Weather insurance and index-based Insurance
Reflections by Thomas Loster

Mexico City, 9 November 2014
Weather Insurance

1. Traditional versus “new”
   - Differences
   - Examples

2. Index key issues
   - trust and illiteracy
   - demand
   - triggers
   - basis risk
   - expectations and patience

3. Forgotten benefits
The insured and the uninsured World
Non-life including health per person and per year

Source
Munich Re, 2006
## Links between Weather and Financial Risk

New Products for the Insured World (year 2000)

<table>
<thead>
<tr>
<th>Risk Holder</th>
<th>Weather type</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy industry</td>
<td>Temperature</td>
<td>Lower sales during warm winters and cool summers</td>
</tr>
<tr>
<td>Energy consumers</td>
<td>Temperature</td>
<td>Higher heating/cooling costs in cold winters and hot summers</td>
</tr>
<tr>
<td>Beverage producers</td>
<td>Temperature</td>
<td>Lower sales during cool summers</td>
</tr>
<tr>
<td>Building material companies</td>
<td>Temperature/Snowfall</td>
<td>Lower sales in severe winters (construction sites shut down)</td>
</tr>
<tr>
<td>Construction companies</td>
<td>Temperature/Snowfall</td>
<td>Delays in meeting schedules during periods of poor weather</td>
</tr>
<tr>
<td>Ski resorts</td>
<td>Snowfall</td>
<td>Lower revenue during winters with below-average snowfall</td>
</tr>
<tr>
<td>Agricultural industry</td>
<td>Temperature/Snowfall</td>
<td>Significant crop losses due to extreme temperatures/lack of rain</td>
</tr>
<tr>
<td>Municipal governments</td>
<td>Snowfall</td>
<td>Higher snow removal costs during strong winters (snow)</td>
</tr>
<tr>
<td>Road salt companies</td>
<td>Snowfall</td>
<td>Lower revenues during low snowfall winters</td>
</tr>
<tr>
<td>Hydroelectric power generation</td>
<td>Precipitation</td>
<td>Lower revenues during periods of drought</td>
</tr>
</tbody>
</table>

Source: Catastrophe Reinsurance Newsletter, issue 78, August 1999
Commercial index insurance
River Danube – effect of a put option on discharge

Impact of precipitation and streamflow on power production

Source: SFR (Special Financial Risks), Munich Re, November 2014
Commercial index insurance
“HDD Call” detrending of historic weather data

Source: SFR (Special Financial Risks), Munich Re, November 2014
# Commercial index insurance

## Crop and Grassland

<table>
<thead>
<tr>
<th>Country</th>
<th>Types</th>
<th>Index product</th>
<th>Premium [million €]</th>
<th>Liability [million €]</th>
<th>Ø Rate</th>
<th>Farmers insured In million</th>
<th>Area insured In million ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>India (2012/2013)</td>
<td>Crop</td>
<td>Area yield (NAIS/MNAIS)</td>
<td>233</td>
<td>5110</td>
<td>*</td>
<td>18.4</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>Crop</td>
<td>Meteo trigger (WBCIS)</td>
<td>275</td>
<td>2931</td>
<td>9.4%</td>
<td>13.2</td>
<td>18.4</td>
</tr>
<tr>
<td></td>
<td>Grassland</td>
<td>Area yield**</td>
<td>226</td>
<td>3156</td>
<td>7.2%</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Grassland</td>
<td>Meteo trigger (precipitat.)</td>
<td>142</td>
<td>703</td>
<td>20.1%</td>
<td>20.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grassland</td>
<td>Vegetation Index (NDVI)</td>
<td>6</td>
<td>31</td>
<td>19.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spain (2013)</td>
<td>Grassland</td>
<td>Vegetation Index (NDVI)</td>
<td>11</td>
<td>94</td>
<td>11.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* NAIS 3.3% and MNAIS 10.9%// ** Products: GRP, GRIP, GRIPH

Sources: Own calculations using data of Government of India, RMA, Agroseguro 2014

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Source: J. Herbold, Munich Re, November 2014
Weather Insurance
Difference in Developed versus Developing World

Developed
- Long history, good experience
- Good data (Weather Services, NOAA etc.)
- Good modeling
- Various models
- Good trust

Developing World
- Often pilot phase
- Often poor data
- Very different concepts
- Emerging trust
To calibrate your eye, a 20 kilometer radius around a set of accredited meteorological stations… (~1250 square km)

Here, a 50 kilometer area (~7850 square km)

Making climate-related insurance work in Africa: targeting and monitoring micro-insurance programs
John D. Corbett Ph.D., Mudsprings
November 2006

19.11.2014
Rainfall and Rainfall Stations
Deep Science

Figure 1: Decrease of the strength of the correlation between weather stations as a function of distance. The variable is total rainfall over phenological phases for the 25 Nyala stations over the period from 1981 to 2009. Thedekad groups are those defined above in section 3.1, i.e. dekads 15 to 25 (1a; top left), 20 to 25 (1b, top right), 26 to 28 (bottom left) and 29 to 32 (bottom right).

