

(* step one is to define the functions: (i) the variables we have are {ka0,ka,al,z,wbar,d1} (ii) {cbar,what} satisfy the condition that {V'[cbar]==0,R[what-cbar]== what} (iii) we want the condtion that {what<wbar}

```
In[ ]:= Quit[]

In[ ]:= Rfunction = {al Sqrt[w + z] - al Sqrt[z], al Sqrt[wbar + z] - al Sqrt[z] + (w - wbar) / d1};
V[c_] := ka0 Sqrt[c]
Vm[c_] := ka Sqrt[c]
R[w_] := Piecewise[{ {al Sqrt[w + z] - al Sqrt[z], w ≤ wbar},
  {al Sqrt[wbar + z] - al Sqrt[z] + (w - wbar) / d1, w > wbar} } ]
shocka =
  115 /
  100;
shockb = 85 / 100;
qa = 1 / 2;
qb = 1 - qa;
Ra[w_] := shocka R[w];
Rb[w_] := shockb R[w];
cbar =  $\frac{ka0^2}{4}$ ;
what =  $\frac{1}{2} \left( al^2 - \sqrt{al^2 (-ka0^2 + (al - 2 \sqrt{z})^2)} - 2 al \sqrt{z} \right)$ ;
wbar =  $\frac{al^2 d1^2}{4} - z$ ;
d1 = 8 / 10;
al = 30 / 10;
z = 1;
ka0 = 1 / 2;
ka = 52 / 100;

In[ ]:= FullSimplify[Solve[Flatten[
  {Simplify[{V'[cbar] == 1, FullSimplify[R[what - cbar] == what, what - cbar < wbar]}],
  Simplify[D[Rfunction[[1]], w] == D[Rfunction[[2]], w] /. w -> wbar}],
{cbar, what, wbar}][[1]]]

... Part: Part specification Rfunction[[1]] is longer than depth of object.
... Part: Part specification Rfunction[[2]] is longer than depth of object.
... Solve: This system cannot be solved with the methods available to Solve.

Out[ ]:= {V'[cbar] == 1, what == R[-cbar + what], True}
```

$$\text{In}[]:= \text{cbar} = \frac{\text{ka}0^2}{4};$$

$$\text{what} = \frac{1}{2} \left(\text{al}^2 - \sqrt{\text{al}^2 \left(-\text{ka}0^2 + \left(\text{al} - 2 \sqrt{z} \right)^2 \right) - 2 \text{al} \sqrt{z}} \right);$$

$$\text{wbar} = \frac{\text{al}^2 \text{dl}^2}{4} - z;$$

(* step two: find the right variables:

`In[]:= ClearAll[dl, al, z, ka0, ka]`

`In[]:= {NMaximize[
 {dl, Simplify[0 < what < wbar && 0 < what - cbar && 0 < dl < 1 && 0 < ka0 < ka && 0 < z &&
 0 < al && cbar < what - cbar /. {al -> 31/10, z -> 1, ka0 -> 1/2, ka -> 52/100}]],
 dl], NMinimize[{dl, Simplify[0 < what < wbar && 0 < what - cbar &&
 0 < dl < 1 && 0 < ka0 < ka && 0 < z && 0 < al && cbar < what - cbar /.
 {al -> 31/10, z -> 1, ka0 -> 1/2, ka -> 52/100}]], dl]}`

`Out[]:= {{1., {dl -> 1.}}, {0.702698, {dl -> 0.702698}}}`

`In[]:= dl = 8/10; al = 30/10; z = 1; ka0 = 1/2; ka = 52/100;`

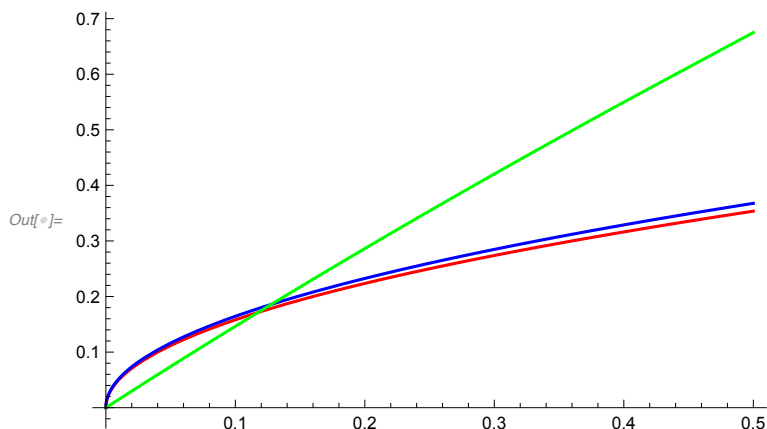
`In[]:= FullSimplify[R[w]]`

`Out[]:= $\begin{cases} \frac{1}{20} + \frac{5w}{4} & 25w > 11 \\ 3(-1 + \sqrt{1+w}) & \text{True} \end{cases}$`

`In[]:= N[{wbar, what, cbar}]`

`Out[]:= {0.44, 0.200962, 0.0625}`

`In[]:= Plot[{V[w], Vm[w], R[w]}, {w, 0, .5}, PlotRange -> All, PlotStyle -> {Red, Blue, Green}]`



`In[]:= N[{R[R[wbar]], R[wbar], R[what], what}]`

`Out[]:= {0.8, 0.6, 0.287652, 0.200962}`

(* step three: code for the market:

```

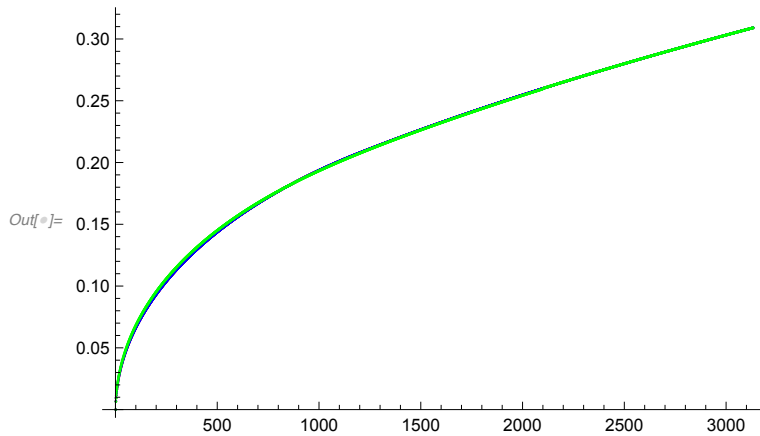
In[ ]:= wupper0 = Ra[Ra[wbar]]; wupper = Ra[Ra[Ra[wbar]]]; grid = 1/2000;
wealth = Table[w, {w, 0, wupper + grid, grid}];
stationc = Flatten[ParallelTable[
  c /. Solve[R[wealth[[i]] - c] == wealth[[i]], c], {i, 1, Length[wealth]}];

In[ ]:= Pm0 = ParallelTable[Vm[N[stationc[[i]]]], {i, 1, Length[wealth]}];
Pm = ParallelTable[Vm[N[stationc[[i]]]], {i, 1, Length[wealth]}];

In[ ]:= Pmplus = Flatten[
  {ParallelTable[N[Max[Table[{1 - dl, dl}.{Vm[wealth[[i]]], {qa, qb}.{{(wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - N[Ra[
      wealth[[j]] - wealth[[i]]]])/(wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - wealth[[
          IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 1]]],
      (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[N[Ra[wealth[[
        j]] - wealth[[i]]]]/grid] + 1]])/(wealth[[IntegerPart[
          N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - wealth[[
            IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 1]]]}],
    {Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
      Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]]},
    {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      N[Rb[wealth[[j]] - wealth[[i]]]])/(wealth[[IntegerPart[
        N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - wealth[[
          IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]]],
      (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
        N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]])/
      (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/
        grid] + 2]] - wealth[[IntegerPart[
          N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]]]}],
    {Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
      Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]]}}],
    {i, 1, j}]]], {j, 1, wupper0/grid}], Pm[[
  Length[Table[j, {j, 1, wupper0/grid}]] + 1];
  Length[
    wealth]]];];

```

```
In[ ]:= ListPlot[{Pm0, Pm, Pmplus}, PlotStyle -> {Red, Blue, Green}]
```



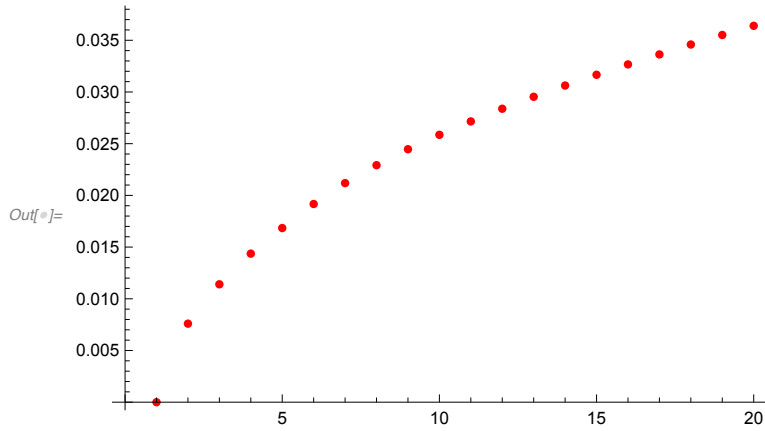
```
In[ ]:= n = 1;
While[n < 25, Pm = Pmplus;
  Pmplus = Flatten[{ParallelTable[N[Max[Table[{1 - dl, dl}.{Vm[wealth[[i]]],
    {qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]])/grid] +
      2]] - N[Ra[wealth[[j]] - wealth[[i]]]]) / (wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 2]] - wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 1]]],
    (N[Ra[wealth[[j]] - wealth[[i]]]) - wealth[[IntegerPart[N[Ra[wealth[[
      j]] - wealth[[i]]]])/grid] + 1]]] / (wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 2]] - wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 1]]]}.
    {Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 1]],
    Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]])/grid] + 2]]},
    {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 2]] -
      N[Rb[wealth[[j]] - wealth[[i]]]]) / (wealth[[IntegerPart[
        N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 2]] - wealth[[
        IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 1]]],
    (N[Rb[wealth[[j]] - wealth[[i]]]) - wealth[[IntegerPart[N[Rb[wealth[[
      j]] - wealth[[i]]]])/grid] + 1]]] / (wealth[[IntegerPart[
        N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 2]] - wealth[[
        IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 1]]]}.
    {Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 1]],
    Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]])/grid] + 2]]}]]],
    {i, 1, j}]]], {j, 1, wupper0/grid}], Pm[[
  Length[Table[j, {j, 1, wupper0/grid}]] + 1 ;; Length[wealth]]]]];
  n++]
```

```
In[ ]:= Beep[]
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```
In[ ]:= {Max[Pmplus - Pm], Min[Pmplus - Pm], Max[Pmplus - Pm0]}
```

```
Out[ ]:= {5.29298 × 10-6, -1.02217 × 10-6, 0.00907764}
```

