

## Supplement: Dynamic Marginal Costs in Fiscal Impact Analyses

This year SPAC estimates sentencing policies' fiscal impacts using a dynamic marginal cost. This approach is necessary to account for the realities of budgeting in Illinois: budgets do not change quickly after the level of services provided change. Instead, budgets “step” up or down only when the level of services changes significantly. The costs-per-person are dynamically larger or smaller dependent on the magnitude of the proposed policy's impact on services. This supplement explains the methodology used to develop and calculate dynamic marginal costs.

In Illinois, budgets are most frequently determined on past practices and to minimize disruptions in services and government spending as much as possible. The nature and extent of the services provided or the expected need in the next fiscal year are not considered. This practice results in a divergence of costs from services: *i.e.*, the number of prisoners in state prisons, or probationers supervised by county probation departments, is not fully predictive of those agencies' budgets. This is most clearly demonstrated by the fact that budget changes for the Illinois Department of Corrections (IDOC) have not correlated the prison population over the past ten years. The same holds true for county public safety budgets. SPAC's *Quantifying County Adult Criminal Justice Costs* report documents this effect by examining the range in costs for a diverse set of counties.<sup>1</sup>

The State's budget practices have made agency and department managers quite adept at accommodating fluctuations in services demanded. This accommodation is a practical necessity in public service management. The dynamic marginal cost approach matches SPAC's fiscal analysis with this practical reality. Almost all costs are held constant until the change in services provided crosses a threshold. Even after the first few thresholds, the overall costs do not increase dramatically. Illinois practitioners should recognize this approach. Managers adapt operations as much as possible to minimize the effect on their constrained budgets. Only at great need will budgets shift up or down measurably.

This supplement proceeds as follows: First, the supplement thoroughly defines the main terms and concepts—defining *what* is modeled. Second, the supplement describes *why* SPAC uses the dynamic approach. Third, the memo describes *how* the methodology actually works. This section expands on the basic principles of this cost analysis approach.<sup>2</sup> Finally, the memo discusses some implicit assumptions and possible limitations.

Dynamic marginal costs measure the costs per client where the costs depend on how big the change is compared to the status quo. The marginal costs can include multiple cost types: traditional variable costs, personnel costs that change at certain steps, and fixed costs related to physical space requirements that vary only with large service changes. Which types of costs are included depends on the size of the change. After examining decades of criminal justice budgets at the State and local levels, SPAC determined that using these dynamic marginal costs brings SPAC's fiscal impact calculations more in line with actual budget practices and resource allocation in Illinois.

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<sup>1</sup> This report is available on SPAC's website: <http://ilspac.illinois.gov>.

<sup>2</sup> The actual equations and spreadsheets used to calculate dynamic marginal costs may be requested from SPAC.

## What?

- Services or resources needed per “client”: the unit of services provided can depend on what part of the criminal justice system is impacted. This concept can also be imagined as services demanded, output of a system actor, or number of clients/cases handled. Each part of the system has a different “client” and therefore a different unit that can change and require different resources:
  - For a court actor, such as judges, state’s attorneys’ offices, public defenders, and the related support offices such as circuit court clerks, sheriff’s security staff, etc., the resource use is per criminal case.
  - For jails and prisons, the resource use is per inmate.
  - For probation departments and the parole division, the resource use is per probationer or parolee, respectively.
- **Dynamic Marginal Costs: SPAC-calculated cost of adding or subtracting one “client” into or out of the criminal justice system.** Depending on the size of the change of “clients,” dynamic marginal costs may include variable, step, and fixed costs. Specifically:
  - A small change in “clients” will only involve variable costs.
  - At a calculated threshold, a change in “clients” will include both variable and step costs.
  - At larger thresholds, a change in “clients” will include variable, step, and fixed costs.
- **Variable Costs: Direct relationship to the addition or subtraction of one “client” into or out of the criminal justice system.** A variable cost is a cost that directly relates to agency services/output. Variable costs are incurred if the agency has to process one additional client and would change directly as the number of clients increase or decrease. Examples include:
  - External crime lab testing or expert testimony for criminal cases;
  - Jury meals for criminal jury cases;
  - Laundry, food, and medical costs for jail inmates; and
  - Staff overtime costs.
- **Step Costs: Driven primarily by increasing or decreasing full-time employment in the justice system.** A step cost is a constant cost for the agency until service/output crosses a discrete threshold, after which the costs change and remain steady until the next threshold. Step costs are incurred when the change in clients is sufficient to alter staffing levels. Examples include:
  - Staff salaries, benefits, and pension costs; and
  - Office supplies, vehicles, and other equipment or training for staff.
- **Fixed Costs: Costs that are primarily driven by factors other than client or employee.** A fixed cost is one that does not change with an increase or decrease in the number of clients or employees. Examples include:
  - Capital costs for construction; and
  - Interest payments on bonds.

