**Consumer Utility**

Our model assumes that consumers have some general amount of utility by which they favor mom-and-pop stores, although moment-to-moment changes in preferences might override this. To account for both this preference and variability, for the kth consumer, the utility gained from shopping at a mom-and-pop is a positive constant plus some random factor:

Uk = (pM + rkM[0,1])[[1]](#footnote-1)

Consumers gain utility from shopping at the big-box store as well. Thus, the consumer’s overall utility gain is:

Uk = max{(pkM + rkM[0,1]), rkB[0,1]}

The overall utility in the market is expressed as the sum of these utilities over the population:

Σk Uk

To rephrase our assumptions: consumers gain the most utility when both mom-and-pops and big-boxes are around, they do second best when they have available only mom-and-pops, and worst when they have only big-boxes. But it turns out that even in cases of high preference for mom-and-pop store, the consumers’ least preferred outcome can arise.

**Mathematical Analysis**

We give the expected utility in the three periods of our model.

1. When there are only mom-and-pops, E( Σi Ui ) = E ( Σi (pM + riM[0,1])) = ( Σi  (E pM + E riM[0,1])) = ( Σi ( pM + 0.5) ) = N( pM + 0.5) by linearity.
2. When there are big-boxes as well as mom-and-pops, E( ( Σi Ui )) = E ( Σi (max { pM + riM[0,1], riB[0,1] } )) = Σi E max { pM + riM[0,1], riB[0,1] } = N((2/3) + (1/2)pM+(1/2)pM^2-(1/6)pM^3).
3. When there are only big-boxes, E ( Σi Ui ) = E ( Σi riB[0,1]) = ( Σi EriB[0,1]) = N( 0.5 )

We note that for preferences in [0,1], the expected value in (2) is greater than that of (1) which in turn is greater than that of (3).

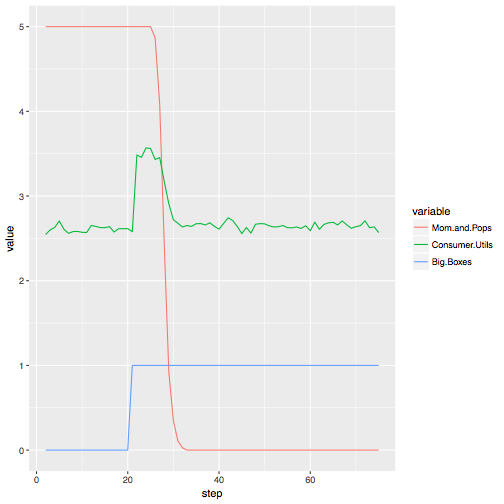
**Big-box Statistics**

**Runs**

The following graphs represent the average run time of models where consumer “added” preference for mom-and-pops is 0.0, 0.2, 0.4, 0.6, and 0.8 respectively. All other variables beside preference are held constant.[[2]](#footnote-2) For each preference level, we ran seventy-five runs of seventy-five periods each. Note that in all experiments the big-box store appears in period 20.

In each experiment we give the expected utilities for (1) having only mom-and-pops, (2) having both kinds of store, and (3) having only big-box stores. We divided the utility by 5 in both the calculation and the model for sake of the data’s presentation.

In the experiments where the preference for mom-and-pops is 0.0, 0.2, 0.4, and 0.6, mom-and-pops tend to vanish leaving the result where consumers end up with the situation of least utility.

