



CENTRE
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Agglomeration economies and spatial sustainability

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Motivation of the research

▶ Lack of knowledge

❑ Sustainable development -> spatial dimension ?

❑ Regional analyses -> Environmental consequences of location choices by agents and activities ?

→ The case of **Climate Change**: emissions from

i. Production activities

ii. Transport

Objectives

1. To contribute to the **New Economic Geography (NEG)** literature → include **Pollution and Spatial dynamics**
2. To provide the so-far abstract concept of **'Spatial Sustainability'** with **analytical formalization**
3. To pave the way for empirical testing of the **sustainability indicator in the context of climate change**

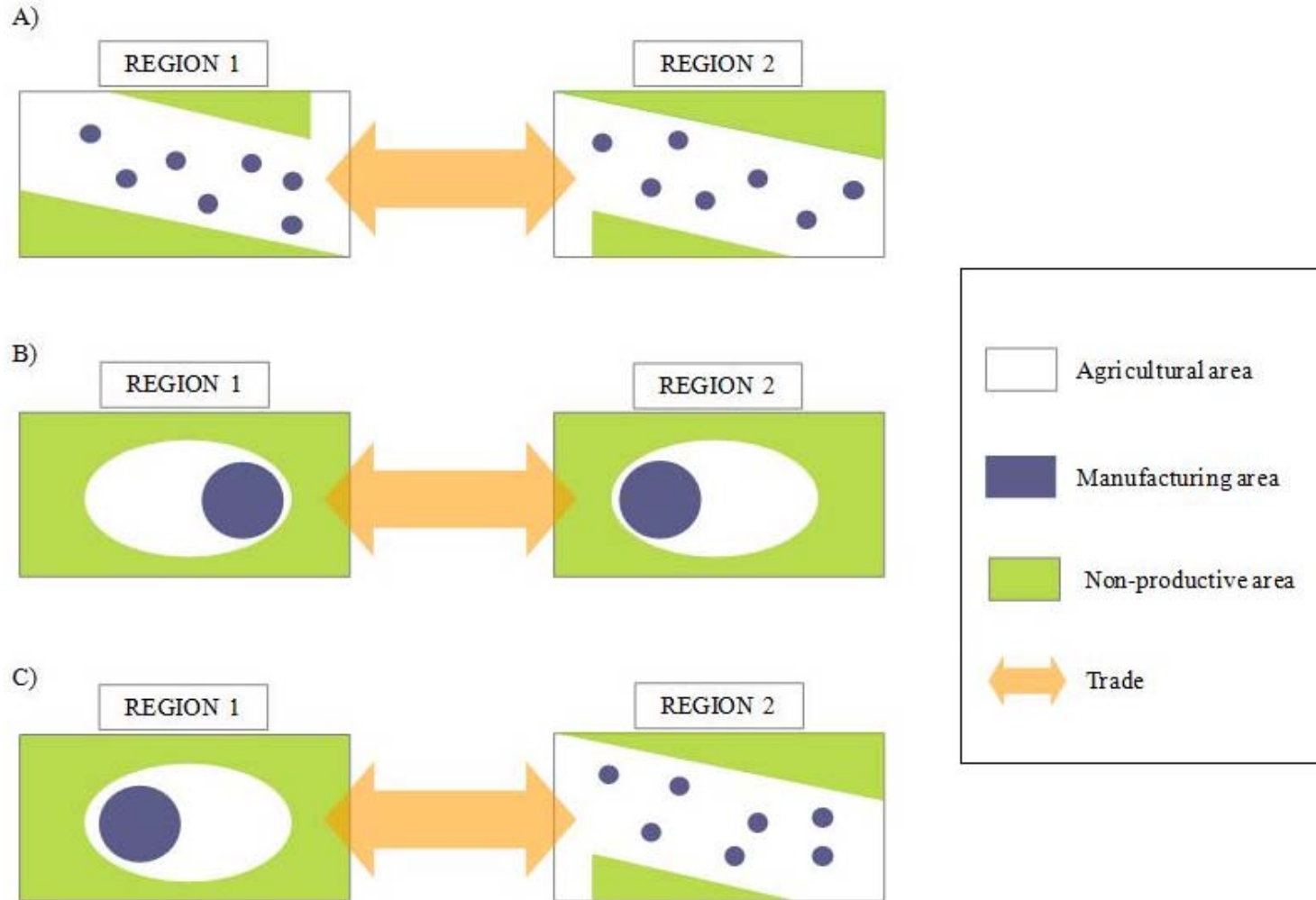
The Method

- ▶ Two-region approach
 - Different spatial configurations
- ▶ Extending the CP Krugman model with agglomeration spillovers, pollution dynamics and trade advantages (Spatial Sustainability Drivers)
- ▶ Stylistic application – numerical example to inform on the design of spatially sustainable configurations of an economy

