

# Macroeconomic Assessment

## Key Messages

- The ECONADAPT project proposed a methodological approach to extend Computable General Equilibrium (CGE) modelling to analyse the economic implications associated to two specific adaptation measures: i) [Coastal zone protection against sea-level rise](#), and ii) [use of irrigation services to reduce the adverse effects of climate change in agriculture](#).
- Some adaptation measures, like coastal protection, require important up-front investments which can only be provided with total or substantive support by the public sector. These interventions constitute planned adaptation. Although additional public expenditures are high, the positive effects in terms of reduced damages, lower GDP losses and higher pre-existing tax revenues respect to the case of policy inaction, can trigger in the medium term an improvement of public finance sustainability reducing the debt and deficit GDP ratios even when adaptation expenditure is financed in deficit spending (issuing government adaptation bonds) and not with new taxes.
- In some other cases, second-order effects may confound the adaptation benefits. This is what found in some countries for irrigation services. Even though, every time it is applied, irrigation expansion reduces production losses from climate change, final effects on GDP are not always positive for all. International trade and competitiveness effects in the market of agricultural commodities will indeed produce both winners and losers independently upon the initial widespread productivity gains.
- When implemented together, adaptation and mitigation could entail lower GDP costs than when implemented separately. The CGE analysis highlighted a positive interaction effect explained by the revenues that mitigation actions implemented with taxes or auctioned permits raise. These revenues accrue to the public budget; decrease the need by the public sector to issue bonds; decrease thus the crowding out of public current expenditure on private investment, and, eventually, decrease the penalization on the capital accumulation process.
- The introduction of the Climate Fund is clearly beneficial for the recipients i.e. developing countries. What is interesting to note is that donors may also experience lower GDP losses. This result depends upon two factors. Donors can benefit from the lower contraction of economic activity in developing countries. But there is also a more subtle mechanism. When receiving the funding, economic activity in developing countries increases, emissions are higher and the carbon tax needed to achieve the respective INDCs is higher (slightly). This favours the relative competitiveness of developed countries goods and services in international markets.

## Introduction

One key research areas for the macroeconomic assessments of climate policies is the trade-off between mitigation and adaptation. In brief, mitigation aims to reduce climate change damages by slowing GHG emissions, while adaptation aims at reducing climate change damages reducing the impacts on human and natural systems.

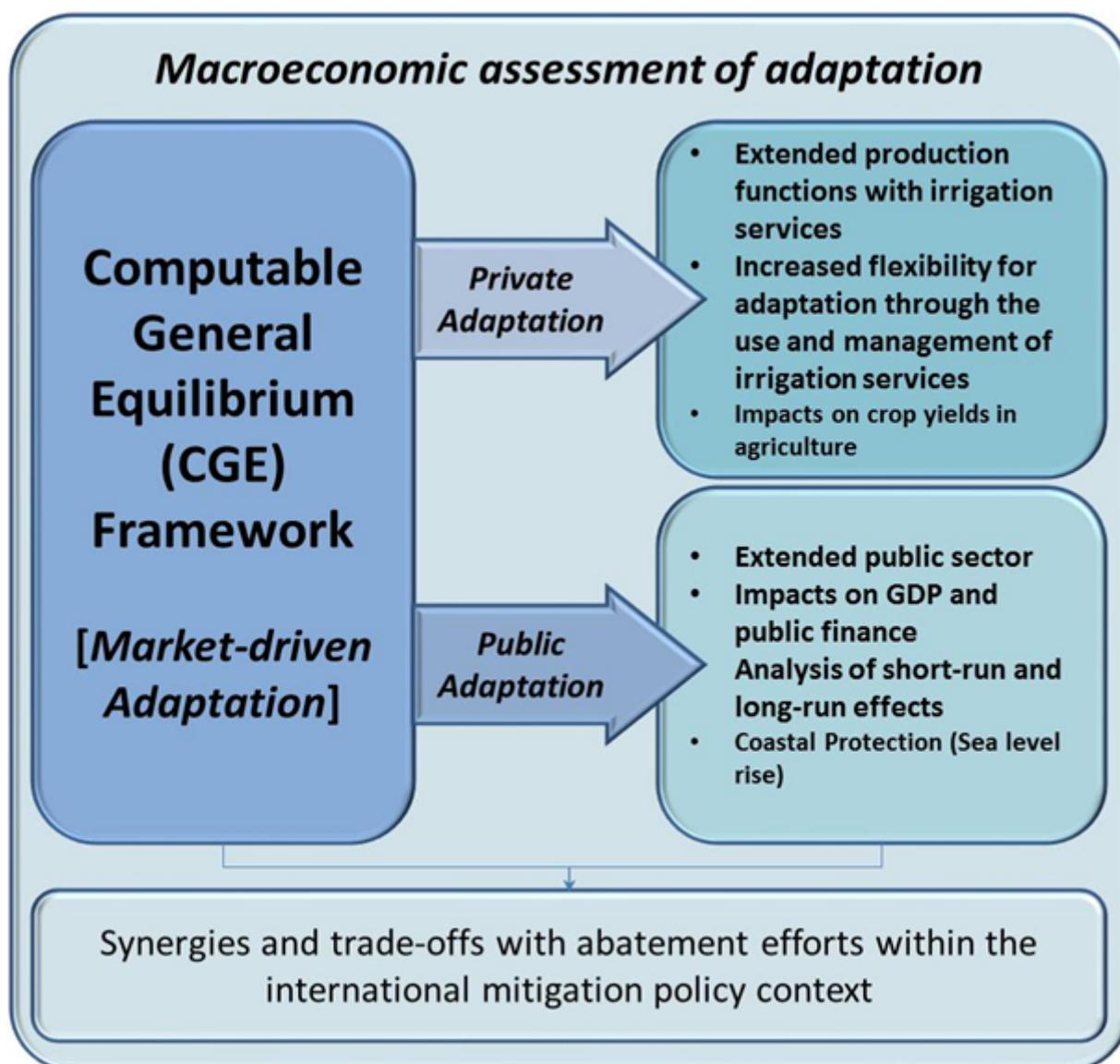
After conducting the analysis of the economic effects of coastal protection and irrigation in separated studies, ECONADAPT has thus conducted a global analysis on the economic implications resulting from the combination of a mitigation policy simulating the pledges countries submitted to the UNFCCC as Intended Nationally Determined Contributions (INDCs) during the last COP 21 in Paris, with adaptation consisting in optimal protection against sea-level rise (SLR). Both of them are implemented by 2030. The [full reports and case studies assessments](#) are also available.

