Comparison of Euclid-Cartesian and Babylonian reasoning in economics

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Two approaches to economics reasoning

There are two main approaches to economic reasoning,[2] the Euclidean-Cartesian (EC) and the Babylonian (BB). Their differences are not often discussed. This paper will argue that it is important to discuss these differences and that they have significant implications for economic methodology.

Intuitively their difference can be described with terminology of artificial intellect, branch of applied software information technologies. The EC logical system is a form of forward reasoning, the path of reasoning being governed by assumptions. Given some set of axioms we should come to some definite conclusion. BB involves a form of backward reasoning, where a path of reasoning is governed by the result. Given some fact we should explain it with relevant economic mechanisms.

The Euclidean-Cartesian approach[3] involves closed logical systems. The method is based on existence of a given set of axioms. Every axiom describes a desired property of an economic agent or the way they interact. The attractiveness of this form of reasoning is based on consistency of conclusions, guaranteed by mathematics. If the set of axioms is not contradictory, application of logical inference (mathematical formalism) generates all the possible outcomes about economic behavior.[4]

Reasoning starts from a set of axioms, so this system of reasoning can be described as deductive. Axioms are considered as purely logical assumptions. Mechanism of logical inference predetermines the set of the model conclusions. This application is just a computational procedure – the correct set of model assumptions generates reasonable conclusions. Some fault in axioms will disable reasoning.

So the question with reasoning (if the procedure of logical inference in doubtless) comes from an axiomatic structure of the problem. Any model can contain all assumptions explicit, but usually there are both of them - explicit and implicit assumptions. Implicit mostly are those which are derived from explicit ones or understood by default.

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[2] Dow S. The methodology of macroeconomic thought: a conceptual analysis of schools of thought in economics. Edwar Elgar, 1996, p.10.

[3] Despite of the title the idea of the method goes back to Aristotle.

[4] If method dominates over subject, we can generate mathematical results with poor economic content.

In some sense assumptions construct the base for the vision of the world and in this sense they become normative for thinking about the world. They construct the basic toolkit for reasoning. We understand a model from EC, as far as we are able to imagine a world, operating according to a given set of limited instructions.

All this makes a model to be a standardized way of reasoning for a given set of axioms. The efficiency of using a model as a mode of thinking comes from the following.

1. It is easily reproduced and there is no need to generate conclusions every time one needs some economic argument. A model allows to use a model as an instrument, as a logical toolkit. One does not need to create it every time.

2/ Earlier prepared set of models is important, when construction of a model is not costless, requires time, efforts and so on.

The Euclidean-Cartesian approach usually is the main toolkit for investigating structure of a new phenomenon in natural sciences. It allows to hypothise and use ceteris paribus principle. It's application constraints come from difficulties of describing features, which need to be isolated from the rest of the world.

The main principle of any contemporary economic models is the *ceteris paribus* principle. This principle makes it possible to demonstrate that a single change can be responsible for the whole effect. Generally, given ceteris paribus, a model becomes a single-reason pattern of thinking.

The difficulty of the EC-model analysis comes from several sources.

1/ Possible high costs of mathematical derivation of formulas and testing correctness of this derivation. It is very important restriction. It restricts application of Aristotle "identity" axiom: "any notion or thing referred to in one constituent statement of the argument must be identical to that notion or thing when referred to in any other constituent statement of the argument"[5]. It assumes that we can easily identify the same concept in any other reasoning context. This is undoubtedly true in the world of free inference. Otherwise we can not apply this axiom, what generates critics over the applicability of the argument. Example can be found in the same book (p.32):

"If the predicate P(…) is "Smith does not know whether … is greater than 800 000", and the number 7^7 and 823 543 are substituted for x and y respectfully, then (s) has the following hardly acceptable consequence. As 7^7 = 823 543 is easily verified[6], it follows that "Smith does not know whether 7^7 is greater than 800 000" implies "Smith does not know whether 823 543 is greater than 800 000".

