Impact assessment of alternative regional industrial specialization policies for Hungarian NUTS 3 regions

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The aim of this paper is twofold. First, we introduce a new GMR-type economic impact model built for Hungary, and second, we study alternative regional development policies for Hungarian NUTS 3 regions. Our main interest is to evaluate smart, sector-specific development policies.

We follow Tödtling and Trippl [2005] where regions are grouped into three different types based on their level of development: a) knowledge regions, b) industrial production zones and c) non-science and technology driven regions (basically lagging regions). According to MacCann and Ortega-Argilés [2015] smart specialization can be adopted in different kinds of regions in different manners where the key issues are embeddedness, relatedness and connectivity. In *core regions* conditions for growth are more typically available. Entrepreneurship and innovation tend to be higher in densely populated areas, in regions with more diversified sectoral structure where local economy is less dominated by large firms and in regions where internationally engaged multinational companies are present. Because almost all industries and technological background is available locally these areas are less likely to be targeted by regional development policies regarding their high level of income.

Less developed regions (especially industrial production zones) usually have more specialized, concentrated sectoral structures which can be dominated by a small number of industries, strongly embedded in local economic relationships. This *embeddedness* refers to strong connections to local and other markets (mainly through their input-output transactions). These industries can serve as local pull factors of development if they are efficiently targeted by policies which attempt to satisfy their local needs that otherwise are constrained. The biggest risk of this approach is too much specialization and thus extreme level of exposure to asymmetric external shocks that can negatively influence local development. Without diversified, more robust industrial structure the local economy is more likely to be very sensitive. This leads to the second issue of smart specialization, *relatedness*. According to specialized diversification (in highly specialized regions) relatedness refers to the diversification of firms into areas, sectors that are related to the original existing and dominant activities. Although this kind of diversification is not complete, thus vulnerability is not reduced significantly, it has an important role in growth, since diversification in the related areas can build on the existing knowledge and capabilities of firms.

In *lagging, peripheral regions* where diversified industrial structure, knowledge intensive firms or dominant embedded productive sectors are not available connectedness of the region can play a crucial role in development possibilities. The level of *connectedness* to external areas (possibly to knowledge regions and production zones), both digitally and physically (with transport infrastructure) could attract more human capital to the region because the most connected local industries have better conditions to learn from developed regions. Thus, very isolated regions have extremely limited possibilities of gaining advantages from smart specialization policies.

We explore the possibilities of regional development in Hungarian areas, where sectoral structure, factor endowments and innovation capacities, thus all issues of smart specialization (embeddedness, relatedness, connectivity) are completely different, in order to provide different recipes for effective regional growth both for prospering and lagging regions.

In impact assessment we apply a newly developed version of the GMR (Geographical, Macro and Regional) model. (For further details on different earlier versions of the model see: Varga [2007], Varga, Baypinar [2016], Varga [2017]) which has been applied many times in regional development policy impact assessments. GMR models consist of three main blocks. The TFP block is responsible for capturing the role of knowledge and innovation in productivity, the spatial CGE (SCGE) block calculates regional economic effects of development policy interventions and finally, the MACRO block estimates impacts at the national level. These three blocks are connected following a strict order and solved accordingly. Thus all changes in TFP will have an effect on the spatial distribution of economic activities and on macro growth, and vice versa. The general equilibrium approach makes it possible to account for regional differences, national growth and technological change in a sophisticated way, however, in earlier GMR versions communication between different blocks of the model makes the process complicated and the calculation of the results is relatively time-consuming (approximately 45 minutes per scenarios). Regarding smart specialization policy impact assessment the major restriction of earlier GMR models is that they do not account for sectoral differences.

The recently developed GMR model applies a somewhat different approach. We developed a multisectoral recursive version of the SCGE model which is integrated with the TFP sub-model and a more simplified macroeconomic block. In the new version dynamism is modeled at the regional level, which allow us to build a less complicated macroeconomic block. We introduced 20 regions (20 Hungarian NUTS 3 regions including the capital) and 37 industries to model (with detailed description of manufacturing industry which plays crucial role in international and interregional trade) and set 2010 as the base year. Since detailed regional data is not available in many countries (just like in Hungary), we needed to carry out an estimation to create an interregional transaction table (containing 20^2x37^2 cells) to depict the interconnections between industries, and an interregional final demand table to describe the relationships between regional final users and producers (and also regional value added). For that reason, in a preceding step we used the available regional data (employment, GDP, consumption, investment, etc.) and non-survey techniques to estimate the Hungarian interregional input-output table which serves as the main source of data for the spatial model. First, we created intraregional input-output tables for all territorial units, using a method developed by Jackson (1998) which allowed for the regionalization of national tables. Then we estimated interregional trade based on a gravity-model (Black, 1972) and finally we used a bi-proportional (RAS) balancing method (Stone, 1961) to ensure the consistency of the table. The parameters of the SCGE model and the initial values of variables were calibrated using this interregional table in a way that the first year in the baseline scenario would reproduce the initial dataset. After calibration and fine-tuning, the multisector approach, the TFP sub-model and the spatial disaggregation made it possible to analyze industry-level regional development policy interventions and their expected impacts in detail.

Our goal is to examine different policy settings for different groups of Hungarian regions. In core areas where all aspects of successful smart specialization are given we could test the possible local and nationwide effects of such interventions. In less developed regions (industrial production zones) we will identify those specific sectors, and capacities in regions that can provide comparative advantage to the local economy, which can serve as targets for development policy interventions. Since embeddedness of these industries will fundamentally influence the effectiveness of regional policies we use the interregional input-output table to reveal the intensity of local economic relationships and to adjust the proposed policy interventions accordingly. In lagging, less densely industrialized regions where many aspects of a successful smart specialization can be absent (e.g. weaknesses in entrepreneurship, in innovation) one could look for other policy recommendations to improve economic performance of these areas (e.g. through improvement of infrastructure, accessibility and connectedness). Through our scenarios, the GMR-model is capable of predicting the impacts of different interventions tailored for each regional economy and allows us to choose between those programs that will lead to the highest economic and welfare improvements at regional and macroeconomic levels. Furthermore, we would like to quantify intra-, interregional and national impacts of such interventions and shed light on the extent of growth that will remain within the region and the extent of spatial leaking, spreading of development in order to find the most rewarding policy alternative for local prosperity.

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