CASH FLOW

New Mexico
Supercomputing Challenge
Final Report
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Team Number 30
Bosque School

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What We're trying to find

The problem:

The problem that we saw which is a growing concern in America is the growing percent of poverty in America. The program is meant to realistically model of the current trends. Cash flow is the amount of positive or negative income that a household makes or loses in a given period. We are trying to look for patterns in the graphs for why people get poor and also why some households are stuck in the middle class. Nearer to the end of the season when we have our data and hopefully some conclusions we will compare it to research of true situations and plug-in real statistics in the wealth distribution portion of the program.

The programs basics:

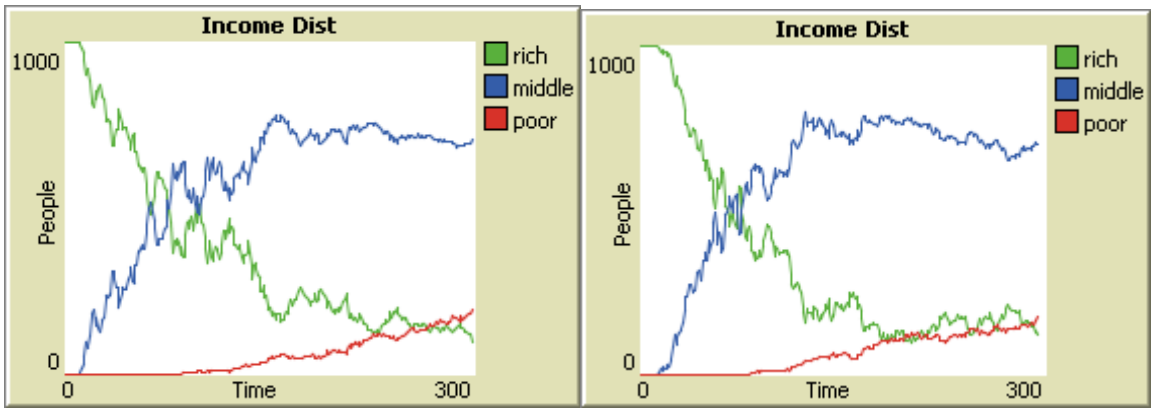
Everyone 0 to 1000 people and starts off with 10000 money that is given to the wealthy class to loan out to the middle and poor classes (with debt). The middle and lower classes use the money to make more money off each other and the wealthy class while dealing with debt. The program divides households into three wealth groups based on income and represents them as colored squares: Red = Poor Class $$<Max Wealth/3 Blue = Middle Class $$ <= Max wealth x 2/3 Green = Wealthy Class $$ >= Max Wealth x 2/3. The program puts the results on graphs that represent the amount of wealthy, middle and poor class households and shows income distribution numbers per class, average amount of money per class, percent of people per class and percent of money per class.

