A FISHY INTRODUCTION TO ECONOMICS

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This is a partial draft of a book I began in 2011 but had to put on hold when I became too busy with other obligations. Now that I have retired I hope to have time to revise, expand and finish it. I welcome any and all comments, which may be emailed to me at Gunnar.Knapp@gmail.com. You are welcome to use and quote from this material as long as you cite it and indicate that it is posted at gunnarknapp.com.

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Fish processing workers, Alaska

1. INTRODUCTION

This book is a "fishy" introduction to economics. It's "fishy" because I wrote it for people who are interested in fish and the fish business: fishing, fish farming, fish processing, fish stores and restaurants, and the all the other businesses that have to do with fish. I've tried to introduce the most important principles of economics in ways that have to do with fish and the fish business.

This is the first in a series of short books I am writing about *fish economics*—which is my term for economics that has do with fish and the fish business. Most economics books and courses cover a lot of topics you don't really need to understand if you're mainly interested in fish economics—and they leave out some important topics that you do need to understand. I hope this book will be a more interesting way to learn the basic economic concepts you need to know to understand fish economics.

Maybe you're skeptical about economics and economists. Economists use confusing jargon and confusing models. Some of their recommendations seem heartless. Do they even think or care about people and the environment?

Yes! Economists care about people and the environment! The truth is that economics is a powerful way of thinking about some of the most important challenges facing people and the environment, and how to deal with them.

I've tried to keep this book short, simple, useful, interesting, and fun. I've tried to focus on important basic concepts and illustrate them with "fishy" examples. I hope you'll enjoy it—and learn something.

Economics matters!

"*The ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else*."—John Maynard Keynes, *The General Theory of Employment, Interest and Money*

Economics is about people!

Salmon fishermen, Alaska

Pangasius farmers, Vietnam

2. WHAT ECONOMICS IS ABOUT

Economics is a "social science." Social sciences study people and societies. Other social sciences include anthropology, sociology, political science, and psychology. The different social sciences overlap in what they study, but they focus on different questions about people and societies and use different methods to study them. They all offer useful insights about the world of fish.

Economics looks at a very wide range of questions about people and societies. But at its core, economics is about how individuals, firms and societies make economic choices about the use of scarce resources. *Economic choices* include *how we use resources* (like labor, machines and natural resources), *what we produce* (what goods we make and what services we provide) and *how we allocate what we produce* (who gets the goods and services).

Economics choices include choices of *individuals* (such as what kind of work they do and what they buy), choices of *firms* or companies (such as what kinds of goods and services they produce and what resources they use to produce them), and choices of *governments* (such as what kinds of government services to produce and who gets them) as well as government *policies* which affect choices of individuals and firms (such as fishing regulations, minimum wages, and food safety laws).

Societies have to make economic choices because *most resources are scarce.* We don't have enough labor, machines and natural resources to make enough goods and services for everyone to have or use as much of everything as they want without affecting how much other people can have or use.

Here are some examples of economic choices that fish economists study:

- How many fish we catch or farm
- What fish products we produce
- How many fishermen we use to catch fish
- What size boats the fishermen use
- What the fishermen get paid
- Who eats the fish products

Explanatory and Advisory Economics

Economics can be both *explanatory* and *advisory*. *Explanatory* economics *explains* economic choices of people, firms and societies. It looks at why they make choices, and how different factors affect choices. These statements are examples of explanatory economics:

- Lower catches tend to cause fish prices to rise.

- Individual fishing quotas tend to result in consolidation of fishing fleets.

- Fish farmers tend to invest more in marketing than fishermen.

Advisory economics advises about how to achieve objectives. A quick way to recognize advisory economics is that it uses words like "should," "best," and "optimal." These statements are examples of advisory economics.

- Individual fishing quotas should be transferable [so that they will be fished by the most efficient fishermen.]

- Catch shares are the best way to manage fisheries [because they result in lower costs and higher value].

- Monopolies are bad [because they result in inefficiently high prices and inefficiently low production.].

There is a critical difference between explanatory and advisory economics. Advisory economics requires assumptions about *objectives*. In particular, advisory economics about *public policy questions*—about what governments should do or what is "best" for society—requires assumptions about what our *public policy objectives* are or should be. Since not everyone agrees about what our public policy objectives are or should be, advisory economics tends to be more controversial than explanatory economics.

In the examples above, the objectives are in brackets. If you don't agree with the objectives, you're probably not going to agree with the advice. When you read or hear advisory economics, always think about what objectives the economist is assuming, and whether you agree with those objectives.

"Explanatory" and "advisory" economics are my own terms. The formal terms are *positive* (explanatory) and *normative* (advisory) economics.

An explanatory economics question:
Why do fish processing companies in China use more workers and fewer machines than fish processing companies in Norway?

China

Norway

Fields of Economics

Just as the social sciences have become specialized into different sciences such as economics, political science and anthropology, economics has become specialized into many different fields which look at particular types of questions from both explanatory and advisory perspectives.

Microeconomics is the study of specific parts of an economy—such as individuals, companies or industries. There are many subfields of microeconomics. For example, *agricultural economics* looks at farming and the food distribution system. For example, *environmental economics* looks at how society's economic choices affect and are affected by the environment, and how different kinds of government policies affect the markets. *Resource economics* looks at how societies use natural resources such as oil, minerals and forests. *Fisheries economics* is a subfield of resource economics which looks at how societies use wild fishery resources.

Macroeconomics is the study of how the whole economy works as a system: what determines *macroeconomic variables* such as inflation, unemployment, interest rates and exchange rates, and how they affect the whole economy.

Fish economics is my term for any kind of economics that has to do with fish or the fish business. Many different fields of economics have to do with fish or the fish business in some way. Most of them are branches of microeconomics.

Some of the fields of economics which relate to fish economics

Fields	Examples of questions related to fish economics
Fisheries economics	How do different management systems for wild fisheries affect fishery resources, costs of fishing, and the net benefits of fisheries? How can fishery management systems be designed to reduce bycatch? What is the optimal harvest rate for a fish stock over time?
Environmental economics	What is the value of fish habitat? What is the optimal level of protection for fish habitat? What kinds of regulations are most effective in protecting fish habitat? What are the "non-market values" created by sport fishing?
Aquaculture economics	What are optimal stocking densities for fish farms? What is the optimal harvest weight for fish farms?
Agricultural economics	What drives food prices at different levels in the value chain? What are effective strategies for marketing food products? What can be learned from other food industries, such as meat and poultry, about how the fish business is likely to change over time?
Regional economics	What explains where fish processing and fish distribution occur? How do changes in fisheries and aquaculture affect regional economies?
Labor economics	What explains how fishing crew are paid, how much they earn, and how many crew are hired?
Industrial economics	What explains the extent of horizontal and vertical integration in the fish business? Who has how much market power in the fish business?
Development economics	What roles do fisheries, fish farming and other parts of the fish business play in the economies of developing countries?
International economics	What are the effects of restrictions such as tariffs and import quotas on fish trade?
Econometrics	What statistical techniques are appropriate for analyzing fisheries economic data?
Experimental economics	How can experiments be designed to test hypotheses about fish economics? What kinds of auctions are best suited for fish markets?

It is difficult for a single person to become an expert in all these different fields of economics. That's why fish economists tend to specialize in particular fields. Someone who studies the optimal harvest rate for a fish stock probably doesn't spend much time studying how the tuna auctions work at the Tsukiji fish market in Tokyo or the "non-market values" created by sport fishing.

But all these topics are important to people involved with fish—which is why I've tried to introduce them at least briefly in this book. To learn about any of these fields of economics in depth—and how they can be applied to fish economics—can take a great deal of study and time.

"Mainstream Economics"

There are different approaches to economics: different ideas about what kinds of questions are important and different ideas about how economists should try to answer them. The economics in this book is what I call *mainstream economics*, by which I mean the approach to economics which is taught at most American universities and used by most American fish economists.

When I use the terms "economics" and "economists" in this book I'm talking about mainstream economics and mainstream economists. Not all mainstream economists think alike! But they tend to agree about what kinds of questions are important and how to approach studying them. Much of mainstream explanatory economics is built on theories about the choices we would expect individuals and firms to make under different circumstances and the combined effects of those choices. Much of mainstream advisory economics is about how markets and government policies affect economic efficiency.

A contrasting approach to economics is *ecological economics*, which focuses on the interdependence of human economies and natural ecosystems over time and space. It tends to emphasize the importance of protecting and preserving ecosystems, as well as issues such as justice, intergenerational equity, and energy flows. Ecological economics looks at many of the same issues as environmental economics (one of the subfields of mainstream economics), but from a perspective focused less on using and protecting the ecosystem as a means to an end (human well-being) and more on protecting the ecosystem as an end in itself.

Another contrasting approach is *Marxian economics*, which is based on economic theories about how capitalism works developed by the economist Karl Marx and his followers. An important part of Marxian economics is the theory that the value of a commodity (such as a fish) derives from the labor needed to produce it.

I don't discuss these contrasting approaches to economics in this book. My goal is to introduce the concepts of mainstream economics which are most useful for understanding fisheries, aquaculture and the seafood business. You may find them interesting as alternative perspectives—but I suggest you start with mainstream economics.

Economics and Other Social Sciences

All social sciences study people and societies, but they study them in different ways and from different perspectives. The different social sciences evolved over the past two centuries as different scientists focused on different questions and different ways of studying them.

Economists tended to focus on how "markets" and "mandates" (government policies) affect economic choices of people and societies. They tended to focus less on other important mechanisms by which people and societies make economic choices, such as "morals" and "might"—leaving these to other social science disciplines such as political science, anthropology, and psychology.

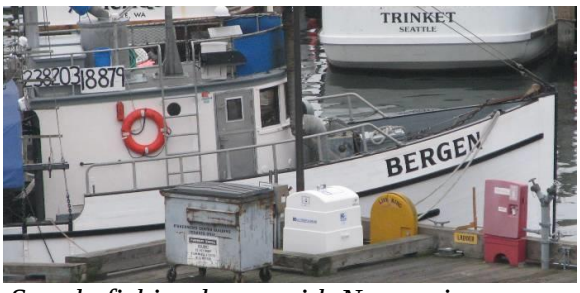
But many of the perspectives and findings of other social sciences are clearly relevant to economics—including fish economics. They probably don't receive as much attention from economists as they should—although they are getting more recently. For example:

Political science is the study of politics, or processes by which people make collective decisions. It includes the study of what kind of governments we have and how they make decisions which affect economic choices.

Economists used to spend more time thinking about politics than they do now. Economics used to be called "political economics" until the mid-1800s. But economists gradually became more focused on the *effects* of government policies, and left the study of what kinds of governments we have, and what policies they choose, to political scientists.

But if we want to understand society's choices about fish, then we need to think about why governments make certain policy choices. For example, the State of Alaska bans salmon farming while Norway actively encourages it. If we want to understand these two societies' choices about salmon farming, we need to think about *why* they adopted these radically different policies.

Anthropology is the study of culture. Culture—our traditions, customs, values, tastes, religions—clearly affects our economic choices—including our choices about fish. Culture is part of the reason that Japanese eat more fish than Americans, or that many of the fishermen in America are of Norwegian, Portuguese and Vietnamese heritage. Economists don't spend much time thinking about culture and they don't have very good ways of explaining culture or its effects.



Seattle fishing boats with Norwegian names

Psychology is the study of how people think and behave. A weakness of mainstream economics is that much of economic theory is based on fairly simplistic assumptions about what motivates people in their actions and choices.

For example, economists generally assume that people tend to act in their own self-interest, that people prefer having more to less of something, and that people will prefer buying something a lower price to a higher price. These can be very useful assumptions! They can help to explain a lot about the economic choices that people make. But what people do and why they do it is a lot more complex than these simplistic assumptions. People don't necessarily act in their own self-interest. They give away lots of money to charities. They volunteer to fight and die in wars. Sometimes they walk away from good business deals. They don't necessarily shop where prices are cheapest, or choose the cheapest products. Psychologists study what we do what we do it—and the more they study it the more complicated and interesting they discover that we are. Most economists don't study these kinds of questions, and they aren't necessarily aware of what psychologists are discovering.

In an ideal world, economists would know a lot and think a lot about politics, culture, and psychology, and integrate this knowledge and thinking into their economic analysis. Put differently, ideally we might have a single social science that studied everything about people and societies in an integrated way.

But that's not very practical. It's hard for any one person to learn everything about all the different social sciences and to integrate the different ways of studying people and societies that they have developed. It's useful to have different social sciences that can focus on particular types of questions. An economist who studies what makes salmon prices go up and down doesn't really need to know or think very much about why Alaska banned salmon farming, why Japanese people like herring roe, or why some people don't buy the cheapest fish.

But at the same time, more and more economists are realizing that what other social science disciplines are studying is critical to the questions they are trying to understand. Many fish economists are incorporating approaches and insights from other social science disciplines into their economic analysis. Whether they do so enough is one of the things you should think about as you learn and think about fish economics.

3. SCARCITY

One of the most important concepts in economics is *scarcity*. Something is *scarce* if there isn't enough for everyone to use as much as they want without affecting anyone else's use. In contrast, something is *abundant* if there *is* enough of it for everyone to use as much as they want without affecting anyone else's use.

When things we use, or *resources*, are scarce, individuals and societies have to make *economic choices* about who gets to use them and how they use them. At its core, economics is about how individuals and societies make economic choices about the use of scarce resources.

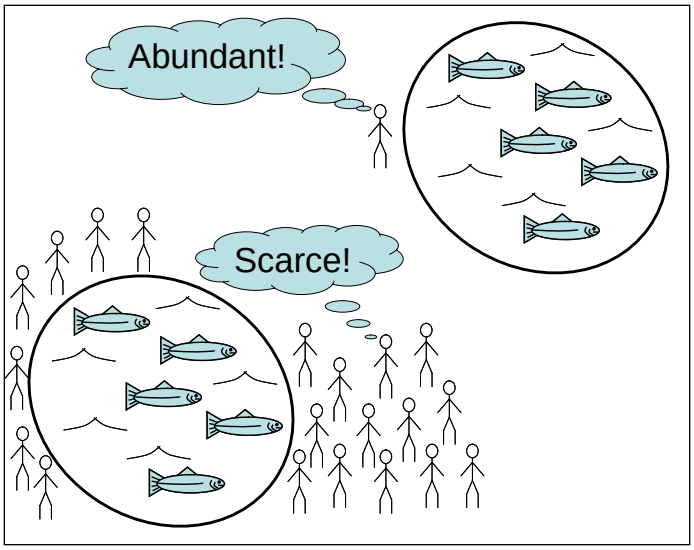
Abundance and Scarcity Depend upon the Circumstances

Whether something is abundant or scarce depends upon the circumstances—such as how much there is and how many people want to use it and how much they want to use it. In some places water is abundant. There is more than enough for everyone to drink and use as much as they want. In other places water is scarce. There isn't enough for everyone to drink or use as much as they want.

Abundance and scarcity are not permanent conditions. Whether something is abundant or scarce, and how scarce it is, depends upon the circumstances.

Abundance and scarcity depend on both how much there is of something and how much people want to use. You can't tell if something is abundant or scarce just by knowing how much there is of it (what economics call *supply*). You also have to know how much of it people want to use (what economists call *demand*).

Something may be abundant in one place and scarce in another place. One lake may have lots of fish and another lake may have few fish. Or one lake may have few fishermen and another lake may have lots of fishermen.



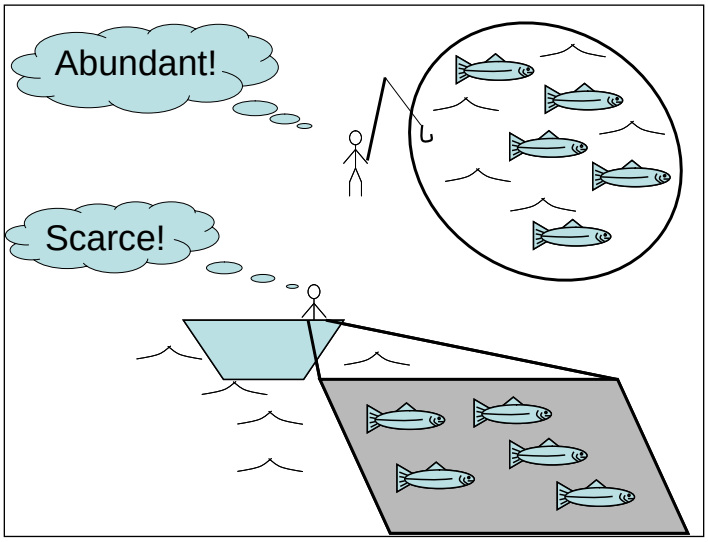
If there is only one fisherman, fish may be abundant.
If there are many fishermen, the same number of fish may be scarce.

Abundance and scarcity may change over time. Something may go from being abundant to being scarce—in two different ways. The amount of it may decline, or how much people want to use may increase. The number of fish in a lake may decline—or the number of fishermen may increase.

How much people want to use of something—like a sport fishing stream—can change. Solitary salmon sport fishing spots on Alaska's Kenai River have become scarce.

Abundance and scarcity are affected by costs. How many fish fishermen want to catch from a lake depends partly on the cost of getting to the lake and catching the fish. If we make it cheaper for fishermen to get to a lake by building a road to it, the fish in the lake may go from being abundant to being scarce.

Abundance and scarcity are affected by technology. As we develop technologies that reduce the cost of using something, we may want to use more of it. If fishermen can only fish with a hook and line, the fish in a lake may be abundant. If they can fish with a net, the fish may be scarce.



If a fisherman is fishing with only one line and hook, fish may be abundant. If he is fishing with a big net, the same number of fish may be abundant.

Something is scarce if there isn't enough for everyone to use as much as they want without affecting anyone else's use. "Anyone else" includes people in the future. Something may be scarce if using as much as we want now affects how much we or our descendants will be able to use in the future.

Remember: you can't tell if something if abundant or scarce just by knowing how much there is of it (supply). You also have to know how much of it people want to use (demand).

A more complete definition of scarcity

Something *at a particular location and time in a particular condition* is scarce if there isn't enough of it for everyone *including potential future users* to use as much as they want without affecting someone else's use.

Abundance and Scarcity in Fish Economics

The concepts of abundance, scarcity, economic choices, and economic choice mechanisms are very important for fish economics. One reason is that it is only relatively recently—over the past century—that many of the world's fish resources have gone from being abundant to becoming scarce.

To think about why this relatively recent transition from abundance to scarcity matters, it's useful to contrast the development of our laws about how we use land with our laws about how we use fish.

Over the past several thousand years, in most places, land was scarce. There wasn't enough land for everyone to farm as much as they wanted to. So we developed laws to limit who could use land and how they could use it. Among the most important of these were *property rights*—the

concept that people could *own* land, use it for their own benefit, restrict other people from using it, and buy or sell it. Put differently, we began to use markets to make economic choices about how land was used.

Not everyone thinks land ownership is fairly distributed. But most people accept the *concept* of property rights for land.

It's different with fish. For thousands of years, most wild fishery resources were abundant (in the economic meaning of the term!) There were enough fish for fishermen to catch as much as they wanted to catch. But over the past hundred years, in many places fish have become scarce (in the economic meaning of the term!), for a combination of reasons:

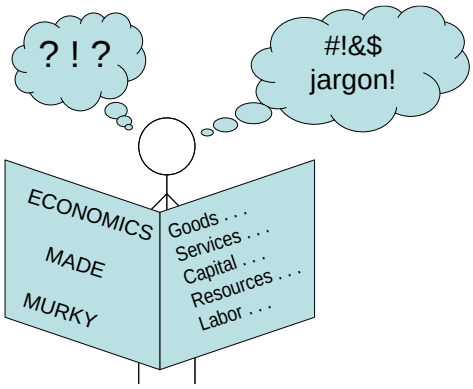
- Fish stocks have been declining in many places due to past harvests.
- World demand for fish has been rising due to growing population and income
- Costs of catching, processing and transporting fish to markets have gone down dramatically due to wide-ranging technological developments in boat building, fishing gear, fish processing and fish transportation—greatly increasing the number of fish we're able to catch and want to catch.

All of these changes are making fish increasingly scarce—which is causing societies around the fish to have to make economic choices about fish in new ways. Non-Governmental Organizations (NGOs) are telling fishermen that traditional ways of fishing are "bad" and they need to fish in more ethical ways. Governments are imposing increasingly strict rules about how much fish fishermen can catch and how they can catch them. Countries are introducing new ways of managing fisheries based on concepts similar to property rights for land, such as Individual Fishing Quotas" (IFQs) and Catch Shares.

These kinds of changes have been difficult and divisive for many fishermen and fishing societies! Most people don't like being told that the ways they (and their parents and grandparents) fished are bad. Most people don't like having governments restrict how, when and where they can fish or how much they can catch. Most people don't like having to pay for the right to catch fish—or having rights to fish become something that can be bought and sold. And most people really don't like having other people take away fish they think of as their own.

The need to make economic choices about fish in new ways has led to many important and difficult policy issues which are the subject of intense debates with very big stakes for people throughout the fish business, around the world. Fish economics has important insights to contribute to these debates.

4. ECONOMIC TERMINOLOGY



Economists use a lot of special terms which economists understand but which are confusing or meaningless to people who haven't studied economics. Some economic terms can be particularly confusing because the words have other meanings in regular conversation.

Here are some terms which economists use frequently and which I use in this book. Learning them will help you understand economics and economists.

Goods are physical things made and used by people which satisfy needs or desires—like canned salmon, fishing boots, and fish economics textbooks.

Services are things done (rather than made) and used by people which satisfy needs and desires, like haircuts, guided sport fishing trips, and fish economics classes.

Government services are services provided by governments, like national defense or fisheries management.

Environmental services or ***ecosystem services*** are things the environment or ecosystem does or provides for us which satisfy needs or desires and that don't involve extracting or processing. Air we breathe, whales we watch swimming in the ocean, wilderness scenery and beautiful sunsets are environmental or ecosystem services.

Consumption is using a good or a service—like eating salmon or taking a guided sport fishing trip or a fish economics class. A ***consumer*** is someone engaged in consumption, or ***consuming*** something.

Production is making a good or providing a service—like catching, farming or filleting a fish, or guiding a sports fishing trip, or teaching a fish economics class. A ***producer*** is someone engaged in production, or ***producing*** something.

Inputs are things used in producing goods or services. Three important kinds of inputs are labor, capital, and natural resources. Inputs are sometimes called **resources.** Economists sometimes talk about ***labor resources***, ***capital resources***, and ***natural resources***.

Labor is work or effort that people do to produce goods or services. There are many kinds of labor—as many as there are kinds of work and kinds of skills needed to do the work.

Capital is machines, buildings and other things made by people which help labor in producing goods and service. Fishing boats, fishing nets, fish cages, processing machinery, processing plant buildings, and fish delivery trucks are all capital. This economic concept of capital is different from the financial concept of capital as money you use to invest in something! To distinguish between the two concepts people sometimes call machines and buildings "physical capital" and money you invest "financial capital."

Outputs are goods and services produced using inputs. Canned salmon, guided fishing trips, and fish economics classes are all outputs.

Firms are companies. Economists generally use the term *firm* for any kind of organization engaged in production. A fishing boat owner, a sports-fishing guide, and Walmart are all firms.

Natural resources are inputs provided by nature, in their raw form before they are extracted or processed. Trees in a forest, oil in a reservoir, water in a lake, and fish in the ocean are all natural resources.

These are enough terms to get you started with economics. There are many more—but we'll introduce them as we go along.

5. ECONOMIC MODELS

Economists study people and societies. That poses special opportunities and challenges.

Economists are people. That gives them many built-in insights about people and societies! However, their insights are not necessarily always objective or accurate! Most economists are not fishermen, or poor people, or from non-western societies. Their assumptions about what fishermen, or poor people, or people from non-western societies want, or how they make economic choices, are not necessarily right.

You can talk to people. Fish biologists can't talk to fish about what they do or why they do it. But economists *can* talk to fishermen and fish consumers and fishery managers. That can give them a lot of insights. But they have to be careful, because people don't always know or tell the truth about what they do or why they do it.

People and societies are complex. People's choices affect each other through very complex feedback loops. Many natural systems are simpler and more predictable than economic systems. That's why astronomers can accurately predict where the planets will be in a thousand years, but fish economists can't accurately predict how the fish business will change over the next decade.

It's hard to do experiments with people and societies. Natural scientists in many fields can do experiments to test theories. It's a lot harder to do experiments with people, and it's even harder to do experiments with societies. We can put different fish in different tanks and feed them different foods and see which fish grow faster or slower. We can't give different fishermen different regulations and see which fishermen get richer or poorer—or at least we can't do it very easily.

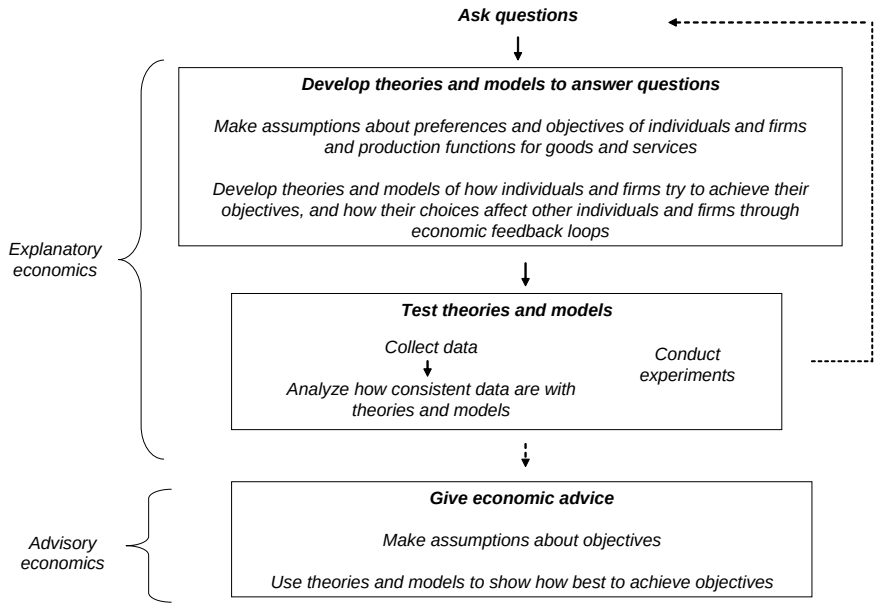
It's hard to collect data about people. Fish don't complain about being studied. But people *do* complain. There are real limits to how much data you can collect about people and how accurate the data you can get. It's hard to observe what fishermen do when they're out on the water! It's hard to know what fishermen or fish farmers are earning if they don't want to tell you. It's hard to know what a fish processor's costs are, or the price he's selling fish for, if it's a competitive secret.

People have a stake in economics. Most people don't care about which natural science theories "win" about what causes earthquakes or how salmon find their way home. But people *do* care—a lot!—about which economic theories "win"—particularly if they relate to advisory economics issues such as the best ways to manage fisheries, or whether we should remove dams to rebuild salmon runs, or whether we should have free trade in fish products.

The methods economists use to study people and societies—in comparison with the methods other sciences use to study other questions—reflect these special opportunities and challenges.

Like other sciences, economists develop theories and models to answer questions. But often they can't or don't "test" their theories or models—because it's impossible or difficult to collect data or do experiments to test them.

How economists do economics (simplified)



As a result, economists are often criticized for relying on theories and models that may not necessarily be realistic or reflect the "real world." Sometimes the criticism is reasonable and justified, and sometimes it isn't. It's important to understand why and how economists develop and use economic theories and models, and when economic theories and models are or aren't useful or helpful.

Economic Models

Economists use reasoning to develop *economic theories* and *models* about the choices people and companies are likely to make in particular circumstances, and the effects of their choices.

An economic *theory* is a general answer to an economic question based on economic reasoning. For example, the "theory of supply and demand" is a general way economists have developed of explaining prices and quantities bought and sold in markets. An economic *model* is a more formal statement of an economic theory, often expressed as mathematical relationships between different variables in the models. An "economic model of supply and demand" would be a description of the supply and demand relationships in a particular type of market. Don't worry about the difference between economic theories and models: it's not very important for fish economics. For the rest of this chapter, I'll just talk about economic models.

