

(\* 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 =
```

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

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

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

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

```
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 = 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]]]
```

... 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:

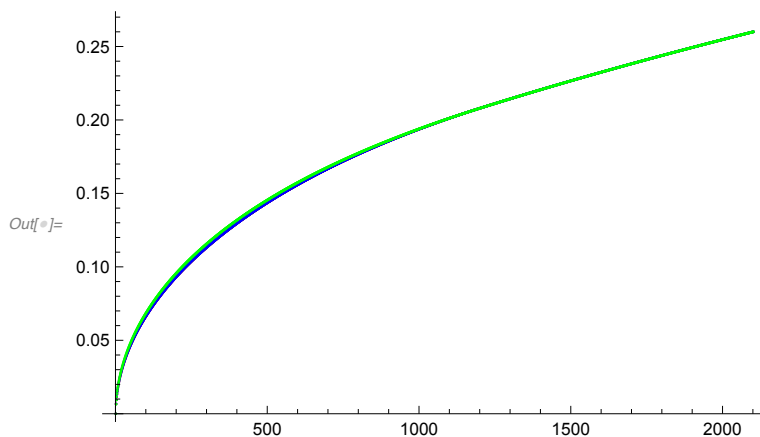
```
In[ ]:= wupper0 = wthreshold; wupper = R[R[wthreshold]]; grid = 1/2000;
wealth = Table[w, {w, 0, wupper + grid, grid}];
stationc = Flatten[ParallelTable[
  c /. Solve[R[wealth[[i]] - c] == wealth[[i]], c], {i, 1, Length[wealth]}]];

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]}

```

```

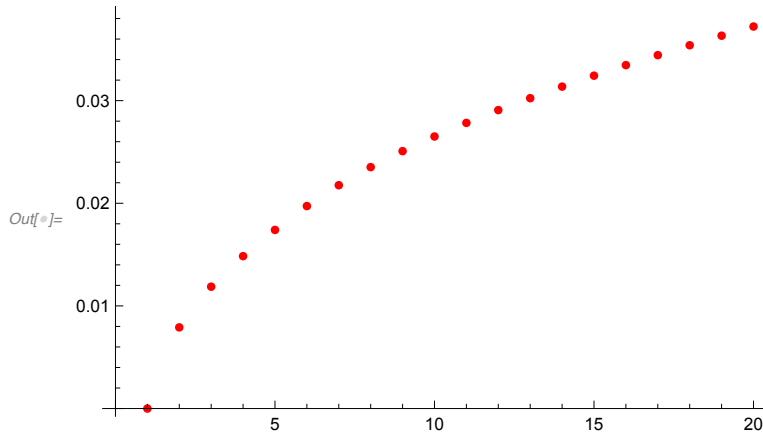
Out[ ]:= {5.96137 × 10-6, -2.86404 × 10-12, 0.0104276}

```

```

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

```



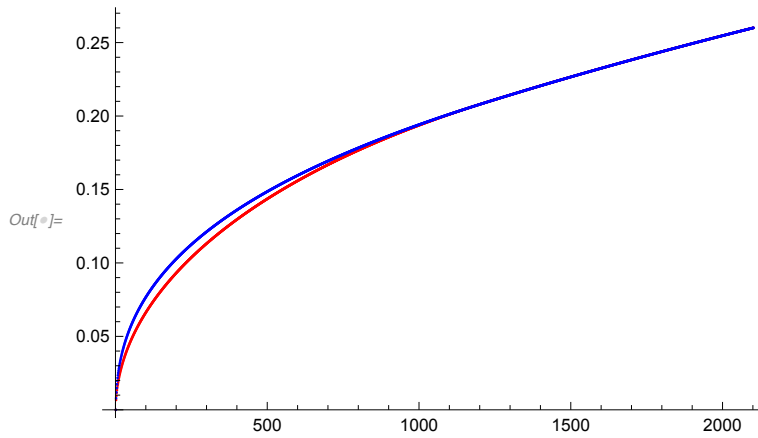
```

