Adaptation Strategies

EES 4760/5760

Agent-Based and Individual-Based Computational Modeling

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Class #13: Thursday, October 7 2021

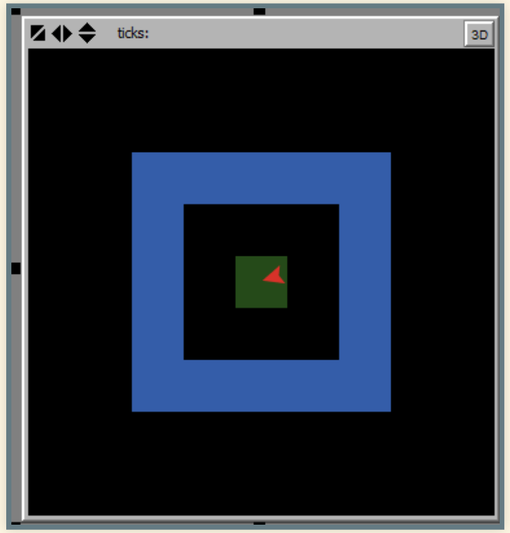
Getting Started

- I have put comments on your research projects in the Box folders.
- Sit with your team partners
- Download model:
  - https://ees4760.jonathangilligan.org/models/class_13/BusinessInvestor.nlog

Subsetting

Subsetting

- Open the BusinessInvestor model in NetLogo
- Click `setup`
- Turn all the turtles red
- Turn turtle 5 green
- Ask turtle 5 to identify all the patches that are exactly 2 patches away from the turtle's patch (not a 2-patch radius from turtle-2)



Hints:

- There are many ways to do this. Let’s look at a way to do this with the `neighbors` primitive.
- Hints:
  - Use `member?` primitive (`member <agent> <agent-set>`)
  - Use `patch-set` primitive to turn an list of many patch-sets into a single patch-set
- Suggestion:
  1. Start by turning all neighbor patches (patches exactly 1 patch away) blue
  2. Next turn all patches within 2 patches blue
  3. Now turn all patches black again
  4. Now turn all patches within a 2-patch distance blue *except* the turtle’s patch
  5. Now turn all patches black again
  6. Now turn all patches within a 2-patch distance blue *except* the turtle’s patch and the patches 1 patch away.

A solution

```
ask turtle 5 [
  ask (patch-set [neighbors] of [neighbors] of self) with
    [not member? self [(patch-set neighbors patch-here)] of myself]
  [
  set pcolor blue
  ]
]
```

- What does `self` refer to in `patch-set [neighbors] of [neighbors] of self`?
  - `self` refers to `turtle 5`
  - `ask turtle 5 [ ... ]` puts the `[...]` in the context of `turtle 5`, so `self` refers to `turtle 5`
- What does `self` refer to in `not member? self [(patch-set neighbors patch-here)] of myself`?
  - `self` refers to the various patches in the `patch-set`: `(patch-set [neighbors] of [neighbors] of self)`
  - `x with [...]`, where `x` is an `agent-set` evaluates `[...]` for each of the agents (patches, turtles, links) in `x`, so `self` in the `[...]` refers, in turn, to each patch in the `patch-set`
- What does `myself` refer to in `not member? self [(patch-set neighbors patch-here)] of myself`?
  - `myself` refers to `turtle 5`
  - `myself` refers to the agent doing the asking

Self vs. Myself

```
to test-self-myself
  ask turtle 5 [
    ask turtle 7
    [
      print (word "first self = " self)
      print (word "first myself = " myself)
      ask turtle 2
      [
        print (word "second self = " self)
        print (word "second myself = "
myself)
      ]
    ]
    ]
  ]
end
```

```
observer> test-self-myself

first self = (turtle 7)
first myself = (turtle 5)
second self = (turtle 2)
second myself = (turtle 7)
```

- `self` refers to the agent *being asked*.
- `myself` refers to the agent *doing the asking*.
- First: `turtle 5` is asking `turtle 7` to do something.
  - `self` is `turtle 7`, `myself` is `turtle 5`
- Second: `turtle 7` is asking `turtle 2` to do something.
  - `self` is `turtle 2`, `myself` is `turtle 7`

