KU LEUVEN

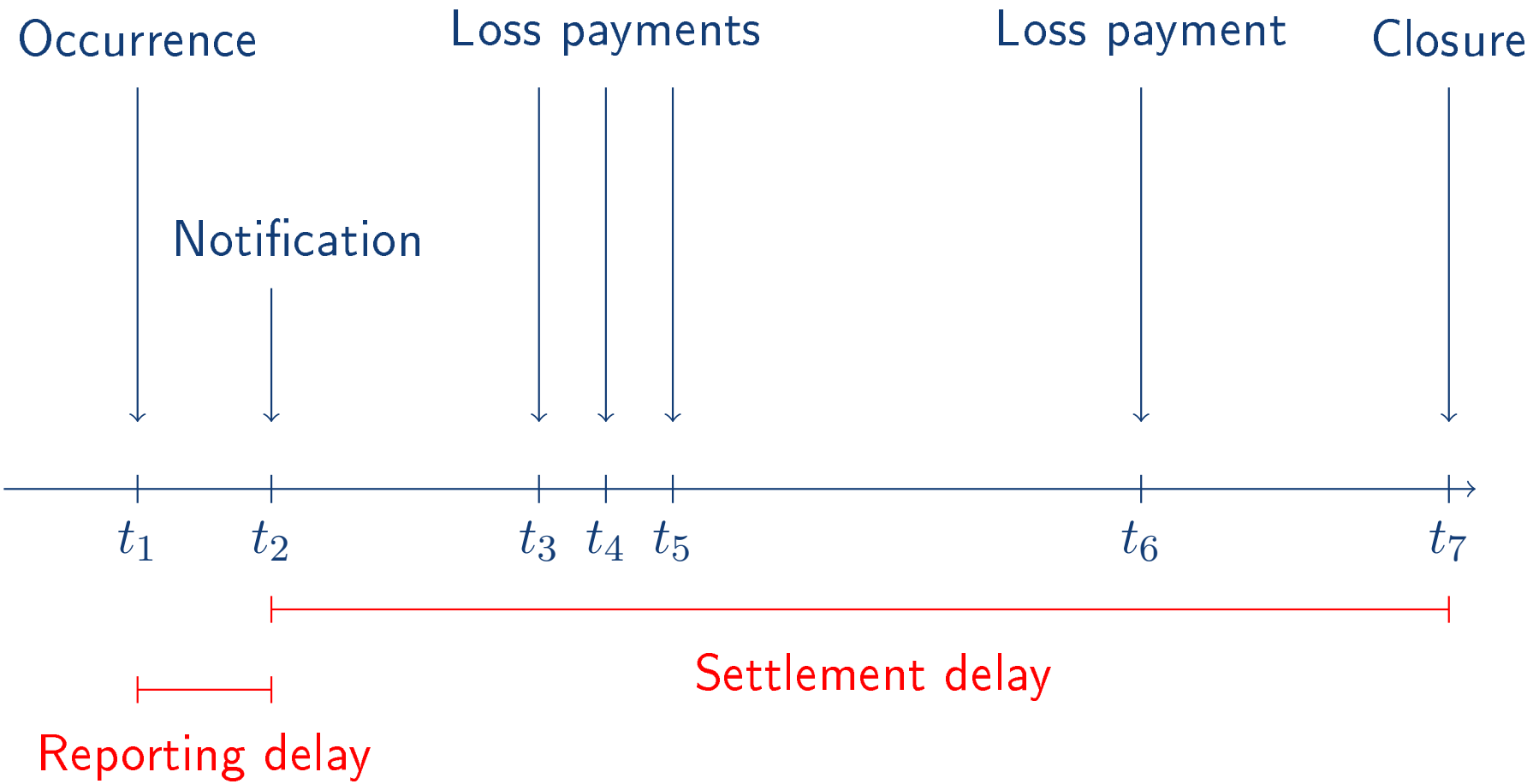
Reserving by conditioning on markers of individual claims: a case study using historical simulation