Economic models can be very simple or very complex. They can be stated in words, as graphs, or as mathematical equations. They can be *qualitative* (a general statement of the type of relationship) or *quantitative* (a mathematical statement of the relationship using numbers).

Typically, economic models include the following

- Questions the model is trying to answer
- Variables
- Assumptions about the preferences or objectives of people, firms and society
- Assumptions about relationships between model variables
- Reasoning about the choices people and firms make to try to achieve their preferences and objectives

Here is an example of a simple economic model expressed in words:

Questions	Suppose fishery managers limit the total allowable catch in a fishery but don't limit who can participate in the fishery. If the price of fish increases, how will the average profit per fisherman change?
Variables	Total catch Average catch per fisherman Average profit per fisherman Number of fishermen
Assumptions about preferences or objectives	Fishermen want to earn profits
Assumptions about relationships between model variables	For any given price, as the number of fishermen increases, average catches and profits go down. For any given average catch, as prices increase, average profits go up
Reasoning about the choices people and firms make to try to achieve their preferences and objectives	If profits are high, more fishermen will enter the fishery. As the number of fishermen increases, average catches and profits will go down. As average catches and prices go down, eventually no more fishermen will want to enter the fishery. The number of fishermen will stabilize at the level at which average profits are low enough so that no more fishermen want to enter. If the price of fish increases, average profits will increase at first. That will cause more fishermen to enter the fishery. But s more fishermen enter the fishery, average profits will go back down again to about the same level. So an increase in the price of fish may not increase the average profit per fisherman: it may just result in higher participation in the fishery.

Why is the model useful? Because it helps to think systematically about an economic question, and it helps to realize that the answer may be different than we would intuitively expect. Intuitively we would expect that a higher price would lead to higher average profits. But our model suggests that it may lead to higher participation rather than higher average profits.

Why Do We Need Economic Models?

Economic models can be confusing and frustrating for non-economists. Sometimes they seem so simplistic that they couldn't possibly be useful for understanding complex real-world situations and issues. Sometimes they seem so complicated that they are impossible to understand. So why do we need economic models? Why can we just talk about the real world? Here are two reasons:

Economic models are *intended* to simplify reality.

Economic models often ignore many things that we know affect peoples' decisions. For example, an economic model might assume that fishermen always sell fish to the processor who offers the highest price.

In reality, we know that that's not always true. We know that other things may matter too, such as whether the fisherman's dad sold fish to a particular processor, or whether their families are related, or how good the coffee is at the processing plant.

Economists understand that these other factors may indeed affect which processor a fisherman sells his fish to. But they may argue that they don't matter so much that we have to include them in the model.

Whether a simple model is good enough or whether we need a more complicated and "realistic" model depends on *what kind of answer we need*. If our goal is to understand why processors tend to offer similar prices, it may be enough to reason based on a simple model that if they didn't, fishermen would stop selling to the processors offering lower prices. If our goal is to understand exactly how many and which fishermen deliver to each processor, then we may need a more complicated model that takes account of other factors such as family relationships.

An economic model is like a map. How detailed and "realistic" a map you need depends on what you need the map for. If you only want to know how to drive from New Bedford, Massachusetts to Empire-Venice, Louisiana, you only need a map which shows major highways. If you need to walk from Homer, Alaska to Seward, Alaska you need a map which accurately shows mountains, glaciers and rivers.[1]

Everyone uses economic models.

When economic model seem simplistic or unrealistic, you might think that it would be better not to use economic models and just think and talk about the way the world really is. But in fact it's impossible *not* to use economic models. The "real world" of how people make choices and how their choices affect each other is so complex that we can't explain it or reason about it without finding ways to simplify it. If you think the coffee matters in explaining which processors

[1] These four towns are all major United States fishing ports. New Bedford and Empire-Venice ranked first and seventh among U.S. ports in the value of fishery landings in 2009. Homer and Seward ranked twelfth and seventeenth.

fishermen sell fish to, you're using a model too. Your model may be more "realistic" because it includes coffee, but it still leaves out a lot of other factors that probably matter too.

The only difference between economists who use models and people who think they don't use models is that the economists are explicitly stating their reasoning. People who think they don't use models have them in their heads—which makes it harder to understand their reasoning or test it against the available evidence.

Economic Models are Based on Assumptions

Economists develop economic models based on *assumptions* about the preferences or objectives of people, firms and society and assumptions about relationships between model variables. Here are some of the most common assumptions that economists make. Most of microeconomics is based on systematic reasoning about the implications of these assumptions.

Assumptions about the preferences or objectives of people and firms

People make decisions based on their preferences between different choices
If it doesn't affect any other choice, most people prefer having more of a good or service to less
If it doesn't affect any other choice, most people prefer not working to working
The more people already have of a good or service, the less they are willing to give up to get another unit of it
Most people prefer to receive goods or services sooner rather than later.
Firms try to maximize profits
Firms prefer having profits sooner rather than later

Assumptions about production relationships

Inputs (labor, capital and/or resources) are needed to make outputs (goods and services)
Each additional unit of input gets you progressively less additional output

Economists don't think these assumptions always apply to everyone: only that they *usually* apply to most people and companies and for most kinds of production and consumption choices—enough so that they are a reasonable basis for developing models of what individuals and companies usually do. When you think about economic models, it's important—fundamentally important!—to think about the model assumptions and whether you think they are reasonable.

Economists are often criticized for assuming that firms try to maximize profits. Certainly some many kinds of business do try to maximize profits. Corporations have a legal obligation to try to earn profits for their stockholders.

On the other hand, you may well know (or be) a fisherman or fish farmer or fish processor who says "I'm not trying to maximize my profits . . . I'm just trying to feed my family, and treat my employees and customers fairly and contribute to my community."

Economists argue that even if firms don't think they try to maximize profits, they can't ignore profits. No firm can stay in business for very long if it loses money. If you go out of business, you won't be feeding your family, or treating your employees or customers well, or contributing to your community. So economists often conclude that assuming that firms try to maximize profits is reasonable for many kinds of economic models.

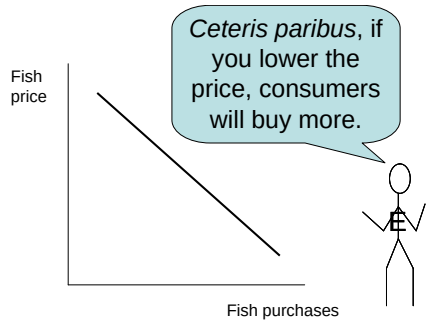
Other Important Things to Understand About Economic Models

Economic models assume everything that's not in the model stays the same.

Suppose you have an economic model of how the price of fish affects how much fish consumers buy. A simple example would be "if you lower the price by half, consumers will buy twice as many fish."

That might be a good model if other factors which affect consumer decisions don't change. But it won't be a good model—it won't do very well at predicting how many fish consumers will buy—if the same day you lower the price, a big news article comes out that says fish are full of mercury and are dangerous to eat.

That's why when economists use models, they often say that they are "assuming everything else stays the same." Even if they don't say it, they are assuming it! The Latin expression for "assuming everything else stays the same" is *ceteris paribus*. You may hear economists use this expression occasionally, particularly when they are talking to other economists.



Economists often use graphs and equations for models because they can help in reasoning and communicating.

Graphs and equations are a very good way reasoning and communicating—for people who are good at using graphs and equations. It's easier to express concepts precisely using graphs and equations. And using graphs and equations imposes a discipline on economists: it shows exactly what they are thinking in a way that is difficult to do just with words.

Many economists are good at using graphs and equations, so graphs and equations help them to think clearly about economic relationships and to explain their reasoning to other economists. However, many people who aren't economists are not good at using graphs and equations. They can find economists' graphs and equations difficult or impossible to understand. This is one reason many people find economics confusing and frustrating.

Here are some examples of equations and graphs from famous articles by fisheries economists:

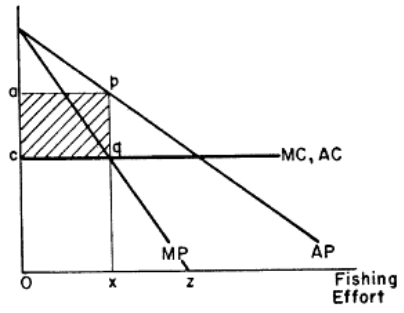
H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery* (1954)

To find the optimum intensity of effort, we have, from equation (3):

$$\frac{dR}{dE} = \frac{dL}{dE} - \frac{dE}{dE}$$

$$= \frac{(1 + cbE)(ca) - caE(cb)}{(1 + cbE)^2} - 1,$$

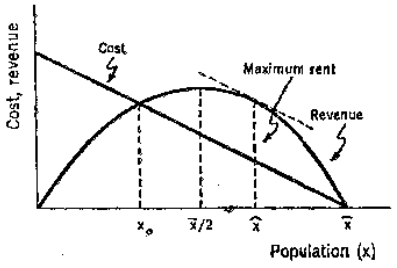
$$= \frac{ca}{(1 + cbE)^2} - 1;$$



Colin Clark, *The Economics of Overexploitation* (1973)

Since by Eq. 5 we have $F(x) = f(x)[p - C(x)]$, a simple calculation reduces Eq. 8 to

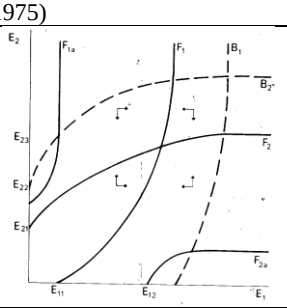
$$\delta - f'(\hat{x}) = \frac{-C'(\hat{x})f(\hat{x})}{p - C(\hat{x})} \qquad (9)$$



Lee Anderson, *Analysis of Open-Access Commercial Exploitation and Maximum Economic Yield in Biologically and Technologically Interdependent Fisheries* (1975)

The proper tax per unit of effort in each biologically interdependent fishery is average revenue in that fishery minus the sum of the components of marginal revenue in both fisheries that results from an extra unit of its effort. For example, the proper tax in Fishery 1 is

$$\alpha_1 \frac{Y_1^*}{E_1} - \left(\alpha_1 \frac{\partial Y_1^*}{\partial E_1} + \alpha_2 \frac{\partial Y_2^*}{\partial E_1}\right).$$



Colin Clark and Gordon Monro, *The Economics of Fishing and Modern Capital Theory: A Simplified Approach* (1975)

Differentiating PV with respect to t_1 and setting $\partial PV/\partial t_1 = 0$, we have

$$e^{-\delta t_1}[p_1 - \phi_1 c(x_1^*)]F(x_1^*)$$

$$= \{e^{-\delta t_2}[p_2 - \phi_2 c(x_2^*)](F(x_2^*) - h_{\max})\}\frac{dt_2}{dt_1} + \int_T^{t_2} e^{-\delta t} \frac{\partial \phi_2 c[x(t, t_1)]h_{\max}}{\partial t_1} dt. \qquad (3.5)$$

Depending on how comfortable you are or aren't using math, you may find these equations and graphs very helpful or very confusing. If you want to be able to understand exactly what these economists are saying, you'll need to learn how to use this kind of math. But economists can and should be able to explain the essence of their models and analysis is words and relatively simple math. That's what I try to do in this book.

Being good at math can help you in understanding economics. But the most important insights of economics—including fish economics—don't depend on complicated math.

Whether an economic model is "good" or "bad" depends on how useful it is for answering the questions you are asking.

The purpose of economic models is to help answer economic questions. Whether a model is "good" or "bad" depends on the questions you want to answer and what kind of answer you need—just like whether a map is "good" or "bad" depends on what you need to use the map for. You can't judge if a model is "good" or "bad" based on how "realistic" or sophisticated it is. You have to think about things like:

- Are the assumptions the model is based on reasonable for the purposes of the model?

- Does the real-world evidence support the model? Is what you know about the real world close enough to what the model predicts that the model seems reasonable for what you want to use it for?

- Is the difficulty and cost of developing the model reasonable given the kinds of answers it will give you and what you need them for?

6. EITHER-OR CHOICES AND HOW-MUCH CHOICES

Economics is about economic choices of people and societies:

- *how we use resources*: how we use labor, capital and natural resources
- *what we produce*: what goods and services we produce
- *how we allocate what we produce*: who gets the goods and services

One of the important insights of economics is that there is an important difference between "either-or" choices and "how-much" choices.

Either-Or choices are choices between two distinct alternatives, like these:

- Should you buy a commercial fishing limited entry permit? *(yes or no?)*
- Should we put a dam across the Yukon River to generate hydroelectric power? *(yes or no?)*

How-Much choices are choices about a range of alternatives, like these:

- What size boat should you buy? *(how big?)*
- What share of the Bristol Bay salmon harvest should be allocated to set-net fishermen? *(how much?)*

You should use different reasoning for "either-or" choices than for "how-much" choices:

- For "either-or" choices, you should ask "which choice makes me better off?"
- For "how much" choices, you should ask "how much makes me best off?"

Reasoning that makes sense for an "either-or" choice doesn't necessarily make sense for a "how-much" choice. Don't use "either-or" reasoning for "how-much" choices—or you might get a very misleading answer.

How Important is Water?

Suppose we ask "how important is water?" We can think about this question in two ways:

Either-or question: Do I need water? (*yes or no?)*
How-much question: How much water do I need? (*how much?)*

If we ask the either-or question, the answer is "Water is very important! I need water to stay alive!"

If we ask the how-much question, the answer is: "If we have enough water to stay alive, irrigate our crops, take showers, wash our clothes, and keep our fish processing operations clean, then having *more* water may not necessarily be very important. Put differently, the answer to the

question "how important is water" is "it depends on how much I have compared with how much I need."

This may seem obvious. But it's important—because using "either-or" reasoning for "how-much" economic choices faced by society is a common logical reasoning error. Just because something is important or essential doesn't make it the only thing that is important or essential. Most of society's economic choices are how-much choices rather than either-or choices. The issue isn't whether we need things, but how much we need them—and how to balance different potential uses of scarce resources.

Don't use either-or reasoning for how-much choices!

	Correct Either-Or Reasoning for an Either-Or Choice	Incorrect Either-Or Reasoning for a How-Much Choice	Correct How-Much Reasoning for a How-Much Choice
How important is sleep?	Sleep is very important! My body needs sleep! I would go crazy if I didn't sleep!	My body needs sleep. I would go crazy if I didn't sleep. Therefore I should sleep all the time.	Sleep is very important. But I also need to work and play. The right balance for me is about eight hours of sleep per night. .
How important is food?	Food is very important! Without food we would starve to death!	Without food we would starve to death! Therefore we should plow up all our lawns and golf courses and plant food crops!	We need food to live. But if we have enough food, it doesn't make sense to grow more food that we can't eat. It makes sense to use some of our land for lawns and golf courses.
How important is fish habitat?	Fish habitat is very important! Without fish habitat we wouldn't have any fish!	Without fish habitat we wouldn't have any fish. Therefore we should tear down all dams and ban any activity that harms fish habitat.	We need fish habitat but we also need food and electricity. It's OK to give up some fish habitat so that we can use water to irrigate farms and dams to generate power.
How important is sport fishing?	Sport fishing is very important! Everyone in Alaska loves sport fishing! We can't imagine life without sport fishing!	Everyone in Alaska loves sport fishing! Therefore we should ban all commercial fishing to make the sport fishing as good as possible!	Everyone in Alaska loves sport fishing! Therefore we should make sure there's enough fish for good sport fishing. But there can still be plenty of fish left over for commercial fishing.

7. THINKING AT THE MARGIN

A *marginal change* is a small change—adding or subtracting just one unit of something. The following are examples of marginal changes:

Fishing one more hour on a fishing trip
Stocking one more fish in a fish farming pen
Hiring one more worker at a fish processing plant

Thinking at the margin means thinking about the effects of small or *marginal* changes. A very important insight of economics is that ***you should make "how-much" choices by thinking at the margin—by thinking about whether or not a small or marginal change would make you better off. Keep on making marginal changes as long as they make you better off. Then stop.***

Here are some "how-much" choices:

How many hours should a fishing boat fish?
How many fish should a fish farmer grow in one pen?
Hire many workers should a fish processing plant hire?

To make these how-much choices, think about the effects of marginal changes.

Would fishing one more hour make you better off? If so, fish another hour. Keep on fishing additional hours as long as each additional hour of fishing makes you better off. When fishing another hour no longer makes you better off, stop fishing.

Would adding another fish to the pen make you better off? If so, add another fish. Keep on adding fish as long as each additional fish makes you better off. When adding another fish no longer makes you better off, stop adding fish.

Would hiring another worker make you better off? If so, hire another worker. Keep on hiring additional hours as long as each additional worker makes you better off. When hiring another worker no longer makes you better off, stop hiring.

Marginal terms

Here are some terms economic use for thinking at the margin.

Marginal product. The increase in production from using one more unit of an input.

Marginal cost. The increase in cost from buying or making one more unit of something.

Marginal revenue. The increase in revenue from selling one more unit of something.

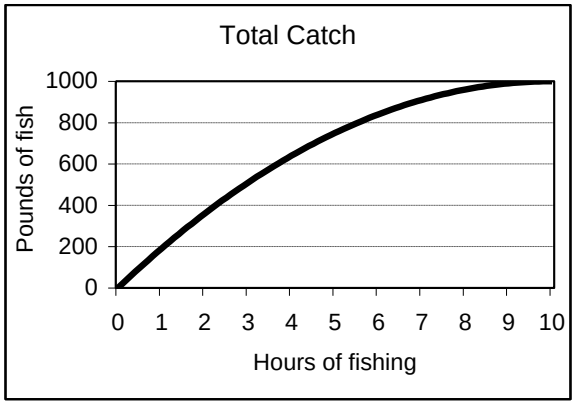
Marginal profit. The increase in profit from producing (or buying) and selling one more unit of something. Marginal profit = Marginal revenue – Marginal cost.

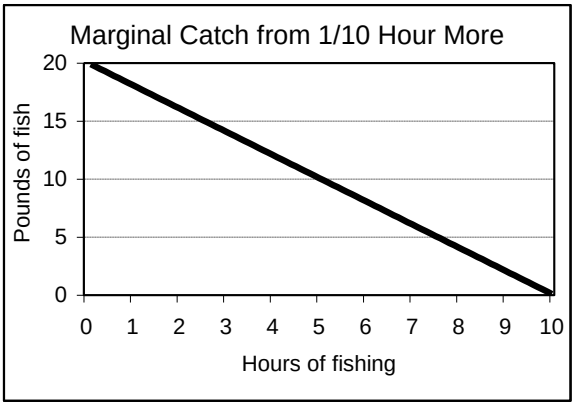
An Example of Thinking at the Margin

To illustrate thinking at the margin, think about the following how-much question. Suppose you're a fisherman and you're trying to maximize your fishing profits. It costs you $30/hour to fish, and you can sell the fish you catch for $.50/lb. You've found a place where the fishing is great at first. But the longer you fish, the less great the fishing, because there are fewer fish left to catch, so your catch rate goes down. How long should you fish?

Economists often use graphs to illustrate thinking at the margin. We'll use pairs of the graphs to think about this question. The left hand graphs show total amounts, and the right hand graphs show marginal amounts.

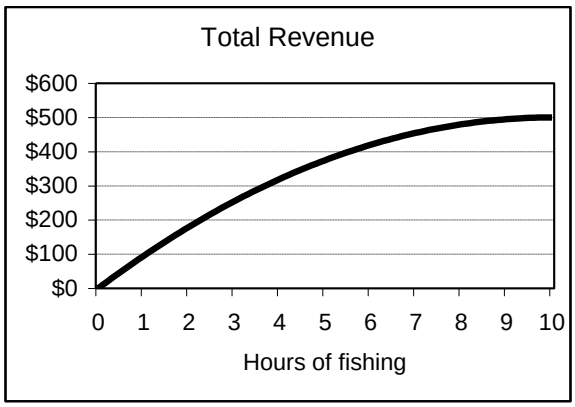
These two graphs show how your total catch and your marginal catch change over ten hours of fishing. The longer you fish, the more you catch—up to 1000 pounds in 10 hours. But your marginal catch for every 1/10 hour of fishing goes down. In the first 1/10 hour (six minutes) you catch 20 pounds of fish. After five hours, your marginal catch from another 1/10 hour of fishing is down to 10 pounds. At 10 hours, your marginal catch from another 1/10 hour of fishing falls to zero (probably because you've caught all the fish).

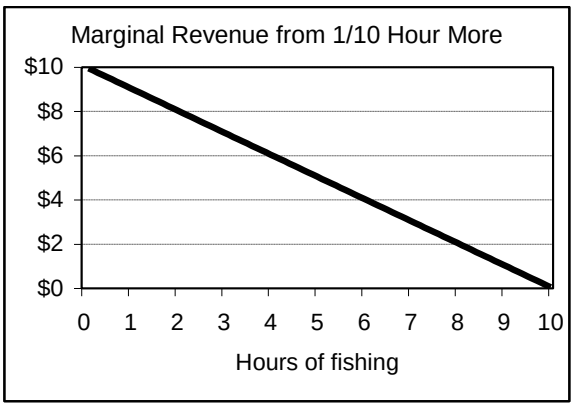




The total catch graph on the left is an example of what economists call a *production function* (the relationship between how you do or use of something and the total physical production). The marginal catch graph on the right is an example of what economists call a *marginal product* curve with *declining marginal product.*

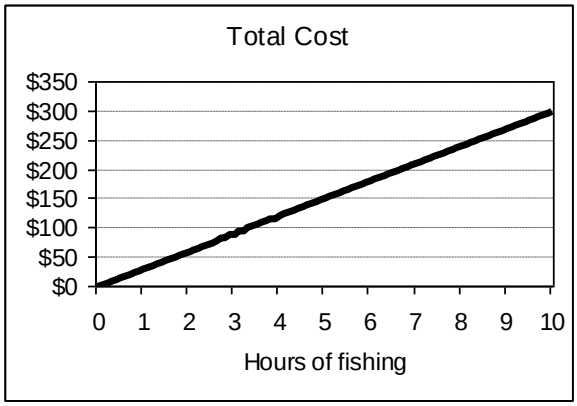
These next two graphs show how your total revenue (from fish sales) and your marginal revenue change over ten hours of fishing. Your total revenue and marginal revenue are simply your total catch and marginal catch multiplied by the price of $.50/lb, so the graphs have the same shapes. The longer you fish, the higher your total revenues—up to $500 in 10 hours. But your marginal revenue for every 1/10 hour of fishing goes down. In the first 1/10 hour (six minutes) your marginal revenue is $10. After five hours, your marginal revenue from another 1/10 hour of fishing is down to $5. At 10 hours, your marginal revenue from another 1/10 hour of fishing falls to zero—because you're not catching any more fish.

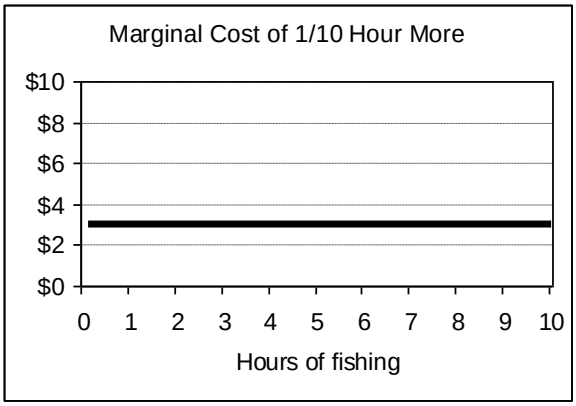




The graph on the left is an example of what economists call a *total revenue curve.* The graph on the right is an example of what economists call a *marginal revenue curve* with *declining marginal revenue.*

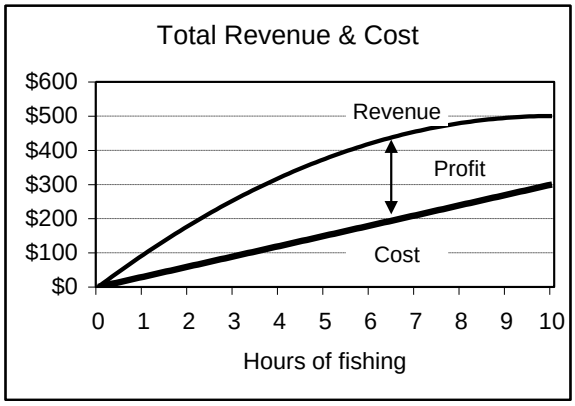
These next two graphs show how your total cost and your marginal cost change over ten hours of fishing. Because it costs you $30/hour to fish, your total costs are $30 after one hour, $60 after two hours, and so on up to $300 after 10 hours. Your marginal cost for every 1/10 hour of fishing is constant at $3.

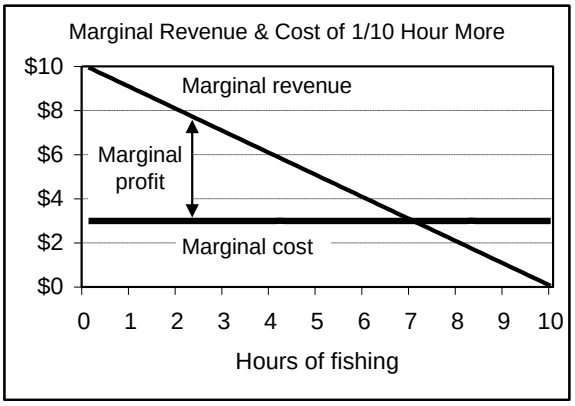




The graph on the left is an example of what economists call a *total cost curve.* The graph on the right is an example of what economists call a *marginal* cost curve with *constant marginal cost.*.

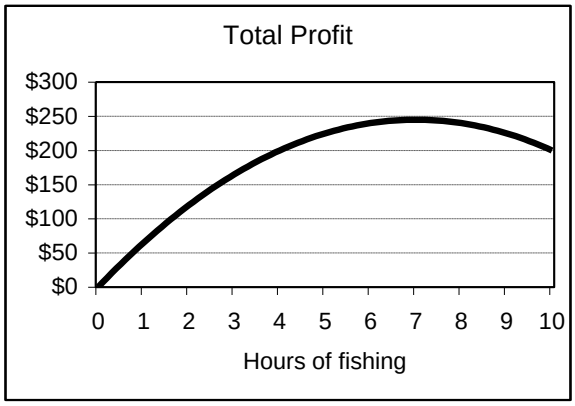
These next two graphs combine the previous two sets if graphs into one set of graphs. The graph on the left shows your total revenue and costs after a given number of hours of fishing. Your profit is your revenue minus your cost. The graph on the right shows your marginal revenue and marginal cost from another 1/10 hour of fishing. Your marginal profit is your marginal revenue minus your marginal cost.

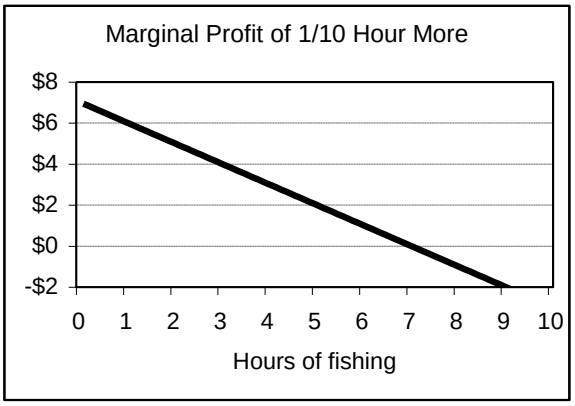




Thinking at the margin—looking at the graph on the right helps you show that you will maximize your profits if you stop fishing after 7 hours. Why? Because up to 7 hours, your marginal revenue is greater than your marginal cost, so your marginal profit is positive. By fishing a little longer, you would make more money. But after 7 hours, your marginal revenue is less than your marginal costs, so your marginal profit is negative. By fishing a little more, you would make less money. You should stop fishing at 7 hours, *when your marginal revenue equals your marginal cost*.

