

## Timely government intervention can prevent environmental collapse in debt-based financial systems

The environment, as several news stories tell, faces a number of challenges from human activity. Besides [climate change](#), there is an [alarming rate of extinction of species](#), and concern about [soil erosion](#), [availability of fresh water](#), declines in populations of [pollinators](#) and [songbirds](#), and [loss of habitat for wildlife](#). [It has been suggested that debt-driven economic growth might be to blame](#). After all, debt is effectively borrowing money from future generations; but the environmental effects of what we do with that money are experienced now. These environmental effects can in turn have impacts on our economy, affecting [agriculture](#), [tourism](#), and even [our ability to live in certain areas](#).

Traditional economic models do not take into consideration the effects economic interventions such as increasing national debt will have on the environment. This is because doing so makes the mathematics too difficult to solve. Instead, economists refer to environmental effects as “[externalities](#)” – matters that might be important, but which the models cannot adequately address. Unfortunately, externalities are all-too-often ignored.

A relatively new modelling technique, called “[agent-based modelling](#)”, uses computer simulation to overcome the limitations of traditional economic models. Advances in computing technology over the past forty years have meant it is now feasible to implement these simulations, and explore the ways a connected social and environmental system behaves.

A [paper](#) published by Dr. Julen Gonzalez with his Ph. D. supervisory team uses agent-based modelling to examine what happens when you constrain an economic model with limited environmental resources. Dr. Gonzalez disaggregated [Prof. Steve Keen](#)’s mathematical model of debt-based economic growth so that its equations related to multiple agents with different contexts, rather than the traditional single representative agent. He then added an environment providing biomass extracted by companies to make goods to sell to consumers. Just as in Prof. Keen’s model, banks lend money to companies and speculators, but in Dr. Gonzalez’s model, money can be used by firms to extract biomass, as well as by speculators to buy and sell credit.

Dr. Gonzalez explores scenarios of fractional- and full-reserve banking. [Full-reserve banking](#) was considered (and eventually rejected) in Switzerland after [a proposal for reforming the financial system](#) was made by the Swiss Association for Monetary Modernisation ([MoMo](#)). It requires commercial bank to have all their customers’ deposits ready for them to withdraw at any time. Under [fractional-reserve banking](#), only a percentage of the deposits are kept; the rest can be issued as loans, allowing banks to make a profit from the interest. Dr. Gonzalez used a figure of 2% in the fractional-reserve scenarios, in accordance with the [European Central Bank](#)’s policy.

In the fractional-reserve scenario, the model shows the economy growing as the biomass in the environment is extracted. However, beyond a critical point, the rate of extraction exceeds the rate of growth of biomass. The extraction becomes unsustainable, and the

economy collapses as the biomass crashes to zero. The full-reserve scenario is able to sustain biomass, but economic growth hovers around 0%.

Dr. Gonzalez then explored what happened if the government intervened to limit resource extraction under the fractional-reserve monetary system. In his model, if the government intervention started once the natural resource stock was at 25% of its original level, this was insufficient to prevent environmental and economic collapse. But if the government intervention started at 50%, natural resource stock was exploited sustainably, whilst maintaining a higher level of GDP growth than the full-reserve scenario. In general, this means that there is a critical point at which governments should intervene in the monetary system to avert disaster caused by debt-driven over-exploitation of resources.

Importantly, the government interventions implemented in Dr. Gonzalez's model included limitations on speculation – this constrains what debt can be used for. Hence, in addition to promoting timely government intervention in the interests of environmental and economic sustainability, Dr. Gonzalez has shown that it matters what the money lent is used for. Simply using money to generate more money requires unsustainable levels of resource extraction to generate value to pay off the interest. This cannot increase indefinitely if resources are finite. Debt, *per se*, need not be problematic, however. What matters is how loans are used. Banks therefore have an important role to play in ensuring environmental – and economic – sustainability in being more discerning about what their customers propose to do with their loans.

[“It's not the 'what', but the 'how': Exploring the role of debt in natural resource \(un\)sustainability”](#), by Julen Gonzalez-Redin, J. Gareth Polhill, Terence P. Dawson, Rosemary Hill and Iain J. Gordon, was published in [PLoS ONE](#) on 20 July 2018.