## The additional challenges of adaptation economic appraisal in macroeconomic assessments

Generally speaking, the CGE methodology is particularly suited to address the effects of market-driven adaptation, i.e. agents reactions triggered by changes in relative prices. However, modelling planned adaptation measures is much more challenging. To the lack of data, and the specificity of the different types of adaptation, there are also methodological complexities to adequately capture the multiplicity of channels through which adaptation expenditure operates and produces effect.

Against this background, ECONADAPT proposed different methodological approaches to conduct CGE macroeconomic assessments of adaptation going beyond the usual autonomous market-driven type (see Figure 1). The first, addressed planned adaptation in the form of public spending for coastal protection. The ECONADAPT project extended a known CGE model with a more detailed description of the public sector allowing to account not only for the final effects of coastal protection on GDP, but also for its impacts on public finance.

The second relates to the possibility of private agents to adapt by changing the demand of specific services able to decrease adverse impacts of climate change. For this particular case, the ECONADAPT project focused on the use of irrigation services as a strategy to reduce yield losses. For this purpose the production function of the agricultural sector in the CGE model mentioned before, has been extended to account for irrigation services.



**Figure 1: Synthesis of the macroeconomic assessment methodology in ECONADAPT**

# The interaction of adaptation, mitigation, and international support for climate change policies

The ECONADAPT project assessed the effects on GDP and public budgets of interacting adaptation, mitigation, and international support for climate change policies from developed to developing countries. This was done considering adaptation against sea-level rise financed with “adaptation bonds” jointly with the international mitigation efforts deriving from the INDCs submitted to the 2015 COP 21 in Paris for 2030. In addition, the analysis examined the effects of a Climate Fund based on the pledge by developed countries to provide between \$ 30 and \$100 billion per year by 2020 to developing regions for mitigation and adaptation activities.

Adaptation and mitigation implemented jointly could entail slightly lower GDP costs than the sum of mitigation and adaptation GDP costs when implemented in isolation. This positive interaction effect is explained by the revenues that mitigation actions implemented with taxes or auctioned permits raise. These revenues accrue to the public budget; decrease the need by the public sector to emit bonds and thus borrow money from the private sector to finance coastal protection expenditures; decrease thus the crowding out of public current expenditure on private investment, and, eventually, decrease the penalization on the capital accumulation process.

The introduction of the Climate Fund is clearly beneficial for the recipients i.e. developing countries. All of them see a decrease of both GDP losses and deficits. What is interesting to note is that developed countries, even though experiencing a deficit increase, as part of their financial resources are channelled out, may experience lower GDP losses as well. This result depends upon two factors. The first and more straightforward is that developed countries can benefit from the lower contraction of economic activity in developing countries. But there is also a more subtle mechanism. When receiving the funding, economic activity in developing countries increases (slightly), emissions are higher (slightly) and the carbon tax needed to achieve the respective INDCs is higher (slightly). This favours the relative competitiveness of developed countries goods and services in international markets.

All in all, there are two key messages from the analysis conducted. The first message regards the fact that public adaptation expenditure crowds out private activity. The second key message is related to the way adaptation is financed. Indeed, the distortionary crowding out effect of adaptation and the consequent penalization of growth is lower when adaptation expenditures are financed through taxes rather than through public debt. While taxes have a recessive effect on private consumption, public debt crowds out private investment. The latter effect is more noxious for economic growth and capital accumulation. In this sense, coupling adaptation with mitigation efforts based on a carbon tax can be an appropriate strategy. Developed countries can benefit from supporting developing countries in their climate change policies. The lower contraction of developing countries’ economic activity can benefit developed countries either directly through lower demand contraction internationally, but also through lower/higher relative competitive losses/gains following the implementation of mitigation objectives.

Econadapt insights

[Economy-wide implications of planned adaptation: The case of sea level rise](#)

[Economy-wide implications of planned adaptation: The case of agriculture](#)

[The role of autonomous adaptation in global assessments at global level](#)

[Uncertainties and causes of uncertainties in climate change adaptation](#)

[Uncertainties and risk analysis in climate change adaptation](#)

[Sourcing and using climate information for economic assessments of adaptation](#)