Links

- Put a slider on the interface and call it `number-of-links`
- Edit the chooser for `vision-mode` to add `links` as an option.
- Edit `to initialize-turtle`:

```
to initialize-turtle
  move-to one-of patches with [ not any? turtles-here ]
  set wealth 0
  set size 0.8
  color-turtle 1.0
  create-links-to n-of number-of-links other turtles
end
```

Links

- Edit `to-report find-best-patch`:

```
ifelse vision-mode = "radius"
[
  set candidates (patches in-radius sense-radius) with [ not any? turtles-here ]
  set candidates (patch-set candidates patch-here)
]
[
  ifelse vision-mode = "neighbors"
  [
    set candidates neighbors with [ not any? turtles-here ]
    set candidates (patch-set candidates patch-here)
  ]
  [
    ifelse vision-mode = "links"
    [
      set candidates neighbors with [ not any? turtles-here ]
      set candidates (patch-set candidates patch-here)
      set candidates (patch-set candidates ([neighbors with [not any? turtles-here]] of out-
link-neighbors) )
    ]
    [
      error "Unknown vision-mode"
    ]
 ]
]
```

Expected Utility Function

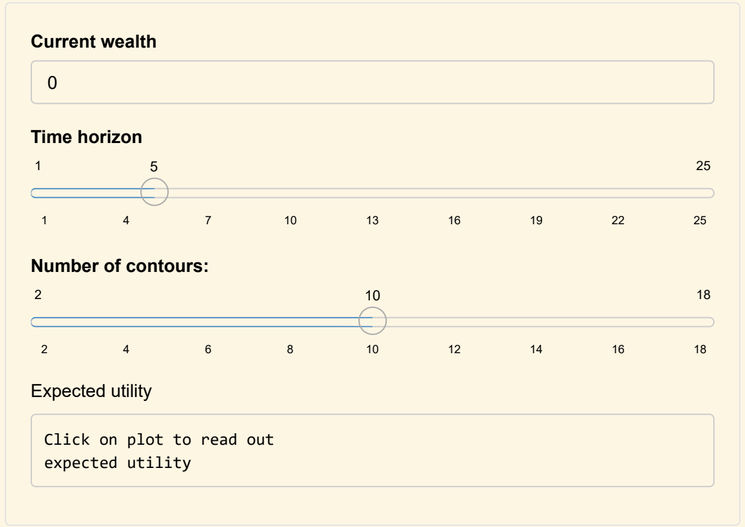
- Function:

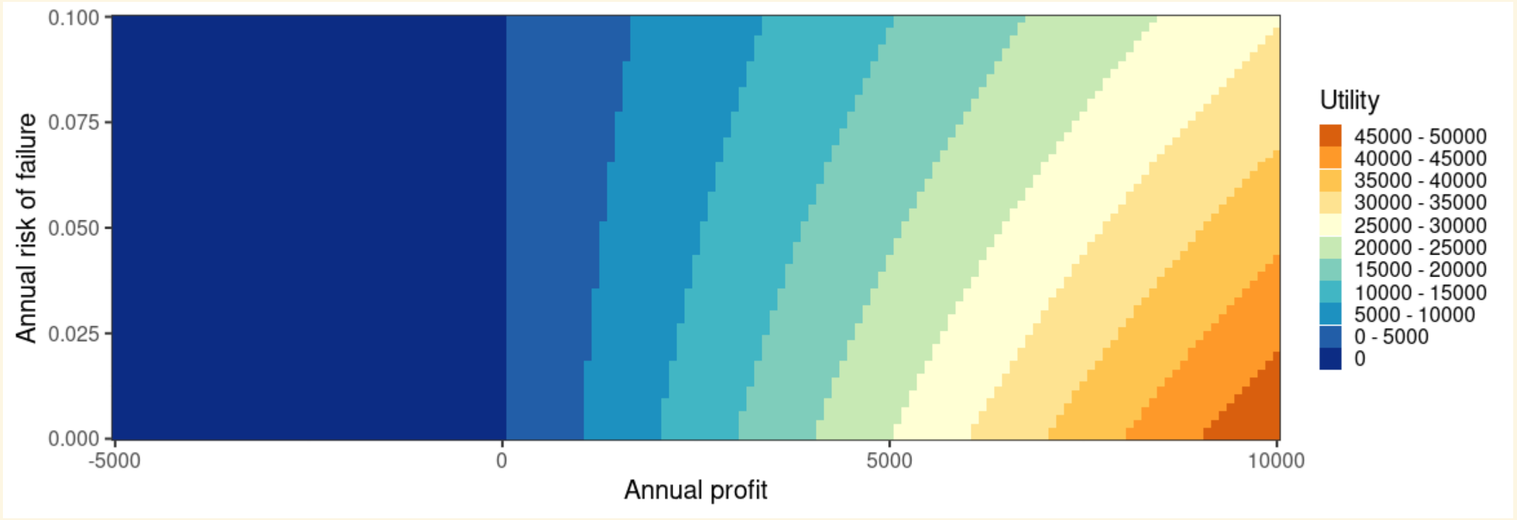
$$U = (W + PT) \times (1 - F)^T$$

W = wealth, P = profit, F = risk of failure, T = time horizon

- How does this change as investors gain more wealth?
- Interactive app https://ees4760.jgilligan.org/contour

