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**Global Best Practices in ERM for
Insurers and Reinsurers Webcast
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**Session # 3A: The Pros and Cons of Economic
Capital Models vs. Stress Testing**

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Moderator

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Global Best Practices in ERM for Insurers and Reinsurers 

Session 3A: The Pros and Cons of Economic Capital Models vs. Stress Testing

Presenters: Stephen P. Lowe, MAAA, FCAS
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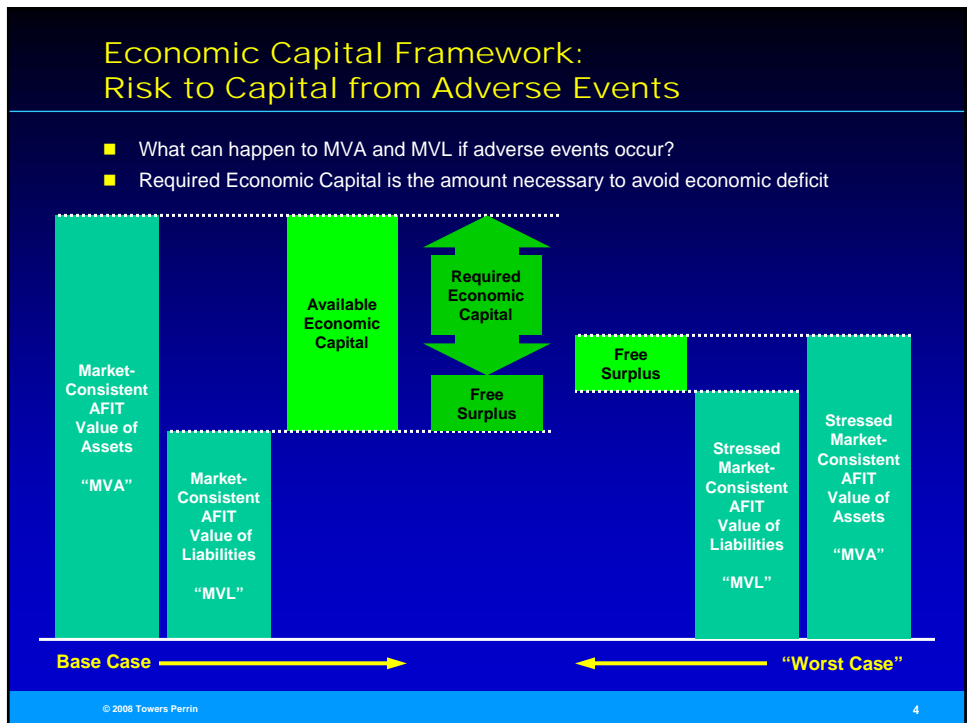
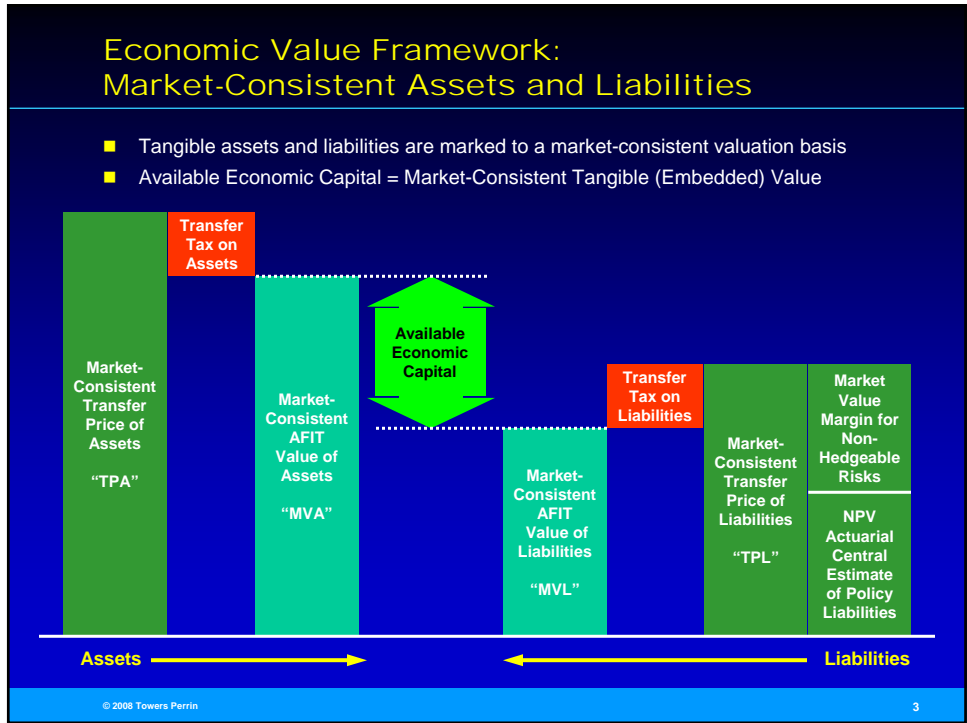
Stochastic Models, Stress Tests and Emerging Risks

