

(* 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} }]
```

```
cbar =
```

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

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

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

```
Rcons[w_] := al Sqrt[wbar + z] - al Sqrt[z] + (w - wbar) / d1
```

```
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 = 31 / 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]]]
```

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

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

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

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

```
In[8]:= FullSimplify[R[w]]
Out[8]= 
$$\begin{cases} \frac{9}{125} + \frac{5w}{4} & 625w > 336 \\ \frac{31}{10} \left( -1 + \sqrt{1+w} \right) & \text{True} \end{cases}$$

```

(* step two: find the right variables.

(* step three: code for the market:

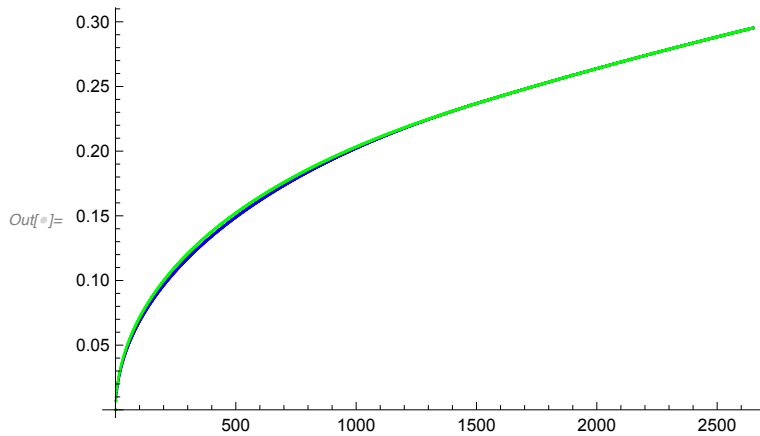
```
In[9]:= wupper0 = wthreshold; wupper = R[R[wthreshold]]; grid = 1/2000;
wealth = Table[w, {w, 0, wupper + grid, grid}];
stationc = Flatten[ParallelTable[
  c /. Solve[R[wealth[[i]] - c] == wealth[[i]], c], {i, 1, Length[wealth]}]];

In[9]:= 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[9]:= 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}]
```



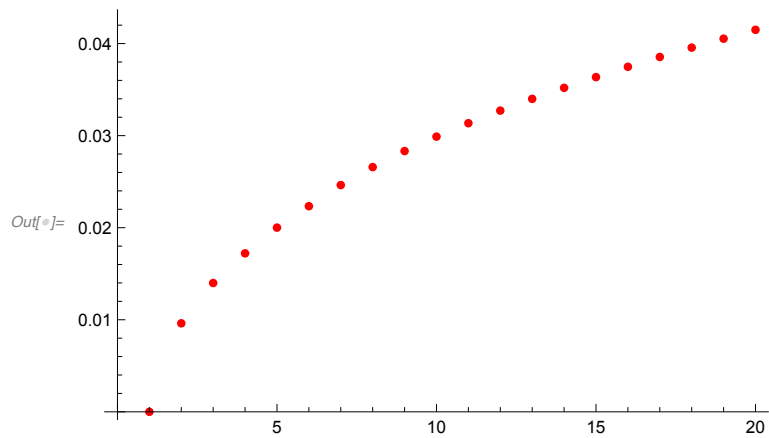
```
In[ ]:= n = 1;
While[n < 25, Pm = Pmplus;
  Pmplus = Flatten[{ParallelTable[N[Max[
    Table[{1 - dl, dl}.{Vm[wealth[[i]]], {(wealth[[IntegerPart[N[R[wealth[[j]] -
      wealth[[i]]]] / grid] + 2]] - N[R[wealth[[j]] - wealth[[i]]]] /
      (wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid]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

```
Out[ ]:= {4.76583 × 10-6, -2.55067 × 10-11, 0.014894}
```

