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Some reflections on the empirical foundations of INFORUM models

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1. Introduction

„Quod non est in actis, non in mundo“ Cicero

Phanomena which are not recorded in official documents are considered to be non-existent by public servants. Translated into the language of an empirically oriented economist: The knowledge about economic reality is limited by the extent and by the characteristics of the available statistical data.

Economic reality is primarily perceived through the eyes of the statistical system of the country. In the case of the builders and users of INFORUM models economic reality is primarily perceived through the lenses of Input-output tables and national accounts.

"The text of the economy is truly an authorless text whose meaning cannot be deciphered by reference to an external legitimating authority....it has to be compiled, sifted and sorted. .. Economists may be regarded as the readers of a highly fragmentary text with missing pages, blanks and erasures. In this, economists my be compared to classical philologists ...the most important part of evidence is provided by empirical data of one sort or another, for examples time series on GNP, inflation" (BROWN 1994, pp.374).

Many users believe that this text (to be found in the publications of our Statistical Offices) is the best (only possible) description/reflection of economic reality we may have.

They assume that the data meets the following criteria

- it is adequate to the question, the concept under consideration
- representativeness
- homogeneity
- objectivity
- provides a unique solution
- full coherence is guaranteed
- accuracy and reliability is not limited
- timeliness

In this context objectivity does not only mean that the data is not manipulated. The statistical result should be independent of the persons involved in the data generating process.

2. Some spotlights on the data generating process

Usually statistical data results from a long process characterized by a high degree of division of labor in which many people of different background are involved.

On the way from the elementary elements of observation to the statistical results some decisions of strategic importance have to be taken with respect to choice of statistical units, of classification systems, valuation systems and the like.

Three different types of models are involved in the various consecutive steps of data transformation, which provide data of different cognitive character.

2.1 Three different types of models to generate statistical data

Models of Type 1 – Condensation of information

- Statistical data which is rooted in observations and which results from classifying and aggregating this information.

Models of Type 2 – Substitution of information

- Statistical data which has been estimated by various types of models although the target variables could - at least in principle – have been observed.

Models of Type 3 – relabelling of information

- Data which has been estimated on the basis of observed variables although the target variable itself is not observable.

Models of Type 1 Condensation of information

The main procedures used are classification, consolidation and aggregation. Each of these steps has a theoretical background,

none of them is neutral with respect to the final use of the aggregates. It is worthwhile mentioning that classification and aggregation is also done on the micro level, long before statisticians apply their criteria.

Classification and aggregation is inevitable to arrive at statistical results. If the rules are known, the implications of applying models of this type are quite clear.

The design and the calculation of indices of all kind also fall within this group. Elementary information is condensed with a specific analytical goal in mind. The user has to know the index formula, the weighting scheme used and all the other technical details if he/she wants to make appropriate use of the index results.

Insofar the consolidation of information is concerned, national accounts in current prices as well as the intertemporal and international price and volume measures belong to this group of models.

As in the case of simple aggregation, the implications of applying even complex models of this type should be evident to the well informed analyst if the rules are known.

The choice of an index formula, of a base year, a level of aggregation, each of these decisions is of course also theory-laden.

It is not possible to discriminate between various alternatives on the basis of empirical tests. Sensitivity studies however can provide some insight into the robustness of the results with respect to modifications in the basic decisions. "Concepts matter".

Models of Type 2 Substitution of information – Generating data elements which are observable

Models of this type substitute observations by model results although the target variable could - at least in principle - be observed.

To this class belong all models that state a functional relationship, in which both the dependent variable and the explanatory variables are observable.

Therefore it is - at least under certain circumstances - possible to test the underlying functional relationship empirically and to estimate parameters.

$$B = f(A_1, A_2, A_3, ,,,,,, A_n)$$

A stands for variables, for which observations are available
B stands for the target variable, for which no direct observations are available

This type of model is primarily used in order to save resources in statistical offices and/or to reduce to response burden.

Model Type 2 .1 Standard case

In the process of compiling commodity and production accounts models of this type are used to overcome obstacles of all kind. Examples are:

o If data on purchases of commodities is available instead of information on inputs by commodities, a functional relationship is assumed to get rid of the inappropriate classification along the time axis.

o If no detailed data on the maintenance costs for cars is available by industries, an estimate is derived by multiplying the available number of cars by industries by the average cost structure per car.

o The input of fuel is assumed to be proportional to the input of tires. Then the known fuel input by industries can be used as explanatory variable for estimating the input of tires. The parameters could be either derived from engineering information or from a small sample.

