



# Surety Insurance

US and Latin American perspectives for Casualty Actuaries

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# Agenda

- Introduction of Surety
- Surety Market in the US
- Surety Market in Latin America
- Pricing Surety Products
- Conclusions



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# LIMITATIONS

UNTIL YOU SPREAD YOUR WINGS,  
YOU'LL HAVE NO IDEA HOW FAR YOU CAN WALK.

# Surety

Surety is a promise by a surety (the obligor or insurer) to pay one party (the obligee) a certain amount if a second party (the principal) fails to meet some obligation, such as fulfilling the terms of a contract.

Long history – Code of Hammurabi, 1790 BC

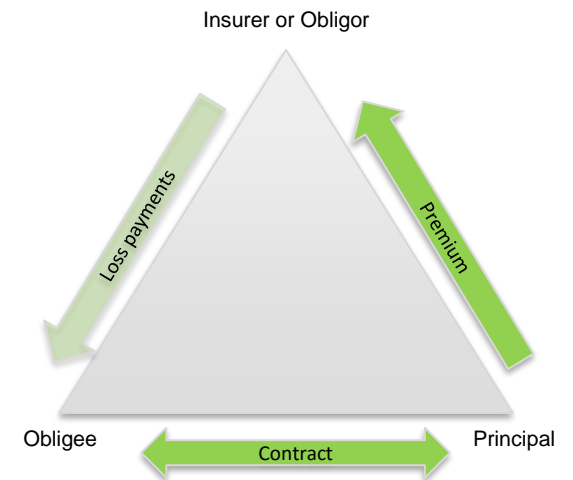
Heard Act of 1894

Miller Act of 1935

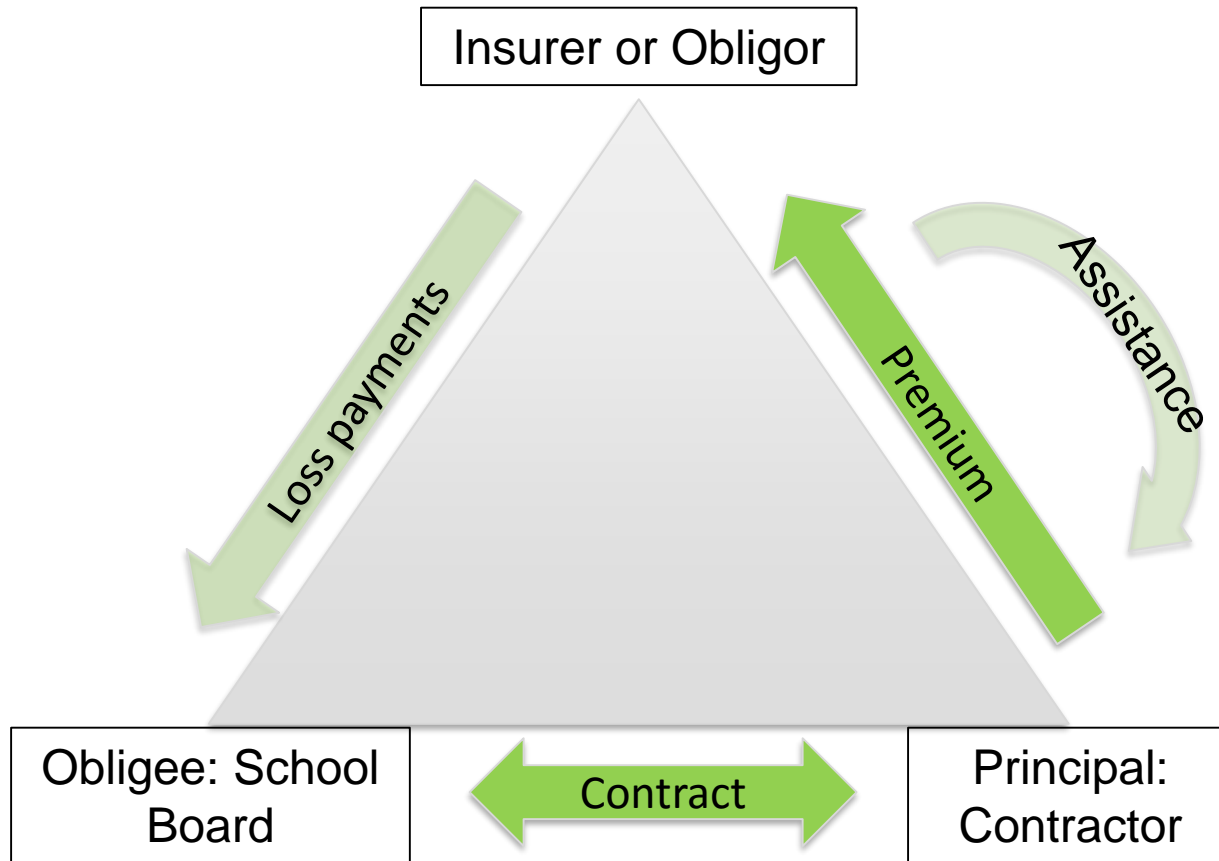
Two broad types:

Contract Surety

Commercial Surety



# Simple contract example: building a school



# Contract Surety

Traditional view of Surety: Principals actions are based strictly on a contract

- Bid bonds
- Performance bonds
- Payment bonds
- Maintenance bonds
- Miscellaneous bonds

Claims typically arises from bankruptcy, cash flow crisis, or contractual dispute

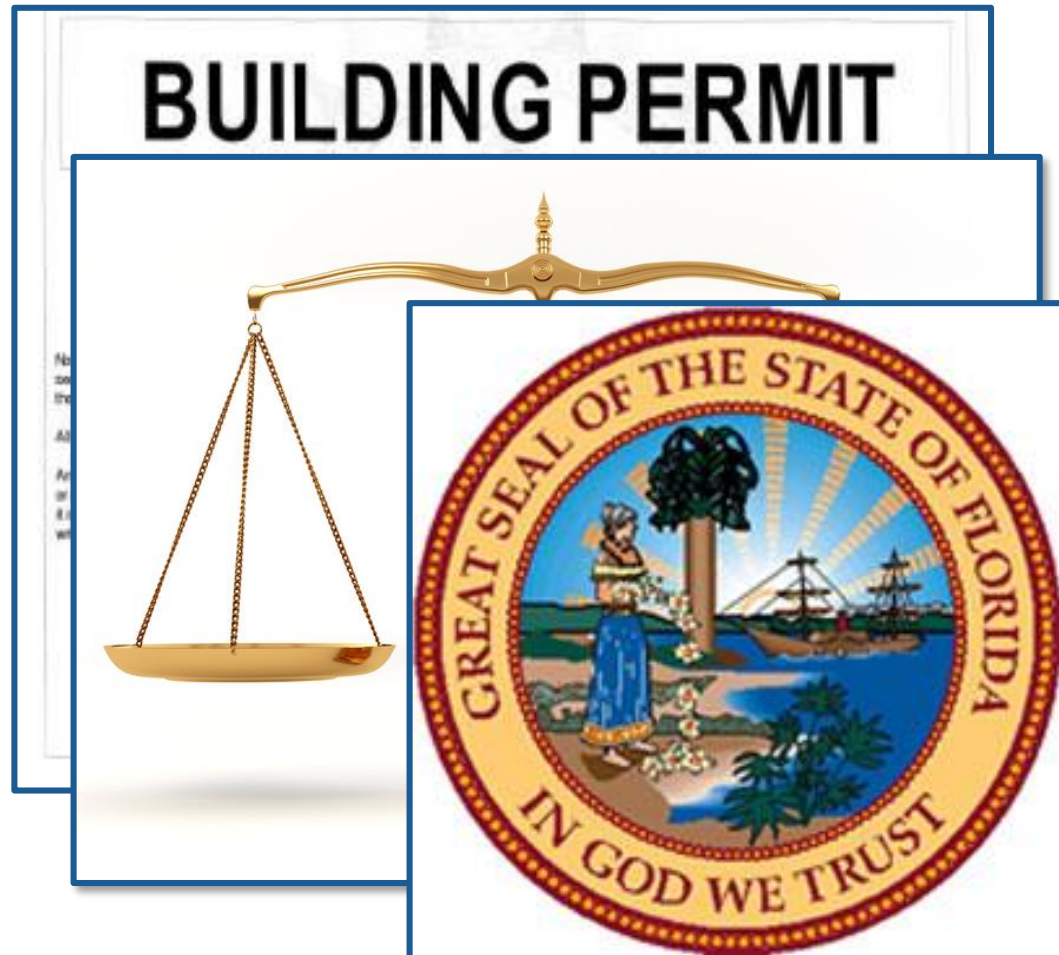
Usually includes an indemnity clause



# Commercial Surety

Bonds that do not fit the contract definition

- License and permit bonds
- Court bonds
- Public official bonds
- Miscellaneous bonds



