# Replication Study

„Can I Trust My Simulation Model?
Measuring the Quality of Business Process Simulation Models“

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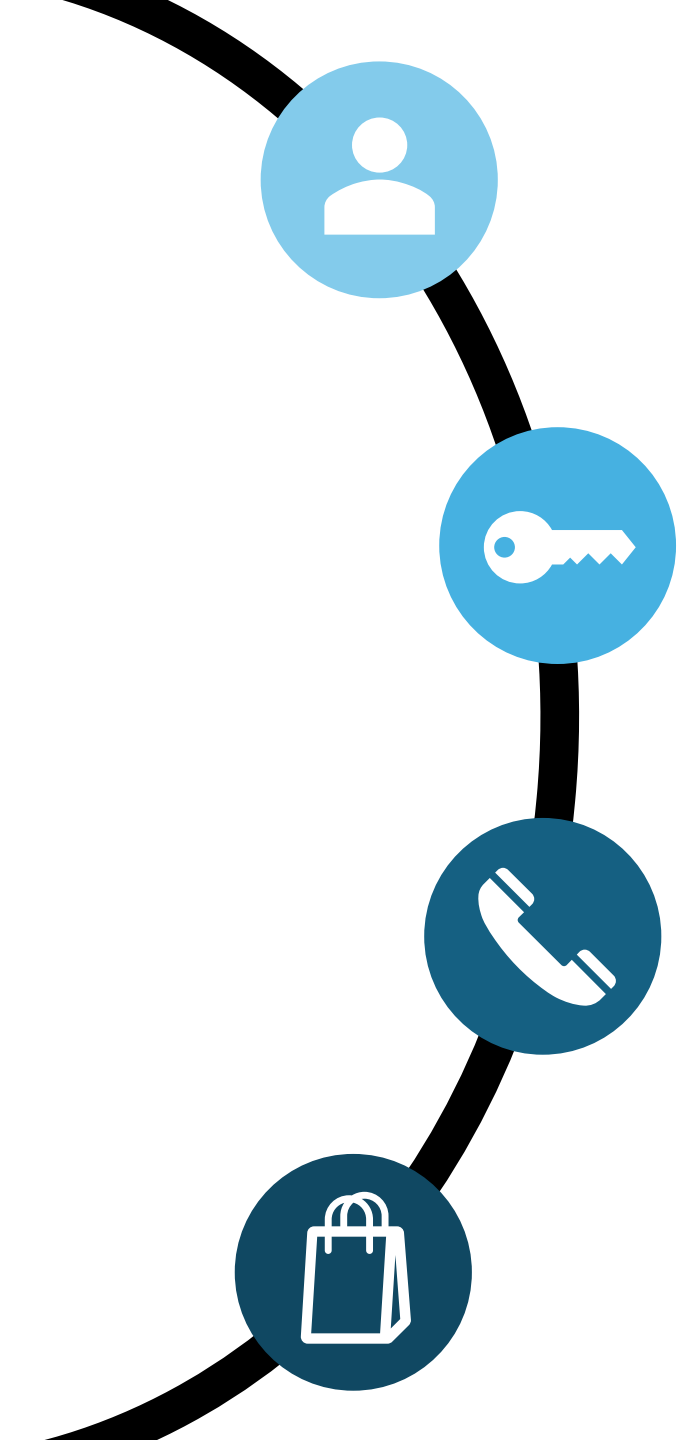
# AGENDA



## 01 – SELECTED PAPER

„Can I Trust My Simulation Model? Measuring the Quality of Business Process Simulation Models"

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## 02 – REPLICATION OF THE PAPER'S RESULTS

Problems & Limitations
Compared Results

## 03 – ADDITIONAL RESEARCH

Replication of BPMN Models
Replication via New Logs

## 04 – CONCLUSION

Successful Replication with Limitations

# "Can I Trust My Simulation Models? Measuring the Quality of Business Process Simulation Models“

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Published in BPM 2023

**Business Process Simulation** = approach to analyze performance of business processes under different scenarios

**Key Research:** evaluating the ability of different measures to discern impact of modifications to a BPS model

uncover relative strengths / weaknesses of SIMOD & ServiceMiner

Resources: executable code (GitHub Repo), used data set, instructions for replication

