

in different administrative units and keeping them updated.

- Accounting dexterity is required to get rid of the problem of double counting in the environmental accounts.
- Effective primary surveys and authentic company documents should be checked to get accurate values of environmental data.
- Delegating and segregating work to groups of economists and accountants with target deadlines for better results.
- Implementation of Government policies so as to promote Green Accounting and its awareness.
- Strict legal policies for companies so that they inculcate green accounts in their company accounts.
- Government should fund a pool of research work on Green Accounting that will add to the resources for faster implementation of this technique.
- Economies should set and work towards target deadlines for full fledged Green Accounting.

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Mitigation of Climate Change: A Game Theoretical Approach

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As the world progresses in the wake of the most happening century in human civilization, suddenly, the earth seems too small a place to hold too many a people – billions of them, who are, as a whole, economically driven to improve the standard of their lives in the material sense of the word. To establish a fundamental point, climate change caused by global warming is not a temporary phenomenon or a passing phase, part of the natural fluctuations of the earth's climatic conditions over time. Kaya's identity directly implies that a more populous

country will inevitably be more likely to pollute more and that a more developed country needs to be more efficient in its energy usage as well as technology of production to offset the increasing effect of greater output on green house emissions. As two general representatives of the developed world, the EU and the USA can be seen to have extremely high emissions per capita and relatively speaking, the developing countries can do little to cut down emissions since they are not heavy contributors in the first place. Even historically the increase in greenhouse emissions can be traced to industrial revolution and the countries that enjoyed high growth rates as a result of it, since we have already proven that emissions, and hence global warming, are caused singularly by growth in total economic production in terms of fuel consumption. Therefore, it can be established that developed countries have developed at the expense of climatic change and continue to do so.

Economic theory predicts that market mechanism is unlikely to guarantee a solution in that aspect as managing the environment presents the classic case of market failure in the form of tragedy of the commons. Similarly, the entire planet benefits from the reduction in emissions by any single agent, since climate change mitigation meets the non-excludability and non-rivalry criterion of a public good. Therefore, there is incentive for every agent to free-ride, and wait for the others to take action, as a result of which efforts to reduce global warming will always be underprovided. The source of market failure lies in the absence of political collectivization and alignment of interests under a cooperative framework. The idea of marketable permits inspired by Coasian solution to assign private rights to externality could be applied, but that cannot be achieved globally since there exists no

single universal authority. Any settlements between countries are purely voluntary and based on self interest. Together with the political strategic considerations involved, the issue forms a classical case of the prisoner's dilemma scenario.

The prisoner's dilemma can be applied to the problem of mitigating climate change. From an individualistic paradigm of analysis where player one is one economically active agent and player two refers to the set of all other economically active agents in a defined system.

Let our lone economic agent P1's strategies be defined by:

$P1_j$ where $j =$
 $\{\text{'cut emissions'}, \text{'continue pollution'}\}$

Similarly P2's strategies are:

$P2_k$, where k
 $= \{\text{'cut emissions'}, \text{'continue pollution'}\}$

The payoffs, $\pi 1_j$ & $\pi 2_k$, respectively are described as follows:

P1 \ P2	Cut Emissions	Continue Pollution
	Cut Emissions	Continue Pollution
Cut Emissions	Improved Environment for everyone; moderate and sustainable levels of development.	P1 loses out on forgone profits, others reap high economic profits as well as sharing the benefits of P1 cutting pollution.
Continue Pollution	P1 reaps commercial success AND	Everyone disregards environmental

	free rides on a better environment ensured by reduced emissions of others. Others save the environment but face heavy private opportunity cost.	considerations, attains private gains but the environment suffers. Not the best outcome, but better for P1 than getting stuck forgoing profits for nothing while the others' cheating continues environmental hazard.
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We see that from an individualistic paradigm, the Nash equilibrium outcome is continued pollution from each member of the set of all economically active agents. Similarly, it would be rational for each government to not make serious efforts to implement laws, create regulations on industry or invest in green technology, since that would come at the cost of forgoing opportunity of economic growth.

However, other forms of political collectivization exist to further economic interests. In the context of mitigation of climate change, a most interesting and widely debated framework is that of collectives of developing vs. developed nation. It is pleaded that developing countries have more to lose by foregoing economic development in favor of environment, compared to the developed since the former has chronic issues such as poverty and poor health facilities to address while the latter has a smaller incremental improvement in its quality of life to forego from emission cuts. The costs of cutting emissions are also higher for the developing countries, since they are far behind on the

learning curve of environment friendly technologies. Climate change will hit the developing countries harder. Developed countries are historically to blame for bringing the sword of climate change so close to everyone's neck by rampant industrialization. Nash Equilibrium occurs for both players continuing to pollute, since for each strategy of the other block, each block has an incentive to continue polluting. Unless there comes to form a real enough political pressure on the developed countries that can be translated into an economic cost in terms of 'punishments' that are imposed by developing countries and the countries currently in transition, economic rationale surrounding the situation will remain the same.

Economic theory predicts that nothing will change unless economic incentives and payoffs do. Encouragingly, there is a growing realization that limits and quotas must also be coupled with punishment (The Economist, 2007). Interestingly, economic theory already suggested this 'responsive' approach, where cooperators are collaborated with for mutual benefit, and cheaters are punished. In context of climate change, the game is 'played' *repeatedly*, or even *continuously* every time there is major decision regarding energy production, or regarding environmental legislation, or every year at conferences on environment. This is called the Iterated Prisoner's Dilemma (IPD) Case, wherein a country cannot simply cheat-and-run; knowing that managing the environment is an issue over which it has to engage with the rest of the world repeatedly over time – 'forever and ever', to be exact. While the dominant strategy for each game in this iterated continuum still remains to cheat, but the fact that the game will be played repeatedly for *unknown* number of times means that countries will be able to respond to each

other's actions, form strategies over time, have the opportunity to collaborate and cooperate. An alternate outcome than the disastrous continued pollution by everyone is possible, based on the increased weight of future outcomes as the payoffs for strategy (*continue pollution, continue pollution*) continue to worsen.

Since dramatic climate changes, displacement of billions of people and sinking of metropolitans is no small negative pay off, therefore growingly (cheat, cheat) begins to give the payoff's of a disaster as well. The payoffs grow so low and the weight attached to the future grows so high that (cheat, cheat) ceases to be an equilibrium and countries, out of their own incentive, will be pushed away from such a strategy. The countries are now set forth in a dynamic game, not happy to be mutually irresponsible but still battling to beat the other, and not yet settling for mutual cooperation. Surprisingly, then, the simplest strategy 'tit-for-tat', which simply responds to cooperation with cooperation and punishes deception with defecting itself as well, turns out to be mutually and individually beneficial in the long run. Hence cooperation is evolved in a framework where deception seemed as the only rational option in a non-iterated setting and impending doom breaks away the equilibrium from (cheat, cheat) as there is a simultaneous growth in incentive to cooperate.

Each passing year is like another iteration of the game, with time to get emissions in check consistently running out. Unfortunately for developing countries, to create an analogy with prisoner's dilemma, they have a bigger stake, are the faint-hearted of the two criminals, and worse, were barely involved in the crime in the first place that landed them in this situation! Both for their own benefit and for

that of world at large, it is important to exert substantial political and social pressure – since, with the corporate sector's interests aligned even more firmly to short run profits, only government regulations and policies can have meaningful impact. Theoretical possibility of a breakthrough exist, where incentive would actually be to begin cooperating and caring for the planet – but whether that would happen before the tipping point when it is too late or not remains the biggest question.

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