Els Godecharle[1], Katrien Antonio[1,2]

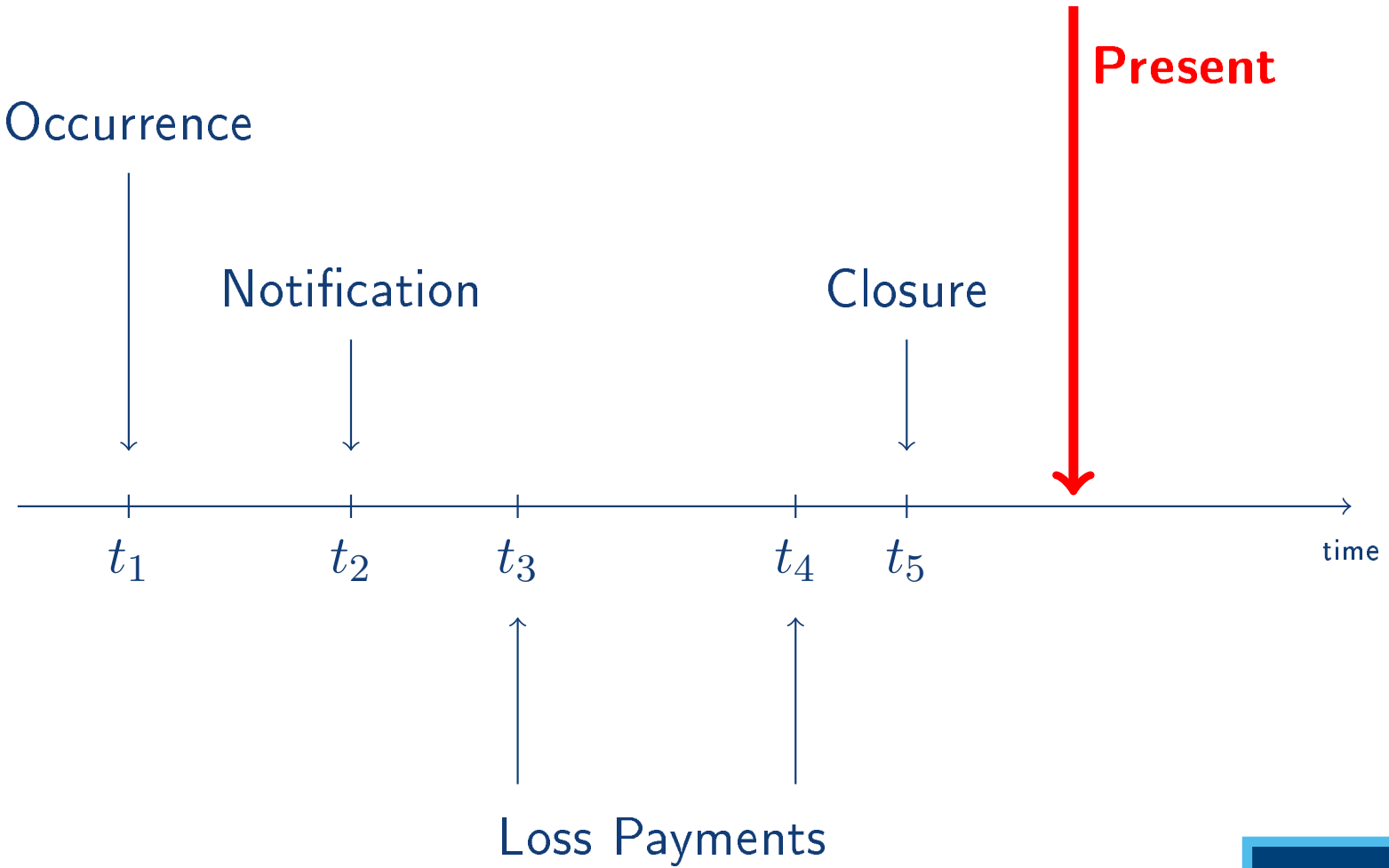
[1]Faculty of Economics and Business, KU Leuven, Leuven, Belgium

