

(* 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[]
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```
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]
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```
R[w_] := Piecewise[{ {al Sqrt[w + z] - al Sqrt[z], w ≤ wbar},  
  {al Sqrt[wbar + z] - al Sqrt[z] + (w - wbar) / d1, w > wbar} }]
```

```
cbar =
```

$$\frac{ka0^2}{4};$$

$$what = \frac{1}{2} \left(al^2 - \sqrt{al^2 (-ka0^2 + (al - 2\sqrt{z})^2)} - 2 al \sqrt{z} \right);$$

$$wbar = \frac{al^2 d1^2}{4} - z;$$

```
Rcons[w_] := al Sqrt[wbar + z] - al Sqrt[z] + (w - wbar) / d1
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```
In[ ]:= w /. Solve[w - c == wbar /. Solve[Rcons[w - c] == w, c][[1]], w][[1]]
```

$$Out[]:= \frac{1}{2} \left(al \sqrt{al^2 d1^2} - 2 al \sqrt{z} \right)$$

$$In[]:= wthreshold = \frac{1}{2} \left(al \sqrt{al^2 d1^2} - 2 al \sqrt{z} \right);$$

```
In[ ]:= d1 = 8 / 10; al = 30 / 10; z = 1; ka0 = 1 / 2; ka = 54 / 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]]]
```

... Solve: $\frac{1}{16}$ is not a valid variable.

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

$$In[]:= cbar = \frac{ka0^2}{4};$$

$$what = \frac{1}{2} \left(al^2 - \sqrt{al^2 (-ka0^2 + (al - 2\sqrt{z})^2)} - 2 al \sqrt{z} \right);$$

$$wbar = \frac{al^2 d1^2}{4} - z;$$

(* step two: find the right variables.

(* step three: code for the market:

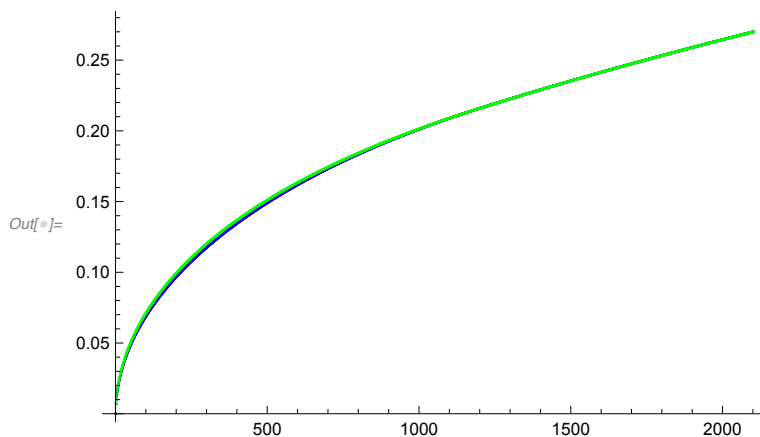
```
In[ ]:= wupper0 = wthreshold; wupper = R[R[wthreshold]]; grid = 1/2000;
wealth = Table[w, {w, 0, wupper + grid, grid}];
stationc = Flatten[ParallelTable[
  c /. Solve[R[wealth[[i]] - c] == wealth[[i]], c], {i, 1, Length[wealth]}]];

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

(* i can try to improve this code. in particular,
  how to get the continuation payoff.)

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

```

```

In[ ]:= Beep[]

```

```

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

```

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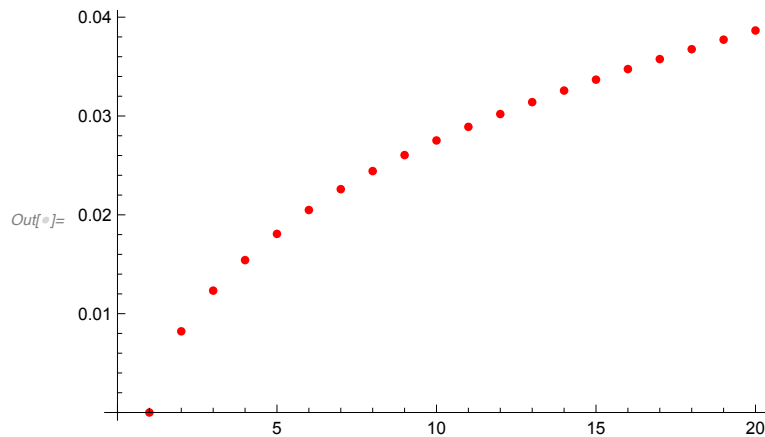
Out[ ]:= {6.19066 × 10-6, -2.97423 × 10-12, 0.0108287}

