Refugee simulation first iteration

Lukasz Pietrasik

November 17, 2016

Abstract

The short desctiption of the script first iteration.

1 Introduction: Stouffers Theory of Mobility

source: http://www.yourarticlelibrary.com/population-geography/4-general-theories-of-migration-explained/43257/

"S.A. Stouffer, an American sociologist, introduced one such modification in the gravity model. Stouffer formulated his intervening opportunity model in 1940, and claimed that there is no necessary relationship between mobility and distance (Stouffer, 1940:846). Instead, the observed decline in the volume of migration is due to an increase in the number of intervening opportunities with increasing distance. Stouffers model suggests that the number of migrants from an origin to a destination is directly proportional to the number of opportunities at that destination, and inversely proportional to the number of intervening opportunities between the origin and the destination.

Stouffers formulation can be mathematically expressed as follows:

$$Y = (\Delta x/x)k$$

where Y is the expected number of migrants, δx is the number of opportunities at the destination, x is the number of intervening opportunities, and k is a constant. Stouffer modified his theory of migration and intervening opportunities in the mid-1950s and added the concept of competing migrants in his model. His modified theory of mobility was published in 1960. The revised model proposes that during a given time interval, the number of migrants from city 1 to city 2 is the direct function of the number of opportunities in city 2, and an inverse function of the number of opportunities intervening between city 1 and city 2, and the number of other migrants for the opportunities in city 2. Thus, the revised formulation would read as under (Galle and Taeuber, 1966:6):

$$Y = (X_1/X_B X_C)k$$

where Y is the number of migrants moving from city 1 to city 2, Xi is the number of opportunities in city 2, X1 is the number of opportunities interven-

ing between city 1 and city 2, Xc is the number of migrants competing for opportunities in city 2, and k is a constant.

It may be realized here that the volume of migration from one city to another is the function of as much the attraction of one city as the repulsion from the other. Hence, another component as a measure of disadvantages that push people from city 1 is introduced in the numerator. The final formulation may be expressed as under:

$$Y = (X_0 X_1^a / X_B^b X_C^c) k$$

where Xo is the number of out-migrants from city 1; a, b and c are parameters to be determined empirically; and other notations are as before.

In Stouffers model the measure of disadvantages or push factors in city 1 (X0) is defined as the total out-migrants from the city. Likewise, the measure of number of opportunities in city 2 (X1) is defined as the total in-migrants in city 2, whereas the measure of intervening opportunities between city 1 and city 2 (X2) is defined as the total number of in-migrants in a circle centred mid-way between city 1 and city 2, and having a diameter equal to the distance between the two cities. And, finally, the measure of competing migrants (Xc) is defined as the total number of out-migrants from a circle centred on city 2 with the distance between the two cities as its radius."

1.1 Function - calculating imigrants:

This function determines the migration between two countries and is the heart of the algorithm. The imigrants from one country to another with the following input:

- number of refugees at destination as the X_0 the push force from i to j
- GDP as the X_1 is the number of oportunities at i
- number of refugees at origin as the X_2 is the pull force from i to j
- GDP between as the X_3 is the number of oportunities between i and j

2 Main

The script starts with the loading of a small preprepared database that consists of:

- Country - the list of n country in used order.
- GDP - the vector of size n with GDP of the given country.
- travelby - the $n \times n$ matrix that contains 0 and 1 values. The travelby(i, j) = 1 if refugee travelling to country i from initial country (Greece) have to travel by country j. If not travelby(i, j) = 0.

Then the function defines initial state which is 0 refugees at each country with 10000 in Greece.

2.1 Part 1: Calculate GDP between two countries

To calculate the GDP between two countries the function calls travelby matrix and evaluates it for every possible route between two countries given countries and calculates the resulting sum of GDP of the countries between.

2.2 Part 2: For loop

The loop runs iteration for each year/month (whatever the timescale was chosen)

2.3 Part 2.1: Calculate emigration between two countries

Y is determined by the function -calculating imigrants. The matrix Y(i, j) contains the number of people migrating from country j to country i.

2.4 Part 2.2: Scale down emigration if the country has not enought imigrants

This part of the code ensures that the number of emigrants form country i is not larger then the current numeber of refugees in the given country. If it happens all the values for Y are scaled down so the number of emigrants is equal to the number of refugees already in the country.

The problem with this solution is that if the force is too high the whole population leaves the country this just should not have happened and if so means that the model is not right but that's how I fixed it ;)

2.5 Part 2.3: Calculating new state

The state function saves the data for the number of refugees for each country after the iteration. The emigration from i country is the sum of the ith row when the imigration is the sum of the ith column. New state is the previous state + imigration - emigration.

2.6 Part 2.4: Add to Greece

This is optional state when the additional refugees coming from Syria can be added to the Greece refugee population.

At the end the function prints the results