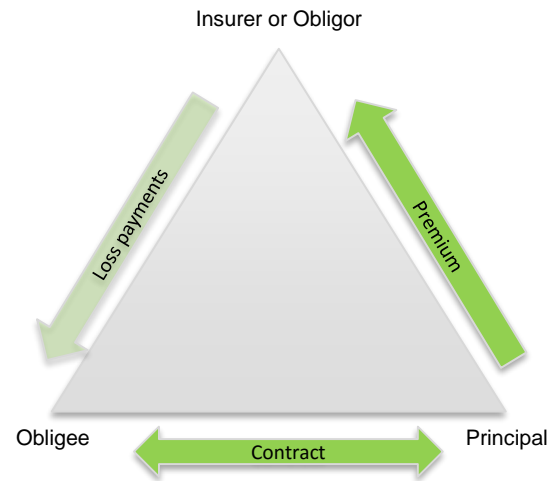
# 3<sup>rd</sup> Party Insurance

## Challenges:

- Moral hazard
- Morale hazard

## Surety Remediation:

- Ongoing concern
- Collateral/liens
- Credit check
- Reputation
- Indemnity



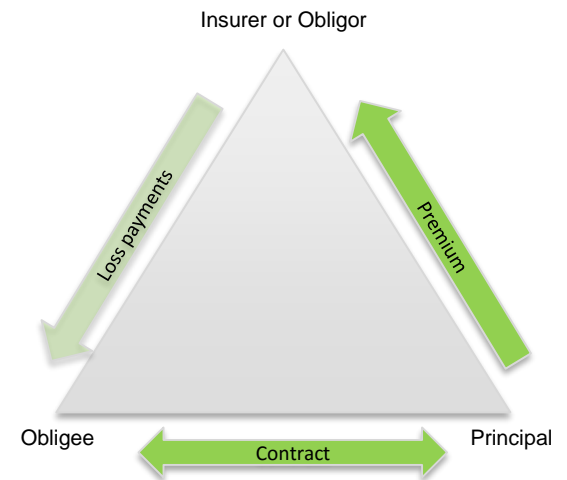


# Surety Market in the US

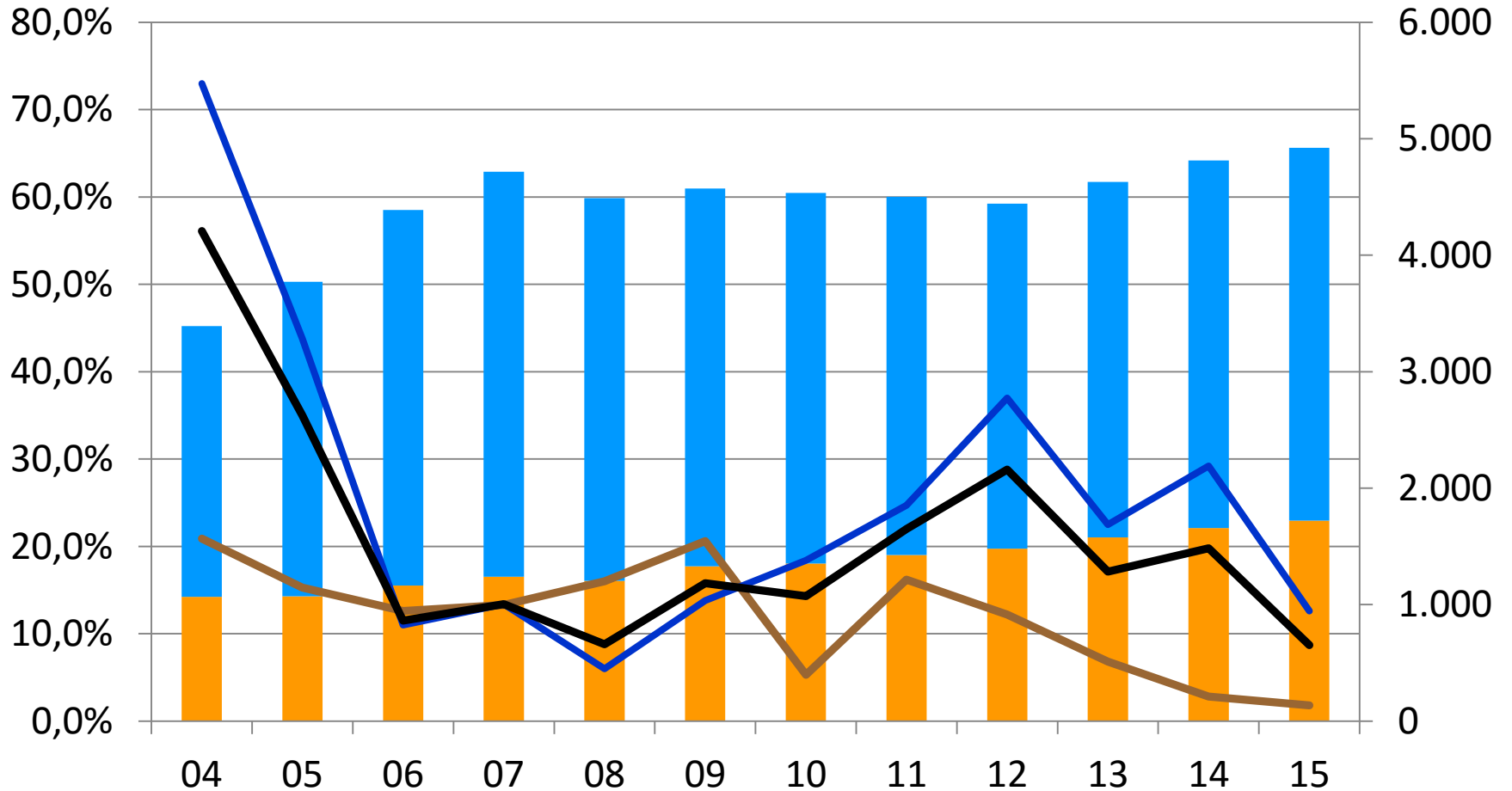


# US Actuarial Data Challenges

- Large limits, idiosyncratic losses, correlation & extreme volatility
- Collateral, Salvage & Subrogation
- Short/Long-tail exposure
- Limited industry data
- Multi-year policies
- Occurrence



# Contract vs. Commercial Industry Results



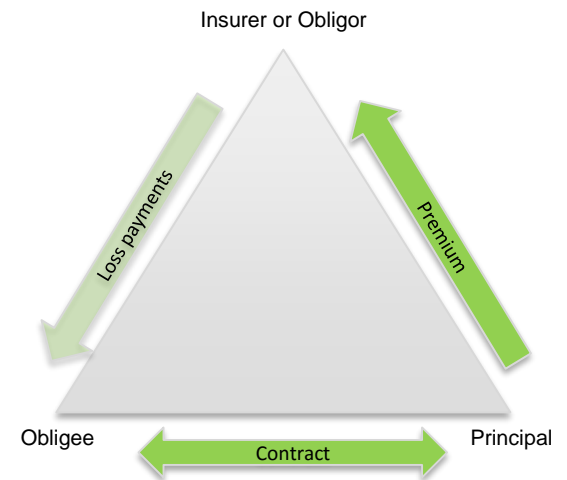
■ Commercial WP    ■ Contract WP    — Commercial LR  
— Contract LR    — Total LR



SFAA Industry preliminary CY results  
Premium in millions <sup>11</sup>

# US Actuarial Data Challenges

- **Large limits, idiosyncratic losses, correlation, & extreme volatility**
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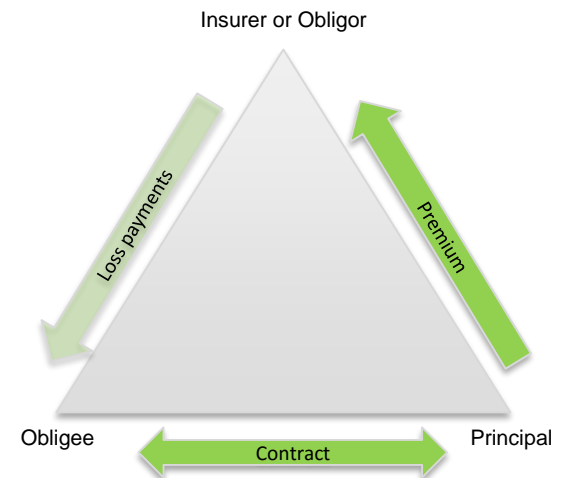
# US Surety Pricing

$$\text{Technical Premium} = \text{Expected Losses} + \text{Expenses} + \text{Target Profit}$$

- Expected losses = frequency x severity
- Frequency → probability of default
  - Credit agencies, experts, models
- Severity → percentage of bond limit of loss
  - SFAA Severity model, internal models

## Additional considerations, the 3 C's

- Character
- Capital
- Capacity

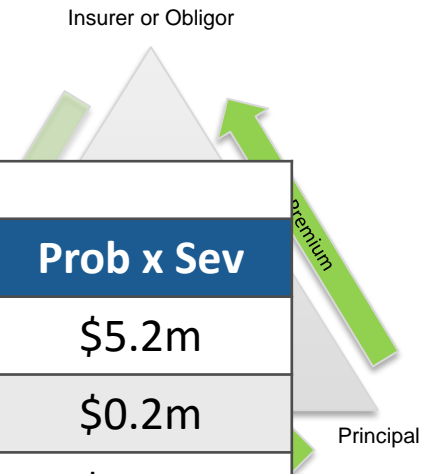


# US Surety Reserving

- Two claim tiers: recent vs. litigation
- Triangular methods limited
- BF & Claims Projection
- Severe events
- Offsets

Simple example of a claims-projection (probability matrix)

| Scenario       | Probability | Loss   | Expense | Prob x Sev     |
|----------------|-------------|--------|---------|----------------|
| Lose           | 10%         | \$50m  | \$2m    | \$5.2m         |
| Prevail        | 10%         | \$0    | \$2m    | \$0.2m         |
| Settlement     | 80%         | \$5m   | \$0.75m | \$4.6m         |
| Expected Value | 100%        | \$9.0m | \$1.0m  | <b>\$10.0m</b> |