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}},
```

[illegible]

[illegible]

[illegible]

```
In[●]:= consumecity = Flatten[%]
```

[illegible]

[illegible]



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233, 233, 234, 234, 234, 235, 235, 235, 236, 236, 236, 237, 237, 237, 238, 238,
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```

```
ln[*]:= wealhtmcrcity =
```

```

Table[IntegerPart[N[R[wealth[[j]] - wealth[[consumecity[[j]]]]]]/grid] + 1,
{j, 1, wupper0/grid + 1}]

```

```

wealhtmcrcity0 = {1, 2, 3, 5, 6, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23, 23, 24, 26,
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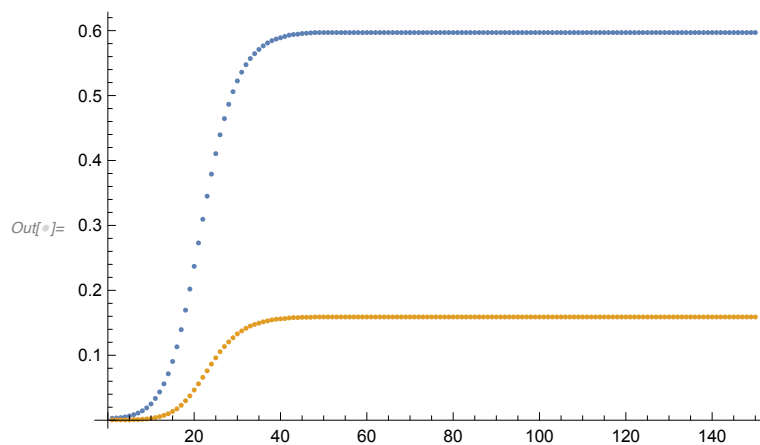
[illegible]



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

[illegible]

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


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

```
{0.`,0.007908500202567217`,0.011873743822232698`,0.014847028241141659`,
0.01740184602074604`,0.01972735671734582`,0.021759739575949684`,
0.02352187033875697`,0.025080157082215334`,0.02650575827916678`,
0.027831608766315075`,0.02907904826270365`,0.030239684152095166`,
0.03136684618563717`,0.03243150579786429`,0.03346155131569774`,
```

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 0.07892144964798205`, 0.07923684472646164`, 0.07954965124714086`,  
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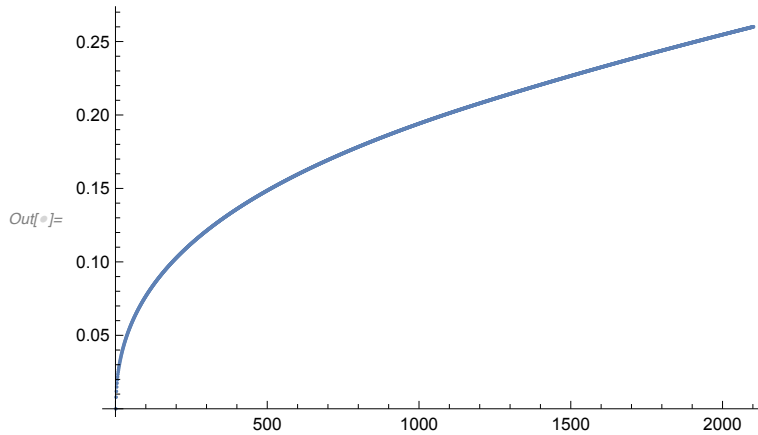
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```

```
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]]];

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[ ]:= {14.0361, 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[ ]:= {410.355, Null}

