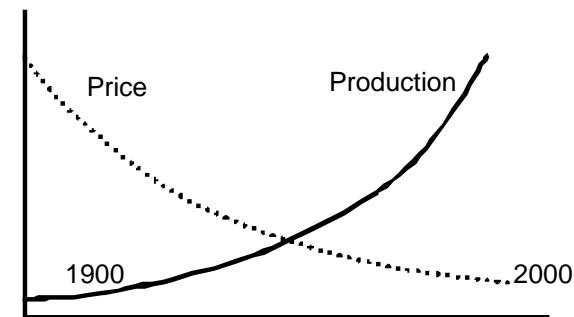


FIGURE 2-3 Generic Commodity Behavior



## Driving Forces

### ***Reinvestment, Efficiency Increases, and Demand Increases Drive the Growth of Production***

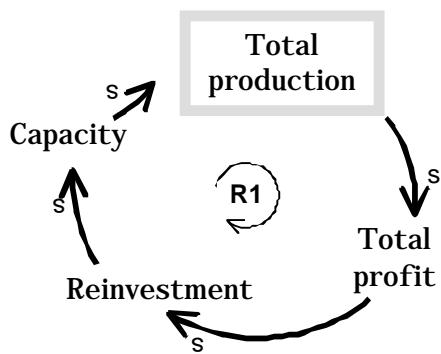
The trend toward higher and higher production and the trend toward lower and lower prices per unit of commodity are not merely coincidental. These two behaviors of commodity systems are linked together in a network of mutual cause and effect made up of three feedback loops, each of which causes growth in commodity production.

These three key driving forces (loops) are:

1. The Capital Growth Loop
2. The Efficiency Boosting Loop
3. The Demand Growth Loop

**.... lets look at each closely.**

FIGURE 2-4 Capital Growth Loop



**Loop R1:** As *Total production* rises, *Total profits* rise too. *Reinvestment* in productive *Capacity* follows, boosting *Total production* yet again. The "R" stands for a "reinforcing" loop.

### READING A CAUSAL LOOP DIAGRAM

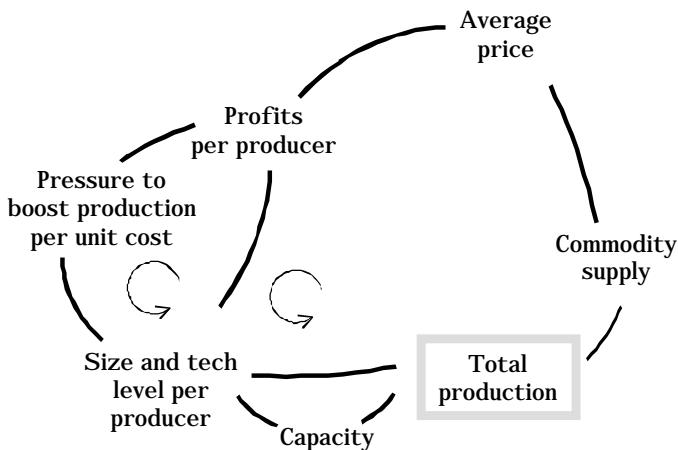
Figure 2-4 is the first of many "causal diagrams" in this paper. In such diagrams, each of the arrows represents a causal connection. Increasing total production, everything else being constant in the system, will lead to an increase in total profit. The "s" at the arrow indicates that the change in total production is in the "same" direction as the change in total profit. More production, more profit. (In later diagrams, an "o" at the arrow will indicate change in the "opposite" direction.) More profits typically lead to more reinvestment in the system, leading to higher total production. This creates a cycle of growth called a reinforcing loop.

The first feedback loop, shown in Figure 2-4, is the process by which productive capacity leads to the creation of more productive capacity. This Capital Growth Loop is the core driving force of industrial expansion. Production creates profits, some of which are reinvested in new capital equipment —sawmills, tractors, fishing boats — which is then used to increase total production. In this growth process production leads to more capacity for production.

Rising industry-wide production means that the commodity supply available on the market can exceed demand and push the average price down (right hand side of Figure 2-5). Falling prices mean lower profits per producer, all else being equal. In times of falling profits, the two options available to individual producers trying to maintain profits are to reduce costs and to expand production volume (loop B1 in Figure 2-5). Often, the route to cutting costs on a per unit basis is to expand the size of the operation so that the costs of a tractor, a fishing boat, the farm family's time, or the mill's labor are spread across a greater volume of commodity production. While

expanding size does cut costs for individual producers, thus compensating for falling profits (loop B1), it also increases overall production (via loop R2). This increase in total production creates a vicious cycle that further decreases prices and profits. The resulting perverse cycle means that producers feel they must "grow or die." The net result is more industry production, ever-lower prices and continuing pressure to reduce costs. These two practices — increasing efficiency and expansion — create the second driver of growth in commodity production, the Efficiency Boosting Loop.

