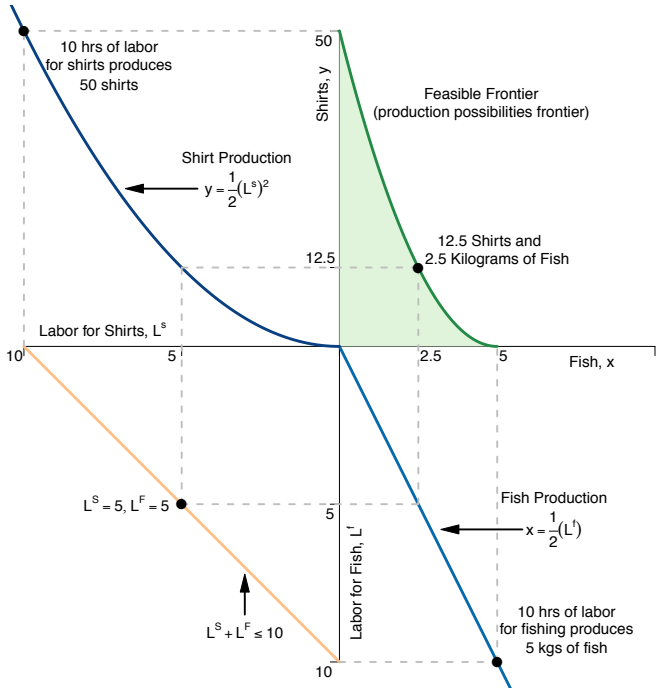

Figure 7.7: The four-quadrant graph shows a ppf with economies of scale in production in the top-right quadrant. The economies of scale depicted in the ppf arise from a relationship in the production technologies from the two different sectors: fishing (bottom right quadrant) and textile manufacturing (top-left quadrant). A worker is constrained by how much of their labor time they can dedicate to either producing fish or producing shirts. Their labor constraint is depicted in the bottom-left quadrant.

for a unit of food, that is, the *relative price* of food in terms of clothing.

If Alex has no one to exchange with, either because institutions to facilitate exchange do not exist or because he is effectively isolated economically by prohibitively high transport costs, he has no choice but to produce both food and clothing, whether there are economies or diseconomies of scale. This situation is represented in Figure 7.6 and 7.8 by the points marked **d** representing the best Alex can do in terms of his indifference curves and the ppf he faces without exchange. To consider what he is able to do with his time and productive capacities, Alex must think about the opportunity costs of one good in terms of the other. He can measure the opportunity costs using the *marginal rate of transformation*. The slope of the ppf at any point is the *marginal rate of transformation* or $mrt(x, y)$ between the two goods. It represents the amount of one good (clothing) Alex has to give up to get a unit of the other good (food).

In contrast with the production with diseconomies of scale captures in Figure 7.6, let us consider the four-quadrant Figure 7.7, which will help us to understand how a feasible frontier can capture the idea of economies of scale. Alex needs to make a choice between three different ways to allocate his time in production to two types of output (fish and shirts).

REMINDER We used exactly the same idea with feasible frontiers in chapters 3 and 4.

MARGINAL RATE OF TRANSFORMATION (MRT) The marginal rate of transformation is the ratio of the reduction of the output of the good plotted on the vertical axis required to increase the output of the good plotted on the horizontal axis by one unit. It is measured by the slope of the tangent to the ppf at any point.