# A view of Surety Market in LATAM

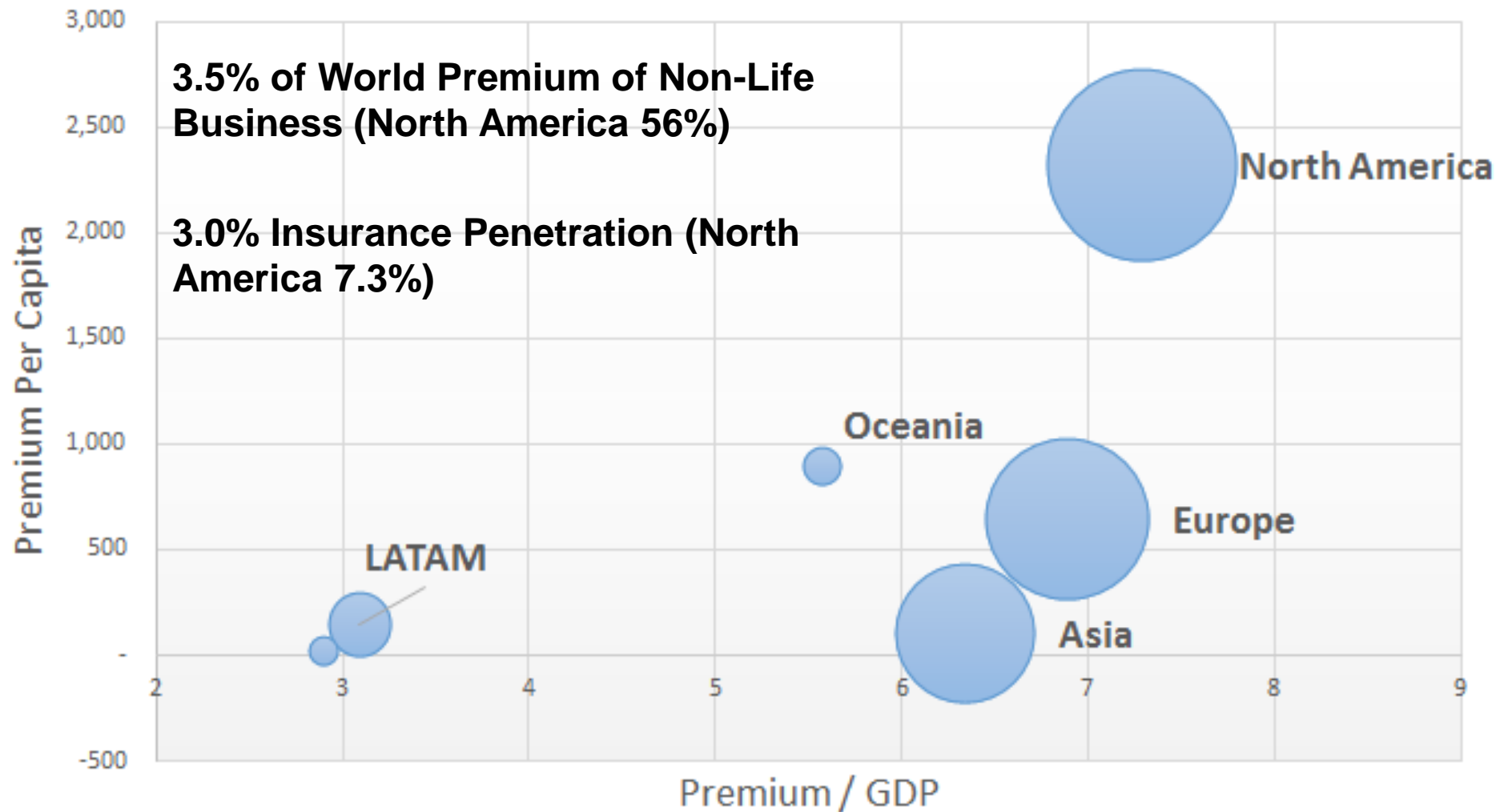


# This is LATAM





# This is LATAM – Non Life Insurance

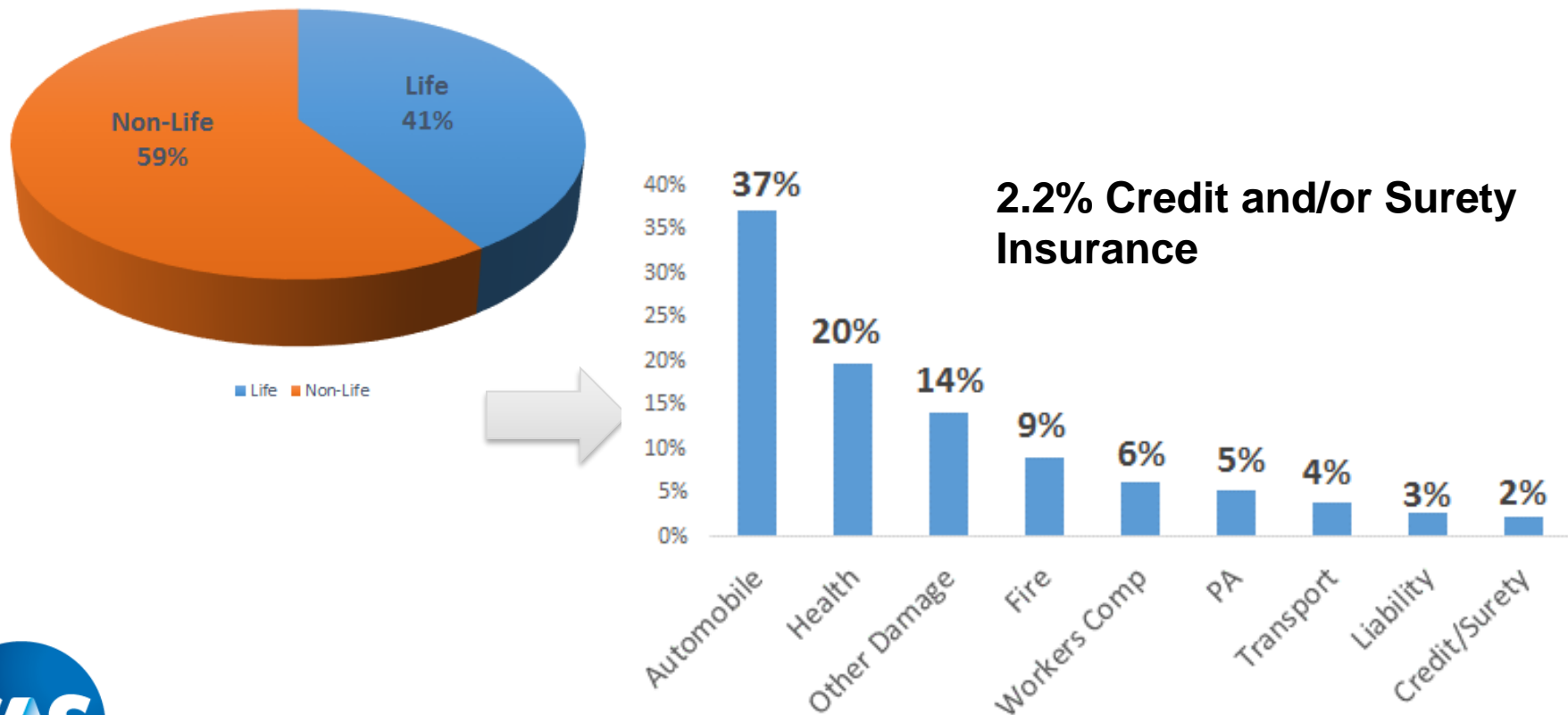


Source: Sigma, Swiss RE

# Insurance Market in Latin America

**USD\$ 91 Billion Non-Life Gross Premium (59% Whole Premium LATAM).**

## Latin America Non-Life Gross Premium

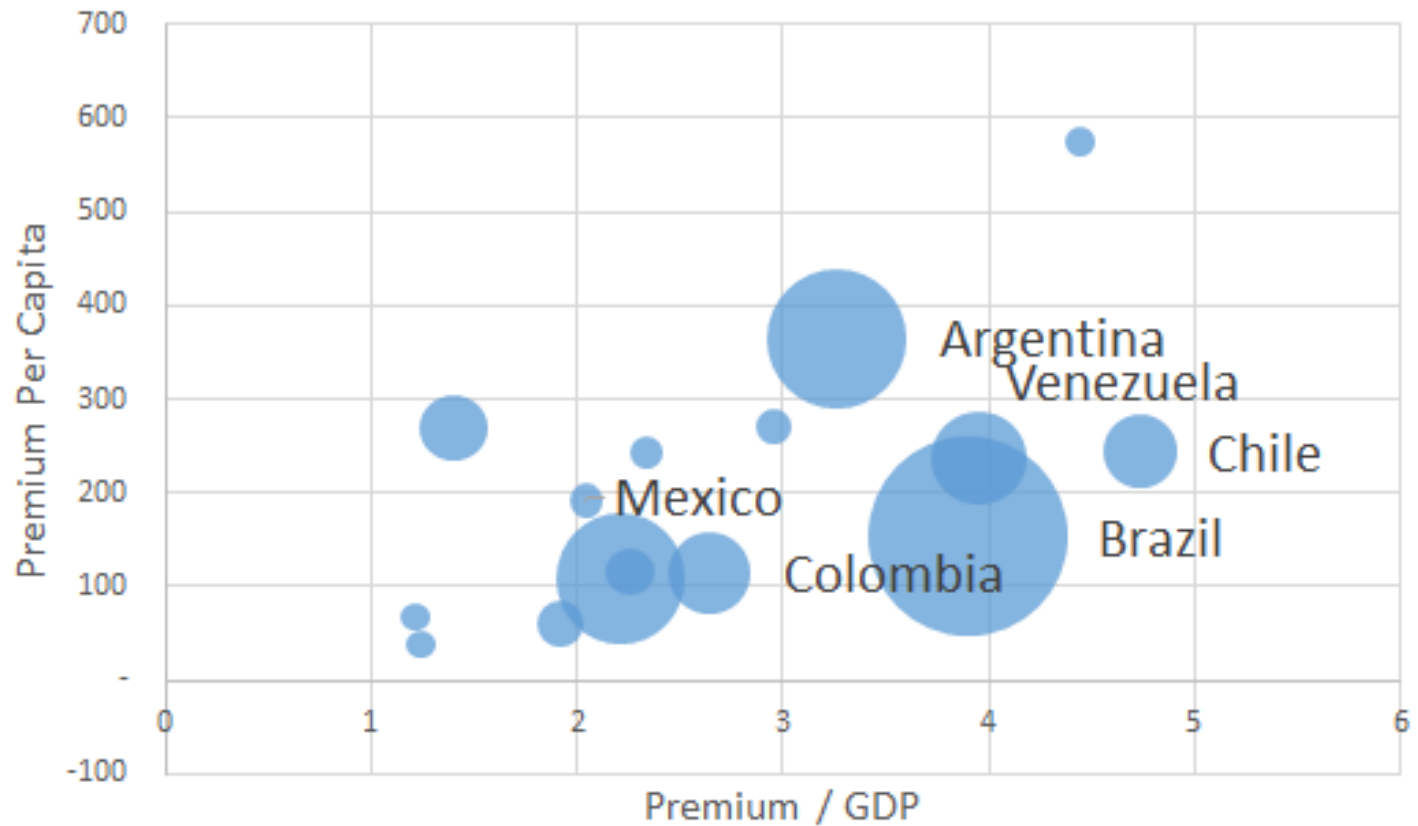


Source: *The Latin American Insurance Market 2013-2014*, Mapfre

# Insurance Market in Latin America

Penetration of Insurance is between 1.3% and 5% of GDP

Penetration (%) and Density(USD\$) of Insurance in LATAM

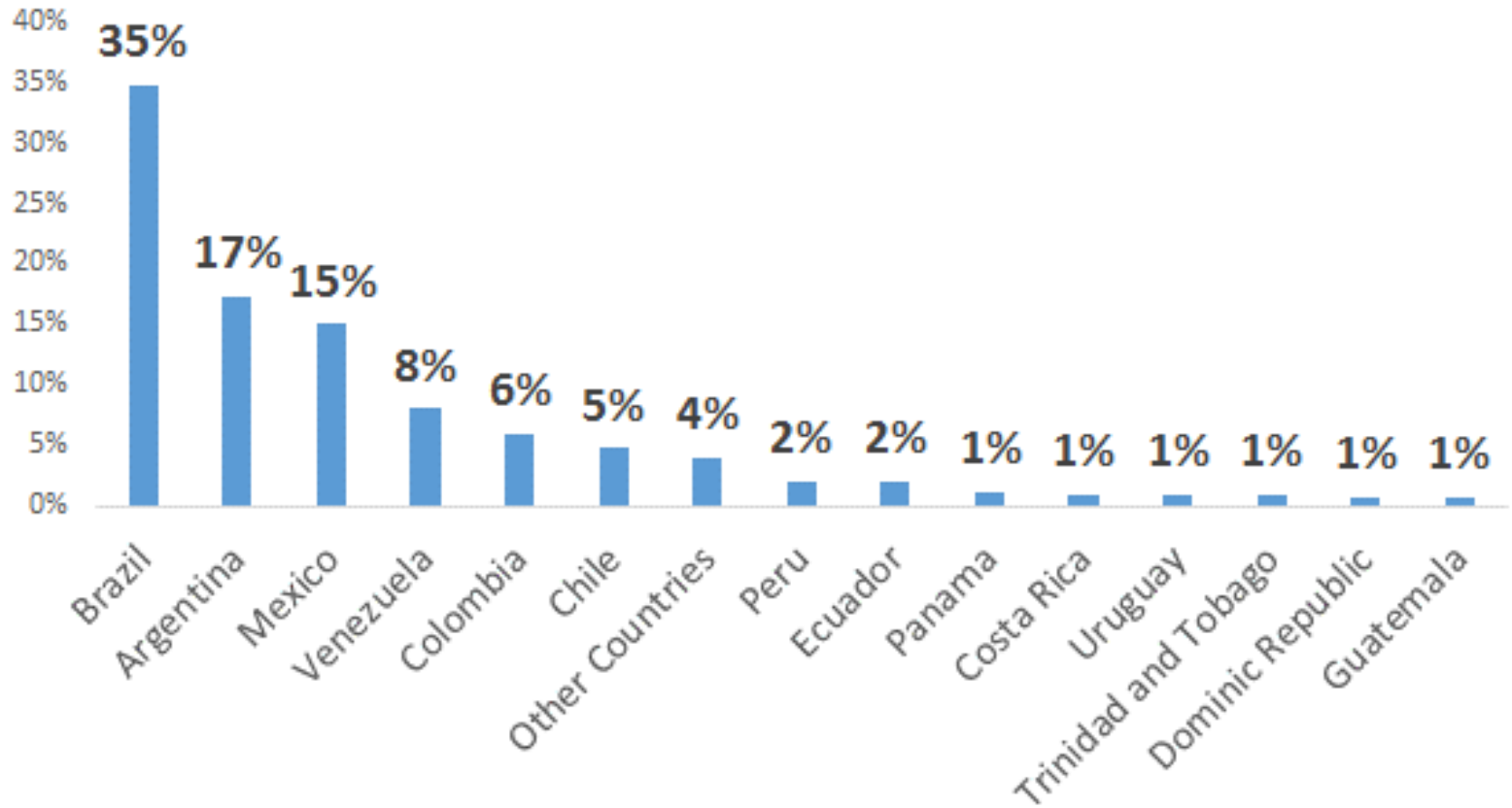


Source: Sigma, Swiss RE

# Insurance Market in Latin America

Six countries explain more than 85% of non-life premium

Latin America Non-Life Gross Premium



Source: Sigma, Swiss RE

# Surety Market in Latin America

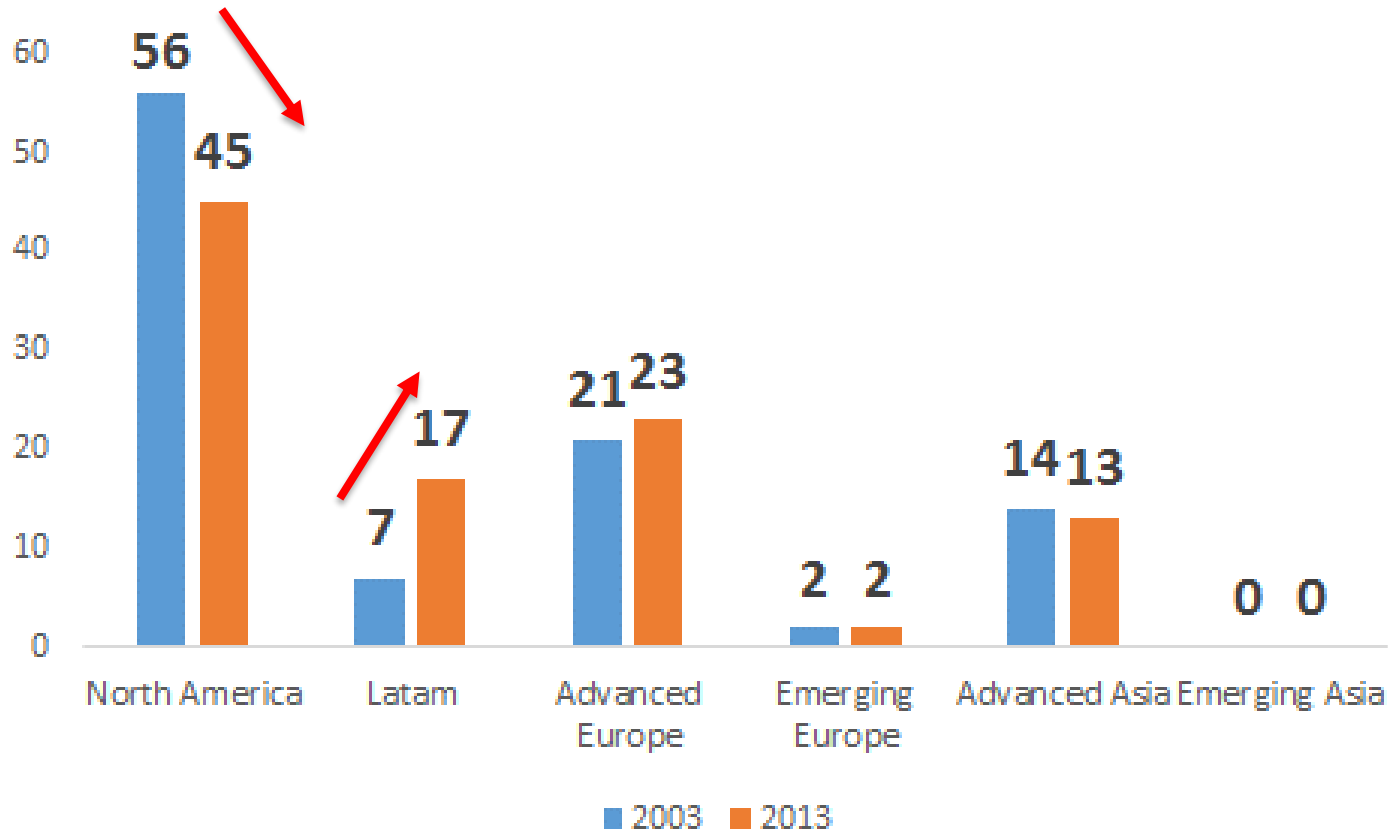
- Commercial Surety and contract bonds (infrastructure projects) are important in LATAM
- Evidence of accumulation of risks in a few contractors or industries inside each country
- Long tail insurance – related with legal process (once claim is noticed)
- Large losses (low frequency / high severity) is a notorious risk



