graph formating

In[1]:=
```
thinn = AbsoluteThickness[.5];
medum = AbsoluteThickness[1.];
thick = AbsoluteThickness[1.5];
black = GrayLevel[0];
BGray = GrayLevel[0.3];
WGray = GrayLevel[0.6];
LGray = GrayLevel[0.8];
SetOptions[Plot, PlotStyle → {{thinn, Black}, {thinn, Black}, {thinn, Black}},
  PlotPoints → 40, ImageSize → 360,
  FrameStyle -> medum, AxesStyle -> medum,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant → Plain, FontSize → 12}];
SetOptions[ListPlot, AxesStyle -> medum,
  PlotStyle → {{medum, black}}, ImageSize → 384,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
SetOptions[ParametricPlot, PlotStyle →
    {{thinn, Black}, {thinn, Black}, {thinn, Black}}, PlotPoints → 40,
  FrameStyle -> medum, AxesStyle -> medum, PlotStyle → medum,
  BaseStyle -> {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
SetOptions[Graphics, BaseStyle ->
    {FontFamily -> "Helvetica", FontSlant -> "Plain", FontSize → 12}];
```

Figure 10.1

In[12]:=
```
{π1, π2, w1, w2, k} = {72., 45., 2.5, 1., 640.};
π1 > π2
π1 / w1 < π2 / w2
(*Both should be "True" before proceeding*)
```

Out[13]= True

Out[14]= True

In[15]:=
```
p′ = (π1 - π2) / (w1 - w2);
p″ = π2 / w2;
w′ = k * w2;
w″ = k * w1;
(*Define 4 line segments beginning upper left*)
l1 = Line[{{0., p″}, {w′, p″}}];
l2 = Line[{{w′, p″}, {w′, p′}}];
l3 = Line[{{w′, p′}, {w″, p′}}]; l4 = Line[{{w″, p′}, {w″, 0.}}];
```

In[22]:=
```
pl101a = Plot[{}, {w, 0, 1.2 * w″},
    AxesLabel → {"w", "p"},
    PlotRange → {0, 1.2 * p″},
    Ticks → {{0, {w′, "Kw2", {0.00625, 0.}, {black, thinn}}, {w″, "Kw1"}},
      {0, {p′, "p'", {0.00625, 0.}, {black, thinn}}, {p″, "p''"}}}];
```

In[23]:=
```
pl101 = Show[pl101a,
  Graphics[{Dashing[{.01, .01}], thinn, l1}],
  Graphics[{Dashing[{}], thinn, l2}], Graphics[{Dashing[{.01, .01}], thinn, l3}],
  Graphics[{Dashing[{}], thinn, l4}], AspectRatio → 0.4]
```

Out[23]=

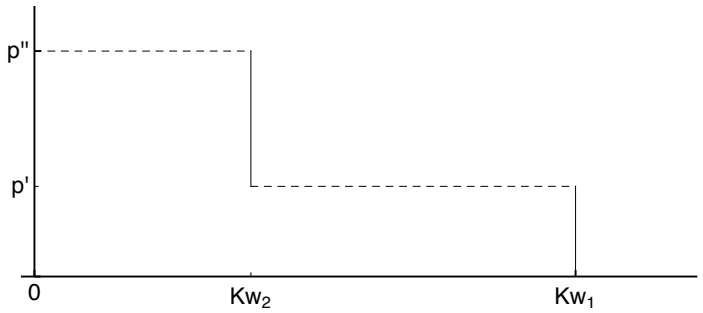
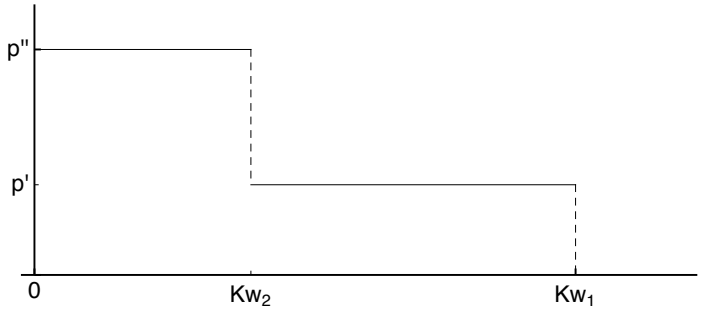


