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Deteriorating environmental problem: how can government constrain environmental degradation through economic policies?

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ABSTRACT

China has replaced the USA and become the main emitter of carbon since 2006, global environmental issue especially the climate change is deteriorating. Therefore, it is urgent for countries to design policies to deal with the climate change and constrain increasing carbon emission. However, countries got stuck into a dilemma: developing economy will prompt production thus causing pollution and hindering the improvement of environment. This article will mainly analyze four possible economic policies—taxation, tradable permits, subsidies and government regulation— that countries can carry out to reduce, halt, and reverse environmental degradation by providing rationales and data to prove their effectiveness. And sufficient evidences conclude that subsidizing on alternative resources can truly help countries to develop economy without hurting the environment.

Introduction

During the first Industrialization Revolution in Britain in the 1800s, coal was extracted and combusted to power manufacturing, which simultaneously produced carbon dioxide and created smog, causing severe environmental degradation. As early as in the 1850s, higher coal intensity was associated with higher death rates from respiratory diseases; an increase of just 1% in coal intensity raised the deaths of infants by one in every 100 births (Beach & Hanlon, 2017). At present, environmental degradation has been exacerbated instead of alleviated, since depleting resources is the most rapid way to develop the economy. Fortunately, most countries worldwide have realized the severity of environmental degradation, and are actively looking for solutions. Therefore, this article will discuss possible economic policies that countries can carry out to reduce, halt, and reverse environmental degradation.

Policy 1: Taxation

Rationale

The primary reason for excessive pollution is the fact that pollution is a negative externality – an undesirable side-effect that affects third parties who are not compensated. Thus, the crux of the problem is to eliminate the existence of these externalities. A prime way of doing this would be to internalize the externalities through the use of Pigouvian taxes. The Pigouvian tax forces producers to pay a tax equal to the external marginal cost at the socially efficient level of production, shifting MPC upwards until it intersects the MSC curve at the socially optimal level of production, Q_{opt} (Figure 1). Achieving lower production and a higher price, P_{opt}, the market reaches allocative efficiency.

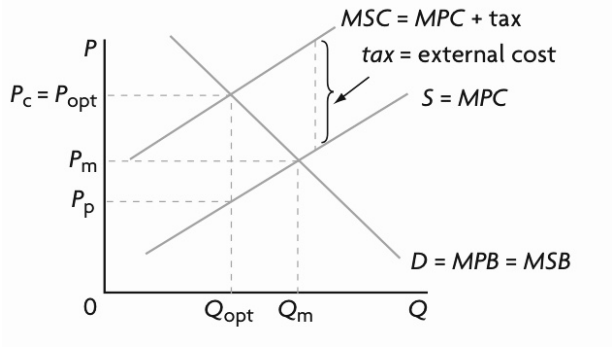

Figure1: shifting MPC to MPS

Effectiveness

Carbon tax, which works well in countries worldwide to ameliorate the greenhouse effect and grant governments with profits. For example, South Africa introduced a carbon tax of R134/tCO2e (US$7/tCO2e) (World Bank, 2020) in 2019, which boosted tax revenue by 43.3million dollars and reduced carbon emissions from 33.4 Gt CO2 in 2019 to 31.5 Gt CO2 in 2020 (IEA, 2020). The French government will also simultaneously achieve $9632 million in tax revenue while reducing its carbon emission per capita from 4.6t in 2017 to 4.4t in 2019 (IEA, 2020) by increasing its carbon tax from EUR44.6/tCO2e in 2018 to EUR86.2/tCO2e in 2022 (World Bank, 2020). Furthermore, tax revenue can be further spent on pollution abatement, feeding into the virtuous cycle.

Though the effectiveness of taxation is significantly affected by the PED (price elasticity of demand) and PES (price elasticity of supply), inelastic demand could provide an opportunity for the government to boost its tax revenue. However, attention should be paid to the distribution of tax burden between consumers and producers, and whether the poor might be disproportionately affected. The government needs to ensure that inequality is not exacerbated as a result of higher taxes on basic necessities such as energy and food.

Policy 2: Tradable Permits

Rationale

Another key tool in internalizing externalities is the use of permits, a notion based on the Coase theorem—if trade in an externality is possible and there are no transaction costs, bargaining will lead to an efficient outcome regardless of the initial allocation of property rights. Consider the case of air pollution, where the Pareto efficient level of pollution is x_1 (Figure 2). If polluters have the right to pollute, victims would pay them an amount equal to the area of triangle ECB to entice them to reduce their emissions from x_2 to x_1. On the other hand, when victims have the right to a pollution-free environment, polluters would need to pay victims the equivalent of the area of triangle OEB to emit x_1 of pollutants. When this notion is applied through using cap and trade, the introduction of the price mechanism into the regulation of pollution could more efficiently motivate firms to pollute less to sell their excess permits or internalize the external costs of production through purchasing permits at a price that is lower than the penalties they would face. Additionally, it may also encourage firms to develop and invest in cheaper pollution-reducing technologies to reduce long-run production costs.

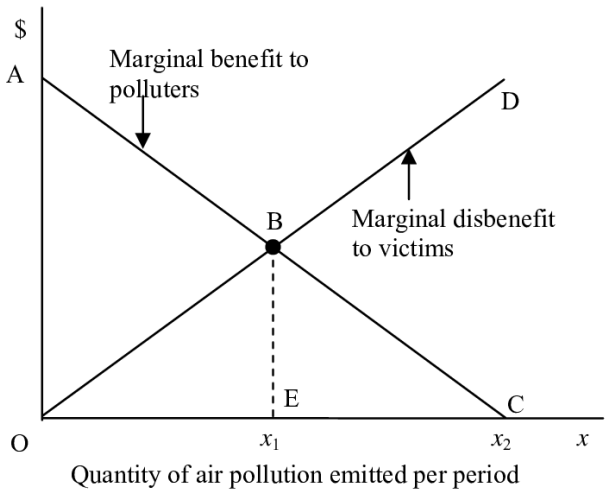

Figure 2: Coase theorem diagram

Effectiveness

However, in reality, it is difficult to determine the socially optimal level of quota. If the government is too strict, firms may not be willing to trade permits and reduce their production. Especially for developing countries that rely on pollutive energy sources for production, their aggregate supply and economic growth rate will decrease significantly (Figure 3). When the aggregate supply curve shifts to the left (from $SRAS_1$ to $SRAS_2$ to $SRAS_3$), real GDP will decrease while the inflation rate increases. Simultaneously, the short-run Phillips curve will shift to the right, increasing the unemployment rate (shown in points a, b, c). The economy may be sacrificed in the pursuit of sustainability.

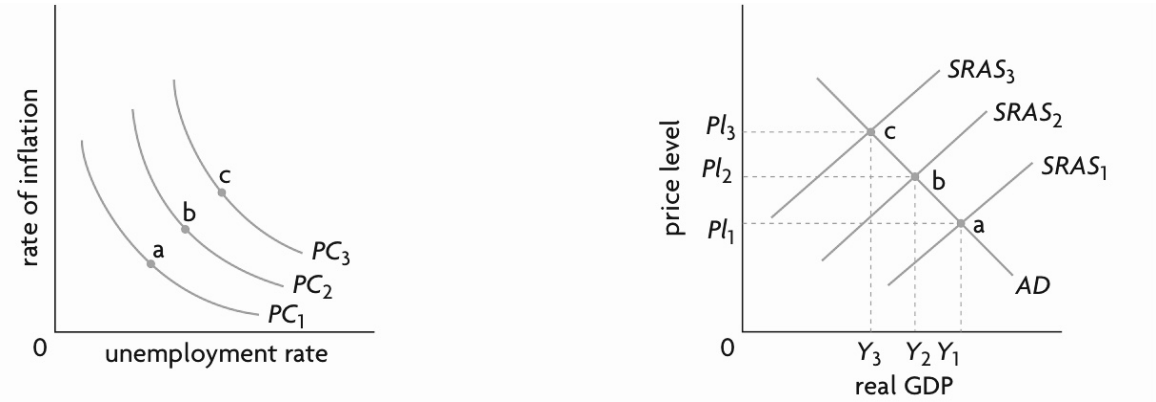

Figure 3: shifting SRAS (short-run aggregate supply) and SRPC (short-run Phillips curve)

Policy 3: Subsidize alternative energy resources

Background

Apart from economic solutions, governments must also explore alternative methods such as promoting the development and usage of alternative energy sources. Currently, coal, a major pollutant, is the primary energy source for many countries. For instance, China consumed 82.27 exajoules of coal in 2020, producing 403 million metric tons of carbon dioxide (Statista, 2021). Therefore, it is necessary to subsidize and promote cleaner renewable resources that can act as reliable substitutes for traditional energy sources (Kim, 2019).

Rationale

Subsidies reduce the cost of production for producers, thus shifting the supply curve of renewable energy sources to the right, reducing the price while augmenting the quantity produced. The optimal subsidy will shift the MPC curve rightwards until it coincides with the MSC curve at the socially optimal level, Q_{opt}, and lower the price from P_m to P_{opt} to achieve allocative efficiency (Figure 4). In this way, consumers and producers may prefer using renewable resources, and coal will be gradually replaced.