In all these standard examples a model is used to generate second-best estimates instead of gathering observations which would be too expensive to collect.

Model Type 2 .2 Sampling

Sampling instead of collecting data from all the units is another example of a model of Type 2 and can be considered as a special case.

Especially when price data is collected, sampling plays an dominant role. Although most of the prices could be observed, only prices of selected commodities are monitored. The observations are limited to certain dates (a sample in time), to certain cities and selected outlets (a sample in space).

Model Type 2.3 Forecasting models

If data from previous periods in connections with some general indicators is combined, a type of a forecasting model is used.

$$B_t = f\,(\,A_t\,,\,A_{t-1}\,,,,,,\,B_{t-1}\,)$$

Most updating procedures frequently used in arriving at more up-to-date commodity and production accounts comprise at least some elements of this model type.

Model Type 2.4 Balancing, reconciliation

Last but not least all balancing procedures belong to this class of models. They are starting from available but not consistent observations (or model results) with the aim to achieve a consistent solutions. In all cases in which the entire discrepancy is not allocated to a single element, balancing procedures destroy the direct link between the elementary observation and the resulting aggregate.

All results based on models of Type 2 are dependent on the specification of the underlying functional relationship and on the validity of the parameters used. Since it is possible to evaluate these relationships empirically, tests can provide some insight into the validity of the model and on the robustness of the estimates.

Models of Type 3 Generating of elements which are not observable

Models of this type rely on functional relationships, in which the explanatory variables are observable but the dependent variable is not.

Therefore it is not possible to test the underlying functional relationship empirically and to estimate parameters. The decision in favor of one of a number of alternatives has to be taken on the basis of a priori considerations.

$$C = f\,(\,A_t\,,\,A_2\,,\,A_3\,,,,,,\,A_n\,)$$

C stands for the target variable, which is not observable

The aim of such models is always to proceed beyond the limits of observability. Two subgroups can be distinguished:

Model Type 3.1 Generating data outside the domain

Models of this type try to generate data outside the domain in which these variables **are** observable. The treatment of rents in national accounts and supply and use tables is an illustrative example. Rents paid are of course observable, they are based on transactions. The imputed rents for owner occupied houses and apartments have no counterpart in the world of observable transactions. If we want to include these services into the output of real estate, we have to **assume** some relationship between factors such as size and quality on the one hand and the rent on the other hand. This relationship can be tested **within** the domain of transactions but not beyond this domain.

Model Type 3.2 Relabelling information

Models of the Type 3.2 generate information which is not observable at all. In this case one has to rely on conventions or a priori considerations. The definition of output of non-market producers as the sum of inputs is a well known example for a model of this type.

Although it is not possible to test the relationships behind models of Type 3 empirically, sensitivity studies can be carried out to gain evidence how sensitive the results are with respect to the underlying assumptions.

Data of descriptive nature and the results of models are not shown separately. Instead, they are merged together. Most aggregates - even after the first steps - consist of layers of different nature. The size of these different layers is unknown to the user and - in most cases - even to the statistical office. What is presented is by no means homogeneous. It is not only aggregation over different layers of accuracy. It is aggregation over elements which are of different cognitive character, from a methodological standpoint it is adding up elements that are not commensurate. Aggregation results in conglomeration.

2.2 Some consequences of the data generating process

In the opinion of the general public – and of some economists – only models belonging to Type 1 are used to generate statistical data. In contrast to the simplistic view many aggregates on the meso and the macro level are not just the result of classifying and adding up observations on the micro level. Model

calculations belonging to the families of Types 2 and 3 enter the data generating process in various stages.

The micro-macro link is not easy to establish and the data offered by Statistical Offices does not always meet the criteria already mentioned.

- adequate to the question, the concept under consideration

The results of models belonging to families two and three never provide data that is fully adequate to the question, the concept under consideration. Substitutes instead of the variable which we are interested have to be used.

- representativeness

One of the reasons why models of Type 2 are used so frequently is to achieve representativeness. The price which has to be paid for a higher degree of representativeness is the conglomeration of data of different character.