## Why?

- When changes to the criminal justice system are small, only small amounts of resources are affected by the change. These variable costs are defined as the resources associated with one criminal case or supervised offender. In criminal justice, variable costs do not include personnel costs as administrators will not increase or decrease staffing for small service changes.<sup>3</sup> However, once the change crosses a threshold or “step,” staffing and more resources are affected. After initially using overtime and other productivity changes, eventually full-time equivalent staffing and administrative overhead will be affected as the changes cross several steps. At some point, each step approaches the per capita costs of that service. “Per capita” costs are the total operating budget divided among the total services delivered.<sup>4</sup>
- This dynamic approach bases the cost-per-client on the size of the change compared to the status quo. As the change increases, the size of the resource and fiscal impact will increase. The advantage of this dynamic approach is that budget analysts and policymakers should not expect to see large resource and fiscal impacts as service demands change unless the service changes are sufficient to impact personnel allocation and staffing decisions. In application, this approach matches practice with a budget model that can give conservative-but-realistic fiscal impact estimates of policy proposals.

## How?

- Analysis of resource consumption over several years indicates how much change occurs naturally month-to-month. The threshold for each step is determined by this analysis: if the expected impact is smaller than *most* monthly fluctuations, then only the variable costs are used. Here, *most* means smaller than 95% of the month-to-month changes.
- The step costs per client will continue to increase gradually as resource consumption increases. In other words, the size of the steps increases as the service demands increase. Once the expected change is greater than 10% of the current resource use, the full amount of step costs will be included in the calculation. Using an example from the state prison system, if the current population is 45,000, all step costs (personnel costs) are included in the cost-per-inmate calculation once the change is larger than 4,500 inmates. In practice, this means that the 100% of the correctional officer costs are included at each step past this threshold.
- Non-operational costs are included after the expected change is larger than 50% of the average of the past maximum and minimum number of clients. Non-operational costs in the prison context include the community supervision (parole, field services, programming services outside of prison), as well as administrative components (research and planning, administrative staff, training). Unless the expected change reaches this high point, these non-operation costs are held constant.

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<sup>3</sup> Many analysts define these variable costs “marginal” because only these costs change directly with more or fewer clients. SPAC defines “marginal” dynamically, so that the marginal costs includes directly variable costs when the change is small but also includes more system costs as the change increases.

<sup>4</sup> “Per capita” costs may also be called average costs because they represent the average expenditures per client. This metric is useful for estimates of past spending per client but is less valuable for predicting future spending.