```

```

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

```



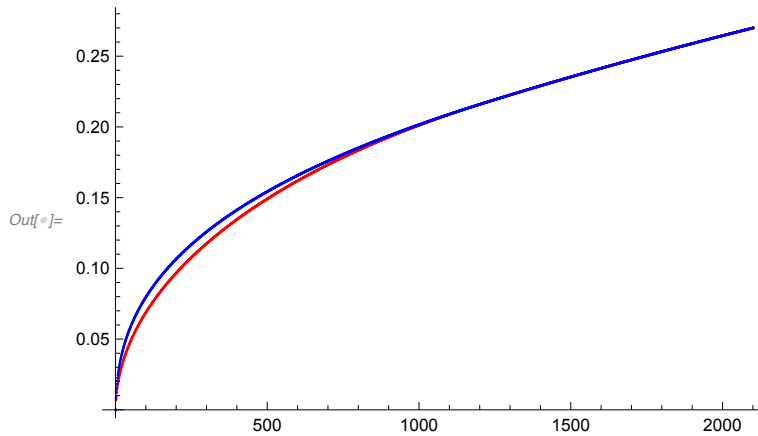
```

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

Out[ ]:= {{{{1}}, {{1}}, {{1}}, {{1}}, {{1}}, {{2}}, {{2}}, {{2}}, {{2}}, {{2}}, {{2}}, {{2}},
  {{2}}, {{2}}, {{2}}, {{2}}, {{2}}, {{3}}, {{3}}, {{3}}, {{3}}, {{3}}, {{3}}, {{3}},
  {{3}}, {{3}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}}, {{4}},
  {{5}}, {{5}}, {{5}}, {{5}}, {{5}}, {{5}}, {{5}}, {{5}}, {{6}}, {{6}}, {{6}},
  {{6}}, {{6}}, {{6}}, {{6}}, {{6}}, {{7}}, {{7}}, {{7}}, {{7}}, {{7}}, {{7}},
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[illegible]

[illegible]

```
In[•]:= consumecity = Flatten[%]
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[illegible]

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ln[*]:= wealhtmcrcity =
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Table[IntegerPart[N[R[wealth[[j]] - wealth[[consumecity[[j]]]]]]/grid] + 1,
{ j, 1, wupper0/grid + 1}]

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Out[*]= {1, 2, 3, 5, 6, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23, 23, 24, 26, 27, 29, 30, 32, 33,
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1190, 1192, 1193, 1193, 1194, 1195, 1195, 1197, 1198, 1198, 1199, 1201, 1201}

```
In[•]:= wealthseq = Table[i, {i, 1, 150}];
```

```
ln[•]:= wealthseq[[1]] = 7;
```

$$\ln[\bullet] := \mathbf{n} = 2;$$

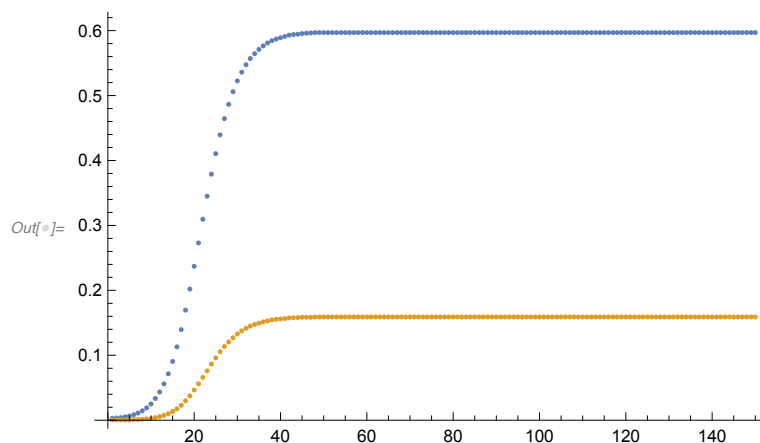
```
ln[*]:= While[n < 151, wealthseq[[n]] = wealhtmrcty[[wealthseq[[n - 1]]]]; n++]
```