# Surety Market in Latin America

**USD \$ 2.2 Billion Gross Premiums in LATAM (17% of world premium)**

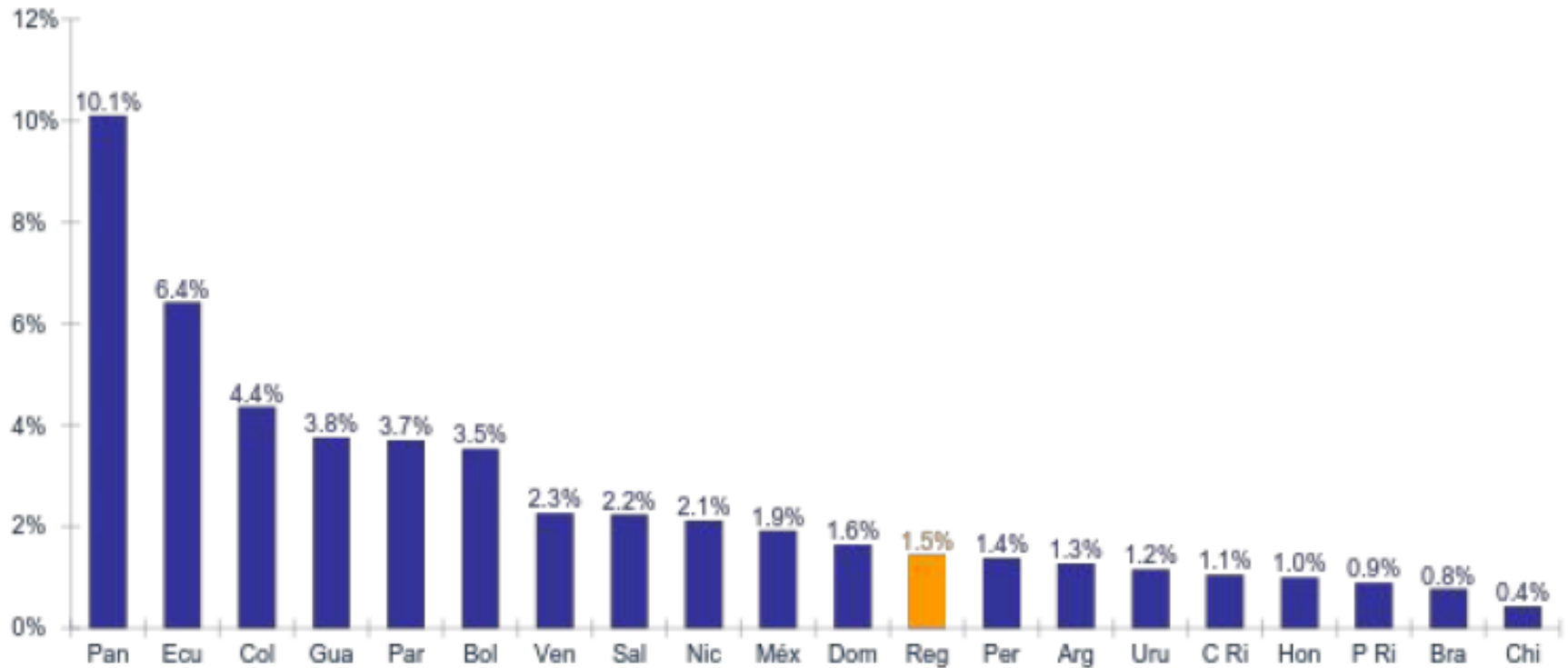
**Distribution of World Surety Premiums 2003-2013 (%)**



Source: Swiss RE

# Surety Market in Latin America

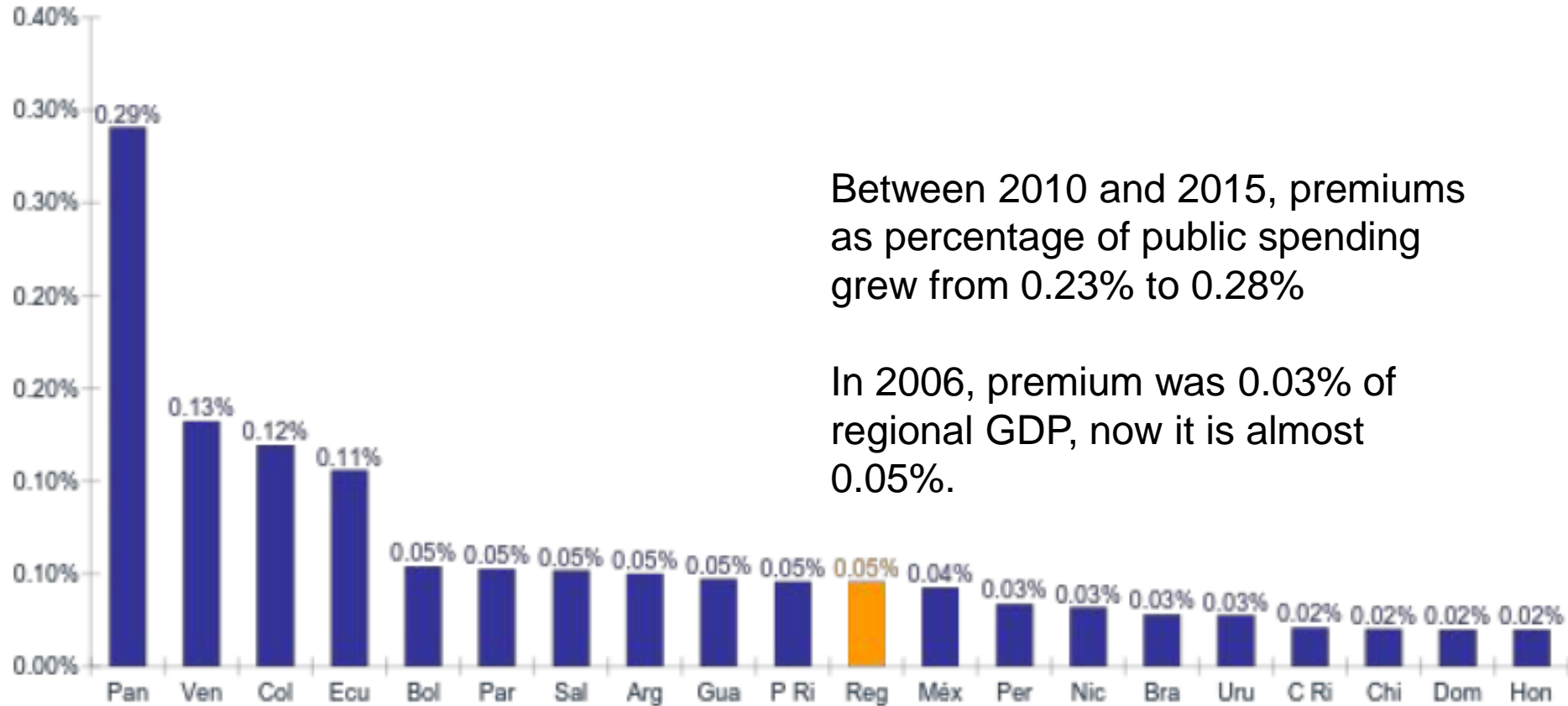
Surety Premiums (% of All Insurance Branches) by Country



Source: APF – PASA, 2015

# Surety Market in Latin America

## Premiums (% GDP) by Country, 2015



Between 2010 and 2015, premiums as percentage of public spending grew from 0.23% to 0.28%

In 2006, premium was 0.03% of regional GDP, now it is almost 0.05%.

