

Chapter 6

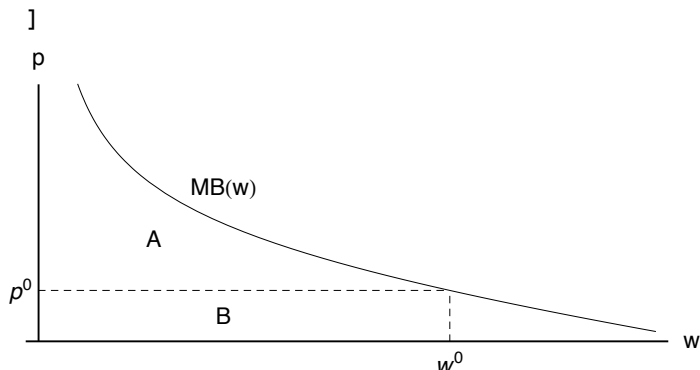
```
thinn = AbsoluteThickness[.5];
medum = AbsoluteThickness[1.];
thick = AbsoluteThickness[1.5];
black = GrayLevel[0];
BGray = GrayLevel[0.3];
WGray = GrayLevel[0.6];
LGray = GrayLevel[0.8];
SetOptions[Plot, PlotStyle -> {{thinn, Black}, {thinn, Black}, {thinn, Black}},
  PlotPoints -> 40, ImageSize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

6.1 Initial Demand

```
(-.002 * w + .1 / w^.4) /. w -> 10
```

```
0.0198107
```

```
pl61a = Plot[{- .002 * w + .1 / w^.4}, {w, 0, 15},
  PlotRange -> {0, 0.1},
  AxesOrigin -> {0, 0},
  AxesLabel -> {"w", "p"},
  Ticks -> {{{10, "w0", 0}}, {{0.0198107, "p0", 0}}},
  ImageSize -> 360, AspectRatio -> 0.4];
pl61 = Show[pl61a,
  Graphics[Text["MB(w)", {4.5, 0.06}]],
  Graphics[Text["A", {2.8, 0.04}]],
  Graphics[Text["B", {4.5, 0.01}]],
  Graphics[{Dashing[ {.01, .01}],
  {Line[{{10, 0}, {10, 0.0198107}], Line[{{0, 0.0198107}, {10, 0.0198107}]}}]}]]
```

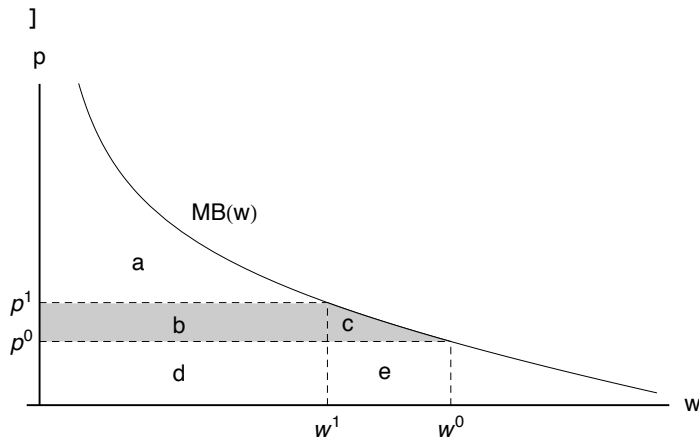


6.2 Price rationing

