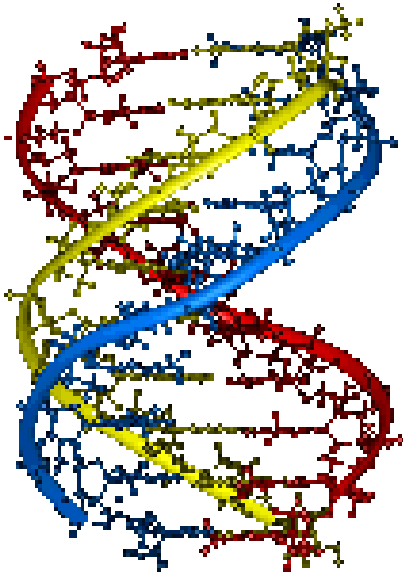


The Knowledge-based Economy and a Triple Helix of university-industry-government relations



Loet Leydesdorff

**Amsterdam School of Communications
Research (ASCoR),**

University of Amsterdam

<http://www.leydesdorff.net>

What is the Knowledge Base of an Economy?

- **How is a knowledge base constructed within social systems and under which conditions can it be stabilized and globalized?**

How can a knowledge base be measured?

- **The endogenous reduction of uncertainty as a statistical indicator.**

Can a knowledge base also be modeled and simulated? (Anticipatory Systems)

“The shift to a digital, **knowledge-based economy, prompted by new goods and services, will be a powerful engine for growth, competitiveness and jobs. In addition, it will be capable of improving citizens’ quality of life and the environment.”**

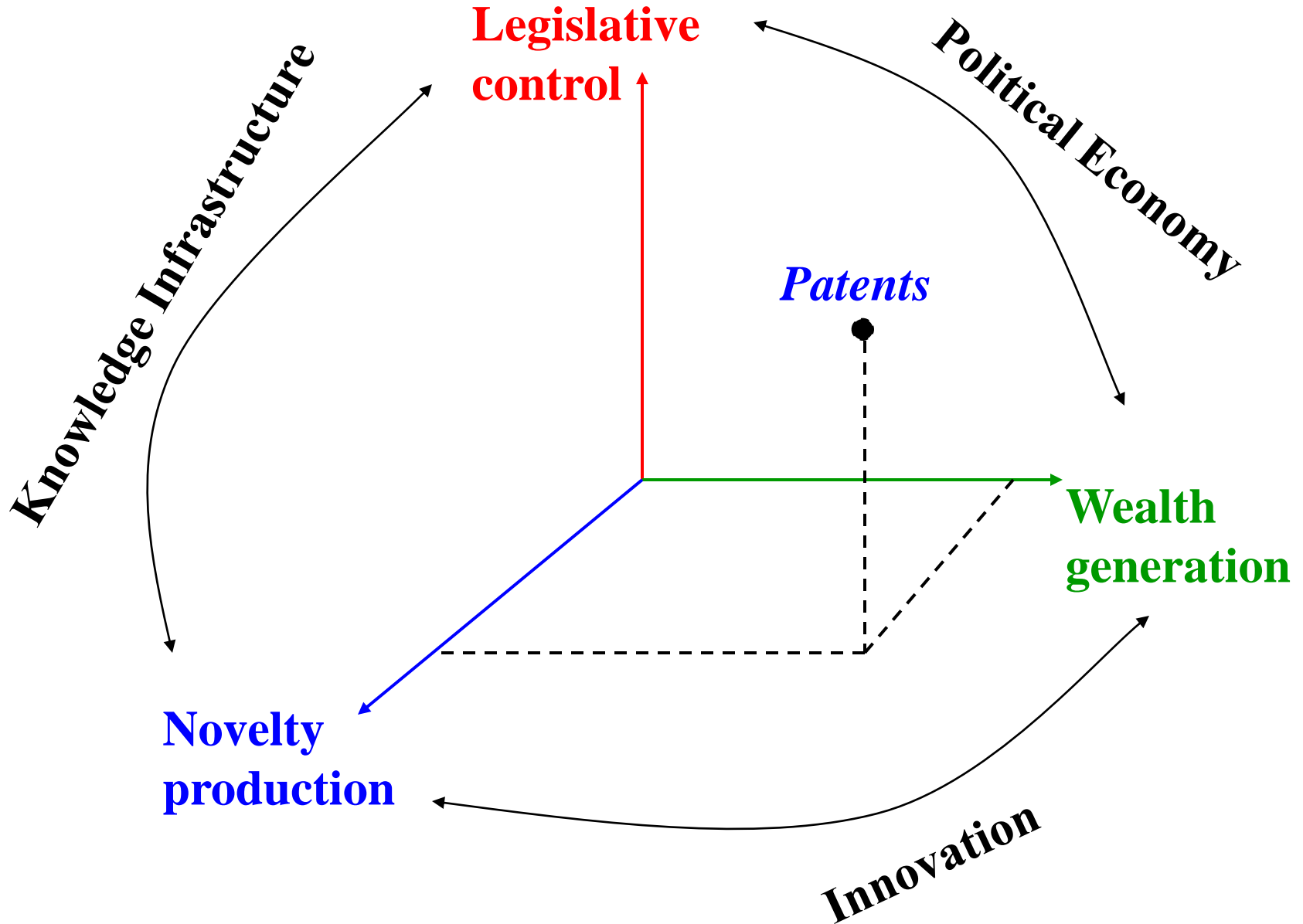
*European Summit,
Lisbon, 23-24 March 2000*

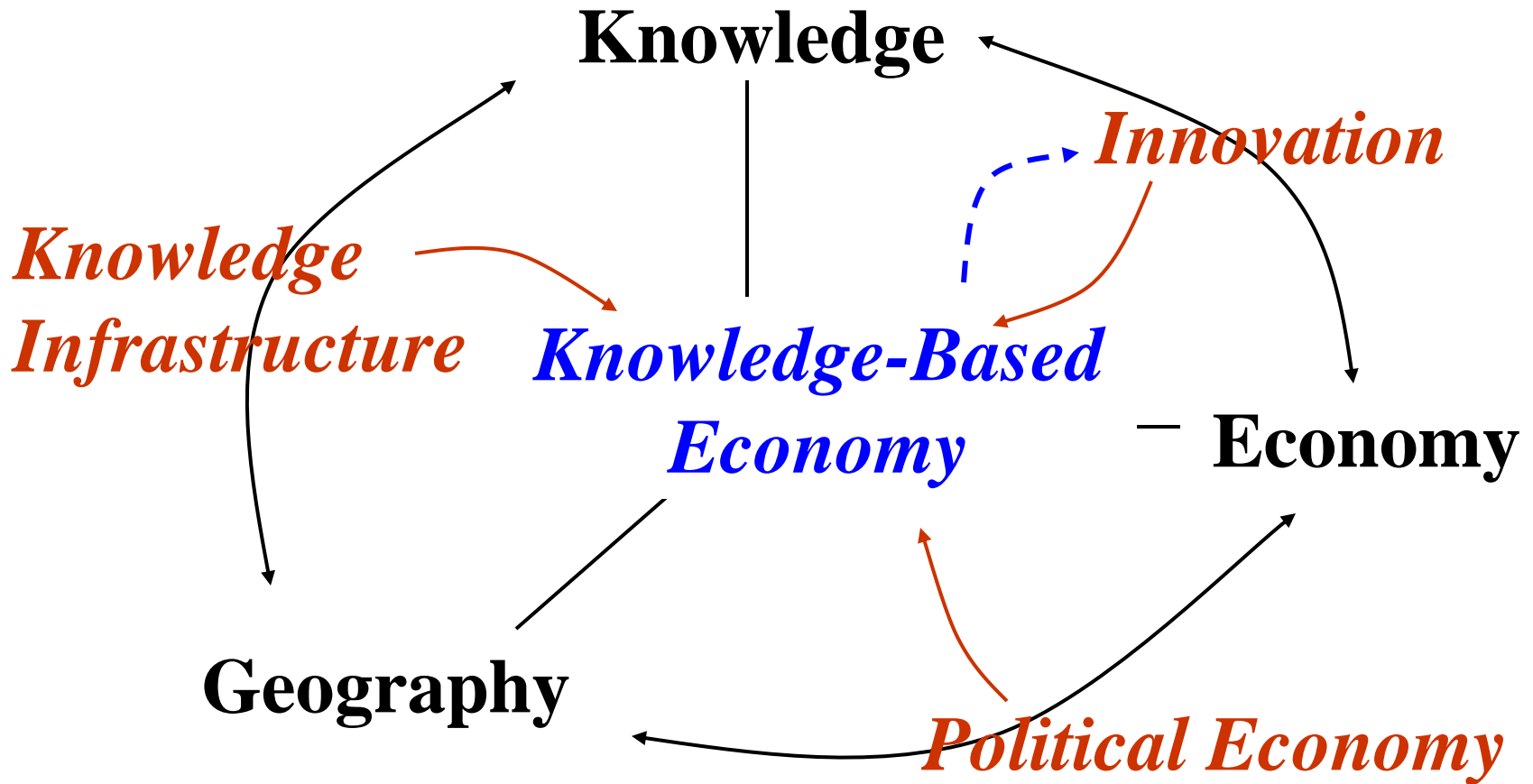
This long-term agenda [...] will require us first and foremost to train and educate our workforce with the skills necessary to compete in a knowledge-based economy. We'll also need to place a greater emphasis on areas like science and technology that will define the workforce of the 21st century, and invest in the research and innovation necessary to create the jobs and industries of the future right here in America.