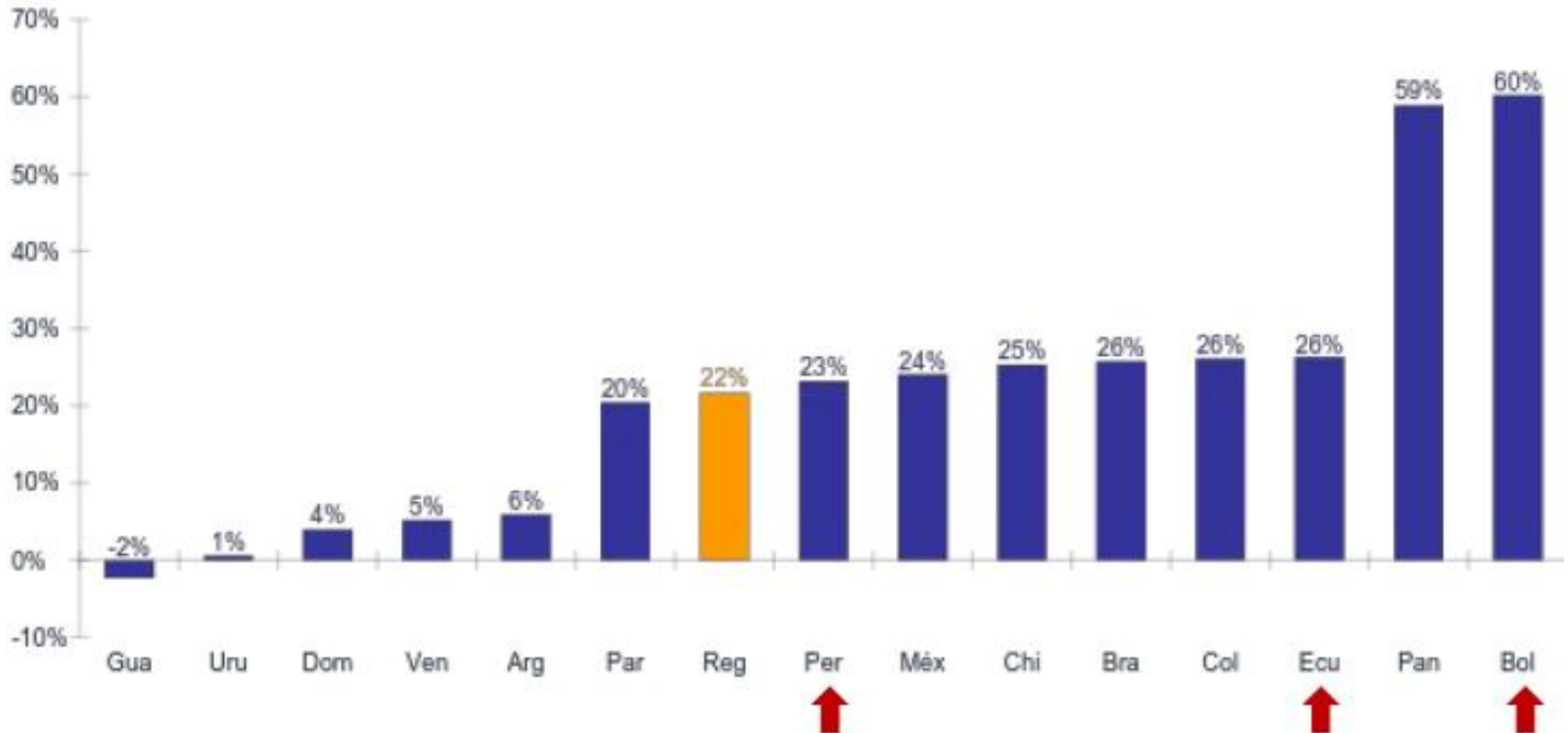


Source: APF – PASA, 2015



# Surety Market in Latin America

## Loss Ratio by Country, 2015

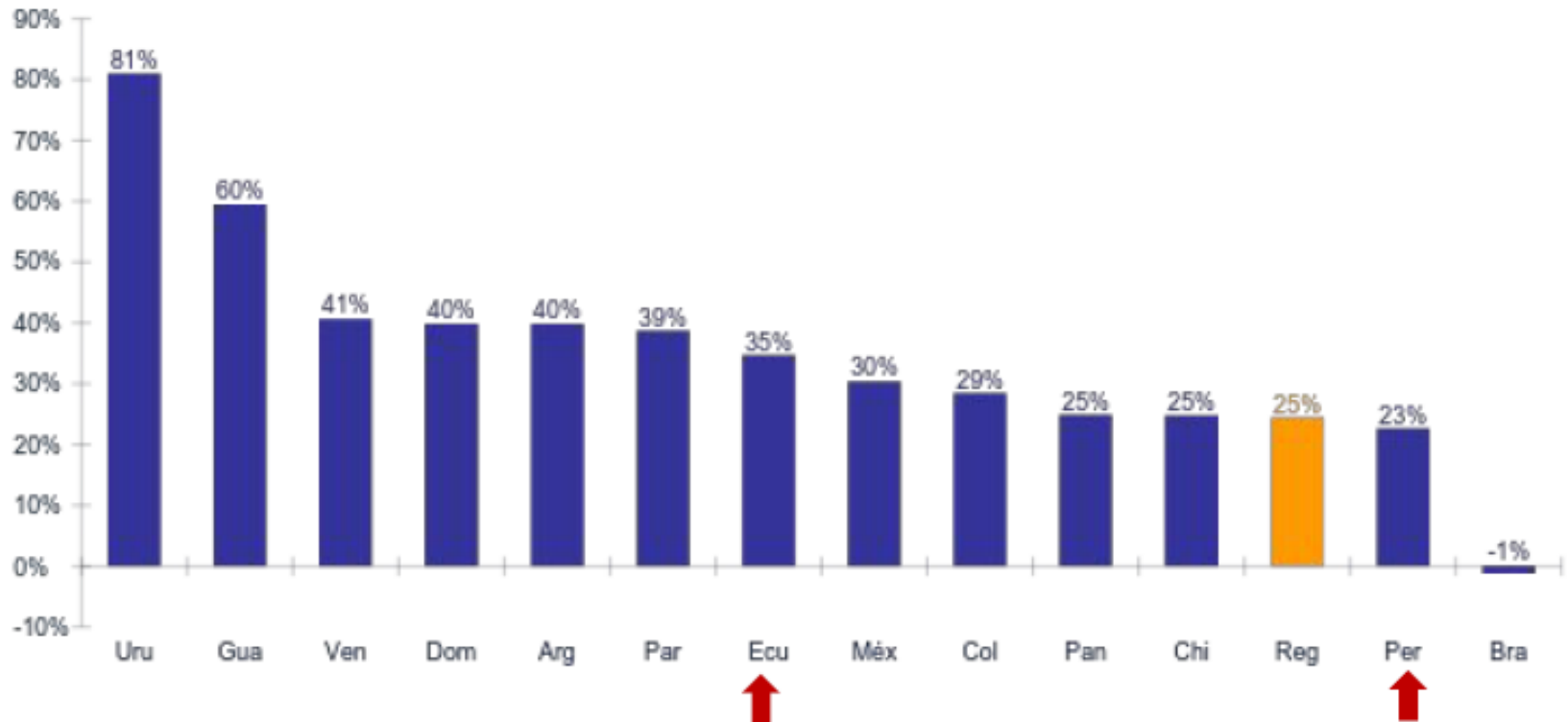


Source: APF – PASA, 2015



# Surety Market in Latin America

Technical Result (% Total Premiums) by Country, 2015

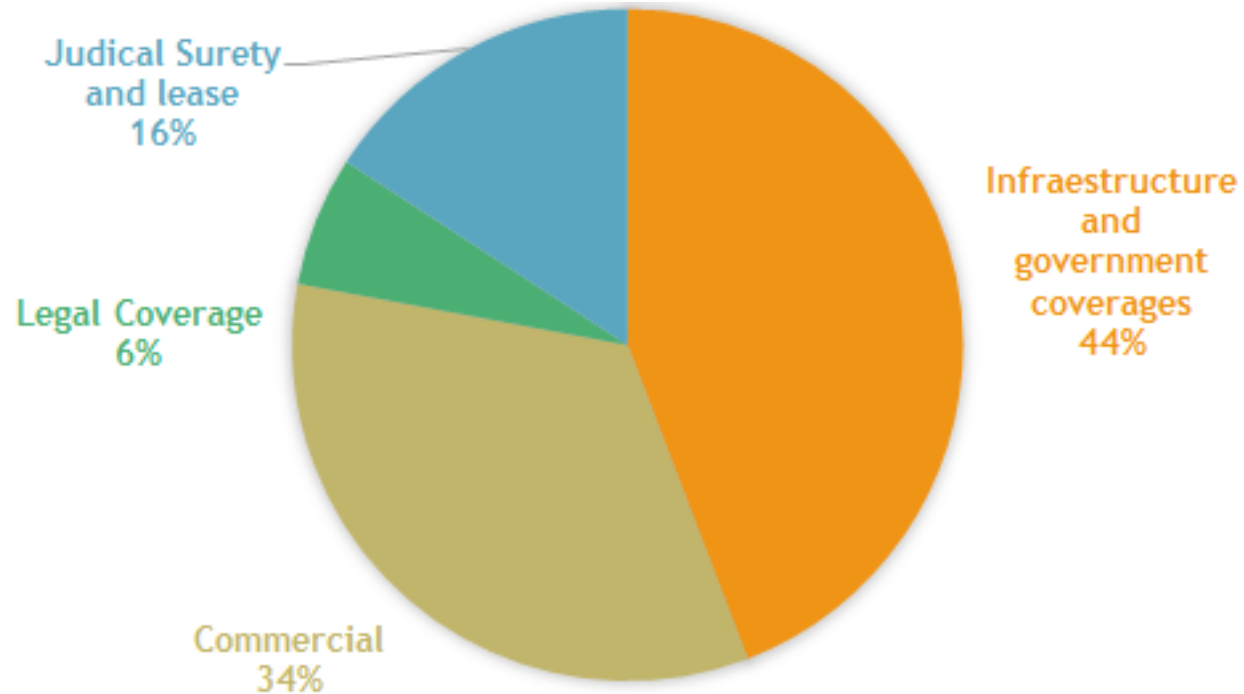


Source: APF – PASA, 2015



# Surety Market in Latin America

Distribution of surety products (Colombian market only)



Source: FASECOLDA

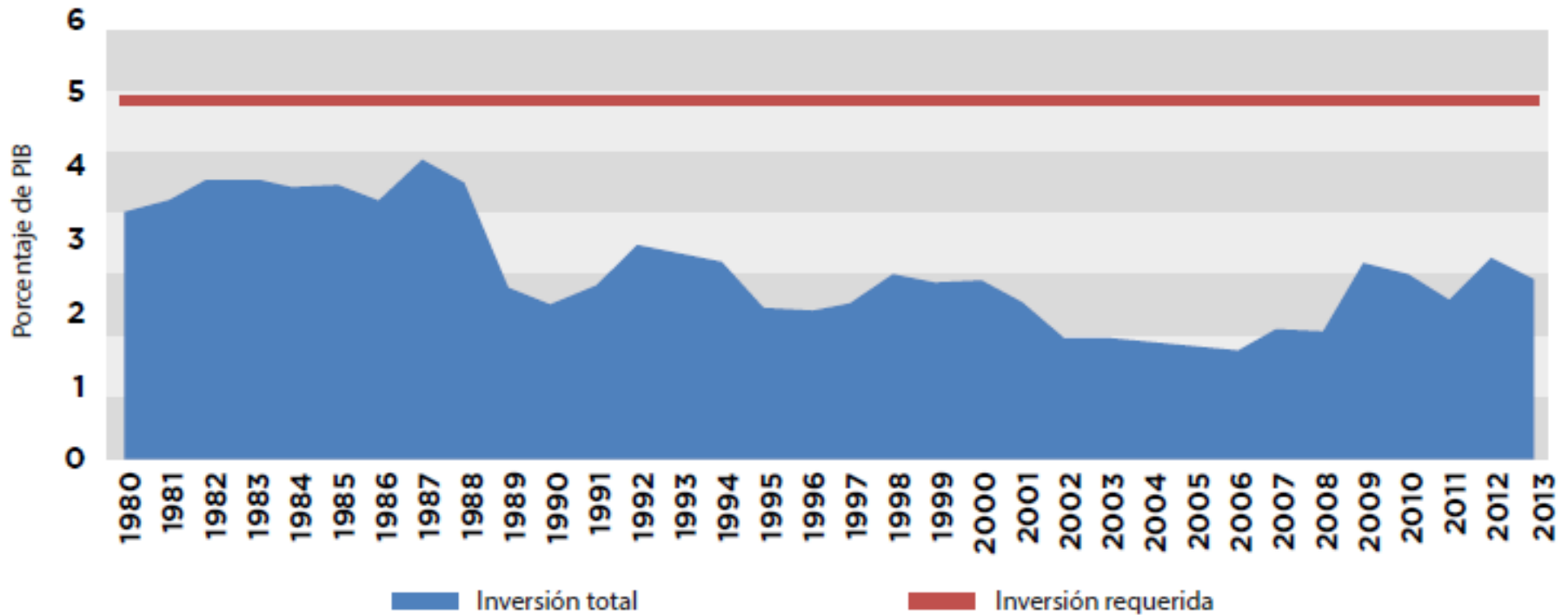


Infrastructure projects are the big challenge for  
Surety in LATAM



# Surety and Infrastructure

## Yearly Investment in Infrastructure in Latin America and the Caribbean, 1980-2013

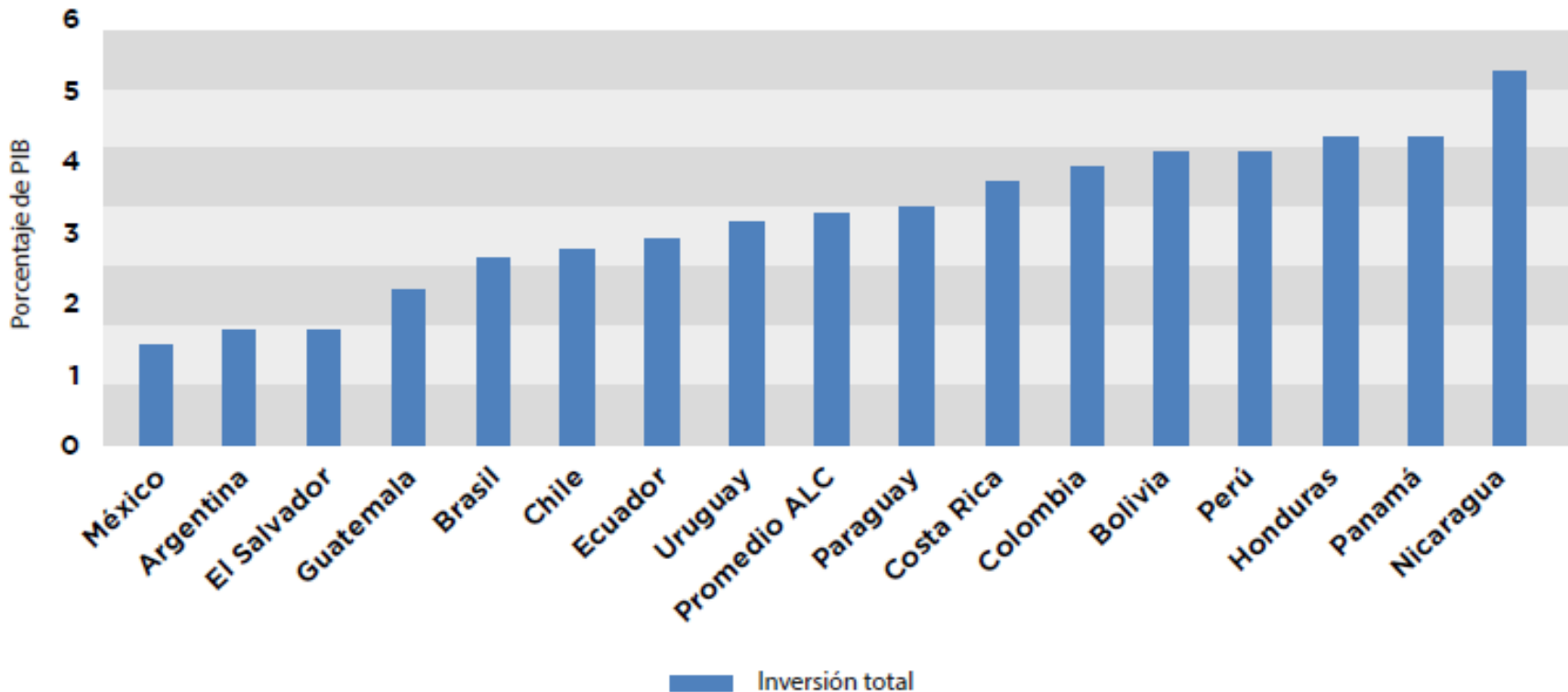


Source: IDB, *Financiamiento de la Infraestructura en America Latina y el Caribe*



# Surety and Infrastructure

Average Yearly Investment in Infrastructure by Country, 2008-2013  
(% GDP)



Source: IDB, *Financiamiento de la Infraestructura en America Latina y el Caribe*



But losses could have long tails for delays in projects...



