Testing the 1st set of experiments

In [2]:

```
from IPython.display import Image
```

Tasks:

1. Check the experiments with migration: 2b and 2c
2. Unravel why the migration decreases time to fixation

Check on the migration experiments

The migration graph looked suspecious as some of the settings did not produce even one successful (i.e. versatilist fixating) run. So the whole set was re-run to make sure there was no error in the setup of the experiments. In addition, in Experiment 2c (pop growth + migration ON) two elements change 1. the population growth is switched on and 2. the initial population size is set to 1/10th of the cc, i.e., 1 000. To ensure only one variable is changed at each time, it was run with a starting population of 1 000 and then again with a starting population of 10 000. There was no significant difference between the results.

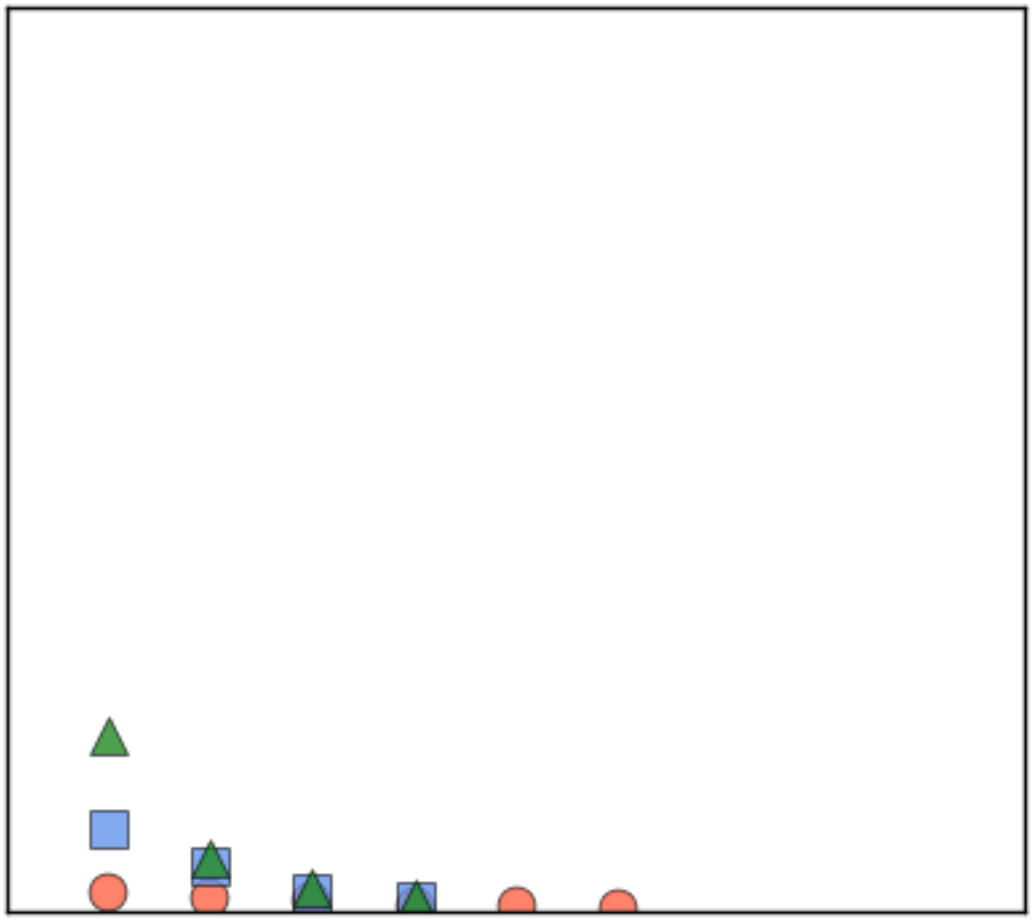
Experiment 2b

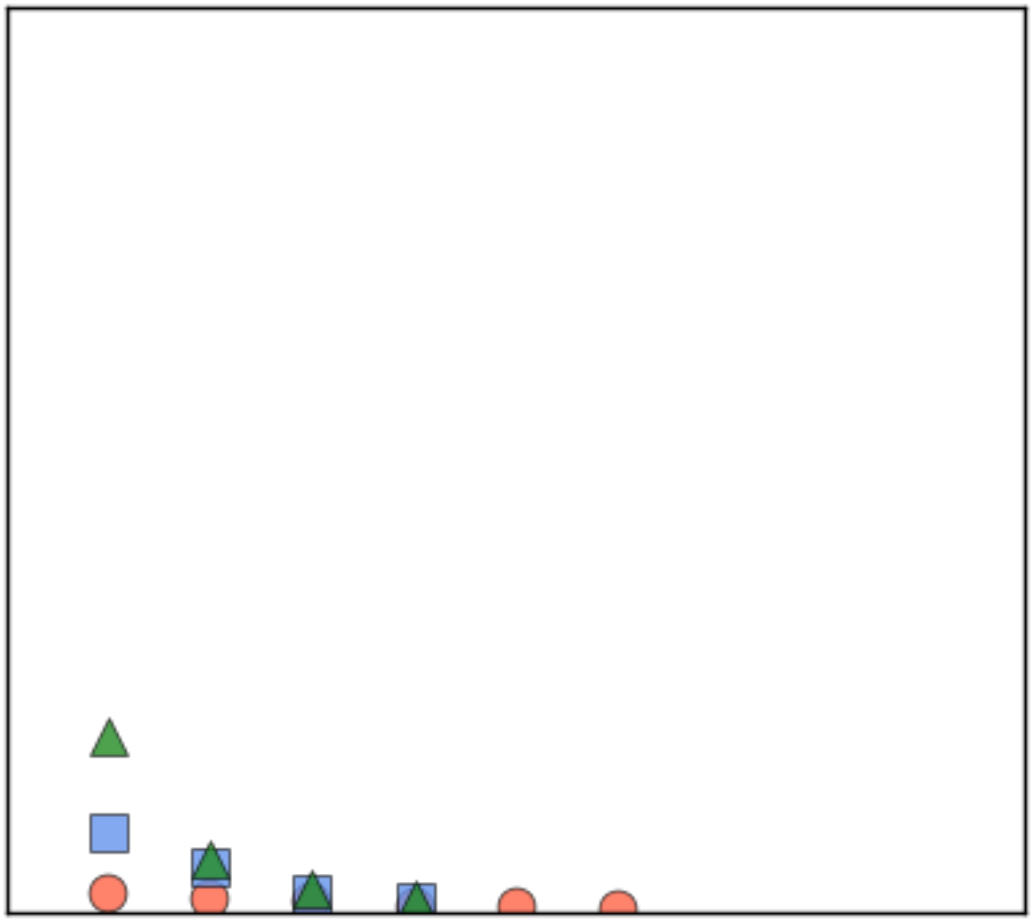
First, the migration is switched on but there is no population growth (the population starts on the cc level and at every time step it is topped up to that level).

Population growth	Migration	Initial Pop size
NO	YES	10 000

In [7]:

```
from IPython.display import Image
from IPython.display import display
x = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/mig_on.png')
y = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/mig_check.png')
display(x, y)
```