Barack Obama: "Change That Works for You," June 9, 2008, at http://www.barackobama.com/2008/06/09/remarks_of_senator_barack_obama_76.php .

Three functions of Triple Helix relations:

- 1. The economic dynamics of wealth generation (“equilibrium-seeking”; **markets**)**
- 2. The knowledge-based production of **novelty** in science and technology (“upsetting the equilibrium”)**
- 3. The government and management (**governance**) of the interaction between the markets and knowledge production (intellectual property; regulation)**

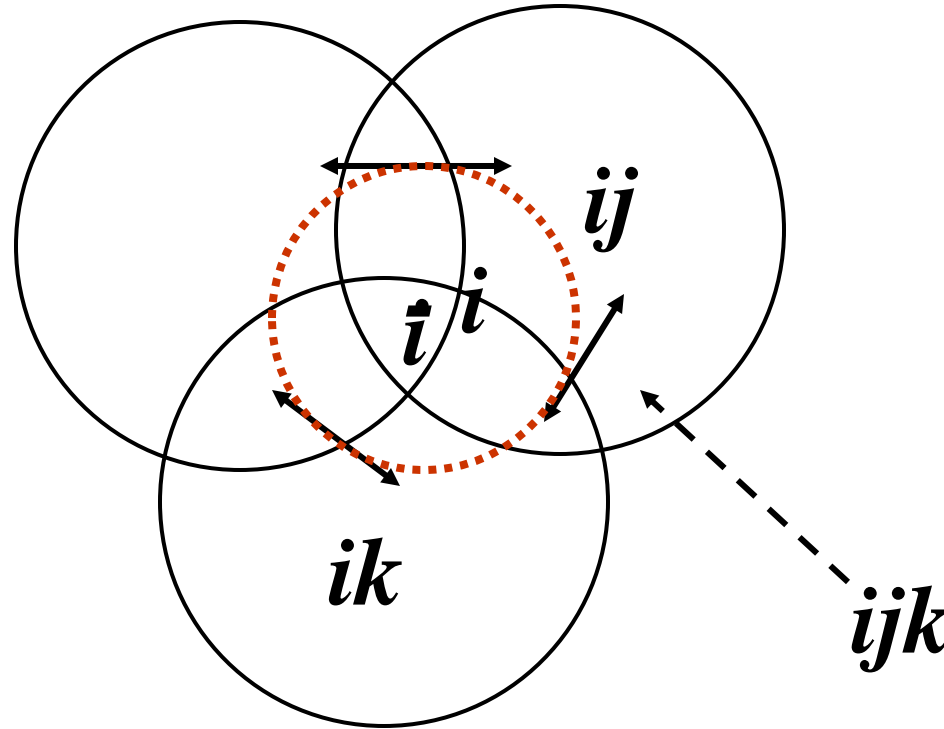




functions (instead of institutions)
→ a complex and composed dynamics

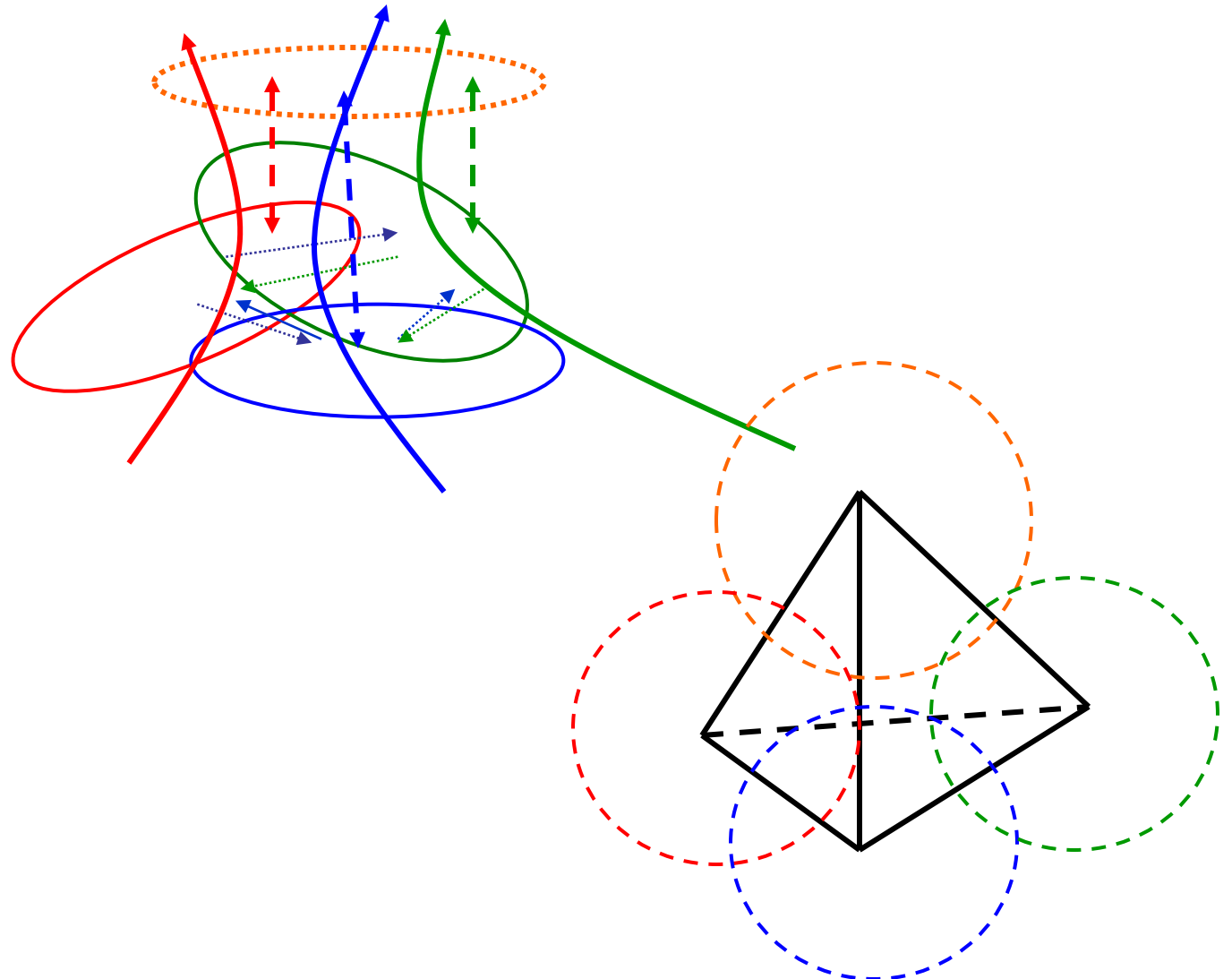
- **The Triple Helix as a development strategy based on collaborations among the three partners**
 - **neo-institutional program of studies of *network arrangements***
- **The Triple Helix as a model for explaining the knowledge-based economy as an *emergent* result**
 - **neo-evolutionary model; *entropy statistics; simulation***

