

# TITLE

Steph Reinke, Olivia Fu, Srika Gopal

October 14, 2025

- 1 Background and Motivation**
- 2 Data and Exploratory Analysis**
- 3 Model Rationale, Implementation, and Evaluation**
  - 3.1 Rationale & Selection**
  - 3.2 Implementation**
  - 3.3 Evaluation**
- 4 Results**
- 5 Limitations and Conclusion**

## 6 Appendix

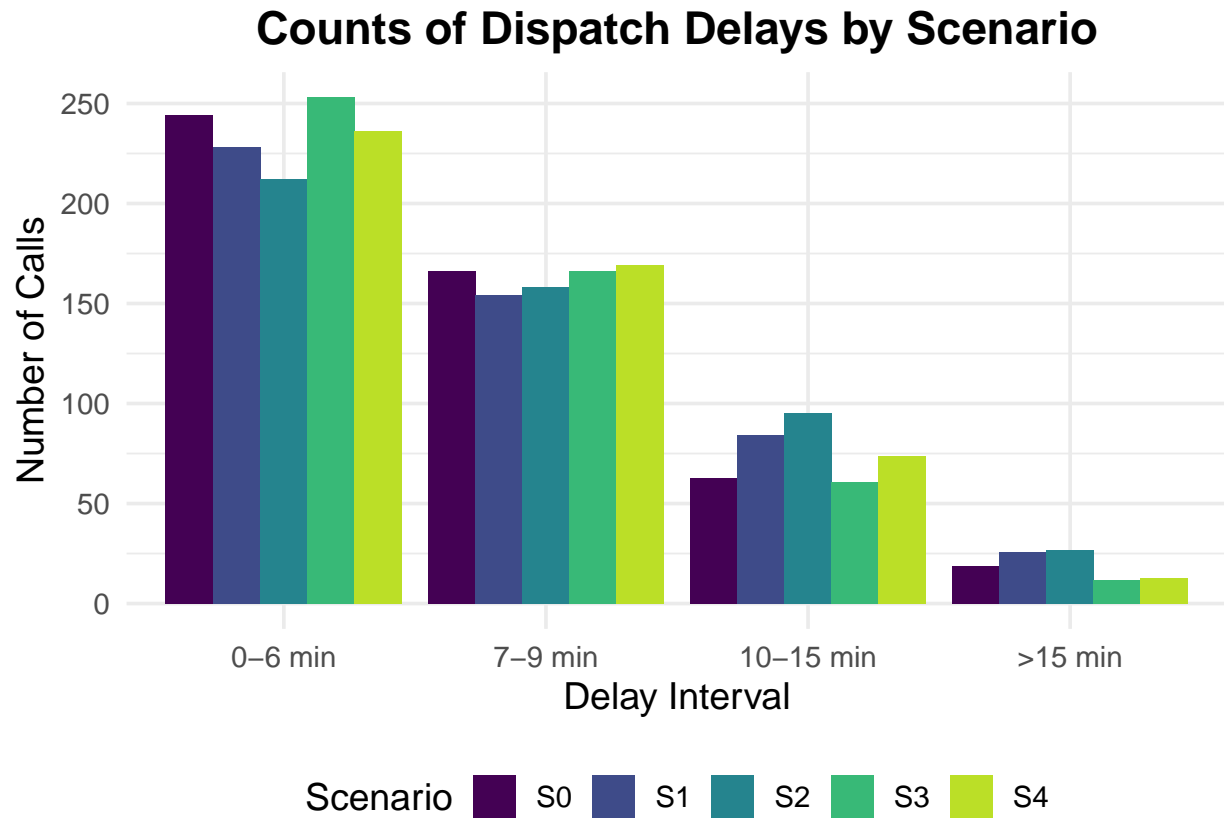


