risks
- Correlate to individual growth patterns and production seasons
- Producers must select at least 2 intervals
Pasture, Rangeland, Forage Rainfall Index (PRF-RI)

- Coverage levels: 70%–90%
- Rating:
  - Each grid, index interval, and coverage level is individually rated
  - Minimizes adverse selection
- Single Peril coverage:
  - Deviation from long-term normal precipitation is used to establish the index
  - Precipitation has a high degree of correlation to forage production
Pasture, Rangeland, Forage Rainfall Index (PRF-RI)

- **Sales Closing Date: November 30**
  - Minimizes possible forecasting and program abuse
    - 60 day lag to the crop year

- **Program supported via internet**
  - Provides the most efficient and effective way to deliver the program
  - Allows access to the mapping tools
  - Locate grazing areas and associated Grid ID numbers
  - Provides access to the historical rainfall indices
  - Allows access to all relevant data, materials, and tools associated with the program
Pasture, Rangeland, Forage Rainfall Index (PRF–NDVI)

- Based on Normalized Difference Vegetation Index (NDVI)
- Data obtained from US EROS satellites observing long-term changes in greenness of vegetation of the earth since 1989.
- NDVI:
  - Alternate measure of vegetation greenness
  - Used to estimate local forage conditions and productive capacity
  - Not a direct measure of any specific crop production
  - It correlates to ALL vegetation or biomass in a grid
The NDVI program uses data over 4.8 by 4.8 mile grid
  - Temperature data used to constrain the NDVI results when extreme temperatures

Losses indemnified based on deviations from normal NDVI (expected grid index) within grid and index interval selected

Producers are indemnified when the NDVI index falls below the “trigger grid index”
  - Trigger grid index = (Coverage level)*(Expected Grid Index)
Pasture, Rangeland, Forage Rainfall Index (PRF–NDVI)

Idaho

Wyoming
NDVI During Drought (2005)

A. (6/1 to 6/14 of 2005)
Forage Production Index

- GRP Insurance
- Based on NASS county level hay yield data
- Products: All hay or alfalfa hay
- Index reflect how much hay is produced relative to the county’s long term trend
- Coverage available in selected counties
AQU Insurance Plan (Pilot)

Protects producers of cultivated clams from deaths related to
- Oxygen depletion due to vegetation,
- Microbial activity,
- Harmful algae bloom,
- Other causes: disease, hurricanes, storms, freeze, tidal wave, and other catastrophic weather events defined by NOAA

Oyster GRP:
Federal Crop Insurance Corp
Summary of Business Report for 2008 thru 2011
As of 11-15-2010

(Net Acre and Dollars in Thousands)

