## Jaffe-Feldman-Varga: the search for knowledge spillovers

Zoltán J. Ács

The switch from old growth theory to endogenous technical change in the 1990s required rethinking the role of technical change, knowledge spillovers and economic growth. Using a knowledge production function, Adam Jaffe was the firsts to identify the extent to which university research spills over into generating commercial activity. Maryann Feldman expanded the knowledge production function to innovative activities and incorporated aspects of regional knowledge infrastructure. Attila Varga extended the Jaffe-Feldman approach by focusing on a more precise measure of local geographic spillovers at the city level. Varga approached the issue of knowledge spillovers from an explicit spatial econometric perspective. The Jaffe-Feldman-Varga approach provided an understanding of the role of knowledge spillovers in technological change.

## Assessing the regional impacts of policies to develop entrepreneurial ecosystems in three EU countries

Attila Varga, Tamás Sebestyén, Norbert Szabó and László Szerb

This paper measures the economic impacts of policies aimed at developing entrepreneurial ecosystems in three European Union countries through the combined use of the GMR impact assessment model and the REDI entrepreneurship index. The REDI index is capable of modelling the effect of policies aimed at different aspects of regional entrepreneurial ecosystems on the entrepreneurial level in a complex way, while the GMR model is able to compute the economic impact of changes in the level of entrepreneurship. On the one hand, the study shows that entrepreneurship development policies need to be tailored to local characteristics, as they can be effective by developing different aspects in different regions. On the other hand, it is also shown how the economic effects of developing entrepreneurship are influenced by other regional factors (e.g. human capital). Finally, based on these findings, the paper shows that policies aimed at developing the national level of entrepreneurship produce greater economic effects, but at the cost of increasing territorial disparities. Although policies aimed at developing entrepreneurship in regions lagging behind are effective in improving regional convergence, the national economic impact of these policies is limited.

## The impact of reindustrialization on the convergence paths of Hungarian regions

Imre Lengyel and Zsófia Vas

In the May 2018 issue of Economic Review, Imre Lengyel and Attila Varga published a study titled "The spatial limits of economic growth in Hungary: An overview and some dilemmas", which examined the convergence paths of different types of counties between 2000 and 2016. Based on their empirical research, they identified both theoretical and economic policy dilemmas, including concerns about the stagnation of the capital region and the dynamism of regions with foreign-owned manufacturing companies. In our study, we analyse the time series until 2022, and our main conclusion is that new convergence paths have emerged since 2016. The economy of the capital region has revived, while the manufacturing counties have declined, falling into a typical development trap, and the convergence of other counties has remained slow. Today, the economic growth of the country is constrained not only by the less developed regions but also by the manufacturing regions. In our opinion, the ongoing reindustrialization programs and projects in several counties are likely to lead to a long-term development trap following short-term convergence, similar to the formerly successful manufacturing regions.

## Research cooperation between universities and companies in local knowledge production

Tamás Sebestyén, Erik Braun, Zita Iloskics and Dávid Bilicz

Long-term economic development is driven by continuous innovation, based on the flow of knowledge and information through the interaction of economic actors. Different economic actors, such as companies and universities, have different knowledge bases. Economic policy makers, as well as companies and universities, have set up a number of programs to share the information available to them, thus promoting the creation and development of new or existing innovative companies. However, few studies in the literature have so far explored the impact of business-university collaborations on innovation on a large scale and across countries. In this paper, we explore this issue using data on research collaborations between actors participating in the EU Framework Programs, applying a multi-layer network analysis approach, using spatial panel econometric models, based on the concept of a regional knowledge production function. The results show that a diverse network structure is needed to foster innovation. This diversity consists not only in the need to establish cooperation with several economic actors, but also in the need to establish links with different types of institutions and partners outside the region. In the design of economic policy programs and university innovation projects, efforts should therefore be made to develop closer cooperation between companies and universities, involving partners that are geographically more distant.

## Measuring local resilience with a spatial computable general equilibrium model

Norbert Szabó, Emese Braun, Tamás Sebestyén and Zsolt Bedő

This paper examines the effects of hydrogen-based mobility on local and national economic resilience using a general equilibrium model. The aim is to understand how hydrogen-based technology affects economic performance and resilience, especially in the event of a significant oil price shock. The analysis uses the GMR Hungary spatial general equilibrium model, complemented by micro data on the technological and financial characteristics of hydrogen-based mobility. The latter are derived from a solar green-hydrogen project in Pécs. Complementing the underlying spatial general equilibrium model, the emergence of hydrogen-based mobility technology in the region is introduced as a new sector. In this analytical framework, indicators for calculating economic resilience are introduced and, as an illustration, the economic impacts of a 50% increase in world oil prices between 2030 and 2033 are simulated with and without the presence of the technology. Simulated trajectories for the endogenous variables of the model form the basis for the calculation of the resilience. Results show that hydrogen-based mobility reduces demand for fossil fuels, mitigating the economic risks of oil price fluctuations. It also increases the local economy's demand for various sectors, such as manufacturing and water supply, as well as for primary resources (labour, capital). The introduction of hydrogen technology reduced the decline in gross value added in Baranya County by HUF 232.5 million in the period under review, mainly by reducing the direct impact of the shock. Although the regional impact of the technology is small, it is positive at the national level, especially in energy-intensive sectors. Future research could investigate the impact of the technology in other regions and at other scales, as well as the need for public support to ensure competitiveness.

## Digital entrepreneurship ecosystems in the Carpathian-Balkan region

Éva Komlósi and Miklós Madár

In our study, we examined the performance of digital entrepreneurship ecosystems in the countries of the Carpathian-Balkan macroregion. The comparison of digital entrepreneurship ecosystems in the fourteen countries was conducted based on the Global Index of Digital Entrepreneurship Systems (GIDES), a composite indicator developed on behalf of the Asian Development Bank. The primary strength of GIDES is its ability to evaluate the performance of national ecosystems by simultaneously considering both entrepreneurship and digitalization. GIDES allows for the easy identification of the strengths and weaknesses of digital entrepreneurship ecosystems at the national level. Additionally, using Qualitative Comparative Analysis, we identified which components of the digital entrepreneurship ecosystem are necessary, and which combinations of these components are sufficient for a high (above average) concentration of startup firms in the Carpathian-Balkan macroregion.

## Universities at the service of regional development

Katalin Erdős

There is a considerable amount of literature on the regional development role of universities, with several consequences. On the one hand, due to the diverse nature of the topic, there still exist under-explored directions and untapped research opportunities, but on the other hand, for those just starting to get acquainted with the field, the multitude of trends and approaches that are somewhat difficult to overview can be disconcerting. The aim of this article is to provide an insight into the regional development role of universities, an area that has been present in the work of Professor Varga from the very beginning, who, in addition to cultivating regional sciences at the highest level, also created a school, supporting and mentoring of young researchers with enthusiasm and professionalism, and also considered it important to disseminate scientific results to the general public. In this spirit, our article aims to serve as an initial compass and overview for those who would like to explore the field, be they scientific researchers or interested non-professionals.