Figure 1: CAPTION

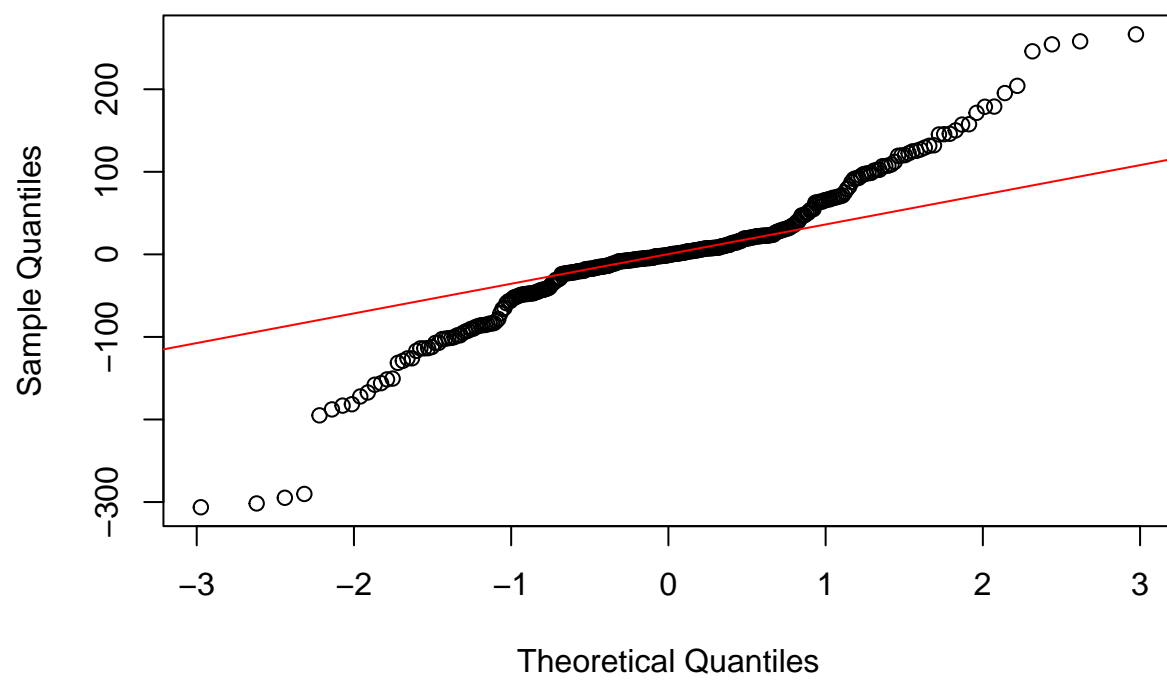
Table 1: CAPTION

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	-1.077	0.104	-10.400	0.000	-1.284	-0.877
ScenarioS2	-0.099	0.148	-0.667	0.505	-0.390	0.192
ScenarioS3	-1.037	0.179	-5.810	0.000	-1.394	-0.693
ScenarioS4	-1.195	0.186	-6.413	0.000	-1.568	-0.836