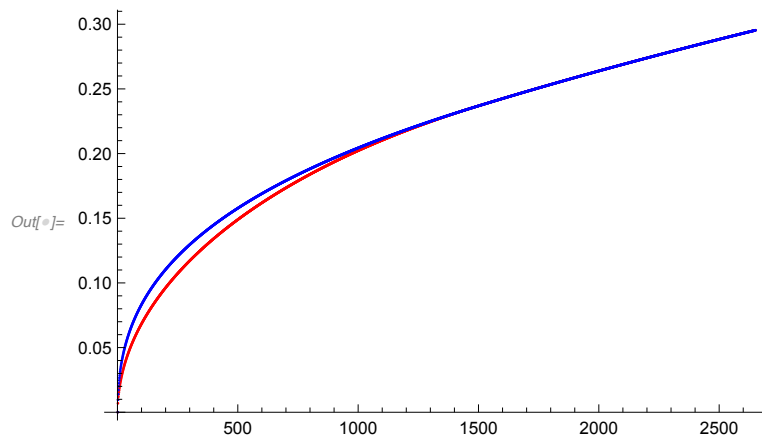
```
In[ ]:= ListPlot[{Pmplus[[1 ;; 20]]}, PlotStyle -> {Red, Blue}]
```



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}},
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[illegible]

[illegible]

[illegible]

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

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ln[*]:= wealhtmtcity =
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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, 4, 5, 7, 7, 8, 10, 11, 13, 14, 16, 18, 19, 21, 22, 24, 25, 27, 27, 28, 30, 31, 33, 35,
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```
In[*]:= wealthseq = Table[i, {i, 1, 150}];
```

```
In[•]:= wealthseq[[1]] = 7;
```

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

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

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

```
ln[•]:= wealthseqvalue = Table[wealth[[wealthseq[[j]]]], {j, 1, 150}]
```

[illegible]

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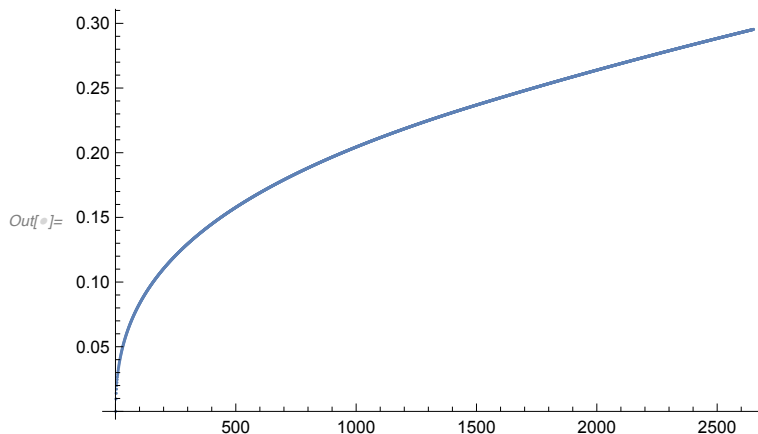
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0.288166, 0.288213, 0.28826, 0.288307, 0.288354, 0.288401, 0.288448, 0.288495,
0.288541, 0.288588, 0.288635, 0.288682, 0.288729, 0.288776, 0.288822,
0.288869, 0.288916, 0.288963, 0.28901, 0.289056, 0.289103, 0.28915, 0.289197,
0.289243, 0.28929, 0.289337, 0.289384, 0.28943, 0.289477, 0.289524, 0.28957,
0.289617, 0.289664, 0.28971, 0.289757, 0.289804, 0.28985, 0.289897, 0.289944,
0.28999, 0.290037, 0.290084, 0.29013, 0.290177, 0.290223, 0.29027, 0.290317,
0.290363, 0.29041, 0.290456, 0.290503, 0.290549, 0.290596, 0.290642, 0.290689,
0.290735, 0.290782, 0.290828, 0.290875, 0.290921, 0.290968, 0.291014,
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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}

```

```
In[ ]:= 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]]];

```

```
ln[8]:= 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 - d1, d1}.{V[wealth[[i]] + b] - b /.
    If[wealth[[i]] < cbar, b → Min[cbar - wealth[[i]], d1 / (1 - d1)
      ({(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[]:= {9.28153, 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}]] +