Pros and Cons of Models versus Stress Testing

Stephen Lowe, Managing Director

10 December 2008

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Framework concepts are simple, but implementation is harder than it looks

- A range of approaches, with two polar extremes
 1. Stress test each risk
 - simpler, easier to understand, but more approximate
 2. Integrated stochastic model
 - more complex, harder to understand, but with more explanatory value
- Common aspects of all approaches
 - Must specify a set of risk drivers, then relate asset and liability behavior to each driver
 - Must specify dependency structure to combine risks together

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In addition to choosing a risk measurement approach, one must also specify a risk horizon

Horizon	Fundamental Question Being Asked	Criticisms	Application
One-Year	<i>What might happen to next year's balance sheet?</i> <i>What EC might be consumed in one year?</i>	<ul style="list-style-type: none"> ■ Assumes that risk position can be reduced or additional capital can be raised at the end of the year 	Companies with: <ul style="list-style-type: none"> ■ Active capital management ■ Strong earnings momentum ■ Significant franchise value
Run-Off	<i>What might the asset and liability cash flows ultimately be?</i> <i>What EC might be consumed in running off the existing liabilities?</i>	<ul style="list-style-type: none"> ■ Requires capital to be held now against possible future consumption later ■ Inconsistent with real-world annual balance sheet reviews ■ Makes aggregation of risks very difficult 	<ul style="list-style-type: none"> ■ Companies that build capital primarily through retained earnings ■ Troubled companies

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Why is there a trend towards one-year risk horizon?

Four principal problems with run-off horizon:

1. **Aggregation of risks with different horizons is an intractable problem**
 - How does one combine one-year equity market risk with workers compensation reserve run-off risk?
 - Putting assets into run-off model dilutes market risk
2. **In the real world, periodic balance sheets (not cash flows) are the way capital adequacy is monitored**
 - Run-off cash flow testing misses mid-course failures
 - Trapping mid-course failures produces ultra-conservative results
3. **Projections of future conditions 10-20 years into the future are speculative**
 - One-year projections only require that we articulate possible future states one year from now, not far into the future
 - Its hard to specify stress tests over multi-year horizon
- **Holding capital now against possible future consumption is inefficient**
 - Efficient markets won't sustain prices at run-off capital levels
 - Firms that have financial flexibility to operate on the one-year model should be allowed that advantage

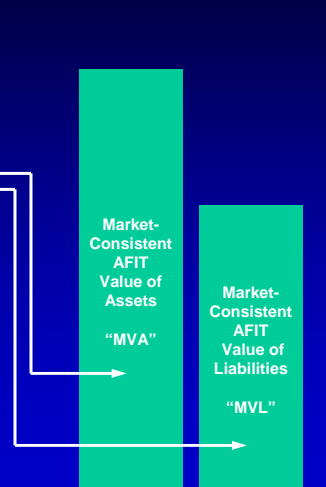
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7

Stress tests focus on the individual impact of direct risk drivers

- Direct risk drivers (illustrative)
 - Change in interest rates
 - Decline in equity market
 - Change in credit spreads
 - Widespread credit defaults
 - Reinsurer defaults
 - Misestimation of policy liabilities
 - Adverse policyholder behavior
 - Catastrophic claim event
 - Catastrophic operational failure
 - Currency movements

*Taken one at a time, how will each risk driver affect the MVA and the MVL?
(Note: may require stochastic valuation)*



