Regulating the Consumption of Plastic Bags in the Cases of South Africa and Ireland

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A Senior Comprehensive Project in Partial Fulfillment of the Requirements for a Bachelor of Arts Degree from Allegheny College

I hereby recognize and pledge to fulfill my responsibilities as defined in the Honor Code and to maintain the integrity of both myself and the College community as a whole.

This work is mine unless otherwise cited.

Pledge

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Abstract

Within the last decade and a half, the anti-plastic movement has gained momentum in its efforts to reduce the global usage of plastic. This paper takes a case study approach to evaluate the effectiveness in using policy tools such as a tax and other forms of regulation in order to reduce consumption of plastic bags. South Africa and Ireland are the subjects of the study, as the results are evaluated while considering outside factors such as strength of the plastic industry within each country, poverty and unemployment levels. This work concludes that Ireland is more successful in getting the desired reduction in usage both in the short term as well as long term. This success is based around three main factors, the size of the existing plastics industry within the country, the strength in an advertisement campaign surrounding the new regulation, and the poverty and unemployment rates of the county. In these three factors, Ireland surpassed South Africa thus having more success with their regulation.
Introduction

Since the mid-20th century, there has been a significant push in plastics technology to a point where the familiar question, “Paper or Plastic?” is no longer heard. What seemed like such a miraculous invention has turned into the dominant option and an environmental nightmare. While plastics may solve a lot of issues for human’s daily lives, it causes many more problems when they find their way into the environment, whether on land or in waterways. In 2010 alone, an estimated 8 million tons of plastic found its way into the ocean via coastal countries. To better comprehend this figure, University of Georgia environmental engineer Jenna Jambeck compares this to 5 plastic shopping bags per foot of coastline around the world (Parker 2015).

The aim of this paper is to contribute to the understanding of what makes regulation on plastic bags work and what makes it fail. This is a crucial question if the world as a whole has a shot to cut down on the overall use of plastic that poisons the environment. The anti-plastic movement has gained speed in the last decade and a half as it has entered developed countries. Through use of different policy tools, such as taxes or bans, many areas have made an effort to reduce the consumption of plastic bags. The ultimate question is, which combination of tools and perhaps other factors breed the most success? I argue that a flat tax alone will be rather unsuccessful.

The pollution that plastics cause begins before the production process. The extraction of oil and natural gas used in the production of plastics causes greenhouse gas emissions such as carbon dioxide and hydrogen sulfur. It is estimated that 12 million barrels of oil are to produce 100 billion plastic bags, the consumption of the United States alone (Clapp and Swanston 2009). Stemming from this estimate, a calculated 120 million barrels of oil are used each year to produce the amount of bags that are consumed alone which, intuitively, is an underestimate of
the entire oil usage by the plastic bag industry worldwide. However, the damage that plastics cause do not end with their production and use of fossil fuels such as oil and natural gas. When discarded these bags enter the environment which harms animals when they mistake them for food. Plastic bags are very prone to traveling long distances due to their light weight parachute design and thus pick up chemicals and contaminates along the way that could poison waterways and wildlife. It is estimated that half of the earth’s sea turtles have ingested plastics, while around 90% of seabirds have consumed plastic debris (Feltman 2015). The ingestion of plastic causes major blockage issues within the intestines, causing failures to the digestive system resulting in death to many of these animals. In March 2011, an article in the Daily Mail reported an incident where a sea turtle was found with more than a square foot of varying colors and shapes of plastic debris in its stomach. Sea turtles favor jellyfish when looking for a meal. Plastic bags take the shape of jellyfish while floating in water. Humans may be able to tell the difference but these sea turtles cannot. Many of the plastics found were sharp which give rise to the possibility of puncturing vital organs in addition to the already present danger to the digestive system (Macrae 2011). There are dozens of pictures of turtles entangled in plastics as well. In addition, many pictures show dead seabirds with open stomachs featuring plastics including bottle lids, lighters and dozens of plastic fragments. The anti-plastic movement could not be more important since many of the world’s wildlife are threatened each day by the existence of plastics within their environment.

This paper is broken into three major sections; background, theory, and case-study analysis. Chapter 1 gives a more extensive look into the invention, usage, and pollution of plastic bags. In addition, the chapter reviews the beginning of the anti-plastic movement and its relation to norm emergence theory. Chapter 2 introduces the theory behind some of the policy tools used
in the regulation efforts of plastic bags such as the Pigouvian tax named after the famous Professor, Arthur Pigou. Chapter 3 presents the case studies of South Africa and Ireland and looks in detail into what made them successful and what held them back from success. This paper serves as an addition to the already extensive library of environmental regulation analysis.

Chapter 1: Background to the Plastic Bag

Invention of the Bag

The invention of what we know today as the plastic shopping bag started back in the 19th century. Hans von Pechmann, a German scientist, discovered some waxy residue at the bottom of his test tube in 1894 and this became the first traces of plastic (Demirors 2011). Pechmann did not understand the significance of the discovery at the time or what impact it would have on the
future. The chemical compound discovered in the test tube was almost identical to what is now called polyethylene. Polyethylene is a petroleum based product that is made up of repeating monomers that come together to make long chains which are called polymers (Polyethylene, Rochman and Browne 2013). This chemical compound comes in many forms and is the base component of what we call carrier plastic bags that are used at many supermarkets and pharmacies. Thus, plastic bags are a petroleum based product with 120 million barrels used to supply the amount of bags consumed on a yearly basis.