Spatial configurations

- ▶ Dual Economy: Two-region (j,k), two-sectors (F, M), two input factors (H, L)
- ▶ Shape of a region:
 - ❑ 3 land-use types (Agriculture, Manufacture, non-productive land)
 - ❑ 2 structural types for Manufacture
 - Concentrated: high agglomeration spillover
 - Dispersed: low agglomeration spillover
- ▶ 3 alternative spatial configurations

The Method: Spatial configurations



The Core Model

- ❑ Consumption, Production and Welfare
 - Short-run equilibrium
- ❑ Dynamics :
 - Migration of skilled workers (indirect utility)
 - Local and Global Pollution (flow and stock)
- ❑ Sustainable long-run equilibrium conditions:
 - No incentive for migration
 - Non-increasing pollution stock in the LT

Results (1)

Sustainability condition on Assimilation and Trade

The economy is parametrized by

- ▶ Trade barrier ($0 \leq \phi \leq 1$)
 - ❑ $\phi = 1$: free trade ; $\phi = 0$: autarky
 - ❑ Trade cost addresses alternative pricing policies on :
 - Use of energy
 - Volume of trade
- ▶ Assimilation capacity of the environment (A)
 - ❑ Condition on sustainability : 'long-run emissions lower than A '

Results (1)

Sustainability condition on Assimilation and Trade

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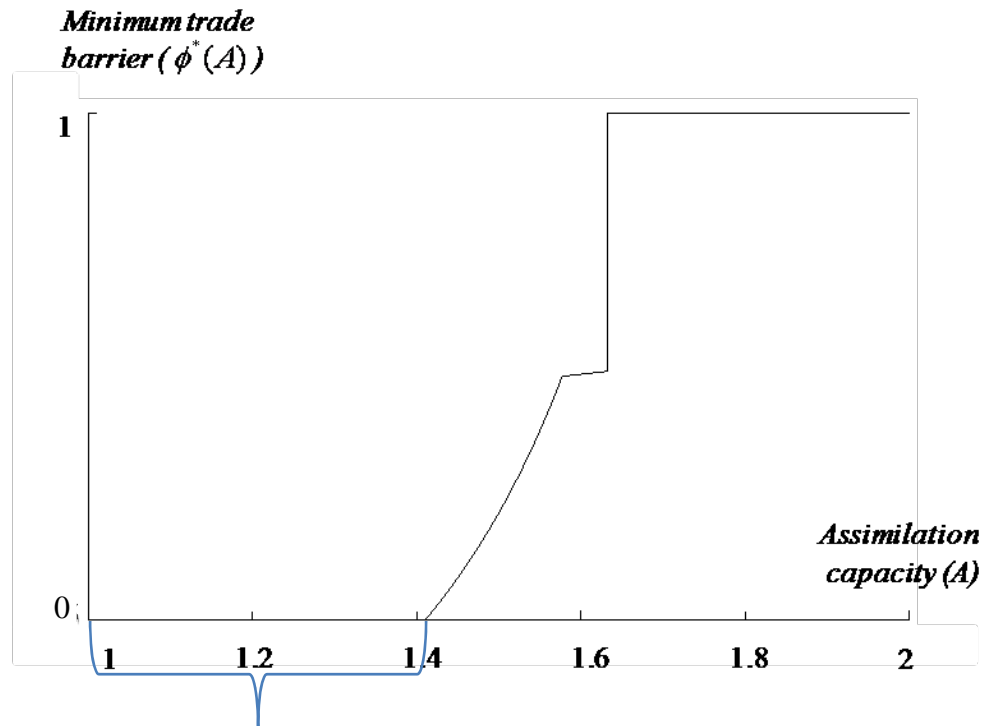
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What is the minimum trade barrier that lowers long-run emissions wrt given assimilation capacity A ?