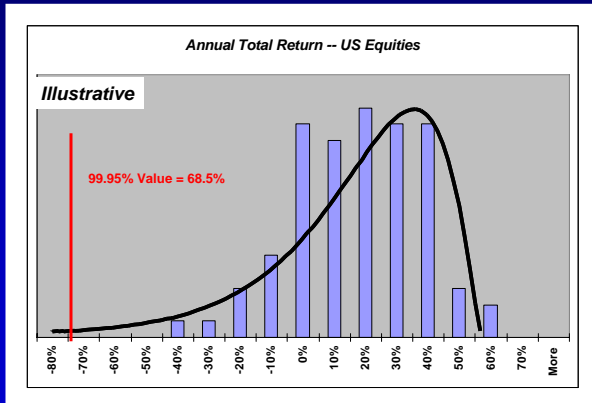
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8

Calibration of each stress test requires specification of the threshold magnitude

83 years of stock market data – from which the 1-in-2000 outcome must be divined

- Which years to exclude?
- What distributional form?
- What judgments to make?

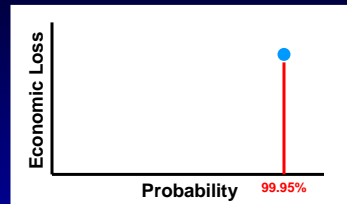


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9

Combining the risks together requires assumptions about their dependencies

- Each stress test implies an amount of required economic capital for that risk factor alone



- Simplifying assumption for estimating required aggregate economic capital across all risk factors:
 - Adopt a mean-variance-covariance framework and combine the *economic capital amounts* together using covariance formula
 - Technically only correct if all distributions are normal
 - Correlation matrix should reflect correlation in the tail, not in the average situation

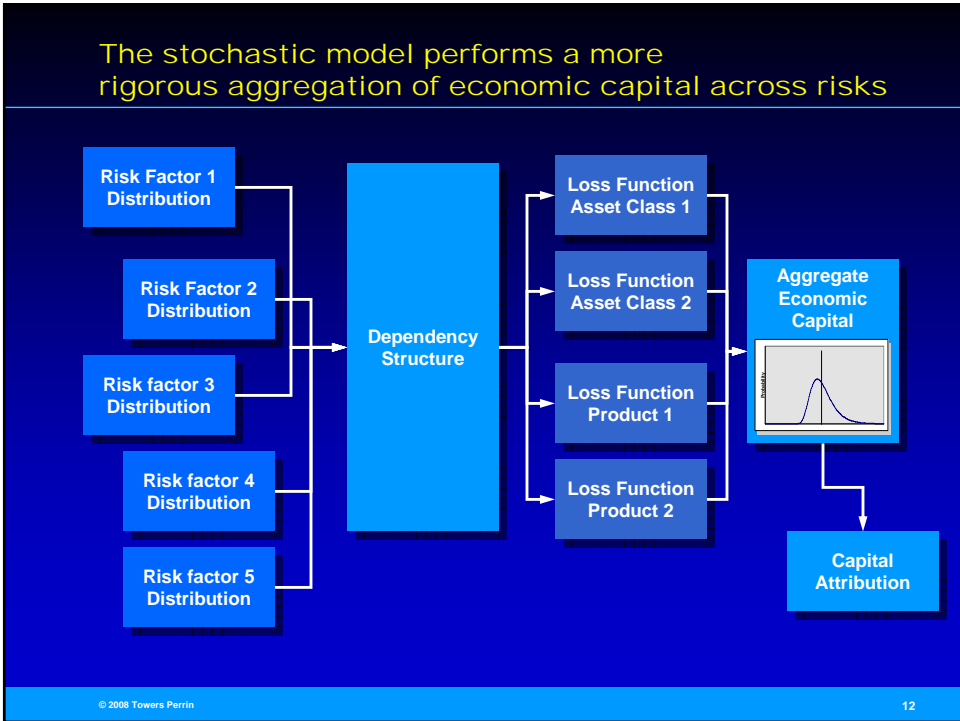
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10