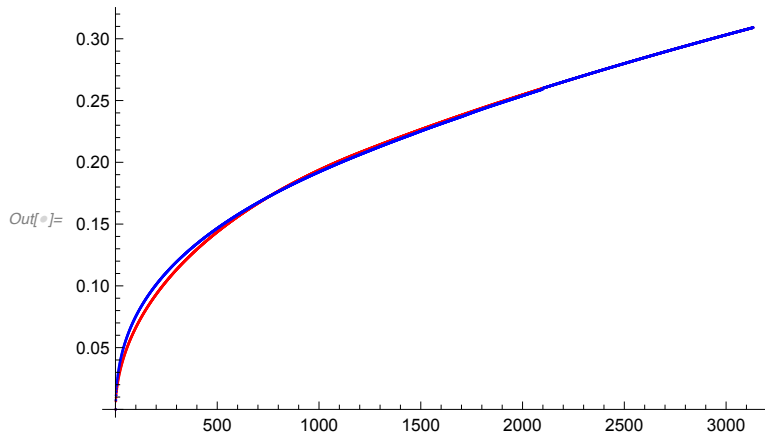
```
In[ ]:= ListPlot[{Pmplus[[1 ;; 20]]}, PlotStyle → {Red, Blue}]
```



```
In[ ]:= (* the first two shall be close to zero, the last one shall be above zero.)
```



```
In[ ]:= ListPlot[{Pm0, Pmplus}, PlotStyle → {Red, Blue}, PlotRange → All]
```



```
(* find the position of updated wealth!
```

```
In[ ]:= ParallelTable[Position[Table[{1 - dl, dl}.{Vm[wealth[[i]]],
  {qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    N[Ra[wealth[[j]] - wealth[[i]]]] /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
  (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]] /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])]},
  {Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
    Pm[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
```

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{ (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
  N[Rb[wealth[[j]] - wealth[[i]]]]) /
  (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
    wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]]),
  (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]])) /
  (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
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{Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
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{i, 1, j}], Max[Table[{1 - dl, dl}.{Vm[wealth[[i]]], {qa, qb}.
  {{ (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
    N[Ra[wealth[[j]] - wealth[[i]]]]) /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
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    (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
      N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 1]])) /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
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    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
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    (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
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    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
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  {Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
    Pm[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]]/grid] + 2]]}},
  {i, 1, j}]]], {j, 1, wupper0/grid}]

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Out[8]= {{ {1}}, {1}}, {{1}}, {1}}, {{1}}, {2}}, {{2}}, {2}}, {{2}}, {2}}, {{2}}, {2}},
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ln[8]:= consumecity = Flatten[%]
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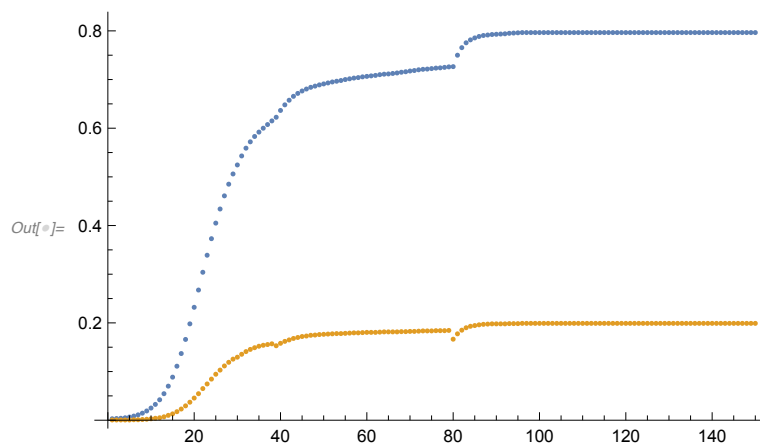
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```
ln[•]:= consumeseqvalue = Table[wealth[[consumecity[[wealthseq[[j]]]]]], {j, 1, 150}]
```

[illegible]

```
In[6]:= ListPlot[{wealthseqvalue[[1 ;; 150]], consumeseqvalue[[1 ;; 150]]}]
```


$$In[\bullet] := \text{Pmp lus}$$

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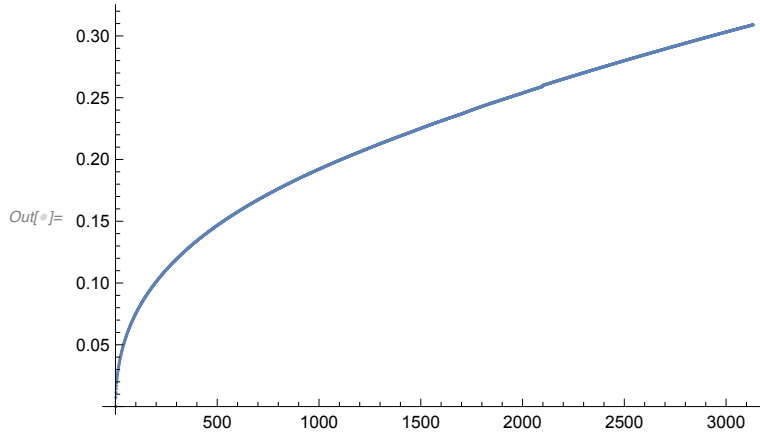
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 0.291293, 0.291339, 0.291386, 0.291432, 0.291478, 0.291525, 0.291571,
 0.291618, 0.291664, 0.29171, 0.291757, 0.291803, 0.291849, 0.291896, 0.291942,
 0.291988, 0.292035, 0.292081, 0.292127, 0.292173, 0.29222, 0.292266, 0.292312,
 0.292358, 0.292405, 0.292451, 0.292497, 0.292543, 0.29259, 0.292636, 0.292682,
 0.292728, 0.292774, 0.29282, 0.292867, 0.292913, 0.292959, 0.293005, 0.293051,
 0.293097, 0.293144, 0.29319, 0.293236, 0.293282, 0.293328, 0.293374, 0.29342,
 0.293466, 0.293512, 0.293558, 0.293604, 0.29365, 0.293696, 0.293742, 0.293788,
 0.293835, 0.293881, 0.293927, 0.293973, 0.294019, 0.294064, 0.29411, 0.294156,
 0.294202, 0.294248, 0.294294, 0.29434, 0.294386, 0.294432, 0.294478, 0.294524,

```

0.29457, 0.294616, 0.294662, 0.294707, 0.294753, 0.294799, 0.294845, 0.294891,
0.294937, 0.294983, 0.295028, 0.295074, 0.29512, 0.295166, 0.295212, 0.295257,
0.295303, 0.295349, 0.295395, 0.295441, 0.295486, 0.295532, 0.295578, 0.295624,
0.295669, 0.295715, 0.295761, 0.295806, 0.295852, 0.295898, 0.295944, 0.295989,
0.296035, 0.296081, 0.296126, 0.296172, 0.296217, 0.296263, 0.296309, 0.296354,
0.2964, 0.296446, 0.296491, 0.296537, 0.296582, 0.296628, 0.296674, 0.296719,
0.296765, 0.29681, 0.296856, 0.296901, 0.296947, 0.296992, 0.297038, 0.297083,
0.297129, 0.297174, 0.29722, 0.297265, 0.297311, 0.297356, 0.297402, 0.297447,
0.297493, 0.297538, 0.297584, 0.297629, 0.297674, 0.29772, 0.297765, 0.297811,
0.297856, 0.297901, 0.297947, 0.297992, 0.298038, 0.298083, 0.298128, 0.298174,
0.298219, 0.298264, 0.29831, 0.298355, 0.2984, 0.298446, 0.298491, 0.298536,
0.298581, 0.298627, 0.298672, 0.298717, 0.298763, 0.298808, 0.298853, 0.298898,
0.298943, 0.298989, 0.299034, 0.299079, 0.299124, 0.29917, 0.299215, 0.29926,
0.299305, 0.29935, 0.299395, 0.299441, 0.299486, 0.299531, 0.299576, 0.299621,
0.299666, 0.299711, 0.299756, 0.299802, 0.299847, 0.299892, 0.299937,
0.299982, 0.300027, 0.300072, 0.300117, 0.300162, 0.300207, 0.300252,
0.300297, 0.300342, 0.300387, 0.300432, 0.300477, 0.300522, 0.300567,
0.300612, 0.300657, 0.300702, 0.300747, 0.300792, 0.300837, 0.300882,
0.300927, 0.300972, 0.301017, 0.301062, 0.301106, 0.301151, 0.301196,
0.301241, 0.301286, 0.301331, 0.301376, 0.301421, 0.301465, 0.30151, 0.301555,
0.3016, 0.301645, 0.30169, 0.301734, 0.301779, 0.301824, 0.301869, 0.301914,
0.301958, 0.302003, 0.302048, 0.302093, 0.302137, 0.302182, 0.302227,
0.302272, 0.302316, 0.302361, 0.302406, 0.302451, 0.302495, 0.30254, 0.302585,
0.302629, 0.302674, 0.302719, 0.302763, 0.302808, 0.302853, 0.302897,
0.302942, 0.302986, 0.303031, 0.303076, 0.30312, 0.303165, 0.303209, 0.303254,
0.303299, 0.303343, 0.303388, 0.303432, 0.303477, 0.303521, 0.303566,
0.303611, 0.303655, 0.3037, 0.303744, 0.303789, 0.303833, 0.303878, 0.303922,
0.303967, 0.304011, 0.304056, 0.3041, 0.304144, 0.304189, 0.304233, 0.304278,
0.304322, 0.304367, 0.304411, 0.304455, 0.3045, 0.304544, 0.304589, 0.304633,
0.304677, 0.304722, 0.304766, 0.30481, 0.304855, 0.304899, 0.304944, 0.304988,
0.305032, 0.305077, 0.305121, 0.305165, 0.305209, 0.305254, 0.305298,
0.305342, 0.305387, 0.305431, 0.305475, 0.305519, 0.305564, 0.305608,
0.305652, 0.305696, 0.305741, 0.305785, 0.305829, 0.305873, 0.305917,
0.305962, 0.306006, 0.30605, 0.306094, 0.306138, 0.306182, 0.306227, 0.306271,
0.306315, 0.306359, 0.306403, 0.306447, 0.306491, 0.306535, 0.30658, 0.306624,
0.306668, 0.306712, 0.306756, 0.3068, 0.306844, 0.306888, 0.306932, 0.306976,
0.30702, 0.307064, 0.307108, 0.307152, 0.307196, 0.30724, 0.307284, 0.307328,
0.307372, 0.307416, 0.30746, 0.307504, 0.307548, 0.307592, 0.307636, 0.30768,
0.307724, 0.307768, 0.307812, 0.307856, 0.3079, 0.307944, 0.307988, 0.308031,
0.308075, 0.308119, 0.308163, 0.308207, 0.308251, 0.308295, 0.308339,
0.308382, 0.308426, 0.30847, 0.308514, 0.308558, 0.308601, 0.308645, 0.308689,
0.308733, 0.308777, 0.30882, 0.308864, 0.308908, 0.308952, 0.308996, 0.309039}

```