Contour plot of investor utility





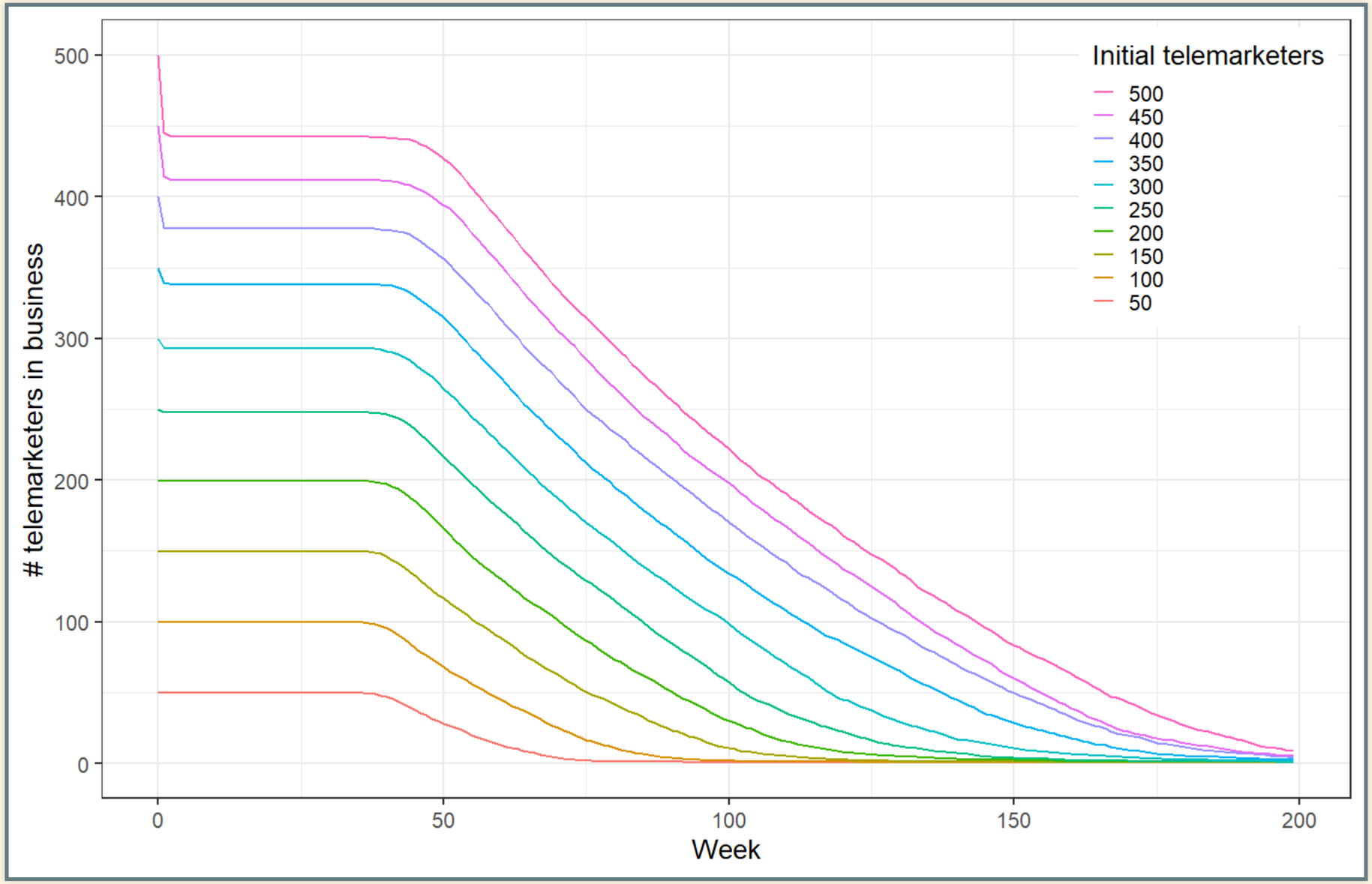
Telemarketer Model

Telemarketer Model

- Telemarketing firms interact
  - Telemarketer calls patches
  - If patch has received a previous call that tick, it hangs up
  - If patch has not received a previous call that tick, it buys something
  - Interaction is indirect, mediated by patches
- Accounting:
  - Net profit = 2 × sales − 50 × size
  - If balance < 0, firm goes bankrupt
- Growth
  - If balance > growth threshold, firm increases size proportional to excess balance