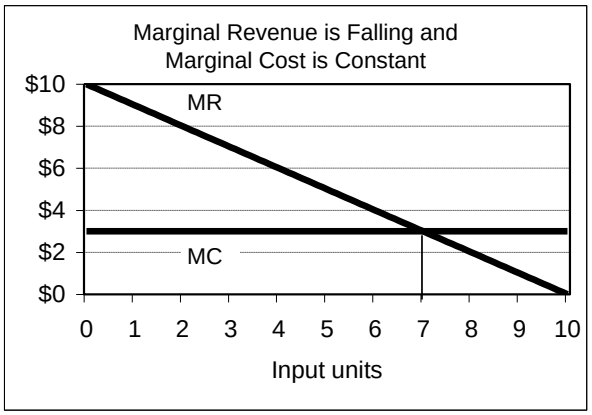
These last two graphs show how your total profit and your marginal profit change over ten hours of fishing. You can maximize your profits by fishing seven hours—the point at which your profits begin to go down if you keep on fishing. You can see this from the marginal profit graph, because the marginal profit is positive for less than 7 hours and negative for more than 7 hours. . You should stop fishing at 7 hours, *when your marginal profit is zero.*





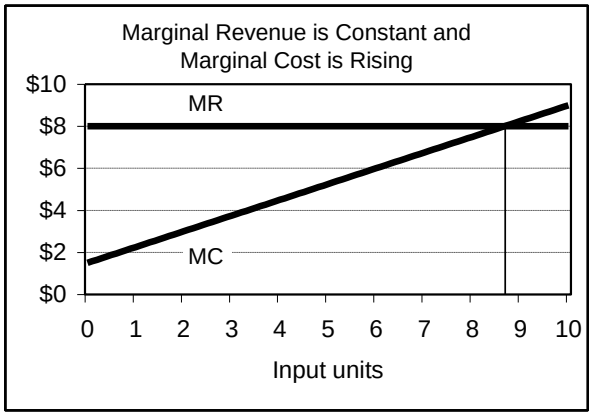
For our example so far, we've assumed that marginal revenue is falling while marginal cost is constant. To maximize your profits, you should stop fishing at 7 hours, when your *marginal revenue equals your marginal cost*.

Profit is maximized at 7 units of input when MR = MC



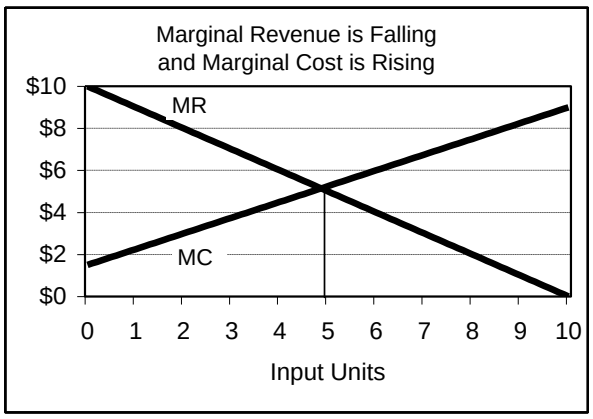
The same principle would apply if your marginal revenue was constant but your marginal cost was rising—for example, if your catch per hour stayed constant but your marginal cost increased as you fished longer (perhaps because you had to keep more and more fish refrigerated for each hour you fished).

Profit is maximized at 8.8 units of input when MR = MC



The same principle would also apply if your marginal revenue was falling and your marginal cost was rising—for example, if your catch rate went down as you fished longer, while marginal refrigeration costs went up.

Profit is maximized at 5 units of input when MR = MC



In each example, the profit-maximizing amount of input units to use would be the amount at which the *marginal revenue equals the marginal cost.*

Profit is Maximized when Marginal Revenue Equals Marginal Cost

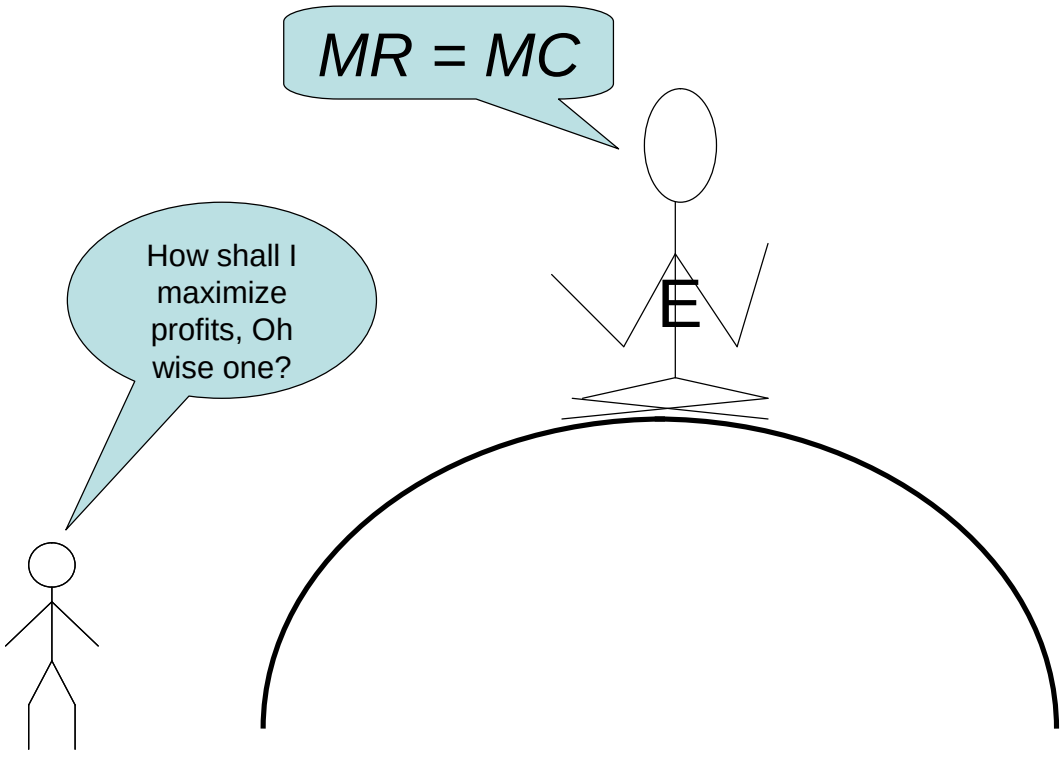
A very common question in economics is how much a profit-maximizing firm should do or use something. If marginal revenue is declining and/or marginal cost is increasing, the answer is: Do or use more of something if the marginal revenue is greater than the marginal cost. Don't do or use more of something if the marginal revenue is less than the marginal cost.

> *To maximize profits, keep doing or using something up to the point at which the marginal revenue from doing it or using it equals the marginal cost of doing or using it.*
>
> *[Remember: this is the condition for maximizing profits if marginal revenue is declining and/or marginal cost is increasing!]*

This is a very important principle in economics, which you'll see over and over in many different contexts. Economists often simply abbreviate it as:

$$MR = MC$$

(Marginal revenue = Marginal cost)



Maximum Physical Production is Not Necessarily Optimum

A very important insight from "thinking at the margin" is:

Maximizing physical production is not necessarily optimum.

Think about our fishing example. If you wanted to catch as many fish as possible, you would fish for 10 hours. But if you wanted to maximize your profits, you would stop fishing after 7 hours—when the marginal cost of fishing exceeds the marginal revenue.

That's why—not surprisingly—most firms don't try to maximize physical production. Fish processing plants don't hire as many workers as possible to process every possible fish and utilize every possible part of the fish that could possibly be used. They stop when the marginal cost of hiring more workers exceeds the marginal revenue.

That's why Alaska salmon processors don't necessarily build their fish processing plants big enough to handle 100% of the salmon available for harvest at the peak of a big salmon run—which is why they sometimes put Alaska salmon fishermen on "limits." The marginal cost of adding extra plant capacity and workers to be able to process the peak catch may be less than the marginal revenue. Fishermen hate not being allowed to catch and sell all the fish they could physically produce—but it makes economic sense for the fish processors.

That's why fish farmers don't feed their fish constantly or keep them until they're as big as they could possibly get. They stop when the marginal cost of feeding the fish more or keeping them longer exceeds the marginal revenue from feeding them more or keeping them longer.

Looking ahead, as we'll discuss later in this book, many people think we should manage wild fisheries for "maximum sustained yield." But fish economists point out that "maximum physical fish production is not necessarily optimum!" They suggest that we shouldn't try to increase production from wild fisheries above the point at which marginal costs of catching the fish exceeds the marginal revenue from increased fish sales. Remember that when we study wild fisheries management!

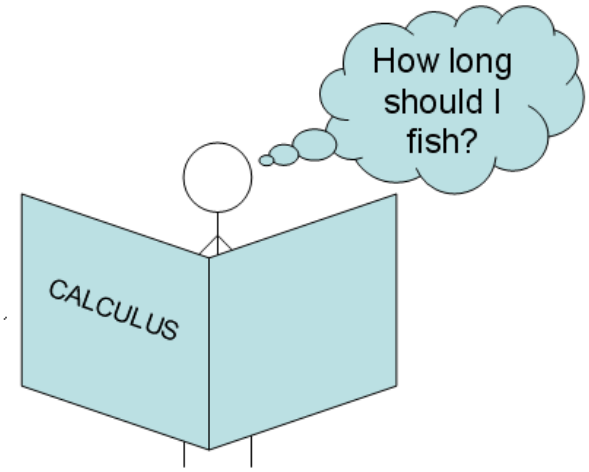
"Thinking at the margin" is easy if you know calculus. Thinking at the margin is what you do in calculus to find the maximum of a function Y = f(X): you look for the value of X at which the derivative of the function, or the marginal change in Y for a marginal change in X, is zero:

Y = f(X) is maximized when f'(X) = DY/DX = 0

If profits Π(X) = revenues R(X) - costs C(X), then profits are maximized when:

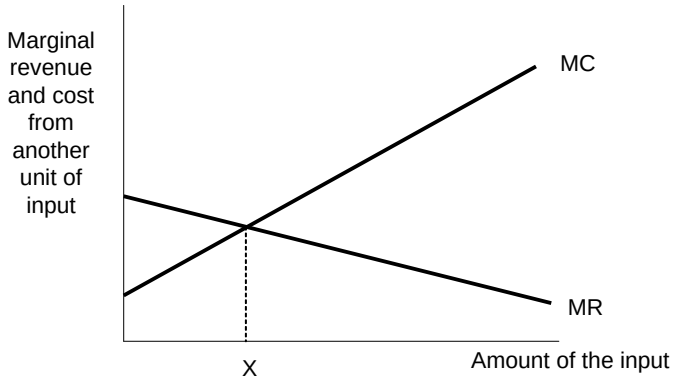
$$\Pi'(X) = 0$$
$$R'(X) - C'X) = 0$$
$$R'(X) = C'(X)$$

Marginal revenue = Marginal cost

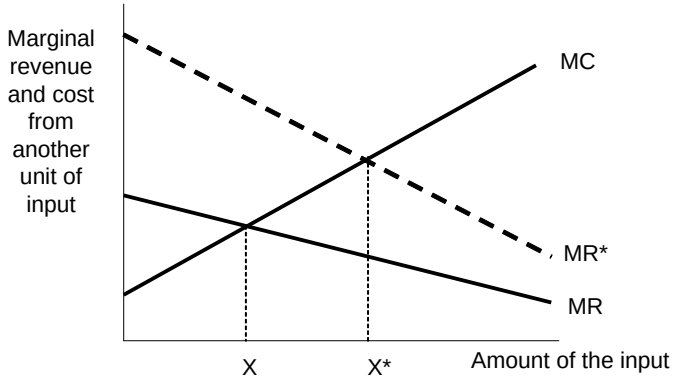


8. EFFECTS OF PRICES ON MARGINAL CHOICES

Suppose you want to know how much of an input you should use to maximize your profits. You've studied economics, so you know that you should use inputs up to the point at which the *marginal revenue from using another unit of input equals the marginal cost of using another unit of input*. So you should use X of the input.

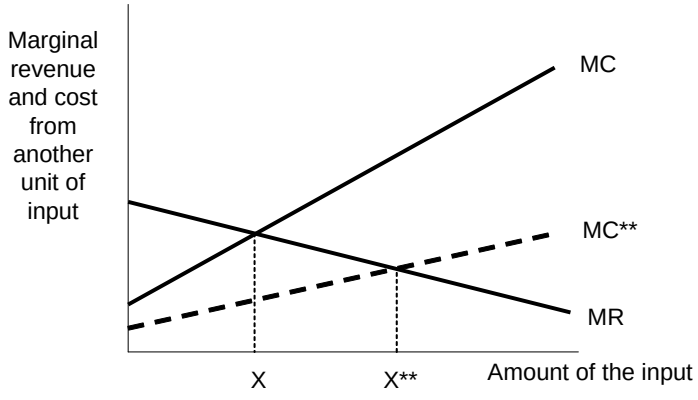


But now suppose the price of your product doubles. That means that for each marginal unit of output, you'll earn twice as much revenue—which means that your marginal revenue curve is twice as high for any amount of input (MR* instead of MR).



Because your marginal revenue curve is higher, the profit-maximizing level of inputs to use, at which the marginal revenue equals the marginal cost, will be higher. Instead of X you should use X*. The effect of an increase in output price is to increase your profit-maximizing amount of input, which also increases your profit-maximizing amount of ouput.

Suppose instead of the price of the output increasing, the cost of the input falls by half. That means that for each marginal unit of input, your marginal cost will only be half as high—which means that your marginal cost curve is only half as high for any amount of input (MC** instead of MC).



Because your marginal cost curve is lower, the profit-maximizing level of inputs to use, at which the marginal revenue equals the marginal cost, will be higher. Instead of X you should use X**. The effect of a decrease in input price is to increase your profit-maximizing amount of input, which also increases your profit-maximizing amount of ouput.

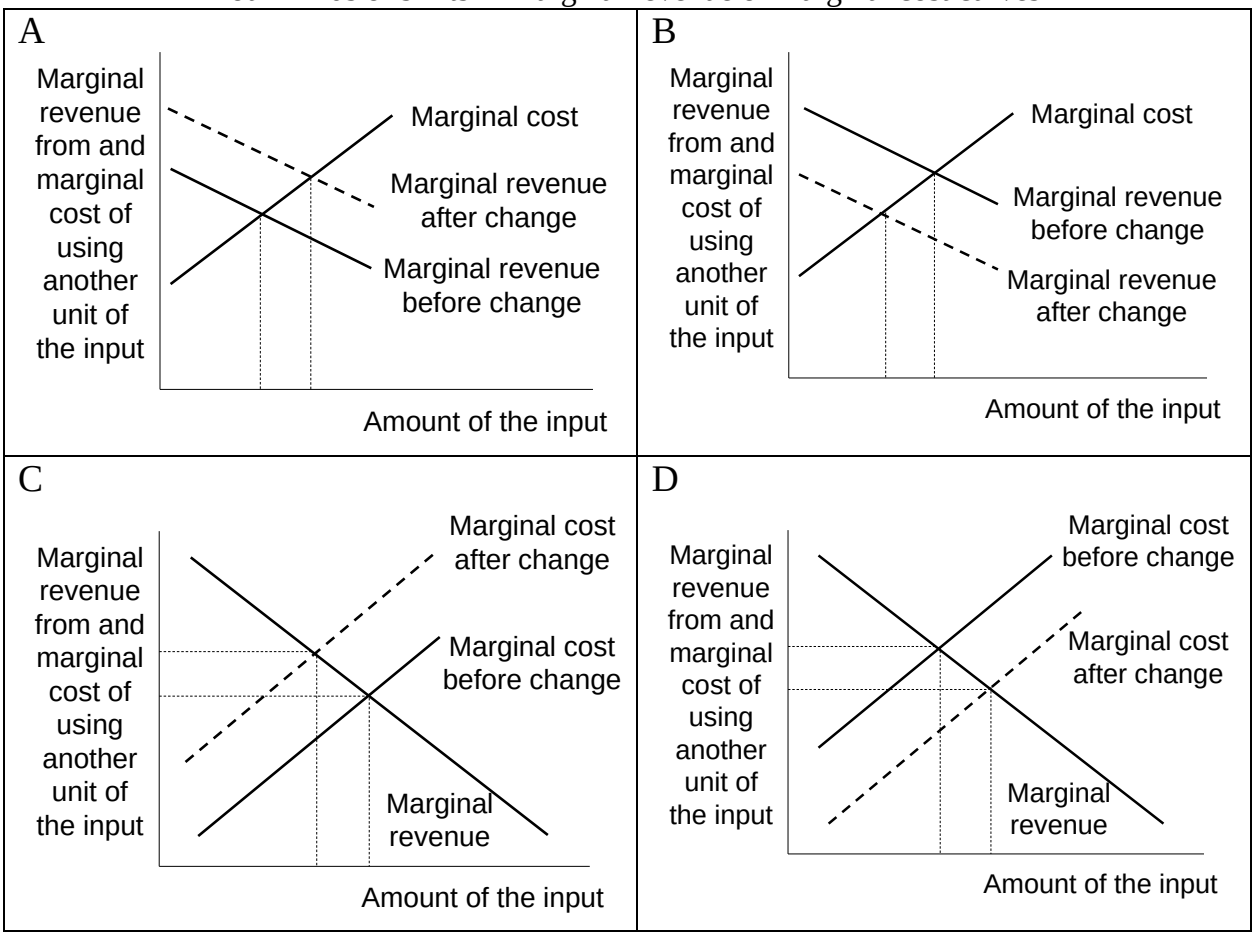
These graphs illustrate a very important principle amount of economics.

The profit-maximizing amounts to use of an input and to produce of an output both depend on the cost of the input and the price of the output. If the cost of the input changes, the marginal cost curve shifts. If the price of the output changes, the marginal revenue curve shifts. These shifts cause the profit-maximizing amount of input to shift, which causes the profit-maximizing amount of output to shift.

Here's a summary of how changes in input or output prices shift marginal revenue or marginal cost curves, and how they affect profit-maximizing input and output levels.

Type of change in input or output price	Effects on marginal revenue or marginal cost curves	Graph which illustrates the change	Effect on profit-maximizing input level at which marginal revenue = marginal cost	Effect on profit-maximizing output level
Increase in output price	Shifts marginal revenue curve up	A	Increases	Increases
Decrease in output price	Shifts marginal revenue curve down	B	Decreases	Decreases
Increase in input price	Shifts marginal cost curve up	C	Decreases	Decreases
Decrease in input price	Shifts marginal cost curve down	D	Increases	Increases

Four kinds of shifts in marginal revenue or marginal cost curves



The fact that prices of inputs and outputs affect profit-maximizing input and output choices might seem obvious when you think about it theoretically or when you draw these kinds of graphs. But it's easy for people to forget.

It's natural to think—and many people do think—that the "best" way to do something is a purely technical question with a technical answer. For example you might think that:

There's a "best" number of fish to harvest annually from a wild fishery
There's a "best" number of fishing boats for a wild fishery
There's a "best" number of crew to have on a fishing boat
There's a "best" way for a fish farmer to feed fish
There's a "best" way to market fish

But economics says it isn't so! *Economics says what best depends in part on prices of inputs and outputs! Since prices can change, what's best can change.*

The "best" number of fish to harvest annually from a wild fishery depends on the price of the fish and the cost of harvesting them

The "best" number of fishing boats for a wild fishery depends on the price of the fish and the cost of operating a fishing boat.

The "best" number of crew to have on a fishing boat depends on the price of fish and the cost of hiring crew.

The "best" way for a fish farmer to feed fish depends on the price of fish and the cost of feed.

The "best" way to market fish depends on the price of fish and the costs of different ways of marketing.

"Optimum Yield"

The Magnuson-Stevens Fisheries Conservation and Management Act (MFCMA), which establishes the policy for managing fisheries in United States federal waters, defines *optimum yield* as "the amount of fish that (1) will provide the greatest overall benefit to the United States, with particular reference to food production and recreational opportunities; and (2) is prescribed as such on the basis of maximum sustainable yield from such fishery, as modified by any relevant ecological, economic, or social factors." Economic theory suggests that the "optimum yield" should depend upon both the price of fish and the costs of harvesting fish—both of which change over time. That means that the *economically* optimum yield might also change over time.

The "Optimum Number" of Limited Entry Permits

Alaska's salmon fisheries are managed by a "limited entry" system under which there are a limited number of permits for each salmon fishery. According to Alaska's limited entry law, the State's Commercial Fisheries Entry Commission is supposed to determine the "optimum number" of permits for each fishery, based on economic, conservation, and fishery management concerns. Economic theory suggests that the "optimum number" of permits should depend upon both the price of fish and the costs of harvesting fish—both of which change over time. That means that the *economically* optimum number of permits for a fishery might also change over time.

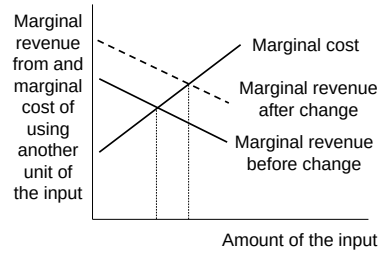
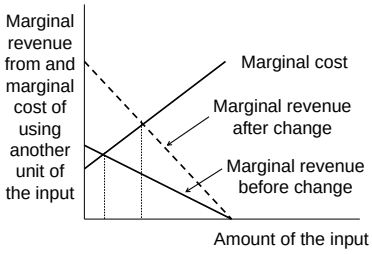
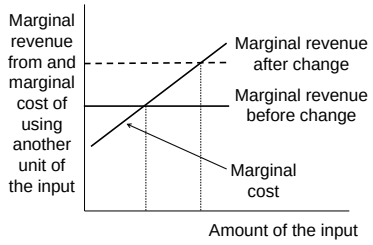
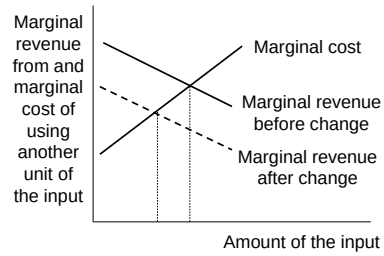
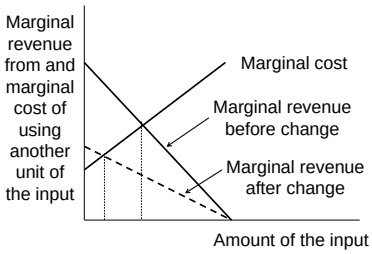
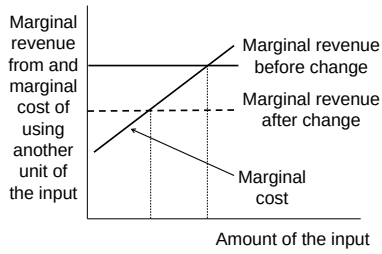
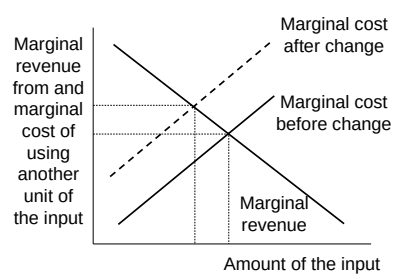
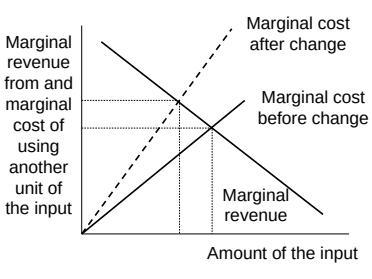
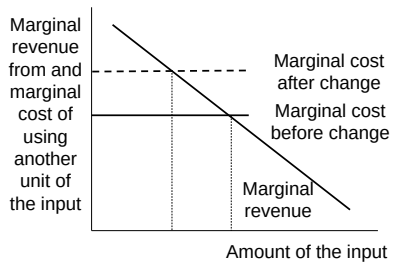
Graphs A-D which we drew to illustrate four kinds of shifts in marginal revenue or marginal cost curves all show the marginal cost curve sloping upwards and the marginal revenue curve sloping downwards. They all show the shifts in marginal cost or marginal revenue as moving the curves up or down by a constant amount so that the new curves are parallel to the old curves. This is a standard way economists often draw these curves to illustrate the effects of shifts in these curves.

However, for any real-world situation, the actual shapes of marginal revenue and marginal cost curves depend upon the *production function*, or how the amount of inputs affects the amount of

output. So real-world marginal revenue and marginal cost curves aren't necessarily straight or upward sloping. Similarly, real-world shifts changes in prices don't necessarily shift the curves by a constant amount. The graphs on the next page show some other potential shapes of and shifts in marginal revenue and cost curves. Economics textbooks and courses spend a lot of time getting students to think about which graphs would be best for different kinds of situations. You should think about that too—but I won't ask you to in this book. Just remember:

> *The profit-maximizing amounts to use of an input and to produce of an output both depend on the cost of the input and the price of the output. If the cost of the input or the price of the output changes, the profit-maximizing input and output amounts can change!*

Examples of different potential shapes of and shifts in marginal revenue and cost curves

Increasing marginal cost and decreasing marginal revenue: effects of a constant shift in marginal cost or marginal revenue	Increasing marginal cost and decreasing marginal revenue: effects of a proportional shift in marginal cost and marginal revenue	Constant marginal cost or marginal revenue: effects of a constant shift in marginal cost or marginal revenue
A 	E 	I 
B 	F 	J 
C 	G 	K 
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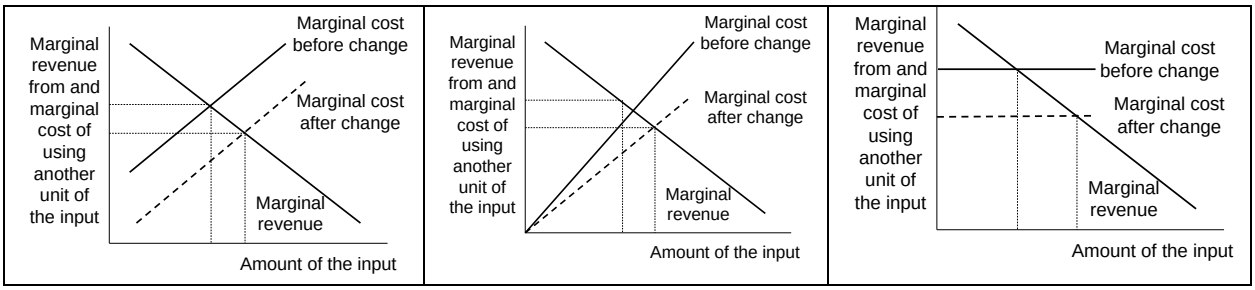

Marginal revenue from and marginal cost of using another unit of the input
Marginal cost before change
Marginal cost after change
Marginal revenue
Amount of the input
Marginal revenue from and marginal cost of using another unit of the input
Marginal cost before change
Marginal cost after change
Marginal revenue
Amount of the input
Marginal revenue from and marginal cost of using another unit of the input
Marginal cost before change
Marginal cost after change
Marginal revenue
Amount of the input

9. EXPLAINING ECONOMIC CHOICES

Explanatory economics *explains* economic choices of people, firms and societies. It looks at why they make choices, and how different factors affect choices. The technical term for explanatory economics is *positive* economics.

How does explanatory economics explain economic choices? By making assumptions about people's and firms' objectives—what they are trying to do—and how they act to try to achieve those objectives. Economists then use models to systematically study the implications of different kinds of assumptions for the economic choices we would expect people and firms to make and the feedback effects of these choices on themselves, other people and firms and society as a whole.

Here are some of the most important assumptions that mainstream explanatory economics is based on:

How People Make Economic Choices

People act rationally and make economic choices based on consistent preferences

People's Preferences

People prefer having more of a good or service to less (if it doesn't affect any other choice)
People refer working less to working more (if it doesn't affect any other choice)
People prefer to receive goods or services sooner rather than later
The more people have of something, the less they are willing to give up to get another unit of it

Firms' Objectives

Firms try to maximize profits
Firms try to earn profits sooner rather than later

Production

Inputs (labor, capital and/or resources) are needed to make outputs (goods and services)
Each additional unit of input gets you progressively less additional output

Economists don't think their assumptions about people and firms and production always apply to all people or all firms or all production: only that they *usually* apply to most people and firms and most kinds of production—enough so that they are a reasonable basis for developing models to explain what people and firms do.