```
ln[ ]:= ListPlot[Pmplus]
```



(* the value is an upper bound, assuming risk neutral for high wealth.

(* step four: code for the community:

```

In[ ]:= wupper0 = Ra[what]; wupper = Ra[Ra[what]]; grid = 1/2000;
wealth = Table[w, {w, 0, wupper + grid, grid}];
stationc = Flatten[ParallelTable[
  c /. Solve[R[wealth[[i]] - c] == wealth[[i]], c], {i, 1, Length[wealth]}]];
Pmplus = Pmplus[[1 ;; Length[wealth]]];

In[ ]:= Ps0 = ParallelTable[N[Max[V[cbar], Pmplus[[i]]]], {i, 1, Length[Pmplus]}];
Ps = ParallelTable[N[Max[V[cbar], Pmplus[[i]]]], {i, 1, Length[Pmplus]}];

In[ ]:= Timing[
  Psplus = Flatten[{ParallelTable[N[Max[Table[{1 - dl, dl}.{V[wealth[[i]] + b] - b /.
    If[wealth[[i]] < cbar, b -> Min[cbar - wealth[[i]], dl / (1 - dl)
      ({qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
        grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]) /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] /
          grid] + 2]] - wealth[[IntegerPart[
            N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]]),
        (N[Ra[wealth[[j]] - wealth[[i]]] - wealth[[IntegerPart[
          N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] /
          grid] + 2]] - wealth[[IntegerPart[N[Ra[wealth[[j]] -
            wealth[[i]]] / grid] + 1]]))}.{Ps[[IntegerPart[
              N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]], Ps[[
                IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 2]]},
        {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] /
          grid] + 2]] - N[Rb[wealth[[j]] - wealth[[i]]]) /
        (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] /
          grid] + 2]] - wealth[[IntegerPart[
            N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 1]]),

```

$$\begin{aligned}
& (N[Rb[wealth[[j]]] - wealth[[i]]]) - wealth[[IntegerPart[\\
& \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 1]]) / \\
& (wealth[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[i]]]] / \\
& \quad grid] + 2]] - wealth[[IntegerPart[\\
& \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])) \cdot \\
& \{Ps[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[i]]]] / \\
& \quad grid] + 1]], Ps[[IntegerPart[\\
& \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 2]]]\} - \{qa, qb\} \cdot \\
& \{ \{ (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] / \\
& \quad grid] + 2]] - N[Ra[wealth[[j]]] - wealth[[i]]]) / \\
& \quad (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[\\
& \quad \quad i]]]] / grid] + 2]] - wealth[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])), \\
& \quad (N[Ra[wealth[[j]]] - wealth[[i]]) - wealth[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 1]]) / \\
& \quad (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] / \\
& \quad \quad grid] + 2]] - wealth[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])) \cdot \\
& \quad \{Pmplus[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] / \\
& \quad \quad grid] + 1]], Pmplus[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 2]]]\}, \\
& \{ (wealth[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[i]]]] / \\
& \quad grid] + 2]] - N[Rb[wealth[[j]]] - wealth[[i]]]) / \\
& \quad (wealth[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[\\
& \quad \quad i]]]] / grid] + 2]] - wealth[[IntegerPart[\\
& \quad \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])), \\
& \quad (N[Rb[wealth[[j]]] - wealth[[i]]) - wealth[[IntegerPart[\\
& \quad \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 1]]) / \\
& \quad (wealth[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[i]]]] / \\
& \quad \quad grid] + 2]] - wealth[[IntegerPart[\\
& \quad \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])) \cdot \\
& \quad \{Pmplus[[IntegerPart[N[Rb[wealth[[j]]] - wealth[[i]]]] / \\
& \quad \quad grid] + 1]], Pmplus[[IntegerPart[\\
& \quad \quad N[Rb[wealth[[j]]] - wealth[[i]]]] / grid] + 2]]]\} \}, b \rightarrow 0], \\
& \{qa, qb\} \cdot \{ \{ (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] / \\
& \quad grid] + 2]] - N[Ra[wealth[[j]]] - wealth[[i]]]) / \\
& \quad (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] / \\
& \quad \quad grid] + 2]] - wealth[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 1]])), \\
& \quad (N[Ra[wealth[[j]]] - wealth[[i]]) - wealth[[IntegerPart[\\
& \quad \quad N[Ra[wealth[[j]]] - wealth[[i]]]] / grid] + 1]]) / \\
& \quad (wealth[[IntegerPart[N[Ra[wealth[[j]]] - wealth[[i]]]] /
\end{aligned}$$

```

grid] + 2]] - wealth[[IntegerPart[
  N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]]}.
{Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
  Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]],
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  N[Rb[wealth[[j]] - wealth[[i]]]] /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
  1]]), (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[
  IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
  grid] + 2]] - wealth[[IntegerPart[
  N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]]}.
{Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
  Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]]}}},
{i, 1, j}]]], {j, 1, wupper0 / grid}], Pmplus[[Length[
Table[
  j,
  {j, 1,
    wupper0 / grid}]]] + 1 ;; Length[wealth]]]]];]

```

```
Out[8]= {34.4012, Null}
```

```

In[9]:= Timing[
  n = 1;
  While[n < 40,
    Ps = ParallelTable[Max[Psplus[[i]], Pmplus[[i]]], {i, 1, Length[Pmplus]};
    Psplus = Flatten[{ParallelTable[
      N[Max[Table[{1 - dl, dl}.{V[wealth[[i]] + b] - b /. If[wealth[[i]] < cbar,
        b → Min[cbar - wealth[[i]], dl / (1 - dl) ({qa, qb}.{{(wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] +
        2]] - N[Ra[wealth[[j]] - wealth[[i]]]] /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
        grid] + 2]] - wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
        (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
        grid] + 2]] - wealth[[IntegerPart[N[Ra[wealth[[j]] -
        wealth[[i]]]] / grid] + 1]]]}).{Ps[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]], Ps[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]],
        {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /

```



```

grid] + 2]] - N[Rb[wealth[[j]] - wealth[[i]]]]) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[
i]]]] / grid] + 2]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
(N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
{Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 1]], Ps[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]]} - {qa, qb}.
{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]]) /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[
i]]]] / grid] + 2]] - wealth[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
(N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - wealth[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
{Pmplus[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 1]], Pmplus[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]],
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - N[Rb[wealth[[j]] - wealth[[i]]]]) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[
i]]]] / grid] + 2]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
(N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
{Pmplus[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 1]], Pmplus[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]]}), b → 0],
{qa, qb}. {{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]]) /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - wealth[[IntegerPart[

```

```

      N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]],
    (N[Ra[wealth[[j]] - wealth[[i]]] - wealth[[IntegerPart[
      N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]]) /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] /
      grid] + 2]] - wealth[[IntegerPart[
      N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]])}).
    {Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 1]],
    Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]] / grid] + 2]]},
    {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 2]] -
      N[Rb[wealth[[j]] - wealth[[i]]]]) /
    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 2]] -
      wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] +
      1]]), (N[Rb[wealth[[j]] - wealth[[i]]] - wealth[[
      IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 1]]) /
    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] /
      grid] + 2]] - wealth[[IntegerPart[
      N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 1]])}).
    {Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 1]],
    Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]] / grid] + 2]]}},
    {i, 1, j}]]], {j, 1, wupper0 / grid}}, Pmplus[[Length[
    Table[
      j,
      {j,
        1,
        wupper0 / grid}]]] + 1 ;; Length[wealth]]]]];
  n++]

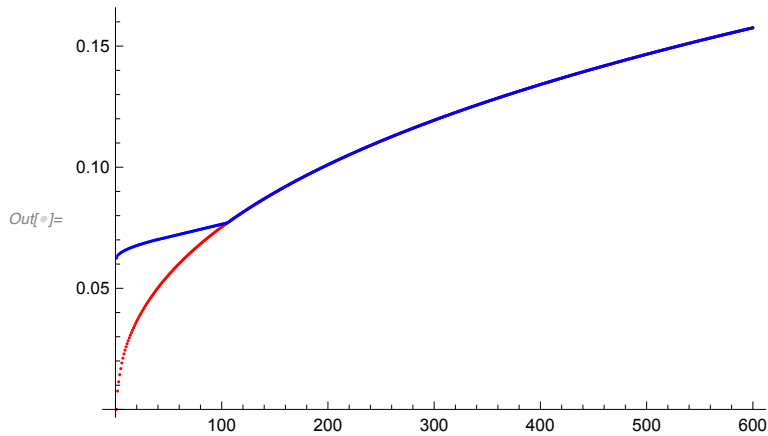
```

```
Out[8]= {2377.31, Null}
```

```
In[8]:= Psplus = Table[Max[Psplus[[i]], Pmplus[[i]]], {i, 1, Length[Pmplus]}];
```

```
(* we want to define a point call selection: this is our wstar
```

```
In[ ]:= ListPlot[{Pmplus[[1 ;; 600]], Psplus[[1 ;; 600]]}, PlotStyle -> {Red, Blue}]
```



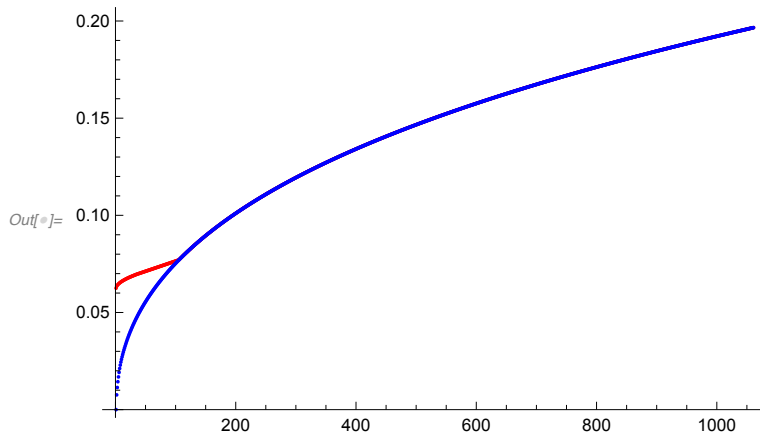
```
In[ ]:= {Max[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]],
  Length[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]]}
wsel = Max[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]]
{Max[Ps[[1 ;; wsel]] - Psplus[[1 ;; wsel]]], Min[Ps[[1 ;; wsel]] - Psplus[[1 ;; wsel]]]}
```