$$\rightarrow \phi^*(A) \begin{cases} \phi < \phi^*(A) : \text{sustainable} \\ \phi \geq \phi^*(A) : \text{non sustainable} \end{cases}$$

Results (1)

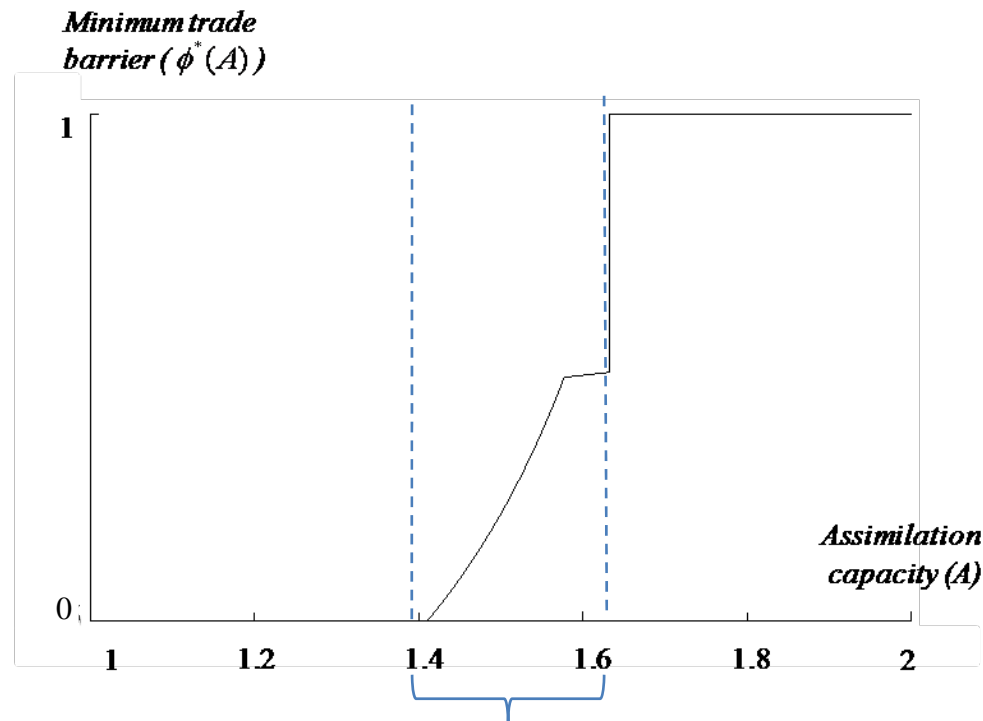
Sustainability condition on Assimilation and Trade



For low assimilation values, the sustainability condition cannot be matched $\phi^*(A) = 0$

Results (1)