# BPS Evaluation Measures

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- Evaluation for **control-flow,**
  - N-Gram Distance (NGD)
  - Control-Flow Log Distance (CFLD)
- **temporal**
  - Absolute Event Distribution (AED / ED)
  - Circadian Event Distribution (CED)
  - Relative Event Distribution (RED)
- and **congestion** dimensions
  - Case Arrival Distribution Distance (CAR)
  - Cycle Time Distribution Distance (CTD)
- Earth Mover's Distance (Wasserstein Distance) for time series

# Used Data

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- 4 real-life event logs
  - Used with 2 automated BPS model discovery techniques (SIMOD, ServiceMiner)
- 1 synthetic event log with 7 modifications

# AcademicCredentials

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- Academic credentials' management process
- Split into disjoint train and test log
- 398 cases with:
  - Up to 1,945 activity instances
  - 16 different activites
  - Up to 54 variants
  - Up to 306 resources

| activity | case_id | resource | end_time | start_time |
|---|---|---|---|---|
| Traer informacion estudiante - banner | 110602 | 13544 | 15.04.2016 23:47 | 15.04.2016 23:47 |
| Radicar Solicitud Homologacion | 110602 | 13544 | 15.04.2016 23:47 | 15.04.2016 23:47 |
| Validar solicitud | 110602 | 22404 | 16.04.2016 00:32 | 16.04.2016 00:32 |
| Homologacion por grupo de cursos | 110602 | 22404 | 18.04.2016 00:43 | 18.04.2016 00:43 |
| Revisar curso | 110602 | 22404 | 18.04.2016 00:43 | 18.04.2016 00:43 |
| Cancelar curso | 110602 | 22404 | 18.04.2016 00:43 | 18.04.2016 00:43 |
| Traer informacion estudiante - banner | 110603 | 13544 | 16.04.2016 00:33 | 16.04.2016 00:33 |
| Radicar Solicitud Homologacion | 110603 | 13544 | 16.04.2016 00:33 | 16.04.2016 00:33 |
| Cancelar Solicitud | 110603 | 13544 | 16.04.2016 01:12 | 16.04.2016 00:40 |
| Validar solicitud | 110603 | 22404 | 16.04.2016 00:40 | 16.04.2016 00:40 |
| Revisar curso | 110603 | 22404 | 18.04.2016 00:48 | 18.04.2016 00:48 |
| Notificacion estudiante cancelacion soli | 110603 | 13544 | 21.04.2016 23:18 | 21.04.2016 23:18 |

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Problems & Differences to the paper's results

# Our Replication

# Problems & Limitations

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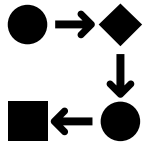
Time Format Error