Results

Results


Initial telemarketers
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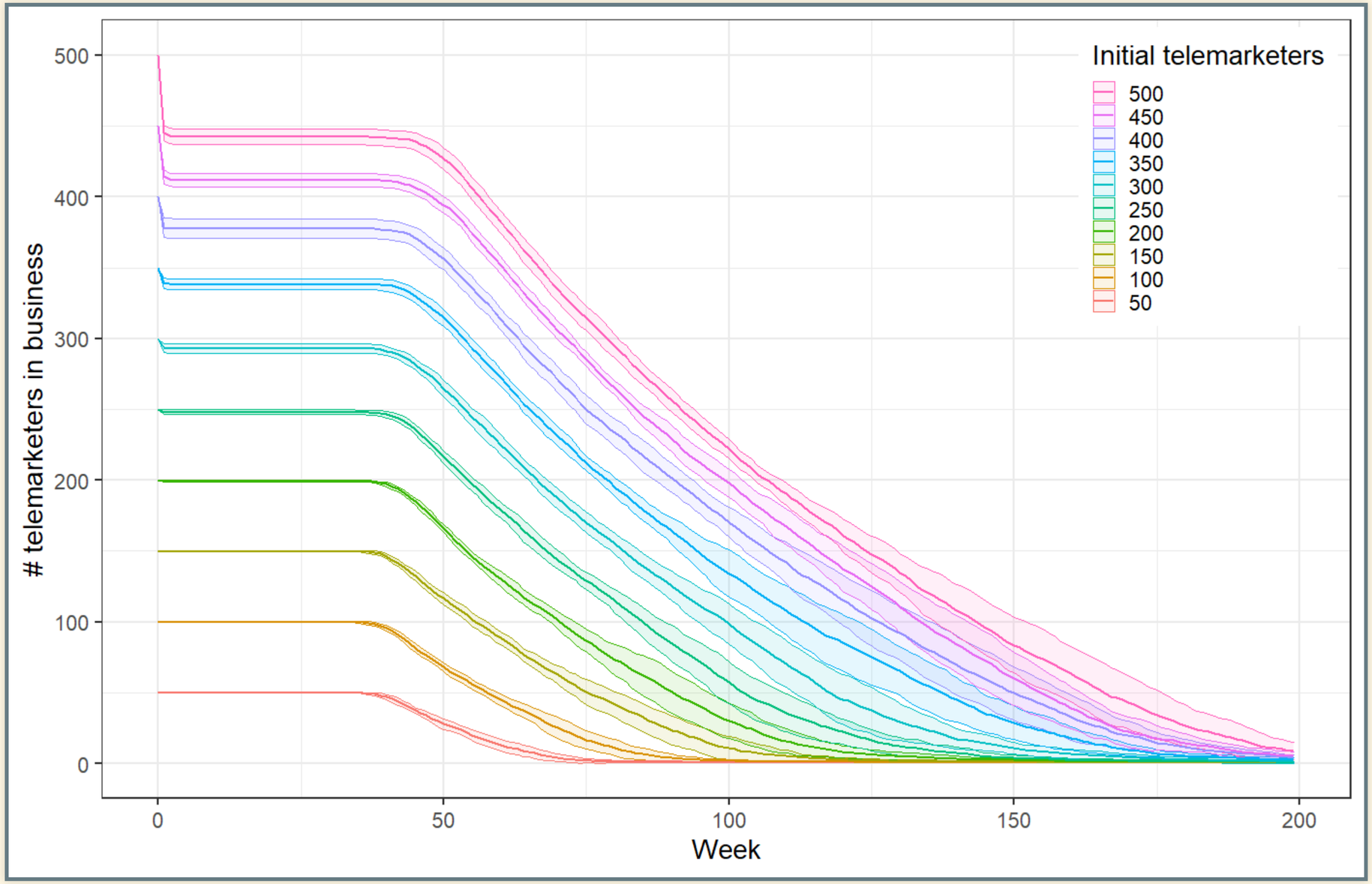
Variation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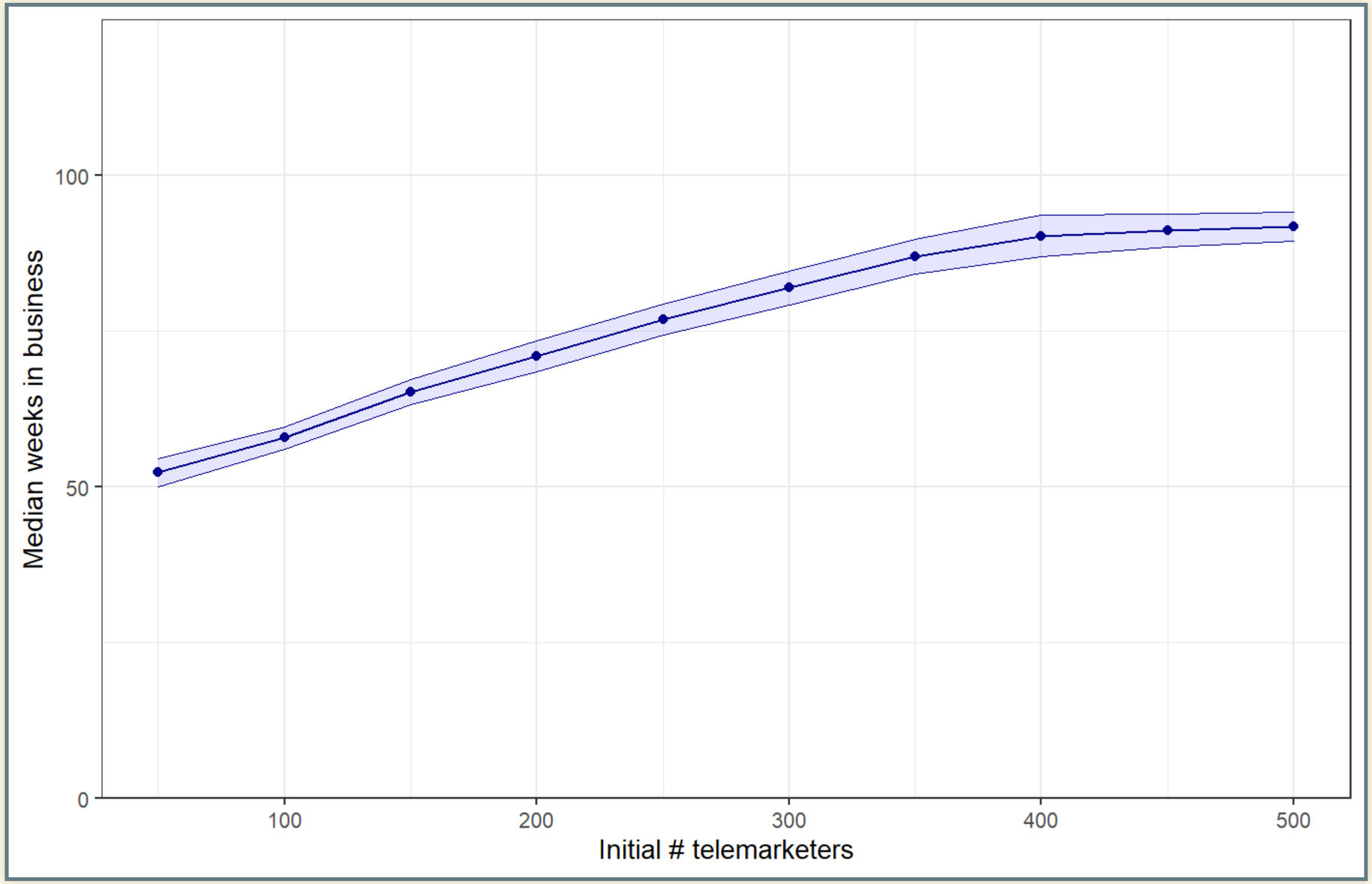
Median Weeks in Business