$$ln[\bullet] := \text{wealthseq}$$
[illegible]


```
In[•]:= consumeseqvalue = Table[wealth[[consumecity[[wealthseq[[j]]]]]], {j, 1, 150}]
```

[illegible]

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


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

```
Out[4]= {0., 0.00821267, 0.0123304, 0.0154181, 0.0180711, 0.0204861, 0.0225967, 0.0244266,
0.0260448, 0.0275252, 0.0289021, 0.0301975, 0.0314027, 0.0325733, 0.0336789,
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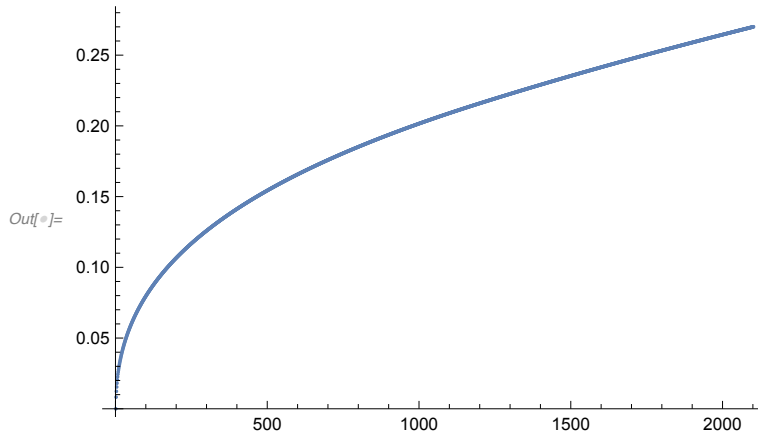
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0.269676, 0.26973, 0.269784, 0.269838, 0.269892, 0.269946, 0.27, 0.270054}

```

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



(* step four: code for the community:

```

In[ ]:= wupper0 = R[what]; wupper = R[R[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)
      ({(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
        2]] - N[R[wealth[[j]] - wealth[[i]]]]) / (wealth[[
          IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
          wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
            grid] + 1]]), (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[
              IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
              (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
                grid] + 2]] - wealth[[IntegerPart[
                  N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])]}.
        {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
          Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]} -
        {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
          2]] - N[R[wealth[[j]] - wealth[[i]]]]) / (wealth[[
            IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
              grid] + 1]]), (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[
                IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
                (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
                  grid] + 2]] - wealth[[IntegerPart[
                    N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])]}.
          {Pmplus[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
            grid] + 1]], Pmplus[[IntegerPart[
              N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]]}], b → 0],
        {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
          2]] - N[R[wealth[[j]] - wealth[[i]]]]) /
          (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
          (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
            N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
          (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])]}.
        {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
          Ps[[IntegerPart[N[R[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[]:= {10.0769, Null}