We estimate crop losses using an adaptation of the Food and Agriculture Organization’s crop water satisfaction model (Cole and Tufano, 2007; Bentvelsen and Branscheid, 1986). In this model, crop losses are proportional to the percentage evapotranspiration\(^1\) deficit from the maximum evapotranspiration by the crop-specific yield response factor \(K_y\). We proxy for evapotranspiration with rainfall, and define the shock \(S\) as follows:

\[
S = 1(R < R_{max})K_y(1 - \frac{R}{R_{max}})Y_n
\]

Where \(R\) is rainfall and \(R_{max}\) corresponds to the 90th percentile of the rainfall distribution, which we assume is the rainfall threshold below which crop losses begin to occur.\(^2\) We assume that the shock is proportional to \(Y_n\), which represents the maximum level of income that can be lost due to a shock. We set \(Y_n\) at 10,500, which is equal to the average yearly difference between income in a good rainfall year versus a bad rainfall year as self-reported by our farmers.
Weather Insurance
1. Chicken rice & chowmain .......... $9 - $14
2. Chicken fry rice ................. $9 - $14
3. Chicken chowmain ............... $9 - $14
4. Chicken & fries ................. $9 - $20
5. Fish & fries ...................... $7 - $10
6. French fries ...................... $7 - $10
7. Pork Rice & chowmain .......... $11 - $16
8. Pork with black bean sauce ... $17 - $22
9. Pork with Ginger sauce ....... $17 - $22
10. Mix rice & chowmain .......... $17
11. Beef rice & chowmain .......... $12 - $17
12. Beef with black bean sauce ... $17 - $22
13. Beef with ginger sauce ...... $17 - $22
14. Fish rice & chowmain .......... $14 - $20
15. Fish with black bean sauce ... $20 - $24
16. Fish with ginger sauce ...... $20 - $24
17. Shrimp Rice & chowmain ...... $20 - $27
18. Shrimp with black bean sauce $22 - $29
19. Shrimp with ginger sauce ..... $22 - $30
20. Sweet & sour chicken rice & chowmain .................. $12 - $17
21. Sweet & sour pork rice & chowmain .................. $17 - $22
22. Sweet & sour chicken .......... $22
23. Sweet & sour Shrimp Rice & Chowmein .................. $24 - $32
24. Sweet & Sour fish rice & chowmain .................. $26 - $27
25. Young chow fried rice .......... $13 - $17
26. Egg fried rice .................. $16
27. Salt fish & chicken fried rice .. $15 - $18
28. Curry Fried rice .............. $12 - $18
29. Curry chowmain ............... $9 - $12
30. Wing rice & chowmain .......... $9 - $13
31. Wing & Fries .................. $11 - $15
32. Crispy wonton .................. $10 - $12
33. Fried chicken .................. $10 - $12
34. Wanton soup ................... $10 - $12
35. Vegetable soup ............... $12
36. Chicken corn soup .......... $12
37. Chicken chop suri ........... $22
38. Pork chop suri ............... $22
39. Fish chop suri ............... $22
40. Shrimp chop suri .......... $22
41. Strip chicken rice & chowmain .......... $10 - $17
42. Spring roll ................... $12
43. Fried Shrimp & Fries ........ $17 - $26
44. Fry shrimp rice & chowmain .. $17 - $22
45. Sweet & Sour chicken with fries .......... $14 - $19
46. Curry chicken rice & chowmain .......... $12 - $17
Ethiopian farmers get their first “drought insurance” payout

Gebre Kiros Teklehaimanot is among the first Ethiopian farmers to receive a payout on his weather insurance policy. Photo: Oxfam
Complexity of Microinsurance Products as seen by the Microinsurance Network (CGAP)

- Natural Disaster insurance
- Crop insurance
- Annuities and endowment (retirement provision)
- Health and disability insurance
- Property insurance
- Term life insurance (payment to beneficiaries on death)

Index Insurance
Different Opinions

„Index Insurance is an ideal tool for serving millions or even billions of poor people.“

„Don‘t use index insurance: it can harm insurance for years and decades in large parts of the world.“

„Index insurance is great when environmental conditions are taken into considerations.“
Index Insurance

Illiteracy

– Convince people who only know about savings

– Tell a farmer after a huge losses that a trigger was not triggered (tell him he gets money even if he had no problem)

– Convince a donor that investing in premiums makes more sense

– Explain to a politician what index insurance is

If the insured does not understand and adopt the principle reputation might be lost for years or decades*

* Maybe the most important sentence of the presentation
Index Insurance in the early 21st Century
Many projects in many parts of the world

Setting
- Climate change adaptation (huge amounts of money in due time)
- Increasing interest in microfinance and microinsurance (buzz words)
- Promising models

Concerns
- Data
- Outreach
- Scaling
- Sustainability

The New York Times

September 30, 2009

Africa Experiments With Climate Insurance -- for $5 a Year
Weather Insurance

19.11.2014
Index Insurance

Summary

– Index insurance is urgently needed, it can be a good solution where better systems cannot be applied (e.g. PPP approaches)

– No success without widely adopted index constructions

– Modeling skills are exciting (high expectations for improved remote sensing serving concepts such as yield index)

– Do not underestimate illiteracy and training (on all sides!)

– Convince the stakeholders and get index insurance beyond pilot stage

– Multi-year engagement needed