Sustainability condition on Assimilation and Trade

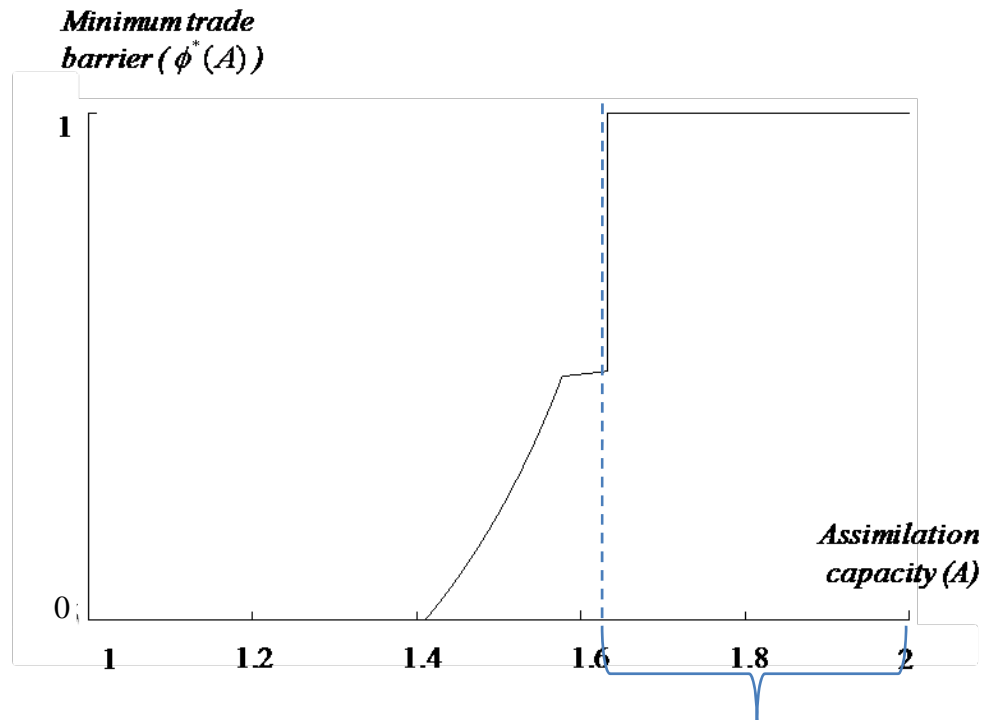


For intermediate assimilation values, the sustainability condition is satisfied only if trade cost is high enough

$$0 < \phi^*(A) < 1$$

Results (1)

Sustainability condition on Assimilation and Trade



For high assimilation values, the sustainability condition is satisfied even with free trade $\phi^*(A) = 1$

Results (2)

Sustainability condition on Assimilation, Trade and Spatial organization

The economy is parametrized by

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Sustainability condition on Assimilation, Trade and Spatial organization

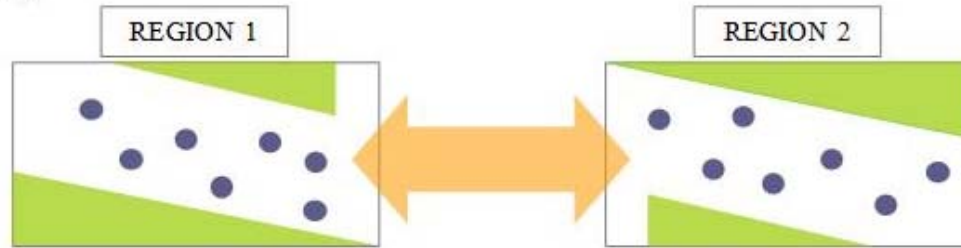
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- ▶ Trade barrier ($0 \leq \phi \leq 1$)
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 - ❑ Trade cost addresses alternative pricing policies on :
 - Use of energy
 - Volume of trade
- ▶ Assimilation capacity of the environment (A)
 - ❑ Condition on sustainability : long-run emissions lower than A
- ▶ Spatial organization (3 alternative configurations)

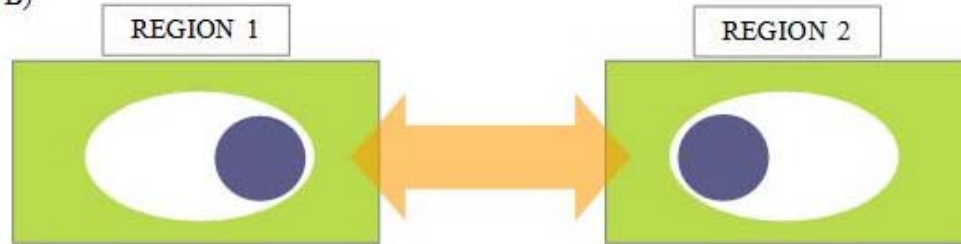
What is the relative role of trade costs and spatial organization to reach sustainability?