[2]Faculty of Economics and Business, University of Amsterdam, Amsterdam, the Netherlands

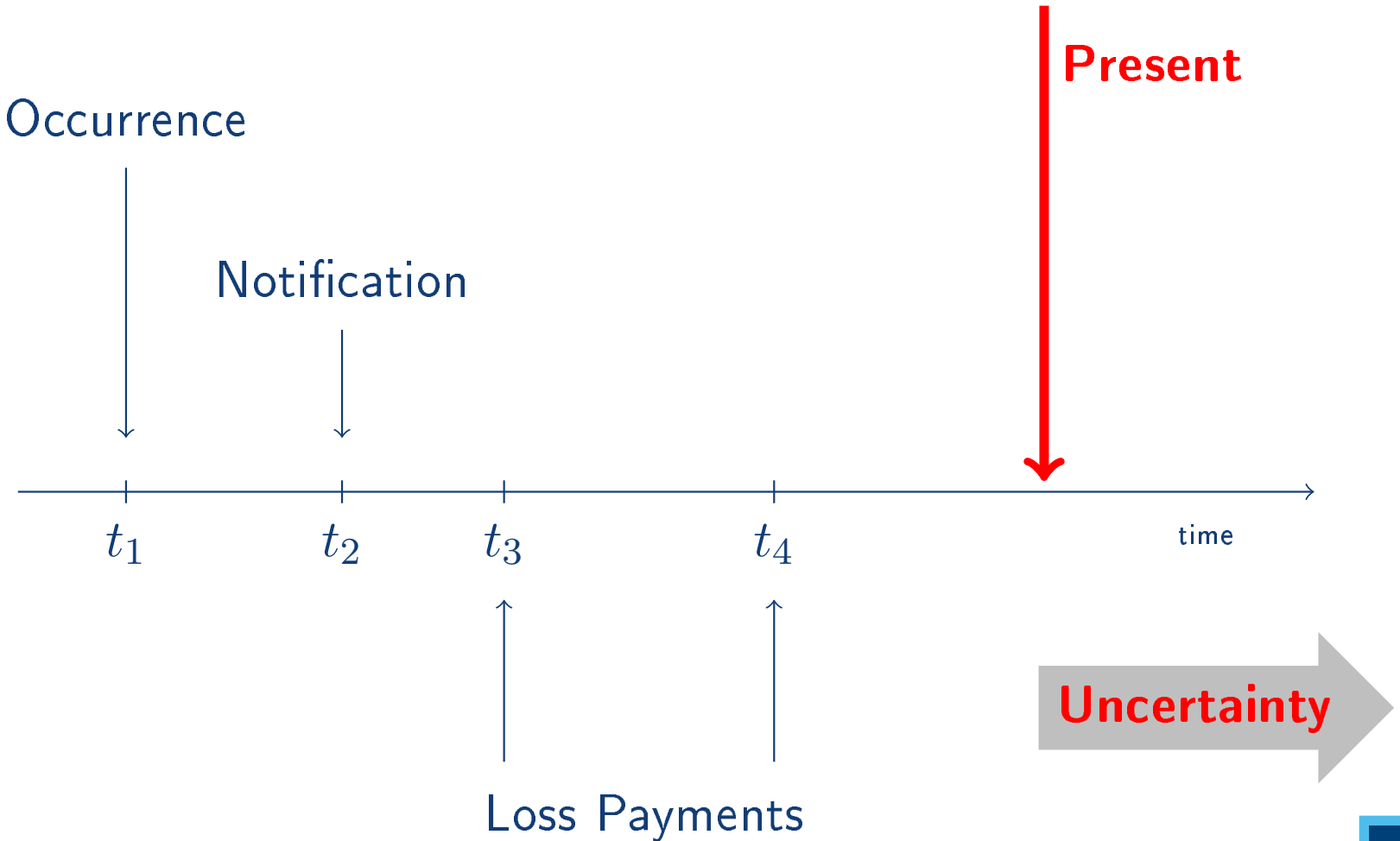
R in Insurance, July 14, 2014


Occurrence
Loss payments
Loss payment
Closure
Notification
t_1
t_2
t_3
t_4
t_5
t_6
t_7
Settlement delay
Reporting delay

