

Johanna Nelson
Challenges of Sustainable Development
Professor Jason Wong
04/23/2019

Economic Commentary on the State of the Great Pacific Garbage Patch

Introduction

The Great Pacific Garbage Patch (GPGP) covers approximately 1.6 million square kilometers in the Pacific Ocean and holds about 1.8 trillion pieces of plastic in its giant gyres.⁸ With a problem of such incomprehensible size, it is difficult to attribute the damage to any single or group of countries. According to the UN, the plastic currently floating in the GPGP is the cause of \$13 billion in environmental damages from beach cleanups, as well as financial loss incurred by affected fisheries.⁶ Although there have been efforts to clean up the GPGP, there have been minimal intergovernmental agreements or economic proposals devoted to avoiding future plastic entering the ocean.⁶ In fact, a study shows that China's waste output into the ocean is expected to double between 2010 and 2025, and India's output may more than double.⁷ This commentary will focus on how to minimize plastic consumption and production in the case of 4 main country/union stakeholders – the United States, the European Union, China, and India. Currently, plastic reduction proposals are mostly on a national level, and recommend either plastic bans or taxes. The most beneficial solution for fixing the negative externalities of plastic is nationally determined but internationally agreed-upon taxes; then, by fixing these negative externalities, future damage and costs related to the GPGP will be minimized.

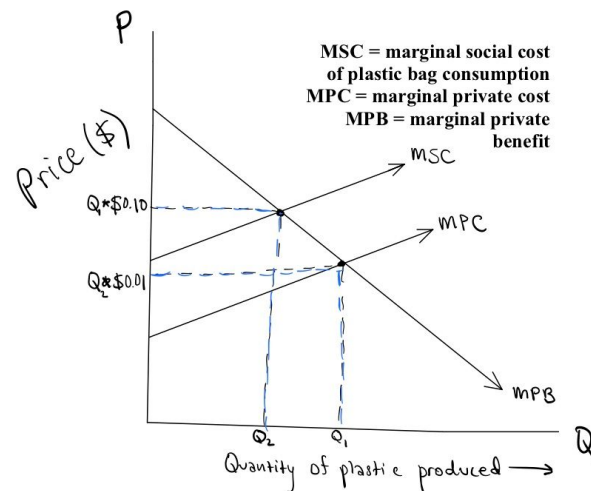
Economic Challenges of the GPGP

The root of most economics challenges related to the GPGP lies in market failure of the plastic market. The extra social cost, or involuntary cost for the world, resulting from the plastic market is the plastic waste in the oceans and its negative effect on marine wildlife. Additionally, since ocean life consumes the plastic, there is a health cost for humans who consume the affected fish. Figure 1 highlights this externality in the case of plastic bag production. While the cost for a firm (MPC) of producing one plastic bag is \$0.01, the cost for everyone else (MSC), resulting from CO₂ emissions, landfill usage, and improper recycling, is \$0.10.³ These may seem like miniscule amounts, but when applied to the 1 trillion plastic bags consumed annually, a \$10 billion private cost results in an annual \$100 billion social cost³. Since this is the social cost for plastic bag production alone, the social cost for all types of plastic production will likely be a disturbingly large number.

This negative externality is caused by the ocean's treatment as a common pool resource. The UN's Law of the Sea Treaty states the most official property rights on the ocean: a nation's aquatic boundary extends 12 nautical miles off its coast.⁶ It can be inferred that the remainder of

the ocean is either owned by all countries, or owned by no countries. Since it is no single country's responsibility to oversee the ocean's usage and treatment, a "tragedy of the commons" situation arises. Individual countries will have no motivation to take action without the promised effort of other countries, since the countries not taking action would be free-riders. There are cases where single countries make large legislative pushes for abating plastic pollution, and these will be discussed later, but in most cases countries will choose to pollute and make no change in their management of plastic production.⁵

Figure 1: Negative Externalities of Plastic Bag Production



4 Country/Union Stakeholders of the GPGP

As just stated, the ocean is a common pool resource; many, if not all countries are involved in the matter of solving the GPGP. In 2015 alone, 322 million tonnes of plastic were produced worldwide.¹ This commentary will focus on the actions of 4 countries or unions: the US, the EU, China, and India. Figure 2 shows the differences in plastic production of these 4 stakeholders, based on a 2015 study.⁷ The US produced 37.83 million tonnes of plastic in 2015 and the EU produced 25 million tonnes. China produced the most plastic, almost 60 million tonnes, while India produced 4.49 million tonnes. However, these numbers are both predicted to at least double by 2025; clearly, a country's annual plastic production should not be the only factor considered when creating plastic reduction policies. Although India produced one tenth of what China produced, the two countries have similar future rates of increase.⁷

In order to determine an economic solution for lowering plastic production, specifically, considering the marginal abatement cost (MAC) of each country is just as important as its plastic production amount. Although there is not currently data on the MAC of different countries for abating plastic pollution, a 2011 study derives the MAC of different countries for abating carbon emissions.¹⁰ Since the cost of abating carbon emissions and of abating plastic pollution involve similar changes in economic policy, the study's findings are used as a proxy for approximate MAC data of abating plastic pollution. CO₂ emissions may not be the only MAC involved in

plastic production, but they are definitely a substantial part of the environmental cost resulting from the plastic production process. Figure 3 shows the MAC of the 4 stakeholders in market exchange rate. Matching China's rank of being the highest producer of plastic, its MAC for abating carbon emissions is also the highest at 1.33 MEP. The EU has the lowest MAC, 0.29, and the US is just above this value with an MAC of 0.40. India, which produces the least amount of plastic, has the second highest MAC of 1.16.¹⁰ The MAC of abatement, therefore, does not have a clear-cut relationship with the amount of plastic a country produces.

Figure 2: National Plastic Production Per Year

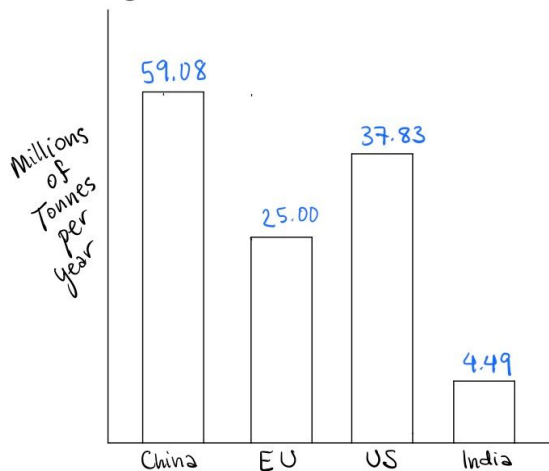


Figure 3: National Marginal Abatement Costs

Country/Union	Market Exchange Rate (MER) (kg of CO ₂ / 2005 US \$ of GDP)
China	1.33
EU	0.29
India	1.16
US	0.40

Current Solutions for Reducing Plastic Production and Consumption

From the data above, the need for a policy that accounts for the biggest abusers of plastic production as well as the wide range of MACs is clear. But despite the involvement of many countries with varying MACs and amounts of plastic production, there currently exists no intergovernmental treaties for plastic pollution. Most plastic-related legislature is on a national level, and it is either in the form of plastic bans or plastic taxes.

Plastic bans, usually plastic bag bans, are more common than plastic taxes in national legislation; this is not surprising since 1 trillion plastic bags are annually consumed worldwide.³ There are, however, more environmental costs incurred than prevented by choosing such a policy. For example, the 2016 plastic bag ban in California actually increased the amount of plastic being consumed rather than decreasing it; studies show that 40 million pounds of plastic bags were eliminated, but there was also a 12 million pound increase in trash bag consumption and an 80 million pound increase in paper bag consumption.⁸ While California was successful in decreasing its plastic bag consumption, it is not worth the environmental costs to ban plastic bags if it means thicker plastic and paper bags are the substitute goods involved.

A plastic tax, on the other hand, would lead to no such substitution. While a ban on plastic bags creates the consumer's need to find another type of bag for daily usage, such as for trash can liners or picking up dog waste, a plastic consumption tax on bags would allow

consumers to be mindful and frugal about using plastic bags. The EU Commission made such a proposal in 2018, for a €0.80 tax per kilo of plastic.² The goals of the tax are to “reduce plastic use in the economy and incentivise widespread recycling of used plastic,” both of which would also reduce the plastic waste that ends up in the GPGP. The Commission proposed a suite of taxes, on different parts of the plastics production, conversion, consumption, and waste chain. Although this tax has not yet gone into effect, the plastic tax amount for the EU was selected to cover the negative externality of plastic production; this, alongside the promise of no goods being substituted, makes a plastic tax a much better policy measure than a plastic ban.

Implementing a tax is more advantageous than a Command and Control (CAC) policy for the case of plastic production and consumption, because only taxes work at the lowest possible cost. Trading systems allow for a cap on pollution amounts and uncertain prices, while taxes allow for vice versa. Firms tend to prefer CAC policies to taxes, but a government-imposed tax will be the best solution for maintaining certain prices; in the case of plastic consumption and production, policymakers could relate these prices back to specific environmental costs, which will eliminate the negative externality of plastic as accurately as possible.

Determining a Plastic Tax

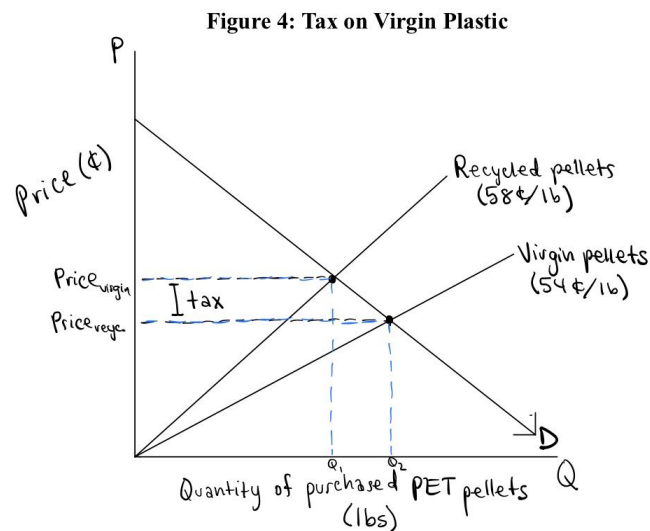
As the EU Commission’s proposal stated, it may be most beneficial to tax multiple stages of the plastic production and consumption chain. There are two types of taxes that would have the greatest effect on reducing the plastic waste of the GPGP: a plastic consumption tax and a plastic production tax, specifically on virgin plastic.

One of the most successful implementations of a plastic consumption tax is Ireland’s Plasti Tax on plastic bags, at €0.15 per bag, in effect since 2002. A study found that the number of discarded plastic bags in Ireland decreased from being 5% of all litter in 2001 to 0.13% of litter pollution in 2015.¹¹ Despite not banning plastic bags, their waste level is practically at 0%. Not only does a consumption tax drastically reduce plastic bag consumption, but it also creates funds for fixing environmental damage. If such a consumption tax were expanded to all forms of plastic, as proposed by the EU Commission, and implemented in more countries, the financial and environmental gains would be significant.

The second type of helpful tax, a plastic production tax, would be most beneficial if placed only on virgin plastic. This creates an incentive for firms to use recycled plastic instead. Virgin plastic is usually cheaper than recycled plastic, making it a more popular option for firms despite its larger environmental costs. Figure 4 shows a hypothetical tax on virgin plastic imposed to make recycled plastic the more appealing option; although virgin PET pellets cost \$0.54/lb and recycled PET pellets cost \$0.58/lb, imposing a \$0.04 tax on virgin PET pellets would take away the financial factor in a firm’s decision to choose recycled over virgin plastic.¹²

It is crucial that these taxes are internationally agreed upon and nationally determined; the former guarantees the participation of many countries and the latter allows for the customization of the plastic tax based on MAC. Both of these qualities, therefore, must be

present for the effect of the tax to be optimized. National determination is especially important, since by the equimarginal principle the least cost solution for society is when firms, and on a larger level countries, abate at the same marginal abatement costs; a least-cost solution will not involve equal abatement effort by all polluters. Flexibility in different taxes for countries with different situations must be possible in any international policy; the plastic consumption and production taxes of China would be significantly different than those of the US, since their MACs are also significantly different. Additionally, differing taxes would also allow be an endorsement of the “polluter pays” principle; those producing more plastic waste will be financially responsible for their pollution through appropriate tax measures.



Conclusion

Any effort in solving the plastic pollution that makes up the GPGP must begin at the root of the problem: the negative externality cause by the plastic industry. Through implementation of plastic taxes, the amount of plastic consumed and produced will lower and future levels of plastic waste will lower as well. However, it is of utmost importance that as many countries as possible are involved in a plastic consumption and production tax policy, especially the countries with the highest plastic contributions; because production taxes will be proportional to the countries' MAC, an international agreement will only work as long as the highest polluters participate and do not continue free-riding on the benefits of the abatement of other countries. In such a case, there would be a higher overall social cost for everyone without any means of compensation. The future of the GPGP plastic levels could be environmentally less dire than now, with participation from enough countries on a tax policy that has been proven to work on a national level. Expanded to an international level, the benefits will multiply, and there will be worldwide responsibility for a vast common pool resource in need of protection.

References

1. “Business Insights.” *BidNet*, www.bidnet.com/resources/business-insights/protecting-our-oceans-how-government-is-working-to-reduce-pollution-and-promote-sustainability-en.jsp.
2. Foeeurope. “The Price Is Right ... or Is It? The Case for Taxing Plastic.” *Friends of the Earth Europe*, www.foeeurope.org/plastic-tax.
3. “Global Efforts to End Plastic Pollution: Single-Use Plastics.” *Earth Day Network*, www.earthday.org/plasticban/.
4. “How to Eliminate the Great Pacific Garbage Patch | Lawrence J. McQuillan.” *The Independent Institute*, www.independent.org/news/article.asp?id=10465.
5. Ocean Cleanup. “The Ocean Cleanup.” *The Ocean Cleanup*, www.theoceancleanup.com/.
6. “Plastic Waste Causes Financial Damage of US\$13 Billion to Marine Ecosystems Each Year as Concern Grows over Microplastics.” *UN Environment*, www.unenvironment.org/news-and-stories/press-release/plastic-waste-causes-financial-damage-us13-billion-marine-ecosystems.
7. Ritchie, Hannah, and Max Roser. “Plastic Pollution.” *Our World in Data*, 1 Sept. 2018, ourworldindata.org/plastic-pollution.
8. Rosalsky, Greg. “Are Plastic Bag Bans Garbage?” *NPR*, NPR, 9 Apr. 2019, www.npr.org/sections/money/2019/04/09/711181385/are-plastic-bag-bans-garbage.
9. Spross, Jeff. “The Surprising Economics of the Great Pacific Garbage Patch.” *Image*, The Week, 27 Feb. 2015, theweek.com/articles/541440/surprising-economics-great-pacific-garbage-patch.
10. Stern, David I., et al. “Where in the World Is It Cheapest to Cut Carbon Emissions?.” *Australian Journal of Agricultural and Resource Economics*, vol. 56, no. 3, 2011, pp. 315–331., doi:10.1111/j.1467-8489.2011.00576.x.
11. Anastasio, Mauro and Nix, James. “Plastic Bag Levy in Ireland.” Institute for European Environmental Policy. December 2016.
12. “US-RPET Pellet Prices Higher than Virgin PET.” *Icis*, www.icis.com/explore/resources/news/2016/01/07/9958742/us-rpet-pellet-prices-higher-than-virgin-pet/.