```

In[ ]:= 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) ({(wealth[[
          IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
          N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[IntegerPart[
            N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] - wealth[[
              IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
          (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
            N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
          (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
            grid] + 2]] - wealth[[IntegerPart[
              N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
          {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
          Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]} -
          {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
            2]] - N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[
              IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
              wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
                grid] + 1]]), (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[
                IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
              (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
                grid] + 2]] - wealth[[IntegerPart[
                  N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
          {Pmplus[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] /
            grid] + 1]], Pmplus[[IntegerPart[
              N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]}], b → 0],
      {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
        2]] - N[R[wealth[[j]] - wealth[[i]]]] /
        (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
          wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
        (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
          (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
            wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]))}.
        {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
        Ps[[IntegerPart[N[R[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]= {374.027, Null}

```

In[9]:= Psplus = Table[Max[Psplus[[i]], Pmplus[[i]]], {i, 1, Length[Pmplus]}];

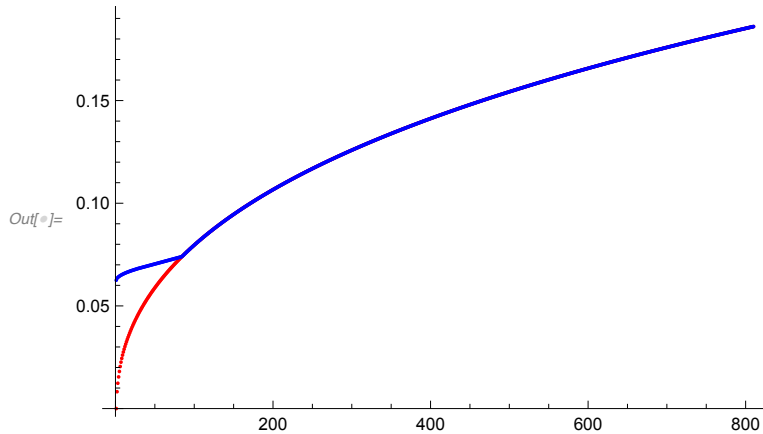
```

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

```

In[9]:= ListPlot[{Pmplus, Psplus}, PlotStyle -> {Red, Blue}]

```



```

In[9]:= {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[9]= {84, 84}

Out[9]= 84

Out[9]= { 9.1189×10^{-6} , 2.07692×10^{-6} }

++++stopped here without defining wsel++++

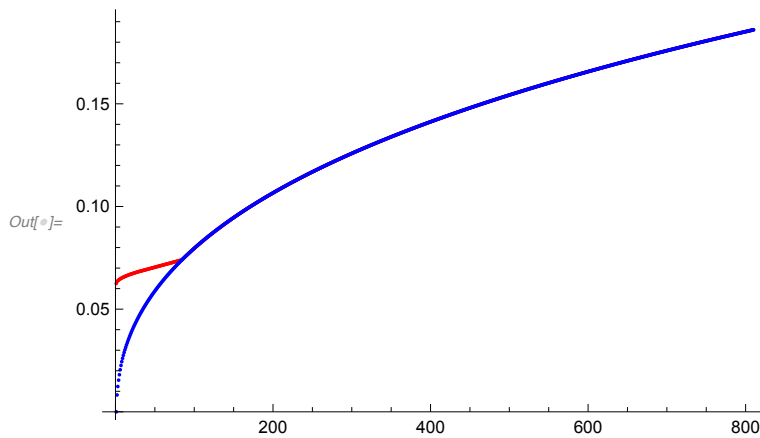
```

In[9]:= wsel

```

Out[9]= 84

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



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