Figure 10.2

In[24]:=
```
pl102a = Plot[{}, {w, 0, 1.2 * w″},
   AxesLabel → {"w", "p"},
   PlotRange → {0, 1.2 * p″},
   Ticks → {{0, {w′, "Kw2", {0.00625, 0.}, {black, thinn}}, {w″, "Kw1"}},
     {0, {p′, "p'", {0.00625, 0.}, {black, thinn}}, {p″, "p''"}}}];
pl102 = Show[pl102a,
  Graphics[{Dashing[{}], thinn, l1}],
  Graphics[{Dashing[{.01, .01}], thinn, l2}], Graphics[{Dashing[{}], thinn, l3}],
  Graphics[{Dashing[{.01, .01}], thinn, l4}], AspectRatio → 0.4]
```

Out[25]=



Linear Programming (&Figure 10.3)

Primal Problem - Priced Water

In[26]:=
```
p = 27.4;
c = {-100., -90., -75., -70., -50., p};
m = {{1.  1.  1.  1.  1.  0.},
     {4.  3.4 2.7 2.6 1.6 -1.},
     {0   0   0   -1.  1.  0.}};
b = {{1000.  -1},
     {0.     0},
     {0.     0}};
ans = LinearProgramming[c, m, b]
profit = -c.ans
```

Out[30]= {0., 0., 0., 500., 500., 2100.}

Out[31]= 2460.

Primal Problem - Water Constraint

In[32]:=
```
ws = 2200.;
c = {-100., -90., -75., -70., -50.};
m = {{1.  1.  1.  1.  1.},
     {4.  3.4 2.7 2.6 1.6},
     {0   0   0   -1.  1.}};
b = {{1000.  -1},
     {ws     -1},
     {0      -1}};
LinearProgramming[c, m, b]
-c.%
```

Out[36]= {0., 0., 166.667, 416.667, 416.667}

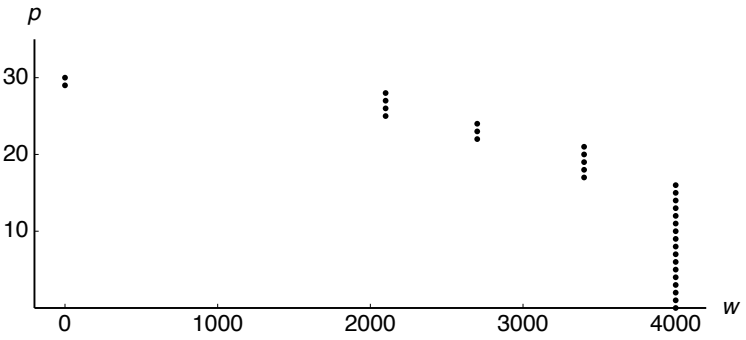
Out[37]= 62 500.

Looping with "Table" command over a Range of Prices to Build the Demand Function

In[38]:=
```
p =.;
c = {-100., -90., -75., -70., -50., p};
m = {{1.  1.  1.  1.  1.  0.},
     {4.  3.4 2.7 2.6 1.6 -1.},
     {0   0   0   -1.  1.  0.}};
b = {{1000.  -1},
     {0.     0},
     {0.     0}};
dpoint[p_] := {Drop[LinearProgramming[c, m, b], 5], p}
allpoints = Table[Flatten[dpoint[p]], {p, 0, 30, 1.}];
```

In[44]:=
```
pl103 = ListPlot[allpoints, AxesLabel → {w, p},
  PlotRange → {{-200, 4200}, {0, 35}},
  AxesOrigin → {-200, 0},
  Ticks → {{{0, 0, {0.00625, 0.}, {black, thinn}},
     {1000, 1000, {0.00625, 0.}, {black, thinn}},
     {2000, 2000, {0.00625, 0.}, {black, thinn}}, {3000, 3000, {0.00625, 0.},
      {black, thinn}}, {4000, 4000, {0.00000, 0.}, {black, thinn}}},
    {{10, 10, {0.00625, 0.}, {black, thinn}}, {20, 20, {0.00625, 0.}, {black, thinn}},
     {30, 30, {0.00625, 0.}, {black, thinn}}}}, AspectRatio → 0.4]
```

Out[44]=



Stat Example (& Figure 10.4)

In[45]:=
```
inc =. ;
c25 =. ;
```

The following command assumes that the file comm30.txt is located in the right place on your hard drive. If you're perplexed about where that is, it's the same place Mathematica export files.