[5] Handbook of Economic Methodology, ed. Davis. J., Wade Hands D., Maki U., Edward Elgar, 1998, P. 87
[6] Rare person can perform this without calculator.

Recent paper Gale D., Sabourian H (2005) [7] studies just the same effect of complexity of equilibrium on behavior. They argue, that "that the complexity of noncompetitive behavior provides a justification for competitive equilibrium in the sense that if rational agents have an aversion to complexity (at the margin), then maximizing behavior will result in simple behavioral rules and hence in a competitive outcome." This means that costs may prevent other equilibrium except competitive.

2/ Possible multiplicity of outcomes, what increases laboriousness. Mathematics guarantees a result, saying nothing about uniquenss. Economics is interested in uniqueness of the results – ultimate equilibrium. Multiplicity if results generates demand for comparison between equilibria.

3/ Mathematical formalism does not support cause-effect link. For example, the sign of equality "=" just revalues a left-hand side variable, as it is a reflexive operation. Whatever value we put in the right-hand side, it will be assigned to the left-hand side. In some cases this is very convenient, when a model can operate in direct way (when prices are an outcome) and in the reverse way, when reasoning starts from exogenous price disturbance. This requires outside control for exogenous and endogenous variables.

Another example of inadequacy of mathematical formalism comes from functional forms. If L(Y,i) is demand for money, that i can be an endogenous variable. From the mathematical side both letters are arguments, i.e. exogenous.

4/ Mathematical operations are defined on sets of exogenous independent and non-interactive variable. For example, on the set of real numbers. So the instrument poses another restriction – we can hardly discuss interacting behavior. For example, market demand is constructed in a way, which excludes possibility of a second best choice of some individuals.

The Babylonian approach, which derives from the Babylonian Talmud, involves open logical systems. It does not assume a unique system of axioms. It is based on two concepts: a norm and case study, which gives interpretations of the norm.

Sheila Dow has claimed that "argument in the Babylonian style is thus conditioned by the problem at hand, employs a range of methods suited to the problem, and these methods cannot be combined into one formal deductive argument without drastically changing their nature" (Dow 1996:13).

This is the initial difference from EC view - reasoning starts from a problem (or empirics), not from axioms and ex ante method of reasoning. BB allows coexistence of several reasoning patterns within one logical argument. In the successful theory they reinforce each

[7] Gale D., Sabourian H. Complexity and competition, Econometrica, Vol. 73, No. 3 (May, 2005), 739–769

other[8].[9] In contrast to EC we can easily switch from one reasoning to another. We can assume that logical and economical consistency is based on references to formal models in the style of EC-approach, which serve as building blocks. Relation of different reasoning within one BB approach is not discussed here.

The BB approach is widely used in law, theology, medicine. Examples can be found even in sciences.

BB approach is based on comparison with a "norm". For simplicity here we take concept "norm" as given here. Norm is assumed to be a paradigm for comparison, for which we ex ante know all the arguments. Inference is reduced to elucidating norms for given example. Non-exactness of comparison generates multiplicity of interpretations. This is one of the reasons why different economists give different explanations for the same fact.

Sometimes a norm can be borrowed from EC models, sometimes motivated by exogenous restrictions.

There are at least two weak points of BB analysis.

1. We can refer to an economic mechanism explicitly even it is not exactly known ex ante, i.e. if there does not exist an appropriate economic model. Reference becomes less quantity persuasive due to lack of formal analysis, if there is no special model, however often this becomes a starting point for consequent research. However reasoning happens in original terms what allows to reduce framing problem.

2. There is not in-built mechanism to resolve conflicts between different ways of reasoning, and the BB approach can be used for speculations.

3. Procedures of comparison between a norm and a given statement is rather vague, what again makes BB approach exposed for speculations.

