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Introduction

Why Analyze Policy?
A policy or regulation is usually written to target a specific problem or goal. But how can we be sure the policy will accomplish its objective? What groups will be affected by the policy? Can we improve the regulation’s net benefit to Rhode Island? What unintended consequences might result from a rule change? Good policy analysis can answer all of these questions.

Overview
The goal of policy analysis is to carefully define the problem that is being addressed, identify the various regulatory alternatives that can address that problem, and evaluate those alternatives by measuring the costs, benefits, economic impact, and the distribution of the effects of the regulation change.

A good analysis has many merits:
- it attempts to measure and capture the total societal effect of a policy change;
- it considers multiple alternative methods of achieving the intended effect;
- it is produced with timely and accurate information;
- it is conducted in a transparent and reproducible manner; and,
- it provides specific references and explanations of data sources and estimation methods.

This guide will provide an introduction to many of the tools that can be used to evaluate regulatory changes. The last half of this guide reviews many of the economic principles that provide the foundation of regulatory analysis.

Checklist
Benefit-cost analysis provides a useful framework to evaluate regulatory options and provides the basis for this analysis guide.

Benefit-cost analysis allows you to identify the wide array of stakeholders affected by a policy change, estimate the societal benefits and costs that affect these stakeholders, and compare those benefits and costs between alternative approaches.

This guide outlines various methods to quantify and/or monetize the policy’s societal effects. This quantification will help you compare the benefits and costs of a policy change and understand the different ways policy mechanisms effect different groups throughout Rhode Island.

Steps for a Regulatory Analysis
- Define the societal problem being addressed by regulatory change
- Define the goal of the regulatory change
- Set the scope of regulatory analysis
- Establish a baseline
- Identify stakeholders affected by proposal and alternatives
- Identify the benefits and costs for each stakeholder
- Quantify benefits, costs, and transfers
- Create schedule of costs, benefits, and transfers over time
- Adjust future benefits/costs/transfers through discounting
- Calculate present values of regulatory proposal
- Perform risk/sensitivity analysis to check the effect of assumptions
- Consider and evaluate alternatives to proposal
Problem Definition and Statement of Need

Before analyzing a proposed regulatory change and alternative approaches, it is important to identify the problem being addressed and the goal of the policy change. It may also be appropriate to discuss any background information that may provide important context regarding the motivation behind the regulatory change (such as relevant federal or state statutes, history of the policy, etc.).

### Hypothetical A: Logging Permits

The Rhode Island Department of Environmental Management (DEM) is writing a rule that requires property owners to receive a state permit before logging any lands.

**What is the problem and goal?**

This regulation could seek to address several different issues revolving around the environment, safety, or compliance. In this case, DEM identified a problem of logging occurring in an unsafe manner. The goal of the permit is to provide a check in the process so that property owners can be notified about proper logging safety protocols, and compliance with these protocols can be checked.

### Setting the Scope of Analysis

The goal of a regulatory impact analysis is to measure the marginal effect of the rule change being proposed. It’s attempting to measure the additional benefits and costs that are caused directly by the regulation under analysis, and not changes that are caused by other factors.

The analysis should measure the societal benefits and costs that accrue to the entire state of Rhode Island. This includes the benefits and costs that accrue to individual citizens, businesses, organizations, and governmental institutions.

The timeline of an analysis should start at implementation and be long enough to encompass the important benefits and costs of the regulatory change. In some cases, the timeframe is fixed and fairly obvious; in other cases, it can be more difficult to determine. If future change to the policy is fairly certain to happen at a specific point in the future, set the timeframe of analysis up to that point. Use your discretion and try to set a timeframe that captures as much of the societal benefits and costs of the regulatory change as is possible.

### Hypothetical B: Youth Sports Concussions

The Rhode Island Department of Education (RIDE) is considering a rule that would mandate a concussion testing protocol performed by a licensed paramedic for all high school athletic events.

**What is the scope of analysis?**

This regulation will be implemented over a five-year period so that schools can comply with the mandate. But is a five-year scope of analysis appropriate? There will be annual compliance costs for schools in perpetuity. During the creation of the regulation, RIDE stated that the goal was to see a decline in the rate of youth concussions within 10 years. Tallying benefits and costs over 10 years would be a good analytical approach.
Establishing a Baseline, Proposal, and Alternatives

Establishing a Baseline
A baseline is the best assessment of the state of the world in the future if a regulatory change is not adopted. A baseline measurement gives an analyst something to measure different regulatory alternatives against.

This baseline is not the status quo—that is, it is not simply the current state of the world. Rather, a baseline takes any other external forces or future trends into account. A good baseline is our best guess of how the future would look in the absence of the policy change under consideration. Establishing accurate baseline measurements is important because the policy analysis is attempting to measure the impact that the regulation change—and only the regulation change—has on society.

Proposed Action
Ultimately, the policy analysis is presenting an analysis of the societal effect of an agency’s proposed policy change, as well as the alternative approaches that the agency considered before arriving at that proposed action. The proposed regulatory action proposed by an agency should be clearly outlined in plain and simple language that minimizes the use of technical language or jargon. This proposed regulatory action will be measured against the baseline to determine the overall societal effect the policy will have on the state of Rhode Island.

### Hypothetical B: Youth Sports Concussions

<table>
<thead>
<tr>
<th>What is the baseline and effect of the proposal?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The easiest measure would be to take the current rate of concussions in youth sports.</td>
</tr>
<tr>
<td>However, this rate has been decreasing at about 3% per year as knowledge about the dangers of concussions spreads.</td>
</tr>
<tr>
<td>You find data that indicates that a similar policy in Michigan decreased concussions rates by 17% within five years of adoption.</td>
</tr>
<tr>
<td>You decide that the baseline should be a steady 3% decrease, and the proposed action should be measured as a 17% decrease every five years.</td>
</tr>
<tr>
<td>These assumptions should be clearly stated in the analysis.</td>
</tr>
</tbody>
</table>
Identifying Stakeholders

Since the goal of the regulatory analysis is to evaluate all of the societal benefits and costs of a regulatory change, it is necessary to identify all of the affected stakeholders who would be impacted by the regulation, both directly and indirectly. This can include government agencies, private businesses, and individual citizens and consumers.

Some of these stakeholder will be obvious, but a good analysis should try to capture the full range of stakeholder groups that are affected. For example, it is generally not sufficient to include “business” as a singular stakeholder—rather, are some businesses affected differently than other businesses?