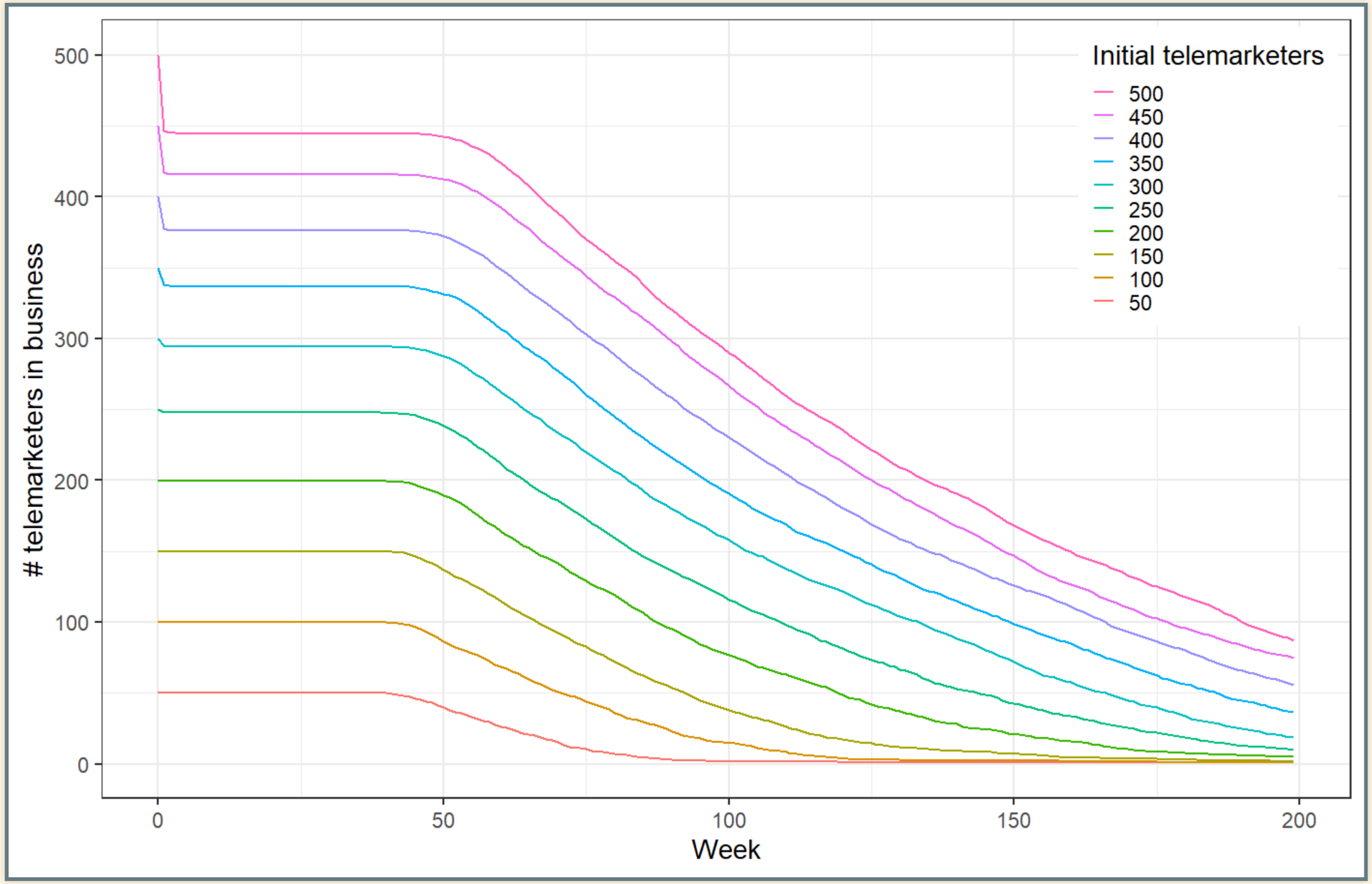


Mergers

Mergers

- Instead of going bankrupt when the bank balance drops below 0, firms look for acquisition partner
  - Find a company that’s bigger and has enough money to pay off deficit.
  - If it finds a parent, parent pays off deficit (child firm ends up with 0 balance)
  - In future turns, child pays parent 50% of its net profits.
  - In future, if child’s balance becomes negative:
    - If parent has enough money, it pays child’s deficit
    - If parent does not have enough money, child dies.