SIMOD Configuration Files



No information on Creation of BPMN Models

Finding appropriate Logs for Testing

# Replication Results

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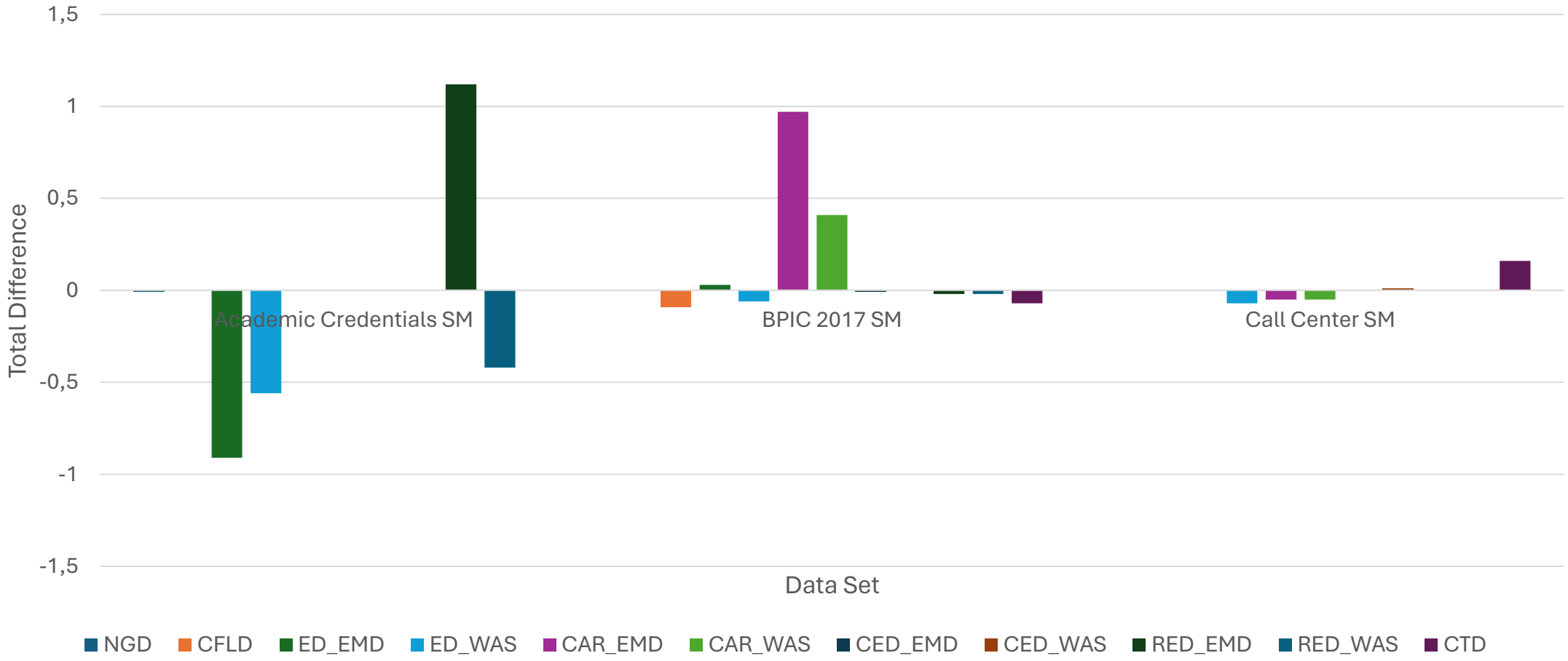