Below are some examples of regulatory stakeholders, as well as some questions that can suggest ways they may be affected by a regulatory change:

<table>
<thead>
<tr>
<th>Type of Stakeholder</th>
<th>Key Questions to Identify Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>State government agencies</td>
<td>• Which agencies will be affected by this rule change, either directly or indirectly?</td>
</tr>
<tr>
<td></td>
<td>• Will any other agencies need to devote more/less time or resources to work due to this change?</td>
</tr>
<tr>
<td>Local governments</td>
<td>• How are city and local governments—as well as their departments and agencies—affected by this regulatory change?</td>
</tr>
<tr>
<td></td>
<td>• Are some localities affected differently than others?</td>
</tr>
<tr>
<td>Private businesses and organizations</td>
<td>• Which businesses will be primarily affected, either directly or indirectly?</td>
</tr>
<tr>
<td></td>
<td>• Are some firms affected more than others?</td>
</tr>
<tr>
<td></td>
<td>• Will they need to purchase licenses or new equipment? Will they spend more or less time due to compliance?</td>
</tr>
<tr>
<td></td>
<td>• Will they face a change in prices?</td>
</tr>
<tr>
<td></td>
<td>• What secondary businesses are affected by any cost changes faced by those primary businesses?</td>
</tr>
<tr>
<td></td>
<td>• Are any other private organizations, such as nonprofits, affected by this rule change?</td>
</tr>
<tr>
<td>Individuals, consumers, and</td>
<td>• How are individuals affected by this change?</td>
</tr>
<tr>
<td>constituencies</td>
<td>• Are some individuals affected differently—either due to geographic location, income level or other demographic differences, or differences between individuals who choose to use a service?</td>
</tr>
<tr>
<td></td>
<td>• Do some consumers face different benefits or costs?</td>
</tr>
<tr>
<td></td>
<td>• Will the regulation have any direct or indirect effects on the prices of goods and services?</td>
</tr>
</tbody>
</table>
### Hypothetical A: Logging Permits

**Who are the stakeholders?**

You identify six stakeholder groups: 1) Rhode Island Department of Environmental Management, 2) environmental advocacy groups, 3) property owners with commercial property intended for logging, 4) residential property owners who want to log their own property, 5) businesses that perform logging operations, and 6) consumers of raw timber.

With a complete list of stakeholders, it will be possible to identify each of the benefits and costs for analysis, as well as potential data sources to assist with the quantification of these benefits and costs. Even if you are not certain of the effects of policy on a given stakeholder, you should include it on the list and suggest some of the ways the group may be affected.
Identifying Benefits and Costs

After identifying the affected stakeholders, list the benefits and costs that accrue to each of these groups. You should view the regulation change from the perspective of each stakeholder:

- What benefits and costs—monetary and non-monetary, direct and indirect—will each stakeholder face with the enactment of the regulation change?
- When do each of these benefits and costs occur?

The goal is to identify the marginal benefits and costs caused by the policy: what incremental increase or decrease in benefits or costs can be directly attributed to the policy, rather than external forces?

The analyst should list the benefits and costs and describe each one. This list should be as comprehensive as possible: it should include the benefits and costs that are known and easily quantifiable, as well as benefits and costs that are uncertain and difficult to measure.

Benefits

Benefits are often the easiest parts of a policy analysis to identify—after all, these benefits provide the motivation for the regulation change in the first place—but they can be difficult to quantify. When identifying and listing the benefits of a regulatory alternative, try to identify all of the direct and ancillary benefits that accrue to each stakeholder.

- **Direct benefits** include those benefits that are the direct result of the regulatory change being analyzed. These direct benefits can take many forms, and may accrue to many different stakeholders in different ways.
- **Ancillary benefits** are benefits that are unrelated to the stated goal of the regulatory change, but nonetheless lead to a societal benefit. Since the goal of regulatory analysis is to find a policy change’s total societal effect of a policy change, ancillary benefits should be identified and quantified when possible.

<table>
<thead>
<tr>
<th>Type of Stakeholder</th>
<th>Key Questions to Identify Benefits</th>
</tr>
</thead>
</table>
| State government agencies              | - Are government expenditures decreasing due to this regulation change?  
                                         - How will revenue change?  
                                         - Do streamlined processes lead to saved time or resources?                                     |
| Local governments                      | - Will local governments see decreased expenditures or higher revenue?                           |
| Private businesses and organizations   | - Do compliance costs decrease?  
                                         - Can firms expect to increase revenue?  
                                         - Are markets affected in a way that increases efficiency or alters the prices that firms face? |
| Individuals, consumers, and constituencies | - Are prices, quality, or the availability of goods and services affected by the regulation change?  
                                           - Are health and safety outcomes affected in a positive way?  
                                           - Are there environmental benefits that society values? |
### Hypothetical B: Youth Sports Concussions

#### What are the benefits?

| The main benefit is a certain number of concussions avoided per year. Remember, this number should be the difference between your policy proposal and your baseline. |

**Costs**

Costs are often easier to quantify than benefits, but it can be difficult to identify the full range of costs caused by the regulatory action due to unintended consequences. When identifying and listing the costs of a regulatory alternative, try to identify all of the direct, indirect, and possible unintended consequences that accrue to each stakeholder.

- **Direct costs** include the cost of implementing, administering, and enforcing a regulation, as well as the costs that businesses and individuals encounter as a direct result of the regulation. This includes the initial startup costs of a program or regulation change, the recurring costs that happen each year, and any termination costs associated with ending a project.

- **Indirect costs** can include the portion of an office's administration budget used, as well as the opportunity cost of affected resources:
  - *Opportunity cost* is the value of the next best alternative use of the resources—the option foregone in favor of the regulation. This takes into account the other possible uses for the resources—such as employee time, office resources, etc.—that would be consumed by the project under consideration.
    
    For example, consider a regulatory change that requires more time spent by an agency employee on a certain task. The value of this additional time spent should be counted as a cost, since the employee's time could be used for other purposes.
  
  - *Costs of reduced competition and substitution effects* should be identified and measured when possible. Regulations that alter competition in markets, such as those that increase barriers to entry or raise the prices of goods and services may have rippling effects on related industries. Please refer to Appendix A for more information.

- **Unintended Consequences** are costs or inefficiencies that occur due to the regulatory change that are not an intended part of the normative goal.
<table>
<thead>
<tr>
<th>Type of Stakeholder</th>
<th>Key Questions to Identify Costs</th>
</tr>
</thead>
</table>
| State government agencies               | • What costs do agencies face to administer the regulation or program?  
• Will employees need to be trained?  
• Are there processes that use employee time or other resources (such as application approvals, inspections, investigations, prosecutions, audits, and monitoring?) |
| Local governments                       | • Will local governments face any additional costs?  
• Will local governments need to devote more time or resources to meet the regulation?  
• Will it alter local government revenue streams? |
| Private businesses and organizations    | • Are there initial costs to plan, train, or otherwise prepare for the regulation?  
• Are there license fees or charges that firms face?  
• Are there higher costs due to equipment or other requirements?  
• Are there compliance costs associated with inspections, record-keeping, or auditing?  
• Will firms face higher prices or lost sales due to changes to the market? |
| Individuals, consumers, and constituencies | • Will consumers face higher prices for goods or services?  
• Will consumers see a reduced range of available products?  
• Will consumers face negative health or safety effects? |

**Hypothetical A: Logging Permits**

*What are the costs?*

Creating a permitting system requires startup costs as DEM must draft forms, create a database, and train employees to administer to process.