A Swedish company called Celloplast filed for a U.S. patent in 1960 for their first idea of a plastic bag. However, a team member at Celloplast, Gustaf Thulin Sten, had a better idea which came to be known as the T-shirt plastic bag. Celloplast obtained a U.S. patent in 1965 on the design of the new bag which is seen everywhere today (Laskow 2014). Mobil Chemical was another major manufacturer that pursued the new development with their own stream of bag patents until they were also producing bags in 1977 (Laskow 2014). These bags made their first appearance in the continental U.S. in 1979 as they were featured in the supermarket store Kroger as well as Safeway (Laskow 2014).

Usage

It has become common ground to leave the grocery store with hands full of plastic bags due to their easy accessibility and durability when carrying goods long distances. According to StatisticBrain, the average family uses 60 plastic bags per four trips to the store, which is an average of 15 bags per trip. An estimated 1 trillion single-use disposable plastic bags are being used annually worldwide, which breaks down to about 2 million each minute (StatisticBrain 2016). In the United States alone, 100 billion bags are used by consumers each year, totalling to
just above 2.7 million per day (Larson 2014). The amount of oil used to produce 14 plastic shopping bags could fuel a car for a mile (Keiren 2016). Therefore, a car could travel the circumference of the earth 2.8 million times using the same amount of oil used to produce the 1 trillion bags used annually.

**Plastic Bags’ Effect on the Environment**

Based off the statistics listed above in the Usage section, it is easily understood that all this plastic consumption must end up somewhere. Plastic bags do not biodegrade. This means that the microorganisms that break down organic materials do not recognize plastics as a food even though their base component is crude oil, a naturally occurring substance. The reason being that throughout the production process, other materials are added to give plastic different characteristics, such as its clear appearance, thus making it a non-organic product. Plastics do decompose however, but not fully. These products go through a process called photodegradation, which means that the sun breaks them down into infinitely smaller pieces so much so that they are invisible to the naked eye (Rochman and Browne 2013). However, these pieces are still in the environment. On average, it takes plastic bags around 1,000 years to decompose (StatisticBrain 2016). Thus, all single use disposable bags ever used are still in existence today.

It is stated above that 1 trillion plastic bags are consumed annually worldwide. Alongside this statistic, the percent of plastic that is consumed each year and makes its way into the ocean is 10% (StatisticBrain). “Scientists estimate that every square mile of ocean contains about 46,000 pieces of floating plastic” (Keiren, 2016). When plastic floats in the water it can be harmful to many kinds of marine life, to be exact an estimated 267 different wildlife species have been harmed by plastic debris (Keiren 2016). According to Rochman and Browne, “as plastic
breaks into smaller pieces, it is more likely to infiltrate food webs”. These micro pieces of plastic can be mistaken for many types of marine food and thus end up in the bellies of turtles, whales, and many seabirds. In general, polyethylene is considered to be a non-toxic plastic, but due to the distance these bags travel because of their parachute design they become contaminated carrying toxins wherever they go. When ingested by wildlife, it can cause more harm and when the bag ends up in the ocean it causes more pollution in waterways that will then affect the marine life. A pollutant that is commonly found in plastic waste is polychlorinated biphenyls (PCBs), which was banned in 1979 due to its impact on human and environmental health (Rochman and Brown 2013, National Oceanic and Atmospheric Administration). Seabirds that have ingested this contaminated plastic show PCB levels at “300% greater concentrations than in those that have not eaten plastic” (Rochman and Browne 2013).

PCBs and many other pesticides and organic pollutants that these bags pick up are put under the category of “priority pollutants” by the U.S. Environmental Protection Agency. When ingested these pollutants can “disrupt key physiological processes, such as cell division and immunity, causing disease” or other harmful side effects (Rochman and Browne 2013). In Rochman and Browne’s 2013 article, the authors call for plastic bags to be put on the hazardous waste list due these very reasons.

The plastic that does not end up in the environment or animals’ bellies ends up in landfills or in incineration plants, such as the kind Taiwan used to operate. These incineration plants cause the release of “priority pollutants” as well as greenhouse gases (Rochman and Browne 2013). Bags and other plastics that end up in landfills take even longer to photodegrade due to the lack of sun exposure and oxygen. When in landfills, chemicals from the plastics leak out into the surrounding habitats causing greater pollution (Rochman and Browne 2013).
From production, to consumption, and then finally to the discarding of plastic bags, pollution is a major factor. Due to their light weight and design, these bags fall victim to the wind, traveling for miles and ending up in trees, bushes, and waterways. They can clog natural waterways causing floods, can strangle wildlife through entanglement, and can poison wildlife through consumption. These bags can carry pollutants far distances, bringing harm to other habitats. With the amount of plastic pollution out there, countries, cities, and regional governments have begun taking steps to reduce future harm caused by these plastic bags.

**Anti-Plastic Movement**

According to norm emergence theory, a norm takes the pattern of North to South (Clapp and Swanston 2009). In other words, norms or movements usually start in the northern part of the globe and make their way south. Another way to look at it is that, generally speaking, the northern part of the globe contains more developed countries whereas the global south has more developing countries and thus norms or movements start in more developed nations. However, the anti-plastic bag movement worked in the opposite direction starting with countries like Bangladesh and South Africa and later appearing in European countries and the United States of America. Each country, city, or municipality to take on the movement has done so through local motivations generally associated with the damage to the environment that these bags cause.

Bangladesh banned bags in early 2002 becoming the first nation to regulate this product (Clapp and Swanston 2009). The main factor that pushed this legislation was the blame placed on the bags for extreme flooding experienced in 1998 by blocking drains, which had led to two months of persistent floodwaters (Clapp and Swanston 2009).
Bangladesh was succeeded by different states in India who passed different versions of bans on plastic bag distribution, use and discard in the early 2000s (Down to Earth 2000). Some talked about increasing thickness while others outright banned the bag all together. The capital city of Delhi has introduced a ban on all forms of disposable plastic within the last couple of years. As stated before, different countries and cities have different reasons for regulating these thin plastic bags. For India, the danger that the bags have posed to their sacred cows through ingestion forced them to take action (Clapp and Swanston 2009). The extreme littering of these bags makes them easily accessible food to the free roaming cows.