Results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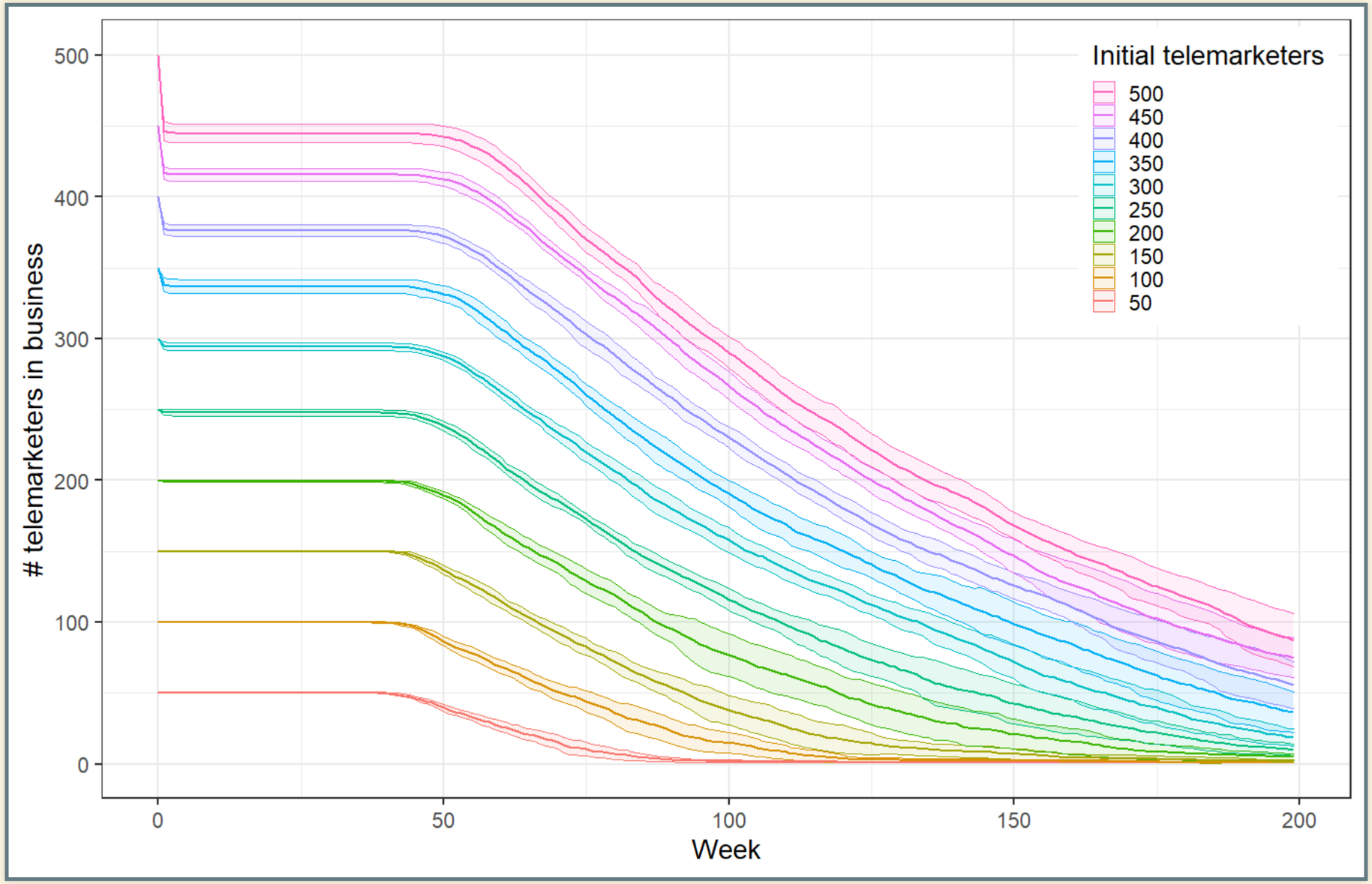
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