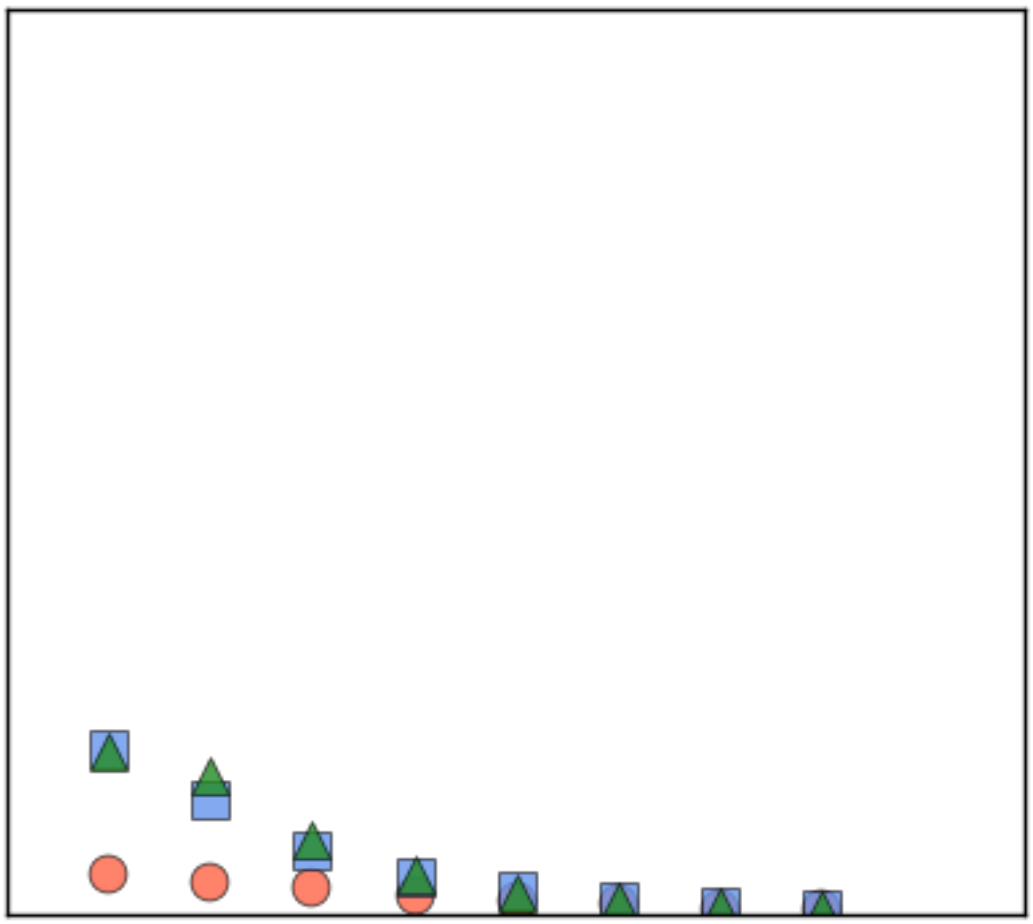
Experiment 2c

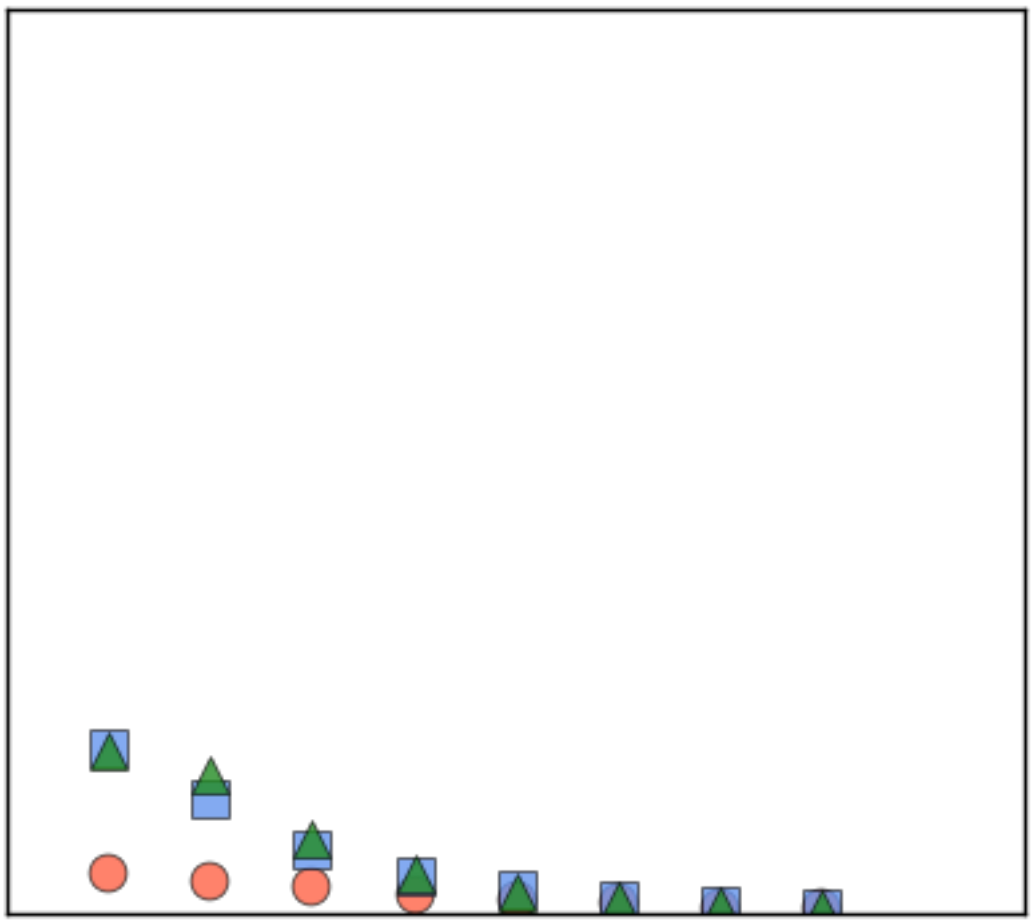
Then, we re-run the experiment with both migration and population growth switched on with an initial pop size = 1000.

