Estimating Prison Stays Among Current Prison Populations

NCRP Conference
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Introduction

- Traditional estimates of time-served ask,

  “What is the average time an offender serves in prison?”
  - Socially important
  - Natural starting point for studying, e.g., changes over time, differences across states, etc.

- An important extension is:

  “Of all offenders in prison, how many are expected to serve sentences of various length?”
  - Different empirical objective – measuring the # offenders by LOS.
  - Question has been raised in research & by BJS
Introduction

- Knowing LOS is a benefit for corrections administrators
- Promotes effective budget allocation
  - Health care expenditures
  - Programming and treatment dollars
- Promotes effective policies tied to prisoner behavior and prison culture,
  - Staff allocation and use
  - Regimens that maximize prison stability
  - Other policies that address offender needs and promote correctional objectives
Introduction

- Current methods are limited
  - Estimates using stocks & flows describe the average expected stay, but not the distribution.
  - Estimates using release cohorts describe the distribution but,
    - require strong assumptions about the flow of prisoners (in and out) over time.
    - are highly variable,
    - require additional data, and
    - do not provide confidence intervals.
Introduction

- We present a new method for estimating expected LOS of current prison populations
- This method improves on estimates obtained using release cohorts.
  - Uses a survival model
  - Requires fewer assumptions
  - Has advantages in application
Introduction

- We test the robustness of our estimator using NCRP data in 38 states.

- Today’s objectives are to:
  - Describe methods (focusing on intuition)
  - Illustrate results
Release Cohort Method

- The logic behind using release cohorts is straightforward and requires two assumptions,
  1. Admissions and releases occur at a steady rate.
  2. Admission cohorts are equally sized over time.
- Thus, any group with stay $S$ is multiplicative to the observed releases, such that $N^S = S \times R^S$
  - $N^S_T$ is the stock with stay $S$, and
  - $R^S_T$ is the released offenders with stay $S$
  - e.g., 200 offenders released after 5 years,
    represent 1,000 (5-year) offenders in the population
Features of the model limit its utility

- Estimated stocks ignore observed information about the current population.
- Estimated stocks diverge from actual stocks when admission rates vary over time.
Features of the model limit its utility (con’t)

- Significant variability among the longest stays.
- No confidence intervals.
- Does a poor job of handling life sentences.

  - Use of life sentences has not been uniform over time, accelerating over the past few decades
  - Increased admissions are largely unobserved in release cohorts.
Survival Method

- We propose using a survival function to estimate expected group membership.

- Advantages:
  - Estimates are applicable to stocks with partially observed information.
  - Confidence intervals are directly estimated
  - Life sentences are naturally handled by the model
  - Estimates are less sensitive to chance variations
  - Admission cohort sizes can be variable

- Still requires steady state assumption for time served
Survival Method

- We offer an intuitive explanation
- Details are available in a paper
Survival Method

Start with a survival function

![Graph showing a survival function over time]
Survival Method

Start with a survival function

![Graph showing the probability of remaining in prison after admission over years. The graph illustrates a decreasing trend, with probabilities ranging from 100% to 0% over a 5-year span.]
Survival Method

Start with a survival function

Length of Stay

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 1 2 3 4 5

Year
Survival Method

Start with a survival function

100% Everyone is Admitted
Survival Method

Start with a survival function

After 1 full year, 50% remain (50% exit)
Survival Method

Start with a survival function

After 2 full years, 25% remain (75% exit)
Survival Method

Start with a survival function

12% remain after 3 full years (88% exit)
Survival Method

Start with a survival function

Eventually no one remains (100% exit)
Of 1,000 people admitted to prison in a given year:

1,000 = 100%

Year

0  1  2  3  4  5

0%  6%  12%  25%  50%  100%
Survival Method

Of 1,000 people admitted to prison in a given year:

1,000 = 500

100% = 50%

0% = 0

Year
Of 1,000 people admitted to prison in a given year:

1,000 = 500 + 250

100% = 500
50% = 250
25% = 125
12% = 60
6% = 30
0% = 0

Year
Survival Method

Of 1,000 people admitted to prison in a given year:

\[ 1,000 = 500 + 250 + 125 \]

Year 0: 100%
Year 1: 50%
Year 2: 25%
Year 3: 12%
Year 4: 6%
Year 5: 0%
Survival Method

Of 1,000 people admitted to prison in a given year:

\[ 1,000 = 500 + 250 + 125 + 62 + 63 \]

Year 0: 100%
Year 1: 50%
Year 2: 25%
Year 3: 12%
Year 4: 6%
Year 5: 0%
Of 1,000 people admitted to prison in a given year:

$$1,000 = 500 + 250 + 125 + 62 + 63$$

Year:
- 0% after 0 years
- 50% after 1 year
- 25% after 2 years
- 12% after 3 years
- 6% after 4 years
- 0% after 5 years
So Where Does the Curve Come From?

- Imagine we track admissions starting in 2013
So Where Does the Curve Come From?

- What about admissions starting in 2012?
Survival Method

So Where Does the Curve Come From?

- 2008 Admission Cohort
Survival Method

So Where Does the Curve Come From?
Constructing “Synthetic” Survival Curve

2009 Admission Cohort

Year
Estimated Number of Current Short-Stay Prisoners

Estimated Population

State 1 | State 2 | State 3 | State 4 | State 5 | State 6

Survival Method | Release Cohort Method

Results – Short Stays
Results – Medium Stays

Estimated Number of Current Medium-Stay Prisoners

<table>
<thead>
<tr>
<th>State</th>
<th>Survival Method</th>
<th>Release Cohort Method</th>
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<tbody>
<tr>
<td>State 1</td>
<td></td>
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<td>State 2</td>
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<td>State 6</td>
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</tbody>
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Results – Long Stays

Estimated Number of Current Long-Stay Prisoners

- Estimated Population
- Survival Method
- Release Cohort Method

<table>
<thead>
<tr>
<th>State</th>
<th>Estimated Number of Current Long-Stay Prisoners</th>
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</thead>
<tbody>
<tr>
<td>State 1</td>
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<tr>
<td>State 6</td>
<td>4,000</td>
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</tbody>
</table>
### Results – Long Stays

#### Distribution of States According to the Estimated Proportion of Long-Stay Prisoners

![Bar chart showing the distribution of states according to the estimated proportion of long-stay prisoners using Survival Method and Release Cohort Method. The x-axis represents the proportion of long-stay prisoners ranging from 0% to 30%, and the y-axis represents the number of states. The chart displays the number of states for each proportion range, with bars for each method overlaid.](chart.png)
Conclusion

- The future is of course uncertain, but...forecasting the future is important

- Enables public administrators to make decisions about the present.
  - foresee budgetary pressures
  - informed decisions about resource allocation.

- With that goal in mind, this paper proposes a new method for estimating inmates by LOS.
Conclusion

- Our method is a general approach & applicable to a wide variety of settings.

- There may be specific circumstances where forecasts are better achieved through other means.
  - e.g., states with determinate sentencing laws
    - perhaps as simple as counting prisoners with known LOS.
    - may require a mixture of methods.

- Our method provides new flexibility in how projections can be achieved.