Taiwan is next on the list as their Environmental Protection Agency (EPA) introduced heavy fines for the distribution of free plastics by stores and restaurants in 2002. These fines initially ranged between $1,800 to $9,000 but were later cut to just between $35 to $180 per offense (McLaughlin 2004). Taiwan’s EPA took this course to reduce waste as a whole due to overwhelming landfills covering the island. Estimates show that the regulation as had more positive environmental effects than negative economic effects and has reduced usage of single-use plastic bags by around 69% (McLaughlin 2004).

The next country to join the movement was South Africa, a developing and impoverished nation. This nation introduced a ban and tax in late 2002. The ban was on thin plastic bags stipulating that bag thickness had to be at least 24μ. Added to this regulation was a tax of 46 Rand cents later lowered to 17 Rand cents (0.013 USD) (Hasson, Lieman and Visser 2007). Reportedly, the regulation was a result of unsightly litter due to plastic bags which harmed their tourist business alongside the damage it caused to the local wildlife. The regulation has been noted as an overall environmental success with minimal harm to the plastics industry within the country.
As the movement progresses, it emerges into the industrialized world starting with the Republic of Ireland in March of 2002. An initial tax of € 0.15 was introduced but later increased to € 0.22 per bag in 2007 (Department of Housing, Planning, Community and Local Government 2014). Clapp and Swanston state that the legislation was motivated by the litter found in coastal areas which was damaging Ireland’s “green” image. This tax has been coined “plastax” leaving Ireland as a general format of success for other countries to emulate due to an overall decrease of around 90-95% in plastic bag usage. Other European countries have also enacted bans such as Italy in 2012 and most recently France with a two stage phase-out ending in January of 2017 (Cereceda 2016). England has a tax that went into place in 2015 as well.

In 2007, San Francisco became the first city within the United States to enact a ban on single-use plastic shopping bags due to litter, damage to marine life, and greenhouse gas emissions related to the production of the bags. Not only did the city pass a ban, it also implemented a tax on most alternatives with the exception of reusable bags. Following San Francisco, California enacted a statewide ban in 2014. In 2010, the District of Columbia enacted a ban on disposable non-recyclable plastic carryout bags along with a fee on other disposable bags. Bans on these bags have also made their way to counties in Hawaii from 2011-2015 and other areas within the United States (Shultz 2016).

*Image 1: Phase-Out of Plastic Bags*
The list of countries, cities, counties, and municipalities above is not all inclusive. To give a better illustration of the breadth of the anti-plastic bag movement, Image 1 provides a detailed and up to date map of the plastic bag legislation. Green areas are places that have enacted plastic bag bans, orange/yellow areas have taxes enacted on some plastic bags while purple areas indicate partial taxes or bans on the municipal or regional level.

The anti-plastic bag movement has picked up speed in the last decade as more and more industrialized countries have enacted various regulation. There has been some push back however, there’s the ban and then there’s the ban on the ban. “A new law in Michigan will prohibit local governments from banning, regulating or imposing fees on the use of plastic bags and other containers” (Harvey 2016). Idaho, Arizona, and Missouri have enacted similar laws as Michigan. The state of Pennsylvania has two pending bills, one from the senate and two from the house, which battle for each side of the movement. House Bill 1280 would go along with the previous states listed as a prohibition of the imposition of regulation regarding plastic bags at the point of sale (Shultz and Tyrrell 2016). Senate Bill 540 and House Bill 1431 aim to impose a 2-cent fee with a stipulation that revenues would be put into programs to improve recycling,
education and compliance of the tax (Shultz and Tyrrell 2016). The main reason for resistance in the anti-plastic movement is its potential danger to manufacturing jobs and local economies.

Conclusion

What once was an innovative miracle to improve hygiene and efficiency became an environmental nightmare. Plastic bags have caused as much of a nuisance as a convenience for the average shopper. The anti-plastics movement is driven by the harmful effects that plastics have on the environment and wildlife. There has been a domino effect in the recent decades regarding environmental regulation and plastics in the next on that list.

Norm emergence generally tells us that norms are driven by international pressures and move in a North to South pattern. However, in the case of plastic bags it has been the opposite. Starting in the global south in third world countries, the movement has since made its way into more industrialized countries perhaps due to lack of recycling facilities and open dumping of waste in developing countries.

The next chapter will take a more extensive look into the theory behind the common policy tools used in environmental regulation as well as provide details in how these policies affect the markets they are applied to.
Chapter 2: Theory Behind Policy Tools

Introduction

Before looking into how to fight the harmful effects of plastic bags on the environment, we must spell out the theories that will be used in this process. Plastic bag pollution and just plastic pollution as a whole can be labeled as a negative externality. In order to fully comprehend what that means in regards to this paper, we will outline what an externality is and how it affects the market. Externalities are a huge topic starting with economists such as Alfred Marshall and Arthur Pigou.

Marshall has been recognized as the founder of neoclassical economics with his famed work *Principles of Economics* written in 1890. Pigou was a prominent neoclassical economics pioneer who specialized in welfare economics. As a successor of the great Alfred Marshall, Pigou’s greatest work is *The Welfare of Economics*, written in 1920.