```
Out[ ]:= {105, 105}
```

```
Out[ ]:= 105
```

```
Out[ ]:= {0.0000140519, 2.07692 × 10-6}
```

```
In[ ]:= ListPlot[{Psplus, Pmplus}, PlotStyle -> {Red, Blue}]
```



```
In[ ]:= Pmplus
```

```
Out[ ]:= {0., 0.00759436, 0.0114016, 0.0143671, 0.0168412, 0.0191667, 0.0211884, 0.0229208,
  0.0244641, 0.0258566, 0.0271538, 0.0283796, 0.0295349, 0.0306223, 0.0316635,
  0.0326676, 0.0336309, 0.0345906, 0.0355125, 0.0363984, 0.0372549, 0.0380789,
  0.0388817, 0.0396668, 0.0404288, 0.0411679, 0.0419064, 0.042624, 0.0433264,
  0.0440121, 0.0446833, 0.0453394, 0.0459807, 0.0466119, 0.047235, 0.0478519,
  0.0484539, 0.0490456, 0.0496307, 0.0502046, 0.0507672, 0.0513196, 0.0518686,
  0.0524124, 0.0529479, 0.0534755, 0.053996, 0.0545087, 0.0550128, 0.0555091,
  0.056005, 0.0564949, 0.0569806, 0.0574588, 0.0579301, 0.0583944, 0.0588535,
```

0.0593099, 0.0597645, 0.0602138, 0.060657, 0.0610951, 0.0615278, 0.0619557,
 0.0623806, 0.0628046, 0.0632243, 0.0636389, 0.0640486, 0.0644542, 0.0648566,
 0.0652556, 0.065654, 0.0660476, 0.0664379, 0.0668241, 0.0672067, 0.0675863,
 0.0679637, 0.06834, 0.0687121, 0.0690806, 0.0694465, 0.0698098, 0.0701691,
 0.070528, 0.0708845, 0.0712383, 0.0715883, 0.0719361, 0.0722816, 0.0726245,
 0.0729669, 0.0733059, 0.0736426, 0.0739774, 0.0743092, 0.0746382, 0.0749672,
 0.075294, 0.0756183, 0.0759404, 0.0762604, 0.0765779, 0.0768944, 0.0772093,
 0.0775223, 0.0778333, 0.0781421, 0.0784487, 0.0787541, 0.0790586, 0.079361,
 0.0796616, 0.0799606, 0.0802573, 0.0805527, 0.080847, 0.08114, 0.0814314,
 0.0817208, 0.0820081, 0.0822943, 0.08258, 0.082864, 0.0831466, 0.0834273,
 0.0837059, 0.0839839, 0.0842611, 0.0845373, 0.0848115, 0.0850839, 0.0853548,
 0.0856252, 0.0858948, 0.086163, 0.0864296, 0.0866945, 0.0869579, 0.0872213,
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 0.188999, 0.189075, 0.189151, 0.189227, 0.189303, 0.189379, 0.189455, 0.18953,
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 0.194927, 0.194999, 0.195071, 0.195143, 0.195216, 0.195288, 0.19536, 0.195433,

```
0.195505, 0.195577, 0.19565, 0.195722, 0.195795, 0.195867, 0.195939, 0.196011,
0.196083, 0.196155, 0.196227, 0.196299, 0.196371, 0.196443, 0.196515, 0.196587}
```

```
ln[ ]:= Ps = Psplus;
```

```
(* step five: wealth dynamics:
   find {c,b,p,w} for each point below wsel;
   (***** important, i actually need
   this for wealth above wsel as well!
```

```
ln[ ]:= priceupdate = Flatten[
  Table[Position[Table[{1 - dl, dl}.{V[wealth[[i]] + b] - b /. If[wealth[[i]] < cbar,
    b → Min[cbar - wealth[[i]], dl / (1 - dl)
    ({qa, qb}.{ (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
      grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]] / (wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
        wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] +
          1]]), (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[
            IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
          grid] + 2]] - wealth[[IntegerPart[
            N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
        {Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
          Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
        { (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
          2]] - N[Rb[wealth[[j]] - wealth[[i]]]] / (wealth[[
            IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
              1]]), (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[
                IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
                (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
                  grid] + 2]] - wealth[[IntegerPart[
                    N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
                {Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
                  Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]} } -
        {qa, qb}.{ (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
          grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]] / (wealth[[
            IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] +
              1]]), (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[
```

```

IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]] /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] +
2]] - wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 1]]).{Pmplus[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]], Pmplus[[
IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
2]] - N[Rb[wealth[[j]] - wealth[[i]]]] / (wealth[[
IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
1]]), (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[
IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]).
{Pmplus[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
grid] + 1]], Pmplus[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]}}], b → 0],
{qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]] /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
(N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]).
{Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
N[Rb[wealth[[j]] - wealth[[i]]]] /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
(N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]).
{Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]}}},
{i, 1, j}], Max[Table[{1 - dl, dl}.{V[wealth[[i]] + b] - b /
If[wealth[[i]] < cbar,
b → Min[cbar - wealth[[i]], dl / (1 - dl)
({qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /

```

```

        grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]) / (wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
        wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
        grid] + 1]]), (N[Ra[wealth[[j]] - wealth[[i]]] - wealth[[
        IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
        grid] + 2]] - wealth[[IntegerPart[
        N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
    {Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
    Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
    {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
    2]] - N[Rb[wealth[[j]] - wealth[[i]]]) / (wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
    grid] + 1]]), (N[Rb[wealth[[j]] - wealth[[i]]] - wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
    grid] + 2]] - wealth[[IntegerPart[
    N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
    {Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
    Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]} -
    {qa, qb}. {(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
    grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]) / (wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
    grid] + 1]]), (N[Ra[wealth[[j]] - wealth[[i]]] - wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
    (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
    grid] + 2]] - wealth[[IntegerPart[N[Ra[wealth[[j]] -
    wealth[[i]]]] / grid] + 1]]))}. {Pmplus[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]], Pmplus[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
    {(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
    2]] - N[Rb[wealth[[j]] - wealth[[i]]]) / (wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
    wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
    grid] + 1]]), (N[Rb[wealth[[j]] - wealth[[i]]] - wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
    (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /
    grid] + 2]] - wealth[[IntegerPart[
    N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
    {Pmplus[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] /

```

```

grid] + 1]], Pmplus[[IntegerPart[
  N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]]]], b → 0 ],
{qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] /
  grid] + 2]] - N[Ra[wealth[[j]] - wealth[[i]]]] /
  (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])),
  (N[Ra[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
  (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
{Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
  Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[i]]]] / grid] + 2]]},
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
  2]] - N[Rb[wealth[[j]] - wealth[[i]]]] /
  (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])),
  (N[Rb[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
    N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
  (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
  wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
{Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
  Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[i]]]] / grid] +
    2]]]]], {i, 1, j}]]], {j, 1, wsel}]]]

```

```

Out[8]= {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
  1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 3, 4, 5, 5, 6, 7, 8, 9, 9, 10, 11,
  12, 13, 13, 14, 15, 16, 17, 17, 18, 19, 20, 20, 21, 22, 23, 24, 24, 25,
  26, 27, 28, 28, 29, 30, 31, 31, 32, 33, 34, 35, 35, 36, 37, 38, 39, 39, 40,
  41, 42, 42, 43, 44, 45, 45, 46, 47, 48, 48, 49, 50, 51, 52, 52, 53, 54, 55}

```

```

In[9]:= wealthupdate = Table[N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]], {j, 1, wsel}]

```

```
ln[ ]:= wealthupdate = {0.` , 0.0007499062734299677` , 0.0014996251873831135` ,
  0.002249156882219605` , 0.002998501498127304` , 0.003747659175118212` ,
  0.004496630053027584` , 0.0052454142715201435` , 0.005994011970083424` ,
  0.006742423288033983` , 0.007490648364513408` , 0.008238687338489203` ,
  0.008986540348759675` , 0.009734207533947714` , 0.010481689032503905` ,
  0.011228984982709633` , 0.011976095522672203` , 0.012723020790327944` ,
  0.013469760923443985` , 0.014216316059615597` , 0.014962686336267073` ,
  0.01570887189065351` , 0.016454872859860803` , 0.01720068938080388` ,
  0.01794632159023024` , 0.01869176962471597` , 0.019437033620671507` ,
  0.020182113714336758` , 0.0209270100417851` , 0.02167172273892115` ,
  0.022416251941483` , 0.023160597785039982` , 0.023904760404996228` ,
  0.02464873993658978` , 0.02539253651488993` , 0.026136150274802095` ,
  0.02687958135106472` , 0.02687958135106472` , 0.02687958135106472` ,
  0.02687958135106472` , 0.02687958135106472` , 0.027622829878252375` ,
  0.027622829878252375` , 0.027622829878252375` , 0.027622829878252375` ,
  0.027622829878252375` , 0.028365895990773105` , 0.028365895990773105` ,
  0.028365895990773105` , 0.028365895990773105` , 0.028365895990773105` ,
  0.029108779822870634` , 0.029108779822870634` , 0.029108779822870634` ,
  0.029108779822870634` , 0.029108779822870634` , 0.029851481508623046` ,
  0.029851481508623046` , 0.029851481508623046` , 0.029851481508623046` ,
  0.03059400118194633` , 0.03059400118194633` , 0.03059400118194633` ,
  0.03059400118194633` , 0.03059400118194633` , 0.03133633897659038` ,
  0.03133633897659038` , 0.03133633897659038` , 0.03133633897659038` ,
  0.03133633897659038` , 0.03207849502614302` , 0.03207849502614302` ,
  0.03207849502614302` , 0.03207849502614302` , 0.03207849502614302` ,
  0.032820469464026836` , 0.032820469464026836` , 0.032820469464026836` ,
  0.032820469464026836` , 0.032820469464026836` , 0.0335622624235028` ,
  0.0335622624235028` , 0.0335622624235028` , 0.0335622624235028` ,
  0.0335622624235028` , 0.03430387403766799` , 0.03430387403766799` ,
  0.03430387403766799` , 0.03430387403766799` , 0.03430387403766799` ,
  0.035045304439457414` , 0.035045304439457414` , 0.035045304439457414` ,
  0.035045304439457414` , 0.035045304439457414` , 0.03578655376164397` ,
  0.03578655376164397` , 0.03578655376164397` , 0.03578655376164397` ,
  0.03578655376164397` , 0.03652762213683802` , 0.03652762213683802` ,
  0.03652762213683802` , 0.03652762213683802` , 0.03652762213683802` ,
  0.03726850969748785` , 0.03726850969748785` , 0.03726850969748785` ,
  0.03726850969748785` , 0.03726850969748785` };
```