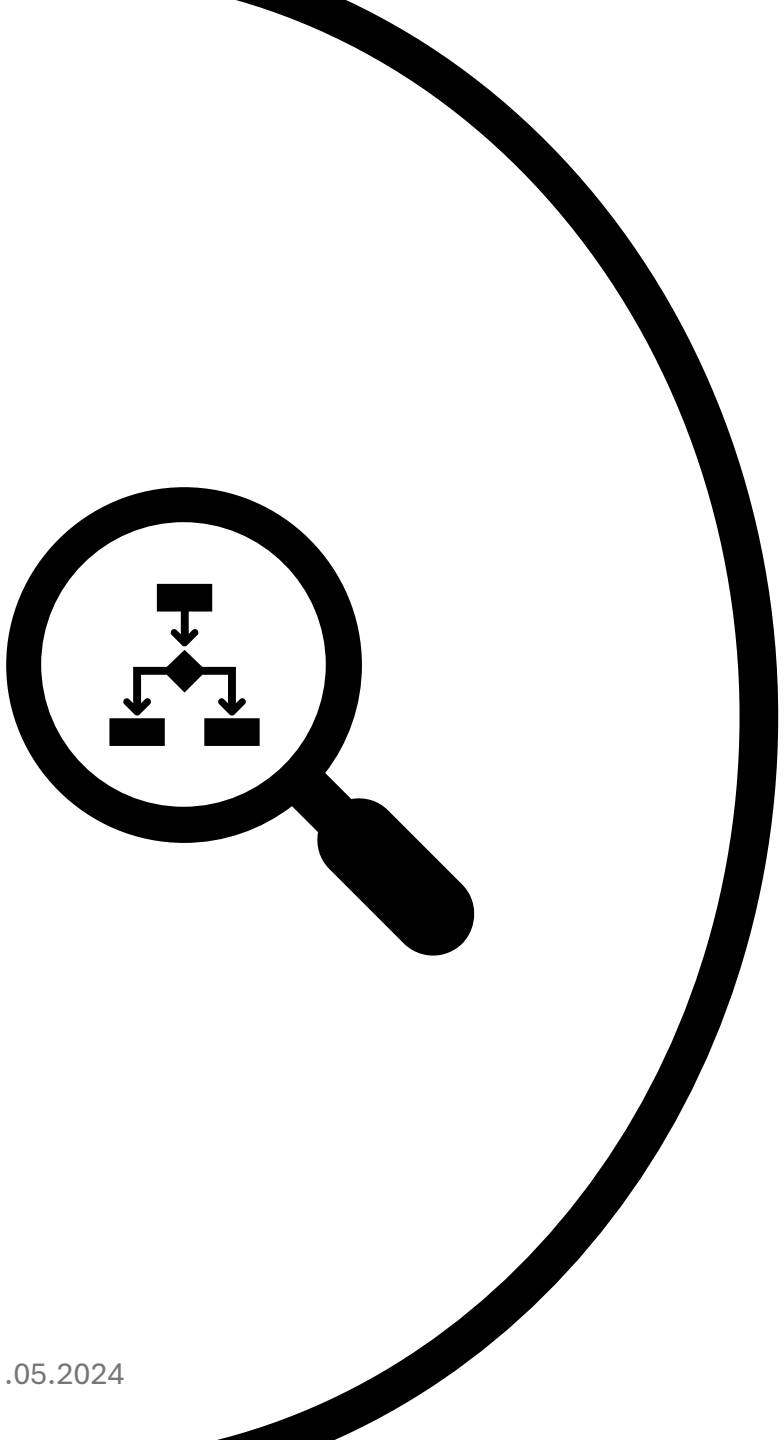

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Replication of BPMN Models & via New Logs

# Additional Research

# Replication of BPMN Models

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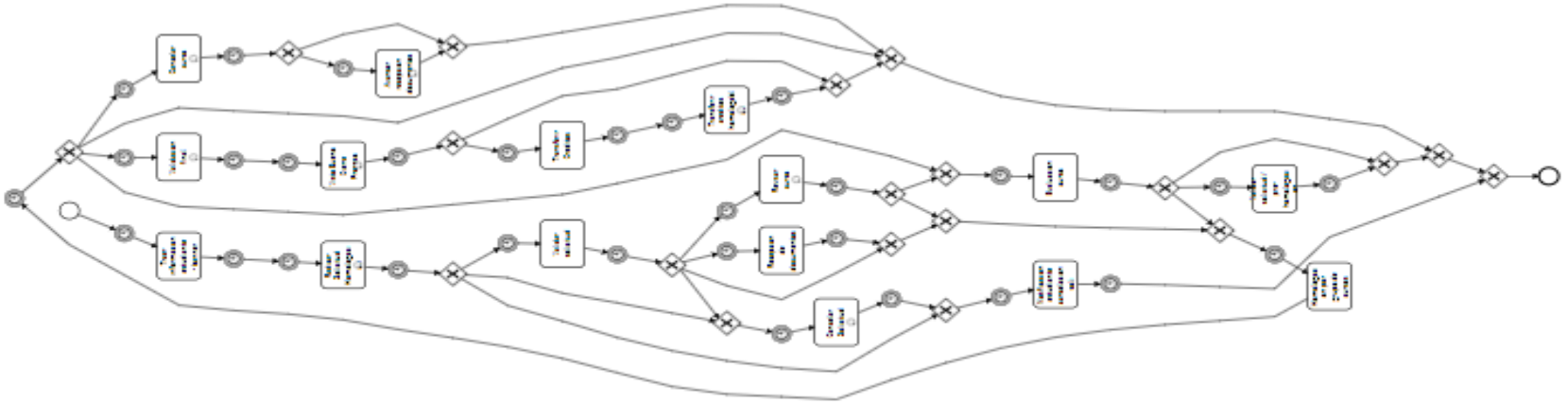
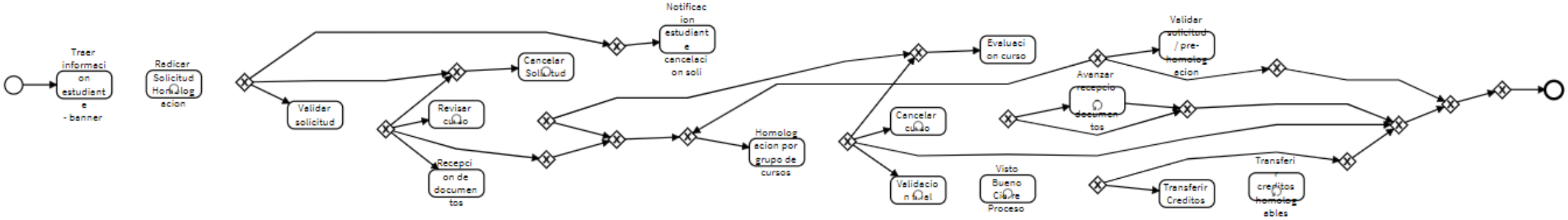