Three subsystems with a center of coordination → a specific *organization*



→ *Self-organization of communication fluxes at interfaces*

An “overlay” of communication in university-industry-government relations



The economic dynamics of wealth generation
(“equilibrium-seeking”; **markets**)

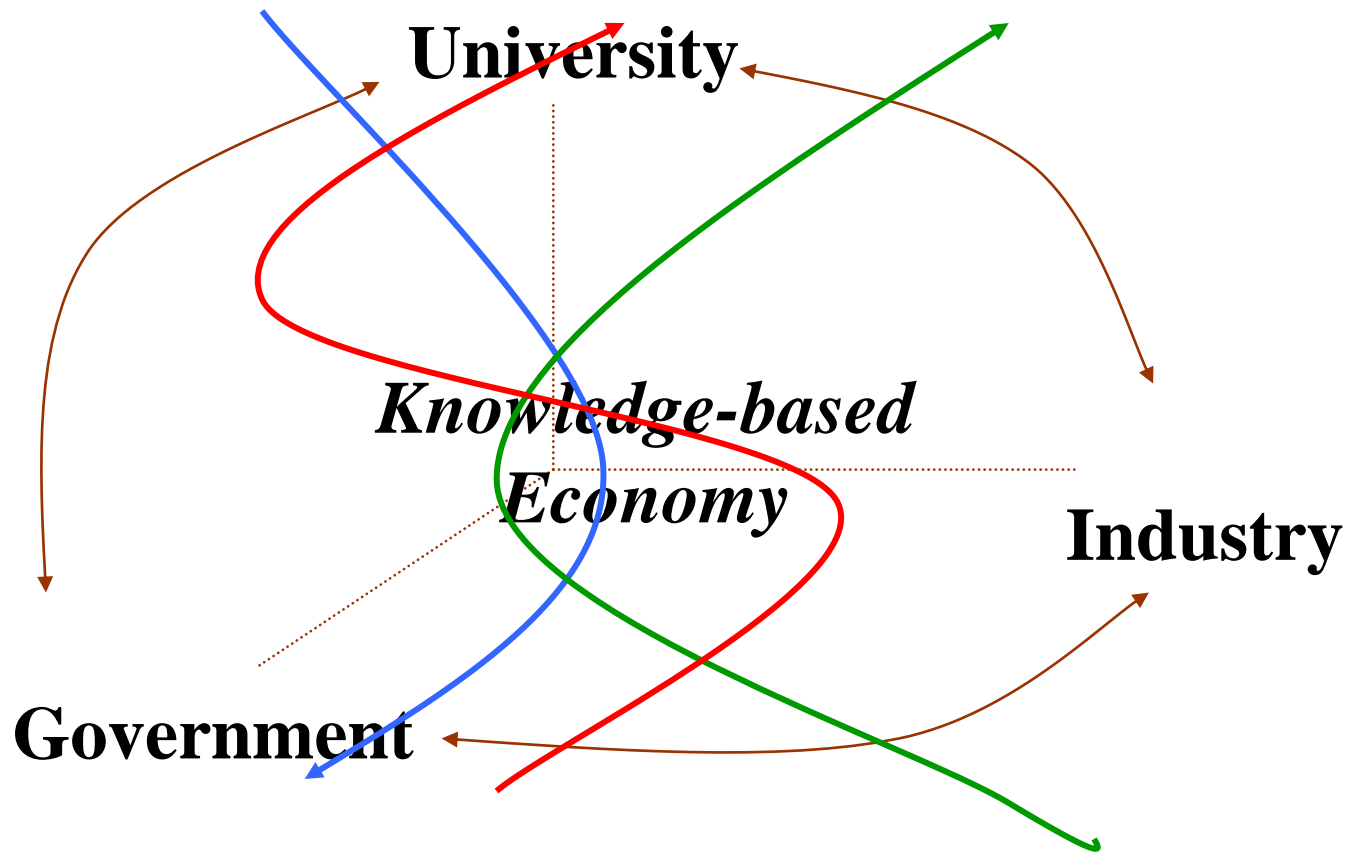
1. Comparative statics:
e.g., economic growth

The knowledge-based production of **novelty** in science
and technology (“upsetting the equilibrium”)

2. Evolutionary reconstructions

The government and management (**governance**) of the
interaction between the markets and knowledge
production (intellectual property; regulation)

3. Control: public/private



The institutional arrangements can be measured in terms of UIG-networks.

How can one go from a network analysis to the measurement of communication flows?

Configurational Information:

$$T_{\text{UIG}} = H_{\text{U}} + H_{\text{I}} + H_{\text{G}} - H_{\text{UI}} - H_{\text{IG}} - H_{\text{UG}} + H_{\text{UIG}}$$

