

Appendix D. Persistence and State Dependence Examples

The concepts of *persistence* and *state dependence* are important in the analysis of outcomes over time. The term persistence describes whether a particular condition, like poverty or food insecurity, is brief or long-lasting. *State dependence* indicates whether the chances of experiencing a condition depend on having experienced the same condition in the past. Some hypothetical examples of a society's experiences with poverty show the distinctions between these two measures.

Consider a society in which half the people are poor in any given year and half are not. This tells us the *level* of poverty in the society but not its *dynamics*. We could imagine several types of dynamic patterns.

Example #1: Some persistence, no state dependence.

This level of poverty could occur if everyone in the society had an equal (50 percent) chance of being poor or affluent in any given year. In this situation, one-half of the people who are poor this year (25 percent of the total population) would be poor next year—that is, would have poverty spells that continued for at least 2 years. One-half of those people (12.5 percent of the total population) would have spells that continued for 3 years, and so on. Thus, the society would be composed of some people (50 percent) who are not currently experiencing poverty, some people (25 percent) who are currently in the first year of their spell of poverty, and other people (25 percent) who are currently in their second or later spell of poverty.

Example #2: Complete persistence and state dependence.

The levels of poverty for this society could also arise with an initial 50-50 distribution of outcomes and no one ever subsequently entered or left poverty. In this case, the chances of leaving poverty would be zero, as would the chances of falling into poverty. Here, the past clearly matters, as a person in poverty never escapes.

Example #3: No persistence, complete state dependence.

At the other extreme, everyone in this society could change places each year. The poor would face a 100-percent chance of leaving poverty, and the affluent would face a 100-percent chance of entering poverty. Each person would cycle from being poor one year to being affluent the next. Once again, the past matters; however, the past contributes to all spells lasting only a single year.

Example #4: Spurious state dependence. Statisticians recognize that unmeasured differences in people's underlying probabilities of entering or exiting conditions may lead to wrong conclusions about state dependence.

Consider our earlier example of a society in which half the people are poor and half are not. Suppose that the population in this society is made up of two types of people: one group that has a high probability of being poor and another that has a low probability. Assume that the people with high probabilities (we can call them H types) have a 90-percent chance of being poor in each year and that this probability does not depend on their prior poverty status. Thus, these people experience very persistent poverty but do not experience state dependence. Assume that the people with low probabilities (L types) have a 10-percent chance of being poor in each year, but again do not experience state dependence. Finally, assume that the two types are equally represented in the total population. The following table summarizes these assumptions:

Type	Proportion of population	Probability of being poor this year if poor last year	Probability of being poor this year if not poor last year
Percent			
H	50	90	90
L	50	10	10

As we go from one year to the next, 81 percent of the H types will continue their poverty spells, 9 percent will end their spells, 9 percent will begin new spells, and 1 percent will remain out of poverty. We can repeat these calculations to determine the transition probabilities for the L types and the population as a whole. The transition probabilities are as follows:

Type	Remain poor	Exit poverty	Enter poverty	Remain affluent
Percent				
H	81	9	9	1
L	1	9	9	81
All	41	9	9	41

Now suppose that we do not know people's types; we observe only their poverty histories. That is, we only observe the bottom row of the table. We would observe that 82 percent of the total population who are poor in a given year remain poor the next year, while 18 percent exit poverty. We would also observe that 18 percent of the total population who are not poor in a given year enter poverty, while 82 percent remain affluent.

In this case, the transition probabilities for the total population suggest that there is state dependence (people who are poor are more likely be poor in the next period). However, this arises spuriously from a failure to account for underlying differences in people's probabilities of being poor.