



The role of econometrics in economic science: An essay about the monopolization of economic methodology by econometric methods

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ABSTRACT

Econometrics is seen as the dominant method in terms of applicability, accuracy and efficiency in economic science. It is widely used and other methods have been reduced to marginal contributions. Econometricians behave as if their techniques were universal when in fact they are not. If alternative methods are accepted, one can largely eliminate the restrictions and distance to reality of econometrics. The article debates the pathways for a satisfactory economics in a context where theoretical and methodological pluralism is entering even in mainstream ideas. The historical construction of econometrics as the main method in economics and the limitations and possibilities of this tool are explored, underlining the need of pluralism.

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1. Introduction: Is it important to discuss econometrics?

Economists and economics have been widely criticized for an excessive use of mathematical formalization, beginning in the differential calculus, through operational research and arriving at econometrics (Hodgson, 2007; Dow, 2007; Chick, 1998).

Currently, it is clear that in the orthodox point of view, there is no other economics than the one that develops economic explanation models with a robust quantitative approach. Economics as a science should try to rethink their ability to accept different theories and methodologies without considering that abdicates from its scientific objectivity. Added to this theoretical debate comes the moment of today when economics is being accused of supporting and legitimizing liberal policies that led to the successive crises, in particular due to the dominance of orthodoxy in the mainstream of the discipline that celebrates the power of market as the main economic institution.

This is an old discussion to redefine economics but that assumes today a renewed importance because of the financial crisis that has been subject of attention in reference journals. Today it is

increasingly clear that econometrics, the most sublimated tool by the orthodoxy of the economic discipline, alone, without a robust interpretation, is a weak instrument, especially if used unreasonably, for example, with little solid data, with variables that not express the phenomena we want to achieve, with poorly specified models, with exaggerated inference to the ability of the model. Discuss the role of econometrics has without a doubt its value, regardless its usefulness or robustness. It is mainly because econometrics is useful in many cases that this article attempts to understand its limits, so economists, social scientists, policy-makers and other users can be alert and able to reduce its flaws.

The following text tries to be a defence of econometrics. Based on its historical construction it is tried to understand how econometrics was established as the dominant technique in economics. Then, central assumptions of econometrics are discussed evidencing strengths and weaknesses. In the end, it is underlined the importance of methodological pluralism to analyze the complexity of economic diversity. The essay concludes that several methodological approaches are consistent with the increasing acceptance of heterodox assumptions in theory. These diverse approaches are arriving to the mainstream of the discipline and beginning to structure a more satisfactory economics, able to explain, in a relevant and accurate way, the complexity of what is the economic.

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2. Econometrics: some historical crucial moments

Unlike the classical economists, such as Adam Smith, David Ricardo or Karl Marx who saw economics as a historicized science of social relations of production and distribution of value, the neoclassical revolution tried to think the social order as a mechanic phenomenon. These new economists, like Jevons, Edgeworth, Menger, Walras, Pareto, among others, have tried to empty the discipline from its social content with a rigorization through quantification and mathematization.

It is worth mentioning, as highlighted by Nelson and Nelson (2002) that economics, before the neoclassical theory was assumed as orthodoxy, was eminently evolutionist and institutionalist. Smith and Marx discussed topics that largely exceeded the limited scope of what could be explained by theories dominated by the rationality of homo economicus.

As stressed by Louçã (2003) the origin of value, an open problem in the second half of the nineteenth century, was overcome with the marginalist revolution and the idea of a subjective utility where each agent is rational and tries to maximize it. These thinkers took the first law of thermodynamics as a unifying mathematical pattern: the lagrangean maximization could be applied to a set of atoms, the agents, the methodological individualism in its extreme, giving relevance to the concept of equilibrium, the point where all dynamics collapses. To this notion, these economists added a normative component, the idea that this equilibrium was the social optimum, the situation where atomized agents moved by their selfishness maximized their utility and thus the collective well-being which consisted of individual preferences aggregation.

When physics developed the second law of thermodynamics, which resulted in the notion of entropy, rather than the equilibrium as the main force of the universe and the introduction of the uncertainty principle of Heisenberg, economists maintained their convictions, following no change in the sciences that initially inspired them.