```
Out[ ]:= {0., 0.00821267, 0.0123304, 0.0154181, 0.0180711, 0.0204861, 0.0225967, 0.0244266,
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 0.168443, 0.168547, 0.168652, 0.168756, 0.16886, 0.168964, 0.169068, 0.169172,
 0.169275, 0.169379, 0.169482, 0.169586, 0.169689, 0.169792, 0.169895, 0.169998,
 0.170101, 0.170203, 0.170306, 0.170409, 0.170511, 0.170613, 0.170715, 0.170817,
 0.170919, 0.171021, 0.171123, 0.171225, 0.171326, 0.171428, 0.171529, 0.17163,
 0.171731, 0.171832, 0.171933, 0.172034, 0.172135, 0.172236, 0.172336, 0.172436,
 0.172537, 0.172637, 0.172737, 0.172837, 0.172937, 0.173037, 0.173137, 0.173236,
 0.173336, 0.173435, 0.173534, 0.173634, 0.173733, 0.173832, 0.173931, 0.17403,
 0.174128, 0.174227, 0.174326, 0.174424, 0.174522, 0.174621, 0.174719, 0.174817,
 0.174915, 0.175013, 0.175111, 0.175208, 0.175306, 0.175403, 0.175501, 0.175598,
 0.175695, 0.175792, 0.175889, 0.175986, 0.176083, 0.17618, 0.176277, 0.176373,
 0.17647, 0.176566, 0.176662, 0.176759, 0.176855, 0.176951, 0.177047, 0.177143,
 0.177238, 0.177334, 0.17743, 0.177525, 0.17762, 0.177716, 0.177811, 0.177906,
 0.178001, 0.178096, 0.178191, 0.178286, 0.17838, 0.178475, 0.17857, 0.178664,
 0.178758, 0.178853, 0.178947, 0.179041, 0.179135, 0.179229, 0.179323, 0.179416,
 0.17951, 0.179604, 0.179697, 0.179791, 0.179884, 0.179977, 0.18007, 0.180163,
 0.180256, 0.180349, 0.180442, 0.180535, 0.180628, 0.18072, 0.180813, 0.180905,
 0.180997, 0.18109, 0.181182, 0.181274, 0.181366, 0.181458, 0.18155, 0.181641,
 0.181733, 0.181825, 0.181916, 0.182008, 0.182099, 0.18219, 0.182281, 0.182372,

```
0.182464, 0.182554, 0.182645, 0.182736, 0.182827, 0.182918, 0.183008, 0.183099,
0.183189, 0.183279, 0.18337, 0.18346, 0.18355, 0.18364, 0.18373, 0.18382, 0.183909,
0.183999, 0.184089, 0.184178, 0.184268, 0.184357, 0.184447, 0.184536, 0.184625,
0.184714, 0.184803, 0.184892, 0.184981, 0.18507, 0.185159, 0.185247, 0.185336,
0.185424, 0.185513, 0.185601, 0.185689, 0.185778, 0.185866, 0.185954, 0.186042}
```

```
In[ ]:= 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!

```
In[ ]:= 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)
    ({(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
      N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[IntegerPart[
        N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] - wealth[[
          IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
      (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[N[R[wealth[[
        j]] - wealth[[i]]]] / grid] + 1]])) / (wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] - wealth[[
            IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]).
      {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]],
        Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]} -
      {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
        N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] - wealth[[
            IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]]),
        (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[i]]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
          wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] +
            1]]).{Pmplus[[IntegerPart[N[R[wealth[[j]] -
              wealth[[i]]]] / grid] + 1]], Pmplus[[IntegerPart[
                N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]]}], b → 0],
    {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
      N[R[wealth[[j]] - wealth[[i]]]] /
      (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2]] -
```

```

    wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
    (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[
      IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]]) /
    (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
    wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]]))}.
  {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
  Ps[[IntegerPart[N[R[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)
    ({(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[IntegerPart[
        N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - wealth[[
        IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])),
    (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
      N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])) /
    (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/
      grid] + 2]] - wealth[[IntegerPart[
        N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]]))}.
    {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
    Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]]} -
    {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      N[R[wealth[[j]] - wealth[[i]]]] / (wealth[[IntegerPart[
        N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] - wealth[[
        IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])),
    (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
      N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])) / (wealth[[
      IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] +
      1]]))}. {Pmplus[[IntegerPart[N[R[wealth[[j]] -
        wealth[[i]]]]/grid] + 1]], Pmplus[[IntegerPart[
        N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]]}}, b → 0],
    {(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      N[R[wealth[[j]] - wealth[[i]]]] /
      (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])),
    (N[R[wealth[[j]] - wealth[[i]]]] - wealth[[IntegerPart[
      N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]])) /
      (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 2]] -
      wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]]))}.
  {Ps[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]]/grid] + 1]],
  Ps[[IntegerPart[N[R[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, 2, 2, 3, 4, 5, 6, 7, 7, 8, 9, 10, 11, 12, 13, 13, 14, 15, 16,
  17, 18, 18, 19, 20, 21, 22, 23, 23, 24, 25, 26, 27, 27, 28, 29, 30, 31,
  32, 32, 33, 34, 35, 36, 37, 37, 38, 39, 40, 41, 41, 42, 43, 44, 45, 45, 46}
```