```

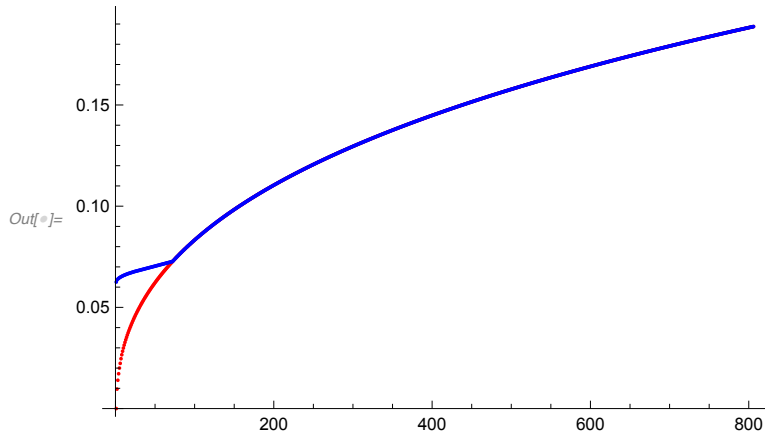
```
1 ;; Length[
  wealth]]]]];
n++] ]
```

Out[8]= {821.78, 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 wstar

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



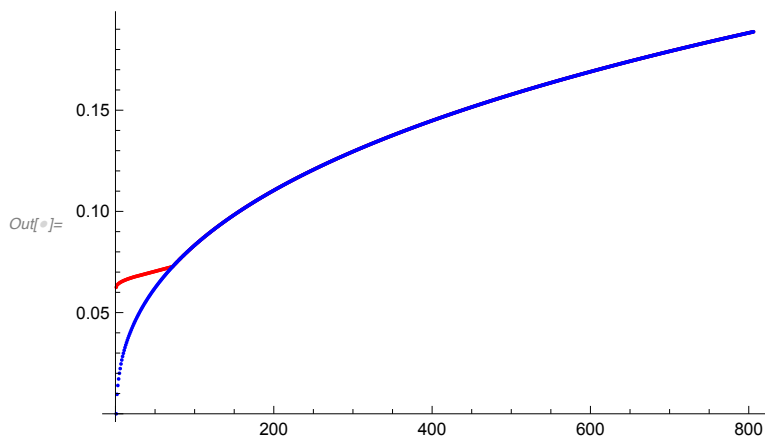
```
In[9]:= {Max[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]],
  Length[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]]}
wsel = Max[Position[Table[Psplus[[i]] > Pmplus[[i]], {i, 1, Length[Pmplus]}], True]]
{Max[Ps[[1 ;; wsel]] - Psplus[[1 ;; wsel]], Min[Ps[[1 ;; wsel]] - Psplus[[1 ;; wsel]]]}
```