Spatial configurations

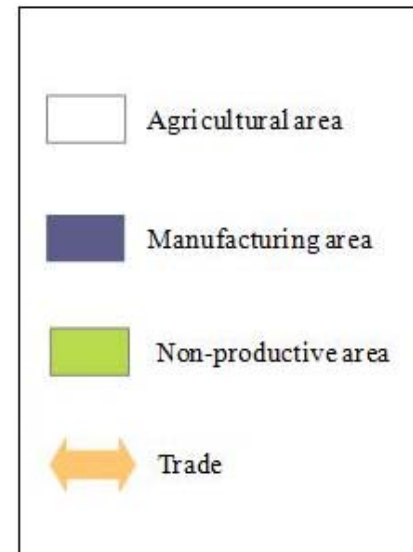
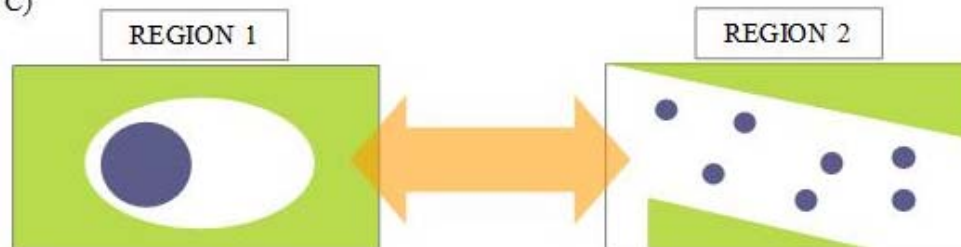
A)



B)



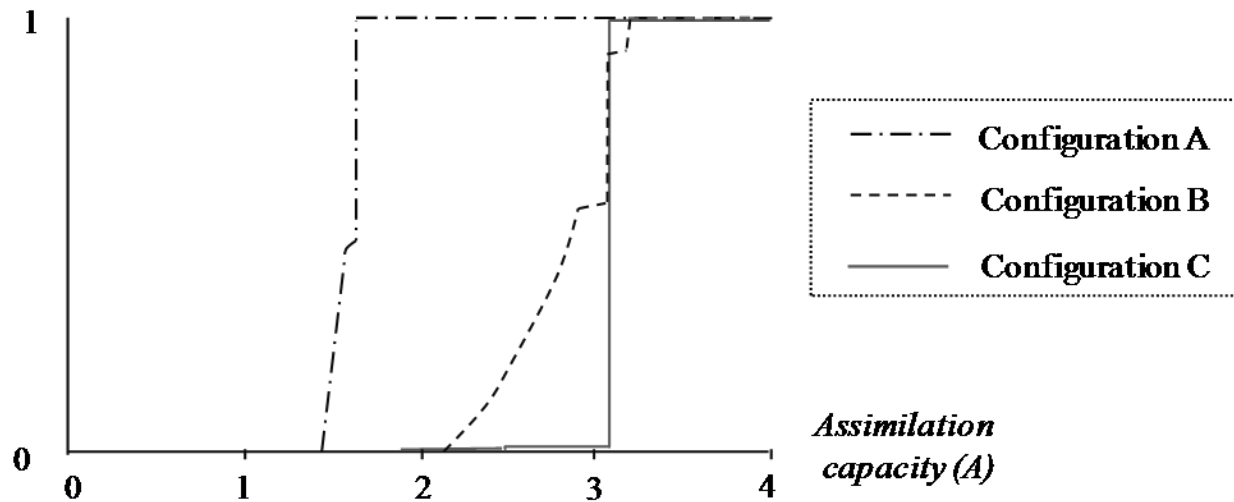
C)



Results (2)