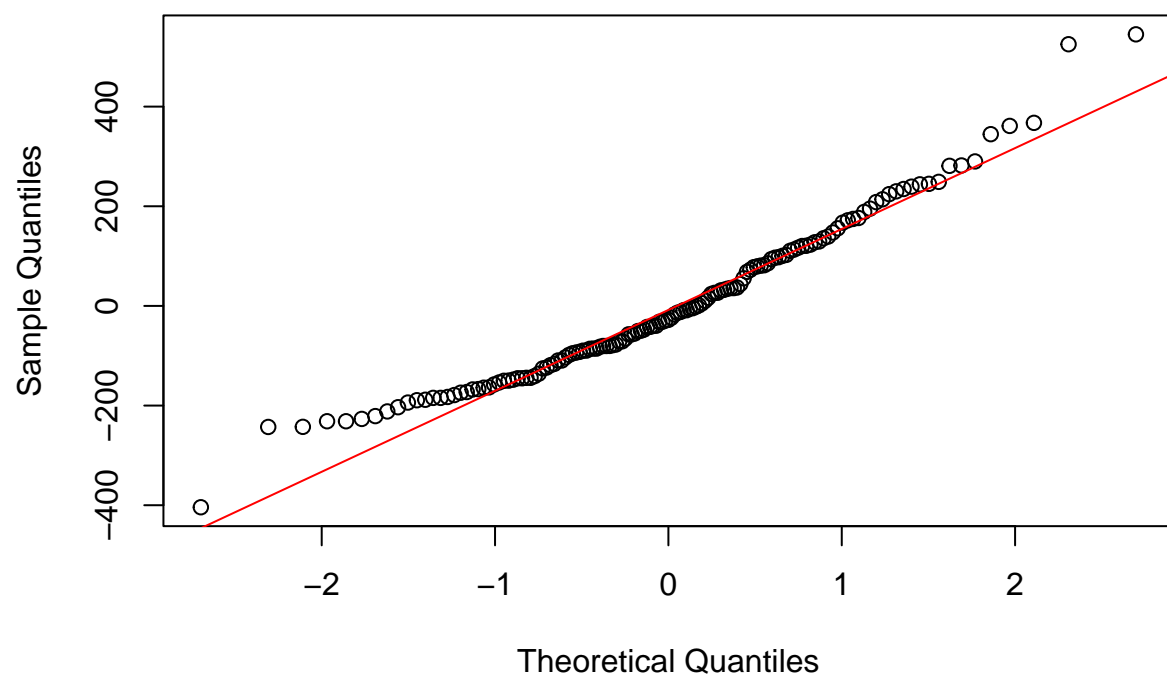
Table 2: CAPTION

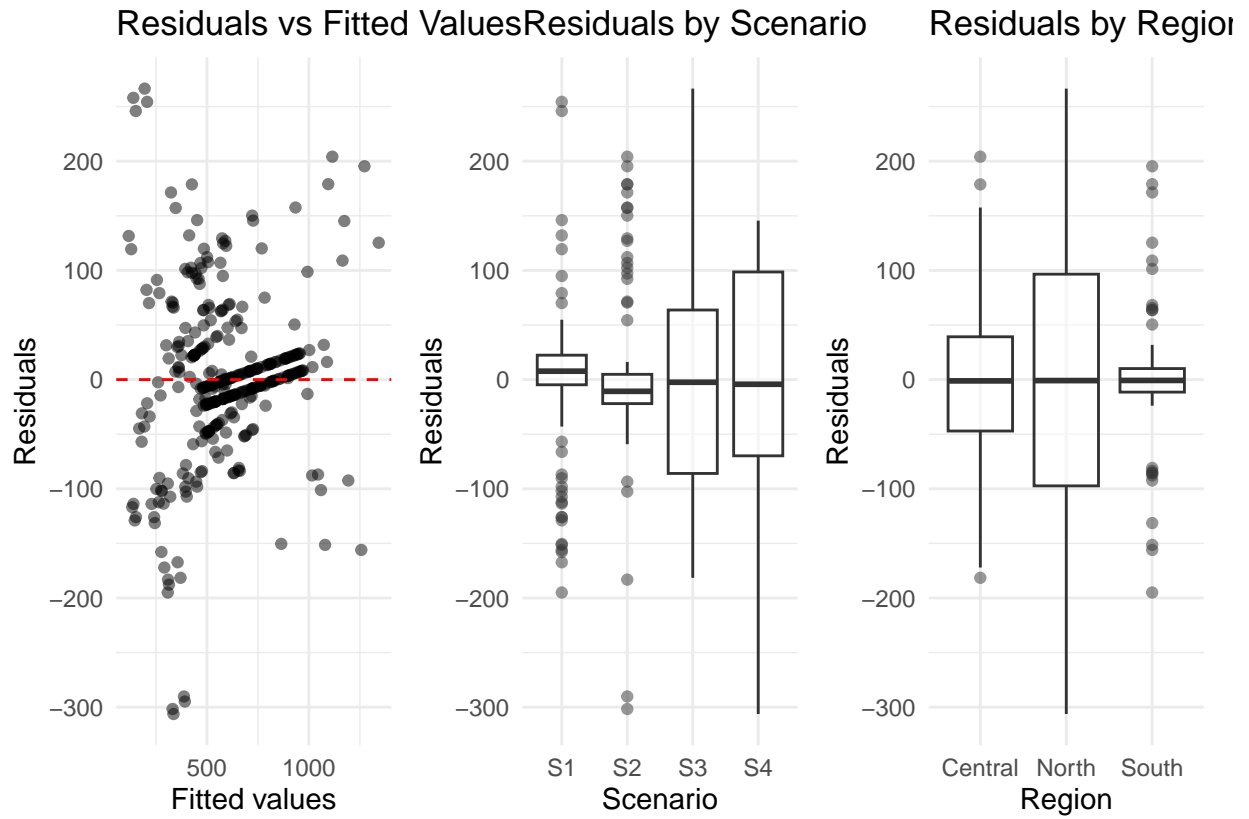
Scenario	predicted_prob
S1	0.254
S2	0.236
S3	0.108
S4	0.093