Externalities exist within the general term “market failure”. Correcting for such market failure to ensure an optimal outcome within the market needs a special approach. Such an
approach includes the implementation of both taxes and regulations, however, not just any tax will work. What we know as a Pigouvian tax is the common tool used when efforts are made to fix a negative externality within a market. In order to reach a Pareto-optimal output level, some form of pollution regulation needs to take place. “The absence of pollution control policy leads both to too excessive output and pollution levels being produced by each polluter and to too many firms operating” (Burrows 1978). The following pages will focus of the theory of externality, taxes, Pigouvian taxes, and environmental regulation.

What is an externality?

Goolsbee, Levitt and Syverson (2013) formally define externalities as “a cost or benefit that affects a third party not directly involved in an economic transaction.” According to Baumol and Oates (1988), in order for something to be an externality it must satisfy two conditions; (1) “an externality is present whenever some individual’s… utility or production relationships include real… variables, whose values are chosen by others… without particular attention to the effects on [the individual’s] welfare” and (2) “the decision maker, whose activity affects others’ utility levels or enters their production functions, does not receive (pay) in compensation for this activity an amount equal in value to the resulting benefits (or costs) to others.” Bator (1958), though he never formally defines externalities, encompasses the notion in what he calls “market failures”.

In simpler words, what Baumol and Oates are trying to get at is that in order for something to be an externality, it has to be the result of a choice made by an individual or group that affects someone, either positively or negatively, without their permission or compensation.
These externalities can take the form of either a cost, or a benefit. Inefficiencies are created within the market with the introduction of these externalities by affecting the private and social costs or benefits received. Social cost is equivalent to the private cost plus the external cost while social benefit is equivalent to the private benefit plus the external benefit.

**Regulation**

Regulation has been a key tool in the fight against carbon dioxide emissions, a leading greenhouse gas emission that is in part responsible for the breakdown of the ozone layer and climate change. The theory of externalities lends a clear explanation to how excess levels of pollution are a market tendency. However, the correction for such external costs is also clear enough. Impose a system of taxes through which the external costs are internalized to be equivalent to marginal external cost or impose some other form of regulation, such as the Clean Air Act, which inherently lowers the amount of pollution to an efficient level (Oates and Portney 2003). The aim of such regulation is to protect the environment and to maximize social welfare.

Environmental Regulation stems from the exploitation of natural resources such as crude oil. Consider a plastics industry. The more crude oil used, the more output made and thus in theory, more profits are accumulated. The Theory of the Commons explains that in order to resolve the exploitation of such a situation, access to the resource must either be privatized or restricted (Hasnas 2009). A tax on the pollution caused by the use of crude oil is indirectly a restriction on its use.
The use of a tax is very common in environmental regulation, an example being the Carbon Tax, which is levied on users of fossil fuels based on content of carbon within the fuels. It is used to decrease the amount of greenhouse gases emitted which will decrease their effect on climate change. A result of such regulation is a “double-dividend” effect. This is the use of environmental tax revenue to cut down on other tax systems such as income taxes (Goulder 2000). The term double-dividend stems from both the benefit to the environment and the benefit to society that arises from such environmental regulations. It’s not always the case that the revenues are put back into cutting down other tax systems but can also be put into other funds that benefit the environment like recycling measuring or cleanup of existing litter. Thus, environmental regulation could have a more beneficial effect on society than just cutting down on negative externalities.

Theory of Negative Externality

Negative externalities can take many forms, pollution being a sizable one that many governments have taken efforts to reduce. As stated previously, negative externalities are the costs heaped onto a third party to an economic transaction who had no part in the decision that lead to the externality. For example, a plastics industry that burns fossil fuels in order to produce plastic bags. Yes, the surrounding people use the plastic bags, however, by burning these fossil fuels the company is emitting pollutants into the air that can cause health and environmental issues not agreed upon by the surrounding inhabitants.
Using a standard price and quantity graph, Figure 1 illustrates what happens when the neighboring area to the pollutant producing company is affected. The x-axis is the quantity of the good produced and the y-axis is the price of the goods produced at different levels. In this graph supply is equal to marginal social cost (MSC) where MSC=MPC+MEC, demand is equal to marginal social benefit (MSB), marginal private cost (MPC) represents the costs to the suppliers to produce goods and marginal external cost (MEC) is the per unit amount of pollution being emitted. Point A represents the socially optimal quantity of bags being produced and pollutants being emitted. At this point, the MSC is equal to the MSB. Point A is achieved if all external costs were paid by either the buyer or the seller of the polluting product. Point B represents the point that the industry actually produces at if it does not bear MEC. This occurs when the the seller pays MPC where, MPC=MSC-MEC. This drives down the price of the product to P1 and
increases the quantity to $Q_1$, at which the intersection of these two variables is the new equilibrium. The producers, at point B, ignore the external costs that occur due to the pollution caused by the burning of the fossil fuels. According to Goolsbee, Levitt and Syverson, “The pollution externality and the market inefficiency it creates arise because the… companies in the industry do not pay pollution costs.” This results in production levels exceeding the socially optimal output (Goolsbee, Levitt, Syverson p.646, 2013). The result of the creation of the negative externality is dead weight loss illustrated by the triangle between points A and B of Figure 1. This deadweight loss accounts for the total loss “from each unit for which society’s costs are greater than the consumer's' benefits” (Goolsbee, Levitt, Syverson p.647, 2013). Due to costs exceeding benefits in the electricity production, social welfare is reduced.

There have been studies by economists such as Pigou, Burrows, Baumol and Oates in which possible solutions to these negative externalities are given. Some argue for a tax on either the buyer or seller of a polluting product, some a subsidy on pollution abatement or environmentally friendly alternatives, and some both.