T_{UIG} is potentially **negative**

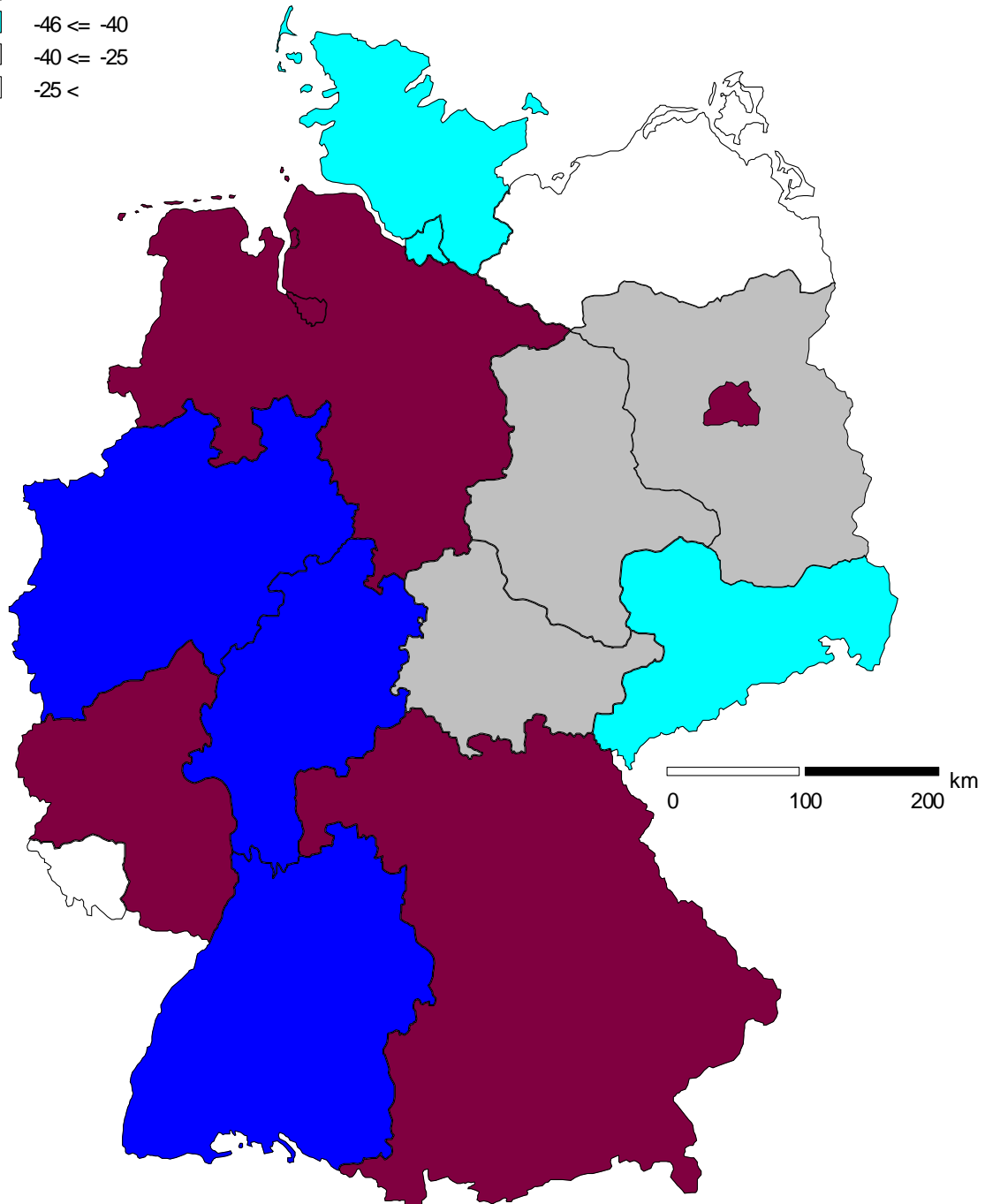
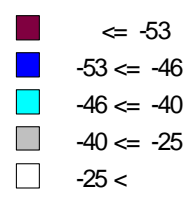
Mutual Information:

The negative terms are a consequence of the relations at the network level

$$T_{ij} = H_i + H_j - H_{ij}$$

$T_{ij} \geq 0$; *always positive*

→ *the configuration reduces uncertainty*



Three independent sources of variance:

1. Geographical addresses

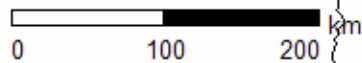
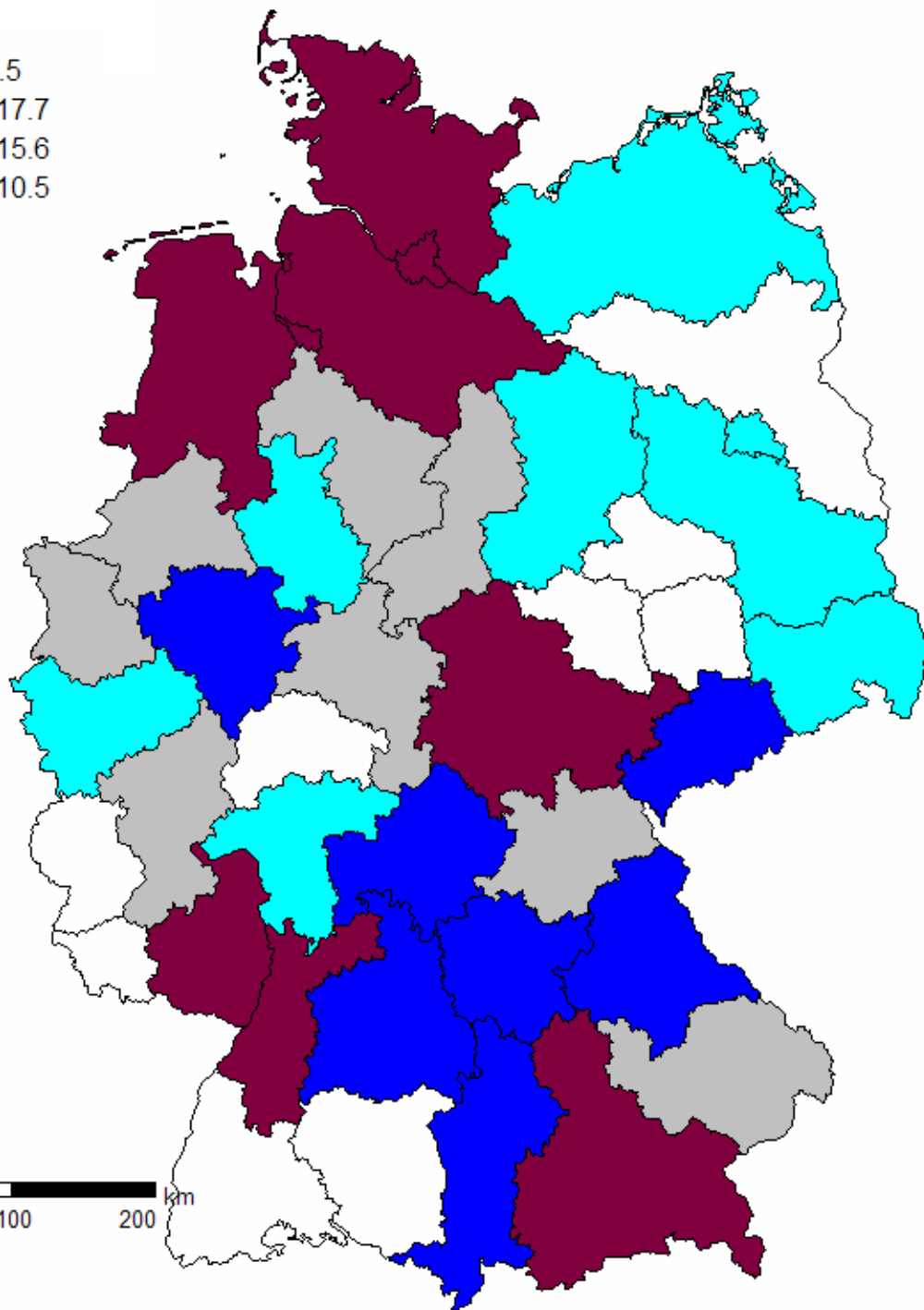
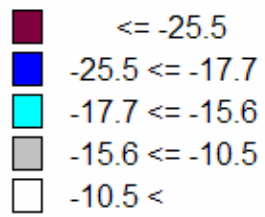
→ type of district (**urban/rural**)