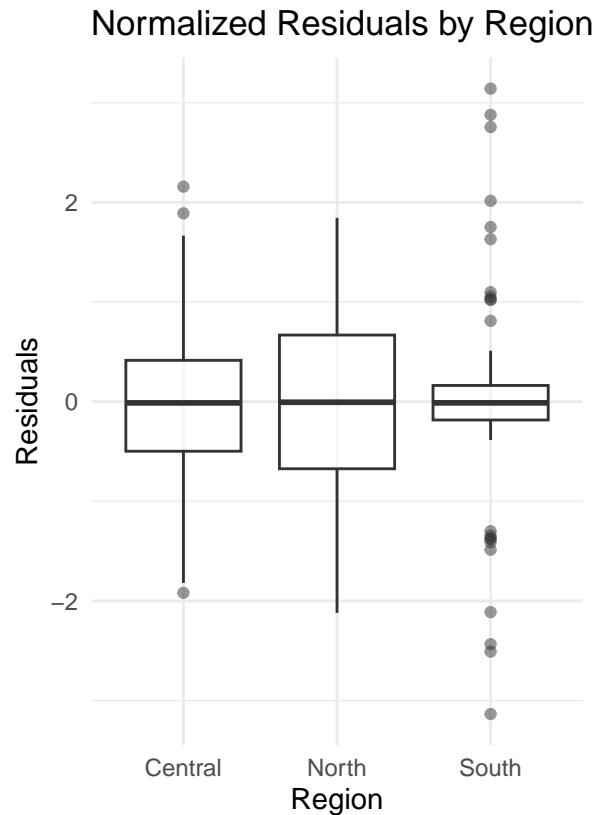
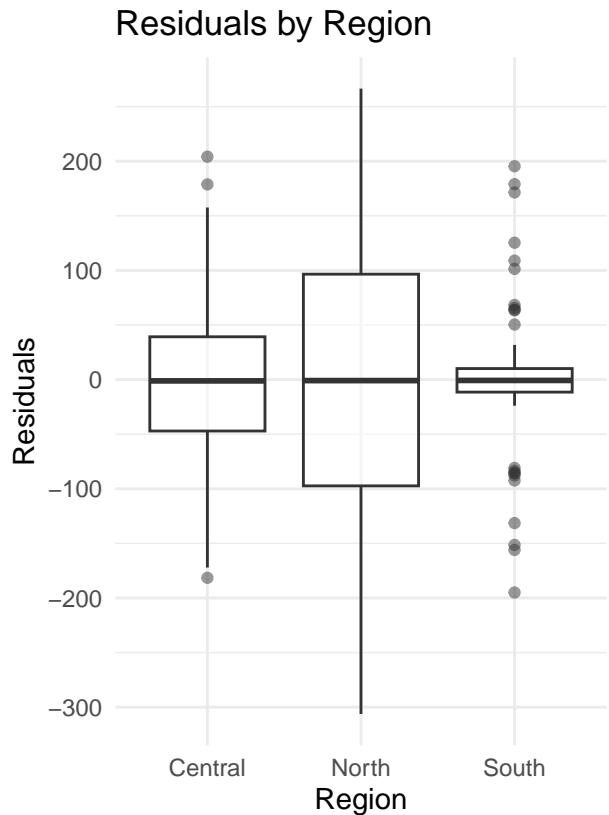
# Residuals