In the last two chapters we looked at how much of an input a firm should use if its objective is to maximize its profits. We showed that if as a firm uses more of an input, its marginal revenue decreases and/or its marginal cost increases, then to maximize its profits a firm should:

- Use the input at the level for which marginal revenue equals marginal cost.
- Produce output at the level of input for which marginal revenue equals marginal cost
- As the price of the input increases, use less input and produce less output
- As the price of the output increases, use more input and produce more output

This is what a profit-maximizing firm *should* do.

Explanatory economics assumes that what a profit-maximizing firm *should* do is what *actual firms actually do*.

More generally, explanatory economics is based on the assumption that we can explain what people and firms do by thinking about what we would *expect* them to do if they are trying to achieve assumed objectives. So explanatory economics concludes that *actual firms will actually do what theory predicts that profit-maximizing firms would do:*

- Use inputs at levels for which marginal revenue equals marginal cost.
- Produce outputs at the levels of input for which marginal revenue equals marginal cost
- As the prices of inputs increases, use less inputs and produce less output
- As the prices of outputs increases, use more inputs and produce more output

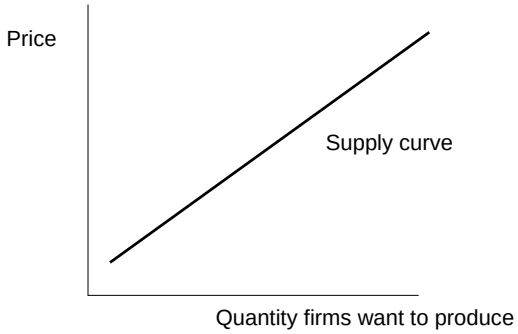
Microeconomics

Microeconomics is the study of specific parts of an economy—such as individuals, companies or industries. Fish economics is part of microeconomics.

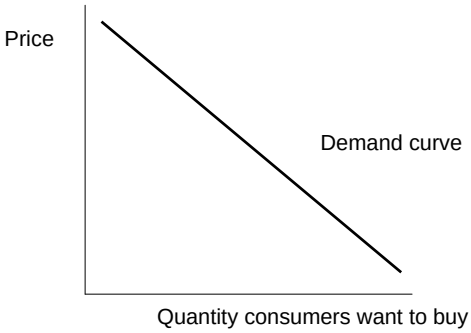
Microeconomics is based on deducing what we would expect individuals, companies and industries to do based on assumptions about production functions and the objectives and people and firms—just as we deduced how firms would respond to changes in prices of inputs or outputs.

Here are five of the most important deductions of microeconomics. They are fairly intuitive. But if you want to see how economists deduce them—and train yourself to think rigorously about economics—you should take a course in economics or read an introductory economics textbook.

1. The higher the price of a product, the more firms will want to produce or "supply." Economists call this relationship a *supply* curve. The supply curve is typically drawn as an upward sloping relationship between price and the quantity firms want to produce, with the price graphed on the vertical axis.



2. The higher the price of a product, the less consumers will want to buy or "demand." Economists call this relationship a *demand* curve. The demand curve is typically drawn as a downward sloping relationship between price and the quantity consumers want to buy, with the price graphed on the vertical axis.



Economists think that if this Japanese store lowers the price of these salmon fillet slices (kirimi) by putting it on sale, consumers will want to buy more of the salmon

3. If the relative prices of two inputs change, firms will tend to use relatively more of the input for which the relative price falls and relatively less of the input for which the relative price rises.

For example, economists argue that fish processing companies in China use relatively more workers and relatively fewer machines than fish processing companies in Norway because the price of labor relative to the price of machines is lower in China.

China

Norway

4. If the relative prices of two outputs change, firms will tend to produce relatively less of the output for which the relative price falls and relatively more of the output for which the relative price rises.

For example, economists argue that if the price of canned salmon rises relative to the price of frozen salmon, Alaska salmon processors will produce relatively more canned salmon and relatively less frozen salmon.

Processing canned salmon

Processing frozen salmon

5. If the relative prices of two products change, consumers will tend to buy relatively less of the product for which the relative price rises and relatively more of the product for which the relative prices falls.

For example, economists argue that if tilapia goes from being half as expensive as Chilean sea bass to being one-third as expensive, Americans will eat relatively more tilapia and relatively less Chilean sea bass.

Which are consumers more likely to buy?

Tilapia @ $4.58/lb

Chilean Sea Bass @ $15.99

Are Economists' Assumptions Realistic?

Economists are often criticized for the assumptions which underlie macroeconomics. Here are three of the most common critiques—and how economists respond to them.

Critique #1: Firms don't necessarily try to maximize profits. For example, you may know (or be) a fisherman or fish farmer or fish processor who says "I'm not trying to maximize my profits . . . I'm just trying to feed my family, and treat my employees and customers fairly and contribute to my community."

Economists agree that not all firms try to maximize profits. But certainly many businesses *do* try to maximize profits. For example, corporations have a legal obligation to try to maximize profits for their stockholders.

Economists argue that for their models—and the insights of microeconomics—to be useful, their assumptions don't have to apply to *everyone*. They just have to apply to enough firms or enough people that they are useful in explaining what firms and people tend to do.

Economists also argue that even if firms don't *think* they try to maximize profits, they can't ignore profits. No firm can stay in business for very long if it loses money. If you go out of business, you won't be feeding your family, or treating your employees or customers well, or contributing to your community. So economists argue that even if firms don't think about maximizing profits, most firms won't stay in business unless they *act* like they were trying to maximize profits.

Critique #2: Firms and people don't think like economists assume they do. You may know (or be) a fisherman or fish farmer or fish processor who says "I never heard of 'marginal revenue' or 'marginal cost.' I don't even know what economists are talking about when they say 'firms use inputs at levels for which marginal revenue equals marginal cost.'"

Economists respond that for their models of how firms or people make decisions to be useful or valid, people don't necessarily have to think about choices in the way that economists say they do—they just have to *act* as if they were thinking that way. Even if you never think about marginal revenue and marginal cost in your business, as you make business decisions you will tend to act as if you were thinking about marginal revenue and marginal cost. You may never ask yourself "what would be the marginal revenue and marginal cost of hiring another worker?" But you are probably going to ask yourself something like "is it worth it to hire another worker?"

Critique #3: We should think about people, not profits! Many people are bothered by the fact that economists think and talk so much about how to maximize profits. They believe that society should focus on other goals—like reducing poverty, treating workers fairly, taking care of the environment, and using resources sustainably.

Economists respond that *explanatory economics is about explaining what firms and people actually do*—not about saying what they should do. If firms and people act like they are trying to maximize profits, then that's what we need to study.

Are People Rational?

One of the fundamental assumptions economists make—and on which much of mainstream economics is based—is that people act rationally and make economic choices based on consistent preferences. Over the past several decades psychologists and some economists have begun to question these fundamental assumptions. In doing so, they are questioning the basic foundations of modern economics.

The psychologist Daniel Kahneman—who had never taken an economics course!—won the Nobel Prize in Economics for psychological research about whether people in fact like economists have always assumed they do. In a recent book, he wrote about reading an essay forty years ago by an economist about the psychological assumptions of economic theory:

> *I can still recite its first sentence: "the agent of economic theory is rational, selfish, and his tastes do not change." I was astonished. My economic colleagues worked in the building next door, but I had not appreciated the profound difference between our intellectual worlds. To a psychologist, it is self-evident that people are neither fully rational nor completely selfish, and that their tastes are anything but stable. Our two disciplines seemed to be studying different species. . ."*[i]

Research about how people actually think and make choices—as opposed to how economists had always assumed that they think and make choices—is beginning to significantly change many areas of economics. It turns out that much of the time, *people don't act rationally or make economic choices based on consistent preferences.*

But it probably won't change most of the fish economics that this book is about—because most of the fish economics in this book works pretty well in explaining what happens in the fish business. Certainly, people in the fish business—and the consumers who buy fish—aren't all rational and don't all have stable tastes. But enough of them act as if they were rational and had stable tastes that even relatively simple economic models can explain a lot of what happens in the fish business pretty well.

Put simply, even though explanatory fish economics is based on relatively simplistic assumptions about how people and firms make economic choices, it is still useful. It still explains a lot.

10. AN INTRODUCTION TO SUPPLY AND DEMAND

One of the most important and useful tools of economics is *supply and demand analysis*. Economists use supply and demand analysis to study three broad types of questions about markets:

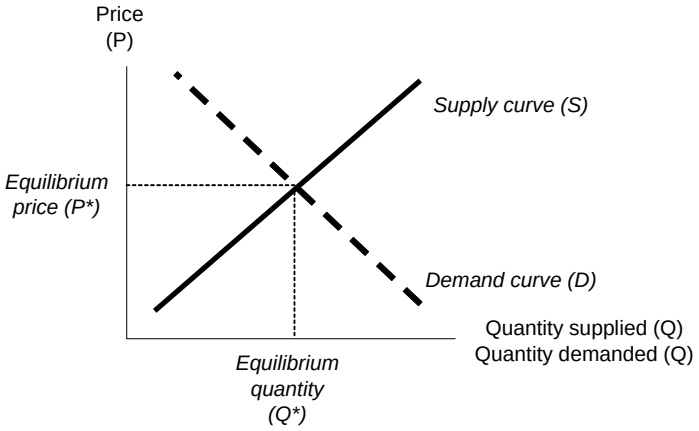
- What determines the price?
- What determines the quantity bought and sold?
- Who benefits, by how much, from the market?

Supply and demand analysis can be confusing—but it is well worth learning! Make the effort to understand these graphs and learn how to use supply and demand. It will help you understand a lot about fish economics—and many other kinds of economics.

"It's easy to train economists. Just teach a parrot to say 'Supply and Demand.'-Thomas Carlyle

Supply and Demand Graphs

Supply and demand analysis uses graphs that look like this:



Before you think about what anything on the graphs means, look at how the graphs are set up:

- The vertical axis shows price (P)
- The horizontal axis shows "quantify supplied" and/or "quantity demanded" (Q)
- There is an "supply curve" (S) which slopes up
- There is a "demand curve" (D) which slopes down
- Where the supply curve and demand curves cross determines a particular price and quantity which economists call "equilibrium price and quantity" (P* and Q*)

An Example of a Very Simple Market

To learn about supply and demand, let's start with a simple hypothetical market. The sellers or "suppliers" are fishermen. The buyers or "demanders" are consumers who buy the fish directly from the fishermen.

Detail from the Great Fish Market," Jan Breughel the Elder (1568-1625)

Assume—for this simple example—that there is only one kind of fish, and all the fish are exactly the same. The fishermen can catch as much fish as they want. But the more fish they catch, the more it costs them per fish, because they have to travel farther to catch the fish.

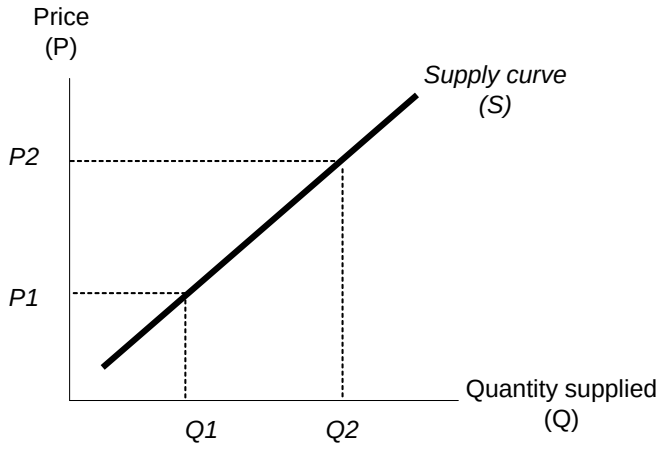
Assume—for this simple example—that the consumers are buying the fish only for themselves. How much they want to buy depends on the price. The lower the price, the more they want to buy.

All we are interested in is—for this simple example—is how many fish are bought and sold each day, and what price they are bought and sold for.

A fish market in Tanzania

The Supply Curve

Economists draw a supply curve (S) to show how much fish fishermen would be willing to sell or *supply* for any given price.



Technically, the supply curve shows, for *a given market (group of sellers and buyers) during a given period of time*, how much of a product would be offered for sale or *supplied* at any given price. Alternatively, the supply curve shows what price would be required to get the sellers to sell or *supply* any given quantity.

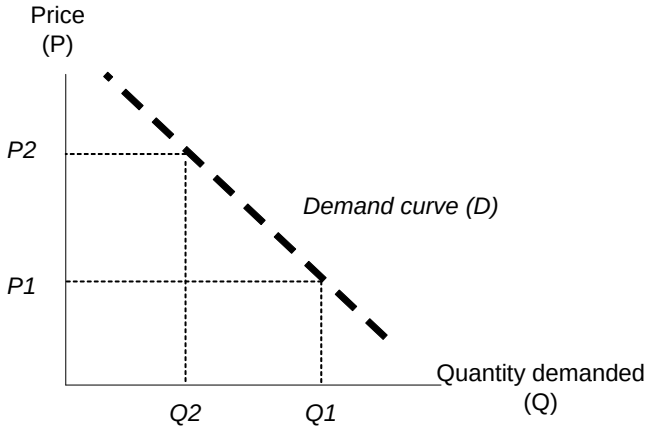
The supply curve is usually depicted as upward sloping. This means that as the price rises, suppliers would be willing to offer more of the product for sale. Alternatively, it means that to get suppliers to supply a greater quantity the price needs to increase.

In our simple example, the higher the price, the more fish fishermen are willing to catch. At a low price like P1 fishermen are only willing to supply Q1 fish (those which they can catch for a lower cost than P1). If the price rises, then fishermen are willing to travel farther, at a higher cost, to catch more fish (quantity Q2).

For simplicity economists often draw the supply curve as a straight line. However it could be any shape of upward-sloping curve. There is no reason to expect that it would necessarily be a straight line.

The Demand Curve

Economists draw a demand curve (D) to show how much fish buyers would want to buy or *demand* at any given price.



Technically, the demand curve shows, for *a given market (group of sellers and buyers) during a given period of time*, how much of a product buyers would offer to buy or *demand* at any given price. Alternatively, the demand curve shows what price would be required to get buyers to buy or *demand* any given quantity.

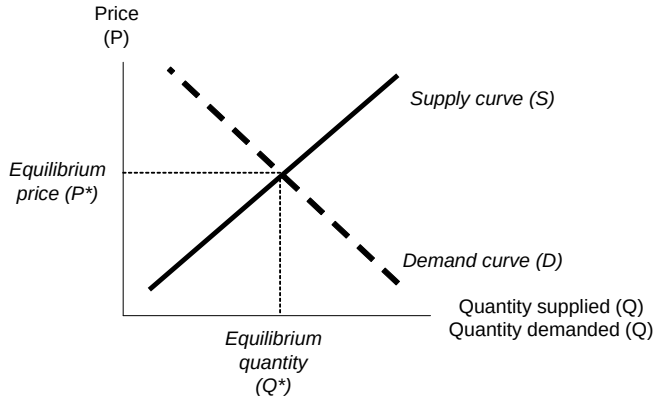
The demand curve is usually depicted as downward sloping. This means that as the price rises, buyers would be willing to buy less of the product. Alternatively, it means that to get buyers to buy a greater quantity the price needs to decrease.

In our simple example, the lower the price, the more fish consumers are willing to buy. At a low price like P1 consumers are willing to buy Q1 fish. If the price rises to Q2, the quantity consumers are willing to buy falls to Q2.

For simplicity economists often draw the demand curve as a straight line. However it could be any shape of downward-sloping curve. There is no reason to expect that it would necessarily be a straight line.

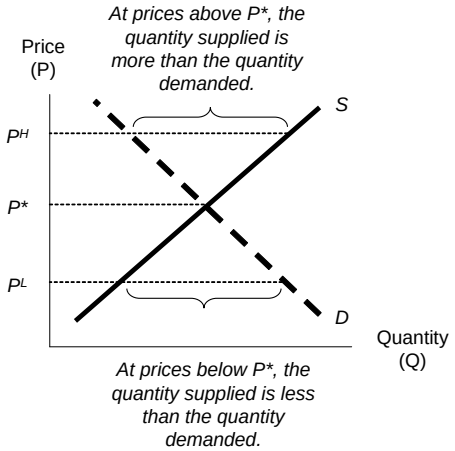
Equilibrium Price and Quantity

The intersection of the supply and demand curves—where they cross—determines a particular price and quantity which economists call the equilibrium price and the equilibrium quantity (P* and Q* in the graph). At the equilibrium price, the quantity supplied equals the quantity demanded. The quantity of fish that fishermen are willing to supply equals the quantity that consumers want to buy.



Economists argue that if a market is "competitive"—if there are many buyers competing with each other to buy fish and many sellers competing with each other to sell fish—then the price and quantity will tend towards the equilibrium price and the equilibrium quantity.

To see why, think about what happens if the price is *not* the equilibrium price. Suppose the price is at P^H, above the equilibrium price P^E. At price P^H, supply would exceed demand. The fishermen would be willing to sell more fish than the consumers would want to buy.



What would happen? The fishermen who couldn't sell their fish would drop their price to try to get consumers to buy from them instead of the other fishermen. Consumers would switch to buying from the fishermen offering to sell for a lower price. And as the price fell, they would be willing to buy more. This process would continue until the price fell to the equilibrium price P*,

at which fishermen would be offering to sell just as much as consumers would want to buy—so that fishermen no longer had any incentive to lower the price further.

Similarly, suppose the price is at P^L, below the equilibrium price P^*. At price P^L, demand would exceed supply. Consumers would want to buy more fish than fishermen would be willing to sell.

What would happen? The consumers who couldn't buy fish would offer to pay a higher price to fishermen to sell to them instead of the other consumers. Fishermen would switch to selling to the consumers offering to pay a higher price. As the price rose, fishermen would be willing to supply more fish. This process would continue until the price rose to the equilibrium price P*, at which buyers would be offering to buy just as much as fishermen would be willing to sell—so that buyers no longer had any incentive to bid the price up higher.

Note that the price only gets bid down or up to the equilibrium price P* if the market is *competitive*—if there are lots of buyers and sellers who make independent decisions. What drives the price down if it's above P* is that some fishermen—those who can't sell their fish—lower the price they are asking for. But if all the fishermen agreed not to lower their price, the price wouldn't go down.

What drives the price up if it's below P* is that some consumers—those who can't buy fish—raise the price they offering to pay. But if all the buyers agreed not to raise their price, the price wouldn't go up.

Whether and how prices actually get to the equilibrium price—the price at which quantity demanded equals quantity supplied—is an extremely important topic in economics. It is also a complicated topic which is beyond the scope of this book. For learning about basic fish economics, it's enough to remember that <u>if a market is competitive, over time the price and quantity will tend to move towards the equilibrium price and quantity—if nothing changes that would cause the supply or demand curve to shift.</u>

Fish buyers, Tsukiji market, Japan

Fish sellers, Kamchatka, Russia

11. ECONOMIC VALUE

One of the most elusive concepts in economics is *value*. "Value" means different things to different people. We use the word "value" in many different ways. Here are some examples:

"The value of that fishing permit has gone up 25%."

"The ecological value of salmon is priceless."

"This community derives incredible value from our local fisheries."

The nutritional value of fish is higher than the nutritional value of beef."

"The cultural value of subsistence fishing is just as important as the food it provides."

"That painting of your boat has no artistic value."

"That boat had a lot of sentimental value to me."

"You can't put a value on a day fishing with your kid."

These statements express a wide range of concepts of value. None of the concepts of value is the "correct" one. They are all "correct" in the context in which they are being used. It would be pointless to argue over which concept is "right" or whether some are "wrong." We understand what each statement means to the speaker.

Economists have several economic definitions of value. These concepts have specific meanings for economists. They are useful for answering certain kinds of economic questions.

Non-economists don't always understand or like these economic concepts of value. For example, sometimes you'll hear people say "economists understand the price of everything and the value of nothing."

But what matters is not how economists *define* "economic value" but how they *use* "economic value" defined in this way. If you want to argue with economists about value, argue about whether the way the arguments they make and the advice they give based on their definition of "economic value" are justified.

Defining Economic Value

Economists define the *economic value* of something as either:

- The highest amount any user or users would be *willing to pay* for it
- The lowest amount any user or users would be *willing to accept* to give it up

These definitions are sometimes abbreviated to *willingness-to-pay* or *WTP* and *willingness-to-accept* or *WTA*.

Economists argue that the value we exactly place on something is measured by what we are willing to give up to get it (*willingness-to-pay* or *WTP*) or to accept to give it up (*willingness-to-accept* or *WTA*).

To an economist, a fish is only "worth" $5/lb if someone is willing to pay that much for it. A fish *isn't* "worth" $5/lb if no-one is willing to pay $5/lb for it.

You may think a diamond ring is ridiculously over-priced. But if someone is willing to pay $100,000 for a painting or a ring, that's its *economic value*.

We're used to measuring economic value in dollars or other currencies because it's convenient. But the economic value of something can be measured in terms of anything we're willing to give up or accept for it—like fish or potatoes or days of labor.

Defining *What* You Are Valuing

In order to talk about the economic value of something, you have to define precisely *what you are valuing, in what amount, in what place, as of when, for what period of time, and for whom.* You need to answer these questions:

What are you valuing? You have to think carefully about this. The value of a fishing boat, a day of sport fishing, or a lottery ticket can all depend greatly on the specific rights and/or restrictions that come with them. The value of a fishing boat is affected by whether you are or aren't allowed to use it in particular fisheries. The value of a day of sport fishing depends on whether you have the fishing spot to yourself or have to share it with other people who may show up. The value of a lottery ticket depends on whether you have to be present at the drawing to win.

How much are you valuing? Economists distinguish carefully between *total value, average value* (value per unit), and *marginal value* (the value of the last unit). These may be very different. The total value of the water from a spring in the desert may be very high because we need at least some water to live—so we are willing to pay a great deal for the our first few drinks of water that keep us alive. The marginal value of the last unit of water may be low or zero if we already have all the water we need or want. Confusing total, average and marginal value is a common source of confusion about value. It helps explain how water can be both "priceless" (the water that keeps you alive) and "worthless" (after you've used all you want).

Where are you measuring the value? Value depends on where something is. Water is worth more in the desert than in the rain forest. A fresh salmon is worth more in a restaurant than on a fishing boat.

As of when are you measuring the value? A meal that you get to each next year will be worth more to you then than it is now. Fish somebody will deliver to you next year will be worth more to you then than they are now.

For *what period of time* are you valuing it? The value of owning a fishing boat permanently is higher than the value of the right to use it for one season.

For whom are you measuring the value? Herring roe has a higher value for Japanese than for Americans. Super Bowl tickets have a higher value for Americans than for Japanese.

Willingness-to-Pay vs. Willingness-to-Accept

Economic value as measured by willingness to pay may be different than economic value as measured by willingness to accept.

If I don't have any money, I won't be willing to pay $10,000 for a car—because I can't afford to. I'll walk, no matter how much I'd rather be driving. But that doesn't necessarily mean that if I had a car I'd necessarily be willing to sell it for $10,000. If I hate walking and love driving, I'll keep the car. The value to me of a car as measured by my "willingness to pay" may be lower than the value to me of a car as measured by my "willingness to accept."

If the people in a town are poor, they won't necessarily be willing to pay a million dollars to clean up a polluted stream—because they can't afford to. But if they have an unpolluted stream, that doesn't necessarily mean they'd be willing to let someone pay them a million dollars to pollute it. The value to them of clean water as measured by their "willingness to pay" may be lower than the value to them of clean water as measured by their "willingness to accept."

So which is the "right" definition of economic value: willingness-to-pay or willingness to accept? Economists argue that it depends on the question you're trying to answer—or the economic choice you're trying to make. What's the value to the town of clean water? If the stream is already polluted, and the question is whether the town (or its taxpayers) should pay $2 million to clean it up, the value that matters is willingness to pay. If the value as measured by willingness-to-pay is only $1 million, the answer may be "no": clean water isn't worth it.

If the stream is clean, and the question is whether the town should let a new factory pay $2 million for the right to pollute it, the value that matters is willingness to accept. If the value as measured by willingness-to-accept is $3 million, the answer may be "no": dirty water isn't worth it.

So if someone's making an argument for a policy choice based on an economist's estimate of economic value, think carefully about whether the measure of value was willingness to pay or willingness to accept—and whether that was the right measure.

Economic Value Depends Upon the Circumstances

Economic value is not inherent or fixed. What people would be willing to pay or accept for something depends upon the circumstances. What people would be willing to pay for water depends upon whether there's been a drought all year or whether it's been raining all year. What processors would be willing to pay fishermen for fish depends on whether or not their plant is already operating at full capacity. What people would be willing to pay for mechanics who can fix boat engines or processing machinery depends on whether it's the peak of the fish season. What people would be willing to pay for survival suits—or would be willing to sell their survival suits for—depends on whether their boat is sinking.

Especially if something has had a high value for a long time, it's natural to think that its high value is inherent or fixed or "right." But it isn't so. Just because people were always willing to pay a high price for something in the past doesn't necessarily mean they'll always be willing to pay that price in the future. Fishing permits that always had a high value can become worthless if the fish disappear. Fish that always had a high value can decline dramatically in value if cheaper substitutes becomes available or consumer tastes change. Skills that always had a high value—like navigating with sextants or repairing typewriters—can decline dramatically in value if cheaper technologies are developed that don't require those skills.

Economic Value is What People *Would be Willing* to Pay or Accept —Not Necessarily What they *Do* Pay or Accept

Suppose 100 movie lovers would each be willing to pay $20 to see a movie, but the movie theater lets them in for free. Even though they don't actually pay, the economic value of the movie showing is still 100 x $20 = $2000. Or suppose they movie theatre only charges them $1 dollar per person. The economic value of the movie showing is still $2000 (*not* 100 x $1 = $100).

Suppose 100 sport fishermen would each be willing to pay $50 for the right to fish for a day on a river, but they get to fish there for free. Even though they don't actually pay, the economic value of their right to fish is still 100 x $50 = $5000. Or suppose the government makes them buy a $5/day license in order to fish. The economic value of their right to fish is still $5000 (*not* 100 x $5 = $500).

Suppose 100 commercial fishermen would each be willing to pay $10,000 for the right to fish commercially for a season, but they get to fish for free. Even thought they don't actually pay, the economic value of their right to fish is still 100 @ $10,000 = $1 million. Or suppose the government makes them buy a $100/season license. The economic value of their right to fish is still $1 million (*not* 100 x $100 = $10,000).

Market Value and Non-Market Value

Market value is the value people actually pay for something. The market value of fish sold in a store is what consumers actually pay for the fish. The market value of sport fishing is what fishermen actually pay to sport fish.

Non-market value is economic value people receive without paying for it: the difference between what they would have been willing to pay and what they actually pay. If I would have been willing to pay $50 for the right to sport fish for a day, but I got to fish for free, the non-market value of my fishing was $50. If I paid $5 for a sport fishing license, the non-market value of my fishing was $45 and the market value of my fishing was $5.

Most of the value created by commercial fisheries is *market value*. Much of the value created by sport fisheries is *non-market value*. That can be confusing, because market value and non-market value are difficult to compare, and because non-market value is harder to measure than market value. That's one of many reasons why people argue about the relative economic value of commercial and sport fisheries.

Economic Value Isn't Necessarily the Same as Price

We often think of economic value in terms of price. If you can sell fish for $2/lb, you may think "these fish have a value of $2/lb." If fish had a higher price last year, you may think "fish had a higher value last year."

For things that are regularly bought and sold in competitive markets for competitive prices, price is a good measure of willingness-to-pay (the highest amount any user or users would be willing to pay for them) as well as willingness-to-accept (the lowest amount any user or users would be willing to accept to give them up). In a competitive market, nobody is willing to pay more than the going price or accept less than the going price.