Population growth	Migration	Initial Pop size
YES	YES	1 000

In [6]:

```
x = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_on.png')
y = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_on_check.png')
display(x, y)
```





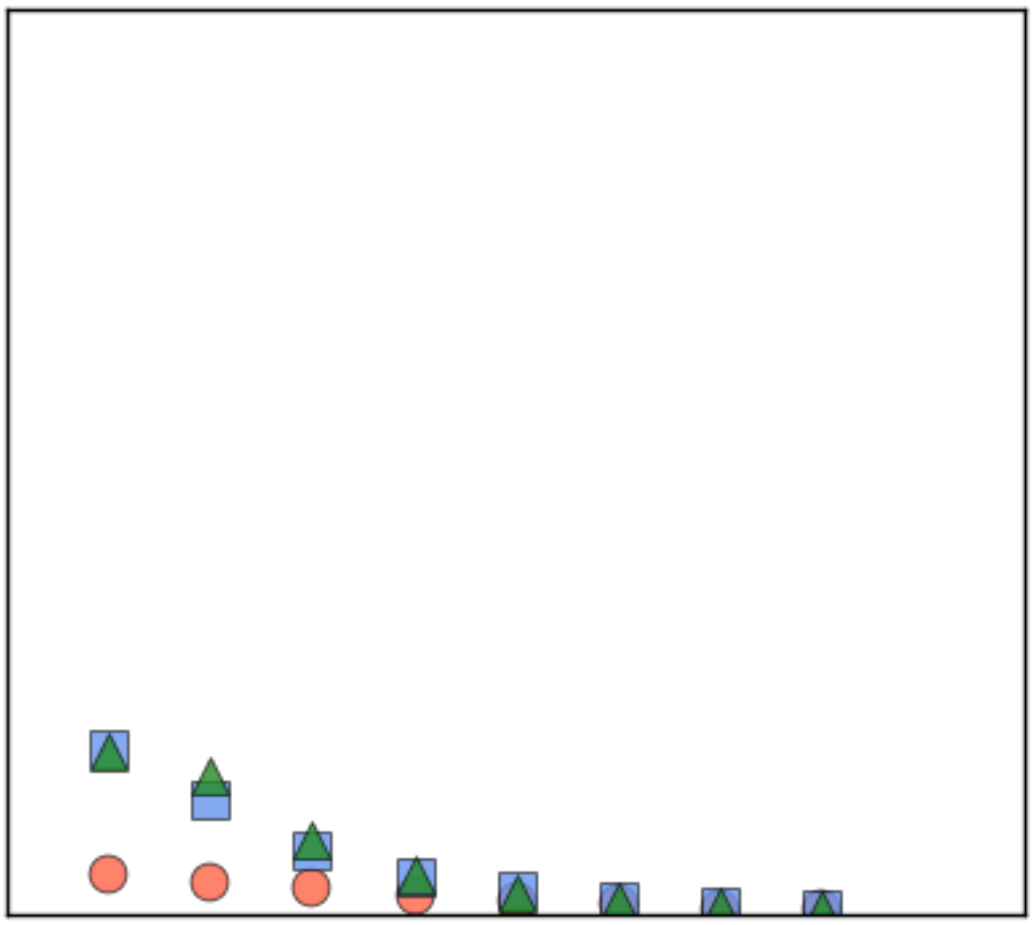
Experiment 2c - modified

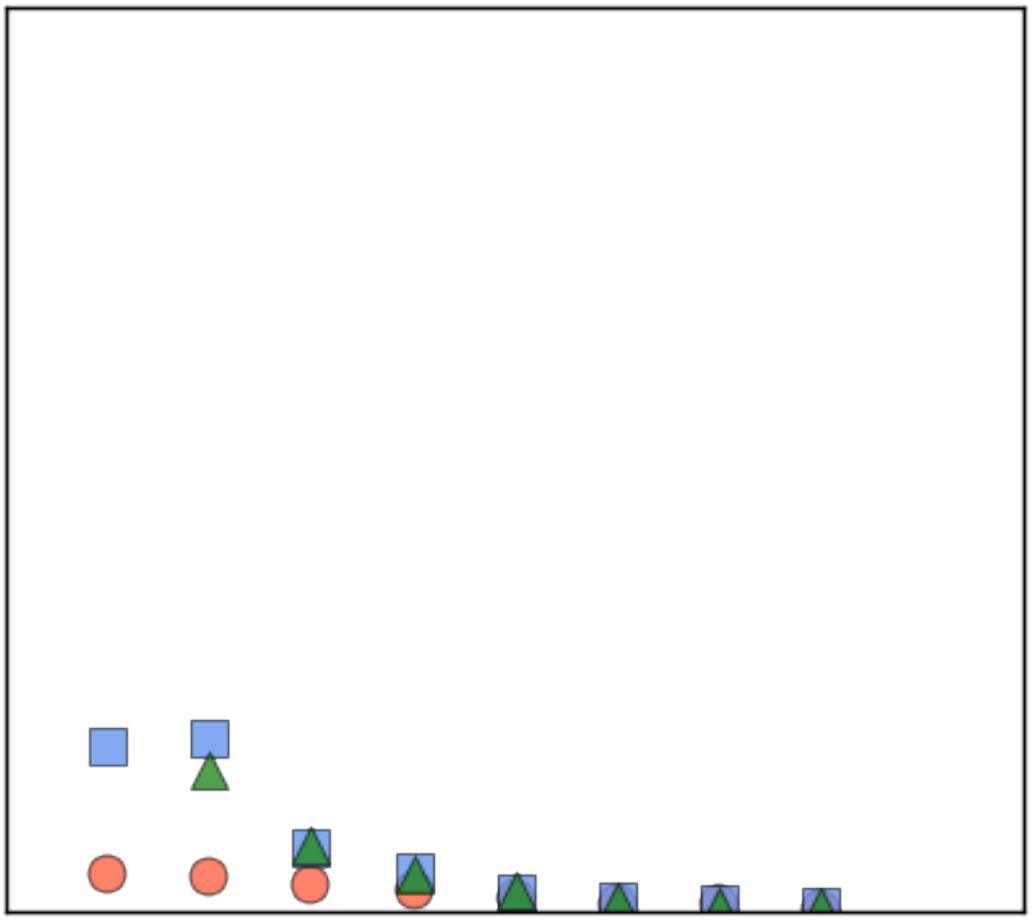
Then we run the experiments with both population growth and migartion switched on but with a starting population of 10 000.