```
(-.002 * w + .1 / w^.4) /. w -> 7
```

```
0.0319157
```

```
pl62b = Plot[{- .002 * w + .1 / w^.4}, {w, 0, 15},
  PlotRange -> {0, .1},
  AxesOrigin -> {0, 0},
  AxesLabel -> {"w", "p"},
  Ticks ->
  {{{7, "w1", 0}, {10, "w0", 0}}, {{0.0198107, "p0", 0}, {0.0319157, "p1", 0}}},
  ImageSize -> 360, AspectRatio -> 0.5
];
pl62bb = Plot[{- .002 * w + .1 / w^.4}, {w, 7, 10},
  PlotRange -> {0, .1},
  AxesOrigin -> {0, 0},
  AxesLabel -> {"", ""},
  Filling -> .0198107, FillingStyle -> LGray
];
pl62bbb = Plot[{0.0315}], {w, 0, 7},
  PlotRange -> {0, .1},
  AxesOrigin -> {0, 0},
  AxesLabel -> {"", ""},
  PlotStyle -> LGray,
  Filling -> .0198107, FillingStyle -> LGray
];
pl62 = Show[pl62b, pl62bb, pl62bbb,
  Graphics[Text["MB(w)", {4.5, 0.06}]],
  Graphics[Text["a", {2.4, 0.044}]],
  Graphics[Text["b", {3.4, 0.025}]],
  Graphics[Text["c", {7.5, 0.025}]],
  Graphics[Text["d", {3.4, 0.01}]],
  Graphics[Text["e", {8.4, 0.01}]],
  Graphics[{Dashing[{.01, .01}],
    {Line[{{10, 0}, {10, 0.0198107}], Line[{{7, 0}, {7, 0.0319157}], Line[
      {{0, 0.0198107}, {10, 0.0198107}], Line[{{0, 0.0319157}, {7, 0.0319157}]]}}]}]
```

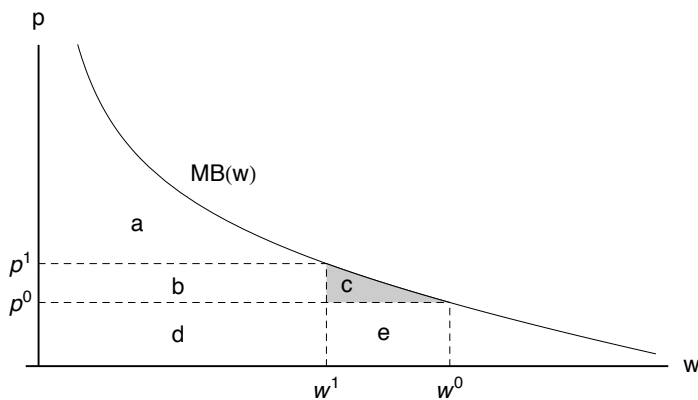


6.3 Quantity rationing

```

pl63 = Show[pl62b, pl62bb,
Graphics[Text["MB(w)", {4.5, 0.06}]],
Graphics[Text["a", {2.4, 0.044}]],
Graphics[Text["b", {3.4, 0.025}]],
Graphics[Text["c", {7.5, 0.025}]],
Graphics[Text["d", {3.4, 0.01}]],
Graphics[Text["e", {8.4, 0.01}]],
Graphics[{Dashing[{.01, .01}],
{Line[{{10, 0}, {10, 0.0198107}}], Line[{{7, 0}, {7, 0.0319157}}], Line[
{{0, 0.0198107}, {10, 0.0198107}}], Line[{{0, 0.0319157}, {7, 0.0319157}}]}]}]
]

```



6.4, 6.5 Demand-shifting policy

Cost and Demand Parameters (taken from Figure 2.8)

```

p = . ;
TC = 2500 + 1.95 * w + 0.00015 * w^2 . ;
AC = TC / w ;
MC = ∂w TC ;
q0 = 35 000 . ;
p0 = 3 . ;
elast = -0.5 ;
c0 = q0 / p0^elast ;
wlog0 = c0 * p^elast ;
plog0 = p /. Flatten[Simplify[Solve[w == %, p]]] ;
q1 = 45 000 . ;
c1 = q1 / p0^elast ;
wlog1 = c1 * p^elast ;
plog1 = p /. Flatten[Simplify[Solve[w == %, p]]] ;

```

Solve::ifun : Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information. >>

Solve::ifun : Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information. >>

Where are intersections?

Solve[AC == plog0, w]

$\{\{w \rightarrow -19065.3 - 24727. i\}, \{w \rightarrow -19065.3 + 24727. i\}, \{w \rightarrow 25130.6\}\}$

AC /. w → 25130.556517100762`

5.81906

Solve[AC == plog1, w]

$\{\{w \rightarrow -21683.9 - 29384.7 i\}, \{w \rightarrow -21683.9 + 29384.7 i\}, \{w \rightarrow 30367.8\}\}$

AC /. w → 30367.783970908364`

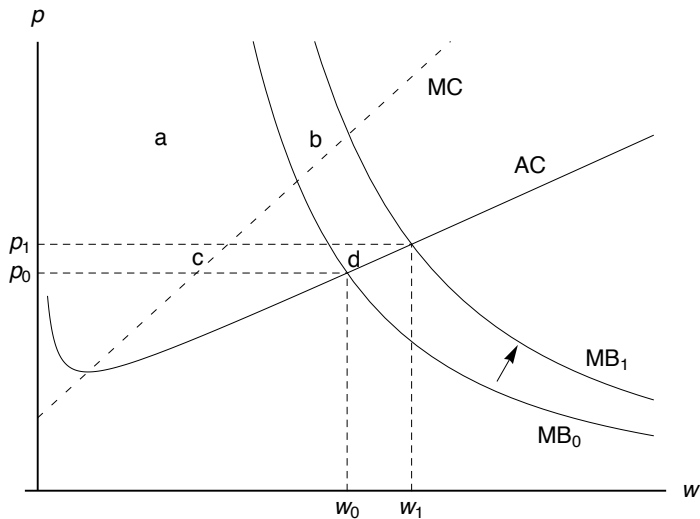
6.58749

Plots