```
In[9]:= priceupdate
```

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

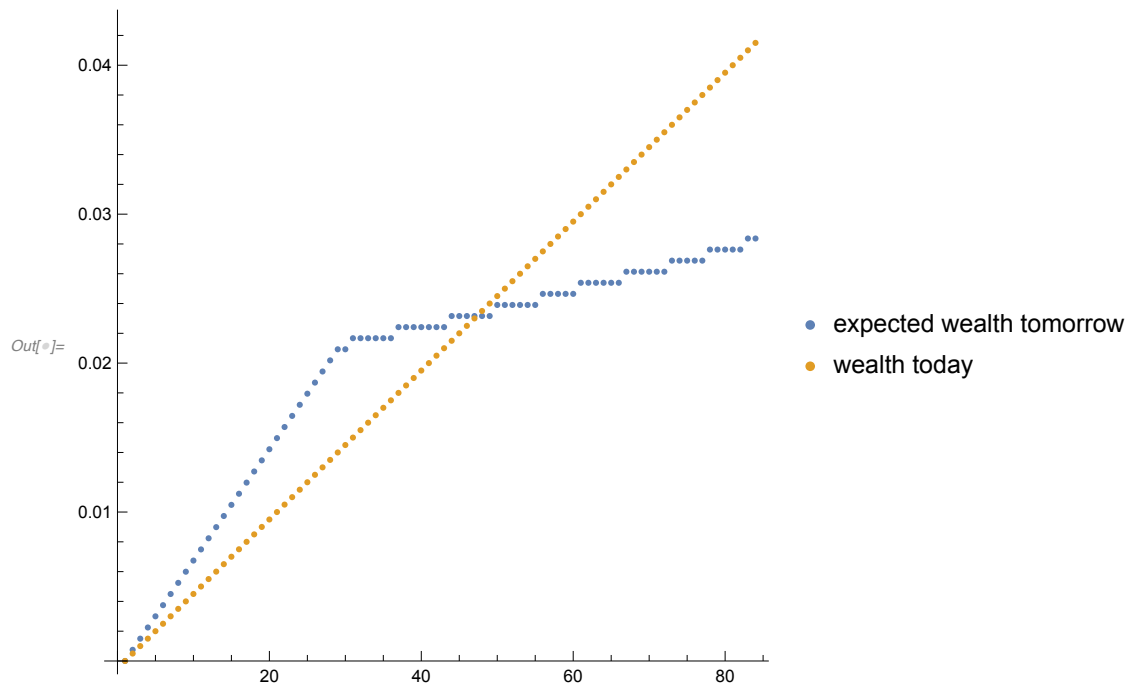
```
In[9]:= wealthupdate = Table[N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]], {j, 1, wsel}]
```

```
Out[9]:= {0., 0.000749906, 0.00149963, 0.00224916, 0.0029985, 0.00374766, 0.00449663,
  0.00524541, 0.00599401, 0.00674242, 0.00749065, 0.00823869, 0.00898654, 0.00973421,
  0.0104817, 0.011229, 0.0119761, 0.012723, 0.0134698, 0.0142163, 0.0149627,
  0.0157089, 0.0164549, 0.0172007, 0.0179463, 0.0186918, 0.019437, 0.0201821,
  0.020927, 0.020927, 0.0216717, 0.0216717, 0.0216717, 0.0216717, 0.0216717,
  0.0216717, 0.0224163, 0.0224163, 0.0224163, 0.0224163, 0.0224163, 0.0224163,
  0.0224163, 0.0231606, 0.0231606, 0.0231606, 0.0231606, 0.0231606, 0.0231606,
  0.0239048, 0.0239048, 0.0239048, 0.0239048, 0.0239048, 0.0239048, 0.0246487,
  0.0246487, 0.0246487, 0.0246487, 0.0253925, 0.0253925, 0.0253925,
  0.0253925, 0.0253925, 0.0253925, 0.0261362, 0.0261362, 0.0261362, 0.0261362,
  0.0261362, 0.0261362, 0.0268796, 0.0268796, 0.0268796, 0.0268796, 0.0268796,
  0.0276228, 0.0276228, 0.0276228, 0.0276228, 0.0276228, 0.0283659, 0.0283659}
```

```

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

```



```

In[ ]:= wsel = Length[priceupdate]

