Quantifying the development of Hungarian counties with LISREL estimation procedure during the period 1990-2016

**Keywords:** LISREL, factor analyses, regional development, latent variable, relative development

# Introduction

Development of Hungarian counties is described generally using the indicator GDP per capita. This is a very simply approach because this phenomena is more complex, it is multidimensional problem. We argue that development of counties is a latent variable. A linear regression cannot be made because the dependent variable is unknown.  But a special factor analytic method is able to give a solution for this problem. The unobserved dependent variable is influenced by determinants and in turn has an effect on the indicators. Using the LISREL estimation procedure, it is possible to quantify the relative development level of counties. This method is used in calculation of hidden economy but we can prove that this is a useful method to quantify other latent variables. Having a measure of development it can be analysed the assumption that the integration into the global value chain of Hungary has a significant impact on development of counties during the period reviewed.

# Methods

The indicator systems for description of regional development usually do not emphasize the structure of causes and consequences, indicators of the current status of relative development properly. We suggest that the complex analyses of causes and consequences results a reliable picture of relative development of Hungarian counties between the years 1990-2016.

The relation between causes and consequences can be captured by a latent variable which is in our research the relative development. The modelling of latent variables with causes and indicators are commonly used method for example in psychometry (Bollen, 1989) or in estimation of hidden economy (Frey B. a., 1984/30), (Frey & Weck-Hanemann, 1984/26), (Leandro & Schneider, 2018) The alternative methods for estimation of a latent variable can be classified into three groups. The original method for modelling of latent variable is improved by Kofler and Menges (Kofler & Menges, 1976) and called “soft modelling”. The second alternative method is the estimation of “hidden variables”. The third is a factor analytic method, the LISREL model (linear interdependent structural relationship) presented by Jöreskog that is a combined model of previous two models and the generalizations of the MIMIC (multiple indicators multiple causes) approach. (Jöreskog, 1969) The measurement model links the latent variable to observed indicators. The structural equations model specifies the causal relationships among the unobserved variables. This factor analytic approach is applied in our research.

The collected county-level data are available for the period 1990-2016, from this dataset the determinants are identified as the causes of change of relative development by Granger causality test. We consider five determinants can be detected that have a significant impact on the development of counties: the presence of successful private companies with capability of export production, the characteristics of available labour force (quantify, qualification, elasticity), the infrastructure, the presence of universities and social situation. These determinants are variables which are observed through indicators. The presence of successful private companies has the consequences that gross value added per capita is increasing. The available labour force is observable in rate of unemployment and change of migration and immigration among counties. Infrastructure includes the factor of utility gap, the length of national public roads and the number of retail shops and pharmacies. For the presence of universities the number of students in universities is a good indicator. Awareness of the direction of causes measurement and structural equation are fitted.

The results of economic development can be measured also with five indicators, which include the economic growth, the real wages and the development of infrastructure with the construction activity by location, the number of students by permanent space of residence and the internal migration difference.

For this model specification LISREL software is applied.

# Results

In the nineties ended the regime change and the structure of Hungarian economy adopted to the market economic environment. The economy integrated in the global value chain in high level because of the increasing foreign direct investments of multinational enterprises. The regional distribution of these corporations has been concentrated. The multinational corporations produced for export therefore their location was determined much more by the input opportunities of the region initially as the regional demand opportunities.

Later the increasing industrial concentration also became a self-generating process. The change of relative development of counties resulted changes in income and so in the final demand of households, as well.

These processes can be followed in our model because the counties’ integration into the global value chain also caused a significant increase in their relative development.

# Conclusions

We argue that our model is appropriate for the estimation of relative development of Hungarian counties between the examined years 1990-2016. We determined the regional causes and the consequences of economic development in Hungary during this period. The measurement and structural models are specified in LISREL software.

We conclude that the export-oriented, competitive multinational enterprises selected such regions where the input supply was more favourable. This process became a self-generating process, and the gap between developed and less developed regions also deepened.

In addition, it is shown that the modelling of latent variable is appropriate for the estimation of relative change of counties’ economic development.

# References

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