- DEM plans to hire one new staff member to handle this permitting process.
- In addition, you discover that DEM plans to transfer an additional employee who currently handles hunting and fishing licenses.
- DEM estimates that is will be able to process 150 fewer licenses each year as a result, and each license generates about $26 in revenue for the state.
- This lost revenue is an *opportunity cost* of the proposal.

There is also a cost to businesses or individuals who need to apply for a permit.

- The permit will cost $5 to file (this is a transfer, which is explained on page 10).
- Additionally, these people will have to spend time complying with the permitting regulation, and this time can be included as a cost—estimated to be $10 per permit.
- You estimate that because the permit is fairly simple and the fee is low, the permitting process shouldn’t have an effect on the market for timber.
- If compliance costs were high, loggers might choose to pass these costs along in the form of higher prices. Or, loggers might believe that compliance costs are so high that they want to decrease or even stop the production of timber.
- The increase in price that results from either of these scenarios would be a cost.
Unintended Consequences

As noted above, unintended consequences can be a cost that must be accounted for in a benefit-cost analysis. But how can you anticipate those consequences, especially if they’re unintended?

- **Substantive surprises**
  Simply put, if the substance—the facts—around which the analysis are incorrect, there can be unintended consequences. In the concussion example, if the current supply of paramedics available to work at athletic events is overestimated, this policy could result in a shortage of staff that harms emergency medical services.

- **Unexpected incentives, for both individuals and firms**
  Most policies try to affect behavior, often by changing the incentives. These incentives can be at the person level, or at the level of a business or organization. A tax on cigarettes is an attempt to make smoking expensive so that smokers quit. But not thinking through these incentives, especially the less obvious ones, can be disastrous. In the concussion example, what if the policy creates incentives for players or coaches to underreport concussions? The problem may actually get worse.

- **Implementation problems**
  This might sound obvious, but implementing a policy or regulation is often the hardest part. A policy should be written with this implementation phase in mind. If the logging permit only allows for an in-person cash payment, logging operations will grind to a halt as property owners clog up the DEM offices.

- **System issues**
  This is related to implementation, but takes a broader view. Policies aren’t created in a vacuum, but rely on larger systems. If the system that trains paramedics to administer concussion protocols is inadequate, then mandating their presence on the sidelines won’t do much good.

Thinking About How Benefits and Costs Are Distributed

The advantage of outlining all the stakeholders is that the various benefits and costs can be considered by how they fall on each group differently.

For example, a policy might have the goal of helping all car owners. You identified owners of SUVs and owners of sedans as two different stakeholder groups. If the costs fall mostly on sedan owners, while the benefits accrue mostly to SUV owners, this should be noted in the analysis.

While not all policy changes must impact everyone equally, it’s still important to be clear about how cost and benefits are distributed to each stakeholder group. If a policy is burdensome to a group, especially a group that is often protected by law (examples include those in poverty or small business owners), it should be reconsidered.
The Difference between Transfers and Benefits/Costs

Transfer payments are monetary payments from one group to another that do not affect total resources in Rhode Island. Transfer payments do not count toward net costs or benefits as the resources on each side have not changed. However, the effects of transfer payments can generate real costs or benefits. For example, in the logging example noted below, the $5 permit fee is counted as a transfer from applicants to DEM. However, the permitting program may still yield societal benefits in the form of health and safety benefits, and costs in the form of time and travel expenses needed to obtain the license.

Transfer payments are not counted with the benefits and costs of a regulation, but they should be listed in a separate section as a way to examine the distributional and equity effects of the regulation. Transfer payments often appear to be costs or benefits at an individual stakeholder level. However, when considering all of the stakeholders in Rhode Island as a whole, transfer payments sum to zero. Consider the following examples of transfers:

<table>
<thead>
<tr>
<th>Transfer Nets to Zero</th>
<th>Cost to ____</th>
<th>Benefit to ____</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee to agency for service provided</td>
<td>Fee-payer/consumer</td>
<td>Government agency</td>
</tr>
<tr>
<td>Payment by RI government for private services</td>
<td>Government agency</td>
<td>Service provider</td>
</tr>
<tr>
<td>Transfer of resources between firms</td>
<td>Some firms increase their sales</td>
<td>Some firms decrease their sales</td>
</tr>
<tr>
<td>Transfer of resources between consumers</td>
<td>Some individuals consume less or face higher prices</td>
<td>Some individuals consume more or face lower prices</td>
</tr>
</tbody>
</table>

**Hypothetical A: Logging Permits**

**Are there any transfers?**

The $5 permit fee is a transfer from applicants to DEM. While this transfer should not be ignored, the benefits and costs will sum to zero in the analysis, and the transaction should be noted in the transfer section. However, the costs of time and travel needed to complete the permit application are counted as costs, since they have an effect on overall Rhode Island resources.
Quantifying, Estimating, and Monetizing Benefits, Costs, and Transfers

Quantifying benefits and costs is a vital part of benefit-cost analysis—it’s what allows you to directly compare alternatives and weigh the benefits and costs against each other.

You should make every effort to quantify each societal cost and benefit by estimating the price and quantity of a benefit/cost by combining a range of information from multiple sources, including:

- information revealed in the marketplace;
- data collected by government agencies;
- surveys/consultation with stakeholders; and,
- academic, technical, or professional literatures.

The following data are examples that can be used to calculate the amount of a cost or benefit:

<table>
<thead>
<tr>
<th>Type of Information</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information revealed in the marketplace</td>
<td>The price of a good or service; the amount of consumed; wages of affected employees</td>
</tr>
<tr>
<td>Data collected from government agencies</td>
<td>The number of people affected; values of certain affected assets</td>
</tr>
<tr>
<td>Time necessary to complete a task</td>
<td>The time/effort needed to process an application, conduct an inspection, or comply with a regulation</td>
</tr>
<tr>
<td>Frequency of an action, cost, or benefit</td>
<td>Yearly, weekly, daily; sporadically, or constantly</td>
</tr>
<tr>
<td>Estimated number of stakeholders effected</td>
<td>Number of firms affected, individuals, etc.</td>
</tr>
</tbody>
</table>

**Hypothetical B: Youth Sports Concussions**

**How can you quantify costs?**

One cost you choose to quantify is how much school districts will spend on paramedic services each year.