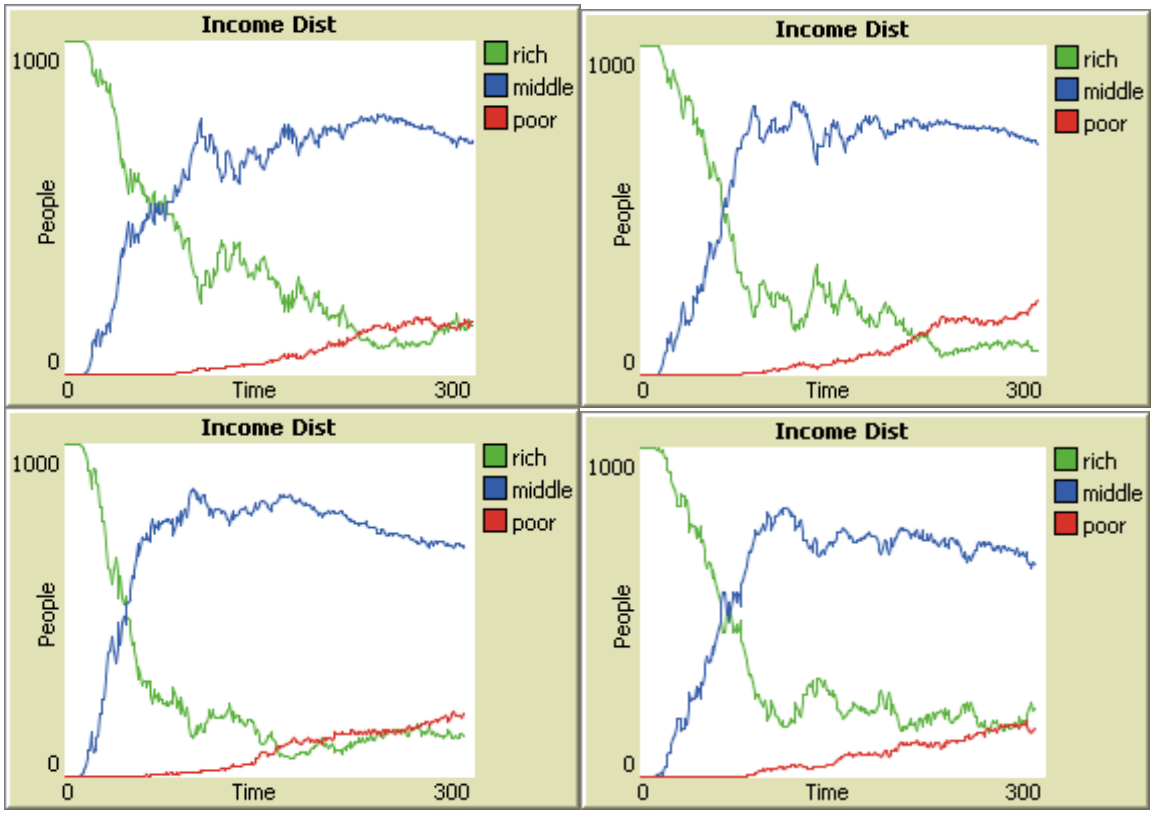
Program Explanation:

The way the program works is that it starts off in the setup with two classes one wealthy, one poor. The wealthy start out with all the money. Once the program starts running the wealthy loan out their money to the poor who depending on how much they got might advance to the middle class. Once all the poor class citizens have money they do business with each other. In that phase probability determines if they make or not make money. All the results are recorded on flow charts. The rich reach the poor class easily because they tend to lend out all of their money.

Results:

Time: 300





Info:

Start out amount money: 100

# of People: 1000

% of rich people: 8.7%

% of middle class people: 71.1%

% of poor people: 20.2%

% of money in the rich class: 13.98%

% of money in the middle class: 75.308%

% of money in the poor class: 10.712%

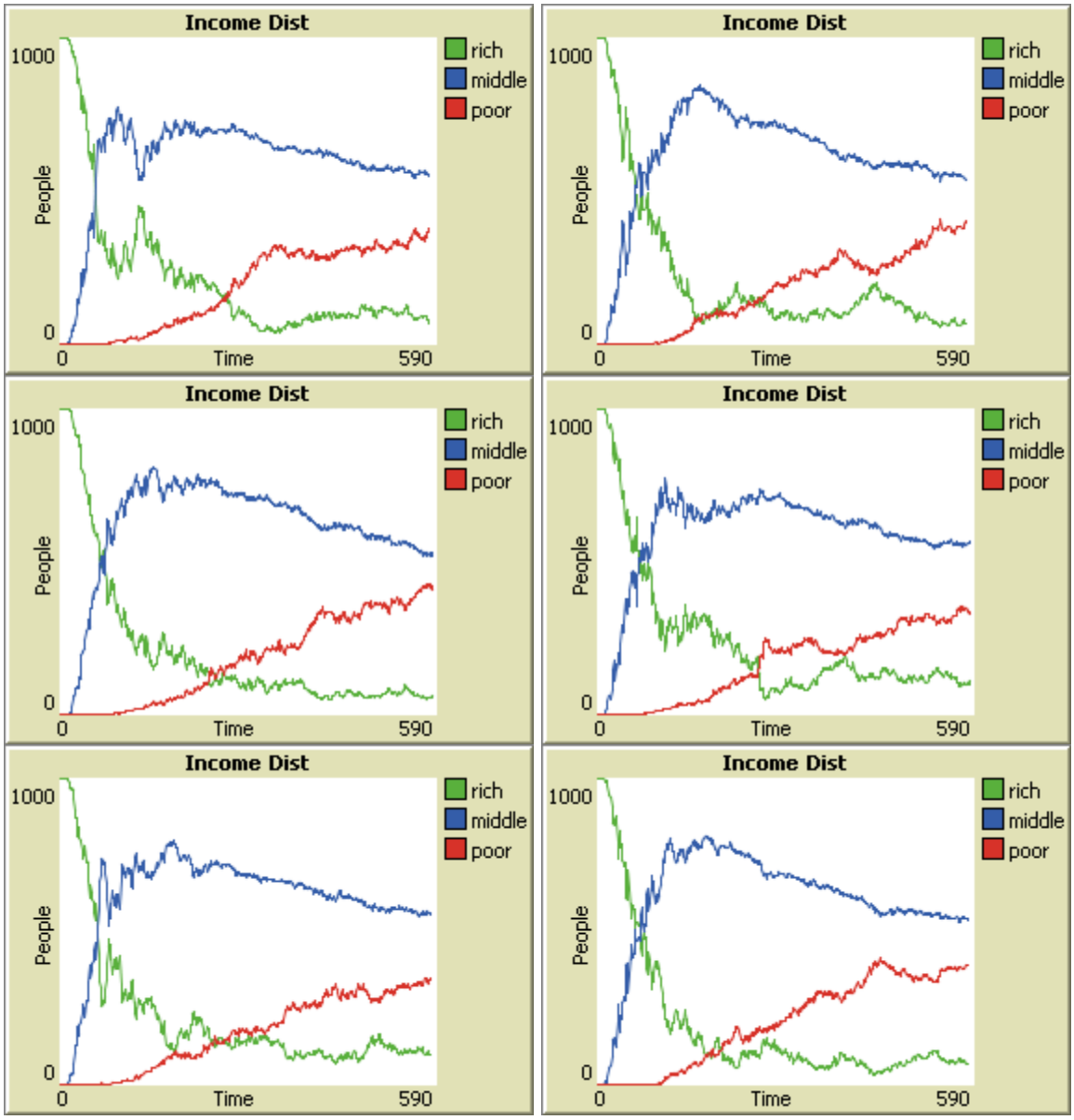
Average amount that a rich person has: $161

Average amount that a middle class person has: $106

Average amount that a poor person has: $53

Obversasions: The % of rich drops rapidly and the % of middles class rises fast % of poor goes up slowly

Time: 590



Info:

Start out amount money: 100

# of People: 1000

% of rich people: 7%

% of middle class people: 53.9%

% of poor people: 39.1%

% of money in the rich class: 13.527%

% of money in the middle class: 66.424%

% of money in the poor class: 20.049%

Average amount that a rich person has: $193

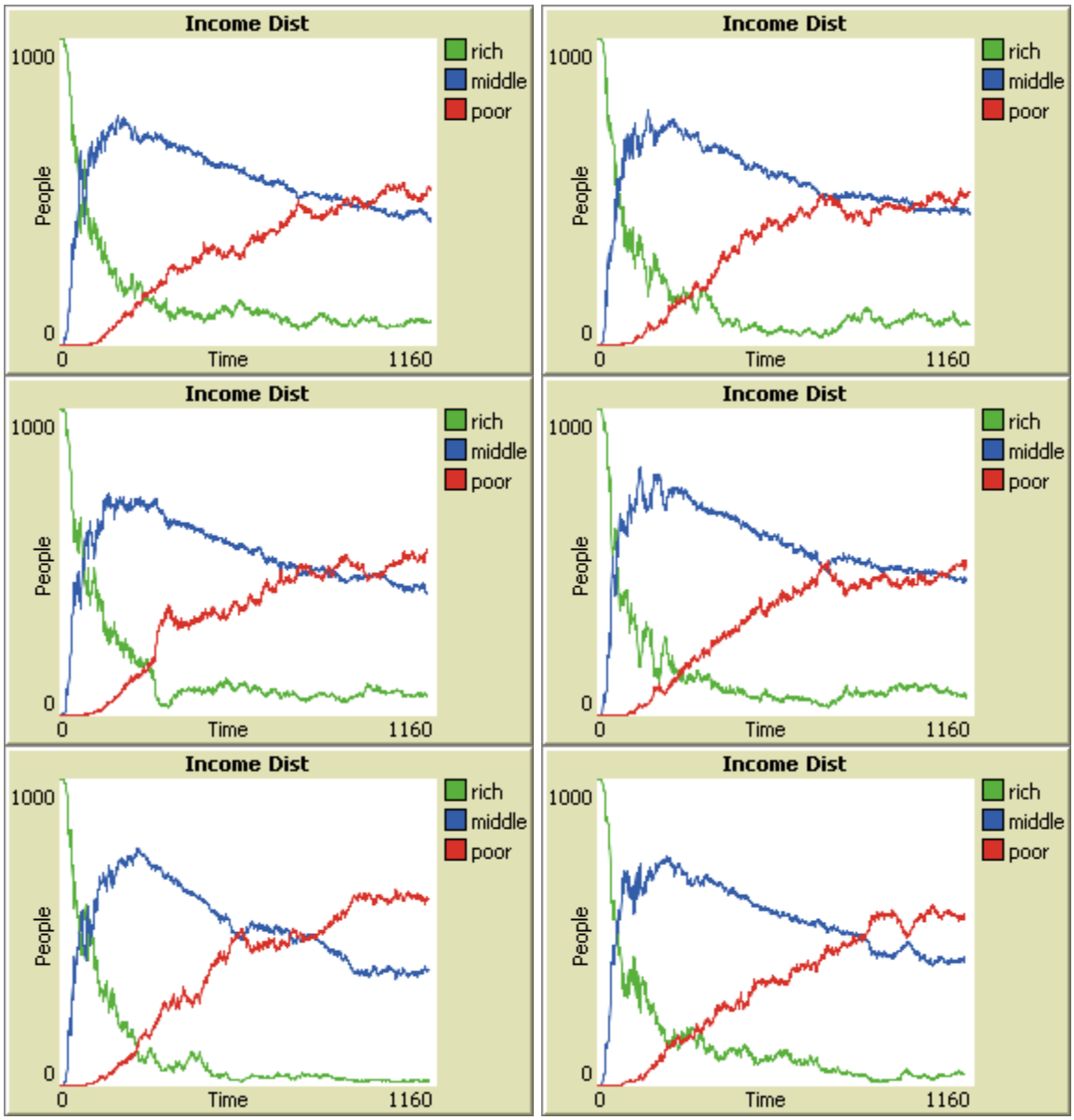
Average amount that a middle class person has: $123

Average amount that a poor person has: $51

Obversasions: The % of rich continues droping and the % of middles class slowly drops

% of poor continues to go up

Time: 1160



Info:

Start out amount money: 100

# of People: 1000

% of rich people: 3.5%

% of middle class people: 41.1%

% of poor people: 55.4%

% of money in the rich class: 8.568%

% of money in the middle class: 62.88%

% of money in the poor class: 28.552%

Average amount that a rich person has: $245

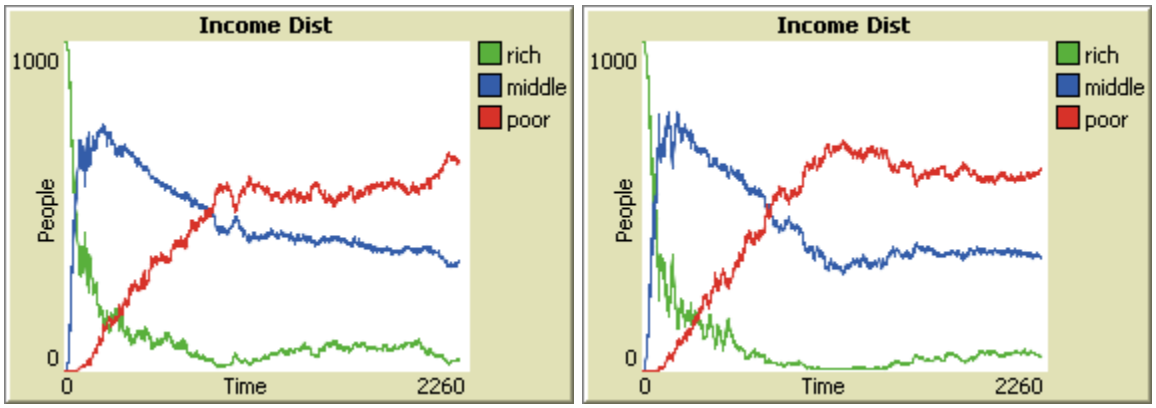
Average amount that a middle class person has: $153