It is worth mentioning that at this historical moment, the neoclassical school of thought could not beat their theoretical opponents: the German historical school, the American institutionalism and the Cambridge tradition of Alfred Marshall maintained a strong membership and robustness. Before World War I and in the interwar period, pluralism was the dominant force in economics (Morgan and Rutherford, 1998), where different and internally highly plural theories coexisted. These authors underlined that the economists of the early twentieth century shared a type of scientific economic science more concrete than abstract, with a moral commitment to ensure standards of scientific inquiry, objectivity combined with advocacy. Louçã (2003) underlined that the change came only with a second generation of economists. Their motives were to combat the effects of the 1929 recession through proactive policies. They came from areas such as mathematics or physics and intended to act on the social reality. The program based on econometrics, a non-neoclassical approach, supported regulation and state intervention in private activities, abandoning the concept of invisible hand. The main idea focused on rebuilding economics for the rigorous and quantified knowledge. John Maynard Keynes was a crucial figure in this process. The efforts of many organizations at this time to build relevant macro databases, such as the National Bureau of Economic Research, were central to stimulate these practices. Other examples of these thinkers are central economists in the history of the XX century: Tinbergen, Marshak, Lange, Koopmans, Neyman, Meade and specially Ragnar Frisch, the founder of the Econometric Society whose motto was “*science is measurement*”. These names are particularly prominent if we connect them to the Nobel distinction (Neves, 1998). Economics was seen as a policy tool against unemployment, generating descriptive and normative knowledge. Previous theoretical tools of neoclas-

sical school were outdated and had not allowed to prevent and remedy the problems of the crisis (Louçã, 2003:597). Institutional economist started coming under attack in the late 1930s, partly because they were unable to provide a set of policy recommendations that were considered to be successful against the Great Depression. For Morgan and Rutherford, the World War II stimulated a move in economics towards the formalism of neoclassical economics. At this time, economists were demanded to build up tools for solving policy problems. Economics emerged as specific tool-kit knowledge instead of an area of study for a specific socio-economic domain. The establishment of a more formal economics required changes in language, form, and tools where econometrics fitted like a missing piece of a puzzle. This new style became a set of standards that was reducing in itself the possibility of pluralism in the discipline, economists left the advocacy and the success of neoclassical economics methodological approach instilled a belief in the ideas behind them (Sent, 2006).

At this moment there was a very important theoretical debate about the true relevance of econometrics. Jan Tinbergen severely criticized Schumpeter's Business Cycles since the book was unaware of econometrics, and the relevant variables were the shocks and not the mechanism (Freeman and Louçã, 2004). The doubts of John Maynard Keynes regarding a blind utilization of econometrics are well-known and remain very relevant thirty years after Hendry (1980) stressed the role of Keynes ideas as a compulsory reading for all that apply statistical methods to the economic phenomena. Skidelsky (2009) synthesises the criticism of Keynes regarding econometrics in four central arguments. The first, regards estimated parameters that are not constant overtime or between groups. It is not reasonable to assume that these relations are stable and a regression is accurate if varying time or observations. Secondly, the process to estimate the best model is biased by the choice of the observations, creating a dangerous control to select the observations that are in accordance with a priori thoughts. In third, there are some economic dimensions are not possible to quantify and that are not reducible to a format that econometrics can manage, transforming the utilization of proxies and approximations inadequate and creating worthless results. Finally, a fourth limit of econometrics to Keynes was the parsimony and simplicity of the models. Even if econometrical analyses are useful to detect patterns in complex relations, the utility in uncertain and multi-dimensional processes. Keynes in 1939 criticized the excesses of Tinbergen, introducing the metaphor of econometrics as alchemy [as referred by Swann (2006)]. From Keynes letters it is noted that he had a high esteem by Tinbergen (Hendry, 1980; Louçã and Caldas, 2009) but this did not prevent him in thinking that econometrics was a dangerous tool, almost a kind of black magic. John Maynard Keynes defended an economic science, where technical knowledge and intuition create a trained common sense capable of dealing with a moral subject, dependent on the uncertain character of the human behaviour and that cannot be restricted to the utilization of a tool like econometrics that needs accurate quantification and estimation to be valid. The comparison of econometrics with alchemy for Keynes was justified by three different ideas: (i) the fact that econometrics tries to make a real transmutation of economic data (base metals) in parameters (pure gold), (ii) the idea of econometrics as an elixir that apparently brings honour, respect and a long (academic) life to its users, and (iii) the fact that econometrics is taken as an alkahest, a universal solvent that allows dilute everything. This comparison was recovered in the (now classical) article of Hendry (1980) that defends that even if econometrical practices have limits it should be seen as a scientific method. The tool is not flawless and some user bad practices subsist but there is no doubt that relevant knowledge about the economic realm can be produced if the statistical results are moderated by the existing theoretical understanding.