```
ln[ ]:= wsel = Length[wealthupdate]
```

```
Out[ ]:= 105
```

```
In[ ]:= N[Transpose[{wealth[[1 ;; wsel]], wealth[[1 ;; wsel]]}/0.052`]]
```

```
Out[ ]:= {{0., 0.}, {0.00961538, 0.00961538}, {0.0192308, 0.0192308}, {0.0288462, 0.0288462},
{0.0384615, 0.0384615}, {0.0480769, 0.0480769}, {0.0576923, 0.0576923},
{0.0673077, 0.0673077}, {0.0769231, 0.0769231}, {0.0865385, 0.0865385},
{0.0961538, 0.0961538}, {0.105769, 0.105769}, {0.115385, 0.115385},
{0.125, 0.125}, {0.134615, 0.134615}, {0.144231, 0.144231}, {0.153846, 0.153846},
{0.163462, 0.163462}, {0.173077, 0.173077}, {0.182692, 0.182692},
{0.192308, 0.192308}, {0.201923, 0.201923}, {0.211538, 0.211538},
{0.221154, 0.221154}, {0.230769, 0.230769}, {0.240385, 0.240385}, {0.25, 0.25},
{0.259615, 0.259615}, {0.269231, 0.269231}, {0.278846, 0.278846},
{0.288462, 0.288462}, {0.298077, 0.298077}, {0.307692, 0.307692},
{0.317308, 0.317308}, {0.326923, 0.326923}, {0.336538, 0.336538},
{0.346154, 0.346154}, {0.355769, 0.355769}, {0.365385, 0.365385}, {0.375, 0.375},
{0.384615, 0.384615}, {0.394231, 0.394231}, {0.403846, 0.403846},
{0.413462, 0.413462}, {0.423077, 0.423077}, {0.432692, 0.432692},
{0.442308, 0.442308}, {0.451923, 0.451923}, {0.461538, 0.461538},
{0.471154, 0.471154}, {0.480769, 0.480769}, {0.490385, 0.490385},
{0.5, 0.5}, {0.509615, 0.509615}, {0.519231, 0.519231}, {0.528846, 0.528846},
{0.538462, 0.538462}, {0.548077, 0.548077}, {0.557692, 0.557692},
{0.567308, 0.567308}, {0.576923, 0.576923}, {0.586538, 0.586538},
{0.596154, 0.596154}, {0.605769, 0.605769}, {0.615385, 0.615385}, {0.625, 0.625},
{0.634615, 0.634615}, {0.644231, 0.644231}, {0.653846, 0.653846},
{0.663462, 0.663462}, {0.673077, 0.673077}, {0.682692, 0.682692},
{0.692308, 0.692308}, {0.701923, 0.701923}, {0.711538, 0.711538},
{0.721154, 0.721154}, {0.730769, 0.730769}, {0.740385, 0.740385}, {0.75, 0.75},
{0.759615, 0.759615}, {0.769231, 0.769231}, {0.778846, 0.778846},
{0.788462, 0.788462}, {0.798077, 0.798077}, {0.807692, 0.807692},
{0.817308, 0.817308}, {0.826923, 0.826923}, {0.836538, 0.836538},
{0.846154, 0.846154}, {0.855769, 0.855769}, {0.865385, 0.865385}, {0.875, 0.875},
{0.884615, 0.884615}, {0.894231, 0.894231}, {0.903846, 0.903846},
{0.913462, 0.913462}, {0.923077, 0.923077}, {0.932692, 0.932692},
{0.942308, 0.942308}, {0.951923, 0.951923}, {0.961538, 0.961538},
{0.971154, 0.971154}, {0.980769, 0.980769}, {0.990385, 0.990385}, {1., 1.}}
```

```
In[ ]:= N[Transpose[{wealth[[1 ;; wsel]], shockb wealthupdate}/0.052`]]
```

```
Out[ ]:= {{0., 0.}, {0.00961538, 0.0122581}, {0.0192308, 0.0245131}, {0.0288462, 0.0367651},
{0.0384615, 0.049014}, {0.0480769, 0.0612598}, {0.0576923, 0.0735026},
{0.0673077, 0.0857423}, {0.0769231, 0.097979}, {0.0865385, 0.110213},
{0.0961538, 0.122443}, {0.105769, 0.134671}, {0.115385, 0.146895},
{0.125, 0.159117}, {0.134615, 0.171335}, {0.144231, 0.183551}, {0.153846, 0.195763},
{0.163462, 0.207972}, {0.173077, 0.220179}, {0.182692, 0.232382},
{0.192308, 0.244582}, {0.201923, 0.25678}, {0.211538, 0.268974},
{0.221154, 0.281165}, {0.230769, 0.293353}, {0.240385, 0.305539},
{0.25, 0.317721}, {0.259615, 0.3299}, {0.269231, 0.342076}, {0.278846, 0.354249},
{0.288462, 0.36642}, {0.298077, 0.378587}, {0.307692, 0.390751},
{0.317308, 0.402912}, {0.326923, 0.41507}, {0.336538, 0.427226},
{0.346154, 0.439378}, {0.355769, 0.439378}, {0.365385, 0.439378}, {0.375, 0.439378},
{0.384615, 0.439378}, {0.394231, 0.451527}, {0.403846, 0.451527},
{0.413462, 0.451527}, {0.423077, 0.451527}, {0.432692, 0.451527},
{0.442308, 0.463673}, {0.451923, 0.463673}, {0.461538, 0.463673},
{0.471154, 0.463673}, {0.480769, 0.463673}, {0.490385, 0.475817}, {0.5, 0.475817},
{0.509615, 0.475817}, {0.519231, 0.475817}, {0.528846, 0.475817},
{0.538462, 0.487957}, {0.548077, 0.487957}, {0.557692, 0.487957},
{0.567308, 0.487957}, {0.576923, 0.500094}, {0.586538, 0.500094},
{0.596154, 0.500094}, {0.605769, 0.500094}, {0.615385, 0.500094}, {0.625, 0.512229},
{0.634615, 0.512229}, {0.644231, 0.512229}, {0.653846, 0.512229},
{0.663462, 0.512229}, {0.673077, 0.52436}, {0.682692, 0.52436},
{0.692308, 0.52436}, {0.701923, 0.52436}, {0.711538, 0.536488},
{0.721154, 0.536488}, {0.730769, 0.536488}, {0.740385, 0.536488}, {0.75, 0.536488},
{0.759615, 0.548614}, {0.769231, 0.548614}, {0.778846, 0.548614},
{0.788462, 0.548614}, {0.798077, 0.548614}, {0.807692, 0.560736},
{0.817308, 0.560736}, {0.826923, 0.560736}, {0.836538, 0.560736},
{0.846154, 0.572856}, {0.855769, 0.572856}, {0.865385, 0.572856}, {0.875, 0.572856},
{0.884615, 0.584973}, {0.894231, 0.584973}, {0.903846, 0.584973},
{0.913462, 0.584973}, {0.923077, 0.597086}, {0.932692, 0.597086},
{0.942308, 0.597086}, {0.951923, 0.597086}, {0.961538, 0.597086},
{0.971154, 0.609197}, {0.980769, 0.609197}, {0.990385, 0.609197}, {1., 0.609197}}
```

```
In[ ]:= Length[{{0., 0.}, {0.009615384615384616, 0.012258083315682164},
{0.019230769230769232, 0.02451310402453166},
{0.028846153846153844, 0.03676506442089739},
{0.038461538461538464, 0.049013966796311696},
{0.04807692307692307, 0.06125981343943231},
{0.05769230769230769, 0.0735026066360278},
{0.0673076923076923, 0.08574234866907926},
{0.07692307692307693, 0.09797904181867134},
{0.08653846153846152, 0.11021268836209394},
```



```

{0.09615384615384615`, 0.12244329057377684`},
{0.10576923076923075`, 0.13467085072530427`},
{0.11538461538461538`, 0.14689537108549466`},
{0.12499999999999999`, 0.15911685392029917`},
{0.1346153846153846`, 0.17133530149285225`},
{0.14423076923076922`, 0.18355071606352286`},
{0.15384615384615385`, 0.1957630998898341`},
{0.16346153846153846`, 0.20797245522651445`},
{0.17307692307692304`, 0.22017878432552665`},
{0.18269230769230768`, 0.23238208943602418`},
{0.1923076923076923`, 0.2445823728043656`},
{0.20192307692307693`, 0.2567796366741439`},
{0.2115384615384615`, 0.26897388328618616`},
{0.22115384615384615`, 0.2811651148785249`},
{0.23076923076923075`, 0.29335333368645583`},
{0.2403846153846154`, 0.30553854194247254`},
{0.24999999999999997`, 0.3177207418763611`},
{0.2596153846153846`, 0.32989993571512005`},
{0.2692307692307692`, 0.34207612568302564`},
{0.27884615384615385`, 0.35424931400159576`},
{0.28846153846153844`, 0.36641950288962594`},
{0.2980769230769231`, 0.3785866945631535`},
{0.3076923076923077`, 0.39075089123551526`},
{0.3173076923076923`, 0.40291209511733295`},
{0.3269230769230769`, 0.41507030841646997`},
{0.33653846153846156`, 0.42722553333811114`},
{0.3461538461538461`, 0.43937777208471174`},
{0.3557692307692307`, 0.43937777208471174`},
{0.36538461538461536`, 0.43937777208471174`},
{0.375`, 0.43937777208471174`}, {0.3846153846153846`, 0.43937777208471174`},
{0.3942307692307692`, 0.4515270268560484`},
{0.40384615384615385`, 0.4515270268560484`},
{0.41346153846153844`, 0.4515270268560484`},
{0.423076923076923`, 0.4515270268560484`}, {0.43269230769230765`,
  0.4515270268560484`}, {0.4423076923076923`, 0.4636732998491757`},
{0.4519230769230769`, 0.4636732998491757`}, {0.4615384615384615`,
  0.4636732998491757`}, {0.47115384615384615`, 0.4636732998491757`},
{0.4807692307692308`, 0.4636732998491757`}, {0.4903846153846153`,
  0.47581659325846226`}, {0.49999999999999994`, 0.47581659325846226`},
{0.5096153846153846`, 0.47581659325846226`}, {0.5192307692307692`,
  0.47581659325846226`}, {0.5288461538461539`, 0.47581659325846226`},
{0.5384615384615384`, 0.487956909275569`}, {0.5480769230769231`,
  0.487956909275569`}, {0.5576923076923077`, 0.487956909275569`},
{0.5673076923076923`, 0.487956909275569`}, {0.5769230769230769`,

```

