école normale supérieure paris—saclay

Modeling the Relation between Adaptation Investment and Public Debt

Soutenance de Mémoire d'Initiation à la Recherche

Davi Méaille

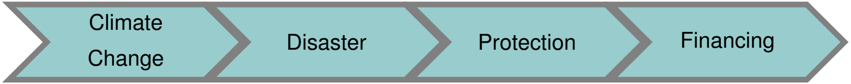
Student in Master of Economics

ENS Paris Saclay

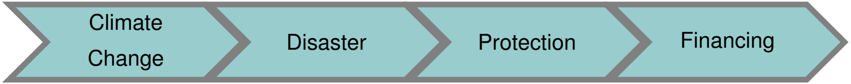
July 5, 2022

Table of Contents

Remainder of the subject

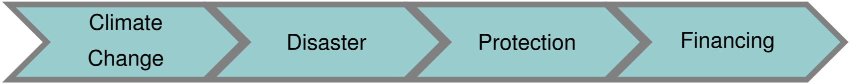


Remainder of the subject



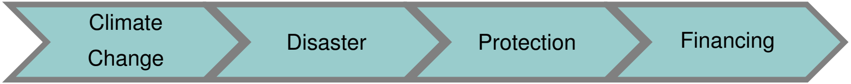
- Climate change $\Longrightarrow$ Natural Disasters

Remainder of the subject



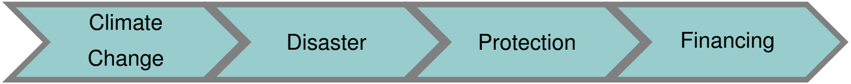
- Climate change $\Longrightarrow$ Natural Disasters
- Impact of climate related natural disasters (floods, heatwaves, landslides ...) $\Longrightarrow$ direct and indirect

Remainder of the subject



- Climate change $\Longrightarrow$ Natural Disasters
- Impact of climate related natural disasters (floods, heatwaves, landslides ...) $\Longrightarrow$ direct and indirect
- Mitigation vs Adaptation

Remainder of the subject



- Climate change $\Longrightarrow$ Natural Disasters
- Impact of climate related natural disasters (floods, heatwaves, landslides ...) $\Longrightarrow$ direct and indirect
- Mitigation vs Adaptation
  - How to protect ?
  - Large literature on natural disasters and public debt

Choice of the topic

- Willingness to understand how to use a model and how to use it for research purposes
- Theme suggested by my supervisor: the sustainability of European public debt in the face of climate change related natural disasters

Research Question

Start:

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Research Question

Start:

Question of the sustainability of European public debt with climate change related natural disaster

Esti-
mates:

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Esti-mates: Not very clear on European countries (rather small developing island countries)

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Esti-mates: Not very clear on European countries (rather small developing island countries)

Fore-cast:

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Esti-mates: Not very clear on European countries (rather small developing island countries)

Fore-cast: Literature can forecasts changes in weather but not precisely in economic costs

école normale supérieure paris–saclay

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Esti-mates: Not very clear on European countries (rather small developing island countries)

Fore-cast: Literature can forecasts changes in weather but not precisely in economic costs

Eu-rope:

Research Question

Start:	Question of the sustainability of European public debt with climate change related natural disaster
Esti-mates:	Not very clear on European countries (rather small developing island countries)
Fore-cast:	Literature can forecasts changes in weather but not precisely in economic costs
Eu-rope:	Most significant effects of disasters: geological disasters but increased frequency of climate related natural disasters

Research Question

Start: Question of the sustainability of European public debt with climate change related natural disaster

Esti-mates: Not very clear on European countries (rather small developing island countries)

Fore-cast: Literature can forecasts changes in weather but not precisely in economic costs

Eu-rope: Most significant effects of disasters: geological disasters
but increased frequency of climate related natural disasters

Liter-ature:

Research Question

Start:	Question of the sustainability of European public debt with climate change related natural disaster
Esti-mates:	Not very clear on European countries (rather small developing island countries)
Fore-cast:	Literature can forecasts changes in weather but not precisely in economic costs
Eu-rope:	Most significant effects of disasters: geological disasters but increased frequency of climate related natural disasters
Liter-ature:	Mechanisms of impact on public debt not did not consider adaptation costs

