

Transition to sustainability? Feasible scenarios towards a low-carbon economy

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September 14, 2014

Keywords: energy transition, sustainability, system dynamics, scenario analysis.

Abstract

The focus of this paper is to evaluate different policies that may promote the transition to sustainability, with particular focus on energy sector. We present a model where three different strategies for sustainability are identified: reduction in GHG emissions, improvements in energy efficiency and the development of the renewable energy sector. Our aim is to analyze the dynamics that those strategies may produce in the economy, looking at different performance indicators: rate of growth, unemployment, poverty, inequality, fiscal position, GHG emission, and transition to renewable energy sources.

A second important goal of the analysis is to evaluate whether it is possible to disjoint wellbeing and economic growth (Victor, 2008). In this respect, an increasing number of contributions show the existence of a stationary level of subjective wellbeing in developed country. Moreover there is not evidence that, reached a certain threshold of development, the economic growth is neither necessary nor sufficient for achieve objectives such as full employment, environmental protection and reductions in inequality. These considerations open the possibility to reduce consumption, without undermining levels of wellbeing (Jackson, 2009).

Sustainability is a complex concept. In our framework we aim to take into account this complexity in three stages. First, we build a simple macroeconomic model where the determination of wages and employment is a result of a modified Lotka-Volterra model. An increase in the employment rate - the prey - brings about an increase in the growth rate of wages - the predator. However, an increase in wages has a negative feedback on the growth rate of employment. This negative feedback creates a cyclical path in our scenarios which allows analysis of the dynamics of income distribution and unemployment.

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Secondly, we integrate the core of the model, with an analysis of the energy sector. While this sector is often underestimated in economic analysis, some recent publications of European Commission recognize as a priority goal for Europe, the development of an efficient energy system. We investigate three different strategies: abatement in GHG emissions, investment in energy efficiency and the development of renewable energy sources (see, for instance, [Manna, 2010](#)). Those strategies can be seen as complementary in the transition to sustainability. Indeed, they aim both, to control climate change and to reduce the dependency of the economy from fossil energy sources. However, given budget constraints, there is a quite strong competition among those strategies. Scenario analysis is a powerful tool to evaluate the dynamics generated by alternative policies which tend to favor one of those strategies. Furthermore, an increase in public expenditure in the energy sector (e.g. through monetary incentives) may reduce the availability of resources for improvements in other performance indicators such as unemployment, inequality and poverty. The model allows for the investigation of this kind of trade-offs.

Finally, while the model can be easily adapted to different countries, we apply it to Italy, making calibration and robustness analysis of the crucial parameters.

Preliminary results show that 'business as usual' scenario is not able to attain European Union prescriptions on renewable energy sources and emissions standard. Moreover, limits on the exploitation of fossil resources generate irreversibility thresholds which may induce the collapse of the whole economy (see, for instance, [D'Alessandro et al., 2010](#)). Policies must take into account those thresholds and induce a significant increase in the investment in the renewable energy sector. However those investments are costly, and may reduce the rate of growth and increase unemployment at least in the short run.

At this stage of the analysis, we get that the three strategies have different outcomes. Abatements in GHG emissions and increases in energy efficiency are effective in the short run, while the development of renewable energy sector has higher effects in the long run.

References

- D'Alessandro, S., T. Luzzati, and M. Morroni (2010). Energy transition towards economic and environmental sustainability: feasible paths and policy implications. *Journal of Cleaner Production* 18, 291–298.
- Jackson, T. (2009). *Prosperity without Growth. Economics for a Finite Planet*. Earthscan.
- Manna, C. (2010). Rapporto energia ambiente. Analisi e scenari. Technical report, National agency for new technologies, Energy and sustainable economic development.
- Victor, P. (2008). *Managing without growth: slower by design, not disaster*. Edward Elgar.