<table>
<thead>
<tr>
<th>Type of Cost</th>
<th>Location of Information</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of paying a paramedic</td>
<td>Hourly wage/labor cost of employees used</td>
<td>$25 per hour</td>
</tr>
<tr>
<td>Number of athletic games in Rhode Island in one year</td>
<td>Estimates from school data</td>
<td>1,760 games</td>
</tr>
<tr>
<td>Average length of a youth athletic event</td>
<td>Estimates provided by youth sports leagues</td>
<td>3 hours per game</td>
</tr>
</tbody>
</table>

$25 per hour x 1,760 games x 3 hours per game = $132,000 per year

**IMPORTANT TIP**

When constructing an estimate for a benefit or a cost, it is vital to list the sources of the data used and any assumptions made that contribute to an estimate.
Formal Quantification Methods

There are numerous formal methods, introduced below, that can be used to quantifying and monetizing benefit and costs. These methods rely on the principle of opportunity cost to measure the change caused by the new regulation under review.

Specifically, these methods utilize the concepts of “willingness to pay” and “willingness to accept” to estimate the value that consumers place on a specific benefit (or cost).

- **Willingness to pay** measures the amount a person is willing to pay to receive a benefit or avoid a cost. For example, it is the amount of money a person is willing to pay a noisy neighbor to turn down a loud stereo.

- **Willingness to accept** is a similar concept—it measures the level of compensation a person requires to give up a benefit or receive a cost. For example, it is the amount of money a person is willing to accept from their noisy neighbor to allow that neighbor to play loud music.

We can use estimation methods—such as the *revealed preference method*, the *stated preference method*, or *equivalent analysis*—to arrive at a good approximation of the benefit or cost.

**Revealed Preference Method**

The preferred method for monetizing benefits and costs relies on revealed preferences. A *revealed preference method* uses market decisions—transactions that have actually occurred—to demonstrate the monetary value that should be used to generate an estimate for a cost or benefit. This method is preferred because it accurately shows what a person is actually willing to pay for a benefit/cost.

### Hypothetical A: Logging Permits

**Using the revealed preference method**

The normative goal of the logging permits is to ensure the safety of those doing the logging. How can you quantify a concept like safety?

Suppose you find an industry report that says a full set of protective gear (hard hat, boots, eye protection, hearing protection, and gloves) reduces the number of accidents by 25%. If the market price of a full set of gear is $3,000, a person is willing to pay that amount to increase safety by 25%. If you assume the relationship is one to one, a person will spend $120 to increase safety by 1%.

If the permits are estimated to decrease the number of accidents by 15%, and there are on average 500 logging operations a year in Rhode Island, the revealed monetized benefit is $60,000 per year.

To use market data, the price revealed in the market must not be subject to market failures: the market should be competitive, it should not have asymmetric information problems, and it should not have positive or negative externalities (see Appendix A for a discussion of these terms).

**Stated Preference Method (Contingent Valuation)**

The value of a benefit or a cost is not always revealed in a market transaction. Additionally, the price revealed in the market may not reflect the true value to society (this is also known as the *shadow price*). *Stated preference methods* use surveys of affected groups to identify the **willingness to pay** that can be used in an estimate.
This method relies on a sample of selected stakeholders accurately stating their preferences through a well-constructed survey. This pricing information can then be used to generate an estimate of the benefit or cost. This method should be used carefully, as there are often significant differences between people’s stated preference versus their actual preference. Additionally, a poor quality survey can easily skew stated preferences.

### Hypothetical B: Youth Sports Concussions

**Using the stated preference method**

A survey of parents is conducted where the questioned is asked “How much would you pay to have your son or daughter avoid a concussion playing sports?” Note that parents are likely to give an overly high estimate of the value of their children’s’ well-being.

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**Health and Safety**

The hardest benefits and costs to quantify usually occur in the realm of human health and safety. One approach is to look at the value of a statistical life.

**Rhode Island uses $9.1 million as the value of a statistical life.** If a policy saves lives, the benefit can be calculated as the number of lives saved times the $9.1 million.

In addition, looking at future earnings can monetize health and safety measures. If a policy will add so many years to a life, the earnings from those additional years can be counted as a benefit (and the loss of years being able to earn can be counted as a cost).

### Hypothetical B: Youth Sports Concussions

**Monetizing health and safety**

You find a study that says traumatic brain injuries (TBIs) are likely to reduce life expectancy by four years. While not all concussions are a TBI, data indicates that an average of seven TBIs occur each year in Rhode Island. The per capita income in Rhode Island is $30,469. If the regulation prevents one TBI in a given year, the benefit for the given year is $121,876.

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**Estimation, Quantification and Research**

While it may not be possible to conduct detailed, formal studies on the benefits and costs associated with the regulation change under analysis, it is possible to create reasonable estimates with data that is available.

Prior research conducted by federal agencies, state agencies, or academic and professional publications may offer data or techniques that can be relevant to the analysis. Other Rhode Island agencies, local academics and organizations, and stakeholder groups may be able to contribute data and suggestions that can help with the estimation of benefits and costs as well. If you’re fortunate, you might be able to find a benefit-cost analysis conducted by another state or organization that applies to your policy.

Before you utilize the benefits quantified in that report, be sure to state the assumptions made in that analysis, and any differences between the policy environments in Rhode Island and the source analysis.
Creating a Schedule of Benefits and Costs

After identifying and quantifying the costs, benefits, and transfers that are part of a regulatory change, it is useful to place these benefits and costs on a timeline. This timeline should cover the entire timeframe established in the scope of analysis, and should include all of the initial, recurring, and termination benefits and costs. Unquantified benefits and costs should be listed to ensure that all of the benefits and costs are captured on the schedule.

This schedule will make it easy to see the various benefits and costs that occur over the timeframe of the analysis. It will also make it possible to later adjust future benefits and costs in ways that makes them directly comparable with present benefits and costs.

Assuming 150 permits per year, a schedule of benefits, costs, and transfers could look like the following:

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
<th>Benefit Schedule</th>
<th>Cost Schedule</th>
<th>Transfer Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 0</td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
<tr>
<td>DEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loggers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased safety</td>
<td>$60,000</td>
<td>$60,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Individuals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial implementation/training costs</td>
<td>-$11,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost licensing revenue</td>
<td>-$3,900</td>
<td>-$3,900</td>
<td>-$3,900</td>
</tr>
<tr>
<td>Loggers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time &amp; travel for permit application</td>
<td>-$1,500</td>
<td>-$1,500</td>
<td>-$1,500</td>
</tr>
<tr>
<td>Individuals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Benefit</td>
<td>-$11,000</td>
<td>$54,600</td>
<td>$54,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary for one new employee</td>
<td>-$43,000</td>
<td>-$43,000</td>
<td>-$43,000</td>
</tr>
<tr>
<td>Permit fees collected</td>
<td>$750</td>
<td>$750</td>
<td>$750</td>
</tr>
<tr>
<td>Loggers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permit fees paid</td>
<td>-$750</td>
<td>-$750</td>
<td>-$750</td>
</tr>
<tr>
<td>Individuals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary to new DEM employee</td>
<td>$43,000</td>
<td>$43,000</td>
<td>$43,000</td>
</tr>
</tbody>
</table>

This combined schedule of benefits and costs provides a useful summary of the various effects of a regulatory change over time. Be sure to include any supporting calculations and estimates that were used to generate the data used on the schedule.
Discounting and the Time Value of Money

Not all of the benefits and costs of a regulatory change occur at the same point in time. For example, a regulatory change may incur most of its costs in the present, with the benefits occurring years later. However, we cannot simply add together these benefits and costs that occur at different times; rather, we must take into account the time value of money.