**Theory of Tax**

A tax is an amount of money that is demanded by the government and can be applied to income, property, and sales (Goolsbee, Levitt and Syverson p.93, 2013). In this example, we will focus on the sale aspect of tax. The graph below represents a firm that produces plastic bags. On the x-axis is the quantity of bags produced while on the y-axis is the prices that both the buyer pays and seller receives. In this case, a plastic bag is taxed at a rate equal to $P_b - P_s$, which is the tax burden. There are two ways in which this tax can be paid: (1) the buyer pays the tax, and (2) the supplier pays the tax. Who ends up paying the tax is called tax incidence.
First, we will explore option 1, the buyer pays the tax. This means that the entire burden of the tax is placed onto the buyer, they will pay the tax in addition to the price the phone is sold at. The addition of the tax will cause the demand curve to shift left from D1 to D2 causing the supplier to receive Ps and buyer to pay Pb at Q1 in Figure 2.

Second, we will explore option 2, the supplier pays the tax. Now, the tax burden is placed on the producer of the bags, causing a shift left of the supply curve from S1 to S2. The result is the same as option 1 with the supplier receiving Ps and the buyer paying Pb at Q1. This in part is due to the producer adding the tax into the price charged to the customers.

A tax, in either option, raises the equilibrium price that a buyer must pay in order to purchase good X. Who pays the tax to the government does not affect the tax burden. It does not matter whether the tax is added on to what the buyer pays,

\[ Pb = Ps + \text{Tax}, \]

or if it is subtracted from what the supplier receives,
Ps=Pb-Tax.

**Pigouvian Tax**

Arthur Cecil Pigou, born 1877, has been famed as one of the top economists to have graced the study. Much of the British economist’s life is yet unknown but over his time as a professor at Cambridge University he wrote many famed works including Wealth and Welfare (1912), The Economics of Welfare (1920) and The Theory of Unemployment (1933). Pigou full-heartedly “embraced the Marshallian theoretical framework” (Knight 2012). It is unarguable that Professor Pigou has changed the way economists view welfare economics.

Goolsbee, Levitt and Syverson (2013) define a pigouvian tax as “a tax on activity that creates a negative externality.” This tool has the sole purpose of fixing a negative externality while taking into consideration social costs and benefits, something a regular tax fails to do. Another interpretation comes from Burrows (1978) as “a fixed-rate charge per unit of effluent emission equal to the marginal damage at the Pareto optimum.” Simply put, a Pigouvian tax is set equal to the marginal external cost which, in this case, is the pollution emitted per unit of production. Pigou introduced this type of tax as a way to offset the marginal external costs incurred due to the presence of a negative externality.

*Figure 3: Pigouvian Tax*
Figure 3 illustrates the effect of a pigouvian tax upon a market that experiences a negative externality. Point B in Figure 3 coincides with point B on Figure 1 as this is a continuation of that model, just as point A is the same in both figures as well.

According to the model, in order to fix the negative externality, a tax must be levied that is equivalent to the marginal externality cost that is imposed upon the individual who did not take part in the economic transaction, which is then the optimal Pigouvian tax. Thus we have,

\[ \text{MEC} = \text{Tax} \times T \]

In order for the supply curve to shift back and achieve the equilibrium point A, this tax must be added into the marginal product cost (MPC) to give us the new marginal social cost (MSC) of,

\[ \text{MSC} = \text{MPC} + T \]

The optimal Pigouvian tax is the vertical distance between the two supply curves which is equivalent to the vertical difference between \( P^* \) and \( P_2 \).

Now that the market solution is back to the socially optimal price and quantity, the negative externality no longer exists. Thus, the deadweight loss has also vanished, creating a Pareto-efficient market solution in theory. This perfect result is not always so easily obtained in practice. Measuring external costs is difficult mainly due to having to measure the social costs
which can vary. Another issue with just using a Pigouvian tax to fix an externality is that for it will reduce the use of the good so much so that too many firms will exit the industry instead of an optimal amount.

**Conclusion**

Prominent economists such as Alfred Marshall, Arthur Pigou, Francis Bator, William Baumol and Wallace Oates are driving forces behind the notion of welfare economics. Marshall has had a major impact upon the works of Pigou, as Pigou looked to Marshall’s framework within his studies in relation to social costs and externalities. Externalities arise from economic transactions that affect a third party who did not partake in the transaction. The third party can either gain (positive externality) or lose (negative externality). When a negative externality arises it is usually due to excessive output by excess firms within an industry. In this case, the appearance of deadweight loss can be seen as output levels move away from the Pareto-optimum. The goal of pollution regulation is to move the industry back towards Pareto-efficient levels. When it comes to regulation, taxes such as the Pigouvian tax are key in decreasing the harmful effects brought about by the existence of a negative externality. A combination of taxes and other forms of regulation will need to be looked into in order for the pollution caused by the production of plastic bags to be reduced. Not only are natural resources used within the process of creating these thin film plastic bags, but these non-degradable items are ending up in the environment causing damage to the wildlife, land, and ocean.

**Chapter 3: The Case of South Africa v. Ireland**

**Introduction**
There have been different policy combinations between taxes and bans across the world that have been directed towards lowering the consumption of plastic bags due to the after-use and production externalities. Many countries such as China, Bangladesh, and cities within the United States have attempted legislation or regulation in order to curb the external costs that come with the use of plastic bags. The ideal “plastax” is one that decreases external costs while having as little effect on the economy as possible. The aim is to hit the optimal Pigouvian tax. This tax is one that is set exactly equal to the marginal external costs that a third party must endure due to an economic transaction that they were not involved in. For example, your neighbor buys a diesel truck. Not only do you suffer from the polluted air but also the possibility of waking up every morning by the thunder of the truck as they go to work. The same type of nuisance is caused by these plastic bags. They end up in our environment not only causing it to be unsightly but endangering wildlife along the way.