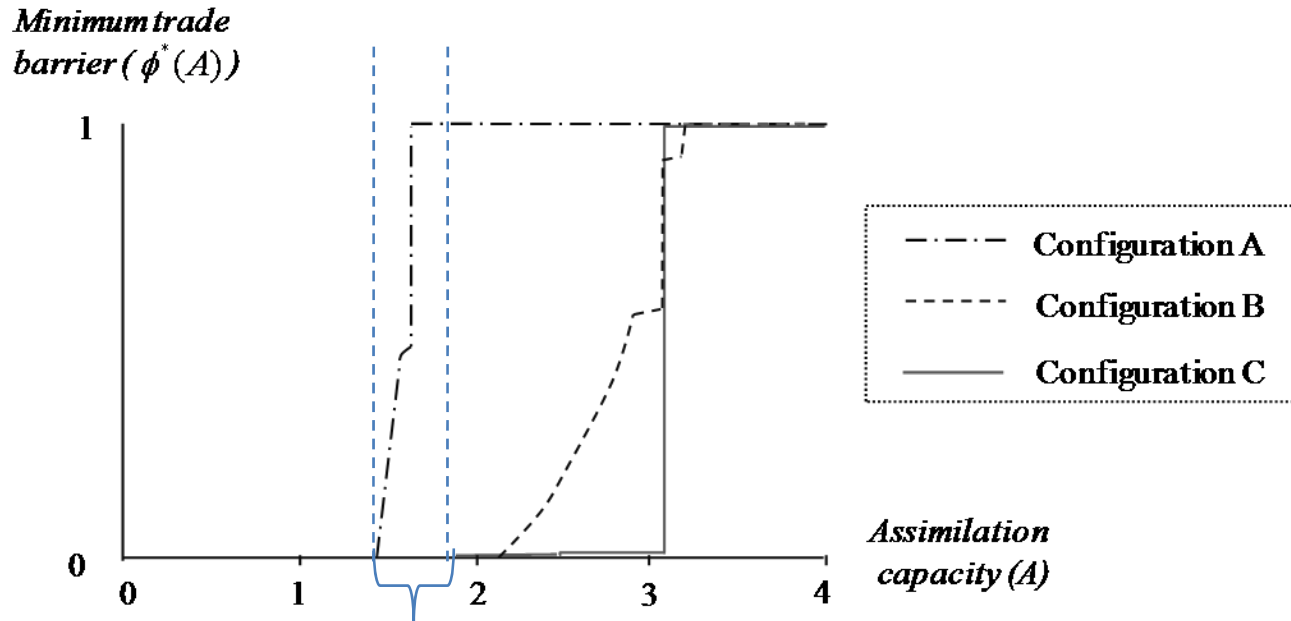
Sustainability condition on Assimilation, Trade and Spatial organization

Minimum trade barrier ($\phi^(A)$)*



Results (2)

Sustainability condition on Assimilation, Trade and Spatial organization

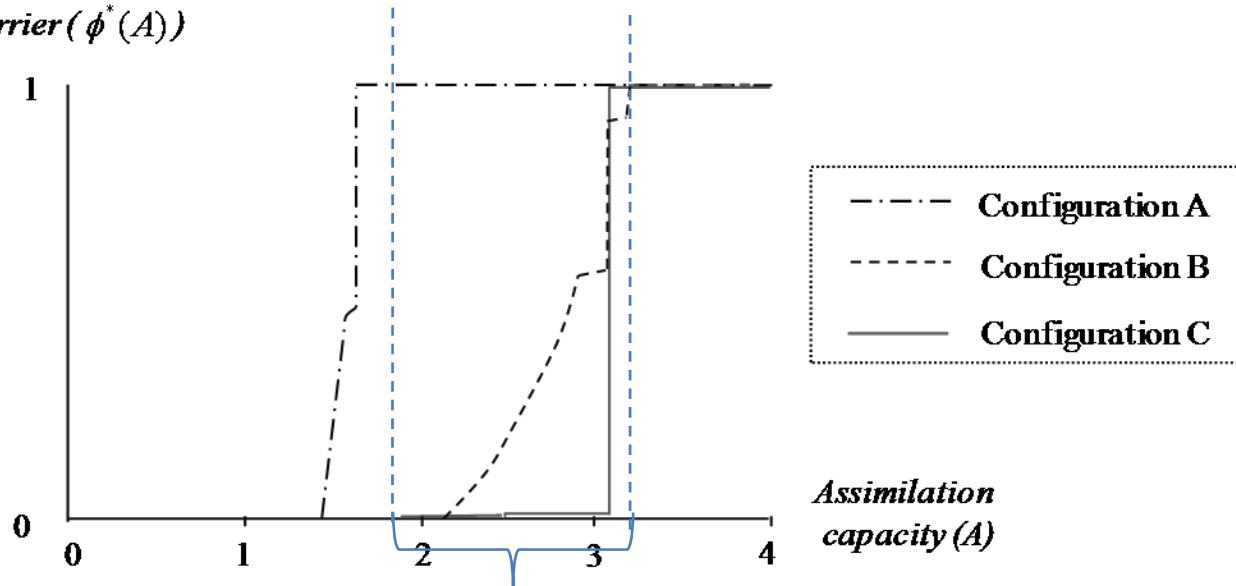


For low assimilation values, only spread vs spread configuration (config. A) is sustainable.