The time value of money suggests that benefits or costs that occur sooner are generally more valuable than those that occur later. A dollar is worth more today than it will be tomorrow, due to the things it can purchase today or its ability to earn interest.

Discounting is the process of adjusting future benefits and costs by a discount factor, giving the present value of those benefits and costs. The formula for discounting a future amount to its present value is:

\[ PV = \frac{FV}{(1 + r)^n} \]

...where \( PV \) is the future value amount, \( r \) is the discount rate, and \( n \) is the number of time periods (typically years) the benefit or cost is in the future.

The Discount Rate is the interest rate used in the discounting formula. It generally represents an estimate of the opportunity cost of pursuing one project over no action. Policy analysts typically use two interest rates when conducting analyses: 7% and 3%.

- The estimated rate of return for private capital in the United States, which represents the opportunity cost of capital (including real estate, small business, and corporate capital), can generally be estimated at 7%.
- Alternatively, the discount rate used for social costs—often called the social rate of time preference—is estimated at 3%.

When conducting an analysis, adjust the benefits and costs with both the 7% and 3% rates to demonstrate the range of the effect of discounting. This switch can easily be done in Microsoft Excel or similar spreadsheet programs.

For example, to calculate the present value of a cost of $100 that is four years into the future using a 7% discount rate, we can find that the present value is:

\[ PV = \frac{100}{(1.07)^4} = 76.29 \]

The same $100 cost that is four years into the future, adjusted using the 3% discount rate, gives a present value of:

\[ PV = \frac{100}{(1.03)^4} = 88.85 \]

By adjusting all future costs to a common present value, we are able to put all of the benefits and costs throughout time on a level playing field. This allows us to directly compare these future benefits and costs in the present day by summing the present values of these benefits and costs into a net present value.
Use discounting to adjust the values on the schedule of benefits and costs. The analysis should present the un-discounted schedule, as well as the schedule with each of the discount rates applied.

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net present value</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Benefit</strong> (undiscounted)</td>
<td></td>
<td>-$11,000</td>
<td>$54,600</td>
<td>$54,600</td>
<td>$54,600</td>
<td>$54,600</td>
</tr>
<tr>
<td><strong>Present Value</strong> (3% discount rate)</td>
<td></td>
<td>-$11,000</td>
<td>$53,010</td>
<td>$51,466</td>
<td>$49,967</td>
<td>$48,511</td>
</tr>
<tr>
<td><strong>Present Value</strong> (7% discount rate)</td>
<td></td>
<td>-$11,000</td>
<td>$51,028</td>
<td>$47,690</td>
<td>$44,570</td>
<td>$41,654</td>
</tr>
</tbody>
</table>

Using a 3% discount rate, the net present value of this policy is $191,954 over a four year timeline, while at a 7% discount rate the net present value is $173,942.

Generally, a positive net present value means the policy has more benefits than costs, and a negative net present value means the policy has more costs than benefits.

Risk and Sensitivity Analysis: Dealing with Uncertainty

Some of the estimates in an analysis may include uncertainty. To test the effect of this uncertainty on an analysis, it is appropriate to conduct sensitivity analyses. It is important to provide not only the best primary estimate for each benefit or cost, but to also make note of the full range of possible values.

A sensitivity analysis will make note of the most likely estimate, as well as optimistic and pessimistic estimates.

Consider a sensitivity analysis of an earlier example:

<table>
<thead>
<tr>
<th>Hypothetical B: Youth Sports Concussions</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity analysis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of Cost</strong></td>
<td><strong>Location of Information</strong></td>
<td><strong>Initial Estimate</strong></td>
<td><strong>Best Case</strong></td>
<td><strong>Worst Case</strong></td>
<td></td>
</tr>
<tr>
<td>Cost of paying a paramedic</td>
<td>Hourly wage/labor cost of employees used</td>
<td>$25 per hour</td>
<td>$20 per hour</td>
<td>$38 per hour</td>
<td></td>
</tr>
<tr>
<td>Number of athletic games in Rhode Island in one year</td>
<td>Estimates from school data</td>
<td>1,760 games</td>
<td>1,520 games</td>
<td>1,980 games</td>
<td></td>
</tr>
<tr>
<td>Average length of a youth athletic event</td>
<td>Estimates provided by youth sports leagues</td>
<td>3 hours per game</td>
<td>2.5 hours per game</td>
<td>3.5 hours per game</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$132,000</td>
<td>$76,000</td>
<td>$263,340</td>
<td></td>
</tr>
</tbody>
</table>

This analysis should be used on each cost and benefit that has uncertainty. Then input the best case and worst case estimates into your benefit-cost model to calculate the entire range of possible net present values.
Developing Alternatives

Benefit-cost analysis is useful not only as a regulation is being finalized, but at the beginning of a regulatory process. It helps assess different policy alternatives that much accomplish the same overall goal. The policy where the benefits most exceed the cost (highest net present value) is usually the best alternative. There are some quick questions you can ask yourself when developing policy alternatives:

<table>
<thead>
<tr>
<th>Type of Alternative</th>
<th>Key Questions to Identify Alternatives</th>
</tr>
</thead>
</table>
| Alternative established by statute | • What options, choices, or flexibility does the statute give the agency?  
• What discretion is the agency using when constructing the rule change? |
| Different degrees of stringency | • Can the agency consider a more stringent standard? Less stringent?  
• How does stringency effect the size and distribution of benefits and costs? |
| Different compliance dates | • Can compliance dates be altered?  
• Are there differences caused by choosing immediate compliance vs. delayed compliance?  
• What about different compliance dates for different groups? |
| Different enforcement methods | • What tools or methods can be used to enforce the rule?  
• Are there substantial differences between active or passive enforcement mechanisms?  
• Are there difference between constant and sporadic monitoring? |
| Varying requirements by firm size | • How does the rule affect firms of different sizes?  
• Does it affect small businesses differently than large businesses?  
• Are there ways a rule can be designed to treat different firms in different ways? |
| Varying requirements by geographic region | • How does the rule change affect different regions (e.g. rural vs. urban; coastal vs. inland)?  
• Will it affect different towns or neighborhoods in different ways?  
• Are there ways to construct the regulation to consider these differences? |
| Market-oriented tools vs. direct controls | • What market-oriented tools can be used—such as taxes, subsidies, tradable permits—can be used to meet the regulatory goal?  
• How can performance standards be used instead of design standards?  
• What direct controls can be used? |
| Informational measures vs. regulation | • What information could be gathered, reported, or revealed by stakeholders that can encourage better decision-making? |