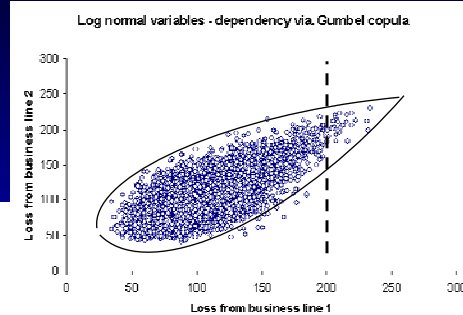
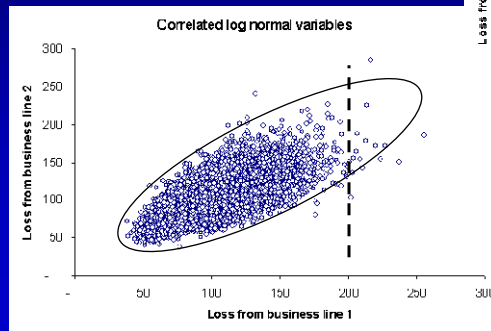
Stochastic models use complete distributions, allow for more risk factors and risk interactions

- Indirect risk factors interact with direct risk factors; affect MVA and MVL
 - Inflation (either general or sector-specific)
 - Housing prices
 - Wages
 - Medical care
 - Energy
 - Recession
 - Unemployment
 - Fiscal and Tax Policy
- Goal of stochastic model is to create plausible scenarios for risk factors, and translate those conditions into MVA and MVL impacts
 - Should replicate stress test results for individual risk factors
 - Provides richer dependency structure
 - Aggregation/allocation of economic capital across risk factors is a by-product

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State-specific dependency structure can be addressed via copulas



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13

Both stress testing and stochastic model don't capture all risks

- Under both approaches calibration reflects stylized historical record
 - Tendency to remove extreme values, treating them as anomalies from “different regimes”
 - 1930's depression
 - WW2 asbestos claims
 - Hyper-inflation
 - Need to hold economic capital for future anomalies, that will be different, but could be the same magnitude as past ones
 - World trade center attack
 - Hurricane Katrina
 - Credit meltdown

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14



Economic Capital Models vs. Stress Testing to detect Emerging Risks and Opportunities

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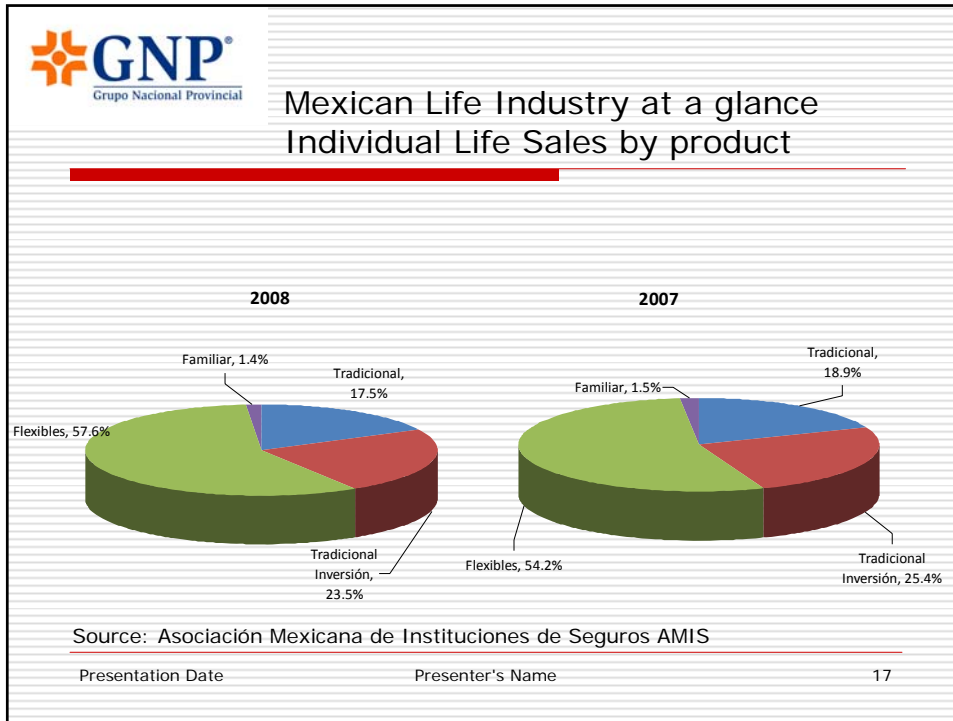
Presentation Date Presenter's Name 15