```

pl64i = Plot[{MC, plog0, plog1}, {w, 0, q0 * 50 / 35},
  AxesLabel → {w, p},
  Ticks →
    {{25 130.6, "w0", 0}, {30 367.8, "w1", 0}}, {{5.819, "p0", 0}, {6.5875, "p1", 0}},
  PlotStyle → {{Dashing[{0.01, 0.02}], thinn, Black},
    {thinn, Black}, {thinn, Black}},
  PlotRange → {0, 12},
  ImageSize → 360, AspectRatio → 0.7
];
pl64ii = Plot[{AC}, {w, 800, q0 * 50 / 35},
  AxesLabel → {w, p},
  PlotRange → {0, 12}];
pl64 = Show[pl64i, pl64ii,
  Graphics[Text["a", {10 000, 9.4}]],
  Graphics[Text["b", {22 600, 9.4}]],
  Graphics[Text["c", {13 000, 6.2}]],
  Graphics[Text["d", {25 700, 6.2}]],
  Graphics[Text["MB0", {42 400, 1.5}]],
  Graphics[Text["MB1", {46 300, 3.55}]],
  Graphics[Text["AC", {40 000, 8.7}]],
  Graphics[Text["MC", {33 100, 10.8}]],
  Graphics[{Arrowheads[0.03], Arrow[{{37 300., 2.92}, {39 000., 3.9}}]}],
  Graphics[{Dashing[.01, .01], thinn, Line[{{25 130.6, 0}, {25 130.6, 5.819}}]},
    Line[{{0, 5.819}, {25 130.6, 5.819}}]},
    Line[{{30 367.8, 0}, {30 367.8, 6.5875}}]},
    Line[{{0, 6.5875}, {30 367.8, 6.5875}}]}]]]