After the World War II, the objective of econometrics was to create a model that allowed, through a set of structural equations, to replace the market in their allocations. To affirm this new economic approach was necessary to use a shared framework. The neoclassical paradigm was available and allowed both the formal rigor and the ability to calculate the policies even if it was based on the notions of equilibrium and atomized agents. In parallel, the assumptions of this school of thought there was a shift of the centre of econometric research from Europe to the United States, linking econometrics objectives to the centrality of market institutions (Freeman and Louçã, 2004). In the post-war period, American society was moving from an aspiration of Public economic intervention towards the support for free market and open competition institutions, corroborating neoclassical ideas. During the Cold War period, the technical turn in economic science was intensified as a result of a shrinking in the range of beliefs, an additional narrowing of acceptable ways of expressing them (Sent, 2006). The developments on the micro-foundations of macroeconomics were crucial in the growing degree of abstraction in economical thought. Morgan and Rutherford (1998) underlined that the decline of pluralism took place within structures of patrons and hierarchies operating within the context of a political and economic society that supported economic intervention in the interwar period and free market operation in the post-war. There was an absorption by the dominant paradigm of neoclassical economics of econometric tools. Thus, from the years 50 to 60, with neoclassical synthesis, the matching of microeconomics with macroeconomics, the advent of IS-LM, the Phillips Curve and evaluation of policies based on models, econometric methods did prosper. In the late sixties, Ragnar Frisch, the father of econometrics, was begging to become a sceptical critic of the manner of how econometrics was used. The discussions surrounding the rise and fall of monetarism, whose central figure Friedman advocated maintaining the stability of a capitalist economy through monetary instruments for controlling the volume of money available, the Lucas critique with the idea that agents anticipate the measures economic policy and make decisions that neutralize its purpose led to a revival and a return to general equilibrium models creating the adequate conditions to structure economics, in terms of research but also in teaching, as an abstract discipline. Though there are several variants of modern macroeconomics, they all have their roots in Fisherian–Walrasian models of the process of accumulation in modern societies (Harcourt, 2010). The basic vision and construct in theoretical terms of Irving Fisher was shown most fully and rigorously in the general equilibrium model of Arrow–Debreu. Harcourt underlines that in the hands of Lucas and others, the model was simplified in order to analyze macroeconomic equilibria and transformed in the basis of stochastic general equilibrium models which at a practical level came to serve policy makers and central banks. Economics lost the touch with reality and complexity, networks, human relations and became territorially and temporally de-contextualized. New developments have remained outside the core of the discipline, namely the introduction of dynamics and evolutionary theories, or territorial specificities have been widely developed by frontier economists far from the discipline orthodoxy.

Several critical positions in this posture of economics as a science are known. It is worth remembering, for example, the acceptance speech of the Nobel distinction Haavelmo (1997:15) where this eminent econometrician of the second half of the twentieth century noted that economic theories were not good enough especially when they start with an inadequate methodological individualism. Beginning to study the behaviour of individuals under certain conditions of choice where the model of society is created from an aggregation process appeared to be a wrong principle. Haavelmo supported that departing with the existing society, its set of rules and regulations, was more suitable to a deeper understand-

ing the economic outcomes. This tension between individualism and collectivism is a major methodological gap between economics and other social sciences, but it seems, after much debate, minimized with the introduction of the concept of reconstructive downward causation by Hodgson (2002), consistent with other proposals, for example in the debates of agency-structure Lawson (2005, 2003). Individuals are influenced by their institutional environment and these institutions are historically and locally specific, involving individuals and institutions that are not only restricted but also enhanced and modified by the causal powers associated with higher levels of decision. With reconstructive downward causation, determinism seems to be eliminated from the top level, by a downward causation process institutions become not only constraints but also inducers of change.