Specific Alternatives to Consider

At the very least, the analysis should compare a less stringent and a more stringent alternative to demonstrate the effect that stringency has on the overall societal benefits and costs of regulation. The analysis should also consider these alternative regulatory approaches: economic incentives, information disclosure requirements, and performance standards.
Economic Incentives
Economic incentive policy tools can often be used instead of command-and-control regulations. Command-and-control regulations are direct regulatory tools that command a specific action and control this action through enforcement. These regulatory solutions are often obvious approaches to meet the policy goal, but they can be expensive and lead to inefficiency or unintended consequences.

Economic incentive techniques are able to meet the same regulatory goals by manipulating markets and decision-making through taxes, subsidies, marketable permits, and shifted legal liability. Taxes and subsidies alter the prices of goods and services, affecting the quantity of goods and services consumed by the market. Marketable permits and shifted legal liability are economic policy tools that can be used to internalize an externality and encourage affected businesses to alter behavior in an efficient manner.

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using economic incentives to improve safety</strong></td>
</tr>
<tr>
<td>DEM decides to create a regulation making property owners liable for any costs resulting from logging accidents on their property. Without mandating any kind of permit or safety regulation, DEM has created an incentive for owners to take their own safety precautions to reduce the risk of being liable.</td>
</tr>
</tbody>
</table>

Information Disclosure Requirements
A regulatory goal may be achievable by fixing the amount of information revealed in the marketplace instead of directly intervening in the market. One primary cause of market failure is incomplete or asymmetric information: parties involved in a market transaction do not have sufficient information, or one party has more information than the other party. While command-and-control regulations are often an appealing way to deal with these types of market failures, information disclosure requirements can be used to require parties on either side of a transaction to reveal specific information that will help market participants make well-informed, efficient choices.

<table>
<thead>
<tr>
<th>Hypothetical B: Youth Sports Concussions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using information disclosure to improve safety</strong></td>
</tr>
<tr>
<td>While the dangers of concussions are becoming more widely known, some parents are still not informed. Instead of mandating paramedics, RIDE decides to require schools to send home a form to be signed by parents outlining the risk of concussions in youth sports. If the most at-risk athletes choose to forgo certain sports as a result of this information, the concussion rate would fall.</td>
</tr>
</tbody>
</table>

Performance Standards
Performance standards set a specific end goal for the regulation and give stakeholders the flexibility to identify their own means of reaching that standard. These are markedly different from design standards, which specify the system parameters through which a stakeholder must meet a regulatory goal. Performance standards are often more socially efficient and allow a regulated entity the freedom to decide how to meet the standard.

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using performance standards to improve safety</strong></td>
</tr>
<tr>
<td>Instead of requiring all property owners to apply for a permit, DEM decides to create performance standards for logging companies themselves. Logging companies that incur more than ten safety violations in a year will be required to have consumers of their services sign a form disclosing their safety record. Logging companies will have an incentive to reduce their violations below this standard.</td>
</tr>
</tbody>
</table>
Comparing Alternatives

Comparing Net Present Values
If net present values are calculated for each alternative, the best method is to choose the alternative with the highest net present value. This choice is complicated if some alternatives impose radically differing burdens on certain groups, or if there are questions of political or legal feasibility. As a whole, comparing net present value is the most analytical rigorous method to choose a policy alternative. For example, the logging permit options comes out on top in the following analysis:

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
<th>Present Value (3% discount rate, four years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging permits</td>
<td>$191,954</td>
</tr>
<tr>
<td>Fines for safety violations</td>
<td>$57,282</td>
</tr>
<tr>
<td>Regulations requiring safety gear</td>
<td>$20,938</td>
</tr>
<tr>
<td>Mandatory disclosure of poor safety records</td>
<td>-$1,204</td>
</tr>
</tbody>
</table>

Benefit/Cost Ratios
Another method to compare benefits and costs is through a benefit-cost ratio. This is calculated by discounting the benefits and costs separately, to create a present value for each. Then divide the discounted benefit present value by the discounted cost present value. If the ratio is greater than one, there are more benefits than costs.

How is this useful if we already have a net present value? A benefit-cost ratio can be used when there are limited resources. The alternative with the highest net present value may have very high benefits, but also very high costs – costs which are greater than the available resources. A benefit-cost ratio will tell you how many benefits the state will receive for every dollar invested. For example, the benefit-cost ratio for the logging example is 7.18, which means that for every $1 in costs, $7.18 in benefits is returned. If costs are constrained, the alternative with the highest rate of return, rather than the highest net present value, can be chosen.

Cost-Effectiveness Analysis
There is another option if all benefits and costs can’t be quantified. Often, it’s the case where costs can be quantified, but not benefits. In that case, a cost-effectiveness ratio can be calculated. This ratio divides the cost by an expected benefit. This benefit, rather than in monetary terms, can be in other units. The lowest cost-effectiveness ratio indicates the alternative that produces the desired option most cheaply.

<table>
<thead>
<tr>
<th>Hypothetical A: Logging Permits</th>
<th>Cost-effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logging permits</td>
<td>$414 per accident prevented</td>
</tr>
<tr>
<td>Fines for safety violations</td>
<td>$879 per accident prevented</td>
</tr>
<tr>
<td>Regulations requiring safety gear</td>
<td>$2,831 per accident prevented</td>
</tr>
<tr>
<td>Mandatory disclosure of poor safety record</td>
<td>$450 per accident prevented</td>
</tr>
</tbody>
</table>
Appendix A

Producing meaningful and useful benefit-cost analysis requires you to think like an economist for a short time. Even the most seemingly benign regulation can have profound, unexpected impacts on supply and demand. Since the Rhode Island economy is sensitive to the actions undertaken by state agencies, it’s up to regulators to identify and weigh the possible negative and positive outcomes.

The Theory of Demand

The theory of demand describes the amount of a good or service a consumer is capable and inclined to buy for a particular transaction. This is a combination of consumer’s willingness to pay and ability to pay. In basically any typical circumstance a regulator may influence, the relationship between the price of a good and demand is inverse. That is, the more something costs, the less of it consumers will purchase.

This is because as consumers attempt to maximize utility, receiving less for more makes consumers worse off.