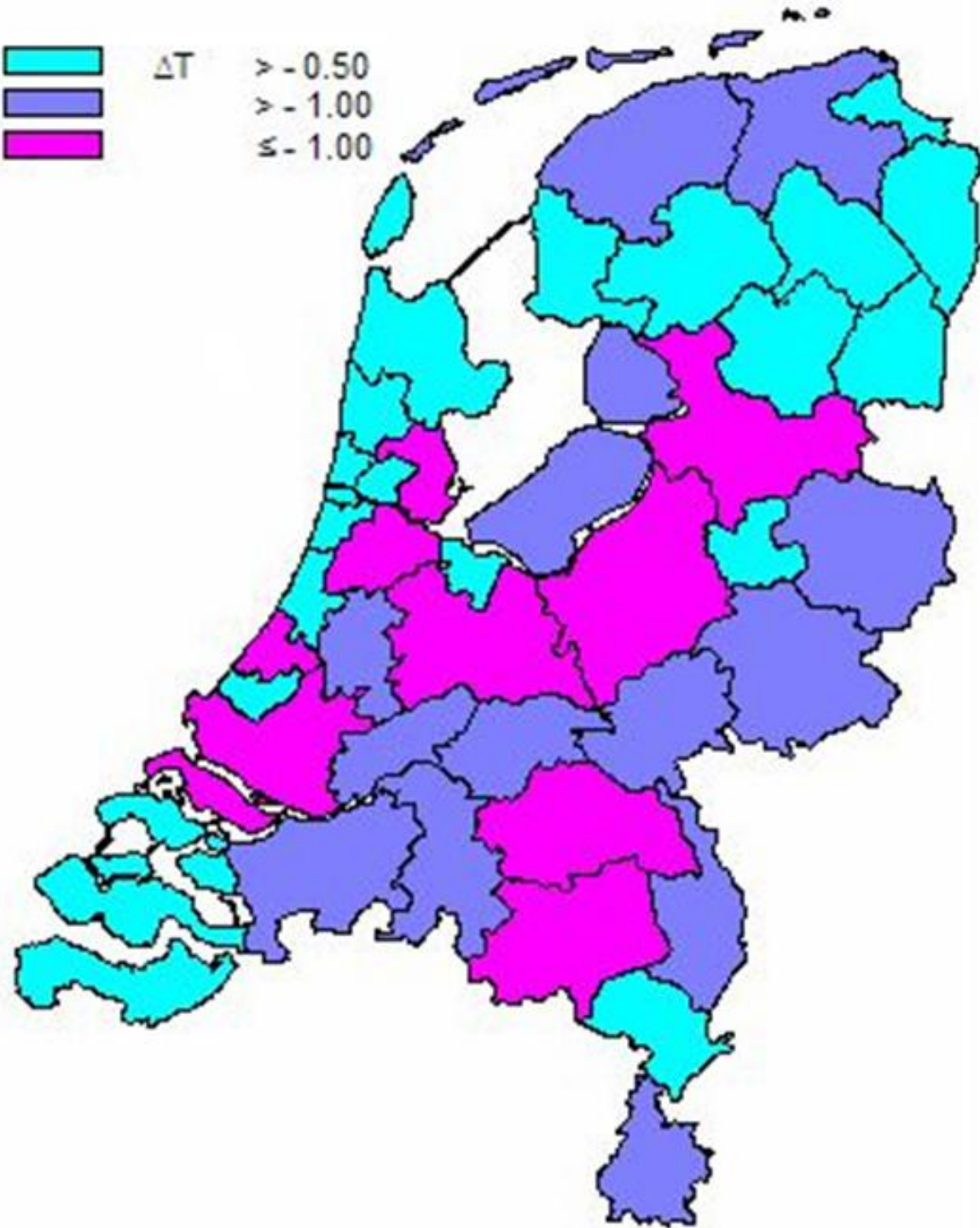
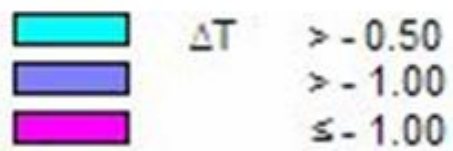
2. Classification of the industry

→ indicator of the **technology**

3. Number of employees

→ indicator of the **organization**

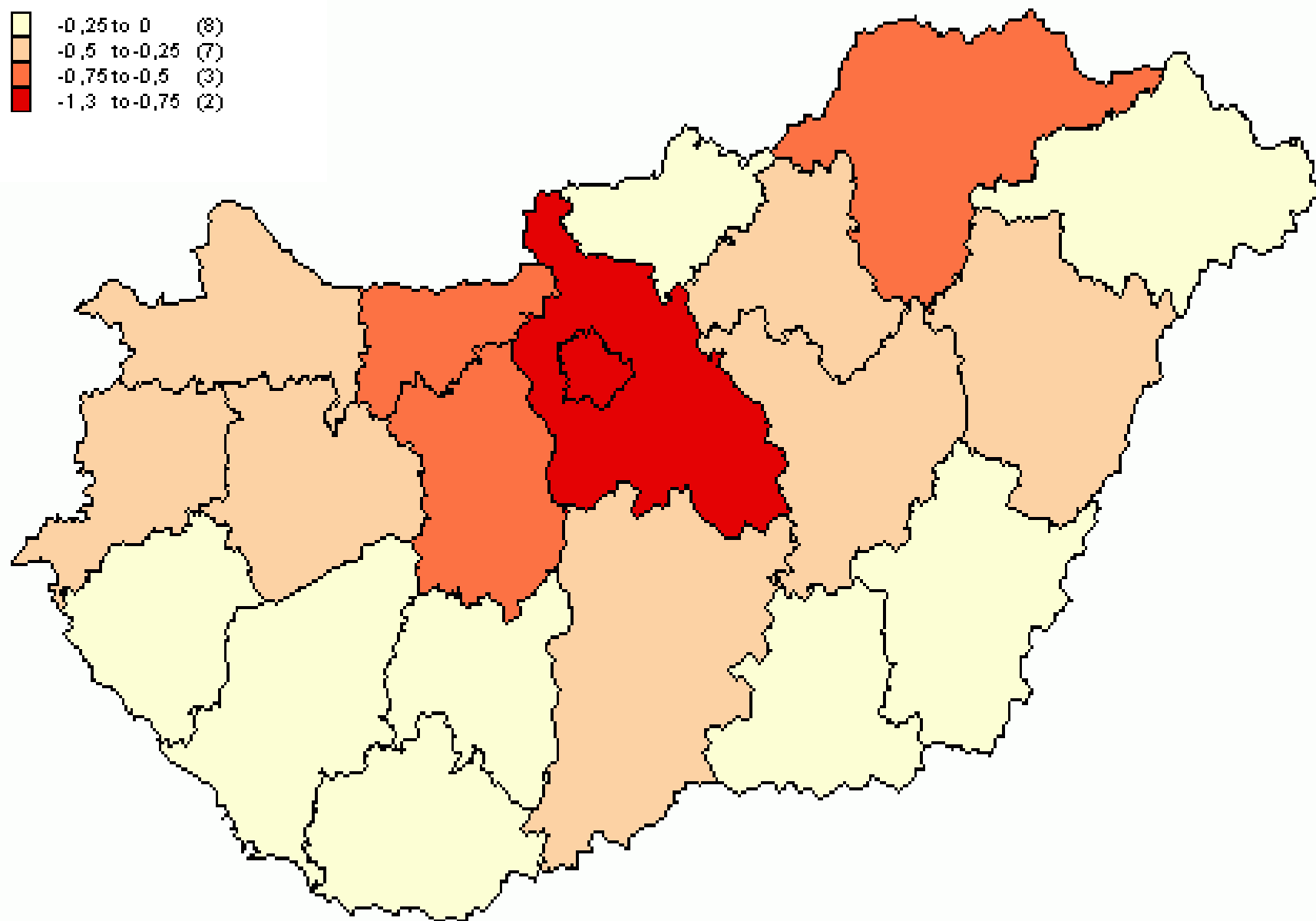
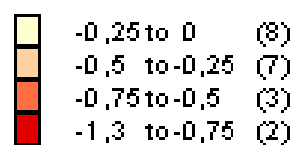