South Africa and the Republic of Ireland have taken steps towards decreasing the number of plastic bags that enter the consumption stream and ultimately end up in the environment. South Africa is a developing country that has high unemployment and poverty rates. South Africa enacted their legislation regarding regulation on consumption of plastic bags in 2003 just a year after the Republic of Ireland. The plastic tax has been criticized as a regressive tax that unfairly harms the poor, which can cause potential issues in South Africa. On the other hand, Ireland is a highly developed nation with relatively low unemployment and poverty rates. This analysis will compare two vastly different countries in order to pick out points of reason behind successes and failure.

**South Africa: Legislation**
In May of 2000, the Republic of South Africa put together a first draft of proposed regulations in efforts to reduce the consumption of plastic bags. These regulations initially proposed a ban on what they called carrier bags or thin film plastic bags. Thus, this draft put regulations into place that would require the thickness of these bags to be increased incrementally over the period of 18 months, ending at minimum thickness of 80μ (micrometers). The idea behind the increase to thickness is the requirement of less bags to carry the same amount of goods based on the increase in sturdiness. The impact of these regulations would be drastic to manufacturers as the thickness of these thin film plastic bags were currently around 17μ (Hasson, Leiman, and Visser 2007). Therefore, manufacturers would either be forced to purchase new machinery to produce thicker bags or close down their factory, creating major impacts upon the economy. The second draft of these proposed regulations added more types of bags within the category and distinguished among different thicknesses for bags with printing versus bags without.

A Memorandum of Agreement was signed into law in September of 2002 as compromises between the Department of Environmental Affairs (DEAT) and Organized Labor and Organized Business were hashed out. The DEAT cited plastics as a problem after a study was conducted on the waste in South Africa while Organized Labor and Organized business objected to legislation due to negative impacts on jobs, trades, and retail efficiency (Hasson, Leiman, and Visser 2007). This agreement called for minimum bag thickness of 30μ (later changed to 24μ), certain ink to plastic ratio in regards to printing, transparency on the costs of the bags, and a mandatory per bag levy. The levy, around 46 Rand cents (0.035 USD) per 24l bag, was used as a way for businesses to avoid having to absorb the additional costs of these thicker plastic bags (Hasson, Leiman, and Visser 2007).
Manufacturers reported over 500 jobs lost and dramatic reduction of sales up to 80% (Hasson, Leiman, and Visser 2007). Due to the negative economic effect, the minimum thickness requirement was decreased to 24μ and the price of the 24l plastic bags was reduced to 32c in which the public would only pay 17c per bag and the remaining was absorbed by the retailers themselves.

Figure 4: Regulation Approach: Increasing the Thickness of Plastic Bags
In Figure 4(A), the optimal equilibrium is set at the intersection of demand (D) and marginal social cost (MSC). The distance from zero to marginal external cost (MEC) on the price axis equates to the quantity of optimal Pigouvian tax which, combined with the marginal private cost (MPC), will lead the graph to the optimal equilibrium at (Q*, P*). Pre-regulation equilibrium sits at the intersection of MPC and demand, P1 represents the implicit price per bag the retailers charge buyers by adding it into the price of groceries. This is the reason plastic bags are often seen as a “free” good and perhaps why regulation of this good has such a dramatic effect.
After the 2003 legislation passed, the minimum bag thickness increased to 24μ. Thus, more plastic per bag was necessary, effectively increasing the cost of manufacturing each bag as shown in Figure 4(B) as a shift left of MPC to MPC’. These thicker bags were more durable and thus fewer bags per trip to the store were necessary, decreasing the marginal external costs associated with new bags. Thicker bags also have more potential to be recycled and reused. This decrease to MEC is illustrated in Figure 4(C). The sum of MPC and MEC equates to MSC and thus the changes to the former curves creates an overall decrease in marginal social cost shifting the graph to MSC’. These changes create a new optimal at the intersection of MSC’ and demand, as well as a new optimal Pigouvian tax between zero and MSC’ on the price axis. Thus, the regulation alone is effective in decreasing both MSC and MEC.

A levy was also introduced in 2003 as part of the regulation affecting the manufacture and distribution of plastic bags. Initially the levy was set at 46c per 24l bag, the most used volume bag. The immediate decrease in plastic bag consumption ranged from between 60-80%. Such a decrease in demand brought the market close to the optimal equilibrium. This levy essentially made explicit the cost of the bag that was implicit before the legislation. This tool along with the regulation of thickness had a clear effect on consumer behavior. Hasson, Leiman, and Visser state the initial 46c was 2c lower than what would have been an optimal Pigouvian tax.

Later on in 2003 the levy was cut to 17c per bag forcing the remaining 29c to be absorbed by the retailers. It could be the case however that the retailers add the remaining 29c in the costs of groceries thus making the total cost of the bags both explicit and implicit to buyers. This decrease in price increased the demand as well as both external and social costs. The decrease in the tax could have been due to opposition from plastic bag groups along with the general public.
Either way, the resulting decrease in consumption of plastic bags relative to pre-legislation levels ranges from 20-80% with the biggest retail chain only experiencing around a 20% decrease in the quantity of bags demanded (Hasson, Leiman, and Visser 2007).