```

0.5000942500895073`}, {0.5865384615384615`, 0.5000942500895073`},
{0.5961538461538461`, 0.5000942500895073`}, {0.6057692307692307`,
0.5000942500895073`}, {0.6153846153846154`, 0.5000942500895073`},
{0.625`, 0.5122286178865736`}, {0.6346153846153846`, 0.5122286178865736`},
{0.6442307692307693`, 0.5122286178865736`},
{0.6538461538461539`, 0.5122286178865736`},
{0.6634615384615384`, 0.5122286178865736`},
{0.6730769230769231`, 0.5243600148504146`},
{0.6826923076923076`, 0.5243600148504146`},
{0.6923076923076922`, 0.5243600148504146`},
{0.7019230769230769`, 0.5243600148504146`},
{0.7115384615384615`, 0.5364884431619771`},
{0.7211538461538461`, 0.5364884431619771`},
{0.7307692307692307`, 0.5364884431619771`},
{0.7403846153846153`, 0.5364884431619771`},
{0.75`, 0.5364884431619771`}, {0.7596153846153846`, 0.548613904999565`},
{0.7692307692307692`, 0.548613904999565`},
{0.7788461538461539`, 0.548613904999565`}, {0.7884615384615384`,
0.548613904999565`}, {0.7980769230769231`, 0.548613904999565`},
{0.8076923076923077`, 0.5607364025388036`}, {0.8173076923076923`,
0.5607364025388036`}, {0.8269230769230769`, 0.5607364025388036`},
{0.8365384615384615`, 0.5607364025388036`}, {0.846153846153846`,
0.5728559379526692`}, {0.8557692307692307`, 0.5728559379526692`},
{0.8653846153846153`, 0.5728559379526692`}, {0.8749999999999999`,
0.5728559379526692`}, {0.8846153846153846`, 0.5849725134114879`},
{0.8942307692307692`, 0.5849725134114879`}, {0.9038461538461539`,
0.5849725134114879`}, {0.9134615384615384`, 0.5849725134114879`},
{0.923076923076923`, 0.5970861310829292`}, {0.9326923076923077`,
0.5970861310829292`}, {0.9423076923076923`, 0.5970861310829292`},
{0.9519230769230769`, 0.5970861310829292`}, {0.9615384615384616`,
0.5970861310829292`}, {0.9711538461538461`, 0.6091967931320129`},
{0.9807692307692306`, 0.6091967931320129`}, {0.9903846153846153`,
0.6091967931320129`}, {0.9999999999999999`, 0.6091967931320129`}}]

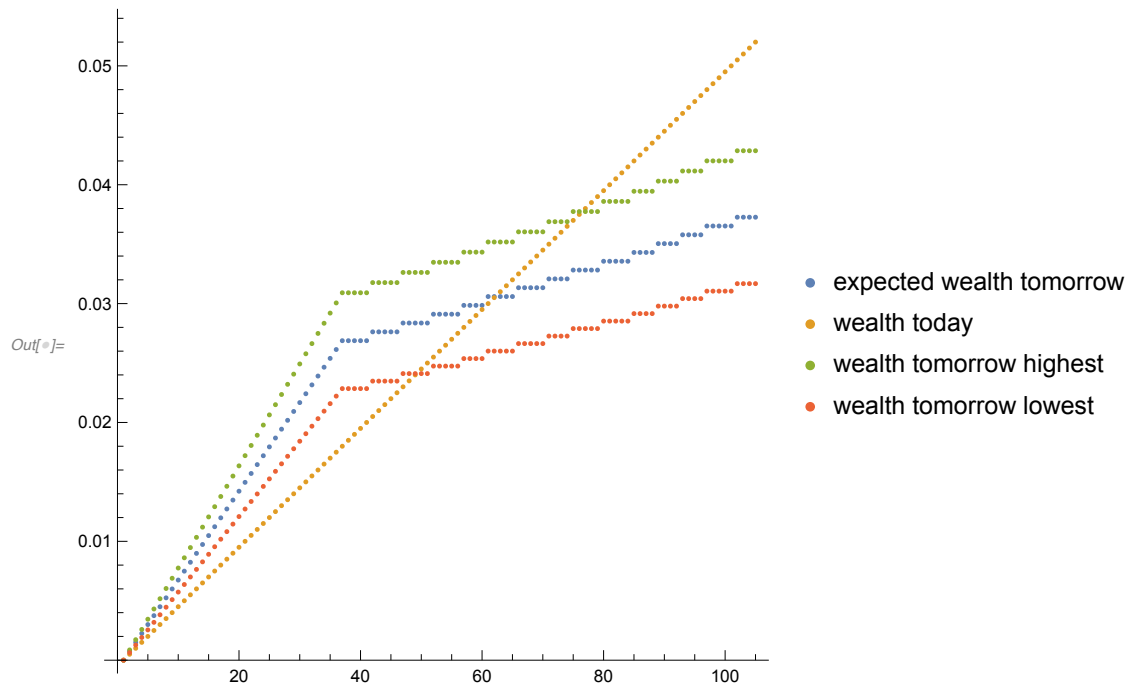
```

Out[]= 105

```

In[ ]:= ListPlot[{wealthupdate, wealth[[1 ;; wsel]], shocka wealthupdate,
    shockb wealthupdate}, PlotLegends → {"expected wealth tomorrow", "wealth today",
    "wealth tomorrow highest", "wealth tomorrow lowest"}, AspectRatio → 1]

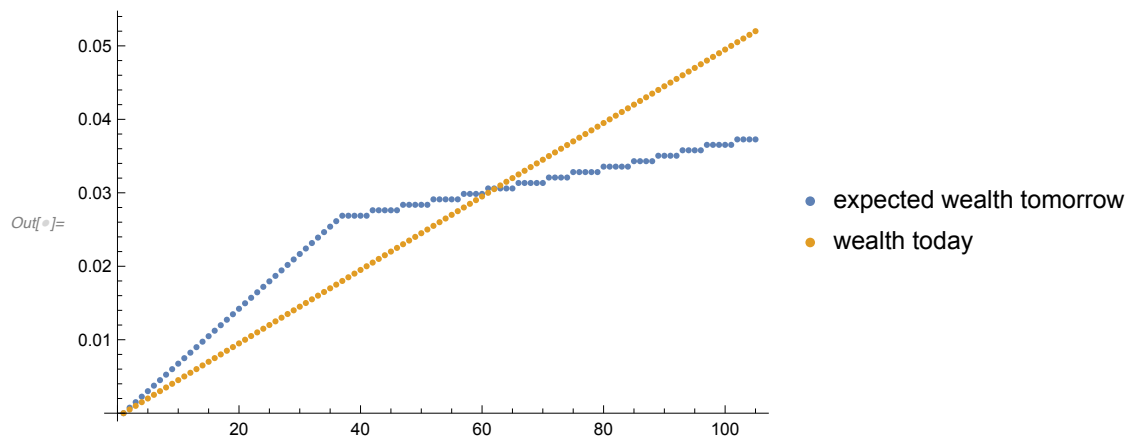
```



```

In[ ]:= ListPlot[{wealthupdate, wealth[[1 ;; wsel]]},
    PlotLegends → {"expected wealth tomorrow", "wealth today"}]

```



```

In[ ]:= N[115 / 85]

```

```

Out[ ]:= 1.35294

```

```

In[ ]:= FullSimplify[Solve[(1 + x) / (1 - x) == 14 / 10, x]]

```

```

Out[ ]:= {{x -> 1/6}}

```

In[*]:= $N\left[\frac{1}{6}\right]$

Out[*]= 0.166667

(* this shows that the proposition doesn't work.)

In[*]:= bupdate = Table[b /.

```

If[wealth[[priceupdate[[j]]]] < cbar, b → Min[cbar - wealth[[priceupdate[[j]]]],
  dl / (1 - dl) ({qa, qb}.{{(wealth[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2)] -
    N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / (wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
    grid] + 2)] - wealth[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]),
  (N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
    grid] + 1]])) / (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[
    priceupdate[[j]]]]]] / grid] + 2)] - wealth[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])}},
{Ps[[IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
  grid] + 1]], Ps[[IntegerPart[
  N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2]]}],
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
  grid] + 2)] - N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
  (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[
    j]]]]]] / grid] + 2)] - wealth[[IntegerPart[
    N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]),
  (N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[
    IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
    grid] + 1]])) / (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[
    priceupdate[[j]]]]]] / grid] + 2)] - wealth[[IntegerPart[
    N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])}},
{Ps[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
  grid] + 1]], Ps[[IntegerPart[
  N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2]]]}} -
{qa, qb}.{{(wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[
  priceupdate[[j]]]]]] / grid] + 2)] -
  N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
  (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[
    j]]]]]] / grid] + 2)] - wealth[[IntegerPart[
    N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]),
  (N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[
    IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /

```

```

      grid] + 1])) / (wealth[[IntegerPart[N[Ra[wealth[[j]] - wealth[[
      priceupdate[[j]]]]]] / grid] + 2]] - wealth[[IntegerPart[
      N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]).
{Pmplus[[IntegerPart[N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      grid] + 1]], Pmplus[[IntegerPart[
      N[Ra[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2]]},
{(wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      grid] + 2]] - N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      (wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[
      j]]]]]] / grid] + 2]] - wealth[[IntegerPart[
      N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]),
(N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[
      IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      grid] + 1]])) / (wealth[[IntegerPart[
      N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2]] -
      wealth[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[
      j]]]]]] / grid] + 1]])).{Pmplus[[IntegerPart[
      N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]],
      Pmplus[[IntegerPart[N[Rb[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      grid] + 2]]]}}], b → 0], {j, 1, wsel}]
pupdate = Table[wealth[[priceupdate[[j]]]], {j, 1, wsel}]
cupdate = pupdate + bupdate
Out[8]= {
 $\frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16},$ 
 $\frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16},$ 
0.0606503,
0.0584022, 0.0562152, 0.0562152, 0.0562152, 0.0562152, 0.0562152, 0.0540779,
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0.0314187, 0.0314187, 0.0297469, 0.0297469, 0.0297469, 0.0297469}

```



```
ln[*]:= citypayment = Table[wealth[[consumeCity[[j]]]], {j, 1, wsel}]
```

[illegible]