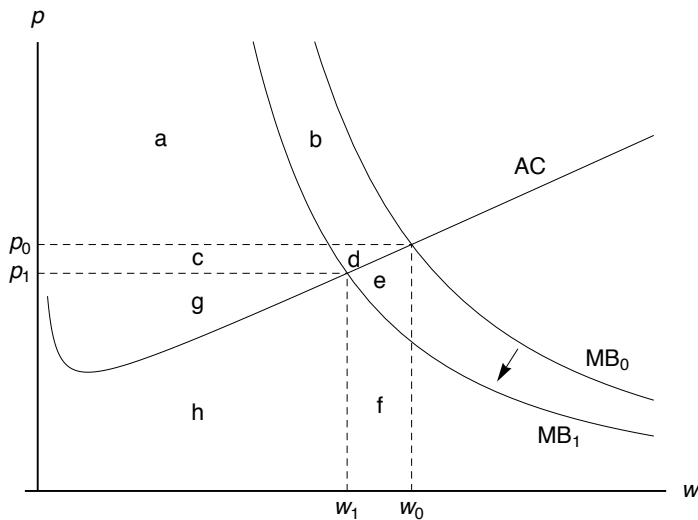
```



```

p165i = Plot[{plog0, plog1}, {w, 0, q0 * 50 / 35},
  AxesLabel → {w, p},
  Ticks →
    {{25 130.6, "w1", 0}, {30 367.8, "w0", 0}}, {{5.819, "p1", 0}, {6.5875, "p0", 0}},
  PlotStyle → {{thinn, Black}, {thinn, Black}},
  PlotRange → {0, 12},
  ImageSize → 360, AspectRatio → 0.7
];
p165ii = Plot[{AC}, {w, 800, q0 * 50 / 35},
  AxesLabel → {w, p},
  PlotRange → {0, 12}];
p165 = Show[p165i, p165ii,
  Graphics[Text["a", {10 000, 9.4}]],
  Graphics[Text["b", {22 600, 9.4}]],
  Graphics[Text["c", {13 000, 6.2}]],
  Graphics[Text["d", {25 700, 6.2}]],
  Graphics[Text["e", {27 800, 5.6}]],
  Graphics[Text["f", {27 800, 2.3}]],
  Graphics[Text["g", {13 000, 5.0}]],
  Graphics[Text["h", {13 000, 2.1}]],
  Graphics[Text["MB1", {42 400, 1.5}]],
  Graphics[Text["MB0", {46 300, 3.55}]],
  Graphics[Text["AC", {40 000, 8.7}]],
  Graphics[{Arrowheads[0.03], Arrow[{{39 000., 3.8}, {37 300., 2.92}}]}],
  Graphics[{Dashing[.01, .01], thinn, Line[{{25 130.6, 0}, {25 130.6, 5.819}}],
    Line[{{0, 5.819}, {25 130.6, 5.819}}],
    Line[{{30 367.8, 0}, {30 367.8, 6.5875}}],
    Line[{{0, 6.5875}, {30 367.8, 6.5875}}]}]]

```



6.6 Supply-shifting policy

Cost and Demand Parameters (taken from 5.4)

$$TC0 = 2500 + 1.95 * w + 0.00015 * w^2 . ;$$

$$AC0 = TC0 / w ;$$

$$TC1 = 3000 + 1.35 * w + 0.00013 * w^2 . ;$$

$$AC1 = TC1 / w ;$$

Where are intersections?

Solve[AC0 == plog1, w]

$\{\{w \rightarrow -21\,683.9 - 29\,384.7\,i\}, \{w \rightarrow -21\,683.9 + 29\,384.7\,i\}, \{w \rightarrow 30\,367.8\}\}$

AC0 /. w → 30 367.783970908364

6.58749

Solve[AC1 == plog1, w]

$\{\{w \rightarrow -21\,530.3 - 31\,089.7\,i\}, \{w \rightarrow -21\,530.3 + 31\,089.7\,i\}, \{w \rightarrow 32\,676.\}\}$

AC1 /. w → 32 675.996262814984

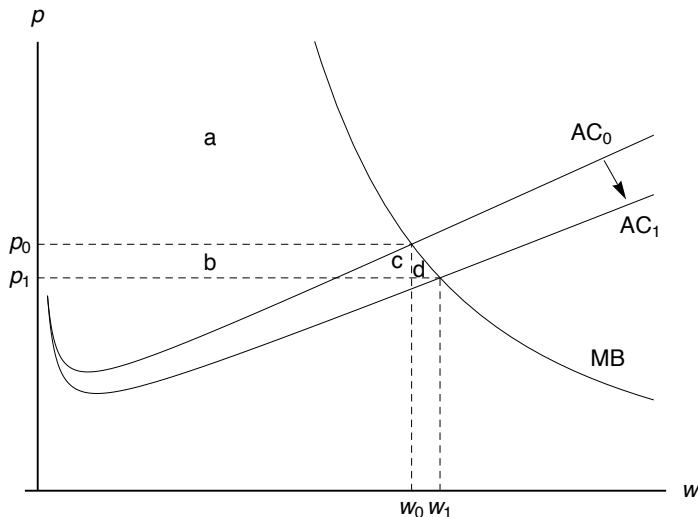
5.68969

Plots