école normale supérieure paris–saclay

Research Question

Start:	Question of the sustainability of European public debt with climate change related natural disaster
Esti-mates:	Not very clear on European countries (rather small developing island countries)
Fore-cast:	Literature can forecasts changes in weather but not precisely in economic costs
Eu-rope:	Most significant effects of disasters: geological disasters but increased frequency of climate related natural disasters
Liter-ature:	Mechanisms of impact on public debt not did not consider adaptation costs

The Importance of Timing

The Importance of Timing

Initial questions on what is more optimal

The Importance of Timing

Hard to answer with a model

Initial questions on what is more optimal

The Importance of Timing

- Simpler: model explaining potential mechanisms between capital and debt
- Hard to answer with a model
- Initial questions on what is more optimal

The Importance of Timing

Observations on IRFs and behavior of the model that the concrete implementation of adaptation capital has the main role

Simpler: model explaining potential mechanisms between capital and debt

Hard to answer with a model

Initial questions on what is more optimal

The Importance of Timing

- Intuitive, and thus the model is used to explain it, differentiating time-to-build and frictions
- Observations on IRFs and behavior of the model that the concrete implementation of adaptation capital has the main role
- Simpler: model explaining potential mechanisms between capital and debt
- Hard to answer with a model
- Initial questions on what is more optimal

Time-to-build vs frictions on investment

Time-to-build of capital

- Does not prevent adjustment of investment, but delays the effective realization of the capital
- The investment depends on the benefit of the capital during the period of actual realization

école normale supérieure paris–saclay

Time-to-build vs frictions on investment

Time-to-build of capital

- Does not prevent adjustment of investment, but delays the effective realization of the capital
- The investment depends on the benefit of the capital during the period of actual realization

Frictions on investment

- Decrease the ability of investment to adjust totally suddenly, by increasing the costs of adjustment
- Optimal investment is thus realized progressively
- And less largely

Impact on Public debt

- Use of a simplified rule on lump-sum tax ratio:

Policy Rule

$$t_t = \lambda b_{t-1} + \mu - g_t \tag{1}$$

Impact on Public debt

- Use of a simplified rule on lump-sum tax ratio:

Policy Rule

$$t_t = \lambda b_{t-1} + \mu - g_t \quad (1)$$

- Simplify analysis. Downside: loss in richness of mechanisms
- Explain that the reactions of debt depend largely on mechanisms for implementation of adaptation capital

Impact on Public Debt

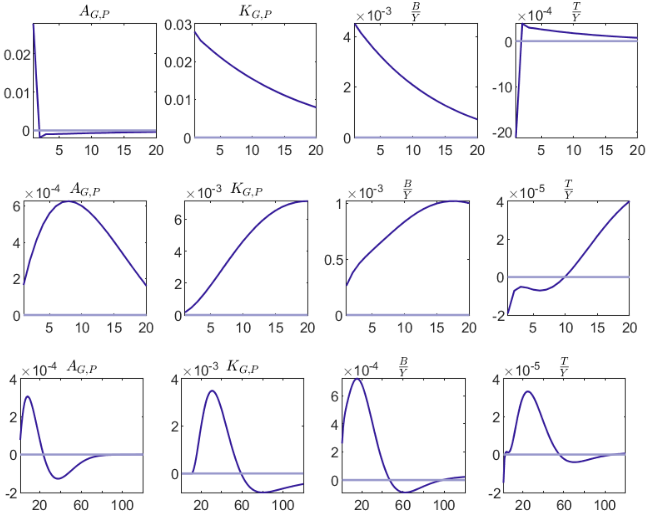
Time-to-build

- Decrease the magnitude of indebtedness
- Because decrease the magnitude of adaptation investment

Frictions on investment

- Force indebtedness to progressively increase during adjustment, before decreasing
- As shock fades away, decrease the magnitude of investment

Timing and Public Debt



Practical implications

What policy recommendations with this model?

- Optimal magnitude of adaptation investment depends on its time-to-build (if no future shock)
- Lump-sum taxes decrease first with the increase in public expenditures and then increase to cool public indebtedness (according to our debt rule)

Practical implications

What policy recommendations with this model?

- Optimal magnitude of adaptation investment depends on its time-to-build (if no future shock)
- Lump-sum taxes decrease first with the increase in public expenditures and then increase to cool public indebtedness (according to our debt rule)

The meaning of indebtedness during climate change

- An expansion of public debt linked to a good management of adaptation?
- Problem: the financial markets and how they will perceive the risks: between the risks of higher debt and more vulnerability
- Also the risk of non-enough adaptation if debt constraints too high?