# Random Effects







```
## region = Central:
## Scenario emmean SE df lower.CL upper.CL
## S1 520 33.3 142 454 586
## S2 590 34.4 142 522 658
## S3 534 35.6 142 464 604
## S4 649 36.2 142 577 720
##
## region = North:
## Scenario emmean SE df lower.CL upper.CL
## S1 296 44.7 140 208 385
## S2 477 47.8 140 382 571
## S3 284 45.8 140 194 375
## S4 481 49.4 140 384 579
##
## region = South:
## Scenario emmean SE df lower.CL upper.CL
## S1 712 21.1 140 670 754
## S2 728 21.1 140 686 769
## S3 648 36.0 140 577 720
## S4 798 37.5 140 724 872
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
##
## region = Central:
## contrast estimate SE df t.ratio p.value
## S1 - S2 -69.92 26.4 188 -2.650 0.0430
```

```

## S1 - S3    -14.23 35.4 188   -0.402  0.9780
## S1 - S4   -128.83 36.6 188   -3.517  0.0031
## S2 - S3     55.69 37.2 188    1.497  0.4414
## S2 - S4   -58.91 37.8 188   -1.558  0.4053
## S3 - S4   -114.60 29.7 188   -3.856  0.0009
##
## region = North:
## contrast estimate    SE  df t.ratio p.value
## S1 - S2   -180.60 44.2 188   -4.082  0.0004
## S1 - S3    12.09 42.1 188    0.287  0.9917
## S1 - S4   -185.22 45.9 188   -4.033  0.0005
## S2 - S3    192.70 45.6 188    4.230  0.0002
## S2 - S4    -4.62 47.4 188   -0.097  0.9997
## S3 - S4   -197.31 46.5 188   -4.245  0.0002
##
## region = South:
## contrast estimate    SE  df t.ratio p.value
## S1 - S2   -15.61 10.4 188   -1.497  0.4411
## S1 - S3    63.59 31.8 188    2.000  0.1918
## S1 - S4   -85.63 33.6 188   -2.550  0.0557
## S2 - S3    79.20 32.0 188    2.474  0.0673
## S2 - S4   -70.02 33.7 188   -2.079  0.1637
## S3 - S4   -149.22 32.7 188   -4.563  0.0001
##
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates

## region = Central:
## Scenario emmean      SE  df lower.CL upper.CL
## S1         6.19 0.0646 142     6.06     6.32
## S2         6.34 0.0676 142     6.21     6.47
## S3         6.22 0.0711 142     6.08     6.36
## S4         6.46 0.0726 142     6.31     6.60
##
## region = North:
## Scenario emmean      SE  df lower.CL upper.CL
## S1         5.44 0.1641 140     5.12     5.76
## S2         5.96 0.1831 140     5.60     6.33
## S3         5.37 0.1710 140     5.03     5.71
## S4         5.94 0.1928 140     5.55     6.32
##
## region = South:
## Scenario emmean      SE  df lower.CL upper.CL
## S1         6.53 0.0360 140     6.46     6.60
## S2         6.56 0.0361 140     6.49     6.63
## S3         6.38 0.0791 140     6.23     6.54
## S4         6.66 0.0832 140     6.50     6.83
##
## Degrees-of-freedom method: containment
## Results are given on the log (not the response) scale.
## Confidence level used: 0.95

```

Scenario	emmean	SE	df	lower.CL	upper.CL
S1	509.3643	19.87365	140	470.0730	548.6556
S2	598.0756	20.85770	140	556.8388	639.3124
<b>S3</b>	<b>488.8784</b>	<b>22.76260</b>	<b>140</b>	<b>443.8755</b>	<b>533.8813</b>
S4	642.5900	23.93618	140	595.2669	689.9131

Scenario	region	emmean	SE	df	lower.CL	upper.CL
S1	Central	519.8270	33.29319	142	454.0127	585.6414
S2	Central	589.7501	34.36772	142	521.8116	657.6886
S3	Central	534.0567	35.60059	142	463.6811	604.4324
S4	Central	648.6590	36.19282	142	577.1126	720.2053
S1	North	296.2400	44.73992	140	207.7868	384.6932
S2	North	476.8432	47.83522	140	382.2704	571.4160
S3	North	284.1472	45.84026	140	193.5185	374.7758
S4	North	481.4583	49.40186	140	383.7881	579.1284
S1	South	712.0259	21.08464	140	670.3405	753.7114
S2	South	727.6336	21.11980	140	685.8786	769.3886
S3	South	648.4313	35.97907	140	577.2988	719.5639
S4	South	797.6528	37.49671	140	723.5198	871.7858

## 6.1 Emmeans

## 6.2 Emmeans with contrasts