Pref. pM = 0.0

(1) 2.6

(2) 3.5

(3) 2.6

*Average Consumer Utility …*

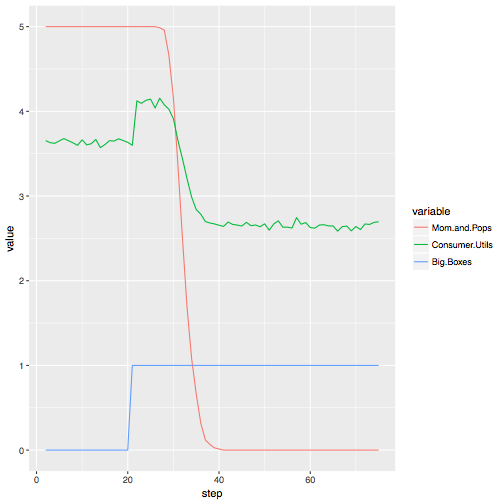
Min: 1.93

1st Quartile: 2.47

Median: 2.68

3rd Quartile: 2.91

Max: 3.79

Pref. pM = 0.2

(1) 3.6

(2) 4.1

(3) 2.6

*Average Consumer Utility …*

Min: 2.00

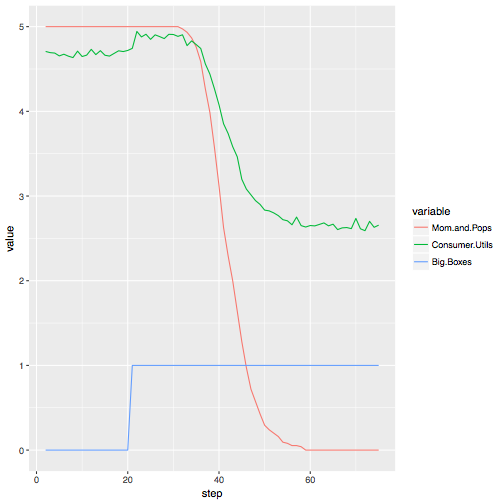
1st Quartile:2.63

Median: 3.00

3rd Quartile: 3.65

Max: 4.49

Pref. pM = 0.4

(1) 4.6

(2) 4.8

(3) 2.6

*Average Consumer Utility …*

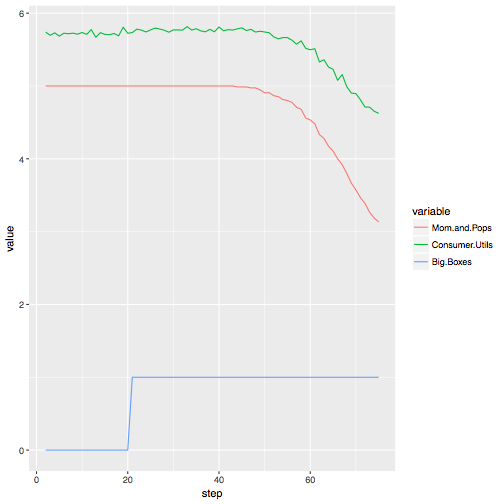
Min: 2.10

1st Quartile: 2.79

Median: 4.15

3rd Quartile: 4.76

Max: 5.37

Pref. pM = 0.6

(1) 5.7

(2) 5.8

(3) 2.6

*Average Consumer Utility …*

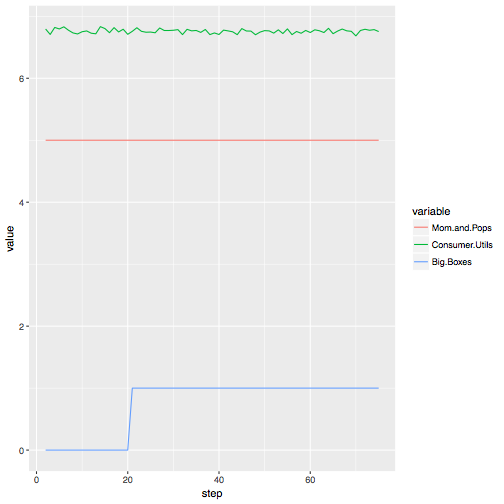
Min: 4.22

1st Quartile: 5.36

Median: 5.68

3rd Quartile: 5.89

Max: 6.43

Pref. pM = 0.8

(1) 6.8

(2) 6.8

(3) 2.6

*Average Consumer Utility …*

Min: 6.05

1st Quartile: 6.57

Median: 6.76

3rd Quartile: 6.95

Max: 7.47

1. The variables pM and rM[0,1] are between 0 and 1 inclusive. pM is consumer preference for mom-and-pops, and rX is a random number. We abbreviate “mom-and-pop” by *M* and “big-box” by *B.* The subscript indicates the variable belongs to the type of retailer. [↑](#footnote-ref-1)
2. There are 26 consumers, 5 mom-and-pop stores, each of which have an initial endowment of $30, gain $2 per purchase, and loose $10 per step. The big-box appears on period 20. It has an initial endowment 1000 times that of the big-box-store, and it pays five times the rent. [↑](#footnote-ref-2)