Population growth	Migration	Initial Pop size
YES	YES	10 000

In [9]:

```
x = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_on.png')
y = Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_check_start10k.png')
display(x, y)
```





There is a difference between the original experiment (start on 1000) but it's not significant.

Unravelling the faster rate of fixation for versatilists gene if migration is on

In all the subsequent experiments population growth and migration are both on. What we are interested in is:

Why is the versatilists fixating faster if the migration is switched on?

The dominant hypothesis is that as we switch the migration on, more specialists migrate (because some of them are at the bottom of the pile), leaving more space in the original cell, which increases the chances of the versatilists to produce more descendants. In short migration helps agents of suboptimal fitness because it weakens the winners and removes the loosers faster so that it takes them more time to climb up and less time to loose ground when the conditions change.

To test the above:

1. k was flipped to -k
2. a flatline scenario was run

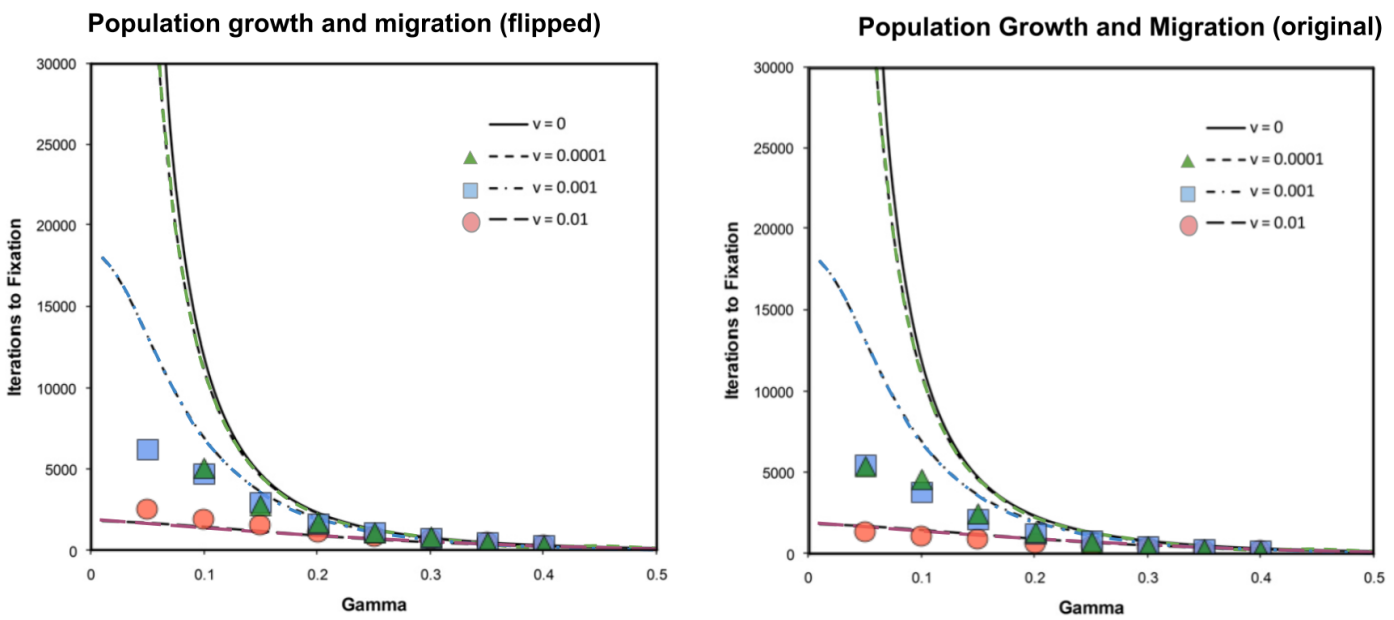
Test one: the logistic curve used to determine migration probability flipped

k = -5 as opposed to k = 5 in the original experiment). Now the agents with the highest fitness are the most likely to migrate. The specialists are symetrical (i.e., it doesn't matter if it's a hot or cold specialist - one of them will be at the top of their fitness curve while the other one will be at the bottom). Thus, if we are correct this change should produce no significant differences in the results.