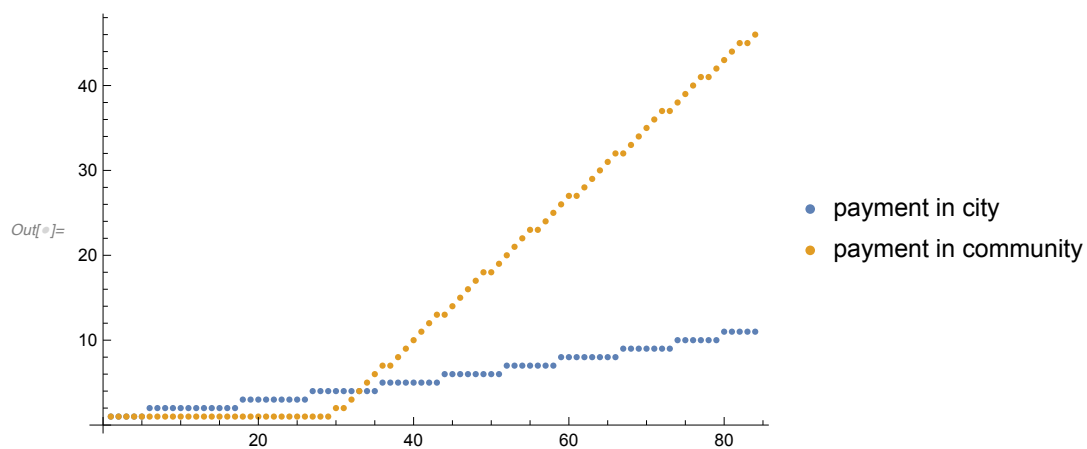
```

Out[]:= 84

```

In[ ]:= ListPlot[{consumecity[[1 ;; Length[priceupdate]]], priceupdate},
  PlotLegends -> {"payment in city", "payment in community"}]

```




```

In[ ]:= bupdate = Table[b /. If[wealth[[priceupdate[[j]]]] < cbar,
  b → Min[cbar - wealth[[priceupdate[[j]]]], d1 / (1 - d1)
    ((wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
      grid] + 2)] - N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
      (wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
        grid] + 2)] - wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]]),
    (N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[IntegerPart[
      N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])) /
      (wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
        grid] + 2)] - wealth[[IntegerPart[
          N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])),
    {Ps[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] / grid] +
      1]], Ps[[IntegerPart[
        N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 2]]] -
      ((wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
        grid] + 2)] - N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] /
        (wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
          grid] + 2)] - wealth[[IntegerPart[
            N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])),
      (N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] - wealth[[IntegerPart[
        N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])) /
        (wealth[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
          grid] + 2)] - wealth[[IntegerPart[
            N[R[wealth[[j]] - wealth[[priceupdate[[j]]]]]] / grid] + 1]])),
      {Pmplus[[IntegerPart[N[R[wealth[[j]]] - wealth[[priceupdate[[j]]]]]] /
        grid] + 1]], Pmplus[[IntegerPart[N[R[wealth[[j]]] - wealth[[
          priceupdate[[j]]]]]] / grid] + 2]]]]], b → 0], {j, 1, wsel}]
pupdate = Table[wealth[[priceupdate[[j]]]], {j, 1, wsel}]
cupdate = pupdate + bupdate

```