Price is generally a fairly good indicator if economic value for fish—because fish are generally (not always) bought and sold in competitive markets. Price is generally a fairly good indicator of the economic value of the right to participate in an Alaska salmon fishery—because Alaska salmon limited entry permits are generally bought and sold in competitive markets.

For things that are bought and sold for prices that are *not* set in competitive markets, price is not necessarily a good indication of economic value. Here are some examples of prices which are not set in competitive markets:

The price of an Alaska sport fishing license
The price of tuition at the University of Alaska
The price of visiting the Grand Canyon
The price the right to drive in Alaska (an Alaska driver's license)

These prices are not necessarily good indicators of what people would actually be *willing to pay* for these things if they had to pay.

If something is not bought or sold then it has no price—but it can still have economic value! Here are some things that are not bought and sold—but which definitely have economic value!

The air we breathe
American citizenship

Economic Value Depends on the Distribution of Wealth and Income

How much people are willing to pay or accept for something depends on who has wealth or income and what matters to them. If rich people are willing to pay more for harbor berths for their yachts than commercial fisherman are able to pay for berths for their fishing boats, then using harbor berths for yachts has a higher economic value than using them for commercial fishing boats.

If wealthy diners in a fancy restaurant are willing to pay more for an Alaska wild salmon than hungry children in a homeless shelter, then the salmon has a higher economic value going to fancy restaurant than the it would going to the homeless shelter.

If fish feed companies are willing to pay more for Peruvian achovetas than poor Peruvians--because the feed companies will use the anchovetas to make feed for farmed salmon to sell to rich Americans—then using anchovetas for fish feed to grow salmon for rich Americans may has a higher economic value than using anchovetas to feed poor Peruvians.

You may find these examples of "higher" and "lower" economic value to be disturbing. But they are just examples of the implications of defining economic value based on willingness to pay.

Remember my earlier advice that matters is not how economists *define* "economic value" but how they *use* "economic value" defined in this way. If you want to argue with economists about value, argue about whether the way the arguments they make and the advice they give based on their definition of "economic value" are justified.

Here's a preview of advice that economists often give: they advise that *we should use resources in ways that maximize economic value*. So economists who make this advice would argue that it's "better"—in the three situations described above—to use the harbor berths for yachts, to send the salmon to a fancy restaurant than the homeless shelter, and to use the Peruvian anchovetas for feed.

You should think about whether you agree with this advice! Whether you agree should depend, in part, on whether you agree with these economists' assumption that the objective of maximizing economic value is more important than other potential objectives such as keeping working fishing boats in our harbors or helping poor Peruvians buy anchovetas or hungry Americans buy salmon.

"Ýou Can't Put a Value On . . ."

Sometimes people say "you can't put a value on a human life" or other things that matter a great deal to us. But actually, you can, and actually, we do—if we use economists' definitions of economic value.

All the time we see examples of what people are willing to pay to save peoples' lives—for example on search and rescue missions for fishermen when their boats are sinking. Sometimes it's hundreds of thousands or even millions of dollars. But it's not unlimited, particularly if we think of what we're willing to pay to improve the statistical chances of saving someone's life. Fishermen aren't willing to pay unlimited amounts for survival gear, or to give up all their income in order to stay on shore and be completely safe.

Economists say that we do put a value on human lives—and that the value we put on human lives is revealed by what we actually are (and aren't) *willing to pay* to save human lives.

And what people are willing to pay to save lives varies between countries. People in Bangladesh don't pay hundreds of dollars for survival suits or hundreds of thousands of dollars for search and rescue missions for fishermen—because they can't afford to. The *economic value* of a human life is lower in Bangladesh than in the United States.

You may find that disturbing. I *hope* you find it disturbing! But take some time to think about whether it's true. And take some time to think about whether you think people in Bangladesh *should* spend as much on survival suits as they do in America. There isn't any right answer to that question—I just want you to think about it.

Bangladesh fisherman	*Alaska fisherman*
	

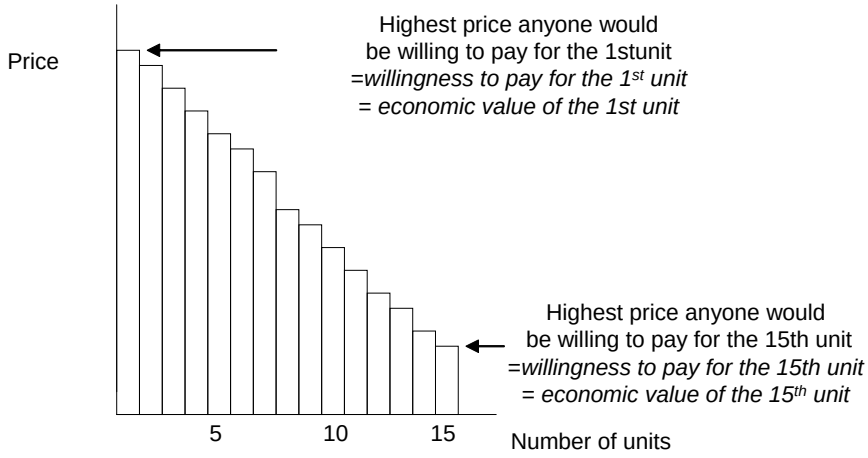
A cold hard fact is that when societies face scarcity we have to make economic choices. We can't have everything. Economic value is reflected in the choices we make—what we're willing to give up to get things. Richer societies can afford to make different choices than poorer societies.

12. GRAPHING ECONOMIC VALUE

Economists often use graphs to illustrate economic value and a number of important related concepts. Let's look at some of these graphs and concepts. There's some more terminology or jargon to learn—but it's worth learning, because you'll encounter these concepts frequently.

In all the graphs, the horizontal axis shows the number of units of some good or service or resource. The vertical axis represents price or cost.

In this graph, the height of each rectangle shows the highest price that anyone would be willing to pay for each of 15 units. Each rectangle is one unit wide. The area of the rectangle represents the *willingness to pay* for or *economic value* of that unit.

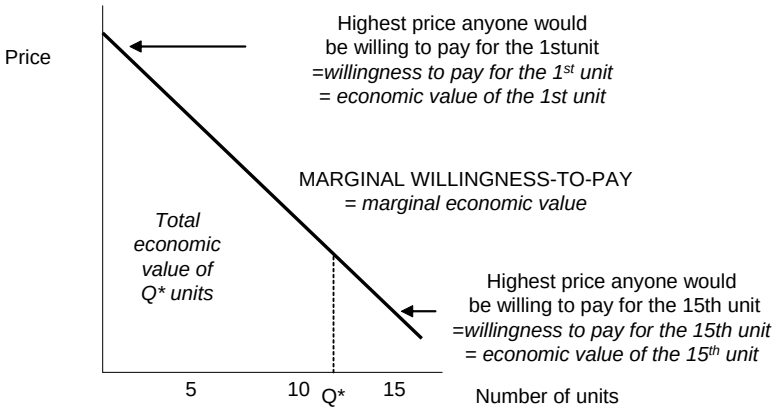


The *total willingness to pay* or *total economic value* for all 15 units would be the combined area of the 15 rectangles. As you move to the right in the graph, the height of each rectangle shows the *marginal willingness to pay* for another unit, or the *marginal economic value* of the unit.

Note that in the graph, marginal willingness to pay and marginal economic value decline as the number of units increases: the more units people have already bought, the less they are willing to pay for an additional unit. So marginal willingness to pay or marginal economic value is declining.

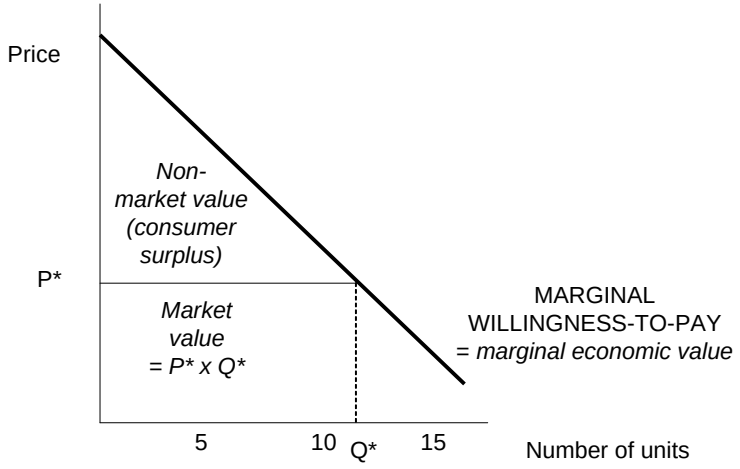
Here is the same graph, but with the rectangles replaced by a line showing marginal willingness to pay for each additional unit.

The total economic value for any number of units would be the area under the marginal willingness-to-pay line up to that number.



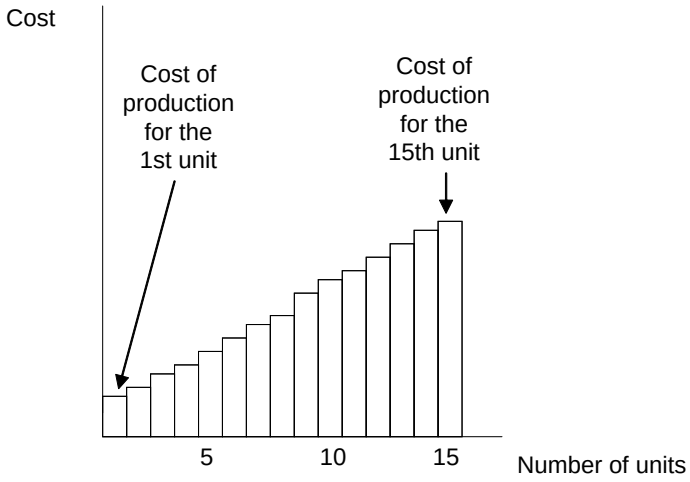
Now suppose that consumers buy Q* units at a price of P*. The *market value* of the Q* units—what people actually pay for the fish—is P* x Q*, as illustrated by the rectangle in the bottom left corner of this graph.

The rest of the total economic value (represented by the triangle at the top of the graph) is *non-market value*.



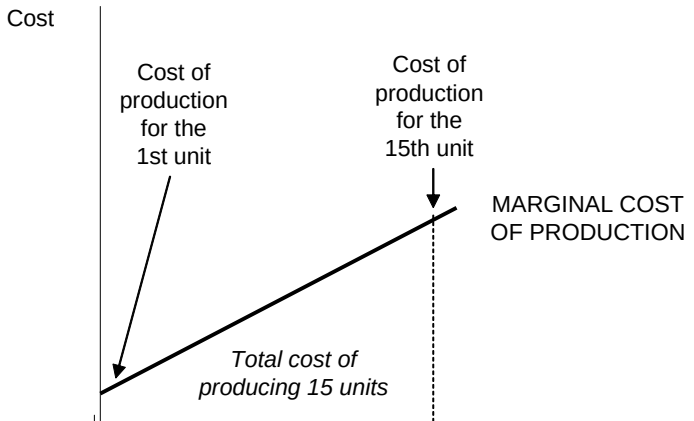
Economists sometimes call non-market value *consumer surplus*. Another definition of consumer surplus is the difference between what consumers would have been willing to pay (total economic value) and what they actually do pay (market value).

In this graph, the height of each rectangle shows the shows the *cost of production* for each of the first 15 units. The area of each rectangle is the cost of production for that unit. The total cost of production for 15 units would be the area of the 15 rectangles.

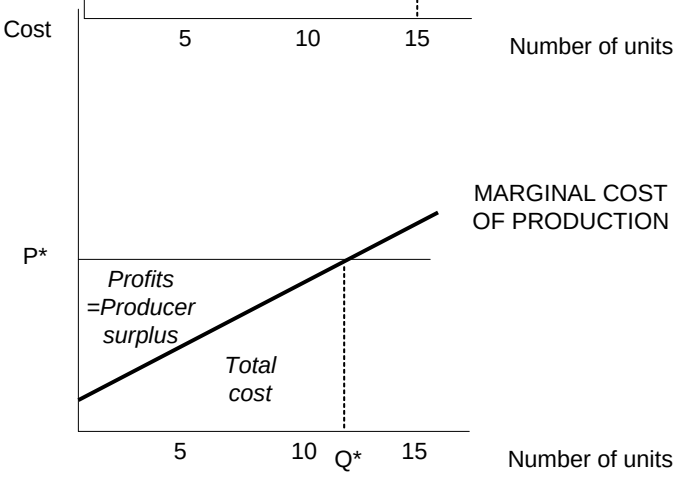


As you move to the right in the graph, the height of each rectangle shows the *marginal cost of production* for another unit. Economists often assume that the marginal cost of production increases as the number of units increases, as shown in this graph.

Here is the same graph, with the rectangles replaced by a line showing the marginal cost of production for each unit. The total cost of production for any number of units would be the area under the line up to that number.

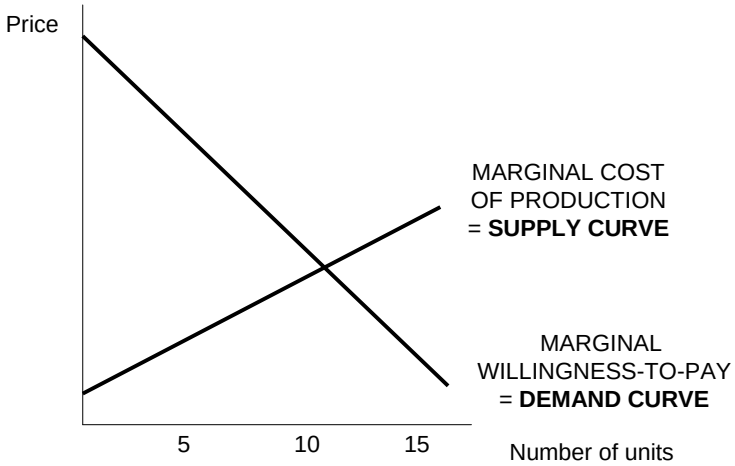


Suppose the producers sell Q* units for a price of P*. *Their total revenue* would be P* x Q*, the area of the rectangle in this graph. Note that total revenue is the same as *market value.*



The marginal cost line divides the total revenue rectangle into two parts. The bottom part—the area under the marginal cost line—represents the total cost of producing Q* units. The top part represents the difference between total revenue and total cost, or the producers' *profits*. Economists sometimes call producers' profits *producer surplus.*

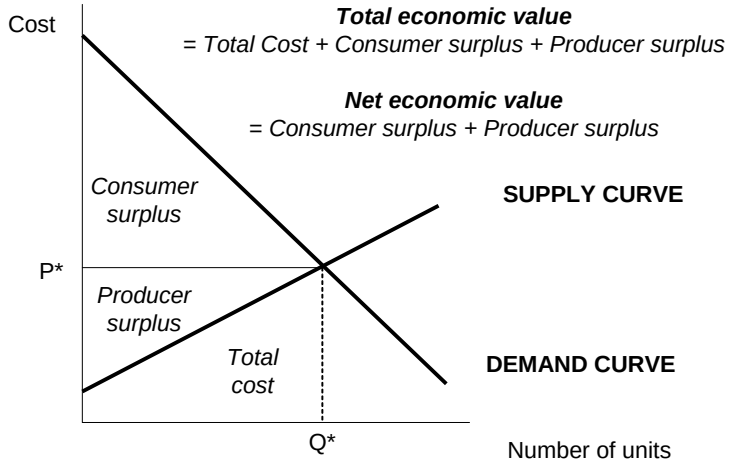
This graph combines the marginal willingness to pay curve with the marginal cost of production curve. If this graph looks like a supply and demand graph to you, it should.



A supply curve shows the amount that sellers would supply at any given price—or the price that would be needed for sellers to supply any given amount. Here the sellers are producers. They will only supply a given amount only if the price is at least high enough to equal the additional or marginal cost of production of the last unit. So (in a competitive market) the producers' supply curve is the same as their marginal cost of production curve.

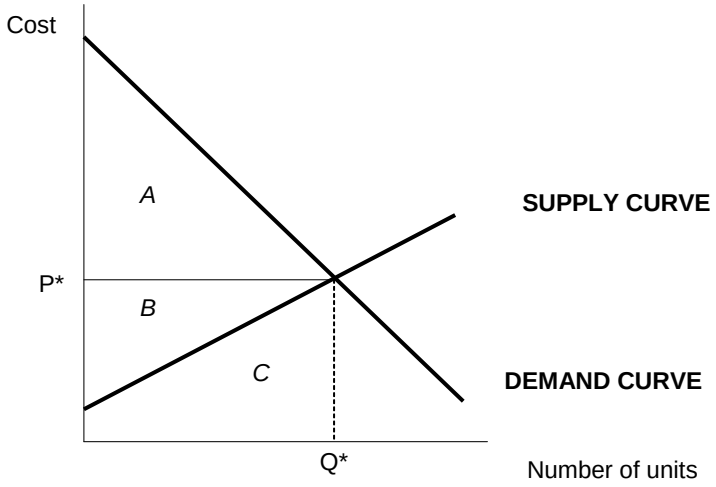
The marginal willingness to pay curve is a demand curve. A demand curve shows the amount that buyers would buy at any given price—or the price that would be needed for buyers to buy any given amount. The buyers will buy a given amount only if the price is at least low enough to equal the additional or marginal willingness to pay for the last unit. So (in a competitive market) the buyers' demand curve is the same as their marginal willingness-to-pay curve.

Suppose supply and demand are in equilibrium: the price is at the equilibrium price P* at which the quantity demanded Q* equals the quantity supplied Q*. At the equilibrium price and quantity, the total economic value would be the area under the demand curve from 0 to Q*.



Here is a summary of all of the economic value concepts we've illustrated. Learn them! You'll encounter them frequently in fish economics and other kinds of economics.

Concept	Definition	Illustrated in the graph by:
Total economic value	Total amount buyers would have been willing to pay	A + B + C
Total revenue *Market value*	Price x Quantity = P* x Q*	B + C
Total cost	Total cost of production	C
Non-market value *Consumer surplus*	Total value – market value Total amount buyers would have been *willing* to pay – amount buyers actually *do* pay	A
Profit *Producer surplus*	Total revenue – Total cost	B
Total surplus	Consumer surplus + Producer Surplus	A + B



13. ECONOMIC RENT

A very important concept for natural resource economics—and for fish economics—is *economic rent.*

Economic rent—which is also called *resource* rent or *scarcity rent* or simply *rent*—is a technical economic term which means *the net economic value derived from using a scarce resource*:

Economic rent to society provided by a resource	=	Total economic value to society provided by the resource	-	Total cost to society of using the resource

A simple way to think of economic rent is "the profits to society from using a scarce natural resource."

Suppose there was no cost to society of using a resource. Then all the value provided by the resource would be economic rent.

For example, suppose delicious fresh water flowed out of a natural spring next to your house, or delicious salmon jump out of a river into your frying pan. Then all of the value of the water or salmon would be economic rent.

But if there is a cost to society from using a resource—like labor to carry the water, or labor and boats and nets and fuel to catch the salmon—then less of the resource value is economic rent.

Mainstream economists often say that society's objective in using scarce natural resources should be *to maximize the economic rent generated by the resources.* Why? Because they think we should society should get the most possible net value using scarce natural resources. To mainstream economists, not maximizing economic rents is wasteful.

> *Although ecologists and most in the environmental community use yields and stock levels as metrics of success and sustainability, economists have attempted to direct attention to the flow of rents generated and the consequent value of marine stocks as economically productive assets.*—James Wilen, "Property Rights and the Texture of Rents in Fisheries"[ii]

Costs to Society vs. Transfers

Economic rent can be a confusing concept, partly because "costs to society" can be a confusing concept. In using a resource, *costs to society* are the costs of any inputs which could have been used to produce something else for society.

Costs to society don't include transfers. Payments are *transfers* when the payment doesn't involve using a scarce resource that could have been used to produce something else for society, such as labor or fuel or a machine. Put different, transfers are redistribution of wealth or income

rather than using scarce resources. So transfers of the income generated from resource uses like fishing don't affect the amount of economic rent generated by the resource.

Taxes are transfers—because they don't require society to use any additional resources. So if fishermen pay taxes, that doesn't affect the amount of economic rent they generate from fishing. It just redistributes it from the fishermen to the government entity they pay the tax to.

Payments to buy or lease fishing privileges like limited entry permits or individual fishing quota are transfers—they are redistributions of wealth or income but don't involve a cost to society.

Profits vs. Economic Rent

Suppose the annual value of the catch from a wild fishery is $1 million. The boat owners spend $200,000 on fuel, they pay their crew $300,000, and they pay $150,000 for other costs such as insurance and boat depreciation. They also pay $75,000 in taxes, and they pay $250,000 to lease individual fishing quota (the right to catch the fish).

The *fishermen's profits* from this fishery would be:

Total value – Total costs to fishermen
= Total value – Total costs to society paid by fishermen – Transfers paid by fishermen

= $1 million
- [$200,000 (fuel) + $300,000 (crew) + $150,000 (other costs)]
- [$75,000 (taxes) - $250,000 (quota lease payments)]

= $1 million – $650,000 - $325,000 = $25,000

The *economic rent* (profit for society) from this fishery would be:

Total value – Total costs to society paid by fishermen

= $1 million
– [($200,000 (fuel) + $300,000 (crew) + ($150,000 (other costs)]

= $1 million – $650,000 = $350,000

The taxes and the quota lease payments are costs to individual fishermen, and reduce their profits. But taxes and quota payments aren't costs to society. They are transfers: redistributions of income from fishermen to other fishermen (lease payments) or to the government (taxes).

What about the payments to the crew? Aren't those just transfers too? No. The payments to crew are an actual cost to society, because if the crew hadn't worked on the fishing boat, they could have been doing something else of value to society. Theoretically, the payment to the crew is a measure of the value of their time—the value of what they could have produced in some other kind of work.

14. ECONOMIC COMPARISONS OVER TIME

Many economic choices involve economic comparisons over time. Here are some examples:

- Should a fisherman buy a fishing permit now that will allow her to earn money from fishing in the future?

- Should a fish farm harvest its fish now or in the future when they will be bigger and worth more money?

- Should fishermen cut back on catching fish now to allow fish stocks to rebuild so they can catch more fish in the future?

- Should we develop a gold mine which will produce $1 million of profits for 10 years if it will destroy a fish stream which would produce $10,000 of profits forever?

Economists use a technique called "discounting" for making economic comparisons over time. Discounting and related techniques are also used widely in business and finance.

Discounting works well for some kinds of economic comparisons over time, particularly short-term financial choices for individuals and firms. But discounting doesn't work as well for other kinds of comparisons—particularly long-term choices for society between different kinds of costs and benefits, like the choice between the gold mine and the fish stream.

It's important to understand basic principles of discounting, because it's a useful and common technique. It's also important to understand the limits to discounting.

Comparing the Value of Money at Different Points in Time

The easiest economic comparisons over time are *short-term financial choices for individuals or firms:* choices between different options for spending and receiving money over a relatively short period of time (a few years). Here are two examples:

- Should you spend $10,000 on better insulation for the freezer in your processing plant for an estimated $4000 annual savings in fuel costs for the next three seasons?

- Should you harvest the fish you are growing at your fish farm in 3 years when they will be worth $10,000 or in 4 years when they will be worth $11,000?

These choices are relatively easy because:

- *Only one person or firm is involved.* When more than one person or company is affected, the choice may be more difficult because they may be affected in different ways and have different preferences.

- *The choices are only about money*. You don't have to balance money with other factors like you do if you're choosing a car (a cheap car that isn't fun or an expensive sports car that's lots of fun) or a career (money vs. location, lifestyle, coworkers, etc.).

Comparing the value of money at different points in time is relatively straightforward if you can invest or borrow money. Investing or borrowing is a way of trading money you have now for money in the future, or money you will get in the future for money now.

By investing, you can exchange money now for more money in the future. So the *future value* of money you have now is greater than the *present value* of money you have now. By borrowing, you can exchange money in the future for less money now. So the *present value* of money you will have in the future is less than the *future value* of money you will receive in the future.

For example, suppose you can invest or borrow money at a 10% rate of interest. If I offer you $1000, would you rather have it now or a year from now? Most people would choose getting the money *now*. Regardless of whether you plan to spend the money now or in the future, you'll be better off if you get the money *now*:

- If you want to spend the money now, you would have to borrow it and pay it back with the $1000 you would get in a year. If you have to pay a 10% rate of interest to borrow, you could only borrow $909 to spend now) because you'd have to use the rest of your $1000 that you get next year to pay the interest on the loan you took out.

- If you don't want to spend the money now, if you take the $1000 now and invest it at a 10% rate of interest, you'll have $1100 to spend a year from now.

If you get money sooner, you can spend more money now, or you can spend more money in the future

		When you get $1000:	
		Now	A year from now
How much you could spend	Now	**$1000**	**$909** At a 10% rate of interest, you could borrow $909 now and pay it back with $1000 a year from now (because $909 * 1.10 = $1000)
	A year from now	**$1100** If you invested $1000 at a10% rate of interest, you would have $1100 a year from now (because $1000*1.10 = $1100)	**$1000**

The important point is that *if you can invest or borrow money the value of money to you now depends on when you get it. Having money now is worth more than having the same amount of money at some time in the future!* Since the value of money depends on when you have it, any time you compare values—for example when you compare the cost of an investment with the income you'll earn from the investment—you should be sure to compare the values *as of the same point in time*.

Formulas for Comparing Values as of the Same Point in Time

Suppose someone offers you the following deal: "pay me $X today and I'll pay you $Y in the future." How can you tell if it's a good deal? You need a way of comparing values *as of a common point in time*.

One way to do this is to compare the values as of a common future point in time, or their *future value*. Another way is to compare the values as of the present time, or their *present value.* Although it's more common to calculate present value, starting with the formula for future value makes it easier to understand the formula for present value.

Future Value

The *future value* of money we have now is what its value will grow to by a specific time in the future if we invest it. Future value depends on the how far in future we are measuring value, and on the rate of interest we can invest money at.

Suppose we can invest $100 at an interest rate of 8%. After 1 year, we would have $108. After 10 years, we would have $215.89. So if we have $100 now, its "future value 1 year from now" is $108 and its "future value 10 years from now" is $215.89.

If PV is present value and R is the rate of interest you can earn on an investment, then the future value of the investment in year t is given by the formula[2]:

$$FV(t) = PV * (1+R)^t$$

For example, if the interest rate is 8% or .08, and we have $100 now, then the future value 10 years from now will be:

$$\begin{aligned} FV(10) &= \$100 * (1.08)^{10} \\ &= \$100 * 2.1589 \\ &= \$215.89 \end{aligned}$$

[2] Here's how you can derive this formula. If you can earn an interest rate of R on an investment, then if V(t) is the value in year t the value in year t+1 will be V(t+1) = V(t) * (1 + R). The value as of year 1 is PV * (1+R) = PV * $(1+R)^1$. The value as of year 2 is V(1) x (1+R) = [PV * (1+R)] * (1+R) = PV * $(1+R)^2$. The value as of year 3 is V(2) * (1+R) = [PV * (1+R) * (1+R)] * (1+R) = PV x $(1+R)^3$. And so on.

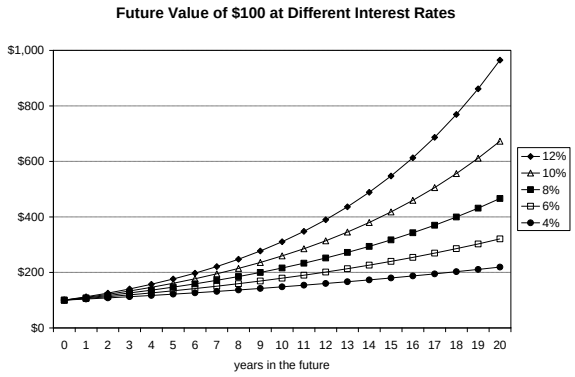
The future value of $100 which you receive now, if you can invest at 8% interest

The year for which you are calculating future value	Future value (FV) $FV = (PV) * (1+R)^t$
1 year from now	$\$100 \times 1.08^1 = \$108$
2 years from now	$\$100 \times 1.08^2 = \$116.64$
3 years from now	$\$100 \times 1.08^3 = \$125.97$
10 years from now	$\$100 \times 1.08^{10} = \$215.89$
20 years from now	$\$100 \times 1.08^{20} = \$466.10$
50 years from now	$\$100 \times 1.08^{50} = \$4,690$

Here are two important things to remember about future value:

- *The longer the period of time you invest, the bigger the future value.* If you let an investment grow for a long time, the future value can get really big! That's why financial advisors always tell you it's important to start saving for your retirement when you're young.