- homogeneity

What is pretended to be a homogenous body of data is by no means homogenous. Many aggregates results from lumping together elements which belong to different categories of information. Homogeneity is neither given in time series nor across branches, etc.

National accounts are not homogeneous with respect to the character of the building blocks in two respects. On the one hand the empirical content differs from aggregate to aggregate. Consequently some types of analysis have a better empirical foundation than others. On the other hand the empirical content differs from version to version. In a time series the last observations usually are first estimates and preliminary results and are thus of a different character compared to the other elements in the time series.

The obvious heterogeneity of the various elements of an IO table - not only with respect to reliability and accuracy - is of special relevance for all applications of IO techniques because the calculation of the Leontief inverse starts from the basic assumption of perfect homogeneity of the data.

In the resulting Leontief Inverse each element - to an unknown degree - is dependent on elements belonging to the category of facts and on elements belonging to the category of model results.

- objectivity, a unique solution

When models belonging to the family of Type 2 are used, there is always a wide range of modeling alternatives. Because of the wide range of alternatives no statistical result may be interpreted as a unique solution. It is one our of a whole range of competing solutions.

- full coherence is guaranteed

The aim to present a coherent and complete system requires to proceed far beyond the limits of observability. In the case of constant price calculations, the wish to offer a parallel system to the set of current price calculations, forces the statistician to go beyond the domain in which the change in prices can be isolated from changes in other factors in an acceptable way. The domain of observability differs from variable to variable. In order to guarantee coherence in a closed system of data (such as national accounts), models of Type 3 come into the picture.

- accuracy

Is accuracy in economic observations – in the sense of small errors in observations - really the key problem?

- timeliness

The various building blocks of our statistical system become available with different time lack after the reference period. In order to meet the users demand for up-to-date data information observed data is combined with model results of Type 2.3.

In the case of models of Type 2 the information background differs from what the user would prefer to have. It is always a kind of a set of proxy variables which is offered. In the case of models of Type 3 the data provides the illusion of measuring the "unmeasurable".

3. Implications for INFORUM modelling

INFORUM models attempt to forecast economic development or - more precisely - to forecast what the statistical agency will publish a few periods afterwards. In the case of the evaluation of policy alternatives the aim is to simulate the

statistical pictures that might occur under certain circumstances.

The fundus of statistical information which is the empirical background of any INFORUM models contains – as has been illustrated - elements which belong to three different categories of information. In the standard case all three types of information are aggregated, quite often no or little information is available about the character of the data.

The implications of using data of different cognitive character are quite different whether this data is used for testing hypotheses in the course of model building or whether the data is used for forecasting and simulation purposes.

3.1 Model building – Testing and estimating parameters

When equations are estimated in order to integrate them into an INFORUM model this is usually not done with the intention to test economic theories. Testing theories in a strict formal sense is almost impossible in the field of economics because numerous auxiliary assumptions are required. Empirical work at least attempts to find specifications that are meaningful in the light of a priori considerations. And it always the aim to evaluate particular empirical models and specifications relative to alternatives.

When alternatives are evaluated and parameter estimated it is of relevance whether the underlying data was generated by models of Type 1 only or whether the data was also generated with the help of models of Types 2 and 3.

In the latter cases – viewed from the perspective of the information content of the variables – the equation is „respecified". In the simplest case the chosen variable is replaced by the variable which the statistician substituted for the target variable in the data generating process.

The example of a simple consumption equation

A simple consumption equation might have the following specification

$$pce_i^t = f(\, pdi^t, pdi^{t-1}, pdi^{t-2}, .. p_i^t, ...)$$

pce private consumer expenditures of commodity i
pdi personal disposable income
p price of commodity i

The data generating process which leads to an estimate for pce could be

$$\overline{pce_i^t} = pce_i^{t^0} \cdot O_j^t / O_j^{t^0}$$

O turnover of retail trade branch j

The respecified equation therefore is

$$pce_i^{t^0} \cdot O_j^t / O_j^{t^0} = f\,(\,pdi^t\,,\,pdi^{t-1},\ldots.\,p_i^t,..)$$

The example of labor productivity

Labor productivity plays a very important role in many INFORUM models. The simplest form of the specification is

$$\ln(E/Q) = a_0 + a_1.t + a_2.\Delta \ln Q$$

Q real output
E employment

The inverse of labor productivity is viewed as a function of time and the change of output in constant prices.