<table>
<thead>
<tr>
<th>Additional Business</th>
<th>2008 Crop Year To Date</th>
<th>2009 1 Year Ago To Date</th>
<th>2009 Crop Year To Date</th>
<th>2010 1 Year Ago To Date</th>
<th>2010 Crop Year Prev Week</th>
<th>2010 Crop Year To Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies with Premium</td>
<td>1,028,537</td>
<td>1,074,600</td>
<td>1,076,191</td>
<td>51,622</td>
<td>1,057,450</td>
<td>1,058,138</td>
</tr>
<tr>
<td>Units with Premium</td>
<td>2,836,500</td>
<td>2,530,242</td>
<td>2,581,462</td>
<td>116,283</td>
<td>2,443,821</td>
<td>2,445,227</td>
</tr>
<tr>
<td>Liability</td>
<td>81,443,005</td>
<td>71,532,107</td>
<td>71,662,776</td>
<td>3,025,549</td>
<td>70,746,582</td>
<td>70,813,184</td>
</tr>
<tr>
<td>Total Premium</td>
<td>9,515,653</td>
<td>8,625,214</td>
<td>8,642,078</td>
<td>257,576</td>
<td>7,296,560</td>
<td>7,303,697</td>
</tr>
<tr>
<td>Subsidy</td>
<td>5,355,130</td>
<td>5,107,238</td>
<td>5,118,395</td>
<td>153,846</td>
<td>4,423,898</td>
<td>4,428,530</td>
</tr>
<tr>
<td>Indemnity</td>
<td>8,605,655</td>
<td>3,108,819</td>
<td>5,142,315</td>
<td>489</td>
<td>1,835,997</td>
<td>2,049,297</td>
</tr>
<tr>
<td>Loss Ratio</td>
<td>0.90</td>
<td>0.30</td>
<td>0.60</td>
<td>0.00</td>
<td>0.25</td>
<td>0.28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catastrophic Business</th>
<th>2008 Crop Year To Date</th>
<th>2009 1 Year Ago To Date</th>
<th>2009 Crop Year To Date</th>
<th>2010 1 Year Ago To Date</th>
<th>2010 Crop Year Prev Week</th>
<th>2010 Crop Year To Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies with Premium</td>
<td>120,767</td>
<td>95,708</td>
<td>95,775</td>
<td>9,514</td>
<td>80,061</td>
<td>80,100</td>
</tr>
<tr>
<td>Units with Premium</td>
<td>186,727</td>
<td>148,069</td>
<td>148,252</td>
<td>10,393</td>
<td>123,547</td>
<td>123,683</td>
</tr>
<tr>
<td>Net Acres Insured</td>
<td>30,039</td>
<td>22,226</td>
<td>22,277</td>
<td>1,122</td>
<td>20,135</td>
<td>20,150</td>
</tr>
<tr>
<td>Liability</td>
<td>8,454,591</td>
<td>7,893,505</td>
<td>7,914,170</td>
<td>2,687,671</td>
<td>7,052,284</td>
<td>7,055,520</td>
</tr>
<tr>
<td>Total Premium</td>
<td>335,973</td>
<td>307,796</td>
<td>308,174</td>
<td>51,966</td>
<td>265,236</td>
<td>265,483</td>
</tr>
<tr>
<td>Subsidy</td>
<td>335,973</td>
<td>307,796</td>
<td>308,174</td>
<td>51,966</td>
<td>265,236</td>
<td>265,483</td>
</tr>
<tr>
<td>Indemnity</td>
<td>75,294</td>
<td>38,616</td>
<td>70,793</td>
<td>0</td>
<td>23,154</td>
<td>24,223</td>
</tr>
<tr>
<td>Loss Ratio</td>
<td>0.22</td>
<td>0.13</td>
<td>0.23</td>
<td>0.00</td>
<td>0.09</td>
<td>0.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combined Business</th>
<th>2008 Crop Year To Date</th>
<th>2009 1 Year Ago To Date</th>
<th>2009 Crop Year To Date</th>
<th>2010 1 Year Ago To Date</th>
<th>2010 Crop Year Prev Week</th>
<th>2010 Crop Year To Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies with Premium</td>
<td>1,149,304</td>
<td>1,170,608</td>
<td>1,171,966</td>
<td>61,136</td>
<td>1,137,511</td>
<td>1,139,238</td>
</tr>
<tr>
<td>Units with Premium</td>
<td>3,023,227</td>
<td>2,728,311</td>
<td>2,729,714</td>
<td>126,876</td>
<td>2,567,368</td>
<td>2,568,910</td>
</tr>
<tr>
<td>Net Acres Insured</td>
<td>272,281</td>
<td>264,371</td>
<td>264,769</td>
<td>8,997</td>
<td>255,365</td>
<td>255,565</td>
</tr>
<tr>
<td>Liability</td>
<td>89,897,596</td>
<td>79,425,612</td>
<td>79,576,946</td>
<td>5,713,220</td>
<td>77,798,866</td>
<td>77,868,704</td>
</tr>
<tr>
<td>Total Premium</td>
<td>9,851,626</td>
<td>8,933,010</td>
<td>8,950,752</td>
<td>304,542</td>
<td>7,561,796</td>
<td>7,569,180</td>
</tr>
<tr>
<td>Subsidy</td>
<td>5,691,103</td>
<td>5,415,034</td>
<td>5,426,569</td>
<td>205,812</td>
<td>4,689,134</td>
<td>4,694,013</td>
</tr>
<tr>
<td>Indemnity</td>
<td>8,680,949</td>
<td>3,147,435</td>
<td>5,213,108</td>
<td>489</td>
<td>1,859,151</td>
<td>2,073,520</td>
</tr>
<tr>
<td>Loss Ratio</td>
<td>0.88</td>
<td>0.35</td>
<td>0.58</td>
<td>0.00</td>
<td>0.25</td>
<td>0.27</td>
</tr>
</tbody>
</table>
## U.S. Livestock Insurance Summary of Business (2009)

### 2009 Crop Insurance Summary of Business

<table>
<thead>
<tr>
<th>Ins Plan Name</th>
<th>Pol Sold</th>
<th>Net Acres</th>
<th>Liabilities</th>
<th>Total Premium</th>
<th>Subsidy</th>
<th>Indemnity</th>
<th>Loss Ratio</th>
<th>Liab %</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRF–RI</td>
<td>12,719</td>
<td>33,697,591</td>
<td>455,132,528</td>
<td>87,230,740</td>
<td>47,256,652</td>
<td>44,590,101</td>
<td>.51</td>
<td>0.57%</td>
</tr>
<tr>
<td>PRF–NDVI</td>
<td>3,027</td>
<td>7,233,718</td>
<td>78,652,232</td>
<td>8,407,752</td>
<td>4,433,743</td>
<td>1,218,336</td>
<td>.14</td>
<td>0.10%</td>
</tr>
<tr>
<td>AQUACULTURE</td>
<td>225</td>
<td>0</td>
<td>31,131,527</td>
<td>1,078,247</td>
<td>698,932</td>
<td>442,263</td>
<td>.41</td>
<td>0.04%</td>
</tr>
<tr>
<td>All</td>
<td>2,047,737</td>
<td>264,768,508</td>
<td>79,576,263,648</td>
<td>8,950,205,608</td>
<td>5,426,542,784</td>
<td>5,210,568,494</td>
<td>.58</td>
<td>100%</td>
</tr>
</tbody>
</table>