Limitation 1

Only one shock that fades away fast

Agents should anticipate future shocks

Investment with time-to-build: too low actualized marginal benefit since one shock

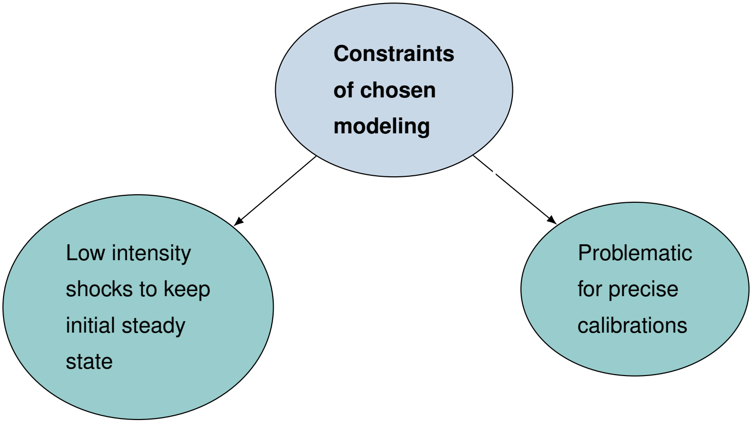
Limitation 2

Limit in the interrelation of debt with the economy

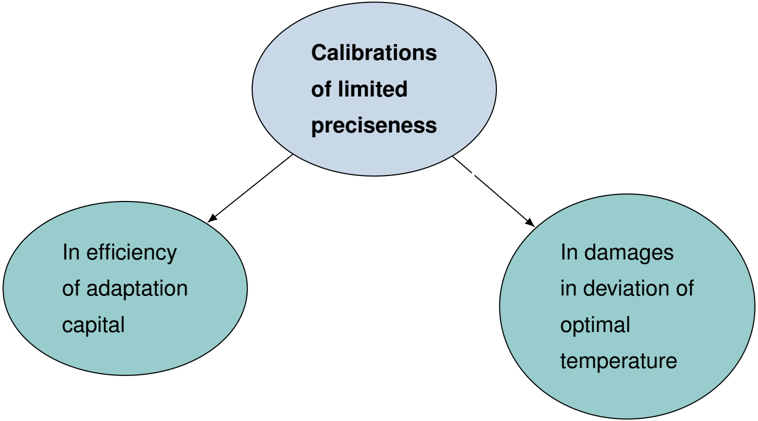
No impact on the economy: key mechanisms missing

No constraint on the possibility of indebtedness

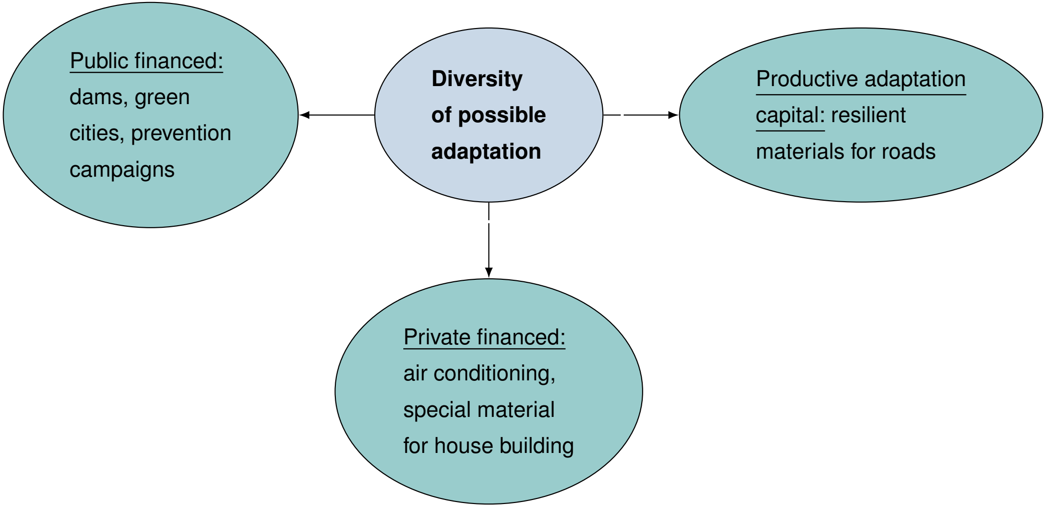
Limitation 3



Limitation 4



Limitation 5



Thank You

for Listening.

Do you have

Questions ?