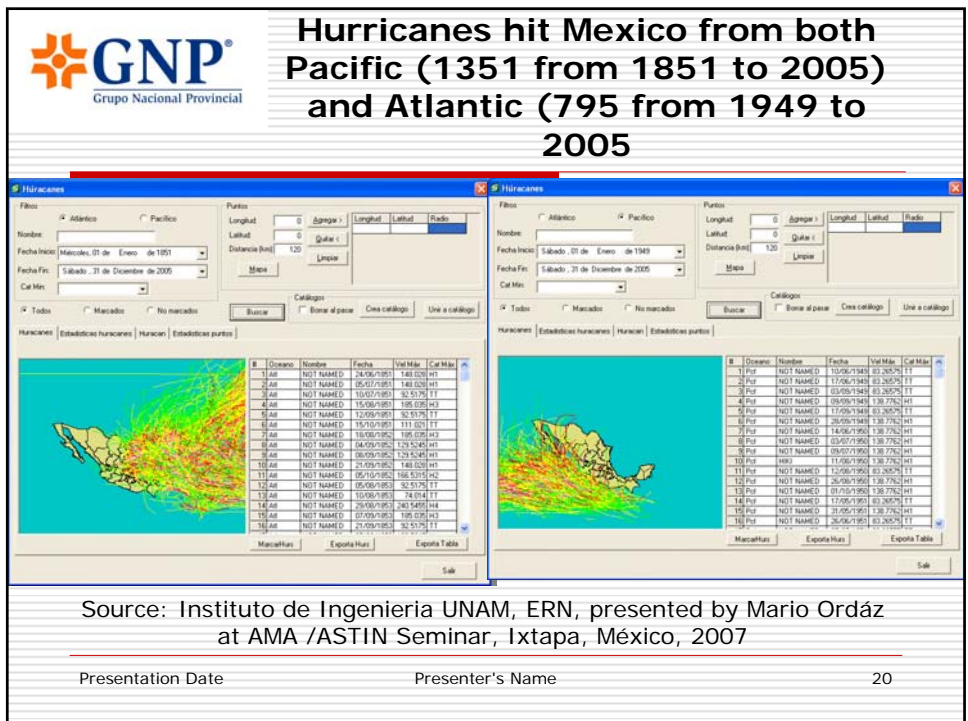
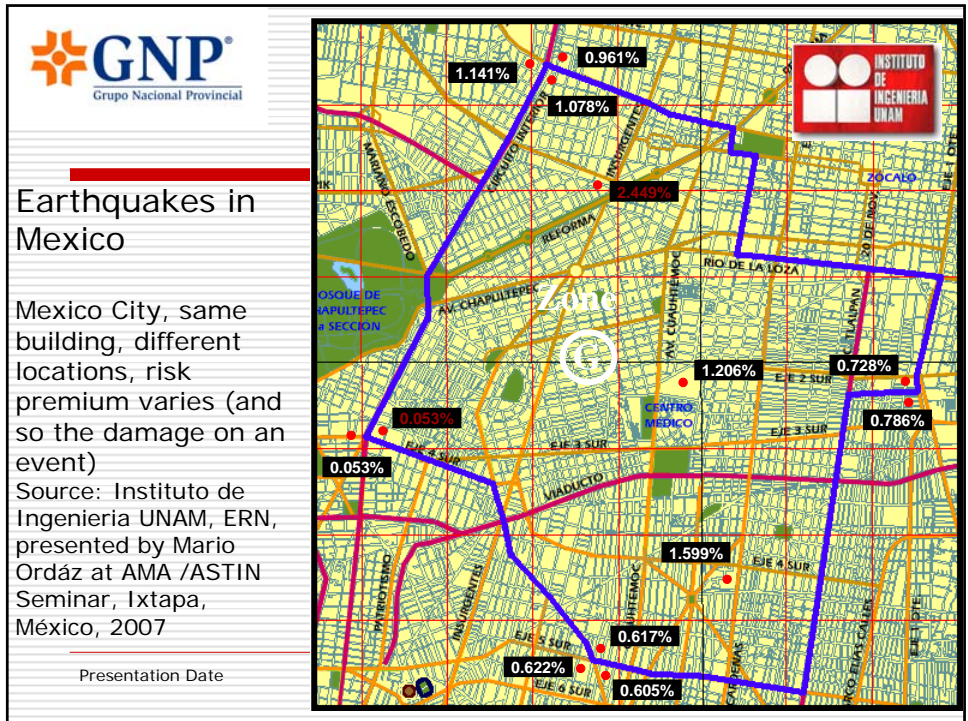
Contents


