

# Incipient Causes in the Economic Process and Measurement Techniques

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## Abstract

*The measurement of multivariate qualitative variable and the approach of the incipient causes, that exert indirect influence on economic process represent the main goals of this article.*

*Regard first aim, we consider useful the decomposition of qualitative variable (q.v.) in view to define certain numerical components. A geometrical mean of the comparable levels of such defined components represents a good measurement of the intensity of analyzed q.v.*

*The second aim is approached as an econometric model with simultaneous equations in which indirect causes are represented by the exogenous variables in the structural form of the model. Finally the indirect influences are estimated in reduced form of the econometric model and that form replaces the “original” equation and its direct influences of the initial factors.*

**Key words:** *qualitative variable, numerical value, geometrical mean, regression function, econometric model, structural form, estimate, reduced form, dummy variable*

## Introduction

In what follows we propose two methodological approaches for two different purposes but having in common an element which can be reduced to a search process in order to stand out some incipient and indirect causes, not very visible but very important for the economic process in question.

Firstly, we describe an algorithm destined for measurement of certain q.v. Especially attention is dedicated to such variable that include many components and allow only an attributive measure (attributes, categorically appreciations, degrees of comparison). As examples, we present: consumer satisfaction, economic and social development, quality of management, attitude against risk etc. Among previous q.v. we can distinguish both results (Y) and factors (X) with an important role regarding certain economic phenomena.

As a consequence quantifying such variables can prove very useful in economic analysis and modeling processes. Certainly, there are several methods with this purpose but we have in mind an algorithm directed to quantifying multivariate q.v.

The second methodological approach is focuses on incipient causes that determine an economic process (Y). We consider the existence of such causes (Z) that “are coming from the past” and influence the process by means of certain direct factors (X).

As a regression model frequently expresses the change of variable Y due to the direct factors (X), can be also useful to quantify the indirect influences and therefore extent the scope of the analyses.

Examples: a product function includes as factors the input capital and labor. But behind input capital there are certain causes as investments, price energy, etc; consumption function for durable goods includes certain direct factors as savings, rate of interest, and variety of supply.

Each factor, in its turn, can be considered as a result of specifically causes as: income in many successive periods (for savings), discount rate (for interest) decision regards import of durable goods (for supply).

The measurement of the role of indirect causes is also important especially when a significant change regarding such causes leads to some major changes of the process (Y)

## A Measurement of Qualitative Multivariate Variables

There are certain solutions or methods destined to attribute numerical values to q.v. Among them we recall: dummy variable for two alternatives-variables, assignment values in succession for variables with more alternatives, the replacement with a representative variable (proxy) that can be quantified [3, 5], scale methods [5] etc.

In what follows we refer to certain qualitative processes, each expressing, as a synthesis, more aspects that defining such a variable. In marketing and psychology it is recommended for q.v. to be measured by a numerical level defined as a weighted aggregate of elements presented in a comparable form (index) [4, 5].

We proposed an algorithm that also lead us to an indicator (can be considered an index number) obtained as a mean level (a geometrical mean) of the defining elements, each related to the best (ideal) value that can be obtained at a certain time.

Hypothesis:

1. a large majority of multivariate q.v. can be expressed by a cluster of defining quantitative variables each having an indispensable role;
2. there is a stock of knowledge that allows us to introduce in the calculation certain components with the properties: a) having an essential role for qualitative process; b) can be expressed by numerical values;
3. admits some different degrees of intensity (usually expressed by degrees of comparison, epithets, rating).

In view to quantify a multivariate q.v. we present the following steps:

- establishing a complete definition (defining limits, meaning agreement) for q.v.;
- finding certain fundamental aspects that are characteristic for q.v. (Y), but also support a numerical evaluation. Note such numerical and defining elements  $x_j$ ;

- establishing for each element  $x_j$  the best level which can be obtained at a time. Note this element  $x_j^{(0)}$ . In relation with mentioned levels it is necessary to unify the direction of

increase for each element  $\frac{x_j}{x_j^{(0)}}$  according to the level of the whole (Y)

So  $Y \uparrow$  if  $\frac{x_j}{x_j^{(0)}} \uparrow$  for all j

- calculate geometrical mean of elements expressed in a comparable form as follow:

$$Y = \sqrt[m]{\prod_{j=1}^m \frac{x_j}{x_j^{(0)}}} \quad (1)$$

Advantages:

- if it is possible to decompose the q.v. in certain determinant and measurable elements we can obtain a numerical level based on a simply modality as an unweighted geometrical mean. The weights are not necessary because each element is considered determinant;
- the value obtained for q.v. is not independent by what is considered, in a certain time, would be the best. On the other hand, the ideal value can be partial subjective, what is significant for certain q.v. (e.g. satisfaction, beauty, appreciation) and our indicator (1) is sensitive for such an aspect;
- it is possible to test the degree of concordance between what we usually estimate through names, epithets, attributes and numerical levels obtained from (1). A rank correlation is recommended for such a verification [6].

Limits:

- finding such elements in view to describe q.v. so that their role is determinant, their levels can be expressed by numerical values and also admit a reference level (the best performance). We consider that a large number of qualitative processes can be decomposed in such elements that accomplished these conditions;
- having in view the properties of the geometrical mean, it is necessary to avoid zero-level, just for a single element. Since zero-level is unacceptable, a however small numerical value is recommended to be included in the calculation.

## **Indirect Explanatory Variable Considered as Incipient Causes of Economic Process**

If in the previous paragraph we have interested to decompose a qualitative phenomena in certain essential elements that can be quantified, in what follows we search also fundamental elements, having an explanatory role about concerning an economic process (Y). The aim is not measuring the level of a q.v. but to quantify the influences of certain indirect but important causes.