In[47]:=
```
dataWhead = Import["comm30.txt", "table"];
```

In[48]:=
```
TableForm[dataWhead];
```

In[49]:=
```
labels = Take[dataWhead, 1]
```

Out[49]=
```
{{AP, PO, CH, INC, SP, C25, Q}}
```

In[50]:=
```
data = Drop[dataWhead, 1];
```

In[51]:=
```
ŵd = Fit[data, {1, ap, inc, c25}, {ap, po, ch, inc, sp, c25}]
```

Out[51]=
```
32.8149 - 26.6394 ap + 0.0725354 c25 + 9.59015 inc
```

In[52]:=
```
LinearModelFit[data, {1, ap, inc, c25}, {ap, po, ch, inc, sp, c25}]
```

Out[52]=
```
FittedModel[32.8149 - 26.6394 ap + 0.0725354 c25 + 9.59015 inc]
```

In[53]:=
```
averagec25 = 1811.375;
averageInc = 6.03658099;
```

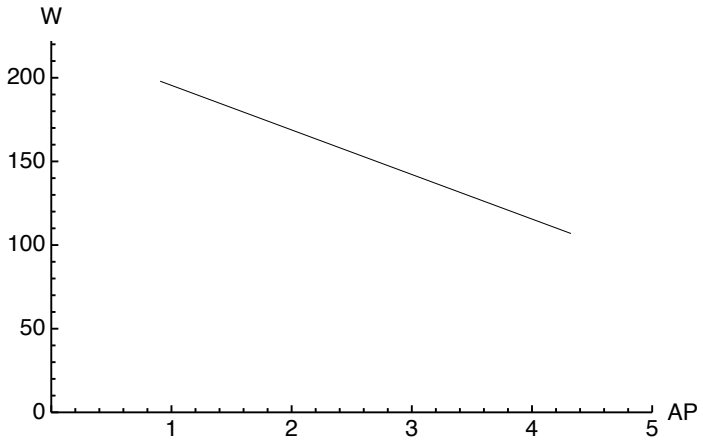
In[55]:=
```
c25 = averagec25;
inc = averageInc;
```

In[57]:=
```
ŵd
```

Out[57]=
```
222.095 - 26.6394 ap
```

In[58]:=
```
Plot[ŵd, {ap, 0.91, 4.32},
 AxesLabel → {"AP", "W"},
 AxesOrigin → {0, 0},
 PlotRange -> {{0, 5}, {0, 222}}]
```

Out[58]=



In[59]:=
```
ŵd /. ap → 0.91
```

Out[59]=
```
197.854
```

In[60]:=
```
ŵd /. ap → 4.32
```

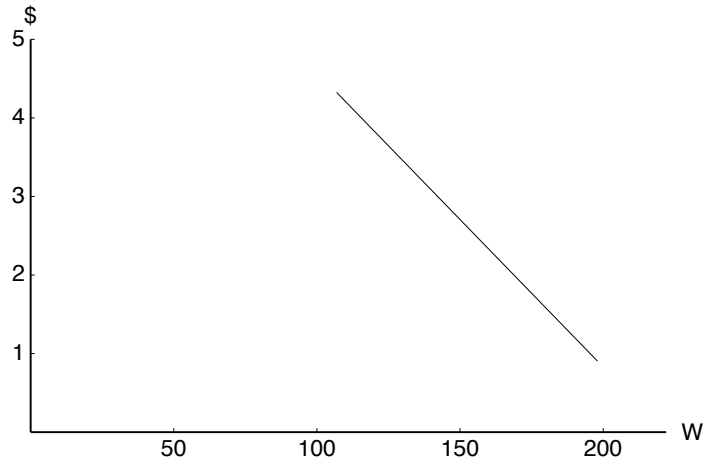
Out[60]=
```
107.013
```

In[61]:=
```
p = ap /. Solve[ŵd == w, ap]
```

Out[61]=
```
{-0.0375384 (-222.095 + 1. w)}
```

In[62]:=
```
pl104a = Plot[p, {w, 107.013, 197.854},
  AxesLabel → {"W", "$"},
  Ticks -> {{{50, 50, {0.00625, 0.}, {black, thinn}},
     {100, 100, {0.00625, 0.}, {black, thinn}}, {150, 150, {0.00625, 0.},
      {black, thinn}}, {200, 200, {0.00625, 0.}, {black, thinn}}},
    {{1, 1, {0.00625, 0.}, {black, thinn}}, {2, 2, {0.00625, 0.}, {black, thinn}},
     {3, 3, {0.00625, 0.}, {black, thinn}}, {4, 4, {0.00625, 0.}, {black, thinn}},
     {5, 5, {0.00625, 0.}, {black, thinn}}}},
  AxesOrigin → {0, 0},
  PlotRange -> {{0, 222}, {0, 5.0}}]
```