- Where are we coming from? Mexican Insurance Industry economic history and cat exposure at a glance
- Detecting emerging risks and oportunitites
- Conclusion

Presentation Date Presenter's Name 16

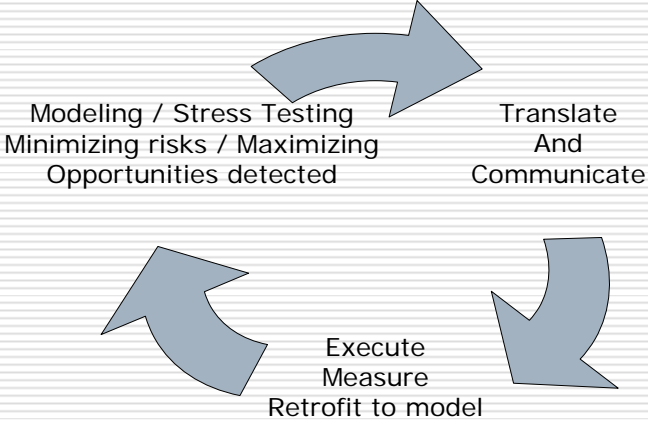


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- ### Mexican Life Industry at a glance. Individual Life Sales by currency
-
- High-end of the market purchases mainly dollar denominated policies
 - Many companies sell only dollar denominated or UDI denominated (inflation indexed products)
 - Traditional products mainly endowments and whole life products
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- Presentation Date _____ Presenter's Name _____ 18



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Detecting emerging risks and opportunities




Modeling / Stress Testing
Minimizing risks / Maximizing
Opportunities detected

Translate
And
Communicate

Execute
Measure
Retrofit to model

Presentation Date Presenter's Name 23

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ERM tools used in México Long term Life and Pensions Products

- ❑ 80's Stress – Testing to asset-shares and model offices
- ❑ 90's 80's plus embedded value and asset liability matching models with monte carlo simulations for investments
- ❑ 2000-present Integrated models starts to be used
- ❑ 2008 on Moving to Solvency II (fair value + Solvency capital determined by modeling)

Presentation Date Presenter's Name 24



Detecting emerging opportunities

- ❑ In the 90's, by building embedded value and asset liability models, we spotted the opportunity of selling highly profitable traditional dollar denominated policies, matching to minimize risk.
- ❑ Same with pensions
- ❑ Key factor: good communication between risk, investment and product managers

Presentation Date

Presenter's Name

25



Detecting emerging risks

- ❑ In the 2000's, the same embedded value and asset liability models, together with an eye on markets, shown less availability of high interest instruments, leading to changes in pricing and agents remuneration and incentives.
- ❑ In pensions, the market virtually disappeared.
- ❑ Key factor: good communication between risk, investment and product managers

Presentation Date

Presenter's Name

26



Detecting emerging opportunities with integral models

- Difficult, because presently
 - Too high level in nature
 - Disconnected to pricing / underwriting models
 - Results hard to communicate and share

Presentation Date

Presenter's Name

27




Detecting emerging risks with integral models P&C

- Statistical models tend to show some emerging risks (not all)
- Disruptions barely detected, for instance, loses can be produced in hurricane, due not only through big events, but also to frequency (due to retention)
- So here stress testing is a must

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Presenter's Name


28

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Conclusions


- Capital Models are a good tool to measure stable evolution
- But stress testing and scenario building is necessary to detect emerging risks and opportunities due to disruptions
- Specially important in day-to-day dealing with cat risks
- And economic spikes

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29

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The Pros and Cons of Economic Capital Models vs. Stress Testing to detect Emerging Risks and Opportunities

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