```
pl66i = Plot[{plog1}, {w, 0, q0 * 50 / 35},
  AxesLabel → {w, p},
  Ticks →
    {{30367.8, "w0", 0}, {32676., "w1", 0}}, {{6.5875, "p0", 0}, {5.6897, "p1", 0}},
  PlotRange → {0, 12},
  ImageSize → 360, AspectRatio → 0.7
];
```

```
pl66ii = Plot[{AC0, AC1}, {w, 800, q0 * 50 / 35},
  AxesLabel → {w, p},
  Ticks → None,
  PlotRange → {0, 12}];
```

```
pl66 = Show[pl66i, pl66ii,
  Graphics[Text["a", {14000, 9.4}]],
  Graphics[Text["b", {14000, 6.12}]],
  Graphics[Text["c", {29200, 6.12}]],
  Graphics[Text["d", {31000, 5.94}]],
  Graphics[Text["MB", {46300, 3.55}]],
  Graphics[Text["AC0", {45000, 9.6}]],
  Graphics[Text["AC1", {49000, 7.1}]],
  Graphics[{Arrowheads[0.03], Arrow[{{46000., 8.83}, {47800, 7.78}}]}],
  Graphics[{Dashing[.01, .01], thinn, Line[{{32676., 0}, {32676., 5.6897}}],
    Line[{{0, 5.6897}, {32676., 5.6897}}],
    Line[{{30367.8, 0}, {30367.8, 6.5875}}],
    Line[{{0, 6.5875}, {30367.8, 6.5875}}]}]]]
```



6.7 Supply-shifting policy

Cost and Demand Parameters (taken from 5.4)

$$TC = 2500 + 2 * w + 0.00015 * w^2 ;$$

$$AC = TC / w ;$$

Where are intersections?

Solve[AC == plog1, w]

{ {w → -21 807.7 - 29 357.3 i}, {w → -21 807.7 + 29 357.3 i}, {w → 30 282.} }

AC /. w → 30 282.01680869621

6.62486

AC /. w → 27 500

6.21591

wlog1 /. p → 6.21591

31 262.3

AC /. w → 32 500

6.95192

plog1 /. w → 27 500

8.03306

Plots

```

p167i = Plot[{plog1}, {w, 0, q0 * 50 / 35},
  AxesLabel → {w, p},
  Ticks →
    {{27 500., "w0", 0}, {30 282.0, "w1", 0}}, {{8.033, "p0", 0}, {6.6248, "p1", 0}},
  PlotRange → {0, 12},
  ImageSize → 360, AspectRatio → 0.7
];
p167ii = Plot[{AC}, {w, 800, 27 500},
  AxesLabel → {w, p},
  PlotRange → {0, 12},
  Ticks → None];
p167iii = Plot[{AC}, {w, 27 900, 32 500},
  AxesLabel → {w, p},
  PlotStyle → {{Dashing[{0.01, 0.01}], thinn, Black}},
  PlotRange → {0, 12},
  Ticks → None];
p167 = Show[p167i, p167ii, p167iii,
  Graphics[Text["a", {13 500, 10.4}]],
  Graphics[Text["b", {13 500, 7.3}]],
  Graphics[Text["c", {13 500, 6.45}]],
  Graphics[Text["d", {28 200, 7.0}]],
  Graphics[Text["MB", {46 300, 3.55}]],
  Graphics[Text["AC0", {27 500, 11.7}]],
  Graphics[Text["AC1", {32 500, 11.7}]],
  Graphics[{Arrowheads[0.03], Arrow[{{27 900., 10.4}, {31 900, 10.4}}]}],
  Graphics[{Dashing[{.01, .01}], thinn, Line[{{27 500., 6.216}, {27 500., 11.}}]},
    Line[{{32 500., 6.952}, {32 500., 11.}}]}],
  Graphics[{Dashing[{.01, .01}], thinn, Line[{{31 262.29, 0}, {31 262.29, 6.216}}]},
    Line[{{0, 6.216}, {31 262.29, 6.216}}]},
    Line[{{30 282.0, 0}, {30 282.0, 6.6248}}]},
    Line[{{0, 6.6248}, {30 282.0, 6.6248}}]},
    Line[{{27 500., 0}, {27 500., 8.033}}]}, Line[{{0, 8.033}, {27 500., 8.033}}]}]]

```

