

## **Facilitation of change: Macroeconomic studies of technology transitions**

### Summary of the thesis

This thesis searches an economic explanation for the sluggishness of technological change and searches for strategies how the transition to low-carbon technologies can be facilitated.

Based on a theory of technological capabilities and learning, the thesis begins with an analysis of diffusion barriers. Using the agent-based macroeconomic model Eurace@unibi-eco, it is shown that the accumulation of technology-specific knowledge can be a source of path dependence.

Technological uncertainty can be macroeconomically costly if learning and R&D resources are wasted for a technology type that is obsolete in the long run. I demonstrate that the effectiveness of diffusion policies is dependent on the type and strength of diffusion barriers.

In the next part, it is analyzed how the transferability of technological knowledge across technology types affects adoption decisions of individual firms.

I introduce the microfoundations of a model of technological learning. In a simulation experiment, it is shown that the transferability may have ambiguous effects. A high transferability accelerates the diffusion in the beginning but it comes with the cost of technological uncertainty and retarded specialization in the long run.

Finally, these theoretical concepts are embedded in a general characterization of competing technologies.

This characterization reflects the properties of technology in given socio-technical, external circumstances and the relative maturity of an emergent entrant technology.

I show how the characteristics of competing technologies can explain the shape of emerging transition pathways and discuss empirical examples.

Policy may change the external conditions of the technology race. In an experiment, it is shown that the performance of different policy instruments depends on the properties of competing technologies.