Out[9]= {72, 72}

Out[9]= 72

Out[9]= { 9.44601×10^{-6} , 2.07692×10^{-6} }

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



```
In[9]:= Pmplus
```

```

Out[n]= {0., 0.00961375, 0.0139914, 0.0172133, 0.0200102, 0.0223357, 0.0246292, 0.0265805,
0.0283245, 0.0298918, 0.0313501, 0.032717, 0.0339941, 0.0351911, 0.0363575,
0.0374772, 0.0385431, 0.03956, 0.040531, 0.0414942, 0.0424328, 0.0433468, 0.0442422,
0.0450992, 0.0459358, 0.0467451, 0.0475311, 0.0482986, 0.0490527, 0.0497918,
0.05053, 0.0512471, 0.0519446, 0.0526297, 0.0533044, 0.0539658, 0.0546128,
0.0552474, 0.0558706, 0.0564927, 0.0571024, 0.057706, 0.0583002, 0.0588819,
0.0594523, 0.060015, 0.0605728, 0.0611218, 0.0616695, 0.0622083, 0.0627395,
0.0632621, 0.0637799, 0.0642916, 0.0647949, 0.0652912, 0.0657866, 0.0662763,
0.0667633, 0.067242, 0.0677148, 0.0681816, 0.0686434, 0.0691011, 0.0695576,
0.0700101, 0.0704567, 0.070897, 0.0713354, 0.0717693, 0.0721976, 0.0726224,
0.0730458, 0.0734653, 0.0738817, 0.0742936, 0.0747014, 0.0751042, 0.0755046,
0.0759036, 0.0763012, 0.0766939, 0.0770826, 0.0774685, 0.0778519, 0.078231,
0.0786084, 0.0789846, 0.0793568, 0.0797271, 0.0800945, 0.0804581, 0.0808182,
0.0811771, 0.0815357, 0.0818916, 0.0822438, 0.0825935, 0.0829408, 0.0832858,
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0.0947679, 0.0950486, 0.0953276, 0.0956055, 0.0958828, 0.0961592, 0.0964338,
0.0967065, 0.0969782, 0.0972486, 0.097519, 0.0977875, 0.0980547, 0.0983209,
0.0985856, 0.0988489, 0.099112, 0.0993738, 0.0996346, 0.099894, 0.100152, 0.100408,
0.100665, 0.100921, 0.101175, 0.101428, 0.10168, 0.101931, 0.102181, 0.102431,
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```

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```
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0.188135, 0.188222, 0.18831, 0.188397, 0.188484, 0.188571, 0.188658, 0.188745}
```

`ln[]:= Psplus`

```
Out[ ]:= {0.0625083, 0.0635421, 0.0640034, 0.0643428, 0.0646345, 0.0648831, 0.0651198,
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0.0665216, 0.066667, 0.0667939, 0.0669218, 0.0670511, 0.0671795, 0.0673071,
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0.185299, 0.185388, 0.185478, 0.185568, 0.185657, 0.185747, 0.185836, 0.185926,
0.186015, 0.186104, 0.186193, 0.186282, 0.186371, 0.18646, 0.186549, 0.186638,
0.186727, 0.186815, 0.186904, 0.186992, 0.18708, 0.187169, 0.187257, 0.187345,
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0.188135, 0.188222, 0.18831, 0.188397, 0.188484, 0.188571, 0.188658, 0.188745}

```

```
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!


```

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]])) /

```

```

(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}]]

```

```

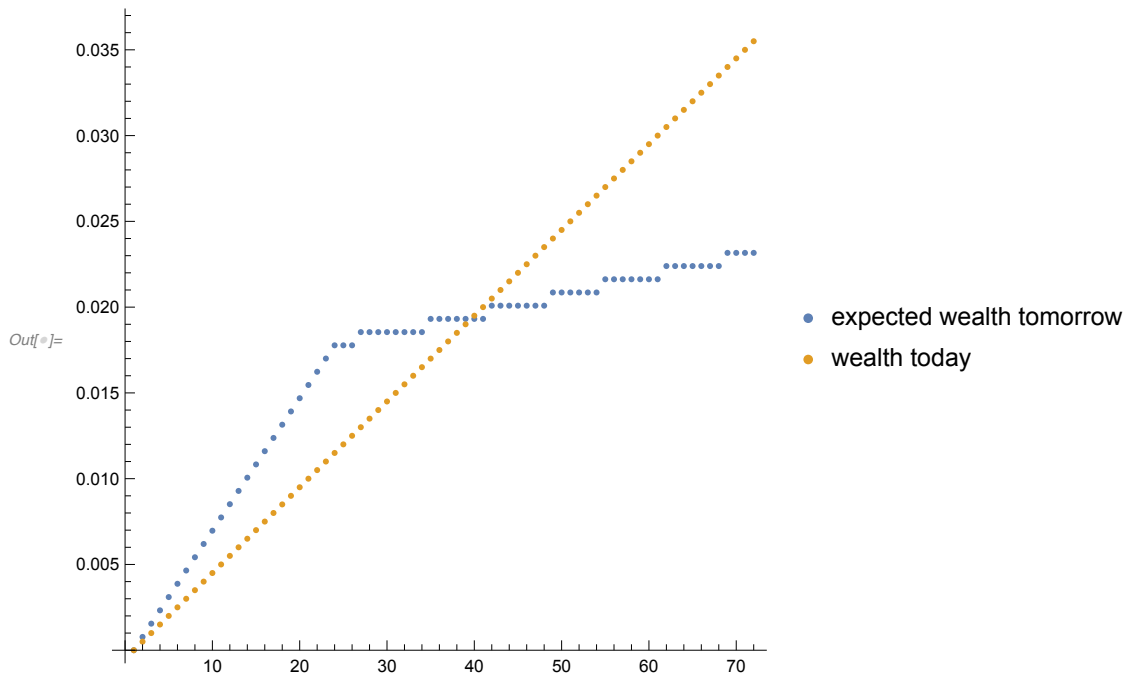
Out[*=]= {1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 3, 3, 4, 5, 6,
  7, 8, 9, 10, 10, 11, 12, 13, 14, 15, 16, 16, 17, 18, 19, 20, 21, 22, 22, 23, 24,
  25, 26, 27, 27, 28, 29, 30, 31, 32, 33, 33, 34, 35, 36, 37, 38, 39, 39, 40, 41, 42}

```

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