### 2009 Livestock Insurance Summary of Business

<table>
<thead>
<tr>
<th>Ins Plan Name</th>
<th>Pol Sold</th>
<th>Number of Head</th>
<th>Liabilities</th>
<th>Total Premium</th>
<th>Subsidy</th>
<th>Indemnity</th>
<th>Loss Ratio</th>
<th>Liab %</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGM</td>
<td>430</td>
<td>532,780</td>
<td>24,667,223</td>
<td>1,333,792</td>
<td>0</td>
<td>3,115,103</td>
<td>2.34</td>
<td>23%</td>
</tr>
<tr>
<td>LRP</td>
<td>6,084</td>
<td>302,418</td>
<td>83,193,358</td>
<td>2,823,566</td>
<td>367,084</td>
<td>5,319,268</td>
<td>1.88</td>
<td>77%</td>
</tr>
<tr>
<td>All</td>
<td>6,514</td>
<td>835,198</td>
<td>107,860,581</td>
<td>4,157,358</td>
<td>367,084</td>
<td>8,434,371</td>
<td>2.03</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Livestock Insurance products are relatively new products
  - Liability share was only 0.84% in 2009
The US operates largest crop insurance program
In existence since 1938
$90 billion in liability projected for 2011
Returns about $2.10 for each $1 in premium paid by farmers
Unique arrangement of federal government and private insurance companies
SRA mechanism provides subsidies and risk sharing to private companies
Table 1: Annual Average Direct Government Payments to Farmers and Federal Crop Insurance Subsidies

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Average Direct Government Payments ($ billion)</th>
<th>Annual Average Federal Crop insurance Subsidies ($ billion)</th>
<th>Federal Crop Insurance Subsidies as a Percentage of Total Direct Payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-84</td>
<td>4.887</td>
<td>0.177</td>
<td>3.6%</td>
</tr>
<tr>
<td>1985-89</td>
<td>12.326</td>
<td>0.748</td>
<td>6.1%</td>
</tr>
<tr>
<td>1990-94</td>
<td>9.592</td>
<td>0.602</td>
<td>6.3%</td>
</tr>
<tr>
<td>1995-99</td>
<td>11.201</td>
<td>1.111</td>
<td>9.9%</td>
</tr>
<tr>
<td>2000-04</td>
<td>17.512</td>
<td>2.514</td>
<td>14.4%</td>
</tr>
<tr>
<td>2005-08</td>
<td>16.122</td>
<td>2.715</td>
<td>16.8%</td>
</tr>
</tbody>
</table>
Mistakes in Pricing? Adverse Selection

- Suppose I price against the risk of average farmer, but in county there is heterogeneity in risk—some more risky, some less risky.
- I then overcharge low risk farmers and undercharge high risk farmers.
- So what if I’m off a little. Errors will average out. On average, I’ll be OK. Right?
- Who has greater incentive to buy insurance?
Ratio of Indemnities to Subsidy-Adjusted Premiums

Source: Unpublished RMA data
Research confirms low risk individuals are more responsive to premium increases.
Thus, errors in pricing will distort risk of pool—skew it toward high risk as low risk individuals are less likely to buy—indemnities rise and program loses money.
How can I fix this? Raise all rates? (GAO).
Raising rates drives out low risk end of pool—pool become smaller and riskier—losses increase.
Eventually, the plan fails.
Called the “death spiral” of adverse selection.
Adverse Selection

- The greatest problem facing any insurer.
- Inaccurate prices lead to pulling in riskier part of the insurance pool.
- This is an information problem.
- In public policy sense, there may be problems with adequately discriminating against higher risks—after all, some say the program is meant to help these individuals.
Catastrophic Risks

- Insurers typically price above fair rate to build reserves and cover operating costs.
- Another issue—crops are special as risks are “systemic”—they cannot be diversified over policies—not true of many private lines (fire, life, etc.).
- For a private insurer, reserves and reinsurance may not be enough to allow for the “big hit”.
- This is an issue related to spatial correlation, due to weather—bad years involve widespread losses.
- How do we price/handle this?
  - Reinsurance (is the market deep enough?)
  - Loading to build reserves
  - Government reinsurance (deeper pockets)
Moral Hazard

- Occurs if insurance buyer changes behavior after buying insurance.
- The term “moral hazard” makes us think of fraud and abuse, but to an economist, it may just be rational behavior.
- Would you drive your car differently if you did not have any insurance?
- Less fertilizer, less chemicals, less “worry” about what-ifs and thus less self-protection.
- Certainly relevant in insurance, and adjusting for losses plays key role.
- Really is a monitoring problem– can the insurer observe behavior and price accordingly?