For example, given the option to spend $5 for one good or $5 for two of the exact same good, most rational people would choose the latter. This is what is referred to as quantity demanded. Quantity demanded is different from demand (although it is a part of it) in that it describes the amount of a good a consumer is willing and able to pay for at a specific price.

The y-axis represents the cost of a good or service. A higher point on the y-axis represents a higher price. The x-axis represents the number of goods or services purchased by a consumer. A point further to the right on the x-axis represents a higher quantity of goods sold. The red line (the demand curve) is high on its left side and low on its right side.

This, as mentioned previously, is merely a representation of how consumers buy more when the price is low and buy less when the price is high.
The Theory of Supply

The *theory of supply* describes the amount of a good or service a producer is capable and inclined to sell for a particular transaction.

Typically, the relationship between the price of a good and supply is positive; the more something costs, the more of it producers will sell. The amount of goods or services provided at a specific price is what is referred to as quantity supplied.

Quantity supplied is distinct from the supply curve in the same way that quantity demanded is distinct from the demand curve. As prices rise, quantity supplied increases, as prices fall, quantity supplied decreases.

The way in which buyers and sellers reconcile their opposing preferences (upwardly sloping supply curves and downwardly sloping demand curves) is what is referred to as a *supply and demand equilibrium*. Simply overlaying the two curves illustrates the relationship between the two.

When the supply curve intersects the demand curve, this represents an agreement between buyers and sellers on how much product to buy/sell and at what price.

This is known as the *market equilibrium* (that small dot in the center of the graph).

In addition to market equilibrium, another interesting result we can observe from this model is *consumer and producer surplus*. Consumer surplus can be thought of as the total benefit received by consumers who are willing to pay a higher price than what is set by the equilibrium.

To relate to this, imagine you are willing to pay $100 for a good. When you arrive at the store you find the good in question is only $80. Your consumer surplus would be found in the $20 you have left over.
Producer surplus is similar except it refers to an equilibrium selling price being higher than a producer was willing to sell for. A market that has achieved equilibrium also maximizes consumer and producer surplus and is said to be efficient. Consumer and producer surplus is different than the more general definition of “surplus” which refers to an amount of excess product.

The supply and demand graph represents this outcome visually with shaded areas. Producer surplus can be seen with the triangle-shaped area above the supply curve and below the price. Consumer surplus can be seen with the triangle-shaped area below the demand curve and above the price.

Essentially, by observing how consumer and producer surpluses change, you can begin to have a causal understanding changing social benefits and costs.

When considering supply and demand, it’s important to remember that these curves are not necessarily fixed. While changes in price are demonstrated by movement along a curve (for example, an increase in price going up the supply curve while going down the demand curve), there are also a number of things that can shift the entire curves up or down.

**IMPORTANT NOTE**

For a market to achieve efficient equilibrium, it must be competitive. Competitive markets have four conditions:

- Many buyers and sellers, so no one person can set the price
- Goods that are similar (so a consumer actually has a choice)
- Buyers and sellers have the same information about the good or service
- Low barriers to entry and exit, so new sellers can choose to enter and leave a market and competition is maintained
Forces That Shift Demand

- **Changes in consumer tastes and preferences**
  - Should the good become more popular, the demand curve shifts up
  - Should the good become less popular, the demand curve shifts down

- **Prices of related goods and services**
  - If goods that can replace the good become more expensive, the demand curve shifts up
  - If goods that are used in conjunction with the good become cheaper, the demand curve shifts up
  - If goods that can replace the good become cheaper, the demand curve shifts down
  - If goods that are used in conjunction with the good become more expensive, the demand curve shifts down

- **Consumer income**
  - If consumer income rises, the demand curve shifts up
  - If consumer income falls, the demand curve shifts down

- **Consumer expectations**
  - If consumers expect the price of the good to rise, the demand curve shifts up
  - If consumers expect the price of the good to fall, the demand curve shifts down

- **Number of consumers**
  - If the number of consumers attempting to buy the good rises, the demand curve shifts up
  - If the number of consumers attempting to buy the good falls, the demand curve shifts down

Forces That Shift Supply

- **Prices of inputs** (Inputs: resources and materials firms need to produce a good or service)
  - If the price of inputs increases, the supply curve shifts up
  - If the price of inputs decreases, the supply curve shifts down

- **Number of producers**
  - If the number of producers decreases, the supply curve shifts up
  - If the number of producers increases, the supply curve shifts down

- **Prices of alternative goods and services**
  - If the price for an alternative good (one that a firm is selling other than the original good) decreases, the supply curve shifts up
  - If the price for an alternative good increases, the supply curve shifts down

- **Development of technology**
  - If technology becomes less efficient, the supply curve shifts up
  - If technology becomes more efficient, the supply curve shifts down

- **Producer expectations**
  - If the producer expects prices to fall, the supply curve shifts up
  - If the producer expects prices to rise, the supply curve shifts down
Example 1: Removing Logging Permits

Going back to our logging permit example, what if DEM already has logging permits in place, and decides to remove the regulation? This would lower costs for producers of timber. It would also lower what are called barriers to entry, which are regulatory or financial burdens that make it hard for new producers to enter the market.

Overall, the lowering of costs and barriers to producers would increase the supply of timber. As the graph shows, the supply curve moves right to indicate this greater supply. The equilibrium price falls, the quantity of goods increases, and the amount of consumer and producer surplus changes.

Example 2: Making Timber More Expensive

What if DEM reinstates logging permits, making logging more expensive? If logging is more expensive, then timber is more expensive. As we’ll see later, if one good becomes more expensive relative to other goods that can substitute for the initial good, the demand for those substitutes will rise.

So in this example, as wood flooring becomes expensive, the demand for tile flooring would increase (as shown by the demand curve moving to the right). This higher demand creates a higher price, a higher quantity of goods, and changes the amount of surplus for producers and consumers.
Elasticity

Since we already have an understanding of how policies can affect the Rhode Island economy, the question remains: to what extent? Elasticity describes sensitivity to changes in a market. While elasticity can be applied to a number of economic factors, for Rhode Island we really only need to focus on two types to start with.

- Price Elasticity of Demand
- Cross-price Elasticity of Demand

With these types of elasticity we can begin to measure whether the economic impact of a regulation (which is identified in the long-run by using factors that shift supply and demand) is significant or negligible. This is important because were a regulation to affect the price of a good that is not sensitive to changes in price, the economic impact will be better understood as potentially minimal, or alternatively, significant if the good is sensitive to changes in price.

If the supply or demand for a good or service is not sensitive to changes in price, the supply or demand is considered to be inelastic. If the supply or demand for a good or service is in fact sensitive to changes in price, the supply or demand is considered to be elastic.