**Republic of Ireland: Legislation**

Based off results from a survey commissioned by the Department of the Environment, Heritage and Local Government, the Republic of Ireland introduced a tax of € 0.15 (0.16 USD) per plastic shopping bag to be collected at retail outlets upon point of sale. This was later changed to € 0.22 (0.234 USD), according to Ireland’s Public Service Information, due to a rising consumption levels after the initial drop from the levy. This increase could be due to consumers adjusting to the initial tax. The initial levy, introduced in March of 2002, was more than six times the average willingness to pay according to the above mentioned survey (Convery 2007). This differs from the tax that South Africa imposed as it is not an attempt at a Pigouvian tax but a simple product tax aimed at decreasing the total consumption by a desired amount. This legislation is just an add on to Ireland’s existing litter ban, the difference being it targets consumption rather than the littering of plastic bags with the same goal to reduce the number of plastic bags ending up in the environment. Using both these tools, the thought process is to “send a strong signal to consumers in order to change behavior towards more sustainable modes of consumption” (Convery 2007). Proceeds from the levy are put into an environmental fund which is controlled and operated by the Department of the Environment, Heritage and Local Government. Specifically, its revenue is used to offset the rise in costs to administer the levy as well as support and promotion to a multitude of different environmental programs (Convery 2007).
The Republic of Ireland focused more heavily upon promotion of the levy as well as securing support from the main stakeholders who would be most affected by the imposed tax. By putting more effort into these goals, Ireland was more successful in swaying consumer behavior as a whole. These “stakeholders” were considered to be the retail stores, Ministry of Finance, local authorities, revenue commissioners and consumers (Convery 2007). Each of these entities would be in some way affected by the tax, be it consumers who would be forced to pay if they desired to use a plastic bag or local authorities who are placed in charge of enforcing the new regulation. In order to achieve some of this backing, a very strong publicity campaign was put out by the Department of the Environment, Heritage and Local Government in efforts to show the general public how extensive the negative effects that plastic bags cause in the local environment as well as to marine life (Convery 2007).

Due to Ireland’s tax being several times greater than the average willingness to pay, an overall reduction of 90-94% of bags entering the consumption stream resulted. The imposed tax of €0.22 is greater than what an optimum Pigouvian tax would have been. Arguably if a product is taxed at a high enough rate, the tax becomes an outright ban. Perhaps Ireland proposed this restrictive tax instead of a ban to allow the people to still have a choice whereas a ban completely restricting plastic bag consumption could have caused greater unrest. Therefore, the price is higher than where MSC meets demand thus dropping quantity consumed by a greater amount.

*Figure 5: Result of Ireland’s Plastax*
In this case, the optimal point is at (Q*, P*) and the starting point is at (Qm, Pm) where demand (D) and MPC intersect. Here Pm represents market price without regulation which can be thought of as the implicit price of the plastic bags while Qm is the market quantity demanded. With an optimal Pigouvian tax set at Pp, the market would be pushed towards optimal where demand and MSC intersect. Since this tax is directed towards consumers it shifts demand instead of MPC. Thus with a tax at Pt (€ 0.22), the market experiences a dramatic decrease in quantity demanded to Qt from the shift inwards of the demand curve to D’. Since the tax was almost as effective as a ban in decreasing bags entering the consumption stream, on graph Pb is higher than P* which is what an optimal Pigouvian tax would have set the market at.

Ireland’s plastax has ended up being essentially a ban, whether that was the intent or not. A price set at the intercept of the price axis and D’ possibly could have given the 100% decrease in quantity demanded that a ban could have been accomplished.

**Underlying Reasons for Success and Failure**

As theory suggests, cheap goods tend to be demand inelastic due to small income effect. Generally speaking, that means that price changes have little to no effect on the demand of the good. However, in the case of plastic bags, which are very cheap, something different occurs.
This may be due to the apparent “free good” now costing something to the consumer. In both cases, the taxes imposed upon the bags are relatively small when compared to household income. However, the reaction was substantial in that most people stopped using plastic bags. Ireland saw a decrease of around 90-95% while South Africa experienced drops in usage ranging from 50-90% across different income level retailers. The difference is, after the initial “price shock”, South African citizens started to gradually resume using the plastic bags whereas in Ireland usage stayed low. The difference may stem from availability of cheap substitute bags. Not all substitute bags are cheap however which may have caused a change in legislation in South Africa due to their level of poverty.

An issue with the taxes presented by both countries is that they represent a regressive tax with potential to unfairly hurt the poor. This had more of an effect in South Africa than in Ireland. South Africa has a poverty rate of around 39% according to an article written in the Daily Maverick in 2015. With such high rates of poverty, the regressive levy placed on plastic bags faced some backlash from the public. The regulation as a whole was meant to be non-regressive in that the bags would now be reusable and more versatile in usages (Hasson, Lieman, and Visser 2007). Despite the bags’ reusability, the majority of citizens did not reuse them resulting in their disposal at waste dumps. One reason is due to the inconvenience in carrying the bags from households to shopping centers (Dikgang, Leiman, and Visser 2010). Thus, the regulation was ineffective in lowering demand for these plastic bags resulting in what was observed as steadily rising consumption patterns in the long run.

A strategy that South Africa did not seem to take advantage of was an advertisement campaign for their regulations. Ireland took this very seriously and could have been a key factor in swaying public opinion towards favoring the levy introduced. Ireland knew that the success of
the levy depended on the stakeholders; the retail industry, local authorities, consumers, etc. (Convery 2007). The government went through very “extensive consultation with the main industry representative body and leading retailers (Convery 2007). This helped to gain support from these stakeholders and ensure compliance with the new levy as well. The government also worked closely with the Minister of Finance, the Revenue Commissioners and the local authorities to ensure their support in “the collection, administration and enforcement of the levy” (Convery 2007). This effort came together with a strong publicity campaign headed by the Department of the Environment, Heritage and Local Government. The campaign ensured all stakeholders, especially consumers, understood the reasoning behind the levy. The tremendous support that Ireland’s plastic bag tax has gained through the process helped to educate the general public to ensure long term success.