# Surety and Infrastructure

Banamericas analyzed the cost overruns and delays in 200 infrastructure projects in Latin America:

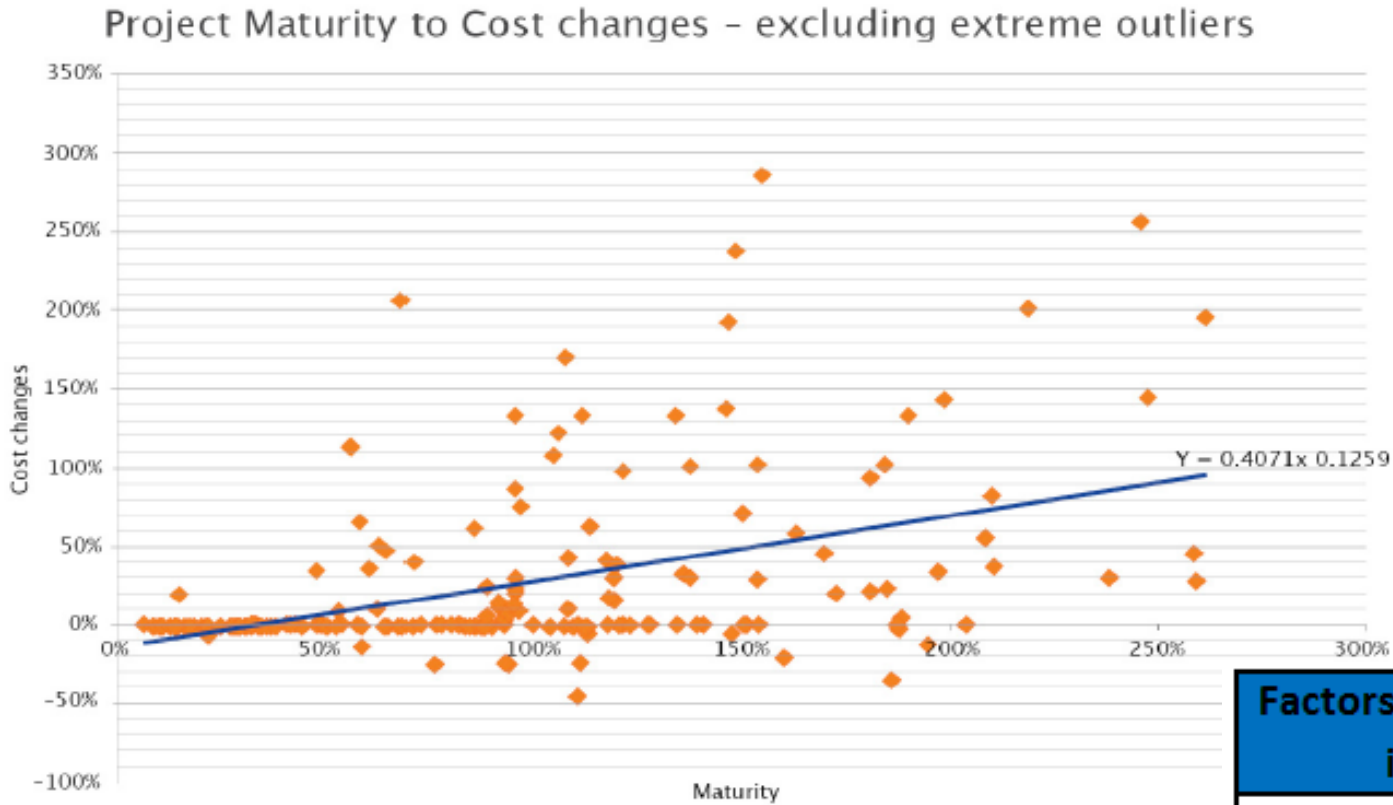
|                | <b>Number of projects</b> | <b>Cost Increase</b> | <b>Lastest estimate for total</b> | <b>Average change in timing</b> | <b>Average change in cost</b> | <b>Average Maturity</b> |
|----------------|---------------------------|----------------------|-----------------------------------|---------------------------------|-------------------------------|-------------------------|
| <b>Private</b> | 58                        | 36,78                | 114,156                           | 28.02%                          | 43.08%                        | 108.11                  |
| <b>Public</b>  | 142                       | 104,476              | 393,852                           | 38.05%                          | 35.3%                         | 101.47                  |
| <b>Total</b>   | 200                       | 141,256              | 508,008                           | 35.14%                          | 37.56%                        | 103.40                  |

*Source: Banamericas, Project Risk Analytics, 2015*





# Surety and Infrastructure



Source: Banamericas, Project Risk Analytics, 2015

## Factors causing the excess in expenses

|                      |    |
|----------------------|----|
| Financial management | 23 |
| Design               | 15 |
| Workforce            | 14 |
| External factors     | 10 |
| Project management   | 8  |
| Ambiental factors    | 7  |
| Community            | 4  |



# Pricing of Surety Products



# Pricing of Surety Products

$$\text{Technical Premium} = \text{Expected Losses} + \text{Expenses} + \text{Target Profit}$$

## Expected Losses:

What do we expect to pay out as a claim on average during the maturity of the business?

## Frequency:

Likelihood of a claim under a bond given a financial default of the obligor

What is the likelihood that  
i) a contractor gets insolvent and ii) a bond is being triggered?

## Severity:

Expected loss fraction after loss mitigation

How much of the bond notional will ultimately result in a loss?



# Frequency: Know Your Client

- Credit rating (e.g. Moody's, S&P)
- Experience of management
- Time in business
- Stability of earnings:
  - Firm – Financial statements, structure of capital
  - Industry segment
  - Concentration of business
  - Partners and exposure in other projects
  - Economic Cycle



## Credit Scoring Models

### Policyholder's Financial Rating

Financial assessment based on the financial statements.

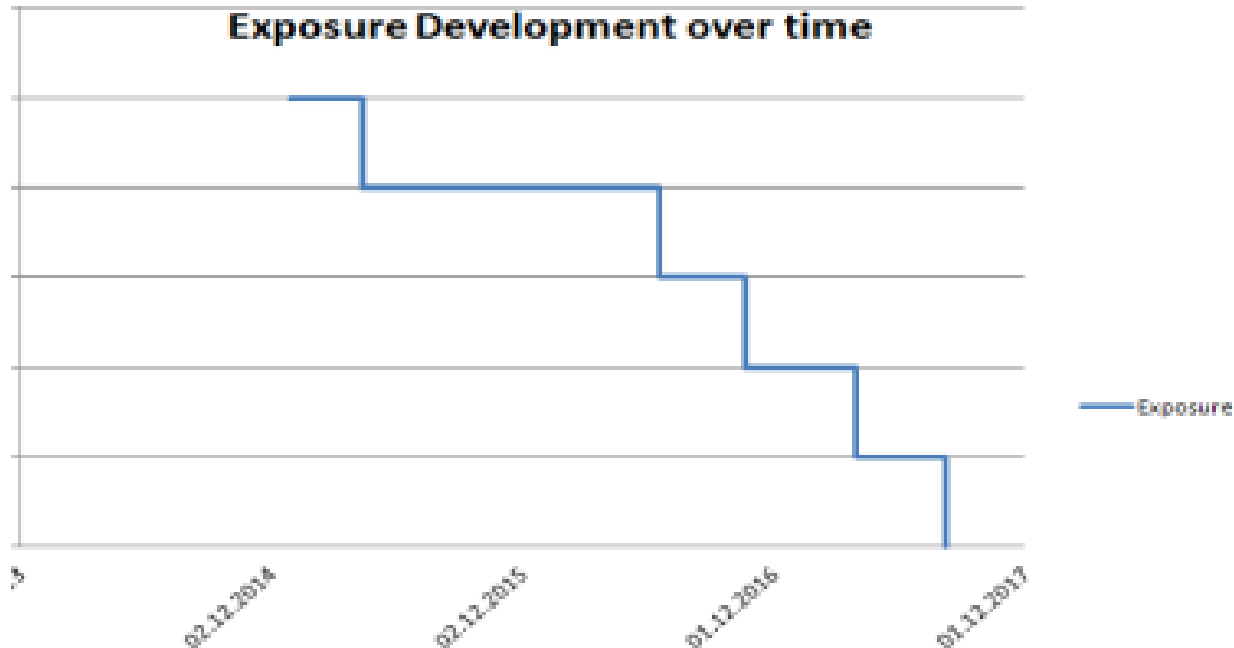
### Policyholder's Financial Capacity

- Evaluation of short/medium term liquidity position.
- Evaluation of credit track record.



# Duration of the Risk

Large duration in the life of the policy is very important.



Probability of non-compliance for a contractor with a low credit rating, like B or BB, increases with time.

Exposure of all policies will change according to lifetime of the project



Source: Munich RE

# Severity: Loss Given Default

$$\text{Severity} = \text{Contract Value} * \text{Loss Given Default}$$

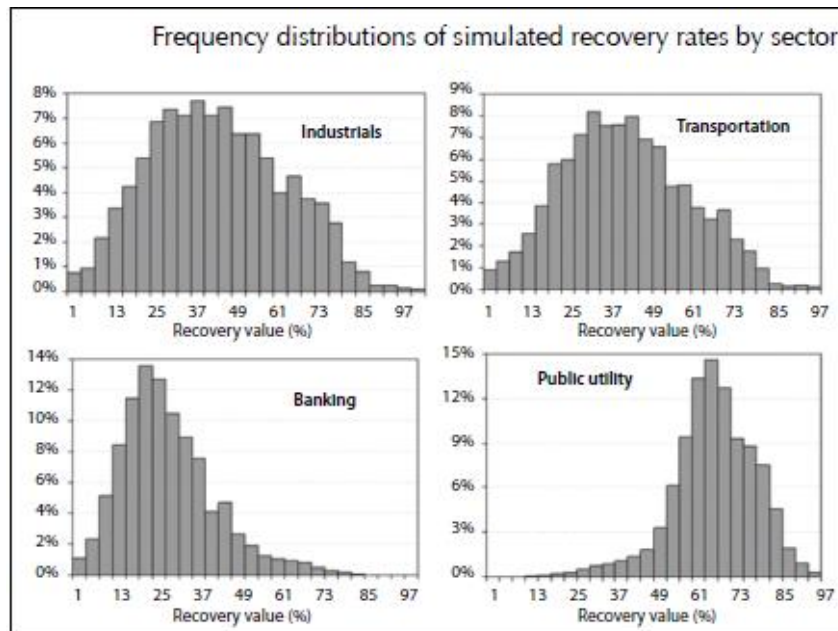
is a random variable as the exact amount of exposure at the time of default may be uncertain

= 1 – Recovery Rate. Random variable reflects the fraction of the exposure that results in a loss after accounting for any recoveries.

Exposure net of retention, usage and recoveries

The risk exposition of the bond amortizes in accordance with the work progress.

- The respective maturity profile needs to be reflected in the modelling of the severity component of surety risks.



# Severity: Loss Given Default

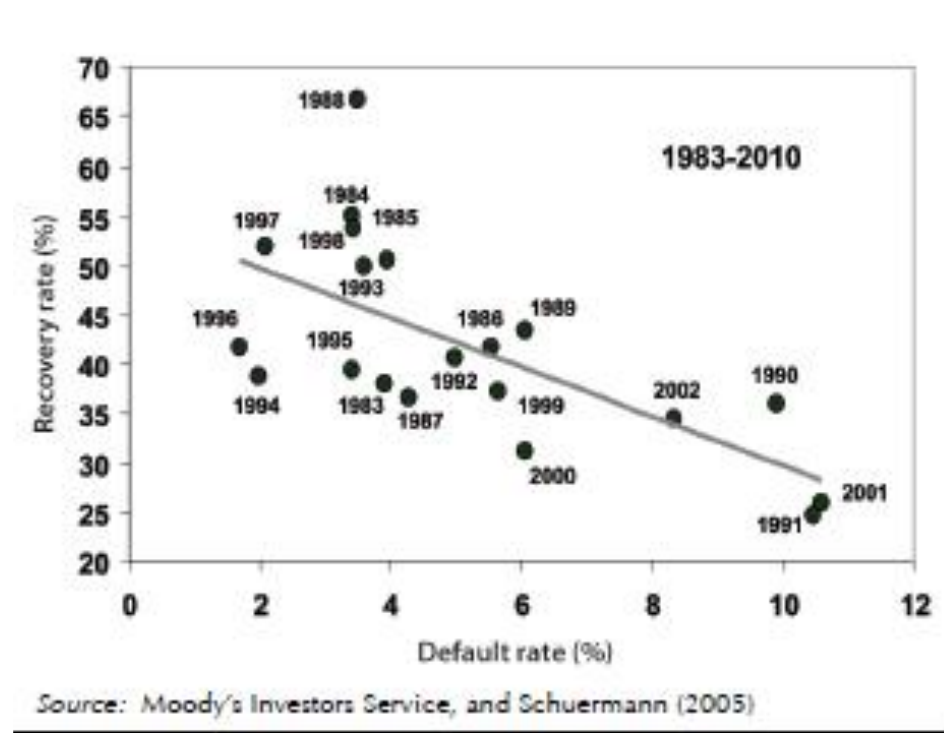
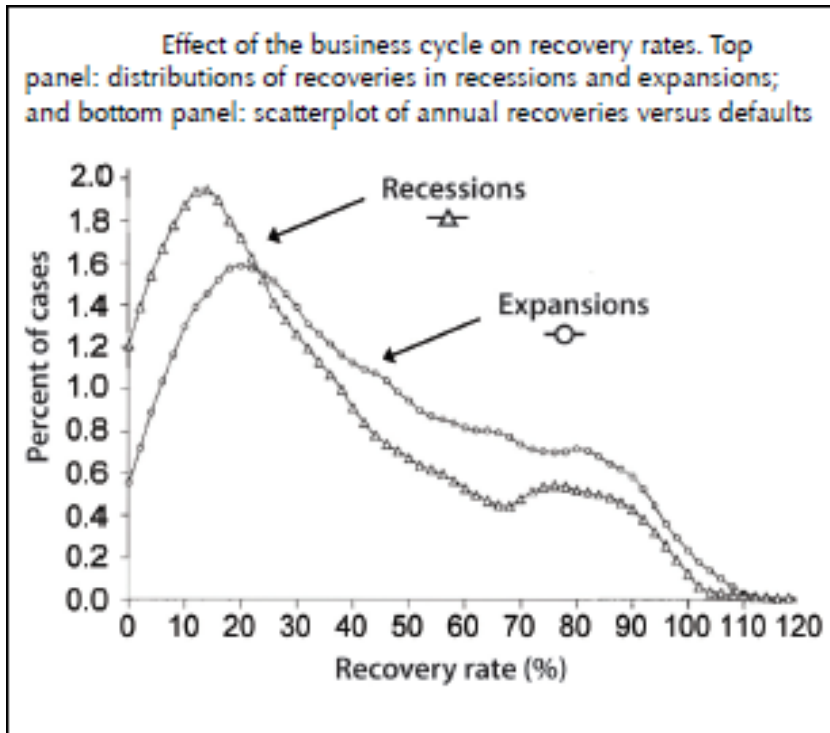
## Loss severity depends on:

- The complexity of the underlying project: can the contractor easily be replaced? what are the costs occurring to mitigate The loss?
- Contract value/exposure
- Availability of collateral and recovery prospects
- Quality of collateral



# Severity: Loss Given Default

Recovery rate could change across economic cycle or according to default rate.

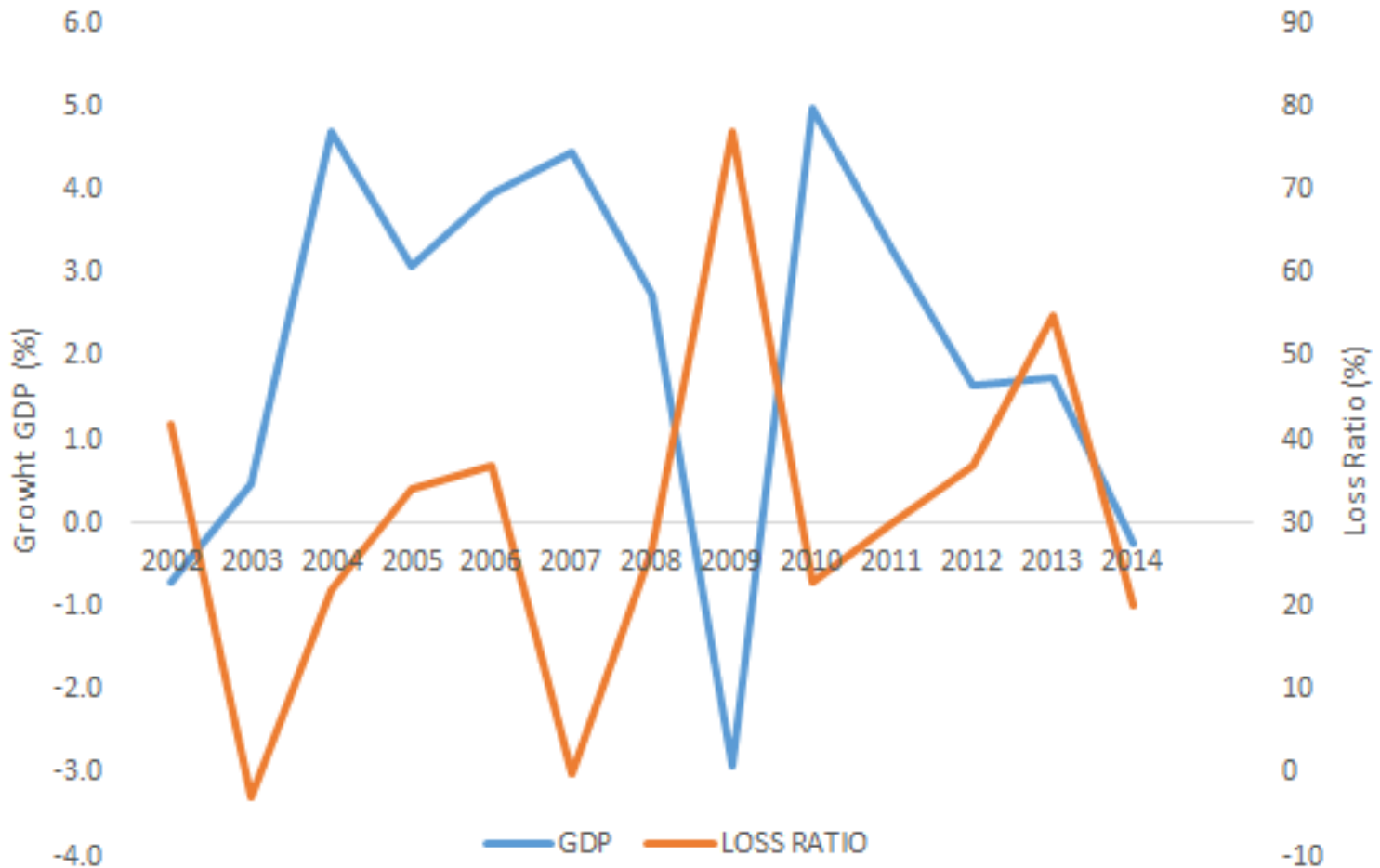


Source: Graphics from Benzshawel (2012) *Credit Risk Modeling: Facts, Theory and Applications*



# LATAM GDP vs Surety Loss Ratio

Coefficient of Correlation -50%



Source: CEPAL and XL Catlin

# Frameworks Comparison

- **Traditional actuarial models**
  - Experience and exposure rating
  - Individual and collective models
  - Aguilar & Gudiño Model
- **Financial Market theory**
  - Relevance of credit rating
  - Alwis & Steinbhach
- **Portfolio Approach**



# An Actuarial Model

- Then Net Premium has two components:
  - Cost of financing the claims
  - Cost of the guarantees that will not be recovered

$$NP = P_{t_1}(r) * S_{t_1} * v^{t_1} \left[ \frac{[(1+r)^T - 1]}{(1+i)^T} * (1 - \varepsilon) + \varepsilon \right]$$

Where:

- $t_1$ : claim date.  $t_2$ : guarantee recovery date.  $T$ :  $t_2 - t_1$
- $P_{t_1}(r)$ : frequency factor. Probability of having a claim
- $S_{t_1}$ : severity factor. Expected claim as fraction of the exposed surety
- $\varepsilon$ : fraction of the claim that will not be recovered (loss)
- $i$ : cost of opportunity of the capital
- $r$ : yield rate of a fixed income instrument



Source: Beltran and Gudiño (2007) *Fundamentos actuariales de Primas y Reservas en Fianzas*. Fundación Mapfre.

# A Financial Markets Model

- Insurance and financial markets converge: same risks
- Severity: using default models from financial markets and adjusting by loss triggers. The expected level of guarantees recoveries is added.

$$E(\text{Loss}) = Ex \cdot EDF \cdot (1 - r) \cdot \alpha$$

Where:

- $Ex$ : exposure
- $EDF$ : probability of claim
- $r$ : recovery rate
- $\alpha$ : probability of claim as a surety product divided by probability of default as a financial product



Source: Alwis and Steninbach, *Credit & Surety Pricing and the Effects of Financial Market Convergence*

# Portfolio Pricing

**Ultimate Losses** = Probability of Default \* (Expected Losses + Unexpected Losses + Economic Capital + Expected Shortfall) \* (1- Recovery Rate)

$$E[CreditLoss] = \sum_{i=1}^N PD_i \cdot E[EAD_i] \cdot E[LGD_i]$$

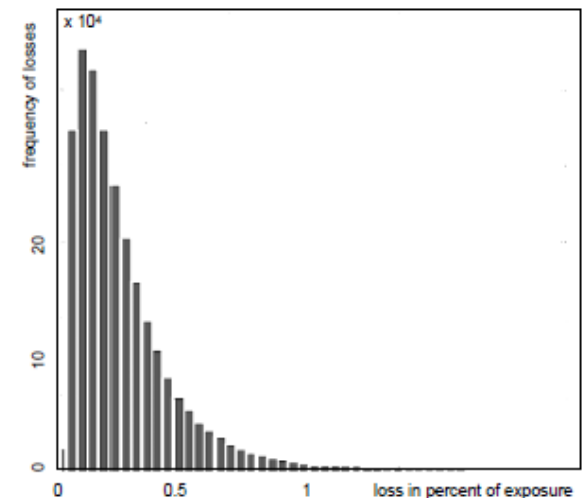
↑  
Probability of Default

**Losses won't be independent (correlation different to zero):**

- One contractor can be responsible for several projects (accumulation of risks)
- Economic Cycle can affect several industries
- Political Cycle can affect infrastructure projects

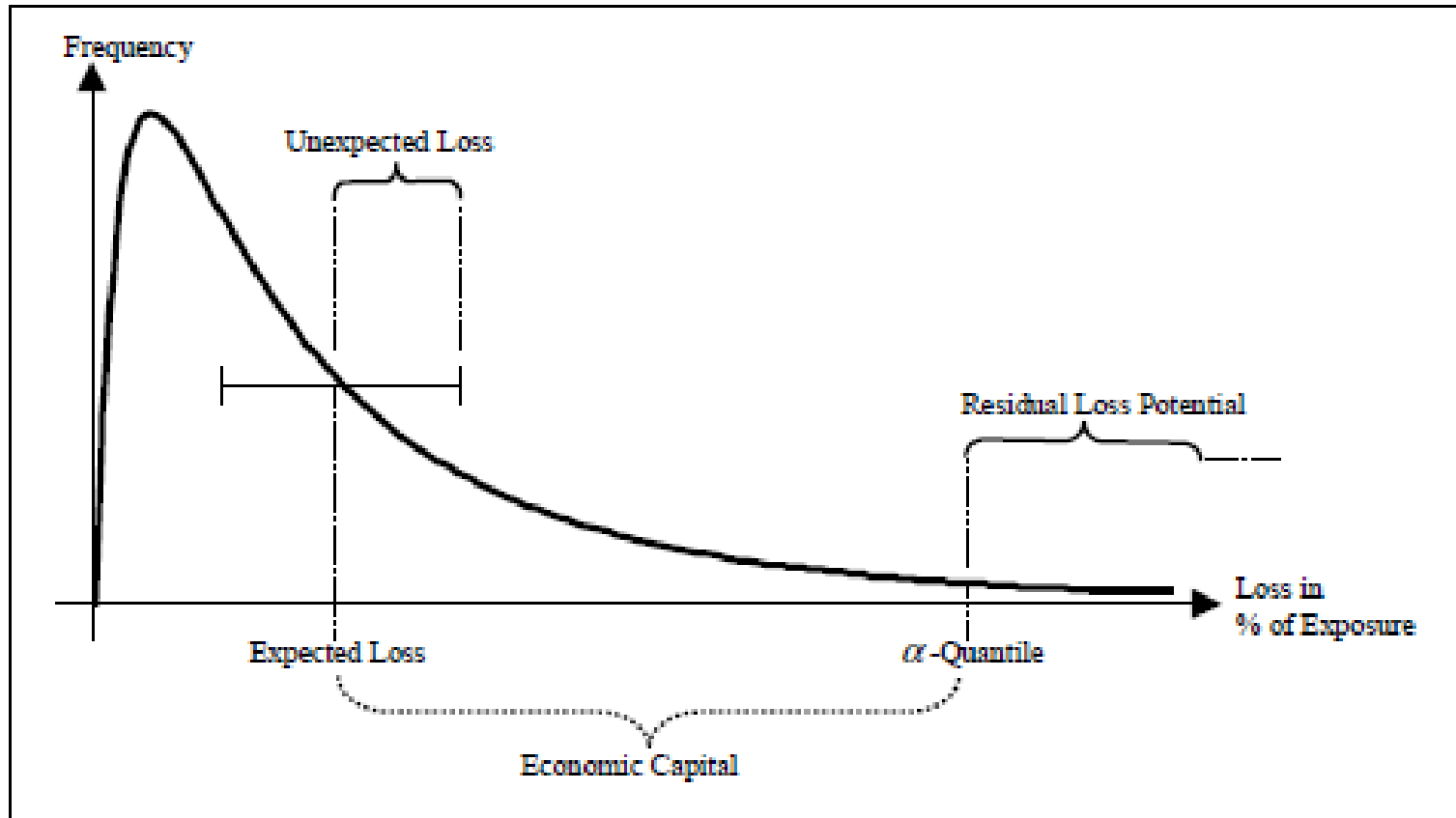


Loss distributions estimated by  
Montecarlo Methods



# Portfolio Pricing

By using Montecarlo simulation, it is possible to include deviations with respect to the expected loss that correspond to events occurring frequently.