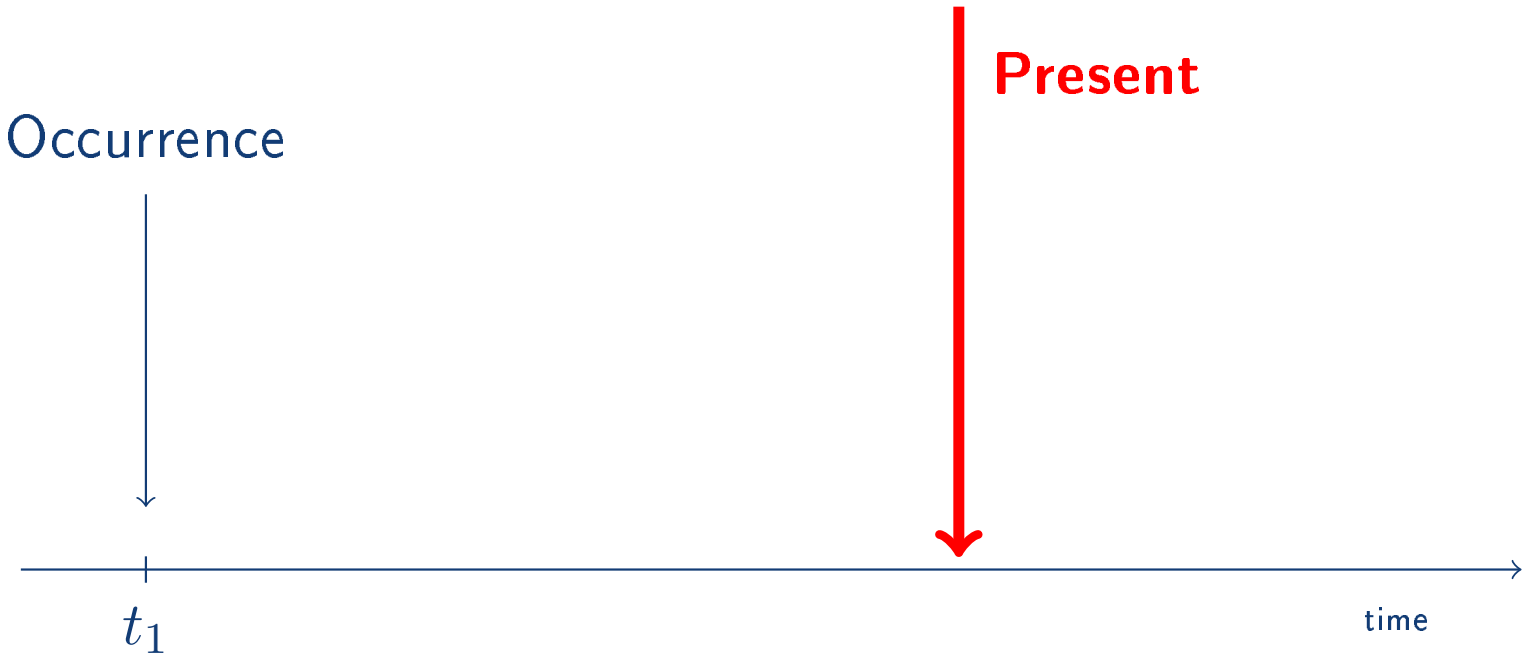
Closed claim = closure (at t_5) $\leq$ present



RBNS claim = reported, but closure > present



IBNR claim = incurred, but reporting and closure $>$ present



Uncertainty

Currently used reserving techniques

At **macro-level**: aggregated data in run-off triangle

267345	882780	1242051	1774606	2320824	2458221	2587751	2926611
206244	679754	991270	1327486	1595997	1651916	1830533	
241482	810914	1219174	1490308	1744413	2030012		
240122	817377	1260952	1759364	2165475			
406312	1232904	1785225	2344150				
272523	856530	1391074					
248706	1006084						
269900							

Big data set with individual claims summarized in small sample design

Loss of information!