```
In[ ]:= N[Transpose[{wealth[[1 ;; wsel]] /.052 + 1.5, (wealth[[1 ;; wsel]] - pupdate) /.052}]]
```

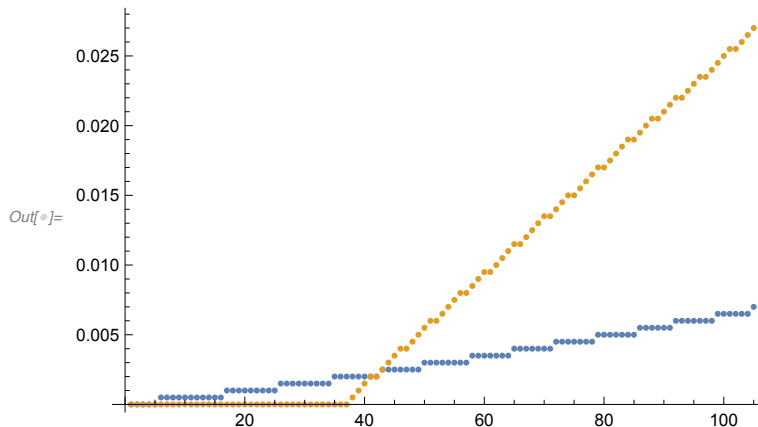
```
Out[ ]:= {{1.5, 0.}, {1.50962, 0.00961538}, {1.51923, 0.0192308}, {1.52885, 0.0288462},
{1.53846, 0.0384615}, {1.54808, 0.0480769}, {1.55769, 0.0576923},
{1.56731, 0.0673077}, {1.57692, 0.0769231}, {1.58654, 0.0865385},
{1.59615, 0.0961538}, {1.60577, 0.105769}, {1.61538, 0.115385},
{1.625, 0.125}, {1.63462, 0.134615}, {1.64423, 0.144231}, {1.65385, 0.153846},
{1.66346, 0.163462}, {1.67308, 0.173077}, {1.68269, 0.182692}, {1.69231, 0.192308},
{1.70192, 0.201923}, {1.71154, 0.211538}, {1.72115, 0.221154}, {1.73077, 0.230769},
{1.74038, 0.240385}, {1.75, 0.25}, {1.75962, 0.259615}, {1.76923, 0.269231},
{1.77885, 0.278846}, {1.78846, 0.288462}, {1.79808, 0.298077}, {1.80769, 0.307692},
{1.81731, 0.317308}, {1.82692, 0.326923}, {1.83654, 0.336538}, {1.84615, 0.346154},
{1.85577, 0.346154}, {1.86538, 0.346154}, {1.875, 0.346154}, {1.88462, 0.346154},
{1.89423, 0.355769}, {1.90385, 0.355769}, {1.91346, 0.355769}, {1.92308, 0.355769},
{1.93269, 0.355769}, {1.94231, 0.365385}, {1.95192, 0.365385}, {1.96154, 0.365385},
{1.97115, 0.365385}, {1.98077, 0.365385}, {1.99038, 0.375}, {2., 0.375},
{2.00962, 0.375}, {2.01923, 0.375}, {2.02885, 0.375}, {2.03846, 0.384615},
{2.04808, 0.384615}, {2.05769, 0.384615}, {2.06731, 0.384615}, {2.07692, 0.394231},
{2.08654, 0.394231}, {2.09615, 0.394231}, {2.10577, 0.394231}, {2.11538, 0.394231},
{2.125, 0.403846}, {2.13462, 0.403846}, {2.14423, 0.403846}, {2.15385, 0.403846},
{2.16346, 0.403846}, {2.17308, 0.413462}, {2.18269, 0.413462}, {2.19231, 0.413462},
{2.20192, 0.413462}, {2.21154, 0.423077}, {2.22115, 0.423077}, {2.23077, 0.423077},
{2.24038, 0.423077}, {2.25, 0.423077}, {2.25962, 0.432692}, {2.26923, 0.432692},
{2.27885, 0.432692}, {2.28846, 0.432692}, {2.29808, 0.432692}, {2.30769, 0.442308},
{2.31731, 0.442308}, {2.32692, 0.442308}, {2.33654, 0.442308}, {2.34615, 0.451923},
{2.35577, 0.451923}, {2.36538, 0.451923}, {2.375, 0.451923}, {2.38462, 0.461538},
{2.39423, 0.461538}, {2.40385, 0.461538}, {2.41346, 0.461538}, {2.42308, 0.471154},
{2.43269, 0.471154}, {2.44231, 0.471154}, {2.45192, 0.471154}, {2.46154, 0.471154},
{2.47115, 0.480769}, {2.48077, 0.480769}, {2.49038, 0.480769}, {2.5, 0.480769}}
```



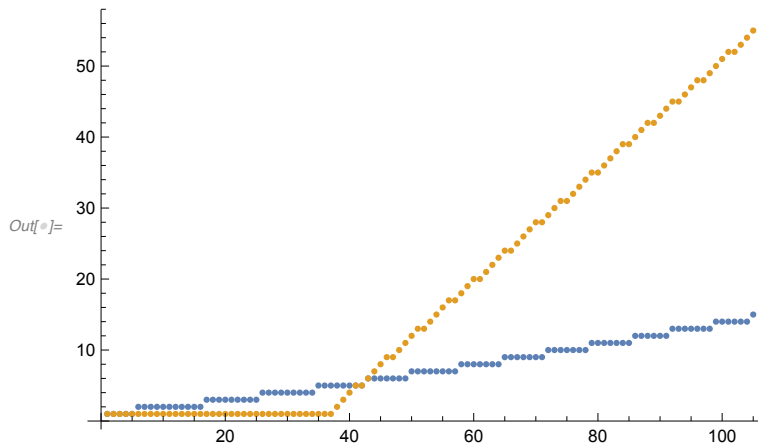
```
In[ ]:= N[Transpose[
  {wealth[[1 ;; wsel]] /.052 + 1.5, (wealth[[1 ;; wsel]] - citypayment) /.052}]]
```

```
Out[ ]:= {{1.5, 0.}, {1.50962, 0.00961538}, {1.51923, 0.0192308}, {1.52885, 0.0288462},
  {1.53846, 0.0384615}, {1.54808, 0.0384615}, {1.55769, 0.0480769},
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  {1.59615, 0.0865385}, {1.60577, 0.0961538}, {1.61538, 0.105769},
  {1.625, 0.115385}, {1.63462, 0.125}, {1.64423, 0.134615}, {1.65385, 0.134615},
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  {1.70192, 0.182692}, {1.71154, 0.192308}, {1.72115, 0.201923}, {1.73077, 0.211538},
  {1.74038, 0.211538}, {1.75, 0.221154}, {1.75962, 0.230769}, {1.76923, 0.240385},
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  {1.81731, 0.288462}, {1.82692, 0.288462}, {1.83654, 0.298077}, {1.84615, 0.307692},
  {1.85577, 0.317308}, {1.86538, 0.326923}, {1.875, 0.336538}, {1.88462, 0.346154},
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  {2.24038, 0.653846}, {2.25, 0.653846}, {2.25962, 0.663462}, {2.26923, 0.673077},
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  {2.31731, 0.711538}, {2.32692, 0.721154}, {2.33654, 0.730769}, {2.34615, 0.740385},
  {2.35577, 0.75}, {2.36538, 0.759615}, {2.375, 0.759615}, {2.38462, 0.769231},
  {2.39423, 0.778846}, {2.40385, 0.788462}, {2.41346, 0.798077}, {2.42308, 0.807692},
  {2.43269, 0.817308}, {2.44231, 0.817308}, {2.45192, 0.826923}, {2.46154, 0.836538},
  {2.47115, 0.846154}, {2.48077, 0.855769}, {2.49038, 0.865385}, {2.5, 0.865385}}
```

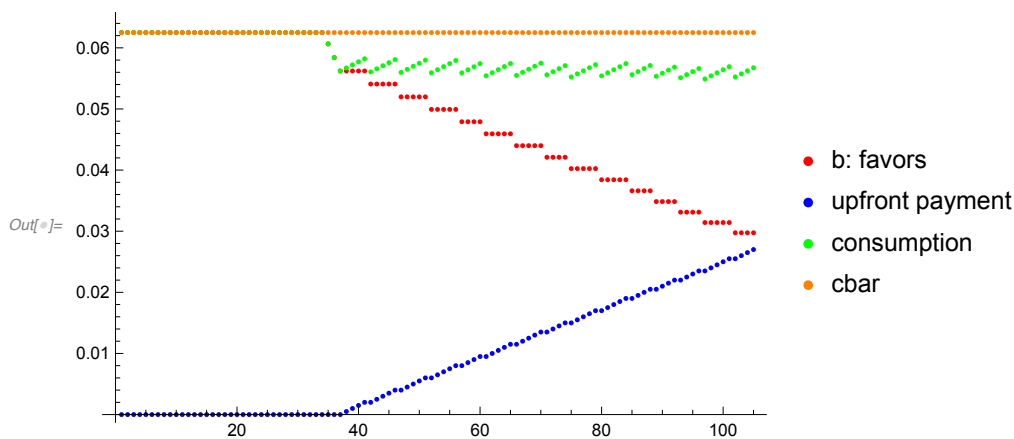
```
In[ ]:= ListPlot[{citypayment, pupdate}]
```



```
In[ ]:= ListPlot[{consumecity[[1 ;; Length[priceupdate]]], priceupdate}]
```



```
In[ ]:= ListPlot[{bupdate, pupdate, cupdate, Table[cbar, {j, 1, wsel}]],
  PlotStyle -> {Red, Blue, Green, Orange},
  PlotLegends -> {"b: favors", "upfront payment", "consumption", "cbar"}]
```



```
In[ ]:= wtre = Max[Position[Table[wealthupdate[[j]] > wealth[[j]], {j, 1, wsel}], True]]
```

Out[]:= 62

```
In[ ]:= Length[wealthupdate]
```

Out[]:= 105

```
In[ ]:= {N[{wealth[[wtre]], wealthupdate[[wtre]]}]}
```

Out[]:= {{0.0305, 0.030594}}

(* the following is the wealth dynamics
in the long run which was not used in the paper.)