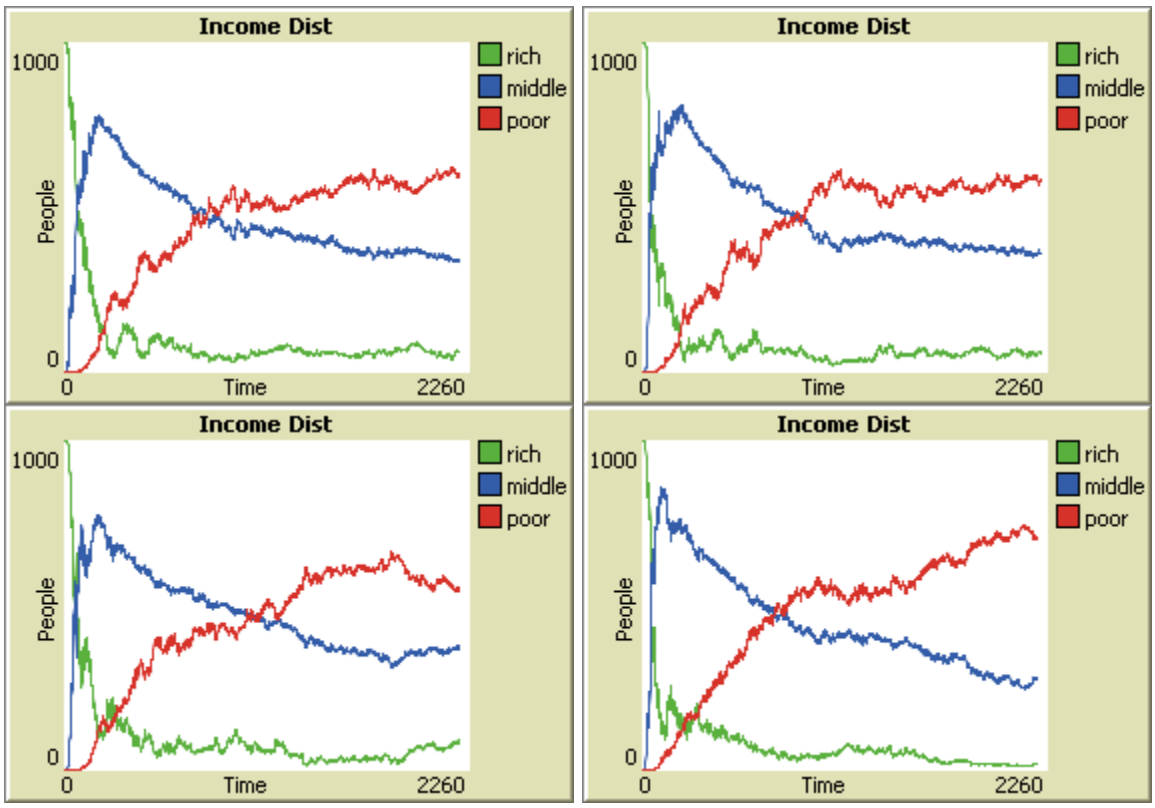
Average amount that a poor person has: $52

Obversasions: The % of rich drops and the % of middles class is finally less than the poor

% of poor goes up more rapidly

Time: 2260





Info:

Start out amount money: $100

# of People: 1000

% of rich people: 1.7%

% of middle class people: 27.9%

% of poor people: 70.4%

% of money in the rich class: 5.591%

% of money in the middle class: 55.819%

% of money in the poor class: 38.59%

Average amount that a rich person has: $329

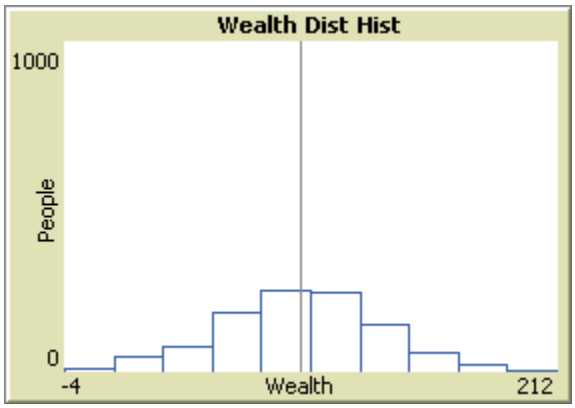
Average amount that a middle class person has: $200

Average amount that a poor person has: $55

Obversasions: The % of rich settles out and the % of middles class starts to settle out % of poor continues up.

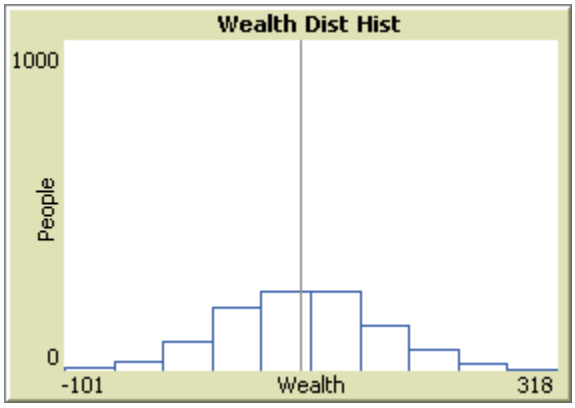
Wealth disruption:

Time: 300



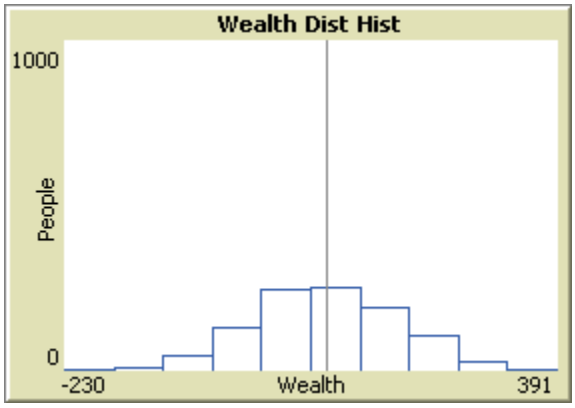
Poorest: -4 Average: 99.6 Richest: 212

Time: 1160



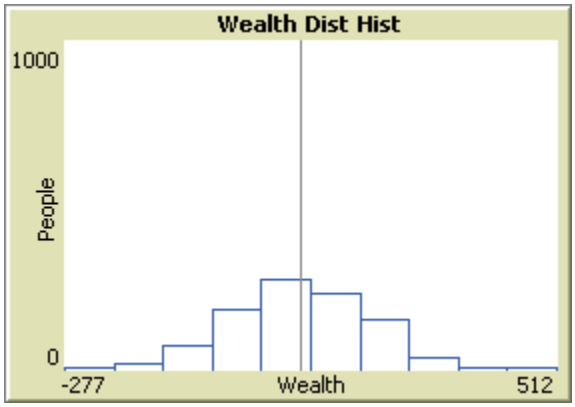
Poorest: -101 Average: 100 Richest: 318

Time: 2260

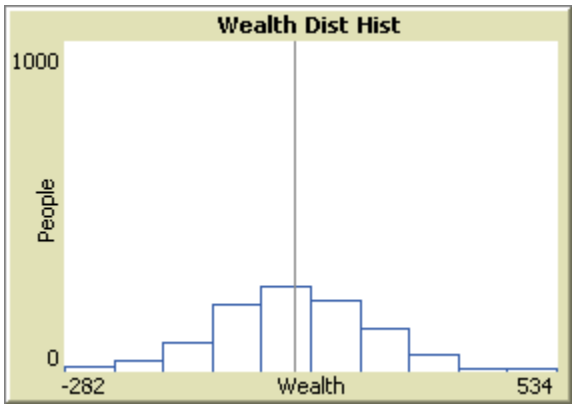


Poorest: -230 Average: 101 Richest: 391

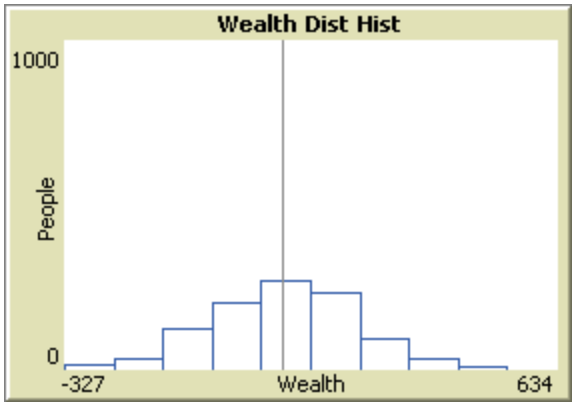
Time: 3540



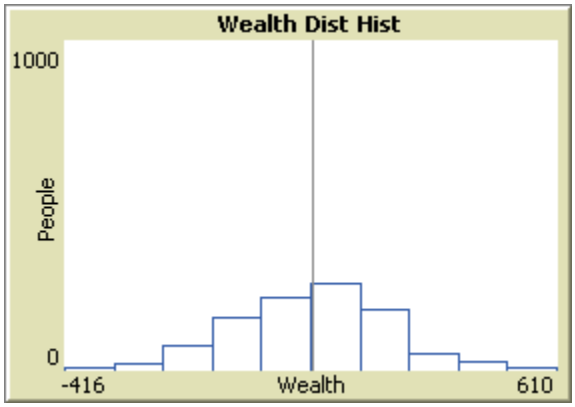
Poorest: -277 Average: 101 Richest: 512
Time: 4354



Poorest: -282 Average: 99 Richest: 534
Time: 5540

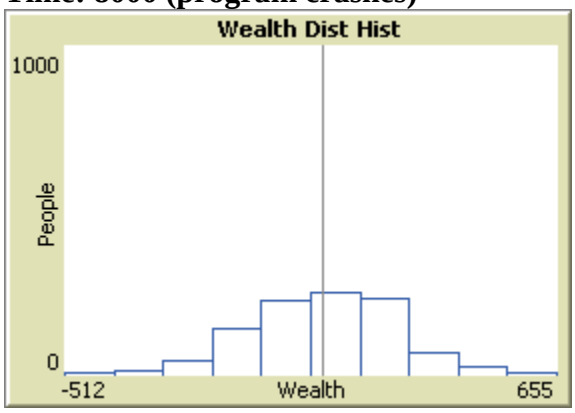


Poorest: -327 Average: 99 Richest: 634
Time: 6930



Poorest: -416 Average: 101 Richest: 610

Time: 8000 (program crashes)



Poorest: -512 Average: 100 Richest: 655

Observation:

When the poorest reach negatives quickly within 300 ticks and continues going down quickly yet the speed that the rich get richer at a slower rate the average always remains around 100.