Differences between Euclide and Cartesian reasoning

There are different views on relation between EC and BB reasoning. Although in the previous version of the paper my claim was that they are not mutually exclusive, I find argument of Professor J.Runde, that they are exclusive, persuasive. This same argument was mention in the very beginning of the paper - difference is the same as the difference between them forward (EC) and backward (BB) reasoning. This implies mutual exclusiveness. However when BB approach exploits conclusions of EC-models, they become complementary.

[8] A good contemporary example of such reasoning is F.Mishkin's theory of financial disturbances due to information asymmetry.

[9] Hicks noted, that in "General theory …" Keynes used hybrid reasoning, Hicks, J. R. (1985) Methods of Dynamics Economics, Oxford: Oxford University Press, p.52.

Anyway, if we claim that two ways of reasoning are different, we need to describe, in which respect they are different.

1. How to control inference. BB-reasoning starts from some fact, which needs to be explained. The absence of an axiom set provides flexibility in choosing economic mechanisms and their combinations. Formal models become building blocks in the inference. Absence of conflict resolution mechanism reduces efficiency of inference.

ED-reasoning is controlled by a set of axioms and by a rigorous mathematical layout. There is no problem with contradictions of difference mechanisms.

To make a long story short, the BB system can be described as fact-run reasoning system, the ED –assumption-run system.

2. Knowledge content. The EC-system can be only ex post reasoning, when some model does already exist. The approach assumes the isolation of a fragment of the world[10]. Isolation is understood as description of a process in terms of a "black box" with an interface with the outside world – set of exogenous and endogenous variables. The model is constructed in physicists' sense - transformation of exogenous variables into endogenous. Sometimes this approach loses the cause-effect relation. Virtual transparency of a model result creates two illusions. 1. The only problem an economist meets is to choose (construct) the correct model. 2. If the whole world is the set of models, than economic research is reduced to learning models and looking for new areas for application of these models.

Goedel uncertainty theorem claims that every closed logical system must contain items, which can not be derived within this theory and need be taken as exogenous. That is why EC closed logical system[11] is rigid for development. One cannot easily introduce a new concept without a possible conflict with the existing ones.

BB-reasoning can be used as the description of the world **ex ante** or/and **ex post.** We do not assume that we know ex ante all mechanisms, their interactions and explicitly assume incomplete knowledge of interaction mechanism. This can not be found in EC-approach, and this makes axiomatic approach unacceptable here. This means that BB approach is appropriate for cases where a problem domain is very complex for analysis or/and the whole construction of the domain is unknown. The size of the problem domain is determined by the volume of material and it's intrinsic interrelations.

3. Instrumental difference. While the ED approach is usually more mathematical, the BB-approach is usually more verbal. Although, this distinction is not so sharp. Formal models usually can not avoid verbal forms, and some parts of verbal reasoning can use mathematics as

[10] Biology equivalent will be an experiment *in vitro*.
[11] Means a model in the EC-style.

construction blocks. So the difference between approaches comes not from the form of presentation.[12] It is more difficult to be precise with words, then with formulas. However formulas have less economic interpretation than words.[13]

Diversity of reasoning in BB prevents it's reduction to a single deductive conclusion. Multiplicity of reasoning can be reduced by exogenous constraint or by a norm.

4. Concurrent reasoning. They can exist in BB-system, but never in an EC-system. Concurrent means that there are may exist simultaneous ways of reasoning (inferences), based on different economic ideas.[14] In EC there is a single way of reasoning, in BB one can use different ways of reasoning.[15] The problem comes when different forms of reasoning are not complementary, but substitutable, i.e. predict opposite outcomes. This generates tension and some exogenous conflict resolution is required. One of the ways can be a new EC model, which explicitly solves the conflict.

5. Application difference. Maybe this is the most known difference. EC-reasoning is mainly used for the construction of blocks of economic theory, which concentrate only on one problem. BB is used more for applied research and logical synthesis. However they are more interlaced. BB is used whenever one need to pose a problem before the solution, what is required in an introduction of any theory. EC may be used as a consistent logical step in descriptive reasoning, in BB.