For many industries there is a considerable lack of annual data of total output in current prices. Even for industries for which data in current prices is available, there is a pronounced lack of price information which would allow the derive adequate estimates in constant prices. Given this situation statistical offices have to rely on models of Type 2 or of Type 3.1 for market industries and on models of Type 3.2 for non-market industries.

A standard approach is:

$$\overline{Q^t} = Q^{t^0} \cdot E^t / E^{t^0} \cdot lpr^t / lpr^{t^0}$$

Output in constant prices in period t is seen as output in the base year multiplied by the change in employment from the base year to period t, adjusted by the assumed change
In labor productivity from the base year to period t.

The definition of employment may be not exactly the same as in the INFORUM labor productivity equation, and the assumed labor productivity lpr does not fully correspond to the parameter to be estimated in labor productivity equation. Nevertheless it is obvious that there is a certain degree of tautology involved and that the explanatory power of an equation based on this type of data is limited.

The following documentation describes the practices used in OECD countries in more detail. Primarily it is devoted to the procedures in order to obtain estimates for value added at constant prices, but it also provides insight into the methods to obtain total output at constant prices.

Market services

Generally speaking it is more difficult to isolate the change in price from the change in other characteristics for services than for manufactured goods. As might be seen from an OECD documentation (OECD 1996) more than 14 different approaches for arriving at value added at constant process are used in the twenty industrialized countries which are covered by this survey. Many of the problems described in this survey also occur in the calculation of total output in constant prices.
In the double extrapolation approach base year values of total output and of intermediate consumption are extrapolated with the help of volume indices. If the extrapolation is based on quantity indices a model of Type 2 or of Type 3.1 is embodied. It is a model of Type 2, if the quantities are only used as a proxy for volumes, although it would be possible to arrive at volume indicators. A model of Type 3.1 is given if the compilation of volume indicators is not possible, not even at very high costs.

The extrapolation/deflation method mixes elements of the double deflation and the extrapolation approach. The basic character of the result is dependent on the character of the part which is extrapolated on the basis of quantity indicators.

Direct deflation of current price value added by an output index is only equivalent to double deflation if total output equals value added. It might be seen as an approximation by a model of Type 2 if intermediate consumption is very small.

Direct extrapolation of base year value added using a gross volume index is almost identical to the approach mentioned before.

Direct extrapolation of base year value added based on physical indicators represents either a model of Type 2 - if the quality change would be observable - or a model of Type 3.1 if this is not the case.

Direct deflation of current price value added by a price index of intermediate consumption is equivalent to double deflation if the prices of intermediate consumption move proportionally to the prices of output. To make such an assumption is only meaningful, if there is some a priori knowledge that the output prices are more or less proportional to the input prices because of some specific index regime. In such a case the approach could be classified as belonging to a model of Type 2.

Direct deflation of current price value added by a wage rate index is be seen as an approximation (of Type 2) if the wage costs are dominant and again some wage rate related index regime is in power.

Direct extrapolation of base years value added by a volume index of intermediate consumption is more or less equivalent to the Direct deflation of current price value added by a price index of intermediate consumption approach.

Direct extrapolation of base year value added using an index of deflated compensation of employees by a wage rate index is similar to the Direct deflation of current price value added by a wage rate index method.

The last four approaches mentioned in the OECD documentation have in common that they are based on the direct extrapolation of base year value added by means of physical indicators.

With the exception of the double deflation procedure and the double extrapolation based on ideal volume indicators, crucial assumption with respect to an underlying production function are embodied in all the alternatives mentioned.

All the single indicator methods are implicitly based on the hypothesis of fixed proportions of all the other primary and intermediary inputs relative to the explanatory variable used. The given or potential impact on capital - just to mention one factor which might be of some relevance - on output is neglected in the way, the functional relationships between the (single) explanatory variables and output at constant prices is defined.

The limitations become very visible in all the alternatives in which some kind of labor input variable in quantity terms is used as explanatory variable. Using the same notation as in the case of the OECD documentation, constant price value added in year t is expressed as a function of labor input (people employed or man hours worked) and labor productivity of year t:

$$VAR_t = VA_0 \, x \, IH_t \, x \, IPR_t$$

VA_0 represents base year value added
IH_t represents an index of labor input in quantity terms in year t
IPR_t represents an index of labor productivity in year t

If no adjustment for labor productivity is made IPR_t is assumed to be equal to one.