Program:

```
globals [
  xmax
  ymax
  rich
  poor
  middle-class
  income-max
]

turtles-own [
```

```
  wealth
  customer
]

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;                        ;;;
;;;  Setup Procedures      ;;;
;;;                        ;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


to setup
  ca
  initialize-settings
  crt people [setup-turtles]
  poll-class
  setup-plots
  do-plots
end


to initialize-settings
  set rich 0
  set poor 0
  set middle-class 0
  set income-max 10
end

to setup-turtles  ;;Turtle Procedure
  set shape "person"
  setxy random-xcor random-ycor
  set wealth 100
  set customer -1
end


to setup-plots
  set xmax 300
  set ymax (2 * wealth-total)
  clear-all-plots
  setup-plot3
  setup-histogram
end

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;                        ;;;
```

```
;;; Run Time Procedures ;;;
;;;                    ;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;

to go
  if ticks >= 8000 [stop]
  repeat 10
  [ask turtles [do-business]
  poll-class
  find-class]
  tick
  do-plots
end

;; polls the number in each corresponding economic class
to poll-class
  let max-wealth max [wealth] of turtles
  ask turtles
    [ ifelse (wealth <= max-wealth / 3)
        [ set color red ]
        [ ifelse (wealth <= (max-wealth * 2 / 3))
            [ set color blue ]
            [ set color green ] ] ]

end

to do-business  ;;Turtle Procedure
  rt random 360
  fd 1
  ;; turtle has wealth to trade with, and there is
  ;; another turtle to trade with on the same patch
  ifelse deat?
    [set customer one-of other turtles-here
      if customer != nobody and (random 2) = 0          ;;50% chance of trading
        [ask customer [set wealth wealth + 1]
          set wealth wealth - 1
        ]
    ]
    [if (wealth > 0) [
      set customer one-of other turtles-here
      if customer != nobody and (random 2) = 0          ;;50% chance of trading
        [ask customer [set wealth wealth + 1]
          set wealth wealth - 1
        ]
      ]
    ]
```

```
end

to find-class
  set rich find-rich
  set middle-class find-middle
  set poor find-poor

end

to-report wealth-total
  report sum [wealth] of turtles
end

to-report find-rich
  report count turtles with [color = green]
end

to-report find-middle
  report count turtles with [color = blue]
end

to-report find-poor
  report count turtles with [color = red]
end

to-report money-total
report sum [wealth] of turtles
end

to-report min-wth
let wealth-list [wealth] of turtles
  report (round (min wealth-list))
end

to-report max-wth
let wealth-list [wealth] of turtles
  report (round (max wealth-list))
end

to-report ave-amount
  let wealth-list [wealth] of turtles
  let ave-wealth mean wealth-list
  report ave-wealth
end

to-report median-amount
```

```
  let wealth-list [wealth] of turtles
  report (round (median wealth-list))
end

to-report ave-rich
report round (mean [wealth] of turtles with [color = green])
end

to-report ave-mid
report round (mean [wealth] of turtles with [color = blue])
end

to-report ave-poor
report round (mean [wealth] of turtles with [color = red])
end

to-report %rich
  report (find-rich / people)
end

to-report %mid
  report (find-middle / people)
end

to-report %poor
  report (find-poor / people)
end

to-report rich%wealth
  report sum [wealth] of turtles with [color = green] / (people * 100)
end

to-report mid%wealth
  report sum [wealth] of turtles with [color = blue] / (people * 100)
end

to-report poor%wealth
  report sum [wealth] of turtles with [color = red] / (people * 100)
end

;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;                     ;;;
;;; Plotting Procedures ;;;
;;;                     ;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
to do-plots

  set-current-plot "Income Dist"
  set-current-plot-pen "rich"
  plot count turtles with [color = green]
  set-current-plot-pen "middle"
  plot count turtles with [color = blue]
  set-current-plot-pen "poor"
  plot count turtles with [color = red]

  every 1 [plot-histogram]
end


to plot-histogram
  set-current-plot "Wealth Dist Hist"
  let wealth-list [wealth] of turtles
  let min-wealth round (min wealth-list)
  let max-wealth round (max wealth-list)
  ifelse min-wealth < max-wealth
  [ set-plot-x-range min-wealth max-wealth ]
  [ set-plot-x-range min-wealth (min-wealth + 1) ]

  ;;draw gray line in center of distribution
  set-current-plot-pen "ave-wealth"
  plot-pen-reset
  let ave-wealth mean wealth-list
  plotxy ave-wealth 0
  plotxy ave-wealth people

  set-current-plot-pen "hist"
  set-histogram-num-bars 10
  histogram [wealth] of turtles
end


to setup-plot3
  set-current-plot "Income Dist"
  set-plot-x-range 0 xmax
  set-plot-y-range 0 people
end


to setup-histogram
  set-current-plot "Wealth Dist Hist"
  set-plot-y-range 0 people
```

end

References

Wilensky, U. (1998). NetLogo Cash Flow model. http://ccl.northwestern.edu/netlogo/models/CashFlow. Center for Connected Learning and Computer-Based Modeling,Northwestern University, Evanston, IL.