Design a reserving method using data available at **micro-level**

Highlights of approach in Godecharle & Antonio (2014):

- Development of individual claims in **discrete time**
- Use specific individual claim characteristics (**'claim markers'**) when predicting the reserve
- Construct a predictive **distribution** for the reserve, not just a point estimate

In research & practice: increasing interest in alternatives for the run-off triangle approach

Event		Date	Our Notation
Accident		05/17/1997	$i =$'1997'
Reporting		02/02/1998	$W(k) = 2$
Cash flow	€200	11/24/1998	$Y(k, 2) = 200$
	€150 €100	02/08/1999 05/11/1999	$Y(k, 3) = 250$
			$Y(k, 4) = 0$
	€50	02/23/2001	$Y(k, 5) = 50$
			$Y(k, 6) = 0$
Closure		03/13/2002	$F(k) = 6$

Starting point: Rosenlund's Reserve by Detailed Conditioning (RDC) method (Rosenlund, 2012)

Deterministic method for reserving individual claims at micro-level in discrete time

Estimates the expected outstanding amount conditional on specific **'claim markers'** of the claim:

- Reporting delay (bounded)
- Censored observation of cumulative payments
- Censored claim length

Stochastic method for reserving individual claims at micro-level

Idea:

- Use the conditioning on specific claim markers as in Rosenlund's RDC
- Combine with historical simulation

→ Program the method in R: `http://www.econ.kuleuven.be/els.godecharle`
→ Evaluate performance in a case-study with real data

Historical simulation:

- Claims with the same claim markers are grouped into 'clusters' (split)
- Development of an outstanding claim is simulated from the cluster of claims with the same claim markers (sample)

RBNS claims

Simulation approach:

1. Simulate the **claim length** conditional on the claim markers:
   - bounded reporting delay
   - censored cumulative payment
   - censored claim length
2. Simulate the **unobserved payments** conditional on the claim markers:
   - bounded reporting delay
   - censored observed cumulative payment
   - bounded (simulated) claim length
3. Repeat 1 and 2 to obtain a distribution

IBNR claims

1. Simulate the **number of IBNR claims** per occurrence year and reporting delay (Pigeon et al. (2013))
2. Simulate the **development** of each of those claims in the same way as an RBNS claim
3. Repeat 1 and 2 to obtain a distribution

Data: portfolio of general liability insurance policies for private individuals

Because of their different nature, we distinguish 2 types of claims and predict their reserve separately:

- Material damage (MD)
- Bodily injury (BI)

Back test to check the performance of the stochastic RDC method

- Training data set: 1997–2004
- Validation data set: 2004–2009

Important note: The validation data set of the BI claims contains an outlier (a claim of €1,000,000 from a deadly accident)