```
Out[ ]:= {0., 0.000774903, 0.00154961, 0.00232413, 0.00309845, 0.00387258,
0.00464652, 0.00542026, 0.00619381, 0.00696717, 0.00774034, 0.00851331,
0.00928609, 0.0100587, 0.0108311, 0.0116033, 0.0123753, 0.0131471,
0.0139188, 0.0146902, 0.0154614, 0.0162325, 0.0170034, 0.017774, 0.017774,
0.017774, 0.0185445, 0.0185445, 0.0185445, 0.0185445, 0.0185445, 0.0185445,
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0.0216246, 0.0216246, 0.0216246, 0.0223941, 0.0223941, 0.0223941, 0.0223941,
0.0223941, 0.0223941, 0.0223941, 0.0231635, 0.0231635, 0.0231635, 0.0231635}
```

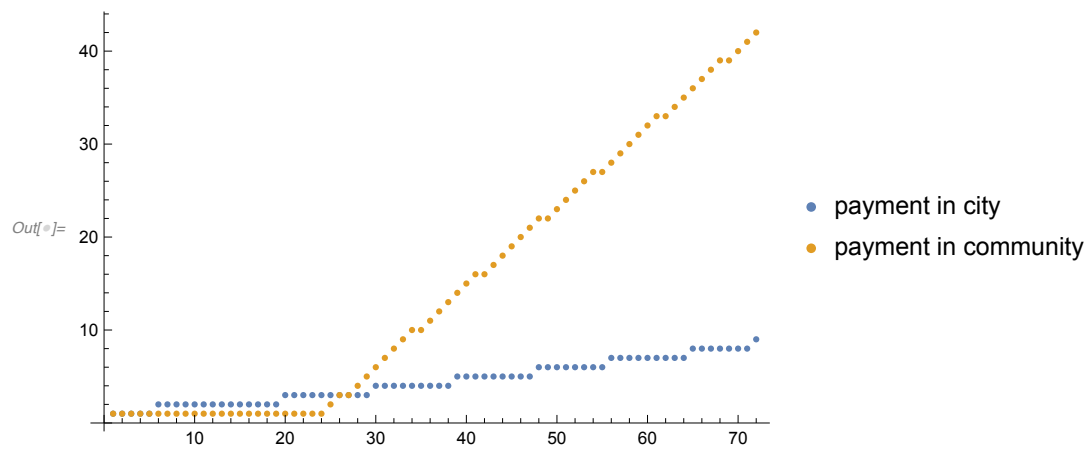
```
In[ ]:= ListPlot[{wealthupdate, wealth[[1 ;; wsel]]},
PlotLegends -> {"expected wealth tomorrow", "wealth today"}, AspectRatio -> 1]
```