```

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

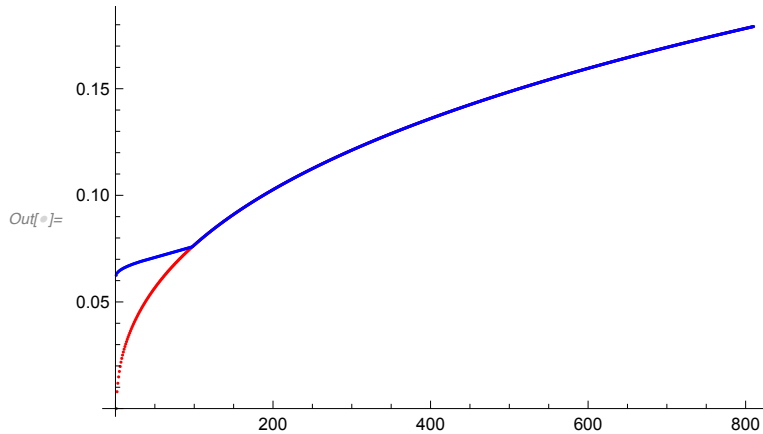
```

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

```

In[ ]:= ListPlot[{Pmplus, Psplus}, 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[ ]:= {97, 97}

```

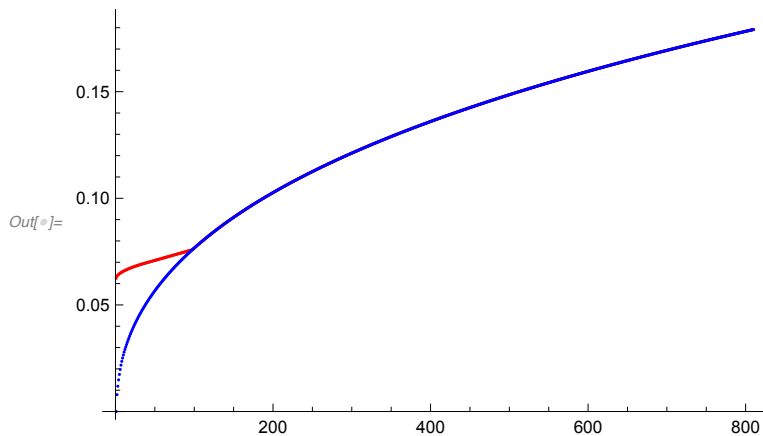
In[ ]:= wsel = 97;