3. The current use of econometrics

It may be useful to try to understand what econometrics is, in an unpretentious approach. It is a discipline that results from the incorporation of knowledge from various fields of economics, statistics and mathematics. Econometrics literally means “*measure the economy*”. It is used in various fields of applied economics to test economic theories, to inform policy makers and to predict future behaviours. Econometric models can be supported by economic theory but sometimes formal option is to insert multiple variables and look to frame what are more relevant relations in the problem under analysis. Currently the use of econometric tools transcends the study of economics being widely applied in several scientific areas.

The purpose of econometric models is the estimation of relation parameters between dependent and independent variables articulating empirical data, not experimental or observable, testing hypotheses about these parameters, values and signals, the validity of economic theories, possible effects on public policies and forecasting. Econometrics seeks to help establish regularities in the economic. The vision of establishing general laws should be completely rejected as a goal of econometrics, as this purpose seems inappropriate given the nature of economic laws in which ‘natural’ justifications in the social sciences cannot resist the agency human. The econometric analysis helps to identify relevant variables in a given case, the commensurability effects and the multipliers, trying to predict behaviour and trends.

The nature of the data largely determines the type of analysis that can be made. A data set containing observations of multiple phenomena observed in a single moment of time is called cross sectional. In cross sectional data, the data values are important but not the ordering. If the data set contains repeatedly observations of a single observed object it is called a time series. In time-series data, both the values and their ordination do matter. A data set containing multiple observations of the phenomena over time is called panel data. While the time series and cross sectional are one-dimensional, the panel data is two-dimensional. The panel data, sometimes called longitudinal data or cross sectional time series are data sets with multiple cases of individuals, companies, countries, etc. observed in two or more periods. There are two types of information that panel data regression techniques are appropriate to examine: (i) differences between the various individuals, and (ii) changes in behaviour over time.

Currently different estimators also permit to obtain adequate models with more complex characteristics of the dependent variable, in terms of its distribution, non-normality and over-dispersion, excessive number of zeros or even limited dependent variables. Techniques have evolved in such an away that can overcome the limitations generated by failing the classical assumptions

regarding the error term¹ or the impossibility to deal with non-stationarity though cointegration (Engle and Granger, 1987). Trying to answer a question from the economic reality with an econometric model could have the following general steps:

- (1) Formulation of the problem (the initial questions, what we want to know).
- (2) Collection of information (primary or secondary sources) and data transformation (e.g., aggregation, differentiation) and problems (missing data).
- (3) Choose the econometric model (cross-section, time-series, panel data).
- (4) Empirical analysis (parameter estimation), diagnosis (overall quality of the model, coefficient of determination (*R*-squared), model specification, linear relationships between variables, normality of residuals; autocorrelation, heteroskedasticity, stationarity, analysis of the multipliers, etc.).
- (5) Modifications to the model (based on tests carried out to propose changes in order to consolidate the model).
- (6) Answer the initial question based on their interpretation of the model.

This process is today plagued by two colossal problems. The first is the disinterest of many econometricians and applied economists in the six stages. In fact, attention is highly focused on points four and five. The econometric analyses do not have often paid attention to what is being discussed nor respond to questions after the modelling is completed. It is assumed that the model is self-explanatory. The second is that commonly the modelling of a process is carried out from specific-to-general, i.e. a theory-first approach, in which the researcher builds a model with few parameters, and apply it a battery of diagnostic tests. According to the results of these tests he decides to add new variables, stopping when he has a model that considers appropriate. This approach to modelling is widely criticized because the researchers eventually show only those models that look acceptable from their initial standpoint in theoretical and statistical terms, leaving out intermediate results. Thus a set of data can be manipulated repeatedly until a model is estimated based on the a priori thoughts of the researcher. Different people with the same data can end up with completely different models. Start with a theory and to insist that reality should behave in this way is possible but wrong. The researcher can torture the data to the limit. In the end the data always confess what the researcher wants to hear.