FIGURE 2-5 Efficiency Boosting Loop - Complete the Diagram



**Loops R2 and B1:** As *Total Production* rises and *Average price* falls, *Profits per producer* fall as well, creating more *Pressure to boost production per unit costs*. This increases the *Size and technology level per producer*, which is intended to increase and restore the *Profits per producer*, via loop B1. (The "B" stands for a "balancing" loop, a feedback loop that seeks stability rather than growth.) However, increasing *Size and technology level per producer* also boosts the *Total production* via loop R2, which puts downward pressure on price and profits and creates a vicious cycle of rising production and falling prices.

In agriculture, this dynamic of increasing production and falling prices has been described as a "treadmill" where individual farmers must produce more and more just to stay in business.

The pressure to increase production and decrease costs has been a feature of commodity systems for as long as they have existed.

*We entered an immense low-ceilinged room and followed a vista of dead swine, upon their backs, their paws stretching mutely toward heaven. Walking down to the vanishing point, we found there a sort of human chopping machine where the hogs were converted into commercial pork. A plank table, two men to lift and turn, two to wield the cleavers,*

were its component parts. No iron cog-wheels could work with more regular motion.  
*Plump falls the hog upon the table, chop, chop; chop, chop; chop, chop fall the cleavers.  
 All is over. But, before you can say so, plump, chop, chop; chop, chop; chop, chop,  
 sounds again... Amazed beyond all expectation at the celerity, we took out our watches  
 and counted thirty-five seconds, from the moment when one hog touched the table until  
 the next occupied its place.*

— Fredrick Law Olmstead, 1857<sup>2</sup>

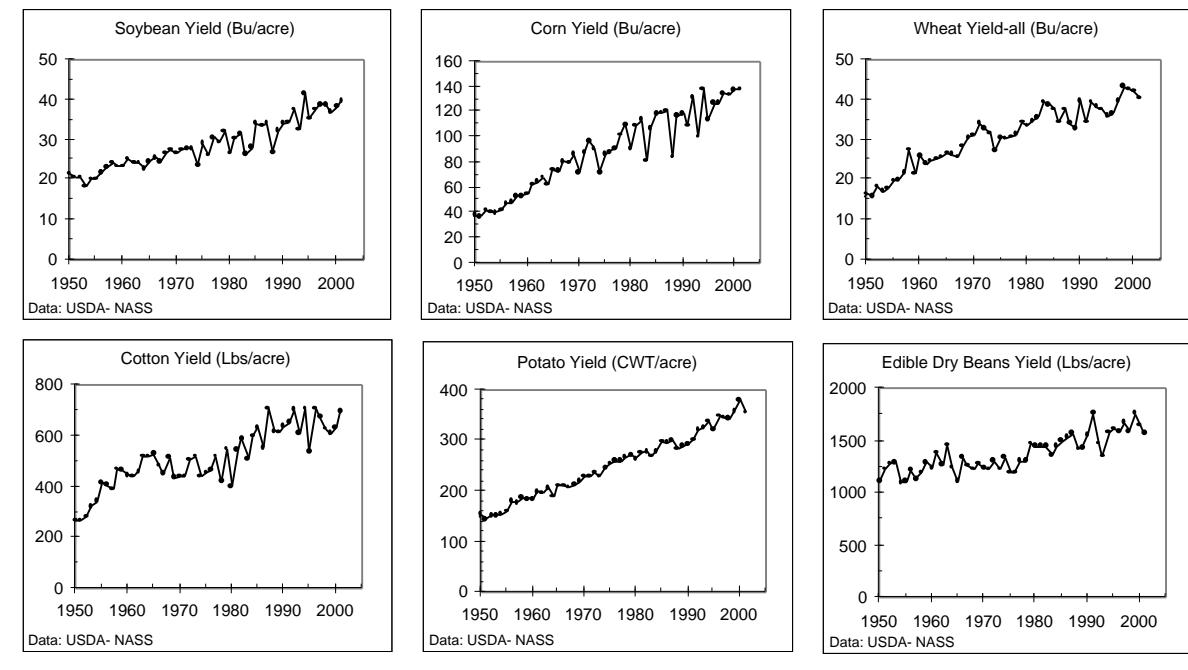
And the same pressures exist all over the world, wherever commodity systems develop.

*In Brazil, for example, government constraints on tree density and planting techniques have been lifted. Tree-planting has become far denser, increasing from the traditional 900-1,200 coffee trees per hectare to 5,000-8,000.*

— *Mugged: Poverty in Your Coffee Cup*, 2002<sup>3</sup>

In many commodity systems, entire industry and government research programs spring up in response to the constant pressure to cut costs and increase production. In agriculture, the delivery of chemical inputs, plant breeding, and, increasingly, genetic modification of seed stock, all result in climbing yields per acre for most agricultural commodities (Figure 2-6). In fisheries, larger boats, bigger nets with a deeper reach, and new technologies for searching out schools of fish increase the catch per year. In forestry sawmills install new equipment for milling smaller and smaller logs — typically processing more wood per day than the old equipment.