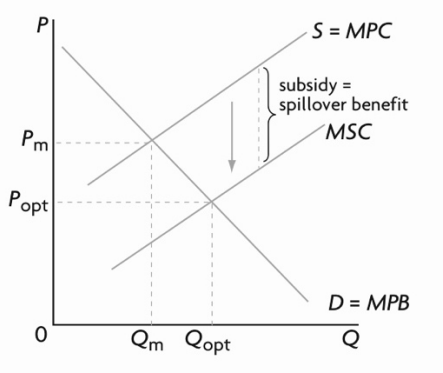

Figure 4: using subsidy to shift MPC to MSC

Effectiveness

Currently, many developed countries have already started to change their primary energy source. For example, Norway estimates that 93% of its total installed capacity of electricity came from hydroelectric plants in 2017 (Central Intelligence Agency, 2017); despite this phenomenal achievement, the Norwegian government increased its national budget for environmentally friendly energy and hydrogen market from 100 million NOK to 200 million NOK in 2020 (IEA, 2020), further incentivizing innovation and entry into this market.

Policy 4: Government Regulation

Rationale

Last but not least, governments can carry out a straightforward measure — setting up laws and regulations. Laws and regulations can dictate the level of pollution and shift the MPC curve upwards until it coincides with the MSC curve; Q_{opt} is produced, price increases from P_m to P_{opt} and the overallocation of resources to produce the pollutants is corrected (Figure 5).

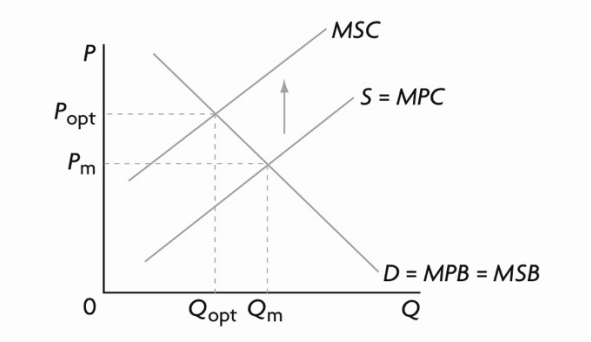

Figure 5: government regulation to correct externalities

Effectiveness

The Clean Air Act in the United States, enacted in 1970, has greatly improved air quality in the country by controlling the type and amount of pollutants released into the atmosphere. Between 1970 and 2020, the combined emissions of the six most common pollutants (PM2.5, PM10, SO_2, CO, CO_2, and Pb) dropped by 78%. More impressively, this progress occurred while U.S. economic indicators remain strong (EPA, 2020), illustrating that growth was not sacrificed as a result of sustainability. More critically, regulations incentivize manufacturers to reduce energy consumption and seek more efficient alternatives, promoting sustainable development in the long run. Following the Energy Policy and Conservation Act of 1975, the U.S. Department of Energy implemented minimum efficiency standards for a wide range of appliances and equipment, resulting in a spectacular fall in the US national energy bill by about $80 billion in 2015 (EESI, 2017).

However, the main drawback of regulations is the significant enforcement cost—governments need significant human and physical capital to examine whether the emission of pollution has reached the standard. According to the statistics, the EPA of the United States spent about 9.06 billion in 2020 to maintain its policies (EPA, 2020). Thus, regulations could incur high opportunity costs and compete for resources with other goals such as poverty alleviation and educational improvements. Moreover, there could also be a rebound effect, where the benefits of energy efficiency might reduce as people adapt their behavior to the regulations. For example, buying an air conditioner that is energy efficient may encourage people to use it frequently, so energy consumption will be uncertain. Thus, although regulations do have their merits, its limitations impede its desirability and effectiveness.

Conclusion

All in all, to halt and reverse environmental degradation, subsidizing alternative energy sources is the most appropriate measure as it fundamentally changes the relationship between production and pollution. By severing the equation between growth and environmental degradation, alternative energy sources provide economies a way to develop without harming the environment, thereby creating a future where reversal of environmental damage is possible. Though the other three methods—taxation, regulations, and permit market—merely restrict environmental degradation, they could be the route that most countries take to play a part in sustainability. They are the most feasible as the majority of countries do not have abundant funds for subsidies and innovation. Thus, there is no panacea to the problem of pollution and any effort to build a better, cleaner future should be recognized, lauded, and promoted.

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