```
wupper0 = Ra[Ra[wbar]]; wupper = Ra[Ra[Ra[wbar]]]; grid = 1/2000;
```

```
wealth = Table[w, {w, 0, wupper + grid, grid}];
```

[illegible]

184, 184, 185, 185, 185, 186, 186, 186, 187, 187, 187, 187, 188, 188, 188, 189,
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633																

[illegible]

[illegible]

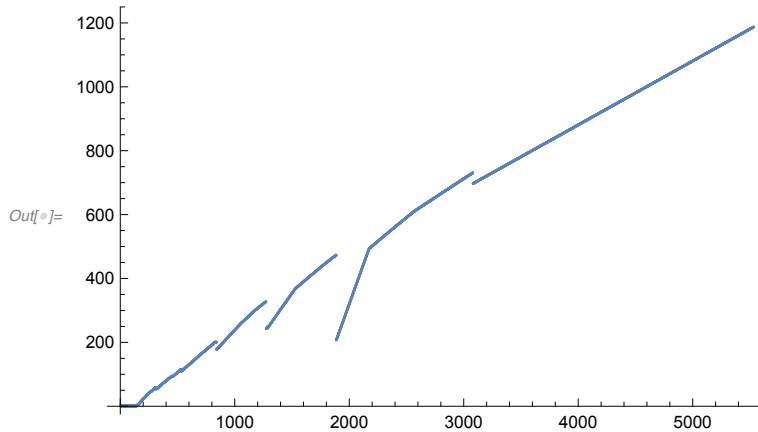
[illegible]

```
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1185, 1185, 1185, 1185, 1186, 1186, 1186, 1186, 1186, 1187, 1187, 1187}
```

```
In[ ]:= Length[priceupdatetotal]
```

```
Out[ ]:= 5532
```

```
In[ ]:= ListPlot[priceupdatetotal]
```



```
In[ ]:= Table[wealth[[i]] - c /. NSolve[R[wealth[[i]] - c] == wealth[[i]], c][[1]],
{ i, Length[Table[j, {j, 1, wupper0/grid}]] + 1,
Length[Table[j, {j, 1, wupper0/grid}]] + 1}]
```

```
Out[ ]:= {1.192}
```

```
In[ ]:= Ranew[w_] := Piecewise[{{Ra[w], w ≤ 1192/1000}, {R[w], w > 1192/1000}}]
Rbnew[w_] := Piecewise[{{Rb[w], w ≤ 1192/1000}, {R[w], w > 1192/1000}}]
```

```
In[ ]:= T = 30;
```

```
Table[list[t] = Range[2^t], {t, 1, T}];
```

```
initial = wsel;
```

```
list[1] =
```

```
{Round[Ranew[wealth[[initial]] - wealth[[priceupdatetotal[[initial]]]]]/grid + 1,
Round[Rbnew[wealth[[initial]] - wealth[[priceupdatetotal[[initial]]]]]/grid + 1]}
```

```
Out[ ]:= {816, 350}
```

```
In[ ]:= n = 2;
```

```
While[n < T + 1, list[n] = Flatten[Table[{Round[Ranew[wealth[[list[n - 1][[j]]]]] -
wealth[[priceupdatetotal[[list[n - 1][[j]]]]]]]/grid + 1,
Round[Rbnew[wealth[[list[n - 1][[j]]]]] - wealth[[priceupdatetotal[[
list[n - 1][[j]]]]]]]/grid + 1}], {j, 1, Length[list[n - 1]]}]];
n++]
```

```
Out[ ]:= $Aborted
```

```
In[ ]:= listwealth = Table[wealth[[list[T][[j]]]], {j, 1, Length[list[T]]};
```

```
In[ ]:= Needs["Histograms`"]
```

```
In[ ]:= listwealth
```

```
Out[ ]:=
```

```
{ 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673,
  400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400,
  673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673, 673,
  400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400, 400,
  673, 673, 673, ... 16 777 144 ..., 183, 39, 79, 17, 129, 69, 33, 141,
  400, 400, 400, 2000, 1000, 2000, 1000, 400, 500, 200, 2000,
  183, 157, 177, 19, 183, 157, 177, 19, 179, 77, 77, 33, 183, 157,
  1000, 2000, 2000, 500, 1000, 2000, 2000, 500, 2000, 2000, 2000, 1000, 2000,
  177, 19, 179, 77, 77, 33, 183, 39, 79, 17, 79, 17, 17, 7}
  2000, 500, 2000, 2000, 2000, 2000, 2000, 1000, 2000, 1000, 2000, 1000, 1000, 1000}
```

large output

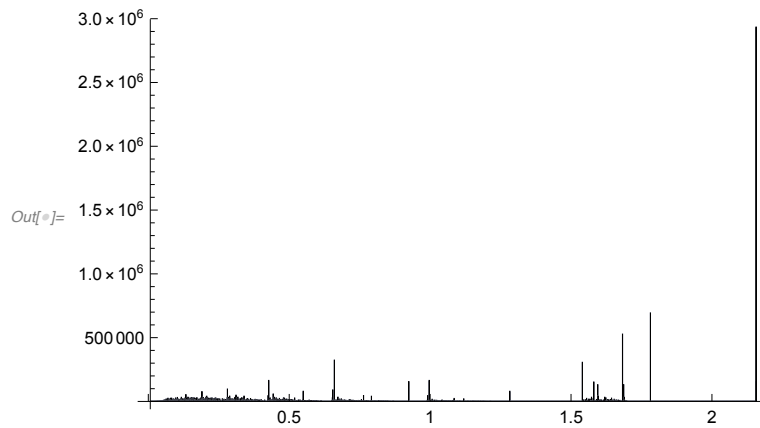
show less

show more

show all

set size limit...

```
In[ ]:= Histogram[listwealth]
```



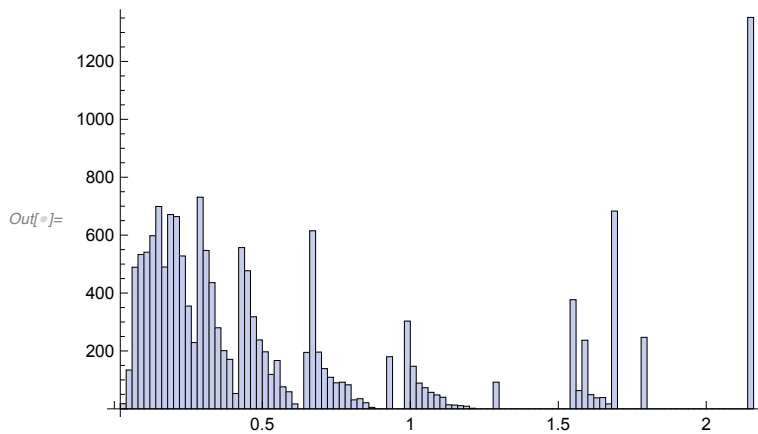
```
In[ ]:= N[wealth[[wsel]]]
```

```
Out[ ]:= 0.258
```

```
In[ ]:= {N[wealth[[Length[wealth]]]], N[Max[listwealth]]}
```

```
Out[ ]:= {2.7655, 2.1565}
```

```
In[ ]:= gcom = Histogram[listwealth]
```



```
In[ ]:= N[wealth[[wtre]]]
```

```
Out[ ]:= 0.028
```

```
In[ ]:= N[wealth[[wsel]]]
```

```
Out[ ]:= 0.0495
```

(* starting from a wealth just above the selection margin, why is it so messy?

+++++

```
In[ ]:= wsel = 100
```

```
Out[ ]:= 100
```

```
In[ ]:= T = 14;
```

```
Table[listcity[t] = Range[2^t], {t, 1, T}];
```

```
initialcity = wsel;
```

```
In[ ]:= listcity[1] =
```

```
{Round[Ra[wealth[[initialcity]] - wealth[[consumecity[[initialcity]]]]]/grid + 1],  
 Round[Rb[wealth[[initialcity]] - wealth[[consumecity[[initialcity]]]]]/grid + 1]}
```

```
Out[ ]:= {141, 116}
```

```
In[ ]:= n = 2;
```

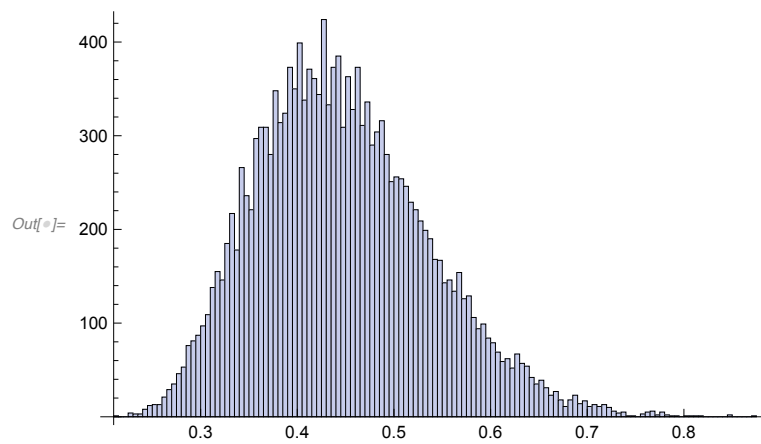
```
While[n < T + 1, listcity[n] = Flatten[Table[{Round[Ra[wealth[[listcity[n - 1]][[j]]]] -  
 wealth[[consumecity[[listcity[n - 1]][[j]]]]]/grid + 1],  
 Round[Rb[wealth[[listcity[n - 1]][[j]]]] - wealth[[consumecity[[  
 listcity[n - 1]][[j]]]]]/grid + 1}], {j, 1, Length[listcity[n - 1]]}]];  
 n++]
```

```
In[ ]:= listwealthcity = Table[wealth[[listcity[T]][[j]]], {j, 1, Length[listcity[T]]};
```

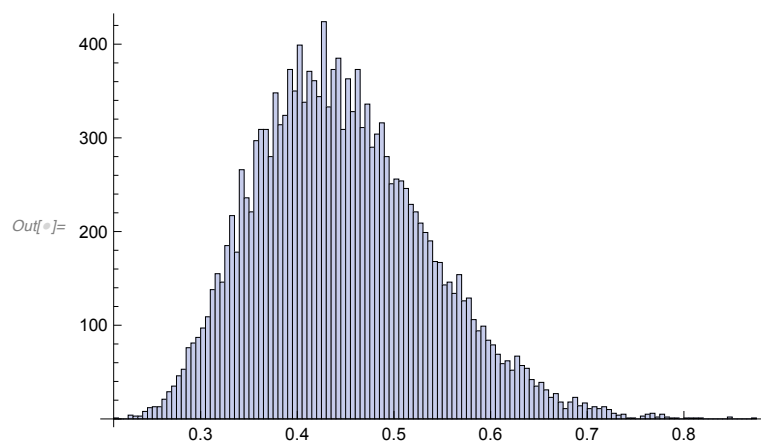
```
In[ ]:= Needs["Histograms`"]
```

General: Histograms` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

```
In[ ]:= gcity = Histogram[listwealthcity]
```



```
In[ ]:= Show[{gcity}]
```



```
In[ ]:= Show[{gcom, gcity}]
```

