The LAPIS (Low-rank Approximation via Partially Imputed Svd) Algorithm

Joshua Derenski

Simulations

Parameters

- Number of Ls: 1

- Draws per L: 250

- Number of Units: 250

- Number of Control Units: 245

- Number of Times: 200

- Number of pre-treatment Times: 190

- Rank of L: 10

- Autocorrelation Parameter: 0

- True Effect Size for Constant Effect: 10

- Error Type: gaussian

- Error Variance (if Gaussian error): 16

- Degrees of freedom (if t-error): 5

- Exchangable: FALSE

- Penalized: TRUE

- Rank Estimation Method: threshold

- Scaling for L: 5

- Treatment Effect Type: decay

- Treatment Design: staggered_adoption

- Lag Structure (if using staggered adoption structure): random

- Average Treatment Length (if using staggered adoption structure, with random adoption): 4

- Maximum lag: 4

Our Method vs Competitors, Fixed Parameters

Results

Signal to Noise Ratio

```
## [1] 36.0568
```

mse for DID

```
##      mse
## 5.69744
```

Se for mse for DID

```
##     se_mse
## 0.1581352
```

mse for SC

```
##      mse
## 205.4238
```

Se for mse for SC

```
##   se_mse
## 2.529337
```

mse for our Method (Explicit Tau)

```
##      mse
## 13.28817
```

Se for mse for our Method (Explicit Tau)

```
##    se_mse
## 0.4753939
```

mse for SDID

```
##      mse
## 202.9051
```

Se for mse for SDID

```
##  se_mse
## 2.58592
```

mse For Our Method (Not Explicit Tau)

```
##      mse
## 13.28821
```

Se for mse for Our Method (Not Explicit Tau)

```
##    se_mse
## 0.4753948
```

mse For Oracle (Perfect L)

```
##      mse
## 10.81137
```

mse For Oracle (Perfect L)

```
##    se_mse
## 0.3957649
```

Matrix Bias vs Reduction in Variance due to Averaging

For more general designs of W (like the block design scheme considered here) we allow a block in the bottom right hand corner of W to be non-zero. When implementing our method, we have two competing effects on estimation:

- The bias that's introduced by making more of the Y_{ij}s zero.

- The help we get with estimating τ by being able to average over cells (because we asmeane tau) is the same for all units and times.

It would appear that accurracy increases for estimating τ to a point, and then decreases when the bias introduced by replacement of cells with 0 in Y becomes too great.

Influence of N_0/N on Performance

Influence of ρ on Performance

Influence of τ on Performance

Influence True Rank on Performance

Influence of Rank Error on Performance

True Treatment Effect Over Time