Hypothesis:

- the development of an economic process involve certain causes chains so that a factor X that influence a process Y is determined , in its turn, by one or more causes Z, etc..
- the route of process Y, but also the changes of X-levels can be decisive influenced by one or more decisions (including dummy variables with values zero ,before decision and 1-after decision, is recommended);
- the economic analysis has in view to estimate the influences of direct factors (X) but the same importance can be attributed to indirect influences (the causes of cause) especially such causes (Z), not always mentioned, having a leading part for the actually state of economic process (Y).

The solution consists in expanding the approach described by the regression model

$$Y = a_0 + a_1x_1 + \dots + a_kx_k + u \quad (2)$$

to a structural form of an econometric model in which all explanatory variables (or the majority of them) become endogenous variables. Such an approach suppose a classification of the factors included in based equation (2) as fallows:

- direct explanatory variables for which is difficult or uninteresting to find causes (e.g. number of population, tradition, cultural level);
- factors that are influenced by important causes, very interesting for a complete analysis of process Y.

Such causes can be economic or social causes, decisions that affected the evolution of a factor, lagged causes. In the following equations (linear form) we present some classical models [1, 2, 6] including causes (exogenous variables) in certain structural equations as fallows:

Consumption function

$$\text{CONSUMPTION (household)} = a_0 + a_1\text{INCOME} + a_2\text{Endowment} + u \quad (3)$$

$$\text{INCOME} = b_0 + b_1\text{LABOR} + b_2\text{INFLATION} + u_2 \quad (4)$$

$$\text{Endowment} = c_0 + c_1\text{AGE} + c_2\text{Dummy} + u_3 \quad (5)$$

Product function

$$\text{PRODUCTION} = a_0 + a_1\text{LABOR} + a_2\text{CAPITAL} + u \quad (6)$$

$$\text{CAPITAL} = b_0 + b_1\text{INVEST}(t) + b_2\text{INVEST}(t-1) + u_2 \quad (7)$$

Monetary function

$$\text{DEMAND for MONEY} = a_0 + a_1\text{GNP} + a_2\text{INTERESTrate} + a_3\text{INFLATION} + u \quad (8)$$

$$\text{GNP} = b_0 + b_1\text{LABOR} + b_2\text{CAPITAL} + u_2 \quad (9)$$

$$\text{INTEREST rate} = c_0 + c_1\text{DISCOUNTrate} + u_3 \quad (10)$$

$$\text{INFLATION} = d_0 + d_1\text{BroadMONEY} + d_2\text{INFLATION}(t-1) + u_4 \quad (11)$$

In equation (2) if we consider  $x_1$  a direct factor (first class),  $x_2$  a factor determined by causes  $z_1$  and  $D$  (dummy variable),  $x_3$  a lagged explanatory variable influenced by causes  $z_2$  and  $z_3$ , we can illustrate a general form as follows

$$y_t = a_0 + a_1x_{1t} + a_2x_{2t} + a_3x_{3,t-1} + u_1 \quad (12)$$

$$x_{2t} = b_0 + b_1z_{1t} + b_2D + u_2 \quad (13)$$

$$x_{3t} = c_0 + c_1z_{2t} + c_2z_{3t} + u_3 \quad (14)$$

A reduced form that allow us to estimate the indirect influences on  $Y$  supposes replacing explanatory variables in (12) with their expressions (13; 14)

$$y_t = a_0 + a_1x_{1t} + a_2(b_0 + b_1z_{1t} + b_2D + u_2) + a_3(c_0 + c_1z_{2,t-1} + c_2z_{3,t-1}) + u_1 = \alpha_0 + \alpha_1x_{1t} + \alpha_2z_{1t} + \alpha_3D + \alpha_4z_{2,t-1} + \alpha_5z_{3,t-1} + v_1 \quad (15)$$

Parameters estimates are obtained applying 2-least squares method [2, 6].

## Conclusions

Having in mind such q.v. which usually are expressed by names or epithets we propose an algorithm destined to decompose the qualitative process in certain defining elements that can be quantified.

We consider that almost all q.v. are based on such elements that can be expressed on a numerical scale. An aggregate that includes different elements supposes a comparable evaluation and the proportions between the actual state and the ideal state (the most favorable) obtained for each element offer such an evaluation. Finally, a geometrical mean leads to a numerical level for q.v.

In view to measure the roles of indirect causes that explain the evolution of an economic process, we continue to refer at "the second line actors" (i.e. some significant causes that determine the magnitudes of direct factors).

As a solution we recommend the structural form of econometric model in view to estimate the contributions of indirect causes considered as exogenous variables. The least squares in two steps method is applicable and the parameters in reduced form express such indirect influences.

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## Cauze inițiale în procesul economic și tehnici de măsurare

### Rezumat

*Măsurarea variabilelor calitative multidimensionale și abordarea cauzelor inițiale, care exercită o influență indirectă asupra procesului economic, reprezintă principalele obiective ale acestui articol.*

*În ceea ce privește primul obiectiv, considerăm util descompunerea variabilelor calitative (v.q.) în vederea identificării anumitor componente numerice. Media geometrică a nivelurilor comparabile ale acestor componente reprezintă o măsurare adecvată a intensității a v.q. analizate.*

*Cel de al doilea obiectiv este abordat ca un model econometric cu ecuații simultane, în care cauzele indirecte sunt prezentate de către variabilele exogene din structura modelului. În cele din urmă, influențele indirecte sunt estimate într-o formă restrânsă a modelului econometric și această formă înlocuiește ecuația „inițială” și influențele sale directe asupra factorilor inițiali.*