Results (2)

Sustainability condition on Assimilation, Trade and Spatial organization

Minimum trade barrier ($\phi^(A)$)*

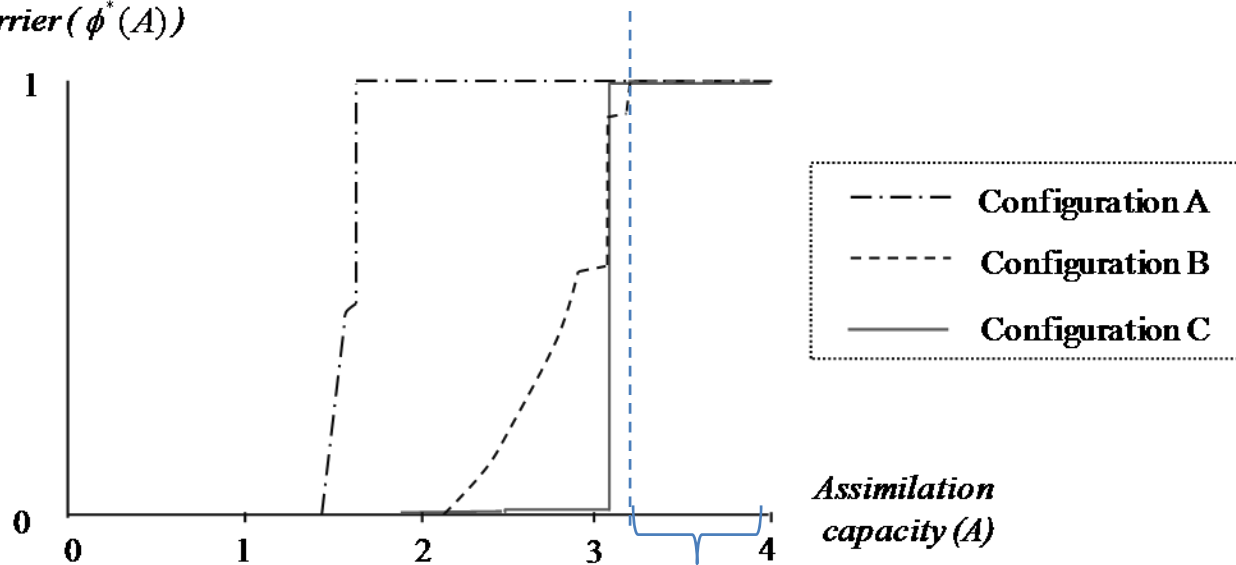


For intermediate assimilation values, several configurations can be sustainable, but with different restrictions (costs) on trade.

Results (2)