The construction of an econometric model should be based on modelling from general-to-specific or a reality-first approach. The selection of the data must be based on broad economic relations without the restriction of a pre-specified direction. This approach advocates using strict principles of econometric and statistical criteria for selecting a good model. It is thus facilitated the discovery of new relationships and validation of theories previously proposed.

Today this general-to-specific approach (GTS) assumes some ascendancy over specific-to-general modelling even if important debates are being developed about the strengths and weaknesses of each approach (Hendry and Mizon, 2010; Lütkepohl, 2007). Pagan (1987) refers that the GTS owes a lot to the influential Sargan's paper about wages and prices in the UK (1964) and reflects oral tradition developed in the London School of Economics (LSE). Modelling from general-to-specific is based on the estimation of

an over-parameterized model encompassing the data generating process and which allows to, step-by-step, eliminate irrelevant variables. The subjectivity of the analysis is smaller and the results are created without a priori understanding or the influences of the researcher about what the final form that the model will take. This method has two key assumptions, simplification, i.e., to remove not significant variables designing a parsimonious model, and evaluation, the final model should be subjected to a battery of tests to confirm the correct specification and suitability. Cook (2003) underlines that the notion of a data generation process, the actual mechanism that originates the observed values underlying a specific economic mechanism, provides the basis for the LSE methodology, a methodology that does not have a solid rival disciplinary matrix in his opinion. Colander et al. (2009) and Juselius (2009) ensure that such an approach remains largely adjusted to contribute to the explanation of complexity in the context of economic crisis. These authors highlighted how certain econometric models, such as the vector autoregressive models, are able to detect patterns behind the empirical data and become a starting point for an approach that captures what happens in the real world. These models also permit to correct the non-stationarity in economic modelling, a common problem and largely ignored by researchers, as noted Juselius, which led to the creation of spurious regressions and introduce major doubts on the use of assumptions such as *ceteris paribus* or modelling based on assumptions of rational expectations.

A trained common sense and the practice of econometrics suggest five principles in using this tool (Table 1) with an approach based on reality. First, data occupies a central place in creating the model that attempts to understand certain process. Second, parsimony regards the preference on a short model to a more complex one, according to the existence of bounded rationality. A third principle suggests that a model to be better than another must also be able to explain alternative models results. A model specification that comes against well studied relations in the economic realm deserves a deeper analysis. Finally, an inter-temporal and inter-analytical unit consistency should be evident to diminish the existence of completely contradictory specifications.

After introducing some basic principles of econometric analysis, the next sections will discuss additional limitations and criticisms and concludes by providing a place for econometrics in economic enquiry.

4. Limitations and criticisms of econometrics

Today (applied) economics is dominated by econometrics. Alternative methods have been overlooked since there is an established view of econometrics as stronger in terms of applicability, efficiency and accuracy. Swann (2006) presents four main reasons for considering the dominance of a single technique as a negative aspect for economics:

- (1) Economists do not have the monopoly of knowledge about the economy – actors and other scientific areas also have valid contributions, even coming from a vernacular economics.
- (2) Econometrics is necessary but not sufficient to understand the economic – there are phenomena that by their nature, for example, when the type of information is not quantitative, that can not be analyzed by this instrument.
- (3) The excessive specialization does not promote dialogue and may not be useful in terms of scientific advance – the border areas are usually more likely to change and cross-fertilize when compared with the core of a particular discipline.
- (4) Econometrics is not appropriate for all research activities – it is necessary to have several types of tools for different tasks.

¹ A error term with white noise characteristics [$ut \sim N(0, \sigma^2)$]. Specifically the conditions of zero mean average for the expected value of residuals [$E(ut) = 0$], a common variance [$Var(ut) = \sigma^2 < \infty$], the existence of no relation between different residuals [$Cov(ui, uj) = 0$] that are in the origin of, among others, the well-known problems of heteroskedasticity and autocorrelation.

Table 1
Principles and corollaries in econometric modelling.

Principle	Corollary
Consistency of data	Is the data that determines the structure of the models
Parsimony	Simple specifications are preferable to complex
Encompassing	The model is able to explain the results of other rival models
Consistent with economic theory	Models to reverse previously studied regularities deserve a careful second look
Consistency of the parameters	The parameters should remain adequate over time and between individuals

Source: own elaboration.