```

```

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

```



```

In[ ]:= Pmplus

```

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 0.143763, 0.143886, 0.14401, 0.144132, 0.144255, 0.144378, 0.144501, 0.144623,  
 0.144745, 0.144867, 0.144989, 0.14511, 0.145232, 0.145353, 0.145474, 0.145595,  
 0.145716, 0.145837, 0.145957, 0.146077, 0.146198, 0.146318, 0.146437, 0.146557,  
 0.146676, 0.146796, 0.146915, 0.147034, 0.147153, 0.147271, 0.14739, 0.147508,  
 0.147626, 0.147744, 0.147862, 0.14798, 0.148097, 0.148215, 0.148332, 0.148449,  
 0.148566, 0.148683, 0.148799, 0.148916, 0.149032, 0.149148, 0.149264, 0.14938,  
 0.149496, 0.149611, 0.149727, 0.149842, 0.149957, 0.150072, 0.150187,  
 0.150302, 0.150416, 0.15053, 0.150645, 0.150759, 0.150873, 0.150986, 0.1511,  
 0.151213, 0.151327, 0.15144, 0.151553, 0.151666, 0.151779, 0.151891, 0.152004,  
 0.152116, 0.152228, 0.15234, 0.152452, 0.152564, 0.152676, 0.152787, 0.152899,

```

0.15301, 0.153121, 0.153232, 0.153343, 0.153453, 0.153564, 0.153674, 0.153785,
0.153895, 0.154005, 0.154115, 0.154224, 0.154334, 0.154444, 0.154553, 0.154662,
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0.155639, 0.155747, 0.155855, 0.155963, 0.15607, 0.156178, 0.156285, 0.156392,
0.156499, 0.156606, 0.156713, 0.15682, 0.156926, 0.157032, 0.157139, 0.157245,
0.157351, 0.157457, 0.157563, 0.157669, 0.157774, 0.15788, 0.157985, 0.15809,
0.158195, 0.1583, 0.158405, 0.15851, 0.158614, 0.158719, 0.158823, 0.158928,
0.159032, 0.159136, 0.15924, 0.159343, 0.159447, 0.159551, 0.159654, 0.159758,
0.159861, 0.159964, 0.160067, 0.16017, 0.160273, 0.160375, 0.160478, 0.16058,
0.160683, 0.160785, 0.160887, 0.160989, 0.161091, 0.161192, 0.161294, 0.161396,
0.161497, 0.161598, 0.1617, 0.161801, 0.161902, 0.162003, 0.162103, 0.162204,
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0.163106, 0.163205, 0.163305, 0.163404, 0.163503, 0.163603, 0.163702, 0.163801,
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0.164687, 0.164785, 0.164883, 0.164981, 0.165078, 0.165176, 0.165274, 0.165371,
0.165468, 0.165565, 0.165662, 0.16576, 0.165856, 0.165953, 0.16605, 0.166147,
0.166243, 0.166339, 0.166436, 0.166532, 0.166628, 0.166724, 0.16682, 0.166916,
0.167012, 0.167107, 0.167203, 0.167298, 0.167394, 0.167489, 0.167584, 0.167679,
0.167774, 0.167869, 0.167964, 0.168059, 0.168153, 0.168248, 0.168342, 0.168437,
0.168531, 0.168625, 0.168719, 0.168813, 0.168907, 0.169001, 0.169094, 0.169188,
0.169282, 0.169375, 0.169468, 0.169562, 0.169655, 0.169748, 0.169841, 0.169934,
0.170027, 0.170119, 0.170212, 0.170305, 0.170397, 0.170489, 0.170582, 0.170674,
0.170766, 0.170858, 0.17095, 0.171042, 0.171134, 0.171225, 0.171317, 0.171409,
0.1715, 0.171591, 0.171683, 0.171774, 0.171865, 0.171956, 0.172047, 0.172138,
0.172228, 0.172319, 0.17241, 0.1725, 0.172591, 0.172681, 0.172771, 0.172862,
0.172952, 0.173042, 0.173132, 0.173222, 0.173311, 0.173401, 0.173491, 0.17358,
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0.174382, 0.174471, 0.17456, 0.174649, 0.174737, 0.174826, 0.174914, 0.175002,
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0.175793, 0.175881, 0.175968, 0.176056, 0.176143, 0.17623, 0.176317, 0.176404,
0.176491, 0.176578, 0.176665, 0.176752, 0.176838, 0.176925, 0.177012, 0.177098,
0.177184, 0.177271, 0.177357, 0.177443, 0.177529, 0.177615, 0.177701, 0.177787,
0.177873, 0.177959, 0.178044, 0.17813, 0.178215, 0.178301, 0.178386, 0.178472,
0.178557, 0.178642, 0.178727, 0.178812, 0.178897, 0.178982, 0.179067, 0.179151}