- *The interest rate has a critical effect on future value.* A small different in the interest rate translates into a big difference in future value.



Present Value

The *present value* of money we will get in the future is what its value is to us now.

There are two ways we can think of the present value of money we will get in the future:

- The amount of money we would have to invest now to get the same future amount of money.

- The amount of money we could borrow now and pay back with the money we will get in the future.

If we can invest money at a positive rate of interest, or if we would have to pay a positive rate of interest to borrow money, then present value is always less than future value. Present value depends on the how far in future we will get the money, and the rate of interest we could borrow at.

We can use the formula for future value to derive the formula for present value. If FV(t) is the future value in year t, PV is the present value, and R is the interest rate we can invest or borrow at, then the formula for future value is:

$$FV(t) = PV * (1+R)^t$$

If we divide each side of this equation by $(1+ R)^t$ we get the formula for present value:

$$PV = FV(t) / (1+ R)^t$$

For example, if we can borrow money at an interest rate of 8% or .08, the present value of $100 which we are going to get 1 year from now is:

$$\begin{aligned} PV &= FV(t) / (1+ R)^t \\ &= \$100 / (1 + .08)^1 \\ &= \$100 / 1.08 \\ &= \$92.59 \end{aligned}$$

Put differently, if the interest rate is 8%, we could borrow $92.59 now and pay back the loan with $100 a year from now.

If we can borrow money at an interest rate of 8% or .08, the present value of $100 which we are going to get 10 years from now is:

$$\begin{aligned} PV &= FV(t) / (1+ R)^t \\ &= \$100 / (1 + .08)^{10} \\ &= \$100 / 1.08^{10} \\ &= \$100 / 2.1589 \\ &= \$46.32 \end{aligned}$$

Put differently, if the interest rate is 8%, we could borrow $46.32 now and pay back the loan with $100 10 years from now.

Economists and business people use the present value formula a lot. You should memorize the formula and practice using it: $PV = FV(t) / (1+ R)^t$

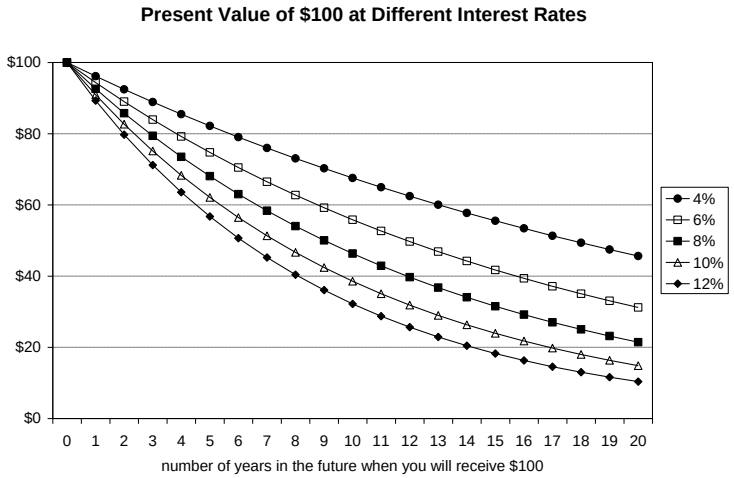
The present value of $100 which you receive in the future, if you can borrow at 8% interest

When you will receive $100	**Present value (PV)** **$PV = FV / (1+R)^t$**
1 year from now	$\$100 / 1.08^1 = \$92.59$
2 years from now	$\$100 / 1.08^2 = \$85.73$
3 years from now	$\$100 / 1.08^3 = \$79.38$
10 years from now	$\$100 / 1.08^{10} = \$46.32$
20 years from now	$\$100 / 1.08^{20} = \$21.45$
50 years from now	$\$100 / 1.08^{50} = \$2.13$

Here are two important things to remember about present value:

- *The longer the period of time before you receive money, the lower its present value.* If you are going to have to wait a long time to get some money, its present value can get really small!

- *The interest rate has a critical effect on present value.* A small different in the interest rate translates into a big difference in future value.



This table shows the present value of $1000 at different times in the future, for different interest rates. Note that if you go a long time into the future, or if the interest rate is high, present value can become very small! For example, if the interest rate is 10%, then if someone offers you $1000 40 years in the future, it only has a present value of $22.

The present value of $1000 received in the future

		Interest rate at which you can borrow money									
		2%	4%	6%	8%	10%	12%	14%	16%	18%	20%
Number of years before you receive $1000	1	$980	$962	$943	$926	$909	$893	$877	$862	$847	$833
	2	$961	$925	$890	$857	$826	$797	$769	$743	$718	$694
	3	$942	$889	$840	$794	$751	$712	$675	$641	$609	$579
	4	$924	$855	$792	$735	$683	$636	$592	$552	$516	$482
	5	$906	$822	$747	$681	$621	$567	$519	$476	$437	$402
	6	$888	$790	$705	$630	$564	$507	$456	$410	$370	$335
	7	$871	$760	$665	$583	$513	$452	$400	$354	$314	$279
	8	$853	$731	$627	$540	$467	$404	$351	$305	$266	$233
	9	$837	$703	$592	$500	$424	$361	$308	$263	$225	$194
	10	$820	$676	$558	$463	$386	$322	$270	$227	$191	$162
	15	$743	$555	$417	$315	$239	$183	$140	$108	$84	$65
	20	$673	$456	$312	$215	$149	$104	$73	$51	$37	$26
	25	$610	$375	$233	$146	$92	$59	$38	$24	$16	$10
	30	$552	$308	$174	$99	$57	$33	$20	$12	$7	$4
	35	$500	$253	$130	$68	$36	$19	$10	$6	$3	$2
	40	$453	$208	$97	$46	$22	$11	$5	$3	$1	<$1
	45	$410	$171	$73	$31	$14	$6	$3	$1	<$1	<$1
	50	$372	$141	$54	$21	$9	$3	$1	<$1	<$1	<$1

Discounting and the *Discount Rate*

In common language when we talk about a "discounted" price we mean a lower price than the regular price. "Discount stores" claim to sell products for lower prices than you would pay at other stores.

Economists use the term *discounting* to refer to using the present value formula to calculate the lower present value of income received (or payments made) in the future. Economists often use the term *present discounted value* (PDV) instead of " present value" (PV). They often use the term *discount rate* instead of "interest rate" when calculating present value. We'll use these terms in the rest of this book when we compare value at different points in time.

What Discount Rate Should You Use to Calculate Present Value?

The discount rate has a critical effect on present value. So it's very important to make sure that you use the correct discount rate when you calculate present value. Whenever someone does a financial analysis or an economic study that involves a calculation of present value, be sure to think carefully about what they assumed about the discount rate and whether you agree with what they assumed!

The correct discount rate to use in calculating present value depends on the choice you need to make and your options for investing or borrowing money in making that choice.

- If you would be borrowing money to make an investment, use the interest rate you would have to pay on the loan

- If you would be financing an investment with your own money, use the interest rate you could earn on your best alternative investment of equal risk.

Simple Examples of Using Present Discounted Value

Let's look at three simple examples of using present discounted value to make decisions.

<u>Should you make an investment?</u>

> *Supposed you could invest $12,000 now and receive the following profits from your investment:*
>
> > *$1000 after 1 year*
> > *$8000 after 2 years*
> > *$8000 after 3 years*
>
> *The discount rate is 20%. Is the investment profitable?*

To answer this question, you would calculate the present value of the three payments you will receive, add them up, and see if whether the total present value of the your future profits is greater than the cost of the investment:

Present value

= $1000/(1.2^1)
+ $8000/(1.2^2)
+ $8000/1.2^3)
= $833 + $5,556 + $4,630
= $11,012

The investment is not profitable because the present value of the returns ($11,012) is less than the cost of the investment ($12,000).

Should you make an investment?

Here is exactly the same kind of question, but phrased in a more complicated way!

Suppose you are planning to build a new fish processing plant four years from now. Until then you are going to keep operating the old plant—which has a poorly insulated fish freezer. You estimate that spending $10,000 now on insulating the freezer better would save you $4,000 in fuel costs for each of the next three seasons. Should you make the investment in the better insulation? How does the answer differ if (a) you would use your own money to buy the insulation, and you have no alternative opportunity to invest it; (b) you'll have to borrow money at 5%; and (c) you would have to borrow the money at 12%?

This table summarizes the answers—calculated in the same way as for the previous question. Note that the investment is profitable if you can use your own money to pay for it (and you had no other use for the money)—or if you could borrow the money to at a 5% interest rate. But if you had to borrow the money at a 12% interest rate, then the present value of the cost savings would only be $9,607—not enough to justify the $10,000 investment.

Should you borrow $10,000 to invest in better insulation?

How you would finance the invesment?	With your own money, and you have no alternative investment	By borrowing the money at 5%	By borrowing the money at 12%
Discount rate you should use (R)	0%	5%	12%
Present value of $4000 in savings 1 year from now = $4000/(1+R)	$4,000	$3,810	$3,571
Present value of $4000 in savings 2 years from now = $4000/(1+R)^2	$4,000	$3,628	$3,189
Present value of $4000 in savings 3 years from now = $4000/(1+R)^3	$4,000	$3,455	$2,847
Total present value of savings	$12,000	$10,893	$9,607
Does total present value of savings exceed investment cost of $10,000?	Yes	Yes	No

When should you harvest fish from a fish farm?

Suppose you operate a fish farm. It's an unusually simple farm: your only cost is $7000 for the baby fish (there are no other costs of feed, labor, capital, etc.)! Each year you leave the fish in the pen, they get bigger and are worth more. When should you harvest the fish? And would this farm be a profitable investment?

Small black cod (sablefish) on a fish farm in Washington State. Look hard at the picture and you'll see a lot of them. You could get a lot of money from harvesting them now. You could get even more money if you let them get bigger and harvest them in the future. When should you harvest them?

The longer you let the fish grow, the bigger they get and the more money you could earn from selling them. Suppose the fish grow at a declining rate, so that they would be worth $5000 if you harvest after 1 year, $8000 after 2 years, $10,000 after 3 years, $11,000 after 4 years, and $11,500 after 5 years.

Present Value of Revenues and Profits from a Hypothetical Fish Farm

	Present value of revenues if you harvest after:				
Discount rate	1 year	2 years	3 years	4 years	5 years
undiscounted	$5,000	$8,000	$10,000	$11,000	**$11,500**
8%	$4,630	$6,859	$7,938	**$8,085**	$7,827
11%	$4,505	$6,493	**$7,312**	$7,246	$6,825
14%	$4,386	$6,156	**$6,750**	$6,513	$5,973

	Present value of profits, assuming the only costs are initial stocking costs of $7000, if you harvest after:				
Discount rate	1 year	2 years	3 years	4 years	5 years
undiscounted	-$2,000	$1,000	$3,000	$4,000	**$4,500**
8%	-$2,370	-$141	$938	**$1,085**	$827
11%	-$2,495	-$507	**$312**	$246	-$175
14%	-$2,614	-$844	**-$250**	-$487	-$1,027

Note: The shaded cells show the years with the highest present value.

As shown in the table, even though the undiscounted value of revenues is highest if you harvest after 5 years ($11,500), the *present value* is higher if you harvest earlier. Why? Because the extra revenue you get from waiting to harvest in year 5 isn't enough to make up for having to discount the revenue by one more year.

The higher the discount rate, the earlier the harvest year which would give you the highest present value of revenues and profits. At a discount rate of 8%, the present value of revenues and profits is highest if you harvest in year 4. At a discount rate of 11%, the present value of revenues and profits is highest if you harvest in year 3. Why? Because the higher the discount rate, the lower the present value of the extra revenue you get from waiting longer to harvest the fish.

Whether the fish farming operation would be profitable depends on the discount rate. The farm would be profitable—the present value of the revenues would be greater than the up-front stocking cost of $7000—if your discount rate is 8% or 11%. It would not be profitable if your discount rate is 14%. You'd make more investing your $7000 at a 14% rate of interest than in investing it in this fish farm. Or, if you had to borrow money for the farm at a 14% rate of interest, the revenue from your future fish sales wouldn't be enough to cover the cost of the loan.

The Present Value of an Asset Which Provides a Continuous Annual Return

An "asset" is something you can own that can provide financial returns or other benefits in the future. Here are examples of assets:

- Processed fish in a cold storage
- A fishing boat
- Juvenile fish in a fish farm which can be harvested in the future
- A fishing permit which gives you the right to participate in a future
- Individual fishing quota (IFQ) which gives you the right to harvest fish in the future

What is the value of an asset? Or, to put the question in a different way, what should you be willing to pay for an asset?

Economists argue that value of an asset is the present value of the future net revenues (revenues minus costs) you will receive from owning the asset.

A special and important type of asset is one which will provide the same annual net revenue indefinitely (for every year in the future). Here is a simple formula which you should memorize for calculating the present value of this kind of asset. Suppose $X is the annual net revenue from the asset, and R is the discount rate. Then the present value of the asset is:

$$PV = X / R$$

For example, if you'll earn net revenues of $100 from an asset for every year in the future, and your discount rate (the rate at which you can borrow or invest) is 10%, the present value of the asset is $100/.10 = $1000.

Here's an easy way to understand the reason for this formula. Suppose you had an asset with a present value of PV. If you could invest it at a rate of R, then each year in the future, you could

earn an amount X = PV * R. Since X = PV * R, we can also write PV = X/R. For example, if you had $1000 and you could invest it at 10%, then every year in the future you would earn $100.

To economists, if you can borrow or invest at an interest rate of R, both of these have the same identical value:

$X every year in the future
$X / R now

We can use apply this simple formula to make a quick estimate of the value of two common kinds of "assets" in the seafood industry. To use this formula, we have to make the simplifying assumption that profits from these assets are the same every year. Since profits are actually *not* the same every year, the formula provides only an approximate estimate of value—but it's still a useful way to make a quick estimate.

What is the value of a limited entry permit with which you could earn after-tax profits of $10,000 per year (after subtracting all the costs of your boat, fuel, crew payments, etc.), if you are going to borrow money at an interest rate of 8% to finance the purchase?

$10,000 / .08 = $125,000.

Note that if you invested the $125,000 at 8% you would earn $10,000 per year.

What is the value of a pound-equivalent of halibut quota shares which will give you the right to harvest a pound of halibut per year, if you can sell halibut for $5/lb and catch halibut for a cost of $3/lb, and you are going to borrow money at an interest rate of 9% to buy the IFQ?

($5-$3) / .09 = $2/.09 = $22

Note that if you invested the $22 at 9% you would earn $2 per year

Note that as the discount rate declines (if you can borrow money at a lower rate) the value of these assets goes up.

The Value of a Sustainable Fishery

People often say that a sustainable fishery has unlimited value because it can provide economic value indefinitely. For example, I often hear people say "we shouldn't even consider developing a mine which will provide value for only a finite period of time, if we risk disturbing a fishery which will provide value indefinitely."

There are probably good ethical and ecological arguments you could make to support that statement. But from a mainstream economic point of view, it's not correct!

From a mainstream economic point of view, a sustainably managed fishery is like an asset that provides a continuous economic return. We can calculate its present value using the formula PV = $X / R, where PV is the present value of the fishery, $X is the net revenue it provides per year, and R is the discount rate.

What is the value to the public of a fishery which generates $60 million in profits per year, if the discount rate is 5%?
$60 million / .05 = $1.2 billion
Note that if you invested $1.2 billion at 5% you would earn $60 million per year.

Based on this calculation, if the discount rate is 5%, then a mine that would produce $2 billion in one-time profits now would have a greater value than a fishery which produced $60 million per year.
But what is the discount rate? If we used a lower discount rate then the present value of the fishery would be higher. For example, if we used a discount rate of 1%, the present value of a fishery that produces $60 million in net revenue per year would be $60 million / .01 = $6 billion—which would be a lot higher than the value of the mine.

Since the discount rate is critical for this kind of comparison, economists argue a lot about what is the right discount rate to use in calculating the value of sustainably managed fisheries, or any other kind of long-term resource benefit. The arguments in that debate are complicated and technical and I won't get into them in this book—because it's just an introduction to fish economics, not a graduate course.

The important point you should remember is that just because a fishery—or any asset—is sustainable and can create profits forever doesn't mean that it has infinite value. The present value of the profits received in the future become smaller and smaller, the farther in the future they occur, until they become negligible.

An interesting Alaska example of why sustainable isn't necessarily better (economically) than non-sustainable is provided by Alaska's North Slope oil. Alaska's oil production is definitely non-sustainable. But part of the profits from the oil has been invested in Alaska's Permanent Fund, which *is* sustainable if the financial managers do a good job. In the same way, part of the profits from a mine could theoretically be invested in a sustainable "Mining Permanent Fund."

Suppose (in our hypothetical example above) the $1.4 billion out of the $2 billion in one-time profits from a mine were invested at 5% in a "Mining Permanent Fund." The annual investment earnings from the Mining Permanent Fund would be $70 million—more than the annual $60 million in profits from the sustainable fishery.

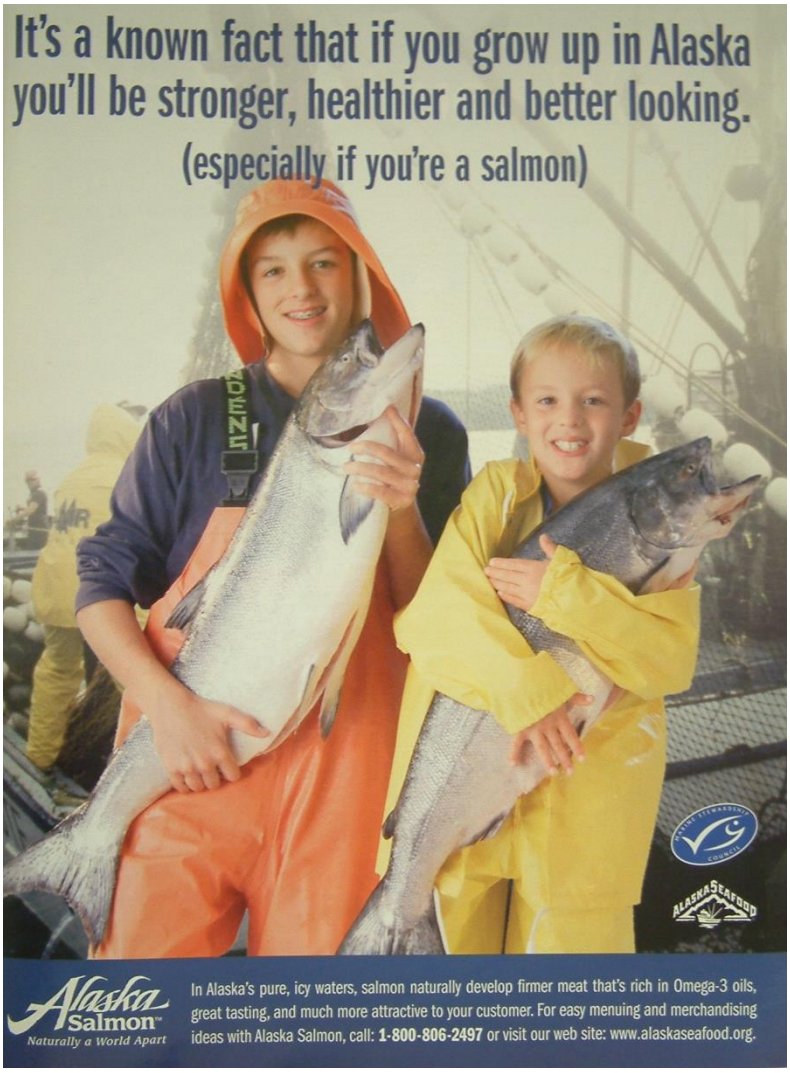
But suppose the permit holders in the fishery were vehemently opposed to the mine, and their political opposition was blocking authorization for the mine. The mine developers could offer to pay the permit holders $70 million from the earnings of Mining Permanent Fund. This might be financially attractive enough to the fishermen to buy them off. So in theory, fishermen

themselves might sell out their sustainable fishery to an unsustainable mine—because they could get more sustainable income from the mine!

This is only a simple introduction to the complicated topic of comparing benefits from sustainable activities with those from non-sustainable activities. In a real public policy debate, economic comparisons of a sustainable fishery with a non-sustainable mine would be a lot more complex—and a lot of other issues would have to be considered! For example, people might talk about the spiritual values a sustainable fishery will have for posterity.

But the important point to remember is that a sustainable fishery isn't *necessarily* always better (from an economic point of view) than a non-sustainable alternative.

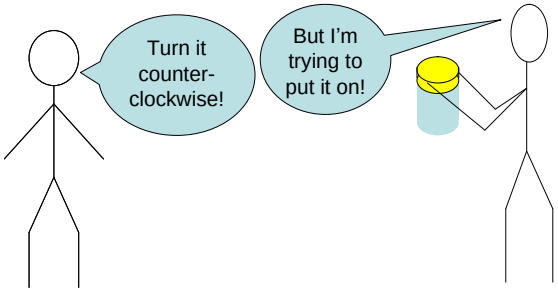
Posterity



"Why should I care about posterity? What's posterity ever done for me?"—Groucho Marx

15. ECONOMIC OBJECTIVES

Economics can be both *explanatory* and *advisory*. *Explanatory* or "positive" economics *explains* economic choices of people, firms and societies. *Advisory* or "normative" economics *advises* about how to achieve objectives. To answer advisory economics questions, you have to make assumptions about *objectives*.



If you're giving advice, it's important to be sure that you understand the objectives of the people you're giving advice to. Otherwise you might be giving them bad advice that doesn't help them achieve their objectives!

If an "expert" is giving you advice, it's important to understand what objectives they are assuming. Not matter how "expert" she is, if she is assuming different objectives, her advice may not help you achieve your objectives.

Economists are often asked to give advice about policy issues, such as "what kind of fish taxes should we have?" or "should we have free trade in fish products?" or "what's the best way to manage our fisheries?" Even when they aren't asked, economists often express their opinions on these kinds of issues.

Giving advice about policy issues requires making assumptions about what our policy objectives are or should be. Economists often assume that society has or should have certain economic objectives. It's very important to understand what kinds of objectives economists tend to assume—and to think carefully about whether or not you share those objectives.

Policy Questions and Policy Objectives

Policy questions are questions about choices for society —or choices for the governments and agencies which make choices for society—such as "should we remove dams to restore salmon runs?"

We can't answer policy questions unless we know our *policy objectives*. Removing dams to restore salmon involves tradeoffs. Removing dams may mean more salmon, but less water for farmers to irrigate their crops or less electric power (or more expensive electric power from other sources, possibly with other environmental effects). How much do these different kinds of effects matter to us? Unless we can define our policy objectives we can't say which policy choice is "best."

Experts, Objectives and Value Judgments

Just because someone is an expert in something doesn't mean that they know or share your objectives—or that you should take their advice. Suppose you go out to dinner with a famous food critic. He might advise you to buy the most expensive fish on the menu because it's an unforgettable culinary experience. That might be great advice if you're rich and you rarely get to eat good fish and you don't care about the price. But it might be terrible advice if you're poor and you're trying to stretch your budget—or if you've been eating fish for a month and would really like some steak.

We need experts—like biologists, ecologists and economists—to help us answer policy questions such as whether to remove dams to restore salmon. We need biologists to tell us how many salmon will return to the river if we remove the dam. We need ecologists to tell us how having more salmon in the river will affect the bears, eagles and the rest of the ecosystem. We need economists to tell us what might happen to prices of electricity, farm crops, and salmon, and how the number of jobs in manufacturing, farming, commercial fishing and tourism might change.

But there are some things experts *can't* tell us—neither biologists nor ecologists nor economists. They can't tell us whether it is more important for farmers or fishermen to be able to keep their way of life. They can't tell us whether having salmon in our rivers is more important than having cheap electricity (or preventing the potential environmental impacts of other ways of generating electricity). How any of us answer these questions depends on our personal *value judgments*—which makes them inherently *political questions*. Experts can't tell us what our personal values should be. A Nobel Prize winner doesn't can't tell you whether *you* should care more about salmon or cheap electricity.

Differences in personal value judgments about what we want or should want—what society's policy objectives are or should be—are often at the root of disagreements about policy questions—between economists, between economists and other scientists, and between fish economists and other people who care about fish and the fish business.

Economic Objectives

Economists often assume that society has or should have certain economic objectives. It's important to understand what kinds of economic objectives economists tend to assume, why they tend to assume them, and whether or not you share those objectives.

The late British fisheries economist David Whitmarsh wrote that *"economics can help to shape policies that ensure that the choices that people make are consistent with the best interests of society as a whole."* Most economists believe that. I believe that. But before you take our advice, you should make sure that you understand what economists mean by "the best interests of society as a whole."

When economists or other experts give advice, you should be careful to distinguish between their technical expertise and what they are assuming about objectives. No matter how much technical

expertise they have, if you don't agree with the objectives they are assuming, you shouldn't necessarily agree with their advice.

> *"The notion of 'best use' is central to economics . . . Economics can help to shape policies that ensure that the choices that people make are consistent with the best interests of society as a whole."*—David Whitmarsh, *Economic Management of Marine Living Resources* (2011)

Maximizing Net Economic Value and Economic Efficiency

In answering advisory economics questions about how society should use scarce resources, most mainstream economists tend to define "the best interests of society as a whole" as *maximizing net economic value*. Net economic value is the total economic value of the outputs we produce minus the total economic cost of the inputs we use. Net economic value to society is analogous to profits for a business: revenues minus costs.

In order to maximize net economic value, most mainstream economists argue that we should use resources *efficiently*. A simple definition of economic efficiency is *producing outputs at the lowest possible economic cost and using inputs to produce the highest possible economic value.* (There are several other definitions which are related but mean slightly different things.)

Why do economists think that maximizing net economic value and using resources efficiently matters? Basically, because economists think that *not maximizing net economic value or using resources inefficiently is wasteful*. Resources are scarce. As a society, we can't afford to be wasteful. There are too many unmet needs.

Here is how mainstream economists are likely to think about the question of whether we should remove dams to restore salmon runs:

- Our objective should be to maximize net economic value to society. We should remove dams to restore salmon only for those dams and rivers where it increases net economic value to society: where the value to society of having more salmon return is higher than the value to society of the electricity and irrigation water we would give up (plus the costs of removing the dams).

- If we want to restore salmon runs, we should do so at the *lowest possible cost*. We should only remove dams if there aren't other less costly ways to restore salmon runs.

The concepts of maximizing net economic value and efficiency are central to mainstream advisory economics. Over and over, from their first course in economics, economists they are taught to think about policy questions from the perspectives of net economic value and efficiency. Over time, it tends to become ingrained in how economists think: an automatic part of how they look at policy questions.

Assuming something *explicitly* means that you specifically state and explain what you are assuming. Assuming something *implicitly* means that you don't specifically state or explain what you are assuming. Many economists assume *implicitly* that society's objectives are

maximizing net economic value and efficiency—without stating or explaining what they are assuming. They're not trying to hide what they are assuming: they just consider it obvious.

What Mainstream Economists Tend to Assume about Objectives

The chief normative economic criterion for choosing among various allocations occurring at the same point in time is called static efficiency, or merely efficiency.—Tom Tietenberg[iii]

There are certain generally accepted criteria for good economic performance that apply to the fisheries as to any other industry. In their simplest form, these call for the use of all resources to provide the largest possible net economic yield. This implies not only the production of the correct amount of end product, but also the use of most efficient methods and the most efficient number of units in producing any given output.—James Crutchfield[iv]

"To evaluate the diverse experiences with ITQs, it is necessary to use criteria to judge their successes and failures. In this study, the experiences of . . . ITQ fisheries are evaluated according to the following criteria: (1) changes in economic efficiency . . . "–Quentin Grafton[v]

Some Definitions of "Efficiency"

Economics have a variety of technical definitions for different kinds of "efficiency." Here are some examples:

The same outputs couldn't be produced using less of some input but no more of other inputs

The same inputs couldn't be used to produce more of some outputs but no less of other outputs

Outputs are produced at the lowest possible cost and inputs are used to produce the highest possible value

No one could be made better off without making someone else worse off ("Pareto-efficiency").