Out[62]=



In[63]:=
```
pl104 = Show[pl104a,
  Graphics[Text["MB(W)", {162., 3.}]],
  AspectRatio → 0.4
]
```

Out[63]=

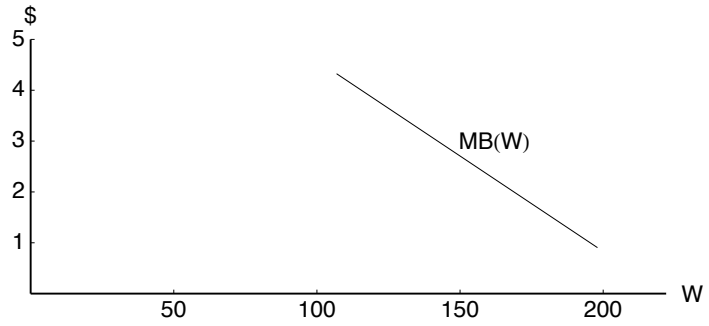


Figure 10.5

In[64]:=
```
pl105a = Plot[{-.002 * x + .1 / x^.4}, {x, 0, 15},
     PlotRange → {0, .1},
   AxesOrigin → {0, 0},
    AxesLabel → {"X", "$"},
    Ticks → {{{7, "x0"}, {10, "x1"}}, {}}
   ];
pl105 = Show[pl105a,
  Graphics[Text["MB(X)", {4.5, 0.06}]],
  Graphics[Text["A", {3.4, 0.025}]],
  Graphics[Text["B", {8.4, 0.014}]],
  Graphics[{Dashing[{.01, .01}],
    {Line[{{10, 0}, {10, 0.0198107}}], Line[{{7, 0}, {7, 0.0319157}}]}}],
  AspectRatio →
   0.4]
```