```

```
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!**

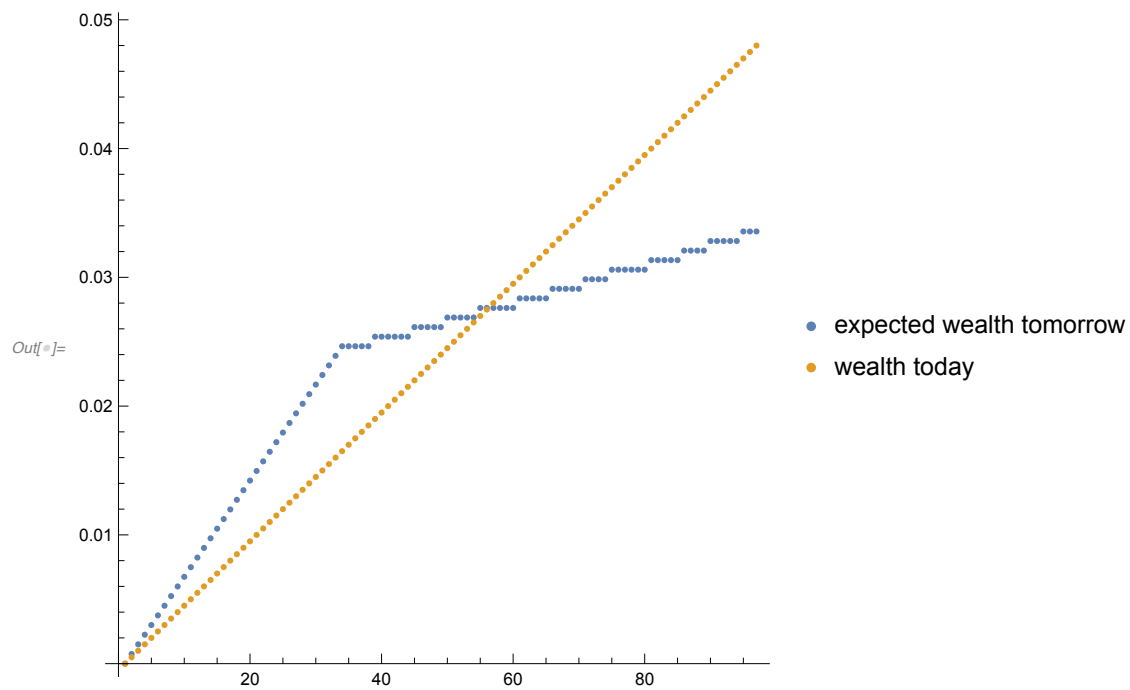
```
ln[*]:= priceupdate = Flatten[
Table[Position[Table[{1 - dl, dl}. {V[wealth[[i]] + b] - b /. If[wealth[[i]] < cbar,
b → Min[cbar - wealth[[i]], dl / (1 - dl)
({(wealth[[IntegerPart[N[R[wealth[[j]] - wealth[[i]]]] / grid] + 2)] -
N[R[wealth[[j]] - wealth[[i]]]) / (wealth[[IntegerPart[
N[R[wealth[[j]]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

[illegible]



```
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`,
 0.02464873993658978`, 0.02464873993658978`, 0.02464873993658978`,
 0.02464873993658978`, 0.02539253651488993`, 0.02539253651488993`,
 0.02539253651488993`, 0.02539253651488993`, 0.02539253651488993`,
 0.02539253651488993`, 0.026136150274802095`, 0.026136150274802095`,
 0.026136150274802095`, 0.026136150274802095`, 0.026136150274802095`,
 0.02687958135106472`, 0.02687958135106472`, 0.02687958135106472`,
 0.02687958135106472`, 0.02687958135106472`, 0.027622829878252375`,
 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`,
 0.03059400118194633`, 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`,
 0.0335622624235028`, 0.0335622624235028`, 0.0335622624235028`};
```