In [12]:

```
Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_on_flipped_comp.png')
```

Out[12]:



The results are virtually the same. This indicates that the migration weakens specialists, giving more space to sub-optimally adapted individuals (agents with lower fitness), therefore increasing the level of diversity in the population.

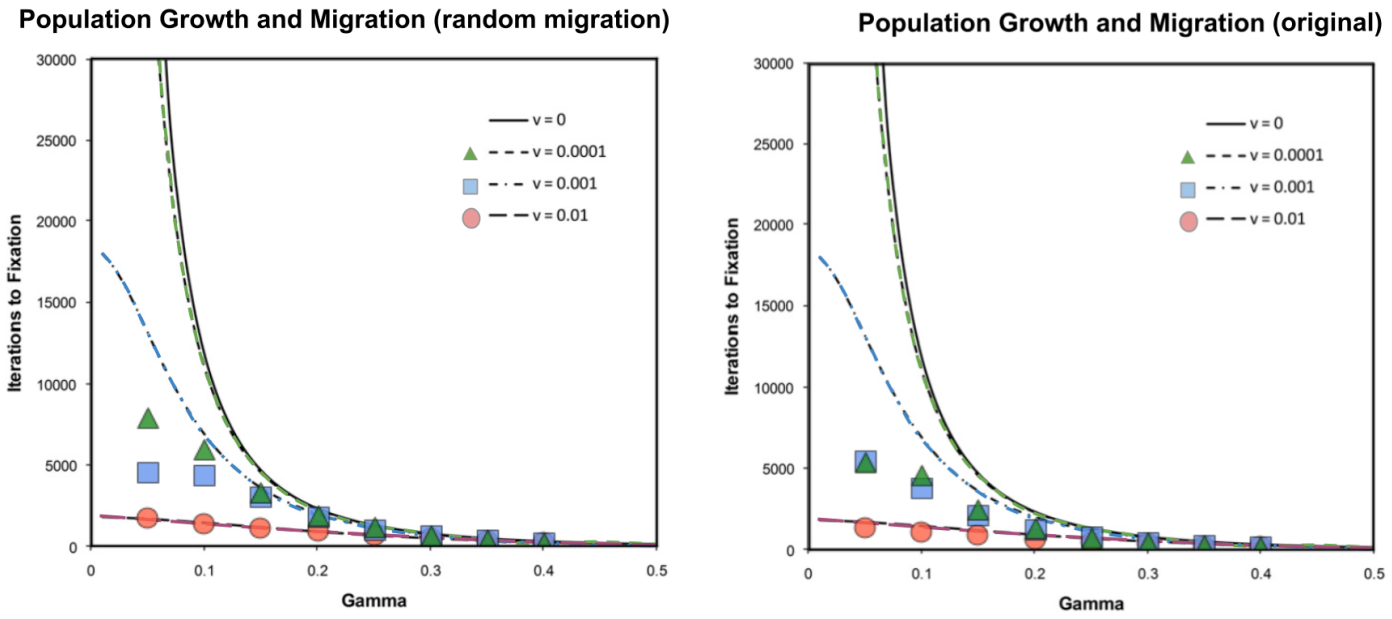
Test two: random agents migrate, but still the same no of migrants

Finally, to test it even further we have drawn the migration and the stay-put populations at random. We expect that migration should still increase the diversity but this time it will have lesser effect as the specialists are not particularly picked on.

In [14]:

```
Image(filename='/Users/iar1g09/Dropbox/IZA/PHD/case_studies/variability_case_study/both_on_flatline(random_migration).png')
```

Out[14]:



Migration is still doing it's job of weakining whoever is the dominant gene at the time but less well - hence the results are closer to the 'original' (the replication) base scenario.

In [ ]: