

## Review of 'The Sustainable Development Goals and the systems approach to sustainability'

The authors reference the systems approach to classify the 17 Sustainable Development Goals (SDGs) into three systems – environmental, economic, and social. They then apply standard choice theory to derive a method of estimating the willingness to pay (WTP) for progress towards meeting any one of the SDGs. They perform a preliminary welfare analysis for efforts to achieve 'No Poverty', when progress does not impact other SDGs and when progress is in conflict with several other SDGs.

The authors develop a classic static model in which individuals are faced with changes in different development indicators, and estimate the required compensation to keep utility constant. The main contribution is the emphasis on systems thinking and applying theory to this critical problem. However, it is difficult to understand how systems thinking and their method of estimating WTP are connected, as the characterization of the 17 SDGs into 3 systems is unnecessary for their application or valuation method in general. Additionally, all the goals are simultaneously determined, so that it is unclear which goals are in conflict, and whether that conflict is due to competition for resources or because the relevant systems fundamentally conflict with each other.

I would recommend this paper for publication; however I have several concerns listed below.

### Comments

- One benefit of taking this approach would be to make it possible to predict which goals are in conflict or are potential 'win-wins', and to identify externalities that need to be addressed in development policy. This is however omitted from the empirical exercise which assumes all SDGs are substitutes. It would be worthwhile to mention specifically why goals might be in conflict, and to relate this back to the systems thinking approach to better link the two sections.
- It makes sense to consider the sustainable development goals as a representation of the system's approach to sustainability, however the need to explicitly categorize them as belonging to only one system seems suspect as the SDGs are broad, even if individual targets and indicators are quite specific. It seems more reasonable to admit that some of them overlap systems, and that there are interactions between systems that impact the indicators. It seems an unnecessary distraction from the paper's point that we can characterize the tradeoffs between SDG indicators.
- Choosing to instead think about the individual indicators and allow SDGs to overlap systems, it may be that some of the SDGs conflict with themselves. For example, doubling food production and ensuring sustainable food production may conflict with each other, if increased production involves greater reliance on marginal land.
- It would be worth discussing the dynamic nature of the SDGs and how the three systems interact, and how those interactions depend on past events. Some discussion by the authors explaining what assumptions they're making to use a static model would be useful, and the implications of these dynamic effects on the welfare impacts of the SDGs. For example, what if eradicating poverty irrevocably damages the climate, while first combating climate change reduces the cost of fighting poverty?

- I concur with the other reviewer that impacts on income or prices are important and should be addressed.
- Please clarify in the text why using ANNI as a measure of sustainable income allows the authors to assume \$1 of income would be spent for a 1% improvement in the indicator for the 'no poverty' goal. This assumption seems vital to simplify (5), however it isn't clear why using this measure of income allows this assumption.
- The statements:

*“For example, one surprising outcome of the preliminary welfare analysis depicted in Table 3 is the potentially large tradeoffs over 2000-2015 between attaining two economic system goals: the positive gains in poverty reduction versus the world economy becoming less successful in providing Good Jobs and Economic Growth. It appears that we are making good progress in attaining the No Poverty Goal, but ironically, it may be coming at the expense of making the global economy less sustainable.”*

*“For example, one of the surprising outcomes of our analysis is that reducing poverty over 2000-2015 may have come at the expense of making our economies less sustainable. On the other hand, the estimated net welfare gains from reducing poverty might be further boosted from the additional positive gains from simultaneous improvements in the indicators for two other related SDGs, Clean Water and Sanitation and Zero Hunger.”*

As these statements depend on the sign and magnitude of the corresponding derivatives, and they are not empirically measured in the paper, they should more accurately be characterized as hypotheses. They're very provocative, and should lead to interesting future work.