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



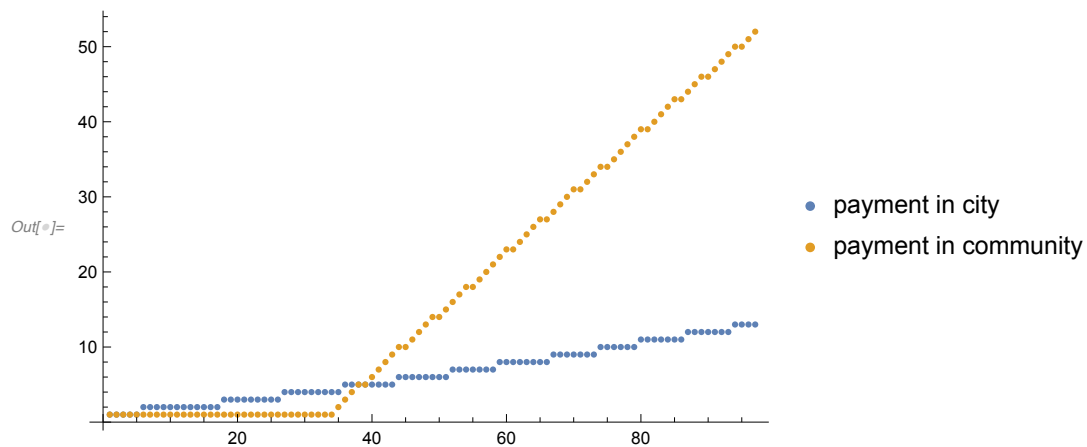
```
In[ ]:= wsel = Length[priceupdate]
```

Out[ ]:= 97

```
In[ ]:= N[Transpose[{wealth[[1 ;; wsel]] / 0.048 + 1.5,
  (wealth[[1 ;; wsel]] - Table[wealth[[consumecity[[i]]]], {i, 1, wsel}]] / 0.048`}]]]
```

```
Out[ ]:= {{1.5, 0.}, {1.51042, 0.0104167}, {1.52083, 0.0208333}, {1.53125, 0.03125},
  {1.54167, 0.0416667}, {1.55208, 0.0416667}, {1.5625, 0.0520833},
  {1.57292, 0.0625}, {1.58333, 0.0729167}, {1.59375, 0.0833333},
  {1.60417, 0.09375}, {1.61458, 0.104167}, {1.625, 0.114583}, {1.63542, 0.125},
  {1.64583, 0.135417}, {1.65625, 0.145833}, {1.66667, 0.15625},
  {1.67708, 0.15625}, {1.6875, 0.166667}, {1.69792, 0.177083}, {1.70833, 0.1875},
  {1.71875, 0.197917}, {1.72917, 0.208333}, {1.73958, 0.21875}, {1.75, 0.229167},
  {1.76042, 0.239583}, {1.77083, 0.239583}, {1.78125, 0.25}, {1.79167, 0.260417},
  {1.80208, 0.270833}, {1.8125, 0.28125}, {1.82292, 0.291667}, {1.83333, 0.302083},
  {1.84375, 0.3125}, {1.85417, 0.322917}, {1.86458, 0.322917}, {1.875, 0.333333},
  {1.88542, 0.34375}, {1.89583, 0.354167}, {1.90625, 0.364583}, {1.91667, 0.375},
  {1.92708, 0.385417}, {1.9375, 0.395833}, {1.94792, 0.395833}, {1.95833, 0.40625},
  {1.96875, 0.416667}, {1.97917, 0.427083}, {1.98958, 0.4375}, {2., 0.447917},
  {2.01042, 0.458333}, {2.02083, 0.46875}, {2.03125, 0.46875}, {2.04167, 0.479167},
  {2.05208, 0.489583}, {2.0625, 0.5}, {2.07292, 0.510417}, {2.08333, 0.520833},
  {2.09375, 0.53125}, {2.10417, 0.53125}, {2.11458, 0.541667}, {2.125, 0.552083},
  {2.13542, 0.5625}, {2.14583, 0.572917}, {2.15625, 0.583333}, {2.16667, 0.59375},
  {2.17708, 0.604167}, {2.1875, 0.604167}, {2.19792, 0.614583}, {2.20833, 0.625},
  {2.21875, 0.635417}, {2.22917, 0.645833}, {2.23958, 0.65625}, {2.25, 0.666667},
  {2.26042, 0.666667}, {2.27083, 0.677083}, {2.28125, 0.6875}, {2.29167, 0.697917},
  {2.30208, 0.708333}, {2.3125, 0.71875}, {2.32292, 0.71875}, {2.33333, 0.729167},
  {2.34375, 0.739583}, {2.35417, 0.75}, {2.36458, 0.760417}, {2.375, 0.770833},
  {2.38542, 0.78125}, {2.39583, 0.78125}, {2.40625, 0.791667}, {2.41667, 0.802083},
  {2.42708, 0.8125}, {2.4375, 0.822917}, {2.44792, 0.833333}, {2.45833, 0.84375},
  {2.46875, 0.84375}, {2.47917, 0.854167}, {2.48958, 0.864583}, {2.5, 0.875}}
```

```
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]]]], dl / (1 - dl)
    ({(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

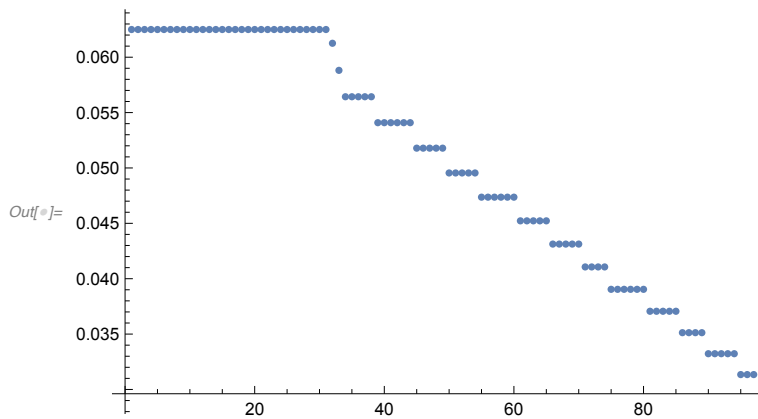
```