Distribution of total loss reserve, as obtained with stochastic RDC

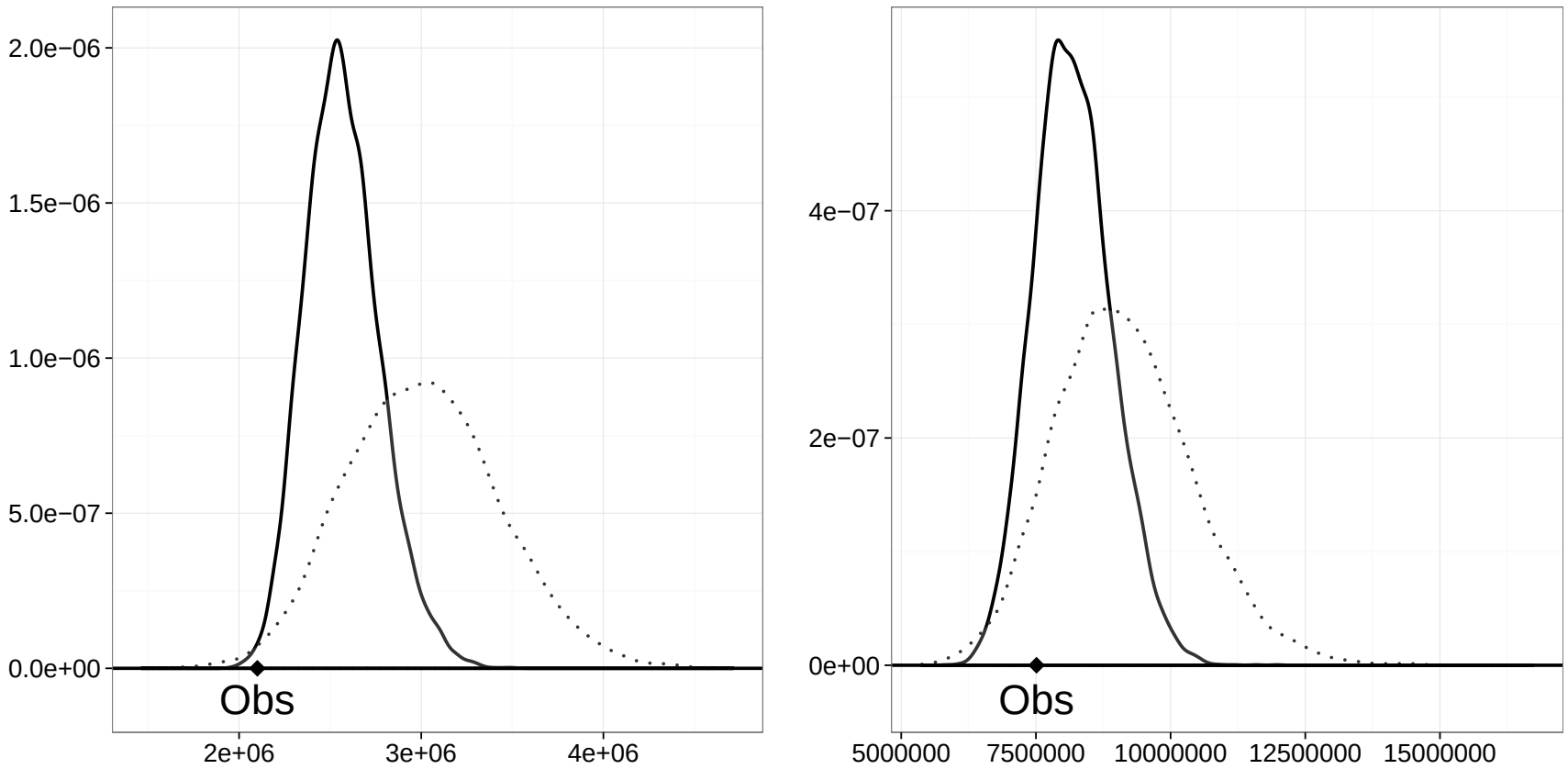


Figure : Results stochastic RDC: MD (left), BI (right)

Highlights of the stochastic RDC method:

- Micro-level reserving method
- Use of specific claim markers
- Predictive distribution for the reserve
- Easy, intuitive to implement
- Flexible: extendable to other claim characteristics
- Good performance in case study, results in line with Antonio & Plat (2014), Pigeon et al. (2013)

- In current implementation: ad hoc selection of parameters, based on descriptive statistics, that avoid getting too small clusters
  $\rightarrow$ possible solution: decision trees
- Stochastic RDC is limited to the triangle boundary
  $\rightarrow$ possible solution: introduction of a tail factor
- Other meaningful claim characteristics e.g. case estimates

Thank you for your attention!

Questions?