In Clapp and Swanston (2013) they compare the plastics industry in Bangladesh and the United States in order to make the argument that a stronger plastics industry causes weaker legislation in regards to regulating the consumption of plastic bags. The bigger the industry, the more equipped they are in lobbying effectively and using legal actions in thwarting legislation. The article concluded that Bangladesh’s plastic industry was weak, which enabled Bangladesh to go national with its plastic bag ban without much backlash. In contrast, within the United States, legislation that regulates plastic bag consumption has come up against heavy legal action by various plastic bag coalitions and unions, which have the power to protect their employees in the industry. San Francisco was the first case to successfully overcome the backlash to make their ban and tax legal throughout the county. Such differences in plastic industry strength could be a key component in understanding why some legislation regarding plastic bags happen on the national level while others only on the regional level.
Ireland’s plastic’s industry in represented by Plastics Ireland. This organization represents its members from “suppliers of raw material and services… as well as the leading plastics processors in Ireland” (PlasticsIreland). There are just over 200 firms within Ireland’s plastics sector. These firms employ 13,125 people which equates to approximately 3.78% of the Republic of Ireland’s manufacturing employment (Gough 2006). With a total population of around 4.7 million people, the percent of these people employed in the plastics industry is about 0.3% (tradingeconomics). Due to the size of the plastics industry as a whole, it is clear to see that this helped in the success of the bag ban nationwide.

South Africa has a total of 2000 plastics companies which employ around 60,959 workers (Trade and Industry Republic of South Africa). With a total population of 55 million people which comes out to be about 0.1% of the total population works in the plastic’s industry. That being said it is also clear that South Africa does not have a big plastics industry either, perhaps making it easier to pass the regulation regarding consumption of plastics bags.

Both South Africa and the Republic of Ireland have very small plastics industry. Therefore, it coincides with Clapp and Swanston’s argument that the weaker the plastics industry the easier it is for the government to regulate it as seen in both the Republic of Ireland and South Africa. It does seem however, that in both economies the plastics industry is growing but perhaps in different ways. Ireland strives to illustrate their green mentality which perfectly matches the landscape of the island. South Africa also has environmentally friendly laws however not up to par with that of Ireland.

It is perhaps clear as to why Ireland has had more success overall with regulating consumption of plastic bags within their country. Due to the strong publicity campaign, they were able to gain support from retails, local governments and consumers ensuring compliance
and understanding for the levy. Thus, more consumers switched to using reusable bags cutting down on the environmental impact of plastic bags. This also helped to cut down the effects of what seems to be a regressive tax that could potentially hurt the poor. Overall, Ireland’s plastic bag levy of € 0.22 has proved an overall success both environmentally and economically. Although South Africa’s regulation did not stand up to Ireland’s success, it was not an outright failure either. The tax did manage to drop consumption in the short run. Perhaps with some adjustment it could have a greater impact.

“If… controls on plastic shopping bags reflect the public will, their success appears certain. The point of sale levy on shopping bags becomes a perennial reminder to an already conscientious public. This success is far less assured when the tariff is intended to coerce reluctant consumers into changing their behaviour” (Dikgang, Leiman, and Visser 2010).

Within this statement perhaps lies the underlying reasoning behind the success of Ireland and the failure of South Africa.
Conclusion

South Africa took the approach of combining regulation and pricing tools while Ireland used just pricing tools. South Africa raised the required minimum for plastic bag thickness to 24 microns in addition to a tax that started at 46 rand cents and was later lowered to 17 rand cents. Ireland imposed a 22 euro cent tax upon consumption of plastic bags. Both countries experienced short term success; however, South Africa’s policies became less effective at curbing plastic bag consumption over time. There are a number of reasons for the success and failures observed in Chapter 3, some of which include price elasticity and poverty levels, strength of the plastics industry within the country, and public opinion.

Ireland was more successful overall due to a strong advertising campaign winning over public opinion in favor of reducing plastic bag consumption while South Africa failed to get everyone on board. Ireland was able to maintain both short term and long term success.

The research done in this article suggests that regulation alone is not enough to ensure success. For instance, South Africa’s tax was not much different than Ireland’s in that it initially reduced plastic bag consumption at very high levels. The difference was seen however in the long run where South Africa’s regulation faltered. Two key factors for success include getting all stakeholders to compromise and support the regulation as well as the local demographics such as poverty and unemployment rates. The size of the plastics industry within the country also can play a crucial role. Ireland outperformed South Africa in these factors and thus overall was more successful in regulating plastic bag usage. Therefore, when thinking about a policy that works best, these factors must be taken into consideration. There is no one size fits all for plastic bag regulation due to the varying demographics of different areas. However, legislation of any kind will be more successful when the public supports it like in Ireland rather than it being forced
upon the public. In addition to regulation, a strong advertisement campaign can help to gain public support to better ensure success.

Research that evaluates environmental regulation must continue. Adding more cases, such as Bangladesh, cities within the United States, more countries in Europe, and China could help give a more detailed understanding of the background factors that sway the effectiveness of the regulation. South Africa and Ireland provide two completely different cases, including their global location, their demographics, and their economy. Adding in more countries, cities, and states will give a more diverse look into the regulation. The plastics industry within the United States has been a huge factor in resisting the regulation and thus in order to provide successful regulation, finding more information on how to either compromise with the industry to work around the industry and not cause too much harm to it needs to done.
Bibliography