$$\text{Out[*]} = \left\{ \frac{1}{16}, \right. \\ \left. \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, 0.0612581, 0.058812, 0.0564292, \right. \\ 0.0564292, 0.0564292, 0.0564292, 0.0564292, 0.0540873, 0.0540873, 0.0540873, \\ 0.0540873, 0.0540873, 0.0540873, 0.0517873, 0.0517873, 0.0517873, 0.0517873, \\ 0.0517873, 0.0495479, 0.0495479, 0.0495479, 0.0495479, 0.0495479, 0.0495479, 0.0473618, \\ 0.0473618, 0.0473618, 0.0473618, 0.0473618, 0.0473618, 0.0452243, 0.0452243, \\ 0.0452243, 0.0452243, 0.0431269, 0.0431269, 0.0431269, 0.0431269, \\ 0.0431269, 0.0410626, 0.0410626, 0.0410626, 0.0410626, 0.0410626, 0.0390412, 0.0390412, \\ 0.0390412, 0.0390412, 0.0390412, 0.0390412, 0.0370602, 0.0370602, 0.0370602, \\ 0.0370602, 0.0370602, 0.0351265, 0.0351265, 0.0351265, 0.0351265, 0.0332281, \\ 0.0332281, 0.0332281, 0.0332281, 0.0332281, 0.0313441, 0.0313441, 0.0313441 \}$$