No one could be made better off without making someone worse off even if the people who were better off compensated the people who were worse off.

Inputs are used to produce the highest possible value over time, after adjusting for how time affects value.

For most basic fish economics, you don't need to worry about these different definitions. They mainly matter for technical theoretical analysis of when policies are "efficient."

What's "Best" Depends upon the Circumstances

Economists argue that what's "best"—what policies maximize net economic value and lead to efficiency—depends upon the circumstances.

Why? Because maximizing net economic value depends on prices of inputs and outputs (or more technically, what the prices of inputs and outputs would need to be to correctly reflect the actual costs of inputs to society and the actual economic value of outputs to society). How to produce outputs at the lowest possible cost depends on the prices of inputs.

How to use inputs to produce the highest possible value depends on the prices of different potential outputs. Since the prices of inputs and outputs vary between places and over time, the most efficient way to use inputs, and the most efficient use of inputs to produce outputs, also varies between places and over time.

For example, the most efficient (lowest cost) way to process fish depends partly on the price of labor. If labor is cheap (like in China), then the most efficient (lowest cost) way to process fish may be to use a lot of labor rather than to use expensive machines. If labor is expensive (like in Norway), then the most efficient (lowest cost) way to process fish may be to use less labor and more machines. Therefore economists are likely to advise that processors in Norway should use relatively more machines and relatively less labor than processors in China.

Should we remove dams to restore salmon runs? A mainstream economist is likely to answer:

> "It depends upon the circumstances. We should do whatever is most efficient and maximizes net economic value. That depends on the marginal costs of removing the dams and the marginal value of salmon, electricity, and irrigation. The answer may vary from river to river.
>
> If the marginal cost of removing dams is high, the marginal value of irrigation and electricity is high, and the marginal value of salmon is low, the efficient choice which maximizes net economic value may be to keep the dams. If the marginal cost of removing dams is low, the marginal value of irrigation and electricity is low, and the marginal value of salmon is high, the efficient choice which maximizes net economic value may be to remove the dams."

You should think carefully about whether you like this answer. Do you agree with the objectives the economist is assuming and her reasoning? If so, you may tend to like other mainstream economic advice. If not, you may tend not to like other mainstream economic advice. But whether you like it or don't like it, it's important to understand how economists tend to think!

Critiques of Economic Objectives—and Economists' Responses

Not everyone agrees with mainstream economists that our economic objectives should be maximum net economic value or efficiency. Here are some frequently-expressed critiques of these objectives—and some of the responses economists make to these critiques. I've simplified both the critiques and the responses. The arguments on both sides are a lot more complex than these brief summaries.

These arguments have been going on for a long time. Neither the economists nor their critics are going to convince each other any time soon. If you find yourself agreeing with the critics, the economists' responses I've summarized here may not convince you either.

But that's not my goal. My goal is to help you understand fish economics. Many of the policy debates that have to do with fish are not really about technical questions but about policy objectives. Many of the debates about fish economists' advice are not really about the economic objectives they are assuming. Recognizing economists' objectives, these critiques, and economists' responses will help you understand these debates better—regardless of whether you agree with the economists or their critics.

"We should care less about efficiency and more about the environment"

Some critics argue that economists blindly pursue an economic ideal of efficiency without caring or thinking about the environment which sustains us all. Critics often argue that the cheapest way to do things isn't really cheapest if we factored in the costs to the environment. For example, even if it's "cheaper" to ship Alaska fish to China for processing by low-cost Chinese labor and then ship them back to America, what about the carbon emissions that result?

Economists respond that they *do care* and *do think* about the environment, and that anyone who says they don't is simply ignorant of the entire field of environmental economics. Economists are well aware that effects on the environment are real costs to society and need to be included in any analysis of net economic value or efficiency or how to attain it. They are well aware that society—including not only "big corporations" but everyone else, including governments and consumers—doesn't necessarily consider the environmental implications of their actions. Economists have given a lot of thought to how societies can do better environmentally, and they think that their ideas are more likely to actually help the environment than many of the ideas preached by their critics.

"We should care less about efficiency and more about people"

Some critics argue that economists blindly pursue an economic ideal of efficiency without caring or thinking about what it means for real people. For example, isn't it both heartless as well as ignorant for economists to argue that we should use fewer fishermen so our fisheries can be more efficient? Just what other industries are there for displaced fishermen in small remote fishing communities? Don't they understand or care about the pain for people and communities that can result from the policies they advocate?

Economists respond that the reason they care about efficiency is that they *do* care about people. It's *because* they care about people that they care about maximizing net economic value and efficiency. An inefficient society which doesn't maximize economic value is a poorer society. Fishermen are poorer if they are inefficient. Inefficiency means wasting resources that could be used to make society better off.

Most of us think it's wrong to waste food. Why, economists ask, isn't it just as wrong to waste fuel or labor catching fish when that fuel and labor could be used to produce other things society needs?

Economists argue that the while change is painful, not changing is ultimately more painful for a society that is using resources inefficiently. If more fishermen are fishing than are needed to catch fish, do we want that to continue indefinitely? If small remote fishing communities don't provide other employment opportunities, isn't it better for some fishermen to move to places that do? Would today's rich countries have been better off if agriculture had never gotten more efficient, and people had never left rural farming communities?

Economists argue that if we really care about fishermen—and their children—we're not going to help them with inefficient fishery management policies that doom them to poverty with too many fishermen trying to make a living from a limited resource.

"More isn't necessarily better"

Some critics argue that the economic objectives of maximizing net economic value and efficiency are based on a false assumption that that "more is better." But is it really? Are the rich any happier than the poor? Are people in rich countries any happier than people in poor countries? Doesn't the blind pursuit of "more" lead to materialism, obesity, and a loss of cultural and spiritual values that are vastly more important than "net economic value"—and which economists can't account for?

Economists respond that they agree that cultural and spiritual values are important, and that materialism and obesity and other problems of rich society are indeed real problems. But they also respond that if having "more" doesn't necessarily make people happier, neither does having "less." What makes people or societies happy and culturally and spiritually strong is far from obvious.

What is obvious, economists argue, is that given a choice between "more" and "less," most of the time most people choose "more." Not many people say they wish they were poorer or that they wish their countries were poorer. Not many fishermen say they wish they were poorer. Why, then, shouldn't we try to make choices that will allow people to have "more" and be less poor?

"More for some isn't necessarily more for all"

Some critics argue that the economic objective of efficiency is based on a naïve assumption that if a society produces more net economic value, everyone will share in the benefits. In reality, policies which lead to more net economic value may make some people better off while leaving other people—maybe more people—worse off.

Critics argue that it may well be that we could increase net economic value by giving fishing quotas to half the fishermen so they can get rich, and telling the others to find minimum-wage

jobs flipping burgers. But only the fishermen who get the quotas will be better off—maybe a lot better off. The ones who end flipping burgers may end up a lot worse off.

Economists respond to this critique in various ways. Some economists argue that even people who appear to be harmed at first by efficient policies will end up better off in the long run. The displaced fisherman flipping burgers will eventually get a better job and be better off than if he had kept on trying to make a living in an inefficient fishery. And he—and everyone else—will be better off when a more efficient fishery makes fish cheaper and more widely accessible. That is what happened over the past century as agriculture became vastly more efficient and tens of millions of rural farmworkers were displaced from farming.

Other economists that a society that always chooses efficient policies ends up making almost everyone better off—even if not all the policies individually make everyone better off. The displaced fisherman flipping burgers may have been harmed by efficient fisheries management policies, but he is helped by efficiency in the rest of society—by efficiency in farming, road maintenance, phone service, and the production of everything else he consumes or uses. The former fisherman will still be better off because everything else works so much better than if we had tried to protect all the jobs in road maintenance, phone service, farming, and so on by keeping those activities inefficient. Put differently, not making any changes which harm anyone can end up leaving everyone a lot worse off.

Without policies that promote economic efficiency, everything becomes more expensive, less convenient, or not available at all: society as a whole is poorer. So—according to these economists—the benefits of efficiency to society as a whole almost always outweigh the losses some people may experience from some policies.

Other economists argue that if policies are more efficient, the winners can compensate the losers. For example, we can tax the fishermen who get the quotas to compensate the fishermen who end up flipping burgers. The economists' critics respond: how, exactly, do you compensate fishermen for losing a way of life? And how often, exactly, does society actually tax the winners to compensate the losers?

Some economists—including me—argue that the critics have a point, and that economists should be careful about advocating policies that help some people but harm others. If they do, they should at least make it clear that their advice reflects in part a personal value judgment.

All of us—including economists—are not necessarily consistent in what we argue about economic objectives. We tend to want other people to be efficient, but we're not as enthusiastic about efficiency if it affects us personally. If one plumber can fix our sink, we don't want to pay for two plumbers. If one mailman can deliver the mail on both sides of the street, we don't want to pay for one mailman for the left side of the street and one mailman for the right side of the street. Why should consumers want to pay for two fishermen to catch the fish they buy if one fisherman could catch the fish more cheaply?

But I wouldn't be very happy if the University of Alaska fired me so they could be more efficient by having other lower-cost professors teach my classes. I might have a different attitude about

that kind of efficiency. It's easier to advocate efficiency for someone else than to have it imposed on you.

Other Perspectives on Society's Objectives—And Economists Critiques

People express a wide variety of policy objectives other than the economic objectives of maximizing net economic value or efficiency. These other objectives include, for example, protecting the environment, sustainability, self-sufficiency, small-scale production, local production, jobs, maintaining communities, and equity. Over and over you will hear people argue for these kinds of objectives in public policy issues related to fish.

Here are some of the critiques economists express of these other policy objectives. Again, I've simplified both the other perspectives and the economists' critiques. The arguments on both sides are a lot more complex than these brief summaries. Again, the arguments on both sides are a lot more complex than these brief summaries, the arguments have been going on for a long time, and the different sides aren't likely to convince each other any time soon. And again, my goal isn't to convince you that the economists are necessarily right. Rather, it's to help you understand better how economists think and the perspectives they tend to have about other policy objectives.

"We should maximize production"

Many people express objectives of maximizing physical production of something, such as "we should maximize sustainable commercial salmon harvests," or we should maximize fish utilization."

Economists are skeptical about objectives of maximum physical production because they don't take account of the circumstances: they don't consider marginal value or marginal cost and don't necessarily lead to maximum net economic value or efficiency. Economists argue that more production isn't better unless it increases net economic value: unless the marginal value exceeds the marginal cost.

Catching more fish doesn't necessarily make a fisherman—or an entire fishery—better off unless the additional value from catching more fish exceeds the additional cost from catching more fish. Increasing fish utilization doesn't necessarily make a fish processor—or the fish processing industry—better off unless the additional revenue from increasing yields or utilizing buy-products exceeds the extra costs.

More generally, economists are skeptical of *any* objectives expressed in physical terms because they don't take account of prices. You can't tell how well a fisherman, fish farmer, or fish processor is doing from his production volume. You also have to know the price of fish and the prices of the inputs used to catch, grow or process fish.

"We should minimize our use of . . . "

Many people express objectives of reducing or minimizing the use of particular inputs to production, such as water or energy or carbon emissions. The logic seems straightforward: by using less, we'll reduce costs or environmental impacts.

But economists argue that in making decisions about how much of an input to use, you can't just think about effects on costs: you also have to think about effects on economic value. Reducing the use of an input only makes sense if the marginal costs savings exceed the marginal value loss.

If farmers use less water, will the savings in water costs—for the farmer or society—exceed the loss in value of crop production? If fishermen use less energy, will the savings on energy exceed the loss in value of fish catches?

"We should minimize our use of . . . " is another example of an objective expressed in physical terms. Again, economists are skeptical of objectives expressed in terms because they don't take account of the circumstances. Driving slowly may make sense to save on energy if you're driving to the grocery store. It doesn't make sense if you're driving to the emergency room.

"Reducing carbon emissions" sound appealing, but would we want the Coast Guard to use sailboats for search and rescue missions instead of helicopters in order to reduce carbon emissions?

"We should protect the environment"

Many people argue that *protecting the environment*—the water, the air, the ecosystem—should be an important—or our most important—policy objective. Economists agree that the protecting the environment matters. But they tend to think about protecting the environment in economic terms—which can be unsettling to people who are used to thinking about protecting the environment in ecological or ethical terms.

To economists, the environment provides *environmental services* which have *economics value to society*, such as clean air to breathe, clean water to drink, habitat for fish, and natural beauty. We know that environmental services have economic value because we would be collectively willing to pay for them. Activities which affect the environment—such as polluting the air or water or destroying fish habitat or wilderness—reduce net economic value. Economists see protecting the environment not as an end in itself, but rather as part of the economic objective of maximizing net economic value.

Economists argue that *environmental policies should be efficient*. We face economic tradeoffs between the value we derive from environmental services and the value we derive from other uses of the environment such as producing food, energy, wood and minerals. We should make efficient choices between different uses of the environment so as to derive the highest possible value from how we use the environment. We should also be efficient in how we protect the

environment: we should find the lowest cost ways to achieve any given level of environmental services.

One implication of this economic way of thinking about the environment—which can be troubling to people used to thinking about the environment as an ethical issue—is that *more environmental protection is not necessarily better.* To economists, the "optimal" level of environmental protection is not necessarily 100%. Rather, the "optimal" level of environmental protection is the level at which the marginal value of protection equals the marginal cost. We shouldn't do things to protect the environment that cost us more as a society than they benefit us. We have to balance the benefits and costs of environmental protection.

Economic thinking about the environment . . .

Environmentalists tell us we should reduce our carbon emissions by walking or biking rather than driving, and by reducing how far we travel by buying locally. But you don't walk or bike to the hospital if you're in labor. You don't buy locally if the specialist who can cure your cancer is in a different city or state. Instead, you do what economists say society should do: you compare marginal value with marginal costs. When the marginal value is higher of getting somewhere quickly (like when you're in labor) or traveling farther away (when you really need to see the cancer specialist) it makes sense to impose a higher environmental cost by driving or traveling farther.

"We should live sustainably"

Many people argue that *sustainability* should be an important policy objective. We have an ethical obligation to future generations to use resources in sustainable ways: to leave them a world in as good or better shape than the world earlier generations left us.

Economists agree that we have an ethical obligation to future generations. But they tend to view "sustainability" as an elusive concept which is more subtle than most people realize, and which is difficult to define or measure. They tend to be skeptical of "sustainability" objectives expressed in physical terms, such as "sustained yield" in fisheries.

To economists, physical sustainability—maintaining the ability to produce the same physical amount in perpetuity—isn't necessarily efficient or "best"—either for us or our descendants Whether or not physical sustainability is efficient depends upon the costs and benefits for ourselves and future generations. Sustainability isn't necessarily "best" for ourselves or for future generations.

One simple reason is that the value and cost to society from using resources changes over time. To economists, it makes sense to harvest more fish in years when fish prices are high and harvesting costs are low, and to harvest less fish in years when prices are low and harvesting costs are high, than to harvest the same volume every year.

Another reason is that physical sustainability is impossible for non-renewable resources such as oil or minerals. By definition, we can't use oil sustainably—since there is only a finite amount!

But—economists argue—it wouldn't make sense to say that we shouldn't use non-renewable resources at all because they aren't sustainable. Instead, they argue that we should use non-renewable resources *in a way which is fair to future generations*.

What does it mean to use non-renewable resources in a way that is "fair to future generations"? That's a subject of considerable debate, not only among economists. But in general economists argue that "fairness" across generations shouldn't necessarily be measured in physical resource use, but rather in well-being. It's fair for one generation to deplete a non-renewable resource if by doing so they make the world better for future generations in some other way. The wealth we create today from using non-renewable resources makes it possible for society to invest in infrastructure, education, research and technological developments that will benefit future generations more than refraining from non-renewable resource use.

Suppose you think that oil-based energy is bad for the environment, and we should get our energy from renewable sources such as solar and wind power. But could we have ever achieved the level of wealth that allowed us to develop solar and wind technologies without using oil?

Some people argue that economic growth is environmentally unsustainable: that if we want to save our fisheries and save our planet we need to pursue radically different policy objectives, such as zero economic growth. Mainstream economists respond that if we really care about saving our fisheries and saving the planet, we need to think very carefully about what policies will actually achieve that goal in our complex global economic, political and environmental system.

Paradoxically, economic growth may be the best path to environmental sustainability. One of the most important drivers of humanity's effects on the environment is population growth. Economic growth is by far the most effective way to lower population growth rates. Birth rates are much lower in rich places like Europe, Japan and the United States than in poor places like sub-Saharan Africa. In addition, richer countries can afford to and generally do take better care of their environments: fisheries and forests are much better protected in the Europe, Japan and the United States than in Bangladesh or Indonesia.

You may or may not agree with these arguments. But economists say—and I strongly agree—that if you really care about saving fisheries or saving the planet—you should make sure you think about not just the immediate local effects of economic choices on the environment, but about their cumulative long-term global effects. What really matters is now what feels ethically right but what actually will work to save fisheries or the planet. And that will depend on whether the billions of poor people in developing countries can achieve a level of economic and political development that enables them to take care of their fisheries and their planet.

"We should create jobs"

Many people argue that *creating jobs* is an important policy objective. People need jobs. Unemployment is bad. Therefore policies that create jobs are good and policies that reduce jobs are bad. It is very common to hear advocates of a policy argue "this will create jobs!" or to hear opponents of a policy argue "this will cost jobs!"

Economists agree that people need jobs and unemployment is bad. But, they argue, that doesn't mean that all policies that create jobs are good or all policies that reduce jobs are bad. Economists argue that we should use labor *efficiently*—where it will contribute the most net economic value. Policies which create jobs which use labor efficiently are good. Policies which create jobs which use labor inefficiently are not good.

If creating jobs was all that mattered, we could pay people to dig holes and then fill them back in again. That's obviously absurd, and we don't do it, for at least three reasons. First, people don't want to work at make-work jobs that don't create any value for society. Second, if we're not getting anything from the work, we'd be better off just giving people money rather than buying them shovels. Third, if people are going to work, we're better off having them do something that creates more value for society—even if it's just raking leaves.

If our main objective was to create jobs, we could create a lot more fishing and processing jobs by banning power machinery and requiring that all the work be done by hand. But nobody really wants that—because we recognize that machinery which allows us to catch and process fish more efficiently (and with less labor) ultimately is better for society—and better for the remaining fishermen and processing workers, who produce more value and earn higher incomes.

Job creation strategy?

Winslow Homer, The Fog Warning, 1885

Economists point out that using labor efficiently so that workers create value matters! The difference between rich and poor societies is *productivity*: how much value they create per worker. Societies with low productivity—with low value per worker—are poor societies. Societies become richer by increasing productivity: by producing more economic value per worker.

A century ago, we employed far more Americans in farming—growing our food—than we do today. Now only a small fraction of Americans work in farming. Economists argue that it was only by increasing productivity in farming—by reducing the number of workers we use to grow our food—that America and rich countries, and their farmers, were able to become rich. If we

still employed as many people on our farms, we would be a much poorer country and our farmers would be much poorer. The poorest countries in the world, with the poorest farmers, are those where most people still work in farming.

Economists argue that way to increase the wealth of a society is to use *fewer* workers for what you're already producing—increase productivity—and use the freed-up workers to *increase total production and value.*

This point is particularly important for wild fisheries. *For most wild fisheries, fishermen and society can't get richer by increasing fishing employment*—because increasing employment won't increase fish catches. Fishermen and society can only get richer by increasing productivity in fishing: by employing *fewer* fishermen to catch the fish, so that each fisherman catches more fish and produces more value.

Fishing societies can't get rich by keeping everyone working in fishing—just like farming societies can't get rich by keeping everyone working in farming. They can get rich by diversifying away from fishing—using fewer people to catch the fish and more people to produce other goods and services.

This may seem like a bleak and cold-hearted way of looking at things. What does it mean for traditional fishing communities where most people working in fishing? What does it mean for people who have to leave fishing to go work in unfamiliar places to find jobs in unfamiliar occupations?

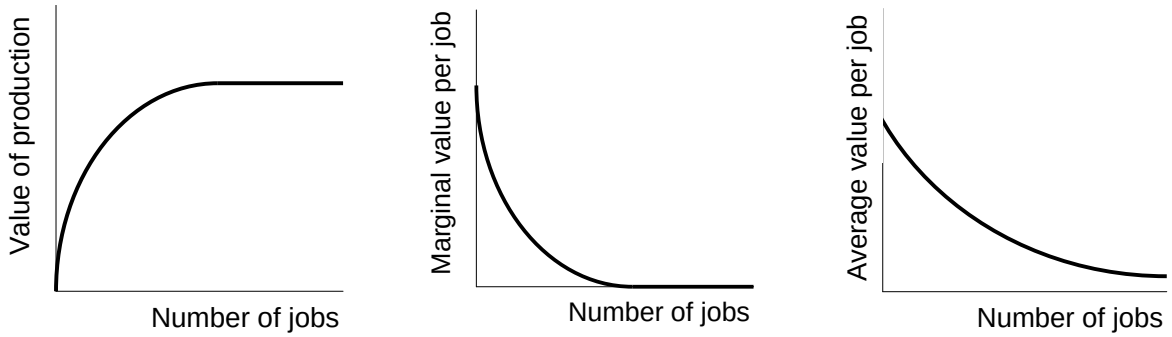
Economists don't dispute that "using fewer fishermen to catch the fish" means difficult social adjustments. They don't argue that societies necessarily have to make that choice and those adjustments. But they argue that only by making that choice and those adjustments can societies and fishermen get richer.

Inefficient Employment vs. Unemployment

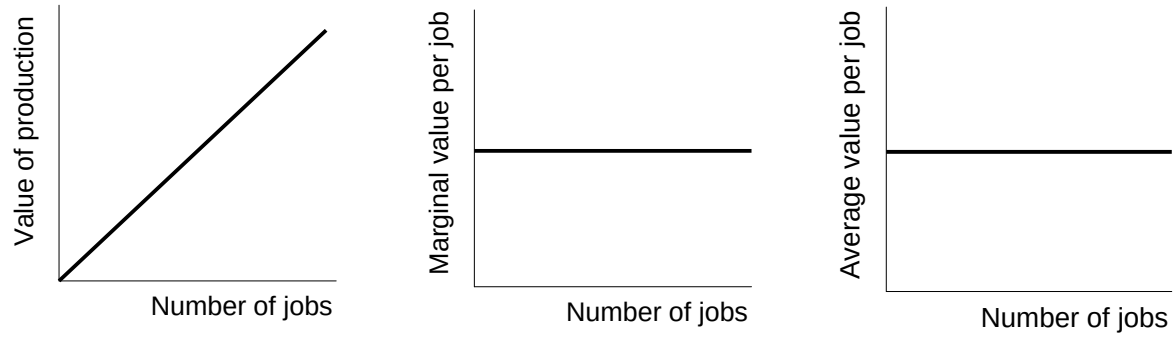
Economists argue that it is better for some fishermen to leave fishing if they could create more value and earn higher incomes in other jobs. But what if there aren't any other jobs—as is often the case in remote fishing communities? Then, economists agree, it may make sense to employ people in fishing even if they aren't adding to the total value of production—if it leads to happier people, families and communities.

Still, economists argue, we should think about what is best for people, families and communities in the long run. In the long run, are people, families and communities better off if they stay staying in low paying fishing jobs or make difficult adjustments to find better paying work in other occupations and communities? The answers aren't obvious or easy. We should think carefully about the questions before assuming either that change is the better or worse choice.

In wild fisheries, after a certain point adding jobs doesn't increase the value of production, because sustainable catches are limited by nature. That means that after a certain point the marginal value per job falls to zero. Adding more workers beyond that point simply reduces the average value of catches per fishing job—making fishermen poorer on average.

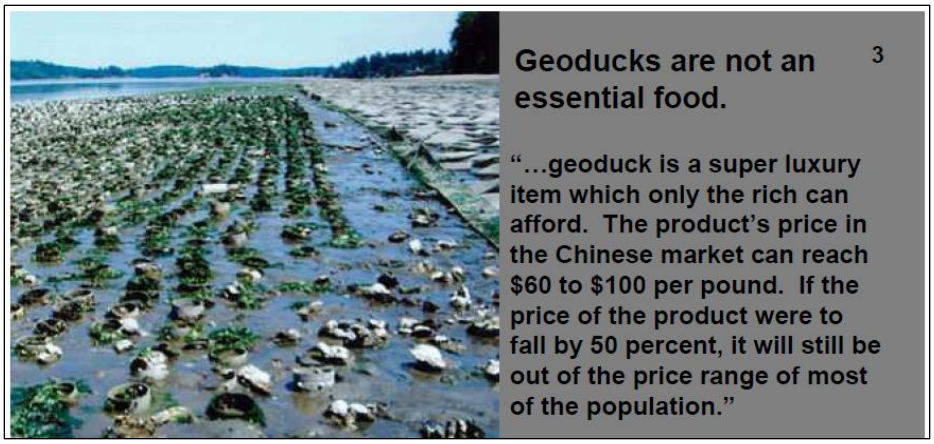


In aquaculture, adding jobs (along with other inputs such as feed) <u>does</u> increase the value of production, because at current levels production is not limited by nature. Unlike for fully exploited wild fisheries, adding jobs in fish farming <u>can</u> make society richer.



"We should feed the world"

A lot of people in the world are hungry. Many people feel that making sure that everyone has enough to eat should be an important economic objective. As the global population grows, meeting this objective will become an increasing challenge. Therefore, they argue, we should pursue policies to use land and water resources in ways that increase food production at prices that the people who most need it—the poor—can afford to pay. We should stop using edible grains to feed livestock, or using edible fish as feed for fish farms—both of which result in less edible food at higher prices. Or, as the organization "Protect our Shorelines" argues, we should stop growing luxury foods for the rich, like geoducks, and concentrate instead on growing essential foods.



Source: "Protect our Shoreline" website: www.protectourshoreline.org

Most economists agree that we should feed the world. But they argue that we should think carefully about the causes of hunger, and what will actually work to reduce hunger. As with saving the planet, what matters is not what feels ethically correct but what actually solves the problem. The world's worst hunger problems have political causes—such as war and dysfunctional societies that lack basic infrastructure such as transportation. Not growing beef cattle or farmed salmon or geoducks won't solve those problems.

In other places, economists argue, people are hungry because they are poor. The real solution to hunger is to increase incomes so that people can afford to buy more food—but using resources efficiently and maximizing net economic value. Inefficient societies are poorer and hungrier.

Economists argue that for most of us—except for people on the edge of starvation—eating is about a lot more than just getting essential nutrients to keep us alive. Hardly anyone buys the cheapest possible food necessary to stay alive or healthy. Eating is pleasurable! We like to eat good food!—including good fish. Enjoying good food is central to many cultures. People are willing to pay a lot for food they like—like geoducks, beef, and farmed salmon. Economists argue that we should produce what people want—what they are willing to pay for. The goal of food industries—including the fish business—is not just to produce nutrients! It's also to produce food that tastes good, and has variety, and which people enjoy eating.

Finally, economists argue, if the world needs more food, the best incentive to get fishermen and farmers to produce more of it is to raise prices—not keep them low. What will help keep food prices low is to use resources efficiently so that fishermen and fish farmers can afford to supply food at lower prices.

The economics of world food supply and hunger is a complicated topic. There is a lot more to these issues, on both sides, than this brief summary. My main point is that you should recognize that this is a complicated topic. Don't assume that the "obvious" ways to feed the world are necessarily so obvious.

"We should be "self-sufficient"
"Buy local!"

