

## **Hybrid Data-Driven and Expert Knowledge-Based Exploration of Economic Growth ABSTRACT FOR THE GENERAL PUBLIC**

### **Subject matter**

Understanding the nature and reasons behind vast differences in the economic growth of various countries has occupied the attention of economists since the beginning of economics as a social science discipline. Up to this day, the issues of economic growth and its inequality are of paramount importance to economists and policymakers.

In line with the economic literature, we acknowledge the variegation among countries in growth experiences as differences in growth regimes and growth patterns. Growth regimes can be understood as the overall environment influencing behavior of economic agents, connected with deep determinants of growth, such as economic institutions, which shape the relationship between growth and its proximate determinants, such as accumulation of production factors and economic policies. In turn, growth patterns can be defined as the temporal characteristics of the economic growth time series

The purpose of this project is to perform a hybrid data-driven and expert knowledge-based exploration of the nature of economic growth processes. We will provide new methods for detection and similarity evaluation of growth patterns and growth regimes based on data mining algorithms. Furthermore, we aim to deliver new methods for the identification and inspection of the driving forces of economic growth and growth patterns of countries characterized by various growth regimes with the use of fuzzy cognitive maps. Maps will be constructed in a hybrid manner, which means that the final shape of the model will be partly defined by experts and partly learned automatically from the data.

Fuzzy cognitive maps describe information in the form of a graph, whose vertices correspond to abstract phenomena. The model designer associates each vertex with linguistic labels using natural language in order to describe them, for instance: “low-quality human capital”, “highly efficient lawmaking”, etc. Weighted edges in the graph represent relationships between the concepts. Fuzzy cognitive maps evolved from the areas of biology, psychology, and sociology, where scientists recognized wide capabilities of applications and intuitiveness of such formalism. A data model based on a fuzzy cognitive map stands out in comparison with other models because of its inherent capability of knowledge structuralization. In other words, we are able to depict causal relationships in the data through the concepts in the map. Constructed maps will primarily consist of nodes corresponding to the determinants of economic growth. Automatic learning procedures will be applied to estimate the influence of those determinants on the economic growth and relationships (interactions) between the determinants.

### **Motivation and originality**

The existing perspectives in research on economic growth are usually either predominantly descriptive or predominantly computational. We will deliver an approach that bonds those two views together. Applying fuzzy cognitive maps renders the possibility to visualize and simulate the dynamics of economic growth with one model. Fuzzy cognitive maps are a modeling framework that is the most coherent with the philosophical doctrine of a diagrammatic representation of knowledge in the human brain. We believe that this way, it is possible to contribute truly novel models and gain new, holistic insights into the phenomenon of economic growth.

Fuzzy cognitive maps allow performing simulations and carry out if-then analyses. By setting certain assumptions on the variables conditioning the system, and then launching the model, it would be possible to simulate the behavior of economic growth. By defining multiple starting scenarios the model can be used to investigate possible consequences of different system circumstances. We envision that for different groups of countries maps would look differently. Thus, one may apply the methods that we plan to deliver to compare economies, but, what is very important, not only by looking at what is the effectiveness of those economies but also at what are the circumstances (conditions) in which they achieve certain effectiveness. We aim to deliver a deeper understanding of the relationships between determinants and economic growth.

The proposed approach is unique and no similar ideas are present in the literature. Thus, we believe that this project will bring value to this domain and open new research directions. We would like to emphasize that the project is positioned at the intersection of two disciplines: economics and information sciences. Successful implementation of the proposed research plan will result in new algorithms for both those domains.