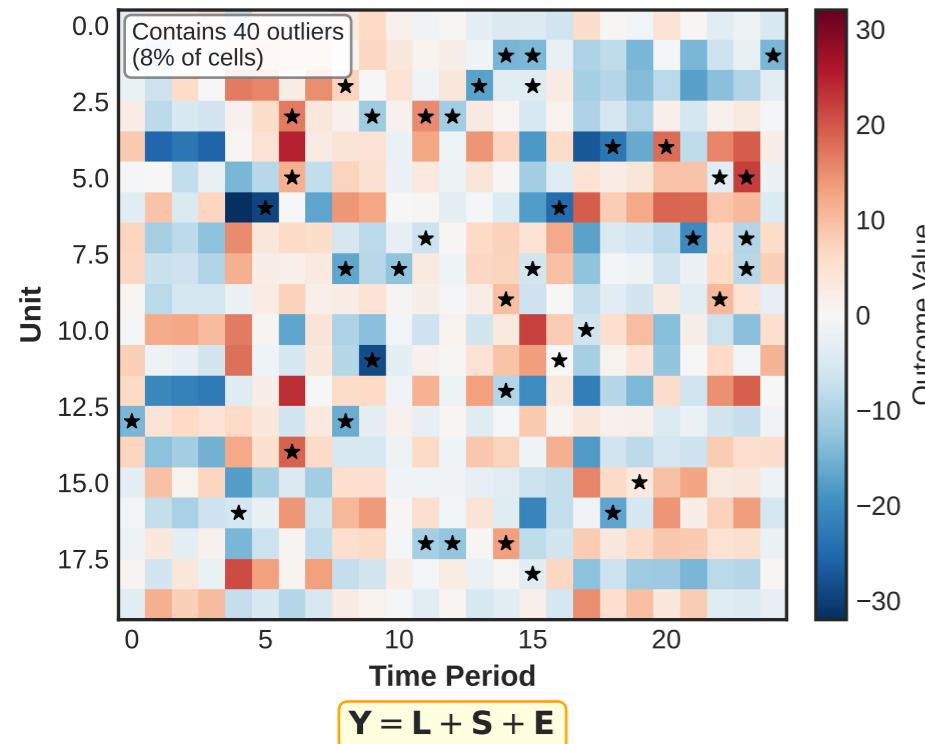
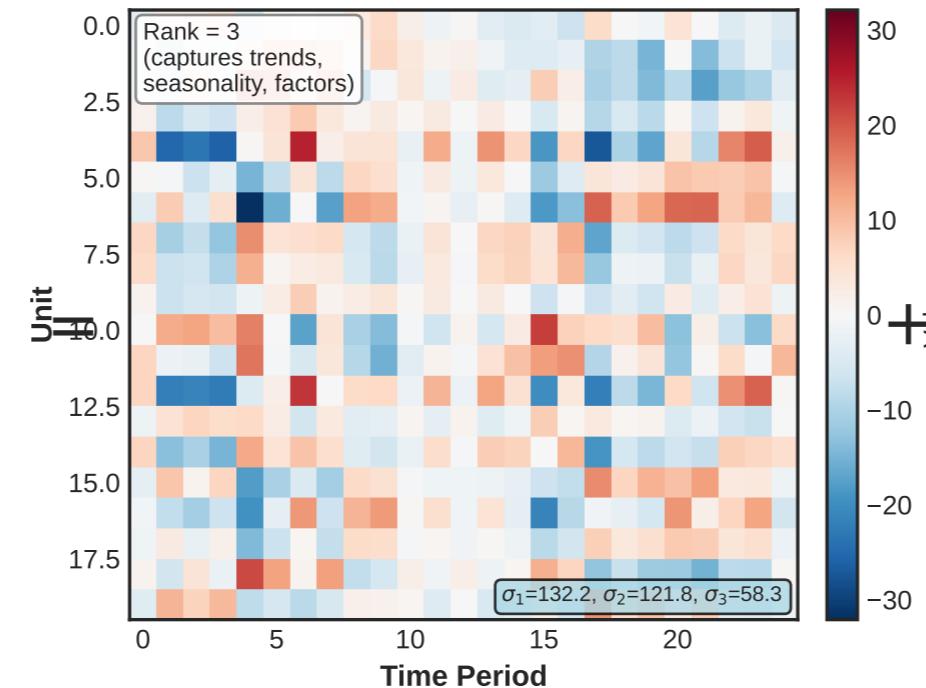


# Robust Matrix Completion: Decomposing $\mathbf{Y} = \mathbf{L} + \mathbf{S} + \mathbf{E}$

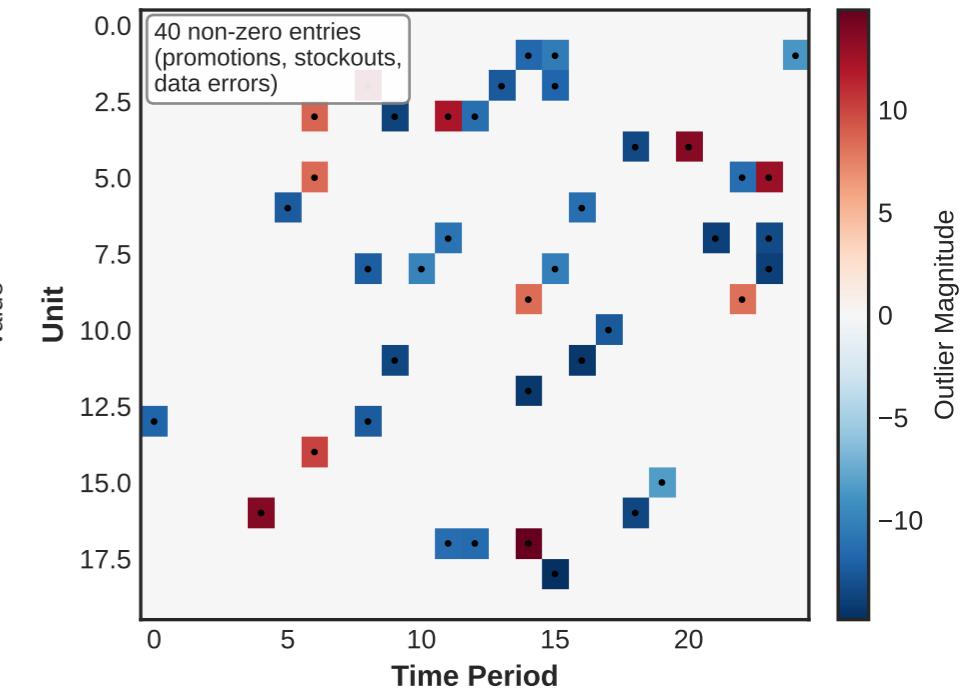
**Panel A: Observed Matrix  $\mathbf{Y}$   
(with outliers marked \*)**



**Panel B: Low-Rank Component  $\mathbf{L}$   
(smooth systematic structure)**



**Panel C: Sparse Component  $\mathbf{S}$   
(outliers/anomalies only)**



Panel A: Observed outcome matrix with outliers (\*). Panel B: Estimated low-rank component capturing systematic trends and factor structure.  
Panel C: Estimated sparse component isolating outliers (promotions, stockouts, anomalies). Counterfactuals use  $\mathbf{L}$  only;  $\mathbf{S}$  identifies cells requiring special treatment.