**Price Elasticity of Demand**

Otherwise known as elasticity of demand, this elasticity measures the sensitivity of demand for a good or service to a change in price. Keeping in mind the law of demand (that as price increases, quantity demanded tends to decline), elasticity of demand measures by how much demand changes given changes in price. This is measured as follows:

- **Given a 1% increase** in the price of a good or service, price elasticity of demand is...
  - elastic if demand for the good or service falls by more than 1%
  - unit elastic if demand for the good or service falls by exactly 1%
  - inelastic if demand for the good or service falls by less than 1%

- **Given a 1% decrease** in the price of a good or service, price elasticity of demand is...
  - elastic if demand for the good or service rises by more than 1%
  - unit elastic if demand for the good or service rises by exactly 1%
  - inelastic if demand for the good or service rises by less than 1%

The reason why the quantity demanded may not change significantly given a change in price is primarily due to the nature of the good or service. Products that consumers need, regardless of price, tend to have inelastic demand. Conversely, products that are luxuries or conveniences tend to have more elastic demand. A good way to conceptualize this principle is by remembering examples of elastic and inelastic goods. Typically, a product with elastic demand should be scrutinized very closely if a regulation threatens to affect its price.

Thinking about our previous examples, the demand for paramedic services is probably inelastic. No matter the price, a municipality will need a certain number of paramedics to treat patients in that community. However, the demand for handcrafted wood tables is probably elastic. As the price rises, demand will fall faster because this item is a luxury good that people can do without.
Cross-price Elasticity of Demand
This elasticity is useful in evaluating how a change in the price of a particular good or service affects other goods and services. When beginning to think about this elasticity, consider the relationships between things like paintbrushes and paint, coffee and tea, printers and printer paper. These things are intuitively related; however, the degree to which they are related is the subject of cross-price elasticity.

Complements and Substitutes
There are two different ways in which goods and services can be related. Complements are products that are desired by consumers in tandem. When the demand for one rises, the demand for the other tends to rise as well. Substitutes are, as the name indicates, goods or services that can be used to replace each other. When the demand for one rises, the demand for the other tends to fall. Cross-price elasticity can be used to determine if goods or services fit into these categories. In addition, cross-price elasticity can also be used to determine if goods and services are unrelated; that is, a change in demand for one has nothing to do with a change in demand for the other.

The factor that influences these changing demands is price. Going back to the above examples, a decrease in the price of paint would increase demand for paintbrushes: they are complementary goods. A decrease in the price of coffee, however, would decrease the demand for tea: they are substitute goods.

Cross-price elasticity of demand is measured as follows:

- Given a 1% increase in the price of good or service “A,” this means that good or service “B” is...
  - a complement if its cross-price elasticity of demand is negative
  - a substitute if its cross-price elasticity of demand is positive
  - an unrelated good or service if its cross-price elasticity of demand is 0

- Given a 1% decrease in the price of good or service “A,” this means that good or service “B” is...
  - a complement if its cross-price elasticity of demand is positive
  - a substitute if its cross-price elasticity of demand is negative
  - an unrelated good or service if its cross-price elasticity of demand is 0
Market Failures

One of the most relevant aspects of economics to policy is the idea of market failures. As seen earlier, efficient markets are able to set an equilibrium price that maximizes both consumer and producer surplus. This efficient market represent the best allocation of resources in that market. Markets, however, can fail. If a market failure exists, there is a strong argument for governmental intervention.

Public Goods and Common Goods

Technically, a public good is something that is both non-excludable and non-rivalrous. If something is non-excludable, it’s impossible to prevent people from using that good. Non-rivalrous means that one person’s consumption does not affect the ability of someone else to use that good.

A good example of a public good is a streetlight. Anyone on a street will benefit from a streetlight, and everyone will benefit equally, no matter how many people are on that street. Having the government provide street lighting makes sense; if buying a street light service was voluntary, some homes might forgo paying while still enjoying the benefits provided by whoever did buy that streetlight.

A common good is also non-excludable but it is rivalrous. This means that everyone can use a good, but one person’s use will leave less of that good for the next person. A classic example is fish stocks. There is no way to prevent someone from fishing, especially in a body of water like the ocean. But the more fish one boats catches, the less there will be for the next boat. This is why many governments regulate the kinds and amounts of fish that someone can catch.

Externalities

Externalities are basically any effect of a market transaction that affects someone outside that transaction. These effects can be negative or positive.

A good example of a negative externality is pollution. A town buys electricity from a local coal power plant located downwind in the valley. The power plant, however, emits a foul smell that negatively affects the quality of life for the next town down the valley.

If the negative impacts of the smell are not reflected in the price of electricity, then the effects are said to be external to the transaction – thus creating a negative externality. Negative externalities typically lead to overconsumption of the good, since the price charged does not reflected the full costs to society of consumption.

An example of a positive externality is vaccination against disease. Individuals make the decision to vaccinate themselves based upon the decrease in likelihood of contracting a specific disease. Vaccination also benefits society, however, in that it reduces the number of potential transmission points across the population.

In cases where the full societal benefit of a good is not included in individual-level demand decisions, the good is typically under-consumed (from a societal standpoint).
Information Asymmetries

An *information asymmetry* occurs when one party in a transaction knows more than the other about the true value of a good.

A classic example is the purchase of a used car. If the seller knows that the car has problems that the buyer cannot see prior to the sale, then the price of the car will be too high. Conversely, if the buyer knows that the car is actually worth more than the seller is asking then the price will be too low.

In either case, the transaction is inefficient. Most government disclosure regulations are an attempt to correct an information asymmetry.

Monopolies

A *monopoly* occurs when a market is not competitive.

As noted earlier, a competitive market must have many buyers and sellers, have goods that are relatively similar, provide both buyer and seller with equal information, and have low barriers to entry or exit. A monopoly occurs when there is only one seller.

This usually occurs because of high barriers to entry. As a seller, the cost of entering the market is too high to justify doing so. For example, why are utilities usually monopolies? Because stringing miles of telephone line or water pipes is extremely costly. It doesn’t make sense for a competing firm to enter the market because the startup costs are too high. Because monopolies can influence the price in their market, they are often regulated by government.

There is a danger that government regulation can create a monopoly. Taxes and regulation act as a barrier to entry. If the government throws up too many roadblocks, current firms will be advantaged over firms that wish to enter the market.
Appendix B: Additional Resources

US Office of Management and Budget
Circular A-4: Regulatory Analysis
https://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf
Circular A-4 FAQ
https://www.whitehouse.gov/sites/default/files/omb/assets/OMB/circulars/a004/a-4_FAQ.pdf

US Environmental Protection Agency
Guidelines for Preparing Economic Analyses

US Department of Transportation
Benefit-Cost Analyses Guidance for TIGER Grant Applicants
http://www.transportation.gov/tiger/guidance