DATA PREPARATION FOR RELATION MODEL FOR TRANSPORT AND ECONOMY EQUILIBRIUM

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This article is focused on statistical methodology for preparative phase of equilibrium model construction betwen systems by means of lation analysis and especially partial problems, that can occure by this analysis and obstruct solution relevance.

Key words: relation model, transport figure, economical figure, equilibrium, correlation, variable, regression, indicator

1 Introduction

Interaction between macoeconomical and transport system can be described by so called relation model.Basic idea of this model is reflection of mutually influence of both systems during two time periods by particular variables characterizing these systems.

2 Relation Model

Relation model points out two basic moments:

- macroeconomical system and its changes during certain time period T_1 are influenced by changes happened in previous period T_0 in transport system and also economical system itself,
- transport system and its changes during certain time period T_1 are influenced by changes happened in macroeconomical system in this period, next by function and state of transport system in previous period $T_{0.}$

As evident, relation model does not reflect dependence of macroeconomical system variables in investigated period T_1 on variables characterizing transport system in this period. This opinion mabe follows from e.g. long-time period contruction of transport infrastructure and impact of its existence will influence to economical variables in next period.

Next dependence uncomprised in this model is relation of transport indicators in monitored period T_1 and economical indicators in previous period T_0. E.g. Inflation or unemployment rate will affect transport indicators (passenger transport quantity) during monitored period and they will impact back economical system in following period. This idea confirmed fact, that it is not necessary to consider above-mentioned relation.

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Practically these all dependences are possible to test them by methods of statistical correlation automatically without put the question of logical relation existence of these selected variables. It is possible to execute directly correlation analysis on the basis of facts in relation model and then to propose equilibrium model following from regressional methodology. Other unmentioned dependences in model are also possible to correlatively assess, but this analysis would have only confirming function, nevertheless it has not to be excepted, that correlation analysis will show some dependence. Then it is up to solver, whether he will deal with other than assumed results of correlation coefficient.

SYSTEM IN PERIOD T_0/T_1	**SYSTEM IN PERIOD T_1**	**DEPENDENCE $X_{T1} = f(X_{T0})$**
ECONOMICAL T_0	ECONOMICAL	YES
TRANSPORT T_0	ECONOMICAL	YES
TRANSPORT T_1	ECONOMICAL	NO
TRANSPORT T_0	TRANSPORT	YES
ECONOMICAL T_0	TRANSPORT	NO
ECONOMICAL T_1	TRANSPORT	YES

From mathematical viewpoint, relation model works also on delayed correlation, its intensity can be examined by the same methods as correlation between two same periods, but it is necessary to shift one time series over specific number of periods.

Relation model works on dynamical expression of dependence. Correlation analysis ca be also used in statical form, e.g. area expression (regional figures, national indicators etc.) during certain time period. It is a question, if this analysis have wider relevant value – is it right to generalize correlation analysis result of space figures in one period on other ones ? If we separately confirmed area result also in next years, we could tip changes of dependence structure of these indicators. Indicators can be divided in partial indicators, which will precise dependence structure (passenger transport according to particular transport modes).

3 Problem of Apparent Correlation

By investigation of time series, we can work on assumption, that they can be described by so called aditive model – sum of deterministic and stochastical components. But investigation of total development tendence of series is not sufficient for unique determination of causal relation between series, because they can have very similar course. An that is why it is necessary to explore existence of any relation between stochastic components of analysed series. If this dependence is demonstrated, then we can assume existence of real causal dependence between monitored time series. We can use statistical methods of measurement of series dependence closeness for stochastic components, thus abstraction from trend or seasonal component. Then course of both series trend will be estimated – we have estimations sequence of trend values. For obtaining of deviation estimations – residues - we must subtract trend value estimations from appropriate empirical figures. Residues represents stochastic component.

By investigation of dependence closeness in time series, choice of type of trend functions describing development of analysed time series is very important step. Reliability of calculated correlation coefficient is namely conditioned by appropriate choice of trend function type, from which there are derive next correlated deviations. Unappropriately selected trend function adjusting time series causes irelevancy of residues sequence as key tool for causal relation analysis between series, therefore deviations will not be stochastically distributed in time. We speak about autocorrelation – dependence between adjacent deviations from trend. This autocorrelation can be detected e.g. Durbin-Watson test for testing of random failures independence.

