Dynamics of spells of poverty

In a classic 1985 article in the Journal of Human Resources, Mary Jo Bane and David Ellwood of Harvard’s Kennedy School of Government explored the distribution of lengths of time people spend in spells of poverty. Their work settled a confusion in the literature on spells of poverty, which up to that time had produced widely varying estimates of the lengths of time people spend in poverty in their lives. As Bane and Ellwood state in their introduction,

“The preliminary analyses we report in this article lead us to conclude that the seemingly inconsistent findings on permanent and transitory poverty from the sixties and seventies can indeed be reconciled. Our primary finding is that although many people have very short spells of poverty, the few with very long spells account for the bulk of all poverty and represent the majority at any given time.”

The insight that Bane and Ellwood pulled from intensive data analyses and explorations of statistical distributions can be most easily seen as an insight about stocks and flows of people moving into and out of poverty. This exercise provides the opportunity to explore the stock-and-flow foundation of the insight that people in spells of poverty would report much longer lengths of such spells than people who have emerged from periods in poverty.

The Task

1. Download the Spells model from the syllabus on the class web site. The model splits the flow of people slipping into poverty into two streams, a “slow mover” stream and a “fast mover” stream. Look at the equations and values of constants in the model and answer the following:

   a. How long do “slow movers” stay in a spell of poverty? How long do “fast movers stay in a spell of poverty?

   [The constants in the model that determine these lengths of time are called “time constants.” For example, the “time constant” for the stock of slow movers in poverty is called “SM time in poverty.” For more information about delays and time constants (and more than you need at this point), skim Business Dynamics, chapter 11.]

   b. How many people total in the model flow into poverty each month?

   c. What is the initial fraction of those people who are “slow movers”? By implication, what is the initial fraction of “fast movers”?

2. Simulate the model, naming the base run something like “spells base.”

   a. Describe what you see in this base run of Spells. What do the graphs look like? (You don’t need to show them.) Note the sizes of the populations: Which are smaller? Which are larger? Can you figure out why? [That’s rather hard to do, and we’ll talk about it in
class, so don’t spend an excessive amount time thinking about it now.]

b. “People in poverty” would be the sum of the two stocks on the left. Use Vensim’s spreadsheet tool to find the numbers of slow and fast movers in poverty and thus the total number of people in poverty in this base run.

c. If one picked a person at random from the pool of people in poverty in this simulation (the two stocks on the left), what is the probability that person would be a slower mover? The model names that the “Probability of polling a slow mover.”

d. What is the average length of a spell of poverty for people in poverty in this simulation. The model names that the “Poverty estimate of spell.”

e. Answer (c) and (d) for the slow and fast movers who are within a year of having emerged from spells of poverty. What is the average length of a (past) spell of poverty for a person in this group? (The model calls that the “Post poverty estimate of spell.”)

f. Bane and Ellwood used data and statistical distributions to compare what are essentially your answers in (2d) and (2e). They concluded that the average length of a spell of poverty estimated from people in poverty is greater than that estimated from people post poverty. Do your numbers agree with Bane and Ellwood’s conclusion?

3. Testing Bane and Ellwood’s conclusion.

a. The fraction of new people in poverty who are slow movers is a constant in the model. We can use the Set button to change that fraction and observe the results. Use the Set button to set the value of the Fraction of New Poor that are Slow Movers to 0.2.

Show graphs of the stocks, the probabilities, and the average estimates of spells in poverty (you should find these graphs in the list of Custom Graphs).

Describe what you see.

What do you conclude about the estimates of the lengths of spells of poverty a researcher would find if the data used were from people in poverty or from people who have recently emerged from poverty? Do they fit Bane and Ellwood’s conclusion? (Use the values you see at the end of the simulation. You can read the values off the graphs, or, better yet, you could use either of Vensim’s “spreadsheet” tools to get precise values.) The buttons for the spreadsheet tools (one horizontal, one vertical) are the grid-like symbols shown at the bottom of the tool bar at the right.

b. So far we have tested the Bane and Ellwood conclusion just two scenarios, the base run and your test in (3a), which kept all the various constants in the model fixed and changed just one, testing the fraction of new poor who are
slower movers as 0.3 and 0.2. To gain confidence that we support the Bane and Ellwood results in a wide set of circumstances we would want to test a lot more scenarios.

So perform a series of simulations, testing values for the Fraction of New Poor that a Slow Movers ranging from 0.05 to 0.5. Show in a table (like the one below) the values (at the end of the runs) for the fraction and the estimates of the average lengths of spells of poverty for people in poverty and for people recently emerged from poverty.

<table>
<thead>
<tr>
<th>Fraction of new poor who are slow movers</th>
<th>Average length of spell for people IN poverty (&quot;IN&quot;)</th>
<th>Average length of spell for people EMERGED FROM poverty (&quot;OUT&quot;)</th>
<th>Is the &quot;IN&quot; estimate greater than the &quot;OUT&quot; estimate?</th>
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<tbody>
<tr>
<td>0.05</td>
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<td>0.1</td>
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<td>0.2</td>
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<td>0.5</td>
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What do you observe about the Bane and Ellwood conclusion in these tests?

1. There are four other constants in the model that one might think might influence these estimates of the lengths of spells of poverty:
   - Total inflow to poverty
   - SM time in poverty
   - FM time in poverty
   - “One year” (the time the model continues to track people after they have emerged from spells of poverty, assumed here to be 12 months, but could be more or less)

Your task in (4) is to design and carry out a series of experiments, testing various values of some of these constants, observing in each test whether or not the Bane and Ellwood conclusion is sustained or refuted.

Report your results in tables (or one table if you can) like the one you produced for (3c).

Some things to think about:
   - Think like a scientist: Make one change at a time and observe the results. If you change more than one parameter for a test (and you’ll probably want to), build up to that test by doing simulations testing changes in single parameters first.
• Think like a scientist: Plan a sequence of tests, not a random bunch of changes. Plan the sequence to try to facilitate conclusions. Plan the tests and what to observe and report.

• Think like a scientist: Test parameters you think have a chance to overturn what we and Bane and Ellwood have observed. (Confirming hypotheses is nowhere near as powerful as producing evidence that refutes a hypothesis.)

Think like a graduate student with limited time: Don’t try to be exhaustive. Plan a sequence of tests that have a chance to teach you something about the model and the estimation of lengths of spells in poverty. Carry out the tests, report the results, and stop.

5. Nothing to do here but to sit back and observe how efficiently and robustly we are able to reach these conclusions using a simple system dynamics model of “slow movers” and “fast movers” in poverty, where “slow” and “fast” are captured in the time constants of stocks of people in poverty.