Out[65]=

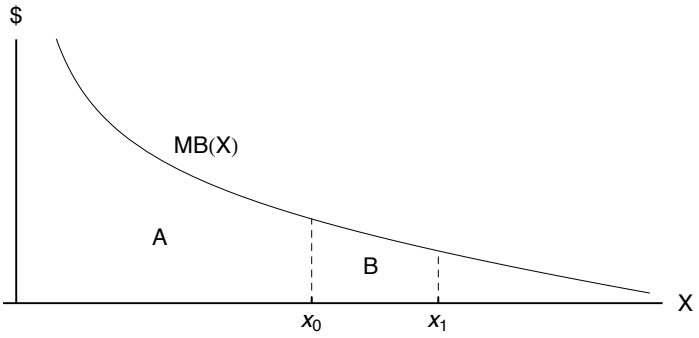


Figure 10.6

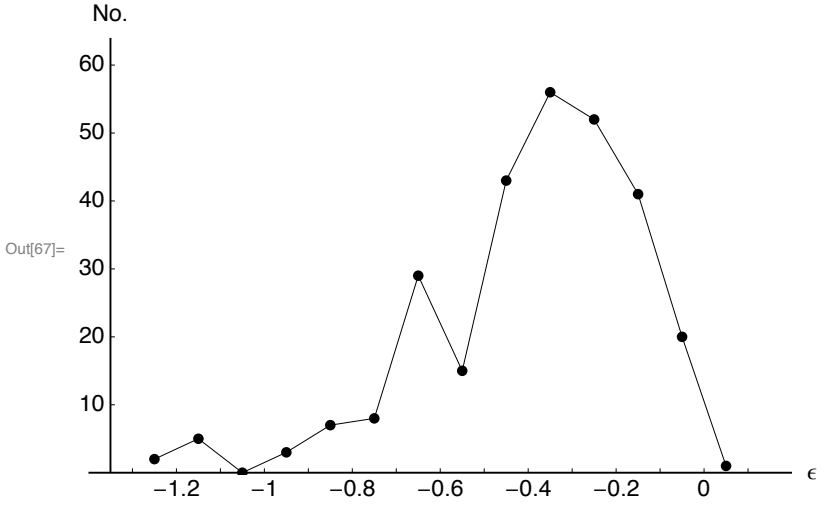
Dalhusien Data

In[66]:=
```
PEdata =
   {{-1.25, 2 },
{-1.15, 5 },
{-1.05, 0 },
{-0.95, 3 },
{-0.85, 7 },
{-0.75, 8 },
{-0.65, 29},
{-0.55, 15},
{-0.45, 43},
{-0.35, 56},
{-0.25, 52},
{-0.15, 41},
{-0.05, 20},
{+0.05, 1 }};
```

Plotting

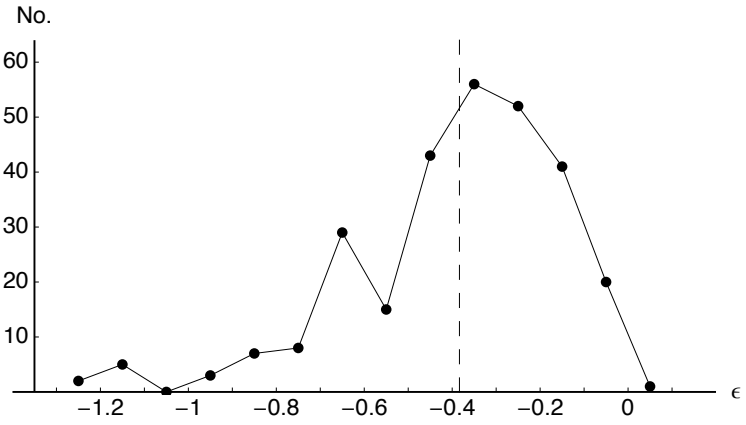
In[67]:=
```
pl106a =
 ListPlot[PEdata, AxesOrigin → {-1.35`, 0}, PlotRange → {{-1.4`, 0.2`}, {0, 64}},
  AxesLabel → {"ϵ", "No."}, PlotStyle → {thinn, black, PointSize[0.015]},
  Ticks → {{{-1.3`, "", {0.00625`, 0.`}, {black, thinn}}, {-1.2`, "-1.2",
       {0.00625`, 0.`}, {black, thinn}}, {-1.1`, "", {0.00625`, 0.`}, {black, thinn}},
     {-1.`, "-1", {0.00625`, 0.`}, {black, thinn}}, {-0.9`, "", {0.00625`, 0.`},
      {black, thinn}}, {-0.8`, "-0.8", {0.00625`, 0.`}, {black, thinn}},
     {-0.7`, "", {0.00625`, 0.`}, {black, thinn}}, {-0.6`, "-0.6", {0.00625`, 0.`},
      {black, thinn}}, {-0.5`, "", {0.00625`, 0.`}, {black, thinn}},
     {-0.4`, "-0.4", {0.00625`, 0.`}, {black, thinn}}, {-0.3`, "", {0.00625`, 0.`},
      {black, thinn}}, {-0.2`, "-0.2", {0.00625`, 0.`}, {black, thinn}},
     {-0.1`, "", {0.00625`, 0.`}, {black, thinn}}, {0.`, "0", {0.00625`, 0.`},
      {black, thinn}}, {0.1`, "", {0.00625`, 0.`}, {black, thinn}}},
    {{10, "10", {0.00625`, 0.`}, {black, thinn}}, {20, "20", {0.00625`, 0.`},
      {black, thinn}}, {30, "30", {0.00625`, 0.`}, {black, thinn}}, {40, "40",
      {0.00625`, 0.`}, {black, thinn}}, {50, "50", {0.00625`, 0.`}, {black, thinn}},
     {60, "60", {0.00625`, 0.`}, {black, thinn}}}}, Joined → True, Mesh → Full]
```

Out[67]=



In[68]:=
```
pl106 = Show[pl106a,
  Graphics[{Dashing[{.02, .02}], thinn,
    Line[{{-0.3835, 0}, {-0.3835, 65}}]
   }], AspectRatio → 0.5]
```