```
In[ ]:= wsel = Length[priceupdate]
```

```
Out[ ]:= 72
```

```
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

```

```

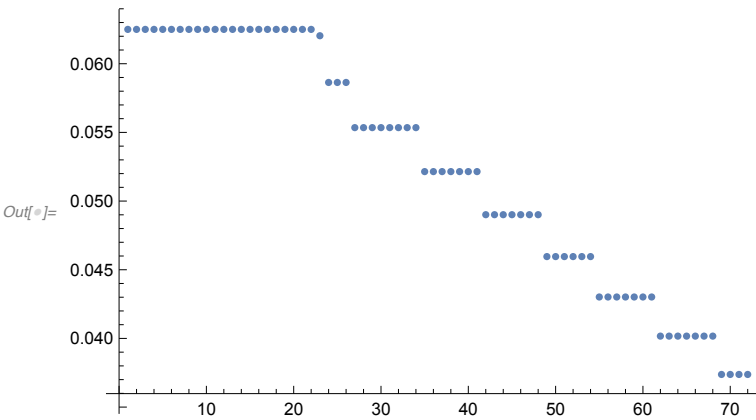
Out[ ]:= {
  1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 1/16,
  1/16, 1/16, 1/16, 1/16, 1/16, 1/16, 0.0620379, 0.0586367, 0.0586367, 0.0586367,
  0.0553475, 0.0553475, 0.0553475, 0.0553475, 0.0553475, 0.0553475,
  0.0553475, 0.0553475, 0.0521463, 0.0521463, 0.0521463, 0.0521463,
  0.0521463, 0.0521463, 0.0521463, 0.0490087, 0.0490087, 0.0490087,
  0.0490087, 0.0490087, 0.0490087, 0.0490087, 0.0459584, 0.0459584, 0.0459584,
  0.0459584, 0.0459584, 0.0459584, 0.0430162, 0.0430162, 0.0430162, 0.0430162,
  0.0430162, 0.0430162, 0.0430162, 0.0401677, 0.0401677, 0.0401677, 0.0401677,
  0.0401677, 0.0401677, 0.0401677, 0.0373764, 0.0373764, 0.0373764, 0.0373764}

```

better investment.nb

[illegible]

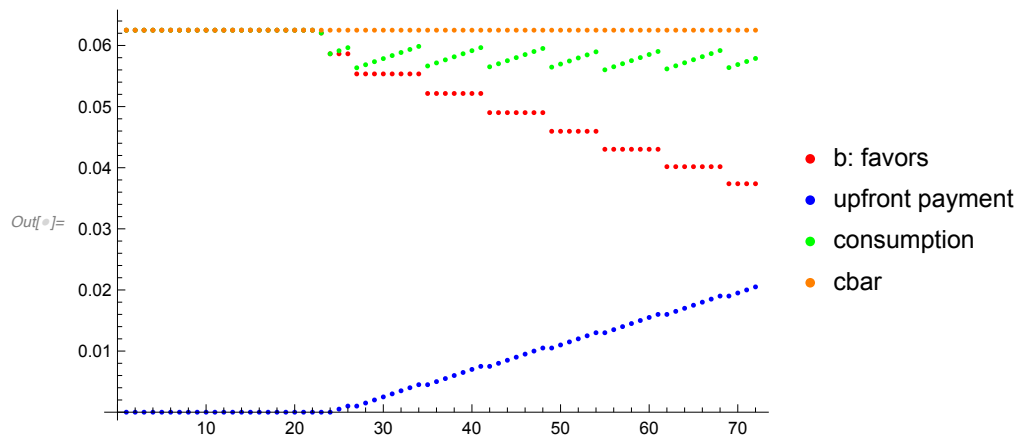
```
In[•]:= ListPlot[bupdate]
```



```

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[]:= 39

```

In[ ]:= Length[wealthupdate]

```

Out[]:= 72

```

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

```

Out[]:= {{0.019, 0.0193148}}

+++++

```

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

```

