Cost Curves

- Average Costs
- Marginal Costs
- Long run and Short Run
In our example, the \textbf{short-run} cost function was:

\[
c(y) = \left[ \frac{70}{(3,000)^{-\frac{1}{3}}} \right] y^{\frac{5}{3}} + 3,000
\]

Variable costs \( c_v(y) \)  \hspace{1cm} Fixed costs \( F \)
Cost Curve

c(y), c_v(y), F

3,000

0

y

F
The short run average cost function:

\[ AC(y) = \frac{c(y)}{y} = \left[ \frac{70}{(3,000)^{\frac{1}{3}}} \right] y^{\frac{2}{3}} + \frac{3,000}{y} \]

Average variable cost \( AVC(y) \)

Average fixed cost \( AFC(y) \)
Average Fixed Cost Curve

\[ AFC(y) = \frac{3,000}{y} \]
Average Variable Cost Curve

\[ AVC(y) = \left[ \frac{70}{(3000)^{\frac{1}{3}}} \right] y^2 \]

\[ AVC(y) \]

0

\[ y \]
Why is AVC Increasing in y?

- Production function and AVC:

\[ y = (3,000)^{0.2} (x_l)^{0.6} \rightarrow AVC(y) = \left[ \frac{70}{(3000)^{\frac{1}{3}}} \right] y^{\frac{1}{0.6} - 1} \]

- Productions function features decreasing returns to scale wrt \( x_l \)
Average Cost Curve

\[ AC(y) = \left( \frac{70}{(3000)^{\frac{1}{3}}} \right) y^2 + \frac{3,000}{y} \]
Marginal Cost Function

The short run cost function:

\[ MC(y) = \frac{\partial c(y)}{\partial y} = \frac{\partial c_v(y)}{\partial y} \]

The short run marginal cost function:

\[ MC(y) = \frac{5}{3} \left[ \frac{70}{(3,000)^{\frac{1}{3}}} \right] y^{\frac{2}{3}} \]
Marginal and Average Variable Cost Curves

\[ MC(y) = \frac{5}{3} \left[ \frac{70}{(3,000)^{\frac{1}{3}}} \right] y^{\frac{2}{3}} \]

\[ AVC(y) = \left[ \frac{70}{(3000)^{\frac{1}{3}}} \right] y^{\frac{2}{3}} \]
Marginal and Average Cost Curves
Variable Costs and the Marginal Cost Curve

\[ MC(y) = \frac{5}{3} \left[ \frac{70}{(3,000)^{\frac{1}{3}}} \right] y^{\frac{2}{3}} \]
Long Run

- In the long run there are **no fixed factors of production**

- Firm can freely adjust inputs

- Production costs are **lower** in the long run
Long and Short Run Cost Curves

$c^S(y), c^L(y)$
Long and Short Run Average Cost Curves

\[ AC_S(y) \]

\[ AC_L(y) \]
Long and Short Run Marginal Cost Curves

$MC_{S}(y)$

$MC_{L}(y)$
Long and Short Run Cost Functions

\[
c^L(y) = 70 \left( \frac{3}{70} \right)^{\frac{1}{4}} \frac{4}{3} y^{\frac{5}{4}}
\]

\[
c^S(y) = 70 \left[ \frac{1}{(3,000)^{\frac{1}{3}}} \right] y^{\frac{5}{3}} + 3,000
\]