```

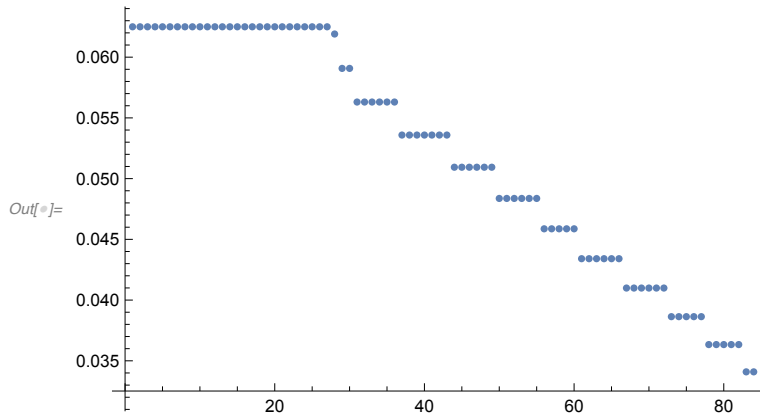
Out[ ]:= {
  1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16,
  1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 0.0619063, 0.0590751,
  0.0590751, 0.0563063, 0.0563063, 0.0563063, 0.0563063, 0.0563063,
  0.0563063, 0.053588, 0.053588, 0.053588, 0.053588, 0.053588, 0.053588,
  0.053588, 0.0509383, 0.0509383, 0.0509383, 0.0509383, 0.0509383, 0.0509383,
  0.0483683, 0.0483683, 0.0483683, 0.0483683, 0.0483683, 0.0483683, 0.0458681,
  0.0458681, 0.0458681, 0.0458681, 0.0434077, 0.0434077, 0.0434077,
  0.0434077, 0.0434077, 0.0434077, 0.040991, 0.040991, 0.040991, 0.040991,
  0.040991, 0.040991, 0.0386349, 0.0386349, 0.0386349, 0.0386349, 0.0386349,
  0.0363369, 0.0363369, 0.0363369, 0.0363369, 0.0363369, 0.0340905, 0.0340905}

```

$$\text{Out}\{\# \} = \left\{ \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \right.$$

 $\frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, 0.0619063, 0.0590751,$
 $0.0595751, 0.0568063, 0.0573063, 0.0578063, 0.0583063, 0.0588063,$
 $0.0593063, 0.056588, 0.057088, 0.057588, 0.058088, 0.058588, 0.059088,$
 $0.059588, 0.0569383, 0.0574383, 0.0579383, 0.0584383, 0.0589383, 0.0594383,$
 $0.0568683, 0.0573683, 0.0578683, 0.0583683, 0.0588683, 0.0593683, 0.0568681,$
 $0.0573681, 0.0578681, 0.0583681, 0.0588681, 0.0564077, 0.0569077, 0.0574077,$
 $0.0579077, 0.0584077, 0.0589077, 0.056491, 0.056991, 0.057491, 0.057991,$
 $0.058491, 0.058991, 0.0566349, 0.0571349, 0.0576349, 0.0581349, 0.0586349,$
 $0.0563369, 0.0568369, 0.0573369, 0.0578369, 0.0583369, 0.0560905, 0.0565905 \}$

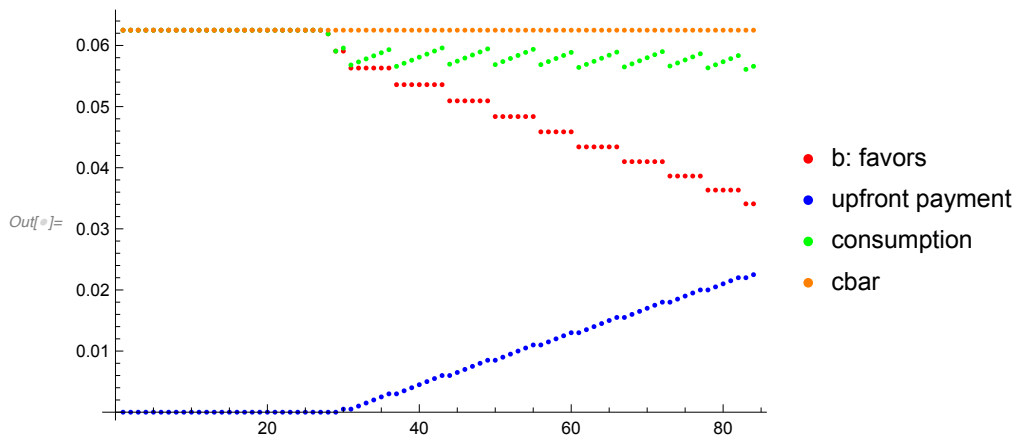
```
In[•]:= ListPlot[bupdate]
```



```

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[]:= 47

```

In[ ]:= Length[wealthupdate]

```

Out[]:= 84

```

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

```

Out[]:= {{0.023, 0.0231606}}

+++++

```

In[ ]:= ListPlot[{bettercity[[1 ;; 110]], benchmark[[1 ;; 110]]}]

```