Our discovered model

Paper reported model



# Discovered process in Apromore

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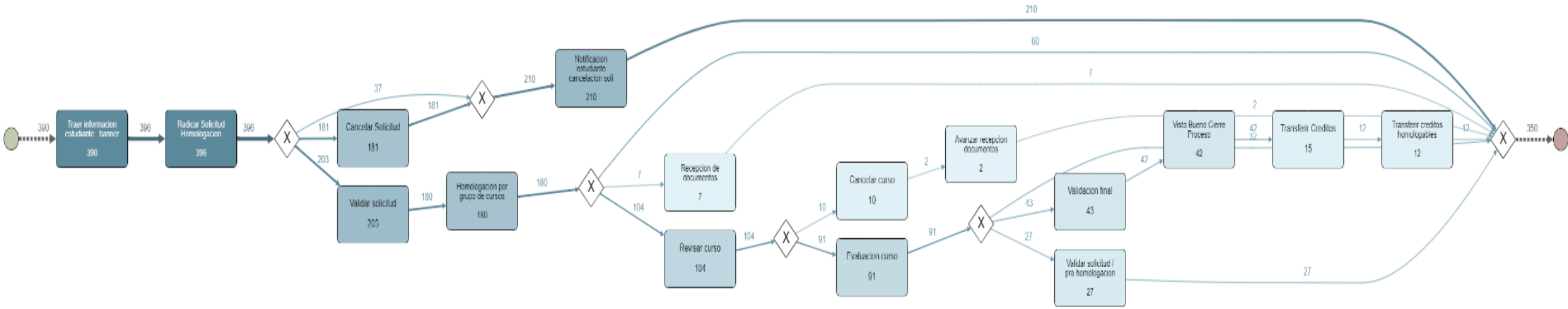