The tautological character of productivity measurement on the basis of constant price output results of this kind needs no further comment.

Even if the models all belong to Type 2, it is not very meaningful to base the analysis of productivity or the estimation of production functions on their results. The analysis cannot lead to important insight into the substitution process between primary factors of production, if the underlying data was generated under the assumption that such substitution does not exist. No significant results can be gained for the role of embodied technical progress when the basic hypothesis behind the data generating process was that the influence of capital on output at constant prices can simply be neglected.

For the user the situation is even more confusing on the aggregate level. As already mentioned, building blocks of different character are lumped together. The user thus may find some significant influence of capital, although the parameters will always be considerably biased. It is, however, not the standard bias of errors in observations, but a built-in-property of the data generating process.

Non-market goods and services

The OECD report mentioned before (OECD 1996) distinguishes fourteen principal methods according to the different model specification used. No distinction, however, is made with respect to the character of the results. As far as market services are concerned the models can either belong to the group of Type 2 models or to the group of Type 3.1 models.

In the case of non-market goods and services it is always a model of Type 3.2 that is used. Models of this type rely on functional relationships, in which the explanatory variables are observable but the dependent variable is not. The output of non-market goods and services is neither observable at current prices nor can the aggregate be decomposed into a price term and a volume term on the basis of price observations.

For some kinds of services the estimation can be based on detailed physical output indicators, the compilation of other

services such as collective services has to rely on the input convention as a proxy for output. Since labor plays a key role as an input in government services, the SNA discusses the use of a volume measure for labor alone combined with an explicit assumption about changes in labor productivity. "The attention of users should always be drawn to any built-in-assumption about the rate of growth of labor productivity which should be stated explicitly, even when it is zero" (SNA 1993, 16.141).

The somewhat special situation of non-market services within the overall framework has been recognized by a number of users. Therefore they limited their analysis to the "private sector", excluding government. To exclude the producers of non-market goods and services is not sufficient to escape the danger of modeling on the basis of models. As described before, exactly the same types of model assumptions occur in the private sector.

Generally speaking, there is no fair chance to escape this type of problems at all. Even on the level of a single statistical unit we face the same basic problem: On the one hand there is a bundle of goods and services produced by this unit. For some of the output items a straightforward way leads to constant price figures which fully correspond to the basic philosophy. But there are also new products and some services which are beyond the domain in which prices can be isolated and observed. Some modeling of the Types 2 or 3 has to be done on the output side if full coverage of the production program has to be ascertained. On the input side descriptive data on labor input is available. Because of the inseparable nature of a statistical unit it is not possible to exclude the part of labor input which corresponds to the part of output, for which the decomposition in the standard way is more or less impossible.

Consequences for productivity analysis

The domain of constant price calculations is considerably smaller than the domain of current price calculations.

The danger that assumptions about crucial relationships which are the task of the analysis have already been used to compile the real product is much more pronounced than in the case of the use of data in current prices.

Real product and all volume measures are very sensitive. This sensitivity is not only given with respect to the accuracy of the price data, the index concept and the base year. The results are equally dependent upon the level of disaggregation. Outside the domain in which prices can observed, they are determined by the specification of the model used. "Small relative errors in the price deflators can introduce errors which are several times

larger than the productivity effects we were looking for" (GRILICHES, REGEV 1995, p. 200).
The shares of the different components - different also with respect to their cognitive character - in real product are changing over time. The shares change because economic development is not proportional in real terms. One of the consequences is that what is measured is - among others factors - the results of the changing composition, a kind of product-mix effect.

The share of modeling components in the aggregate also differs from period to period because the fundus of descriptive data is not the same over time. Consequently in some periods more use has to be made of models of Type 2 and Type 3 than in others. The resulting time series is by no means homogeneous as far as the content of descriptive information is concerned. Perfect homogeneity of the data generating process through time, a condition on which the application of statistical techniques rests, is not given.