4 Autocorrelation Problem

Other attempt to autocorrelation by Durbin-Watson test is case of close dependence between adjacent (or no-adjacent) terms of one time series itself. There exists methodology to discover it – autocorrelation coefficient of k-th degree between two terms of time series, where k-1 is number of other terms between these two explored terms. Confirmation of dependence on basis of this autocorrelation doubts rightness of inclusion of this dependence in final equilibrum model.

5 Application to Final Model

Preparative phase of equlibrium model creation for transport and economical system, resp. finding of relevant expression of relations between selected indicators of both systems, works on analysis of these indicators. Tabelarised expression and functional summary as follows:

Series 1	**Series 2**
X_{T0}	X_{T1}
X_{T1}	X_{T2}
X_{T2}	X_{T3}
X_{T3}	X_{T4}
.....	.....

This table reflects case of autocorrelation of the 1st degree of one selected indicator of certain system. Investigation of two variables correlation (transport and economical) in the same actual period is following:

Series *X*	**Series *Y***
X_{T0}	Y_{T0}
X_{T1}	Y_{T1}
X_{T2}	Y_{T2}
X_{T3}	Y_{T3}
.....	.....

Investigation of correlation between one variable in actual period on basis of change of other variable in previous period as follows:

Series *X*	**Series *Y***
X_{T0}	Y_{T1}
X_{T1}	Y_{T2}
X_{T2}	Y_{T3}
X_{T3}	Y_{T4}
.....	.....

In case of all correlations proving, we can execute regression analysis or its multiple variant, those model will take into acount all necessary time consecution of individual variables. Solver can explore dependence of economical variables on transport variable or vice-versa. It can be complexly assured by method of associated lines (if linear dependence is sufficient model from determination viewpoint), which are in essence inverse functions each other. The problem is, that relation model primarily does not refer to one-variable function – it is not sufficient solution, in addition we can not consider purely inverse forms, because each variable in this model in actual period analyse different character of dependence both on itself and on other variable:

$$E_{T1} = f\,(E_{T0}, D_{T0})$$

$$D_{T1} = g\,(D_{T0}, E_{T1})$$

But it is the simplest case, where only one dependent and one independent variable plus course of dependent variable in previous period. If solver consider the whole range of independent variables, expression as follows:

$E_{T1} = f\,(E_{T0}, D^{i}_{T0})$ for i = 1 to m transport indicators,

$D_{T1} = g\,(D_{T0}, E^{j}_{T1})$ for j = 1 to n economical indicators.

Other complication would be considering of other variables of system, which is represented by dependent variable of actual period:

$E^{1}_{T1} = f\,(E^{k}_{T0}, D^{i}_{T0})$ for i = 1 to m transport indicators, k = 1 to x economical indicators,

$D^{1}_{T1} = g\,(D^{l}_{T0}, E^{j}_{T1})$ for j = 1 to n economical indicators, l = 1 to y transport indicators.

Above mentioned relations follow from construction of relation model, other relations which are not considered in this model, are appropriate to prove.

6 Conclusion

Model is based in essence on long-time period of time factor impact and tha is why it is consider as long-time equilibrium. Model in its own classis form ilustrates general relations between particular systems graphically and verbally, but it is not focused strictly on equilibrium in concrete analytical form. Above-mentioned ideas have goal to confront possibilities of its practical usage.

Reference literature

1. LIBERADZKI, B. *Transport: Popyt. Podaz. Równowaga.* Wydawnictwo Wyzszej Szkoly Ekonomiczno – Informatycznej w Warszawie. Warsaw, 1998. ISBN 83-906188-2-6.
2. HINDLS, R., HRONOVÁ, S., NOVÁK, I. *Analýza dat v manažerském rozhodování.* Grada Publishing s.r.o., 1st press, 1999. ISBN 80-7169-255-7.
3. ŠVADLENKA, L. ; KAMPF, R.; BECKOVÁ, H.; Environmentální aspekty dopravy v ČR. In *Teorie dopravních systémů : soubor odborných statí*. Brno: Tribun EU, 2008. ISBN 978-80-7399-347-4.