Out[68]=



Appendix A (&Figure 10A.1)

for numeric example

In[69]:=
```
tv = 12 000.;
ϵ = -1.;
Δw = 1500.;
w* = 15 000.;
```

In[73]:=
```
averageb = tv / Δw
```

Out[73]=
```
8.
```

In[74]:=
```
b = (2. * tv) / ((w*) ^ 2. - 2. * ϵ * w* * Δw)
```

Out[74]=
```
0.0000888889
```

In[75]:=
```
a = b * w* * (1 - ϵ)
```

Out[75]=
```
2.66667
```

In[76]:=
```
mb = -b * w* + a
```

Out[76]=
```
1.33333
```

for numeric example if functional form is constant elasticity and ϵ is not -1

In[77]:=
```
tv = 12 000.;
ϵ = -0.5;
Δw = 1500.;
w* = 15 000.;
```

In[81]:=
```
averageb = tv / Δw
```

Out[81]=
```
8.
```

In[82]:=
$$k = \left(\left(\frac{\epsilon}{(1+\epsilon) * tv}\right) * \left(w^{*\frac{1.+\epsilon}{\epsilon}} - (w^* - \Delta w)^{\frac{1.+\epsilon}{\epsilon}}\right)\right)^{\epsilon}$$

Out[82]= 40 249.2

In[83]:=
$$mb = \left(\frac{w^*}{k}\right)^{\frac{1}{\epsilon}}$$

Out[83]= 7.2

for numeric example if functional form is constant elasticity and ϵ=-1

In[84]:=
```
tv = 12 000.;
ϵ = -1.;
Δw = 1500.;
w* = 15 000.;
```

In[88]:=
```
averageb = tv / Δw
```

Out[88]= 8.

In[89]:=
```
k = tv / Log[w* / (w* - Δw)]
```

Out[89]= 113 895.

In[90]:=
$$mb = \frac{k}{w^*}$$

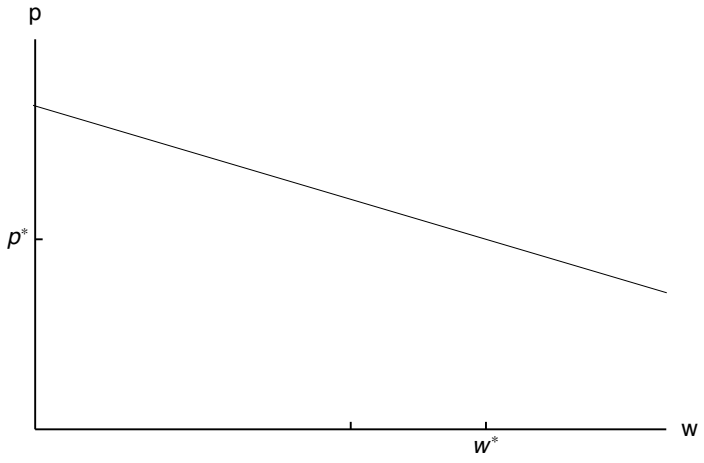
Out[90]= 7.59298

for graph

In[91]:=
```
w = .;
mb2 = -0.0000888889 * w + 2.66667;
```

In[93]:=
```
pl10A1a = Plot[mb2, {w, 0, 17 000},
  AxesOrigin → {10 000, 0.7},
  AxesLabel → {"w", "p"},
  PlotRange → {{10 000, 17 000}, {0.7, 2}}, PlotStyle → {thinn, Black},
  Ticks → {{{13 500, ""}, {15 000, "w*"}}, {{1.33333, "p*"}}}]
```

Out[93]=



In[94]:=
```
pl10A1 = Show[pl10A1a,
  Graphics[Text["Δw", {14 250, 0.77}]],
  Graphics[Text["MB(w)", {15 950, 1.35}]],
  Graphics[{Arrowheads[.03], Arrow[{{14 000, 0.77}, {13 550., 0.77}}]}],
  Graphics[{Arrowheads[.03], Arrow[{{14 500, 0.77}, {14 950, 0.77}}]}],
  Graphics[{Dashing[{.015, .02}], thinn, Line[{{15 000, 0.7}, {15 000, 1.3333}}],
    Line[{{13 500, 0.7}, {13 500, 1.471}}],
    Line[{{10 000, 1.33333}, {15 000, 1.3333}}]
   }], AspectRatio → 0.4
]
```

Out[94]=