Source: Graphics from Benzshawel (2012) *Credit Risk Modeling: Facts, Theory and Applications*


# Portfolio Pricing

Unexpected losses are function of standard deviation of severity of single risks (homogeneity of portfolio)

Surety portfolios are typically less diversified than other product classes. Traditionally, surety portfolios are concentrated around the construction industry, often with a focus on country specific contractors.

The high risk concentration combined with the risk profile, lead to a higher severity risk and hence, are increasing the capital intensity of surety portfolios.

**Ultimate Loss Ratio** will include:

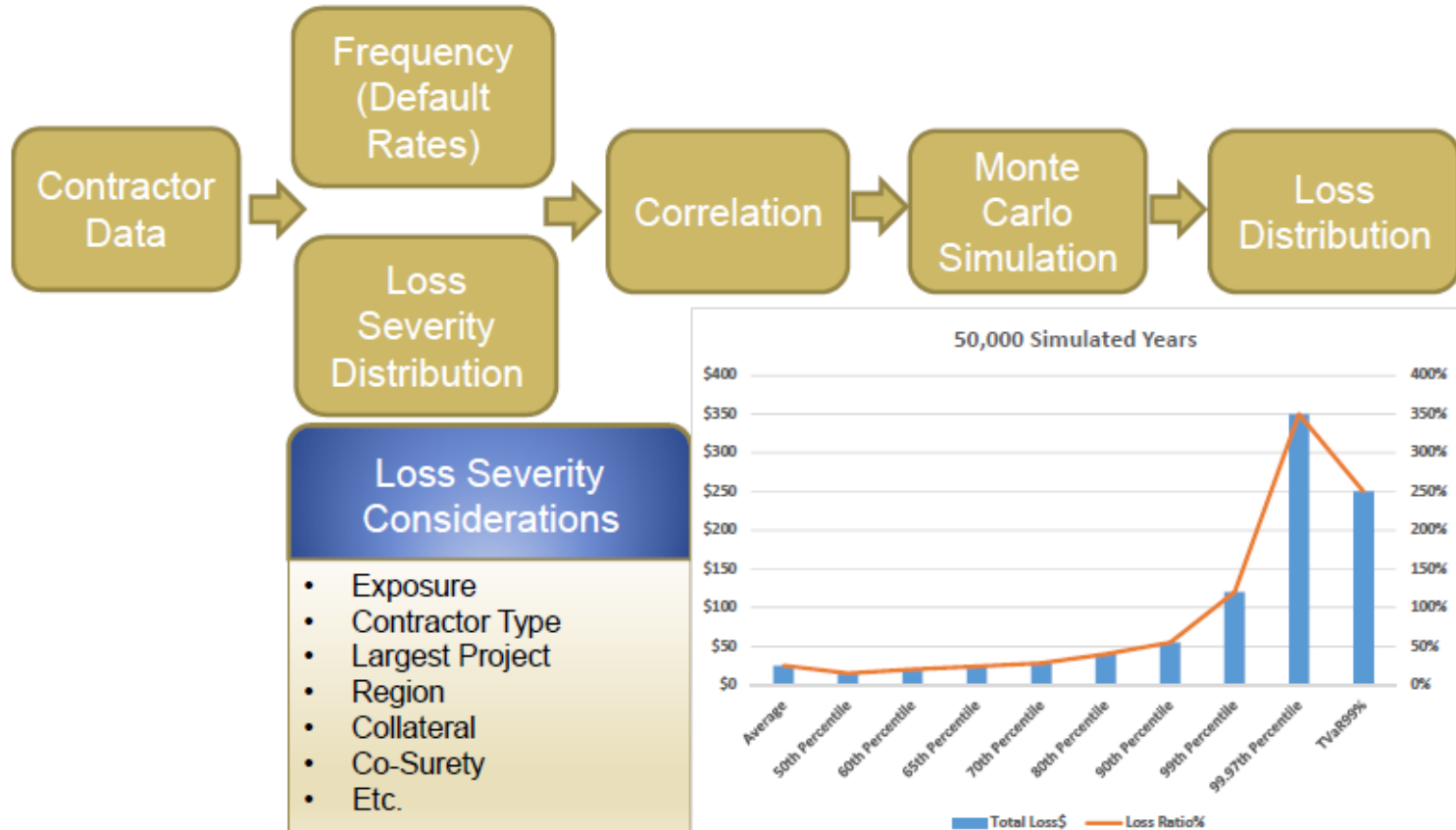
- Expected Losses
- Unexpected Losses
-  Economic Capital + Expected Shortfall

According to:

- Estimated Large Losses
- Portfolio Diversification
- Reinsurance Treaties

# Portfolio Pricing

## Need Surety Data at Individual Contractor Level



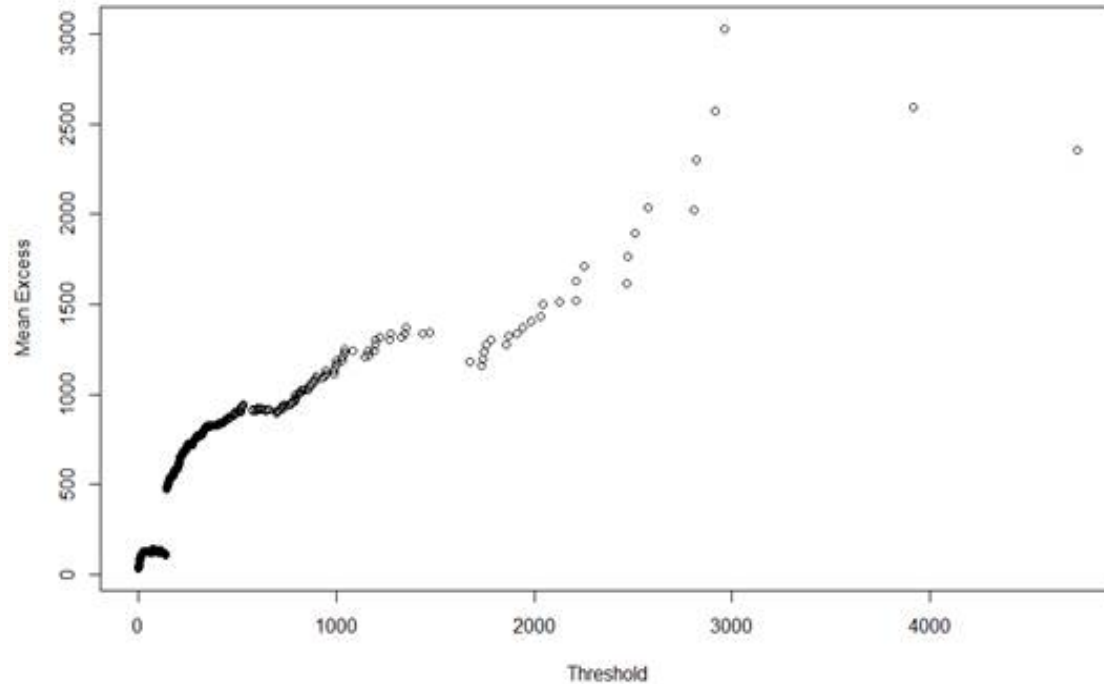
Source: Travelers



# Reserving in Surety Products

## Contract Surety Claims:

Mean excess plot



Then reserving requires analysis of:

- **Large losses** (extreme events)
- **Long Tails**



## Accident date?

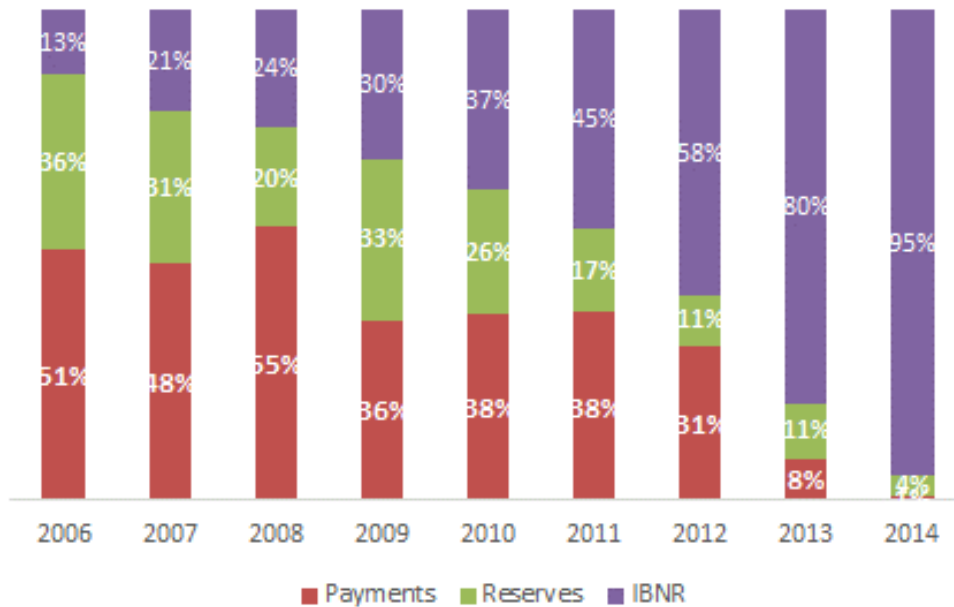
- Loss is not typically “fortuitous”
- claim files can open before a claim is made
- Can be outside the “policy period”

## Offsets include contract balances, indemnity, salvage, and subrogation

- Personal indemnity is not uncommon
- Recovery can extend for years
- Usually requires legal process (several years)

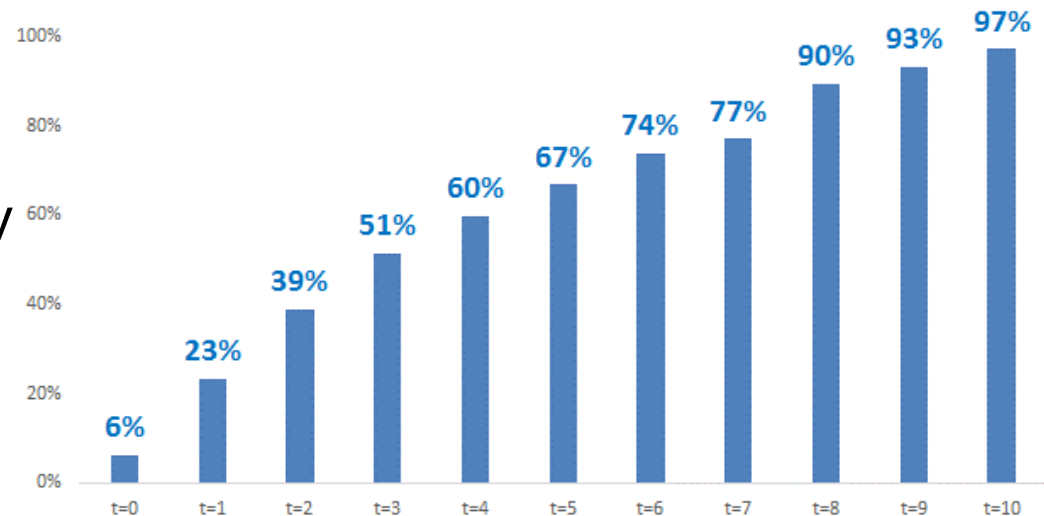
# IBNR of Surety claims

Development of claims of Surety (Colombian Market only)



IBNR reserve is more than 80% of ultimate losses in recent claims

Eight years after the beginning of the coverage an insurance would have incurred losses by 90% of ultimate losses.



Source: FASECOLDA

## In Summary...

Additional to frequency and severity, Portfolio Analysis requires taking account:

Exposure time of the project

- Correlation between risks (accumulation of exposure) and between industries
- Economic Cycles
- Large Losses / Extreme Events
- long tail claims



Thanks for Your Attention!

**QUESTIONS?**