# Replication via New BPS Discovery

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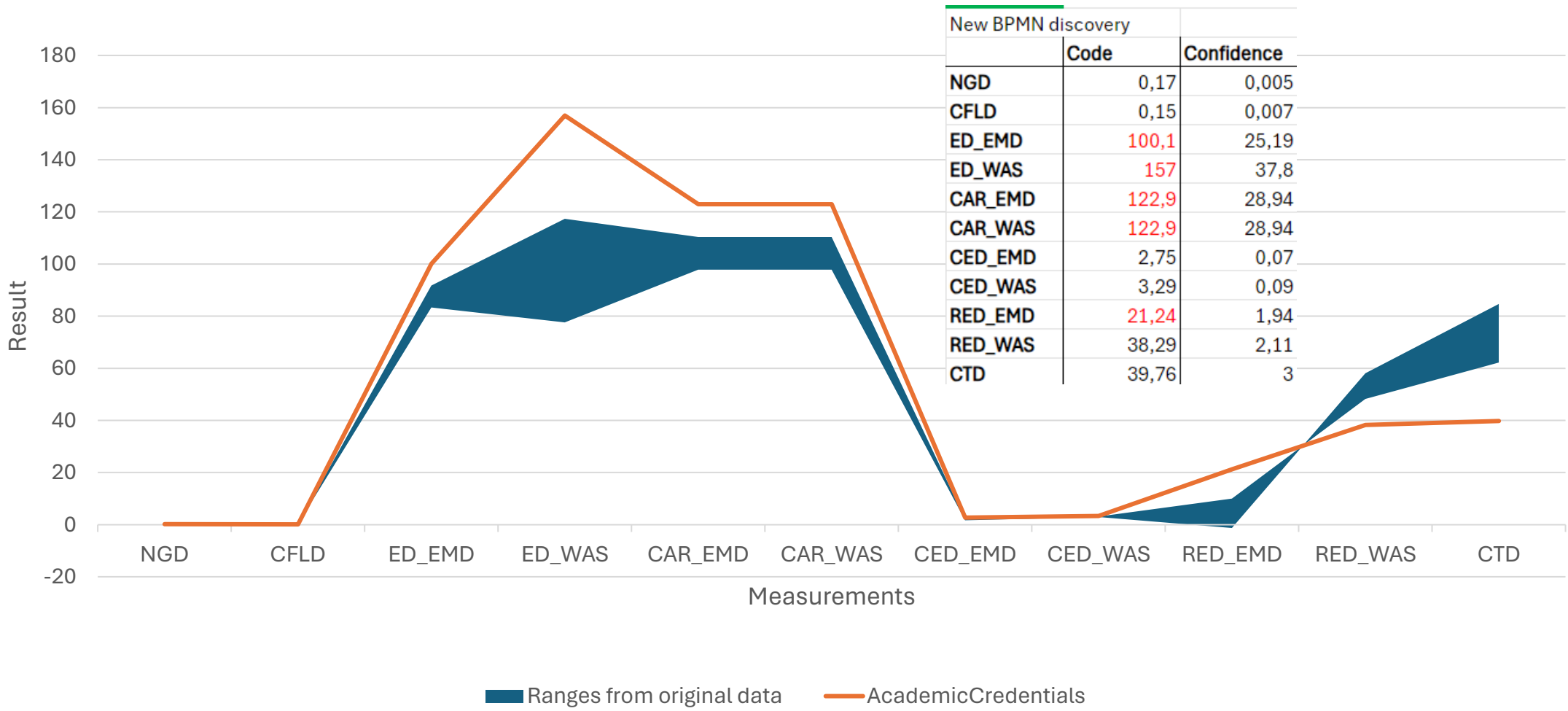


New BPMN discovery

| | Code | Confidence |
|---|---|---|
| NGD | 0,17 | 0,005 |
| CFLD | 0,15 | 0,007 |
| ED_EMD | 100,1 | 25,19 |
| ED_WAS | 157 | 37,8 |
| CAR_EMD | 122,9 | 28,94 |
| CAR_WAS | 122,9 | 28,94 |
| CED_EMD | 2,75 | 0,07 |
| CED_WAS | 3,29 | 0,09 |
| RED_EMD | 21,24 | 1,94 |
| RED_WAS | 38,29 | 2,11 |
| CTD | 39,76 | 3 |