## Assumptions and Limitations:

- SPAC has analyzed each key component of the criminal justice system on the state and county level to develop a reliable top-down budgetary analysis of the costs. SPAC assumes that the resource needs are roughly in line with the current costs.<sup>5</sup> If costs and resources used do not reflect the level of services provided, the fiscal impact analysis may not be biased. However, the analysis is based on the best available data.
- The total dollar impact will be heavily dependent on the step thresholds. If an expected impact is close to a step, the cost estimate could be either quite high (cross the threshold in our dynamic cost model but in reality stay below the threshold) or low (just below the model threshold but in reality staffing increases). Because of this limitation in the model, all cost estimates should be viewed as approximations that require more detailed analysis by the operational departments that would be affected. However, these estimates are a good start to inform policymakers about the potential fiscal impact.
- Beginning with the spring 2017 legislative session, SPAC will use dynamic marginal costs for prison and jails.
- For courts, probation/parole, and law enforcement, SPAC will use the average “per capita” costs until we have a better understanding of how resource needs adjust to service changes over time.
- At this time, the steps are assumed to be similar in size and magnitude regardless of whether the service change is positive or negative (*i.e.*, an increase or decrease in inmates or criminal cases). In private sector cost management, costs generally change differently when the demand increases vs. decreases. SPAC is reviewing this literature, public-sector data, and considering how it may apply to public sector budget predictions; however, at this time, the assumption is that the steps do not vary depending on the direction of the change in clients.
- As stated earlier, SPAC assumes that the current resources match current needs. Importantly, the fiscal impact does not address systemic under- or over-staffing but merely increases or decreases the estimated budget from the current status quo. If the agency or department is already in need of a step increase or decrease, the fiscal impact estimate produced by this approach will not account for that need.
- The capital construction costs, as well as bond and debt repayments, are not included unless the service change is very large (50% of the past maximum or minimum services). In addition, no continuous escalation rates or inflation are included in the estimates.
- The analysis excludes consistent growth in costs caused by inflation and/or regular increases in costs. For example, if inmate medical care increase regularly over time, it would be wrong to assume that no change in inmates means no change in future costs. Further, because the model does not control for inflation, if medical costs per person or staff wages grow faster than overall inflation, the estimates of future costs will be low.
- Jail costs are consolidated for a statewide estimate. The same dynamic marginal cost calculation was conducted on seven counties across the state. If jail populations increased or decreased in each county jail proportionally, the overall dynamic marginal costs can be calculated from a statewide analysis. In other words, a 6% increase in the statewide jail population is assumed to be an increase of exactly 6% in each county’s jail population.

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<sup>5</sup> See, *Quantifying County Adult Criminal Justice Costs* available at: <http://ilspac.illinois.gov>.

## Result Demonstration:

Change To	Modeled Change to Average Daily Population	Dynamic Marginal Cost per Person per Year	Total Fiscal Impact For 1 Year
IDOC Population	+3,000 inmates	\$18,688	\$56.0 million
IDOC Population	+1,000 inmates	\$10,565	\$10.6 million
IDOC Population	+500 inmates	\$6,504	\$3.3 million
IDOC Population	- 500 inmates	\$6,504	- \$3.3 million
IDOC Population	- 1,000 inmates	\$10,565	- \$10.6 million
IDOC Population	- 3,000 inmates	\$18,688	- \$56.0 million
Statewide Jails	+3,000 inmates	\$22,193	\$66.6 million
Statewide Jails	+1,000 inmates	\$3,044	\$3.0 million
Statewide Jails	+500 inmates	\$3,044	\$1.5 million
Statewide Jails	- 500 inmates	\$3,044	- \$1.5 million
Statewide Jails	- 1,000 inmates	\$3,044	- \$3.0 million
Statewide Jails	- 3,000 inmates	\$22,193	- \$66.6 million

Above results based on:

	State Prisons (IDOC)	Statewide Jails (average of survey)	Notes
Variable Cost per Inmate	\$6,504	\$3,044	
Step Cost per Inmate	\$34,548	\$32,060	
Fixed Cost per Inmate	\$28,694	\$1,758	
Total Costs per Inmate	\$69,746	\$36,863	
Current ADP	44,823	17,212	* see notes below.
Current Capacity	32,000	22,385	
Size of Steps (threshold)	823	1,344	95% of monthly change is less than this amount
100% of Step Costs Included (after this threshold)	5,523	3,524	One step higher than 10% of previous maximum ADP
Fixed Costs Included (after this threshold)	23,914	9,973	50% above/below the highest/smallest ADP