Given the high "total modeling content" of real product, the hypothesis that the figures provide wrong signals to economists cannot be rejected. On the basis of data collected by GORDON (1987), Zvi GRILICHES noted an interesting incident and discussed it under the heading "The facts": "The sectors where the productivity slowdown has persisted are largely outside of manufacturing and agriculture. Besides mining and public utilities, which were affected more specifically by the energy-price shocks, it has lingered particularly in construction, finance, and other services where output measurement is notoriously difficult" (GRILICHES 1994, p.3). In Figure 1 given in his paper, GRILICHES goes one step further and makes a distinction between "measurable" productivity and "unmeasurable" productivity. The classification of the industries was done according standard activity classifications. But to some extent the borderline seems to coincide more or less with the domain in which prices can be isolated and observed.

If the economies of the industrialized world are developing more and more towards service economies, the basic concepts of calculating real product are becoming increasingly inadequate.

In a realistic way total labor productivity must be seen as the weighted average of information of different epistemological character. What is the link of this kind of information to the appearance of reality? Was the extensive discussion of the slowdown of productivity growth devoted to a phenomenon of the "real world"? If yes, to which extent? If not, what was analyzed?

3.2 Forecasting - simulation of alternative scenarios

For forecasting and simulation purposes the situation is quite different. Although the link to "economic reality" might not be very strong, the equations might very well model the data generating process efficiently. Thus the equations may serve as good instruments for estimating what the statistical agency will publish a few periods afterwards.

The crucial condition for a good forecasting performance is that the data generating process is not modified and that no major product mix effects occur.

The crucial condition for a good simulation performance is that the data generating process is independent of the design of the scenario under consideration.
In both respects INFORUM models are much better off than macro models. They operate on a more disaggregated level. The probability that the variables used are relatively homogenous with respect to the data generating process ("model type homogeneity") is considerably higher. Nevertheless product mix effects of all kinds may change the size of the different layers in the aggregate even on the disaggregated level.

In order to "stay within the data generating process" it is necessary to have some insight into the data generating process, into the various layers of information and on the hypotheses that go into the calculations.

4. Instead of conclusions: Some methodological considerations

If the metaphor of a text which has to be interpreted by the user is taken up again, it must be concluded that this text does not only contain reports and records of **what has happened** in a condensed form (models of Type 1). Chapters based on speculations what **might have happened** - models of Type 2 - are also present. Last but not least, the text also consists of a number of paragraphs which are of **science fiction** nature (models of Type 3).

"The view treating science as data reduction, may sound over-simplified, but it is in fact a flexible metaphor that should not be controversial. The contentious issues should concern what "data" are to be characterized and what constitutes a "compression" (SIMS 1996, p.106).

Statistical data is not only the basis for economics but also already the outcome of economics, of combining facts and hypotheses. Statistical data is man-made, although "one tends to

suppose that national accounts just naturally appear every month like the new moon. In fact, they are perhaps the single greatest success of economic science" (ALMON 1998, p.83).

INFORUM model are not good examples for pure formal theory. They belong to the class of „appreciative theory". „Appreciative theorising tends to be close to empirical work and provides both guidance and interpretation. In contrast formal theorising almost always proceeds at some intellectual distance from what is known empirically" (NELSON 1994, p.292).

INFORUM Models want to provide results which are of use to decision makers. "To hold that economic theory should bee practically useful and yet to deny that there is any place for empirical testing in economics is, surely, inconsistent" (BLAUG 1994, pp.118). „Without some assurance about the cognitive status of the theory, there is no basis for confidence in it" (ROSENBERG 1994, pp.216).

"Another thing we have emphasized is the need for co-operation between the architects of economic models and the specialists what the building materials can be expected to do both now and in the future. Too long practical men and theorists have lived in separate worlds. The problems of economic strategy cannot be settled over a glass of port, nor can they be worked out from first principles without regard for the facts of economic life" (STONE, BROWN 1962, p.88).

Without access to metadata (both object data and process data) it is impossible to use statistical data in a meaningful way.

Fortunately there is a high degree of awareness among the members of the INFORUM family as far as data issues are concerned. And there is long tradition of paying much attention to the data generating process, just to mention all the work on the estimation of capital stocks and on the purification of IO tables.

A final remark with special reference to Computable General Equilibrium Models: Empirical economists find themselves in a similar situation as detectives. They have to interpret a difficult text, to solve a puzzle. Therefore it might be advisable for them to follow the instruction Sherlock Holmes gave to his friend and companion Dr. Watson: "It is a capital mistake to theorise before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts" (DOYLE 1994, p.7).

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