# Replication via New Logs

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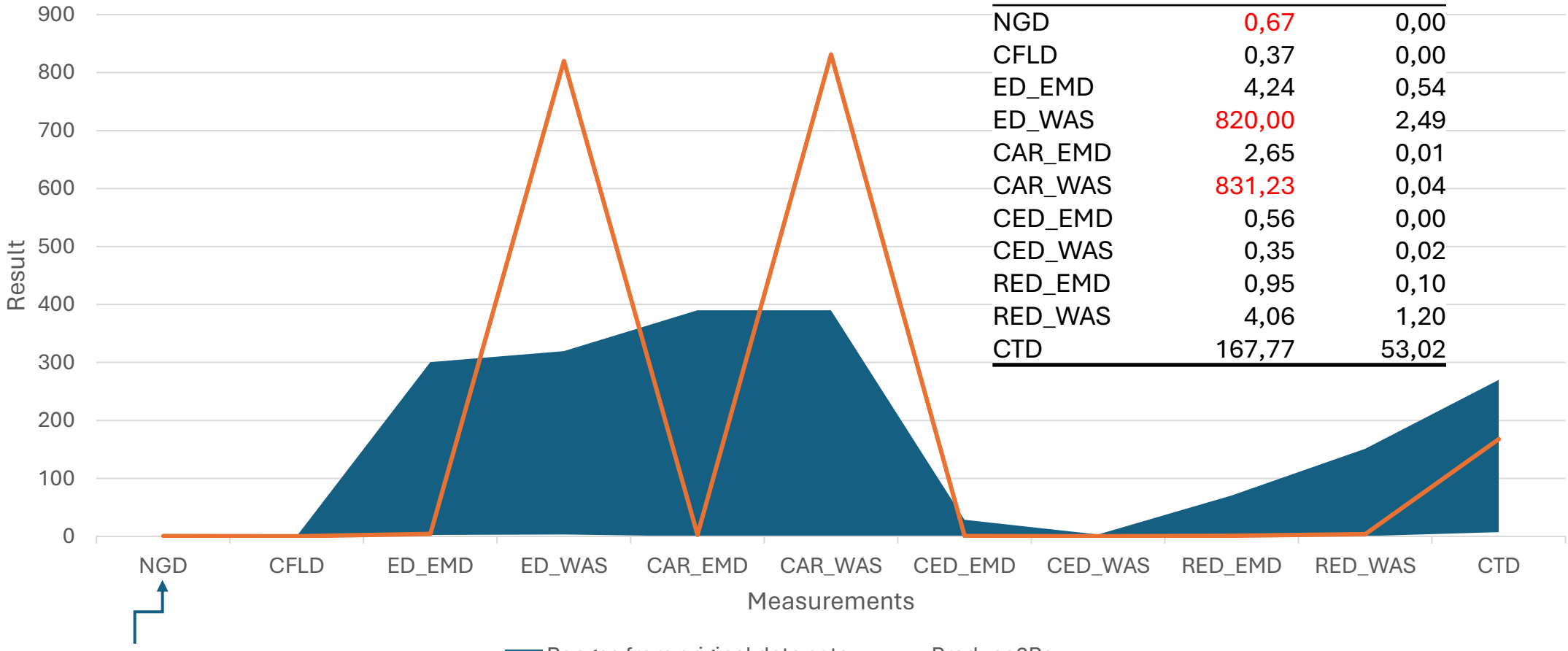


| | Code | Confidence |
|---|---|---|
| NGD | 0,67 | 0,00 |
| CFLD | 0,37 | 0,00 |
| ED_EMD | 4,24 | 0,54 |
| ED_WAS | 820,00 | 2,49 |
| CAR_EMD | 2,65 | 0,01 |
| CAR_WAS | 831,23 | 0,04 |
| CED_EMD | 0,56 | 0,00 |
| CED_WAS | 0,35 | 0,02 |
| RED_EMD | 0,95 | 0,10 |
| RED_WAS | 4,06 | 1,20 |
| CTD | 167,77 | 53,02 |

**slightly not** in range

# Conclusions

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- Successful replication with **limitations**
- **SIMOD** → better in congestion models due to its extraneous waiting time discovery
- **ServiceMiner** → better control-flow performance due to Markovian approach which aligns well with NGD measures
- Significant difference between EMD and Wasserstein on some cases (paper claimed different) because of the penalty

→ depending on the model characteristics we **can trust** our simulation on providing an **accurate** model

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# Questions?

# Resources

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- Our GitHub Repository
- Used Paper
- Their GitHub Repository
- Their used Data Set

# Replication Results

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