Notes:

- The IDOC step cost per inmate includes personnel costs for state prisons, which adds the off-budget expenditures of personnel medical insurance, workers compensation, and pension contributions. In past years, SPAC has included both variable and step costs (\$41,052 per inmate per year) when the expected change is greater than 800 inmates. This dynamic approach increases the costs per inmate at steps and gradually to the \$41,052-per-inmate figure.
- The IDOC total cost per inmate includes fixed costs of not only infrastructure expenditures, but also the operational costs of non-prison IDOC activities, which include ATCs, parole supervision, the Prison Review Board, field services, and administrative oversight of all of these functions. Changes larger than 23,914

inmates would begin to include the fixed costs.

- The prison costs are from IDOC for FY2015.
- The current ADP is the prison population as of June 30, 2016; from IDOC’s Research and Planning Division.
- The statewide jail costs are from SPAC analysis of seven counties’ sheriff’s budgets for recent years. For some counties, SPAC averaged budgets for several years’ budgets to account for unexpected spikes or dips in spending.
- The statewide jail ADP is from December 2014, the most recent data; from IDOC’s Jail and Detention Standards Unit.
- The statewide jail size of steps is the statewide threshold; the 1,344 inmate threshold would be proportionally divided across the entire state. For example, a county that currently comprises 10% of the statewide average daily jail population would need a change of 13 inmates (10% of 1,344) before the first step threshold is met.

SPAC tested this approach with several rough simulations. Hypothetical changes were modeled for the prison population and the results were compared with past spending for prison facilities with roughly the same number of inmates. The results also showed robustness for determining the scale of the change compared to the overall budget and approximate fiscal impacts but were highly dependent on proximity to the thresholds. While many additional factors<sup>6</sup> must be considered in operational budgets and accounts, this analytical tool provides SPAC a much better approach than using either variable or average costs to estimate fiscal impact of proposed policies. The results of these rough simulations are shown below:

<b>Compare:</b>	<b>4,000 change</b>	<b>4,115 change*</b>	<b>10,000 change</b>	<b>9,874 change*</b>
Predicted fiscal impact	<b>\$91.0</b>	<i>\$128.3</i>	<b>\$406.2</b>	<b>\$376.9</b>
Actual IDOC Expenses	\$80.7	\$80.7	\$225.2	\$225.2
Estimated IDOC Off-Budget	\$53.6	\$53.6	\$133.9	\$133.9
Total IDOC Expenses	<b>\$134.2</b>	<i>\$134.2</i>	<b>\$359.2</b>	<b>\$359.2</b>
<b>Difference:</b>	<b>-\$43.2</b>	<i>-\$5.9</i>	<b>\$47.0</b>	<b>\$17.7</b>
<i>All costs are in millions and rounded to the nearest hundred thousand dollars. SPAC calculations and estimates. IDOC data from FY2015. * Italicized estimates are across the nearest step threshold.</i>				

The examples show the importance of each threshold. A simulated change of 4,000 is just below the model’s threshold to the next “step” at 4,115 inmates. At that slightly higher change, the approach underestimates the costs \$5.9 million. Similarly, a simulated change of 10,000 results in an overestimate of \$47 million, whereas a across the nearest threshold (9,875) the estimated fiscal impact underestimates the costs \$17.7 million of actual spending.

Several other scenarios were also run. The model frequently underestimates costs and seldom overestimates them. The conservative nature of the model—the calculated fiscal impact is below the past spending—allows SPAC to maintain a conservative approach to evaluating policy changes. Readers can continue to view SPAC’s numbers as a conservative estimate of potential impacts. These dynamic marginal costs bring SPAC’s fiscal impact calculations more in line with actual budget practices and now better match resource allocation practices in Illinois.

<sup>6</sup> For example, the security classification, programming and health needs, and preventing violence in custodial settings must all be thoroughly considered before opening, closing, or changing the physical infrastructure of prisons and jails.