Many people say we try to be as "self-sufficient" as possible. We shouldn't depend on far-away places and people to produce what we consume—particularly for our food. By buying locally, we will help our neighbors and strengthen our economy. We will also reduce the environmental impacts of transporting products long distances. When we buy locally produced food, it will be fresher and taste better and we'll be more confident that it's safe to eat.

Whether we should be self-sufficient and buy locally—or whether we should allow and encourage trade—is one of the oldest issues in politics and economics. In general, economists tend to be skeptical of the arguments for self-sufficiency and buying locally. Economists argue that society as a whole benefits from trade:

- Consumers have access to a wider variety of products at cheaper prices

- Producers have access to a wider variety of markets. Remember that if everyone bought locally, everyone would also have to sell locally. That wouldn't benefit the large numbers of American fishermen who depend heavily on export markets such as Japan.

- It's not obvious what "local" means or where we draw the boundary for "self-sufficiency." Why is it OK for New Yorkers to buy food from Florida but not from Canada (which is a lot closer)? Why is it OK to buy foreign-grown coffee but not foreign-grown tomatoes?

- Food trade makes you less—not more—vulnerable to famine. If everyone was dependent on local food, we would be a lot more vulnerable to droughts, crop diseases and fish resource failures. Your best protection against starvation is not having a garden or catching your own fish. It's having ways to get food even if your garden doesn't grow and your fish disappear.

Economists also argue that there's a difference between people voluntarily choosing to be self-sufficient and buying locally, and having governments mandate it. If you prefer to buy locally-caught fish, that's fine. Not allowing other people to buy non-local fish is an entirely different matter.

What's "local"?

To James MacKnight, a wholesale seafood purveyor, "local in our market equates to seafood caught in coastal waters from Massachusetts to South Carolina". Mike Stollenwerk, chef/owner of Fish, Little Fish and Fathom, puts it another way: "A boat can leave out of Jersey and head up to Long Island to fish. That's still local."—Beth D'Addono, *The Philadelphia Daily News*, March 31, 2011.

The extreme in self-sufficiency would be to produce everything we use ourselves, or in our own families or communities. Many of us could do that, at least in theory, for some of the things we

use, such as the food we eat, or the clothes we wear. But we would still remain overwhelmingly dependent on trade—and often globalized trade—for much of what we depend on—such as the needle we use to sew our clothes (and the steel used to make the needle) and the medicines we give to our children when they are sick. Around the world, the most self-sufficient societies are often the poorest societies.

"We should be fair"

Many people argue that public policies should be "fair." Economists don't disagree. But they point out that it's not easy to define what is "fair," and that however you define it, it's impossible to be fair to everyone.

What's "fair"?

Every year, hundreds of millions of salmon return to Alaska. Which would be more "fair"? Letting only a few hundred Alaskans catch the salmon "efficiently" and very profitably with salmon traps, or letting thousands of Alaskans catch the salmon less efficiently or profitably using other kinds of gear?

Probably it seems more "fair" to let thousands of Alaskans fish—which is what Alaska does. But think about what Alaska does with another public resource: oil. Alaska only lets a small number of companies drill for oil on State lands. It collects billions of dollars every year from those companies as royalties and taxes, and uses the money to provide services to all Alaskans—and also to send every Alaskan an annual "Permanent Fund Dividend" from interest earnings on some of the oil money. So even though a small number of companies drill for oil, all Alaskans benefit from the oil.

If the salmon were caught efficiently using very profitable traps, the State could charge the trap operators high royalties and taxes, and use the money to pay for services for all Alaskans and higher Permanent Fund Dividends. Which is more "fair"—sharing the benefits with all Alaskans, or letting a few thousand commercial fishermen enjoy all the profits?

"*Small is beautiful"*

Some people argue that we should produce things on a small scale. A craftsman making a violin in his shop is a lot more appealing than a factory mass-producing violins .A single fisherman on a small boat is a lot more appealing than a huge factory fishing ship. A small family farm is a lot more appealing than a large corporate farm.

Economists point out that small may be beautiful but big is often a lot more efficient. If you want to buy your kid a violin from a craftsman who makes two violins per year, that's fine. But you should expect to pay a lot more than for the factory-produced violin. The fish caught by the small fisherman, and the tomatoes grown by the small farmer, will probably cost you a lot more, too—especially if you want the small fisherman and small farmer to earn incomes comparable to the rest of society.

"Food for people, not for profit"

Some people argument that our economic choices should be based on "good" or "ethical" motives such as feeding people rather than "bad" or "unethical" motives such as earning profits. Economists argue that what matters is not good motives but good outcomes. One of the greatest paradoxes of economics is that the "bad" motive of doing in what's in your own interest tends to lead to much better outcomes than the "good" motive of doing what's in other people's interests. The economist Adam Smith pointed this out in a famous passage in his classic book *The Wealth of Nations*:

> *"It is not from the benevolence of the butcher, the brewer, or the baker, that we can expect our dinner, but from their regard to their own interest."*

What Smith was arguing was that we can thank the pursuit of profit for the fact that you can get meat, beer and bread almost anywhere in America. Ranchers wouldn't raise cattle and farmers wouldn't grow hops or wheat just to help out their neighbors—much less the rest of us who aren't their neighbors. They do it for their own self-interest: because they can earn a living from selling what they produce at a profit. Nor would meat-packing plants butcher the beef, or breweries brew beer, or bakeries bake bread except for the self-interested reason of earning a profit. Put simply, if we expected ranchers, farmers, butchers, brewers and bakers—or fishermen and fish farmers and fish processors—to do what they do for people rather than for profit, we would be in big trouble.

Your mom will cook for you because she loves you. The rest of your family and some of your neighbors will help you out—for a while—because that's what you do for family and friends. But they won't spend their whole lives working for strangers.

Remember: *the seafood business—like most of the rest of the economy—is not a charity*. If we expected or asked or required it to be a charity, there would be a lot fewer fishermen and a lot less fish to eat.

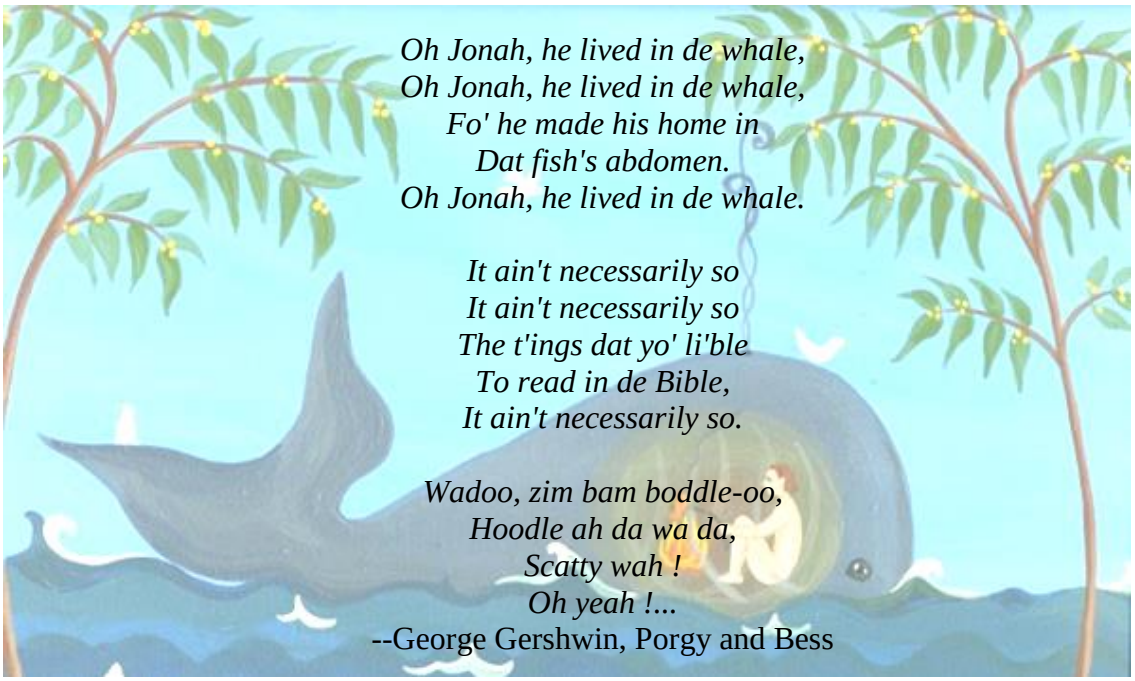
"We should buy local, and live sustainably, and . . ."

People often express multiple objectives for public policy. But what if the objectives conflict with each other? What if buying locally is less sustainable or creates fewer jobs? Economists point out that different objectives often do in fact conflict with each other. If we want to pursue multiple objectives, we should recognize that we may have to make compromises: it may not be possible to get the best possible outcome for each of multiple objectives.

The problem of multiple objectives . . .

"How can a consumer who cares about buying fresh, local produce and supporting sustainable growing practices and the humane treatment of animals apply those principles to buying fish and seafood? Navigating the world of local vs. farmed vs. sustainable can be tricky. . .[According to] executive chef Jeffrey Power, serving only fish out of New Jersey would be too limiting. The way Power sees it, a farmed fish harvested sustainably is a better choice than a local fish caught by trawling the ocean floor . . ."—Beth D'Addono, *The Philadelphia Daily News*, March 31, 2011.

16. IT AIN'T NECESSARILY SO



Oh Jonah, he lived in de whale,
Oh Jonah, he lived in de whale,
Fo' he made his home in
Dat fish's abdomen.
Oh Jonah, he lived in de whale.

It ain't necessarily so
It ain't necessarily so
The t'ings dat yo' li'ble
To read in de Bible,
It ain't necessarily so.

Wadoo, zim bam boddle-oo,
Hoodle ah da wa da,
Scatty wah !
Oh yeah !...
--George Gershwin, Porgy and Bess

Economics can be very helpful in understanding many important questions. That's why I wrote this book.

But it's also important to know much of what you may read or hear about economics—from both economists and non-economists—"ain't necessarily so." Here are some of the common reasons why. Look out for them!

It ain't necessarily correct.

People make mistakes. Sometimes simple mistakes—like adding up numbers wrong or forgetting to convert from kilograms to pounds—can make a big difference. If something doesn't make sense, it's always possible that someone made a mistake!

STATE OF ALASKA

DEPARTMENT OF REVENUE
Tax Division

SEAN PARNELL, GOVERNOR

Re: Amended Alaska Salmon Price Report November 22, 2010

The Amended Alaska Salmon Price Report for the reporting period May-August 2010 is now available at www.tax.alaska.gov/programs/programs/other/fish/salmonreports. This report was amended because of reporting errors discovered after the initial report was published October 19, 2010. The amended report reflects changes in reported chum frozen headed and gutted, sockeye frozen fillets and chum roe.

Some of the data in the original May-August 2010 Alaska salmon price report were wrong. Not all mistakes get discovered or admitted!

Data ain't necessarily so.

It's tempting to think that "facts are facts." But data aren't necessarily facts. Both fisheries data and economic data can be misleading, for lots of reasons:

- People don't necessarily tell data collectors the truth
- The data may be based on a non-representative sample
- The data may be based on a representative sample—but the confidence interval for the sample may be very wide.
- Conditions may have changed since the data were collected.
- The terminology used to describe the data may be misleading

If you read the Alaska Department of Labor's "Annual Employment & Wages" report for 2009, you might be surprised to learn that in Alaska—which accounts for more than half of the United States' total fish harvest—average monthly employment in fishing was only 72! (compared with total employment of 320,265 and employment of 3,987 at Motor Vehicle and Parts Dealers). But it isn't so that there were only 72 fishermen in Alaska. The term "employment" in the report is misleading! It actually refers to "wage and salary employment"—people working for wages or salaries. Since almost all Alaska fishermen are paid on a "share system" (based on a share of the catch value after deducting expenses) they simply don't get counted in the employment data.

Annual Employment & Wages
January - December 2009

Industrial Classification	Average Mo. Emp	Total Earnings	Avg Mo Earnings
TOTAL INDUSTRIES	320,265	$14,933,881,341	$3,886
114 Fishing, Hunting, Trapping	72	$4,990,843	$5,803
1141 Fishing	72	$4,990,843	$5,803
441 Motor Vehicle & Parts Dealers	3,987	$161,837,707	$3,383

All data have a potential margin of error. Always think about what that margin of error might be, and whether the conclusions drawn from the data are reasonable given the margin of error.

It ain't necessarily relevant.

Something can be technically correct but also irrelevant and misleading. For example, suppose you hear that "the average price of salmon went up by 55% this year, from $.44/lb to $.68/lb." It sounds like prices are definitely improving for salmon! Right?

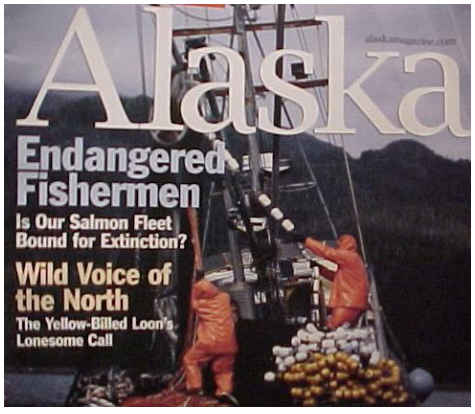
"The average price of salmon went up this year!"

	Species	Last year	This year	Change	% Change
Harvest volume (lbs)	Pink salmon	70,000	30,000	-40,000	-57%
	Sockeye salmon	30,000	70,000	40,000	133%
	Total	**100,000**	**100,000**	**0**	**0%**
Harvest value ($)	Pink salmon	$14,000	$5,400	-$8,600	-61%
	Sockeye salmon	$30,000	$63,000	$33,000	110%
	Total	**$44,000**	**$68,400**	**$24,400**	**55%**
Average price ($/lb)	Pink salmon	$0.20	$0.18	-$0.02	-10%
	Sockeye salmon	$1.00	$0.90	-$0.10	-10%
	Total	**$0.44**	**$0.68**	**$0.24**	**55%**

Not necessarily. Whenever an "average price" changes, the reason could be that the mix of products changed rather than the prices. In the example in this table, what really happened was that relatively more higher-priced sockeye salmon were harvested and relatively fewer lower-priced pink salmon were harvested—which increased the total value of the harvest—even though the prices of both species went down by 10%. It would be very misleading to conclude that prices were improving.

Maybe it *was* so, but it ain't necessarily *still* so.

The world doesn't stay the same. Changes happen— sometimes rapidly and dramatically—with fish, with economies, and with the fish business. Fish stocks go up and down. Prices go up and down. Technologies change. Regulations change. Problems and issues get resolved, and other issues arise. Things that were true not very long ago may no longer be true. When you hear or read something about the fish business, remember to think about how old the information is that it's based on, and whether it's still true.



2002: Record-low prices had people wondering if Alaska salmon fleet was "bound for extinction"

2011: The highest prices in two decades had Alaska salmon optimistic about the future

It ain't necessarily representative.

Be careful with *anecdotal evidence*: individual conversations or stories. They may be completely true. But the situation, experience or beliefs of one or a few people are not necessarily representative of their group as a whole.

Anecdotal evidence is important! To understand what is going on, we *do* need to talk to people, and hear about their situations, experience and beliefs. Anecdotal evidence can be critical to learning about what's really happening in the seafood industry: what data actually mean or don't mean; how fish are caught, grown, processed and sold; how regulations actually work; and what the real issues and problems are. Almost inevitably the real situation is more nuanced and complicated than the data might suggest.

But people aren't all the same (what economists call *homogenous*). People are different from each other (what economists call *heterogeneous*). Not all fishermen fish the same way, think the same way, or feel the same way about fisheries issues. The same thing applies to fish farmers, fish processors, and fish consumers. Be suspicious anytime someone tells you what "fishermen want" or what "consumers like." What they say might be perfectly true for some or even many fishermen or consumers—but it definitely won't be true for all of them.

That's why you have to be careful with anecdotal evidence. Any single person's situation, experience and beliefs are not necessarily representative of their group. Drawing conclusions from what one or a small number of people say is no more valid than drawing statistical conclusions from just one or a small number of observations from a data set. Anecdotal evidence can be very useful for *illustrating* particular situations, experiences or opinions. But be careful of extrapolating from it: of assuming that it is representative.

A particular place to be careful of anecdotal evidence is in press accounts. Peoples' stories are a lot more interesting to read or listen to (and a lot easier for reporters to write about) than statistical analysis of data. Reporters often write stories based on interviews with a few people. The stories may be very powerful and convincing. But be careful of extrapolating from them and assuming that the stories are representative. In fact, there may a natural tendency for a negative bias in press stories about policy issues. Who is more likely to seek out the press? Someone who is doing well and making money and likes the situation? Or someone who isn't doing well and who is losing money and wants to complain?

A single fisherman's situation, experience and beliefs is not necessarily representative of all fishermen—because not all fishermen think the same way! This was clear from a survey I conducted of Alaska halibut fishermen after an Individual Fishing Quota (IFQ) management system was implemented in 1995.

One question asked "what have been the most negative effects of the IFQ program upon your operation?" Many of the fishermen responded "none"—there was nothing wrong with it—it was great! If you read just the responses of those fishermen—and there were lots of them—you'd be convinced the IFQ program was an overwhelming success and fishermen loved it.

What have been the most negative effects of the IFQ program upon your operation?

None (11 responses)
Zero. It's been good.
None. Even though I didn't get as much fish as hoped for I was very happy with the program.
No negative effects.
None I can see as yet.
None that I see.
No negative effects on our fishing operation.
I can think of none.
None, except having to release fish when we catch too many.

Another question asked "what have been the most positive effects of the IFQ program upon your operation?" Many (other) fishermen responded "none"—there was nothing good about it—it was terrible! If you read just the responses of those fishermen—and there were lots of them—you'd be convinced the IFQ program was an overwhelming failure and fishermen hated it.

What have been the most positive effects of the IFQ program upon your operation?

None (9 responses)
None to date.
Zero, zip, nada, nothing, zilch.
I can find no positive effects from the IFQ program.
There are none.
None. None. None. None.
NONE!!
No positives when your income is radically reduced.
I can go fishing when the weather is nice and it's easy because the [#!##'s] didn't give me hardly any quota.
There is absolutely no positive effects of the IFQ program. It has put me out of the Halibut and Black Cod fisheries.

The important point is that *not all fishermen felt the same way*! Suppose I had asked just one fisherman whether he liked the IFQ program. How representative would his response have been?

Reasoning ain't necessarily right.

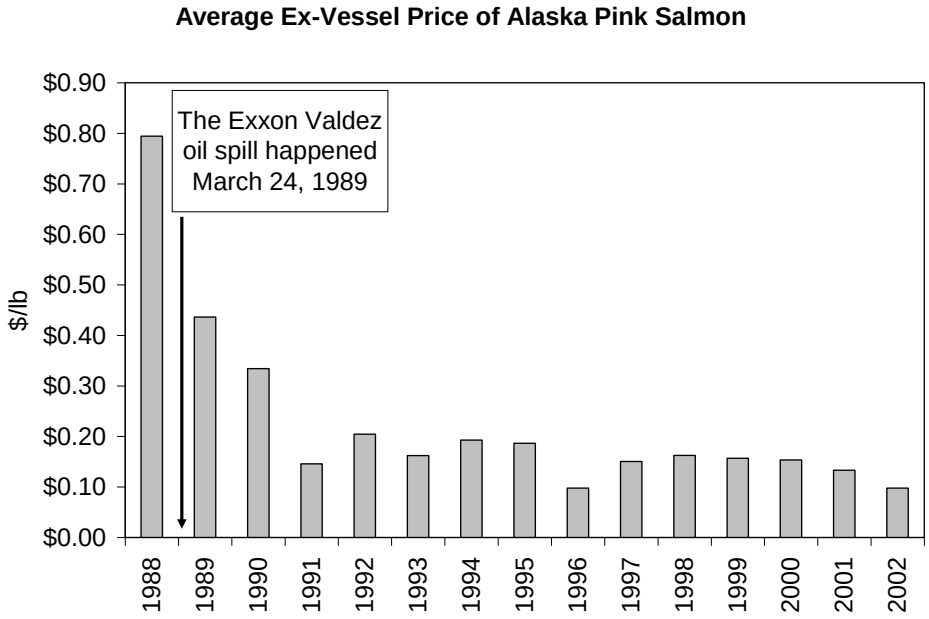
People make reasoning errors—*logical fallacies*—all the time. Here are two of the most common and famous logical fallacies:

***The rooster makes the sun rise*.** Every morning, after the rooster crows, the sun rises! But it's pretty obvious that the rooster didn't *cause* the sun to rise. Just because the A is followed by B doesn't mean that A causes B. The Latin expression for this famous fallacy is *post hoc, ergo propter hoc* (after this, therefore because of this).

I took that new medicine and I felt much better the next day—that stuff really works! But the fact that you felt better doesn't mean the medicine necessarily cured you. You might have recovered just as fast without any medicine at all. That's why medical researchers do experiments in which they randomly assign people to two different groups, give the people in one group medicine, and see whether they get better faster than the people in the other group.

Our management policies succeeded! Fish stocks recovered! But fisheries managers shouldn't necessarily get the credit when fish stocks recover—any more than the medicine should necessarily get the credit if you feel better. The fish stocks might have recovered anyway.

The Exxon Valdez oil spill wrecked Alaska salmon prices! It's true that after hitting record high levels in 1988, Alaska salmon prices fell dramatically in the summer of 1989—right after the Exxon Valdez oil spill. It's easy to blame Exxon, particularly if you're mad about the oil spill. But salmon prices were falling everywhere after 1989—mainly due to competition from farmed salmon. There's no evidence that the oil spill had any effect on Alaska salmon prices.



If he can do it, everyone can do it! This is the famous *fallacy of composition*: thinking that something is true of the whole from the fact that it is true of some part of the whole. Or you can call it the "Lake Wobegone fallacy"—thinking that all the children can be above average.

Some guys are making lots of money selling their fish direct! That's what we should all be doing! But it ain't necessarily so. Just because some restaurants will pay high prices to buy fish directly from some fishermen doesn't mean there are enough restaurants to pay high prices to everyone for selling direct.

Guys with big boats catch more fish and make more money. We should give everyone loans to buy big boats! But if there's a limited number of fish—particularly if there's a total allowable catch—then if everyone has bigger boats, they'll still catch the same amount of fish. They'll just have higher costs and make less money.

These are only two of the most famous fallacies. There are many others! When you hear or read something about fish economics, think about the reasoning and whether it's really right.

"Experts" ain't necessarily experts about everything.

Lots of "experts" write or say things about fish economics. These include "experts" about fish, "experts" about economics, and "experts" about a lot of other topics such as cooking, marketing, and anthropology. But being an expert in any of these topics doesn't necessarily make you an expert about fish economics. You can't be an expert about fish economics unless you have a good understanding about both fish (and the seafood industry) *and* economics.

That includes the "experts" who peer review articles for academic journals. Fisheries experts who review articles about fish economics won't necessarily see errors in the assumptions or reasoning about economics. Economics experts who review articles about fish economics won't necessarily see errors in the reasoning or assumptions about fish or the seafood industry. Don't assume that something is necessarily so because you read it in a prestigious academic journal.

"Experts" don't necessarily want what you want.

"Experts"—including fish economists—may say "this is what should be done." They might be entirely right about what should be done to get where they want to go. But if you want to go somewhere else—if you have different goals than the experts—then you shouldn't necessarily take their advice.

The press ain't necessarily right.

People get a lot of their fish economics second-hand—from the press. In the paper, on the radio, on TV and (increasingly) on the internet, you read on hear what someone said about fish economics. But if you've ever read or heard a story about something you were personally involved in, you probably saw things in the story that weren't quite true. It wasn't the whole story. Or there were other sides to the story. Or there were parts that were simply wrong.

It happens all the time in stories about fish and economics. Reporters don't necessarily understand the issues. They don't necessarily have time to learn the issues, or hear all the different perspectives. Even if they do, they usually have to simplify what they write or say to fit it into the space or time they have, and so their readers and listeners can understand.

So be skeptical about what you read in the press. Someone may or may not have said what they were quoted as saying. The TV sound bite may or may not represent what he really said. Be particularly skeptical when a story presents only one side of an issue. Most issues have two sides. Did the reporter hear both sides? Is the reporter telling you both sides?

> *"In October NFI (the National Fisheries Institute) became aware of a Today Show story alleging problems with imported seafood. . . We provided the producer with significant technical data about the safety of seafood, both domestic and imported. We also suggested that the producer and reporter were being used in a political debate, perhaps unwittingly. . . Subsequently, (NFI Director) John Connelly was interviewed by a reporter for The Today Show . . .. It was immediately apparent that the interview would be hostile. Typically, an interview of this type lasts about 10 minutes. The reporter questioned John for 40 minutes and asked the same question 14 times, hoping for a negative reaction or some kind of 'confession.'"* –from an NFI email reported in Seafood.Com News, November 17, 2010.

"Quote me as saying I was mis-quoted."—Groucho Marx

People ain't necessarily unbiased.

Everyone has biases. Our biases reflect how we were brought up, how we were educated, what we think matters, and many other things—including how we think what we say or write might affect our reputations, our jobs, and our income. Our biases influence what questions we ask and how we answer them. So whenever you hear or read fish economics, think about what biases whoever said or wrote it might have, and how their biases might have influenced what they said or wrote.

It's very easy to rationalize about our biases, and to think that we are telling the truth while the other person isn't. When money, livelihoods or other goals are at stake, people may embrace any argument (or expert) that supports their cause. How balanced, fair, or reliable the argument may be won't necessarily matter that much to them.

Be particularly skeptical of research that is done to prove a point—where the researchers knew the answer they wanted to find before they started.

When people are being paid, think about who is paying them and why and how it might influence them. But also remember that being paid doesn't necessarily make someone wrong or biased. It's hard for anyone—including fish economists—to do good research if they're not paid. And good researchers recognize that their futures depend more on their reputations for good and unbiased research than on what they might get paid for any particular research project.

There are many shades of bias. At one extreme are our unconscious biases. We may think that we are looking at an issue objectively and fairly when in fact we're not. At the other extreme is saying whatever will help your cause without regard for whether it's actually true. In statements about fish economics, you can find both extremes—and everything in between.

> *"It's been happening as long as there have been two sides of an argument -- people lining up support for their point of view. Seafood is no exception. Whether it's about the safety of Gulf seafood following the oil spill, the "truth" about genetically engineered salmon, the debate about whether aquaculture is good or bad, there's no shortage of people, companies and lobbyists waiting to offer their opinions -- for a price. . . Pick a subject, any subject, seafood related or not -- there are gangs of partisan supporters on both sides ready to spew half-accurate information, disinformation, rumor and innuendo, as long as it helps their cause . . ."* –Ben DiPetro, editorial in *Intrafish.com*, November 22, 2010.

Be skeptical!

I'm *not* saying that *all* fish economics is wrong or that you can't believe anything! I'm saying that *some* fish economics wrong and you can't believe everything.

Be skeptical about what you what you read or hear about fish economics. Does it make sense? Is the reasoning sound? Don't assume it's necessarily so because everyone else thinks it's so, or an "expert" says it's so—or you read it in this book. Think for yourself!

Who are you going to believe, me or your lyin' eyes?—Groucho Marx

[i] Daniel Kahneman, *Thinking, Fast and Slow* (New York, Farrar, Straus and Giroux, 2011).
[ii] James E. Wilen, "Property Rights and the Texture of Rents in Fisheries," in Donald Leal, ed., Evolving Property Rights in Marine Fisheries (Lanham, Rowman & Littlefield Publishers).
[iii] Tom Tietenberg, Environmental and Natural Resource Economics, Seventh Edition, page 25.
[iv] James A. Crutchfield, "Economic Aspects of Fishery Management, in Arlon R. Tussing, Thomas A. Morehouse and James D. Babb, Jr., Alaska Fisheries Policy, University of Alaska Institute of Social, Economic and Government Research, 1972. This quote is from a section of the paper discussing the conclusions from a meeting of fisheries experts held in 1965 about "the role of the economist in fisheries management."
[v] Quentin Grafton, "Individual transferable quotas: theory and practice," *Reviews in Fish Biology and Fisheries* 6, 5-20 (1996).