6. Empirical verification. EC model can generate different tests for the same mathematicl construction. BB approach leaves place for empirical work only after certain restriction on interpretations, due to potential multiplicity of inference paths.

7. Scientific inquiry. In most cases a new research starts from the BB approach, as it allows to discuss several mechanisms, when ex ante which to choose is not clear. EC is considered to be a corollary of research.

Although little attention has been paid to the links between these approaches, the issue offers important methodological potential for developing economic thought. For example, Keynes used the BB approach to describe the relation between the interest rate and unemployment, which precipitated a new economic discipline macroeconomics. Hicks completed the mathematical version of Keynes's ideas, using the ED approach. Existence of critics of Hicks interpretation of Keynes ideas (see Lijonhufvud, 1973) demonstrated the relation between two ways of reasononing.

[12] Demand for precision and quantity analysis avoids verbal narration, although verbal instructions can be very precise two.
[13] There are other views on the issue. See J.Runde.
[14] In terms of ED, this implies simultaneous usage of different models for description of the same item.
[15] A multiplicity of types of reasoning implies richer considerations.

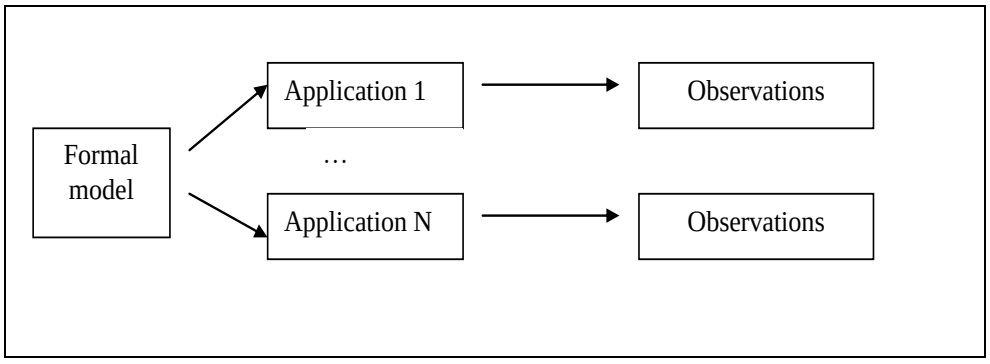
This means that there is no one to one relation between two approaches. There are exist many mapping from a BB reasoning to EC, although the inverse is exactly one to one.

In some sense the BB approach enriches our reasoning about the world as it explicitly requires coordination between different mechanisms and explicitly develops critical reasoning. However modern teaching economics is EC-oriented, which reduces the perception of the world to a single skill – choose **a** correct model. This way of teaching is more akin to engineering, than social science. What is lost by such borrowed teaching is the scope of professional (and social) vision. Engineering education is heavily based on special courses like engineering construction or running engineering projects. They develop skills to see a subject as a domain of interactive ideas and teach to separate and construct logical object (before real production) given problems into subsets with different bases. Modern economic research, encapsulated into ceteris paribus principle, does not serve this.

How do two ways of reasoning co-exist

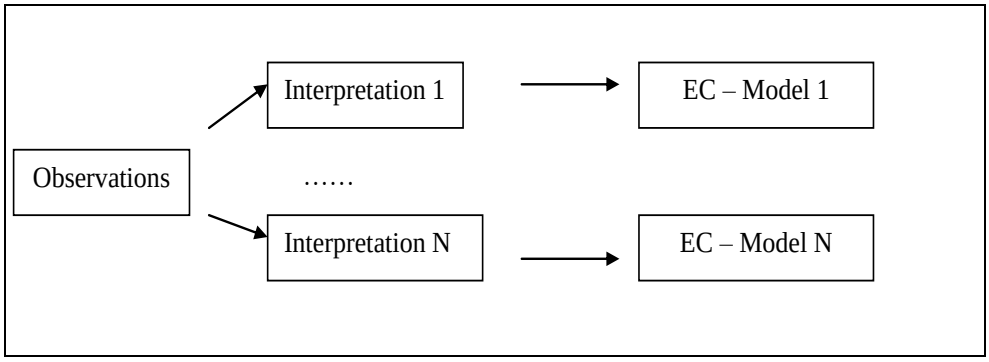
Co-existence of two ways of reasoning poses a question – how this happens? The main reason – there is variety of demands for economic analysis. List of demands for EC analysis looks something like this: educational purposes, developing instruments of economic analysis and quantitative analysis, which requires formulas and estimations.