Conclusions of the analyses

1. Medium-tech *manufacturing* is more important for the knowledge-based configuration than high-tech;
2. Knowledge-intensive *services* uncouple from the geographically defined economy (e.g., regions);
3. *High-tech knowledge-intensive services* (e.g., R&D labs) counteract upon the uncoupling in the services.

millibits



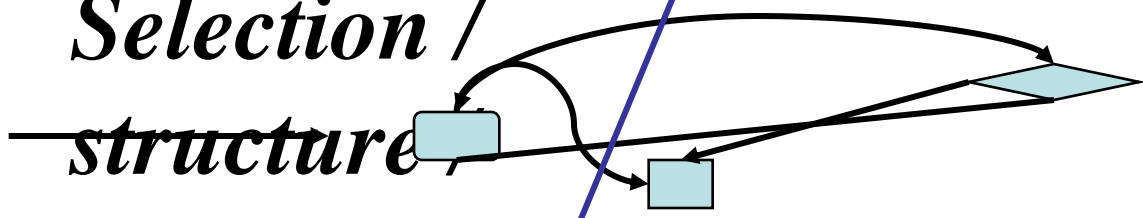
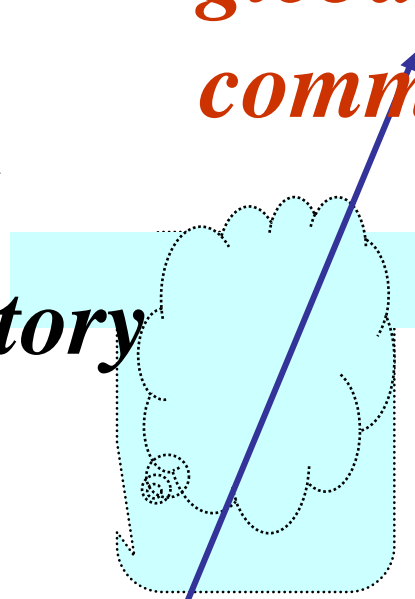
*The sciences function as
globalizers of the
communication*