FIGURE 2-6 Increasing U.S. Yield per Acre

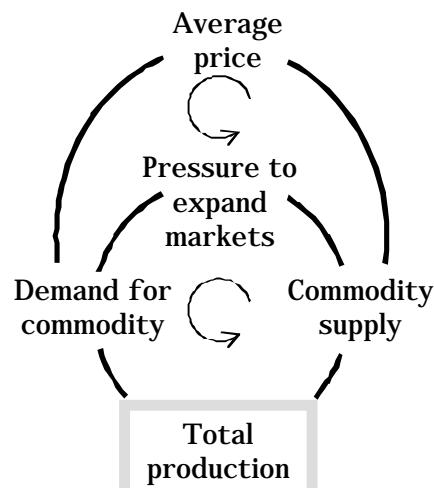


The two reinforcing feedback loops of Figures 2-4 and 2-5 mean that whether profits are high or low, production will rise. Under conditions of high profits, reinvestment leads to increased production. Under conditions of low or falling profits, efficiency measures and expansion lead to increased production. The net result is that whether profits are rising or falling, the typical commodity producer expands production volume year after year.

As production levels rise and prices fall, demand for the product tends to rise as more people can afford it. For example, with commodification, bananas changed from a "specialty" or premium item to an everyday food. Climbing demand gives producers the confidence to invest in increasing production, pushing up supply, pushing down prices, boosting demand, and creating the third driver — the Demand Growth Loop (Figure 2-7). In addition, as commodity supplies build up, commodity producers or their government representatives put effort into creating new uses, for example ethanol from corn, or new markets such as exports. This is shown in loop R4 of Figure 2-7.

Figure 2-8 places all three of these driving feedback loops into a single diagram centered on total production. The inset of this figure shows a simplified representation of the three types of driving feedback loop. We will rely on this simplified figure for the remainder of the paper.

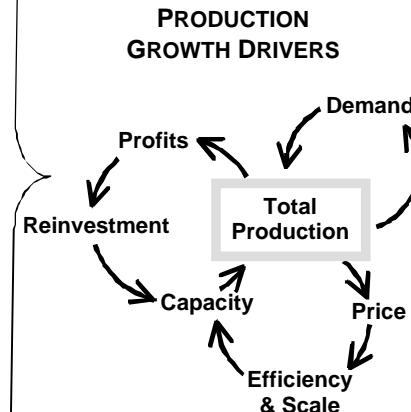
FIGURE 2-7 Demand Growth Loops



**Loops R3 and R4:** As *Total production* rises, the *Commodity supply* on the market rises. More supply leads *Average price* to fall, increasing the *Demand for commodity* and supporting and boosting *Total production* (R3). More supply also increases the *Pressure to expand markets*, increasing *Demand for commodity* (R4).

**Can you build a model which includes all three drivers?**

The summary of these is on the right, but try to draw all three models together as one with arrows, using s, o as needed.



The diagram above combines the feedback loops for Reinvestment, Demand Growth, and Efficiency Boosting in one diagram.

## Why Supply is Often Out of Balance with Demand

One might expect that in the face of falling prices and rising total production, individual producers would leave the commodity system. While it is true that over time the number of producers in most commodity economies tends to decline, several factors minimize this as a balancing force. As a commodity-producing sector begins to struggle, governments — especially in the richer countries — offer subsidies to boost the income of producers, and keep production levels high. Such programs can also take the form of subsidized research and development, spurring the Efficiency Boosting Loop or the Demand Growth Loop.

Subsidies in commodity systems ripple through the global economy. In rich countries, subsidies allow commodities to enter global markets at artificially low prices, placing enormous economic hardship on producers in parts of the world that do not subsidize their natural resource economies.

*Yes [European] milk powder is cheaper than our local milk. But what you must realize is that imports of milk powder have export subsidies on them. The Jamaican farmer has no subsidies whatsoever. Our production figures are true cost.*

— Aubrey Taylor, president of St. Elizabeth Dairy Co-operative, Jamaica, 2002<sup>4</sup>

In addition to government subsidies, many commodity producers will take on outside jobs to keep their farms or their fishing businesses alive. The producers are, in effect, subsidizing the costs of commodity production with their own labor and keeping production levels high even when prices are low.

Commodity producers often feel very little flexibility. Those who use specialized equipment or who have no marketing infrastructure to sell other crops will have little ability to switch commodities in response to falling prices. Commodity production will remain high, even in the face of low prices, if producers have no alternative commodity to produce with their land or equipment.

All three of these factors — subsidies, supplemental employment, and lack of production alternatives — add to the tendencies of commodity systems to overproduce relative to demand.

One might also expect that increases in demand would result in higher prices, bringing the system into balance. However, the Reinvestment and Efficiency Boosting Loops are increasing new supplies, driving down price, generally outpacing the rising demand.