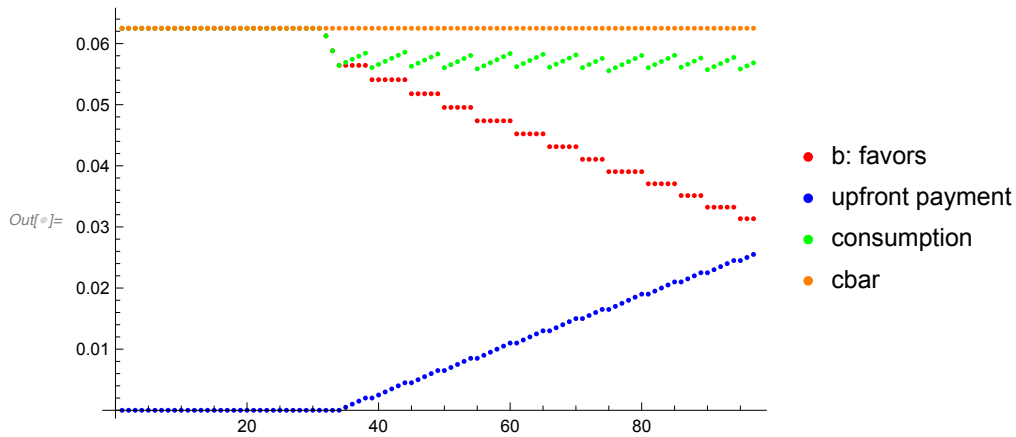
$$\text{Out[*]} = \left\{ 0, \right. \\ 0, 0, 0, 0, \frac{1}{2000}, \frac{1}{1000}, \frac{3}{2000}, \frac{1}{500}, \frac{1}{500}, \frac{1}{400}, \frac{3}{1000}, \frac{7}{2000}, \frac{1}{250}, \frac{9}{2000}, \frac{9}{2000}, \\ \frac{1}{200}, \frac{11}{2000}, \frac{3}{500}, \frac{13}{2000}, \frac{13}{2000}, \frac{7}{1000}, \frac{3}{400}, \frac{1}{125}, \frac{17}{2000}, \frac{17}{2000}, \frac{9}{1000}, \frac{19}{2000}, \frac{1}{100}, \\ \frac{21}{2000}, \frac{11}{1000}, \frac{11}{1000}, \frac{23}{2000}, \frac{3}{250}, \frac{1}{80}, \frac{13}{1000}, \frac{13}{1000}, \frac{27}{2000}, \frac{7}{500}, \frac{29}{2000}, \frac{3}{200}, \frac{3}{200}, \\ \frac{31}{2000}, \frac{2}{125}, \frac{33}{2000}, \frac{33}{2000}, \frac{17}{1000}, \frac{7}{400}, \frac{9}{500}, \frac{37}{2000}, \frac{19}{1000}, \frac{19}{1000}, \frac{39}{2000}, \frac{1}{50}, \frac{41}{2000}, \\ \frac{21}{1000}, \frac{21}{1000}, \frac{43}{2000}, \frac{11}{500}, \frac{9}{400}, \frac{9}{400}, \frac{23}{1000}, \frac{47}{2000}, \frac{3}{125}, \frac{49}{2000}, \frac{49}{2000}, \frac{1}{40}, \frac{51}{2000} \}$$

$$\text{Out[*]} = \left\{ \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \right. \\ \left. \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, \frac{1}{16}, 0.0612581, 0.058812, 0.0564292, \right. \\ 0.0569292, 0.0574292, 0.0579292, 0.0584292, 0.0560873, 0.0565873, 0.0570873, \\ 0.0575873, 0.0580873, 0.0585873, 0.0562873, 0.0567873, 0.0572873, 0.0577873, \\ 0.0582873, 0.0560479, 0.0565479, 0.0570479, 0.0575479, 0.0580479, 0.0558618, \\ 0.0563618, 0.0568618, 0.0573618, 0.0578618, 0.0583618, 0.0562243, 0.0567243, \\ 0.0572243, 0.0577243, 0.0582243, 0.0561269, 0.0566269, 0.0571269, 0.0576269, \\ 0.0581269, 0.0560626, 0.0565626, 0.0570626, 0.0575626, 0.0555412, 0.0560412, \\ 0.0565412, 0.0570412, 0.0575412, 0.0580412, 0.0560602, 0.0565602, 0.0570602, \\ 0.0575602, 0.0580602, 0.0561265, 0.0566265, 0.0571265, 0.0576265, 0.0557281, \\ 0.0562281, 0.0567281, 0.0572281, 0.0577281, 0.0558441, 0.0563441, 0.0568441 \}$$

```
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[ ]:= 56

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

Out[ ]:= 97

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

Out[ ]:= {{0.0275, 0.0276228}}

+++++