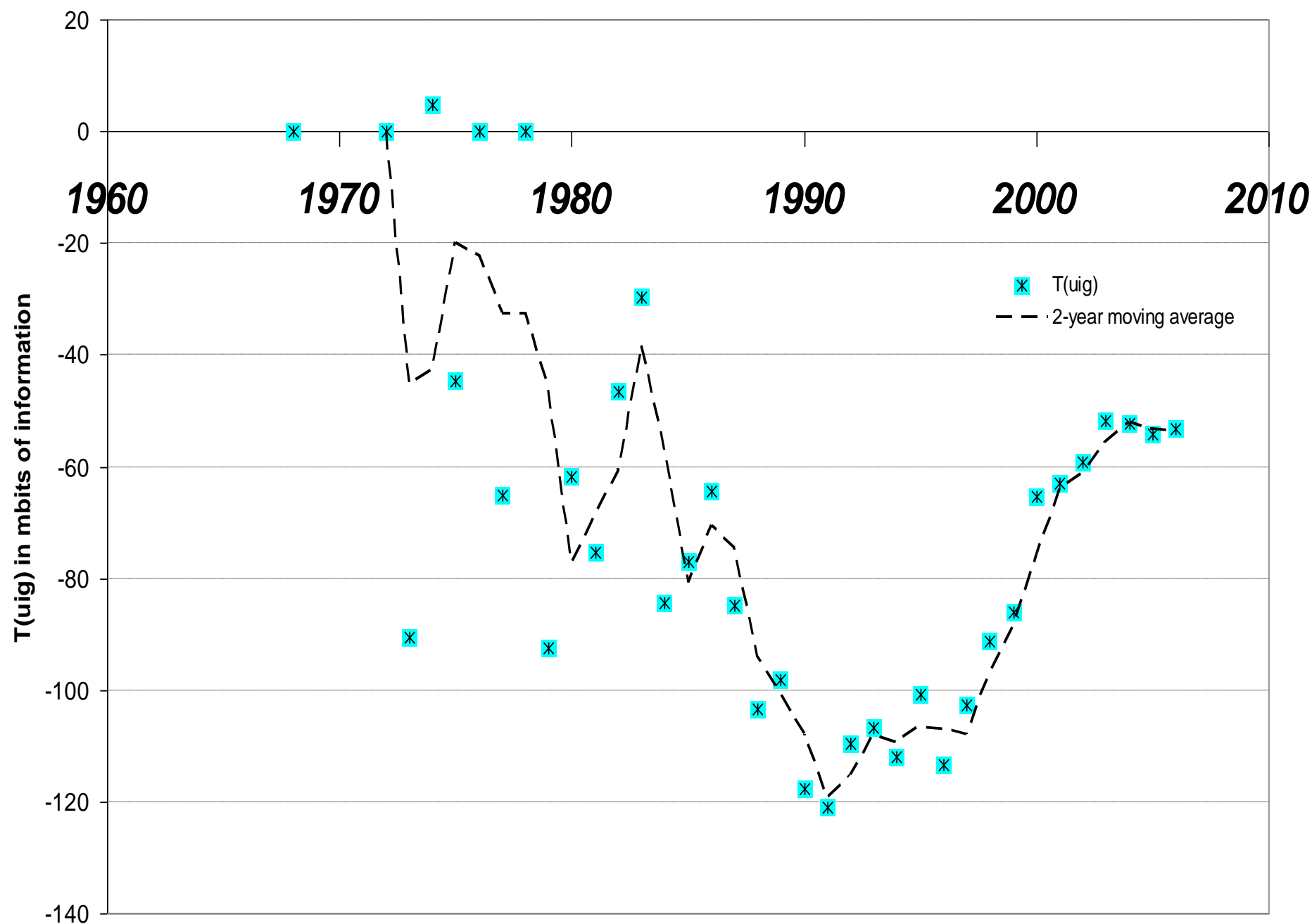
*Stabilization /
trajectory/ history*

*Globalization /
regime*

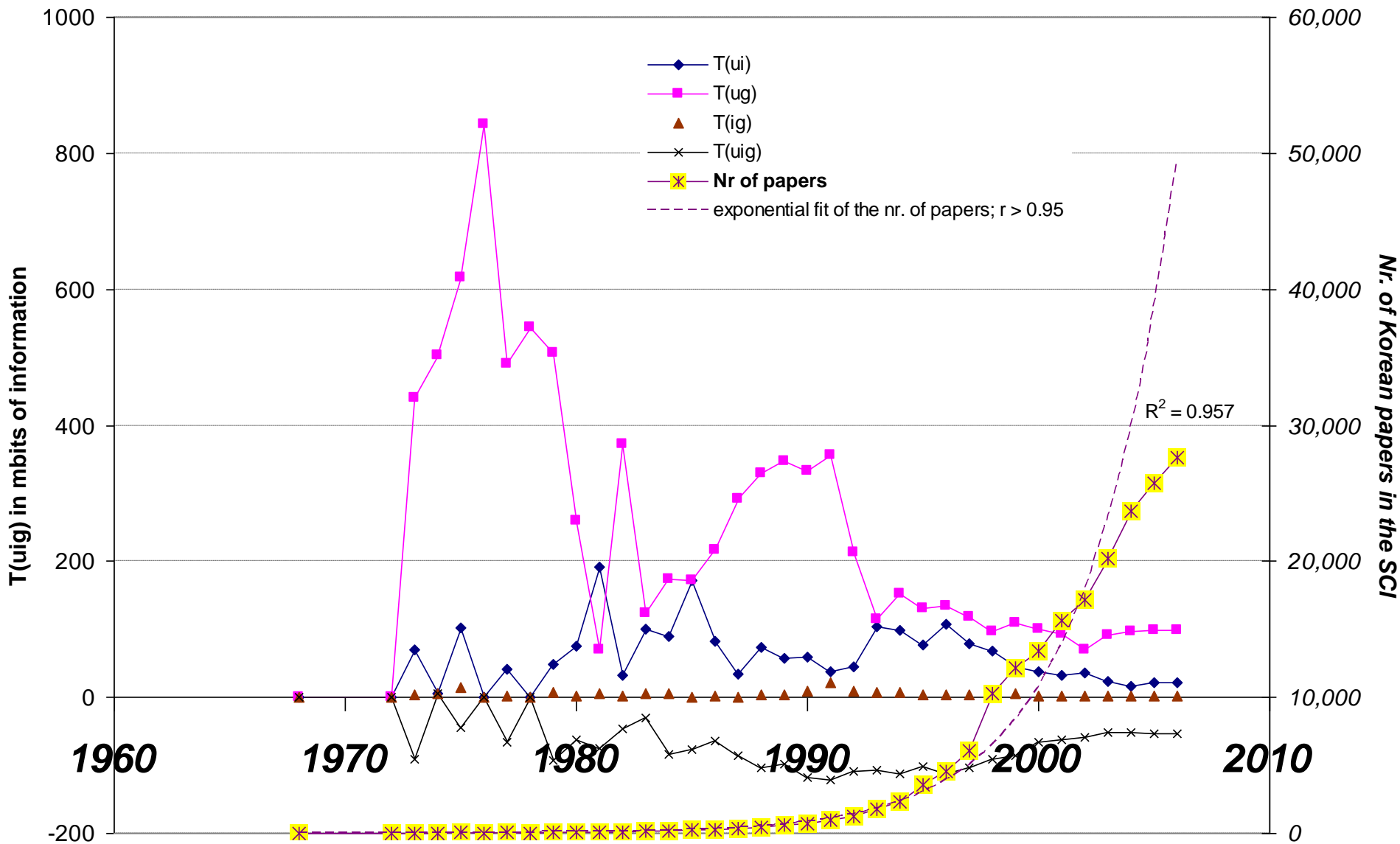
*Selection /
structure
network*

*Variation /vector
knowledge claims*

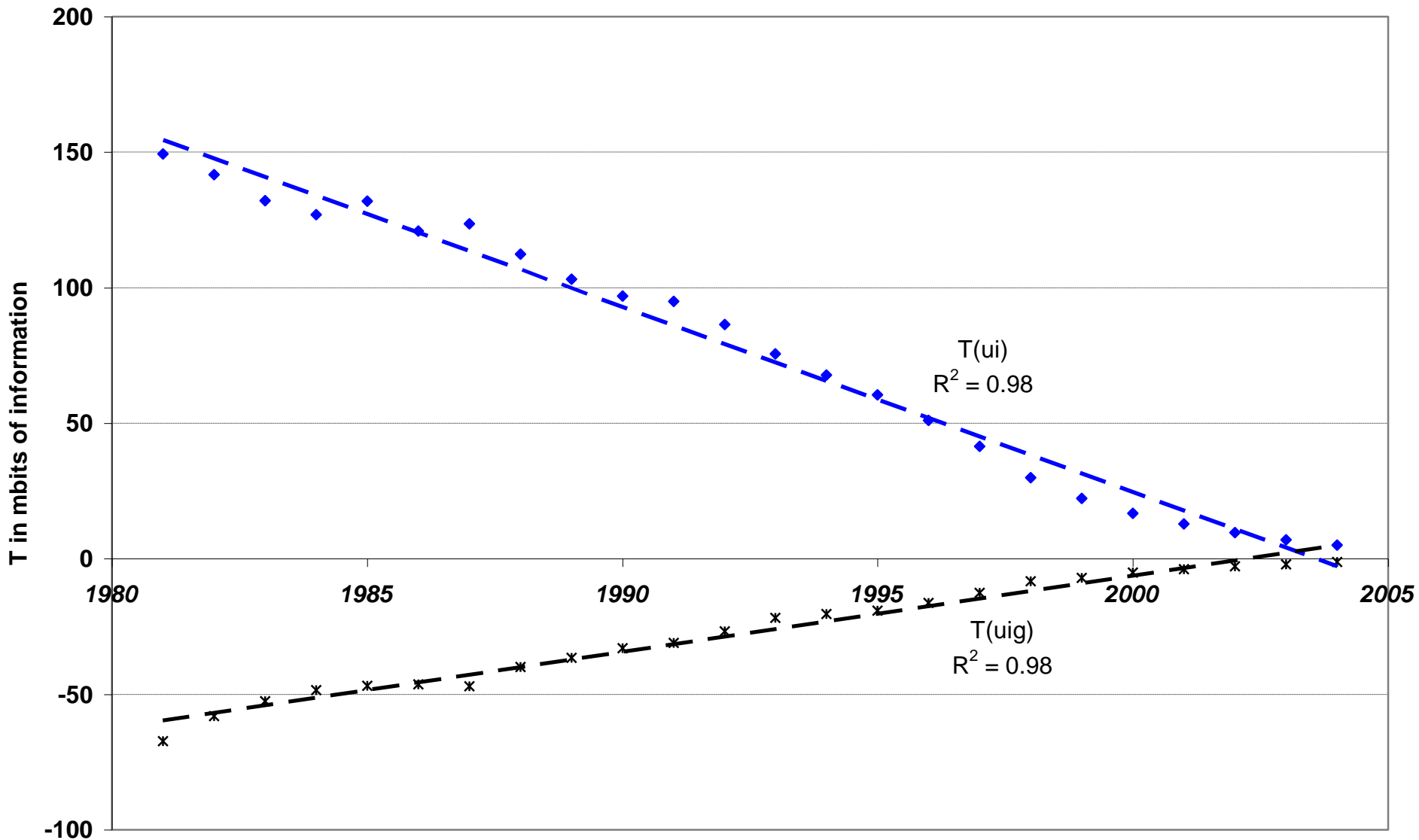




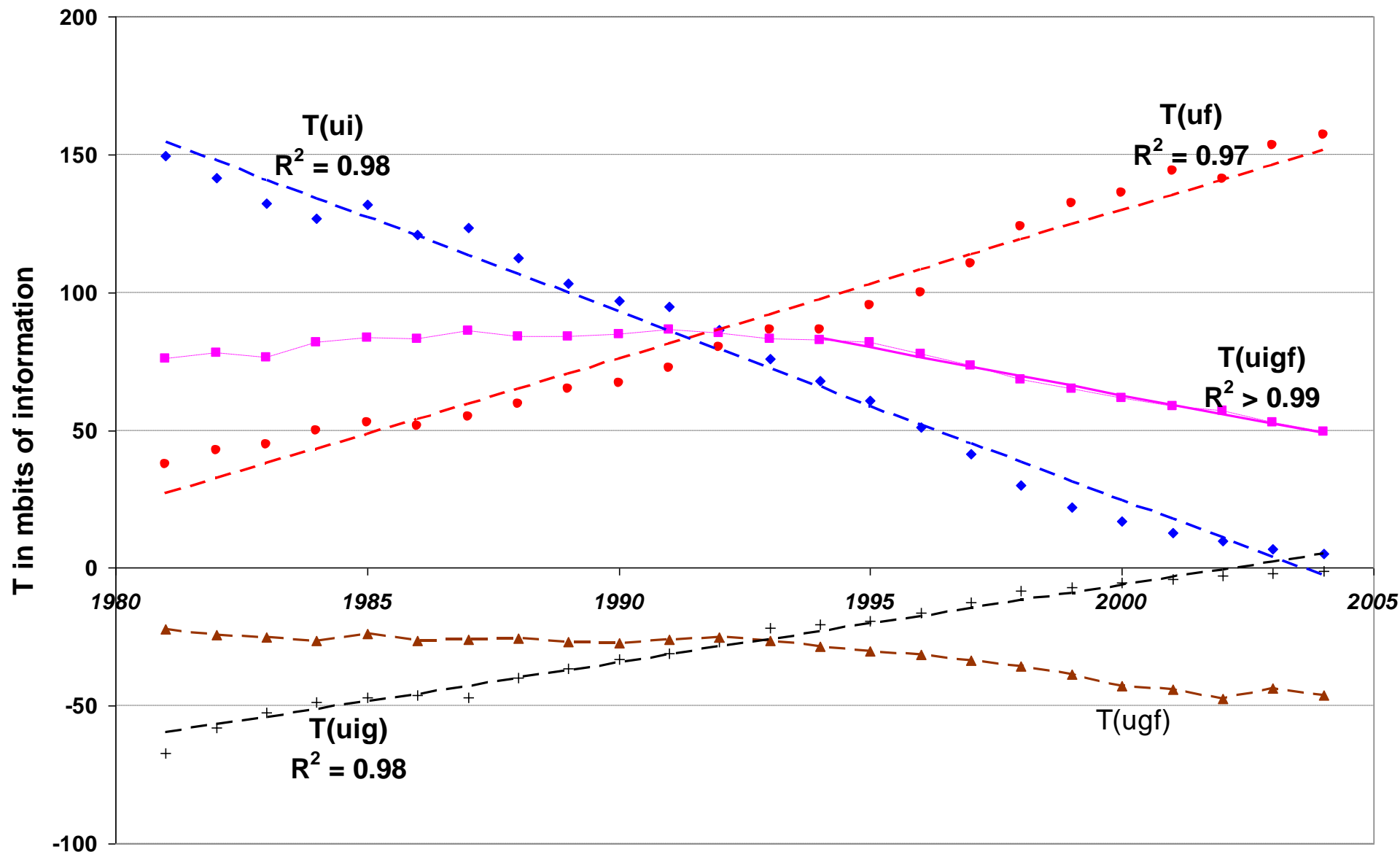
(with Han Park and Min-Ho So, TH 7, Glasgow, 2009)



(with Han Park and Min-Ho So, TH 7, Glasgow, 2009)



Yuan Sun, Masamitsu Negishi, & Loet Leydesdorff, "National and International Dimensions of the Triple Helix in Japan: University-Industry-Government and International Co-Authorship Relations"

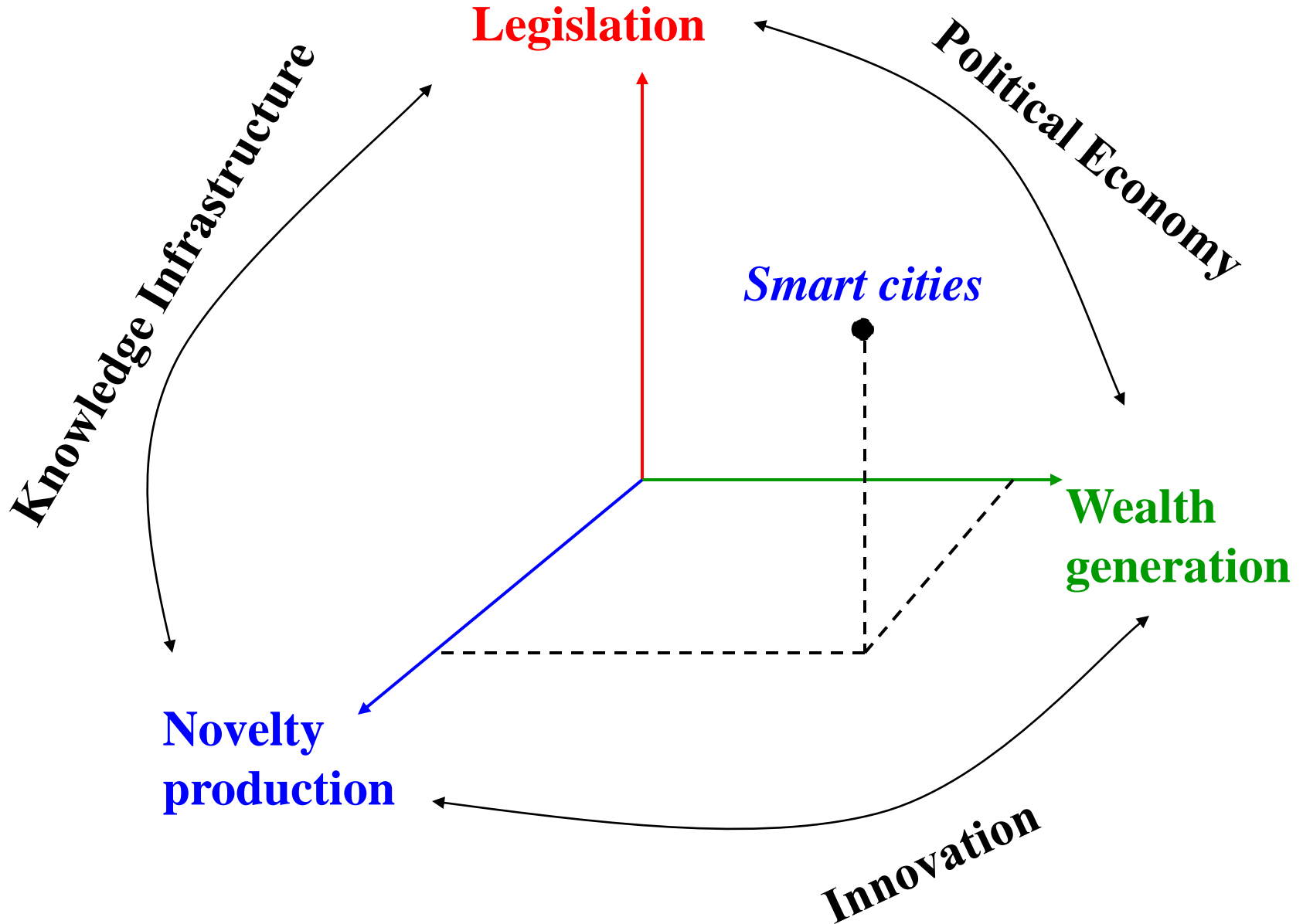


“National and International Dimensions of the Triple Helix in Japan” *JASIST* (with Yuan Sun, Tokyo)

Conclusions about the Science System

- 1. International collaborations** are more important for (natural) scientists than local university-industry-government relations;
- 2. Advanced nations** are able to capitalize on international relations by retaining **wealth from knowledge**;
- 3. Incentives matter differently across national cultures** (e.g., Korea, Japan).

- **The Triple Helix provides us with a model for measuring the knowledge base in an economy**
 - **Three sources of variance:**
 - **geographical diversity (endowment);**
 - **technological capacity (infrastructure);**
 - **industrial structure**
- **Configurational Information**



Methodology

- Specify the variation in relation to the relevant selection environment: “*what* is communicated when the system operates?”
- *How* is it communicated: in terms of what?
 - Indicator (e.g., transactions, publications, regulations)
- Try to answer the *why*-question; develop the semantics.