Rigidity of a model structure (strict assumptions and logical inference) is compensated by multiple usage of the same formalism in different applications, derived from different contexts. Most contemporary economic education is based on this approach. New idea requires construction of a new model.



BB – approach operates in the opposite direction. Multiplicity of interpretations allows develop different EC-models, with different axiomatic basis. This way of reasoning is another goal of applied economic analysis. However, as education is based mainly on EC analysis, loss of reasoning skills reduces diversity of interpretations. We can claim, that BB reasoning is more used in applied analysis, which requires interpretations and quantitative analysis and also

discussion and description of new areas of research. This is the implication of few earlier examples – any theory should be described first before making a rigorous logical system, what allows construct axioms, necessary for EC-approach. Said above can be presented with the following figure.



Dominance of EC approach in economic education can be summarized by "MIT-teaching" method or teaching, starting from examples. Before introducing a model an example is given. The model serves to demonstrate not only how the example operates, but also uniqueness of this interpretation for the example. Take the simplest question: "Why do people get education?" Economics gives only one message – to send a signal to employee. However, there are can be other reasons – tradition, curiosity, following parents' advice, enjoying education, improving general intellectual level… From many social reasons' why a person goes to school, EC approach leaves only one – get a label (stigma). BB approach assumes discussion and competition between reasons.

There is another side of the question. Following Arnold[16] we can hypothesis that if a person prefers one way of reasoning, this can be a result of physiological difference in brain structure. "Rigid" models (in our terminology - EC-reasoning) is based on extensive usage of a left brain semi-sphere, "flexible" model (in our terminology BB-reasoning) requires harmonized activity of both brain semi-spheres.

So this means that individual preference between two ways of reasoning can be motivated by individual physiology. Economists use their individual comparative advantage – one people feel more comfortable with "rigid" models, other with flexible ones. The 20-th century for economics is characterized by the triumph of rigid modeling (EC-approach). If we remember the difference between approaches in application to unknown problems, we can derive that 20-th century formalism exploited advances of non-formal analysis of previous centuries. Ideas, which were accumulated for centuries, were transformed into formal systems within a little bit more than 100 years. Economic ideas, which were not easily introduced into formal analysis, were

[16] Arnold V.I., "Zhestkie" I "mjagkie" matematicheski modeli, МЦНМО 2004, in Russia. "Rigid" and "flexible" mathematical models.

abandoned for years. For example, in 90-s contracts were rediscovered for economic theory. Although, importance of contracts can be traced back even to Bible.[17]

EC-approach must avoid internal inconsistency, what prevents this reasoning from development. Including many interactive economic mechanisms leads to computational difficulties. Possible internal conflicts between interpretations BB contain subject for development.

Conclusion

Discussion of ways of reasoning covers validity of instrumental part of contemporary economic analysis. The real problem is that there are many ideas that do not fit into formal analysis due to different reasons. One of them is impossibility to single out an item as an independent and not-interacting term. Most of these cases come from the area, where economic behavior overlaps with social one. This significantly reduces descriptive and predictive power of quantitative methods of analysis and EC approach in general.

From the other side EC – models provide more unambiguous conclusions, than BB-models. This results in the trade-off – better logical purification of one idea with loss of control over all others. This seems something like uncertainty principle of Heizenberg: we can not simultaneously measure a particle coordinate and it's impulse. This idea used to be a challenge for classical physics and allowed overcome certain difficulties

[17] There are multiple cases where features of human behavior are formalized only in favor of mathematical correctness.