Sustainability condition on Assimilation, Trade and Spatial organization

Minimum trade barrier ($\phi^(A)$)*

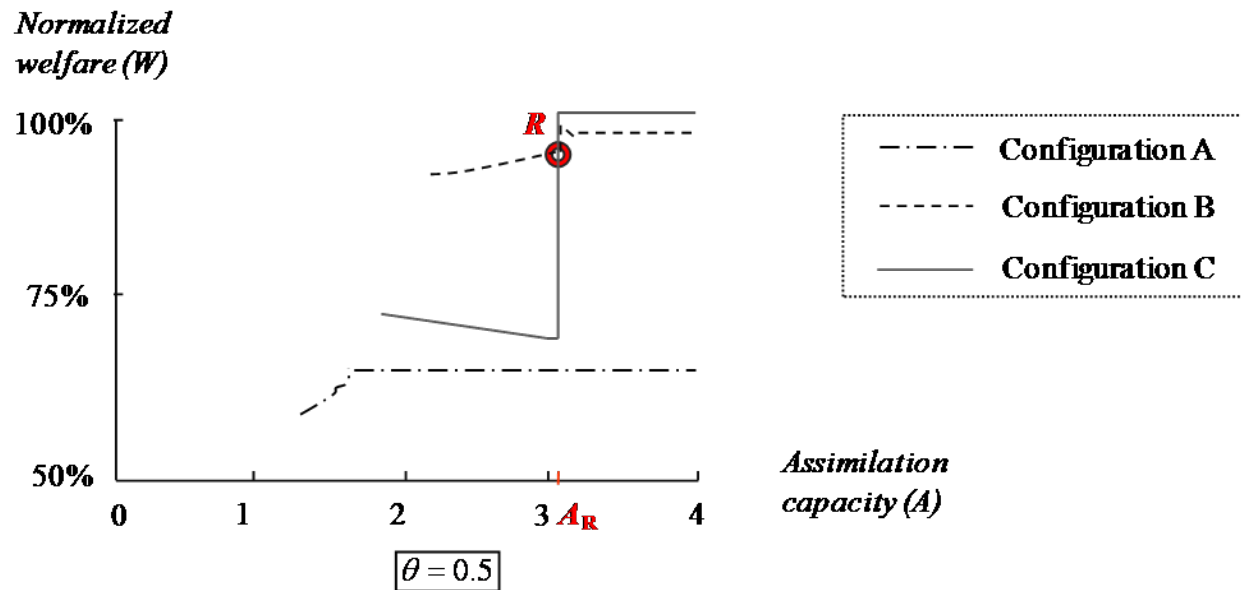


- For high assimilation values, all configurations are sustainable, whatever the restriction on trade (i.e., cost).

Results (3)

Welfare analysis

Socially optimum configuration according to specific assimilation capacity levels



Conclusions (1)

- Importance of coupling spatial and environmental dimensions in a welfare analysis → (costs of) Climate Change
- More thorough comprehension of the sustainability mechanisms
- Respective role of policy instruments on trade vs. local spatial organization

Conclusions (2)

- For low assimilation capacity, only symmetric spread-out spatial organization (config. A) leads to sustainability (through production)
- For high assimilation capacity, a more balanced configuration (config. C) is more rewarded in terms of welfare (through trade)

Questions or Comments?

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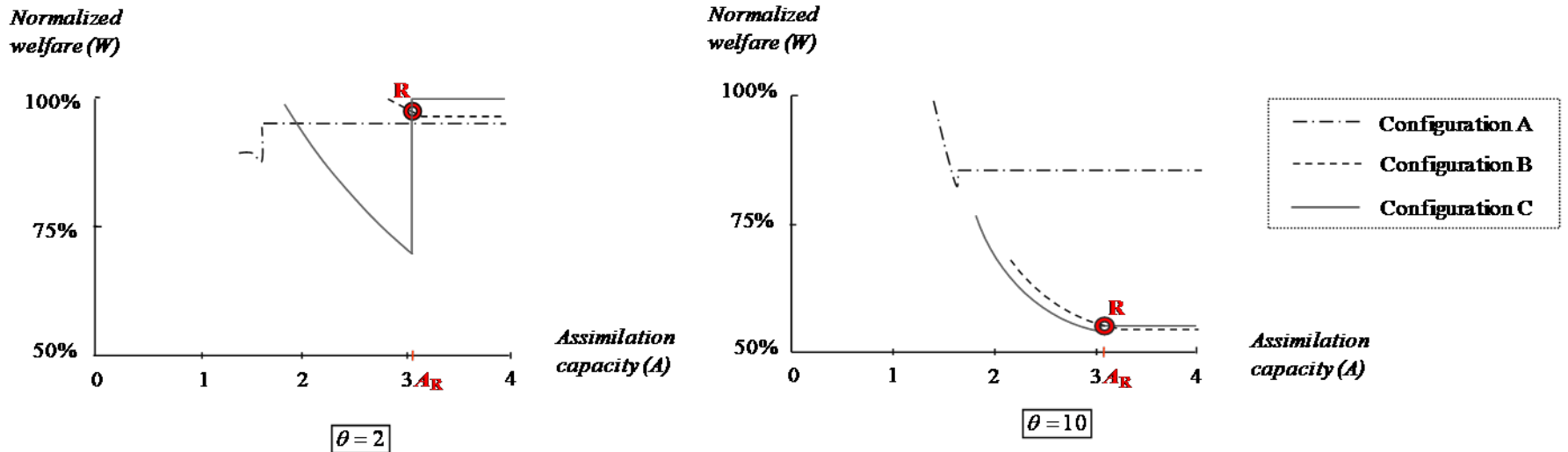
Focus of the research

► Research questions:

1. What are the drivers of spatial sustainability and how can their **welfare-offsetting** effects be embedded in general equilibrium framework?
2. To what extent the economy's spatial structure matters to the debate on **sustainability and climate change**?

Results (4)

Increase in pollution externalities burden



High values of the environmental burden modify the ranking: configuration A is regarded as enhancing welfare