

## Economic growth accounting and environment

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In accounting for economic growth the most usual procedure tends to take mainly the variation of capital and labor. The third factor we have, called, in very broad terms, "technology", is the portion of growth not explained by the variation of the two factors previously mentioned. For those who like technical terms, the later factor is known as the "Solow residual". In relation to the environment, i.e., the material substrate on which our life unfolds, there is little mention to the damage suffer with the development of economic activity.

The problem is not only due to environmental issues related to wants of comfort, quality life, as, for example, changed from a department to a house with garden; but, perhaps overall, very basic issues such as drinking water. However, given certain assumptions, the issue of environmental care is increasingly taken into account as time passes.

In presenting these few ideas we have to assume two things, one, that we are in an economy with positive growth. Also, we must adopt some assumptions on how environmental degradation is produced over time. At this point, several theories have been developed, which we grouped in a schematic classification. The first one argues that given certain initial conditions, typically the industrial revolution, decline began following an exponential trajectory, and can not be stopped. The second, said that in fact, the data that can be collected, suggest no deterioration, i.e., that in the relevant variables we have not structural changes or at least, these changes are not attributable to human activity. Finally, the third assumes that there is environmental degradation, but is reversible. The system presents the characteristics of a chaotic system, i.e., where a small change in initial conditions produces large changes in the final effects. From a certain point, a tipping point, there are levels at which the momentum for change becomes unstoppable. That is, there are certain degrees of pollution from which the system can deteriorate so that it will no longer be possible settlement. It is obvious that the greater the degree of contamination is also greater the degree of probability of being near such points, but no one knows for sure where these points are. This is the theory that we will adopt in the present work.

There are many special features for proper valuation of the change in the environment, some of which are now exposed.

### *Information and time, income and demand*

In view of this work scheme, the first thing we see is that economic agents may have not **information** at all about such matters, quite complex in itself. But also, even taking all available information, it is not possible to have a sort of conceptualization so that the situation of the environment, and the consequences of the activity of agents on the environment, is clearly presented. Two problems arise from this issue. On the one hand, the actors are not able to reveal his preference, and to adequately assess an environment suited to the needs of life. On the other hand, they have no incentive to change their attitude towards the environment, e.g., sorting waste.

Moreover, if we assume that the effects of pollution will have only consequences after a gap of **time**, the larger the period, the agent will have less incentive to improve their

attitude to the environment, since the problems will materialize only to the future generation.

As **income** increases, agents do not demand the same goods in the same proportion as they were doing (non-homothetic **demand**). Thus, once covered the needs for nutrition, as income increases, they do not require the same food, e.g., one can opt for organic food instead of those produced with traditional methods. After a certain threshold, the food expenditure tends to stagnate. The remaining income is spent on other goods. For this, and given our assumptions, the environment would, in a relatively long period, more valued for its further deterioration and because the need for an appropriate environment appear more tangible once exceeded a certain threshold for certain basic needs. The consequence is that future generations will value more than previous generations environmental degradation caused by the previous, which added one more problem to the proper valuation of environmental degradation.

### *Some possible consequences*

As we are taking long periods of time, we should think that the **forms of production**, as time passes, will become friendlier to the environment, simply because of having to confront environmental problems are increasingly serious in the future and given the fact that healthier living conditions were be more valued.

It is possible that some usual problems arise, such as an **structural inflation**, the increase of prices of goods (inputs) more environmentally friendly respect to goods (inputs) that are not. It may also be necessary to encourage certain **public expenditures** for environmentally friendly sectors, which brings as inevitable corollary taxes to be levied for this purpose and the analysis of the optimal structure of this expenditure.

It remains to answer how to resolve the lack of **coordination** between the present and future generations. From a neoclassical point of view **future resources** will be lost due to contamination, therefore no one could achieve full employment of factors in the future. From a Keynesian point of view as time goes on, new activities are needed to encourage the use of **current resources**. In order to preserve future resources and to use the existing, i.e., to break the lack of coordination; it is possible to stimulate **investment and employment** in forms of production environment-friendly (in all sectors, food, energy, manufacturing etc.), particularly in research and development divisions; with the idea of going after increasingly improving these techniques and to use this as quickly as possible throughout the production chain. This will encourage the present generation with present income and the future receives the benefits of a more suitable environment. A forthcoming job will be devoted to expose some significant relationship between this topic and the energy sector.