Economics, to be applied, must be applied in the way that is based on real data and in that is used by others. This last issue introduces the centrality of data. Econometric estimates are often based on data collected from diverse sources, and in most cases, by non-economists with different mindsets. If the economic analysis is illuminated by real data it will then be useful to more people and more people will be encouraged to gather data that may be relevant in economic terms and thus more and better analysis can be done – it is a virtuous circle often broken. Swann (2006) summarizes the various criticisms that have been directed to econometrics. Preliminarily is crucial to underline that economics is not a natural science – it cannot study its subject in the same way that physics, apart from the human agency. With this premise is also evident that econometrics remains a tool with flaws. Although these are constantly being overtaken by new theoretical developments, common practice ignores many of these limitations. The application of econometrics has a restricted domain. It is not a universal tool and should not be used in all kinds of problems, especially those whose analytical dimensions are difficult to express in variables that the tool can work. Econometrics, by emphasizing calculus and forgetting the importance of collecting data lost track of the scientific method. It is, at most, a non-substantive and methodological revolution as advocated by the early econometricians. Econometrics originates a trained incapacity because it is stimulating the production of certain competencies in the researchers and students who are technically capable but with little capability to understand economic reality and stunted the ability of trial and intuition. Econometrics favours the isolation of economics by enhancing an excessive division of labour that departs from the knowledge generated by 'vernacular' economics and other social scientists. These methods seem to have decreasing returns to scale. If the cost of doing regressions is very low and using other methods is higher, it is normal that economists start making more and more regressions that cost less but also are worth little. Finally, econometric approach creates in the opinion of Swann a widespread restlessness, even without knowing why it creates discomfort among other social science specialists and non-specialists.

These criticisms can be answered but not all satisfactorily. Most econometricians can give robust responses to many of these questions by stating that the method that was used was not the most appropriate. The tool is good, the problem is that users do not know how to work with it. There is however evidence that the use of econometrics is a fertile field for deceptions and disappointments. The question is whether it is more than other scientific methods. Ziliak and McCloskey (2004) analyzed two decades of publications in the American Economic Review and point out that substantial part of the econometric studies published did not meet the fundamental assumptions of econometric method, did not discuss the results and did not distinguish statistical significance from economic significance. The arguments of Ziliak and McCloskey have been debated. An example is Engsted (2009) that stresses that these authors overlook important areas in economics where researchers distinguish statistical and economic significance. Engsted argues that conventional statistical testing can be used as an effective tool to obtain well specified and parsimonious models in statistical terms to obtain valuable knowledge about economic phenomena.

Even the critics of Ziliak and McCloskey like Engsted accepted that statistical (in)significance does not imply economic (in)significance and that good empirical research in economics need always to discuss both types of significance. Engsted underlines that real scientific progress in economics, knowledge about how economies work, is mainly achieved through common sense, elegant theories, historical perspective and disciplined conversations among scholars where statistical hypotheses testing is only one among several important tools.

5. The need of methodological pluralism for econometrics

To put econometrics in its place we must accept that econometrics has a place where it belongs within economic science. However, criticisms of econometrics are consistent because its defenders too often behave as if econometric techniques were universal when in fact they are not. If we accept more qualitative methods also coming from other sciences, such as case studies, and informal knowledge of vernacular economics, common sense, intuition, insight or metaphor, we can largely eliminate the restrictions and the distance of econometrics to reality. If complementary methods are used to fill the gaps left by econometric techniques, these limitations are unlikely to be very relevant. Swann (2006) makes an interesting metaphor, econometrics as triangulation, measuring the locations of objects very far with the minimal displacement, the principles of trigonometry introduced by Frisius in 1533. The triangulation method was much applauded at the time but its limitations are evident today. It requires great precision in measurements, particularly when the base of the triangle, the starting point is far from the object. This suggests another triangulation, the triangulation defended by the author, the need to use various tools, methods and theories to find more robust results or paradoxes. Downward and Mearman (2005) stress that triangulation offers a potential solution to the impasse between a formalist approach and the approach of those who are critical to the mainstream 'traditional' methods. For these authors the simplest form of triangulation is the employment of judgement by the economist about their models, tools, theories or data. They refer "(...) an economist might use an econometric model (which often they have created) to produce an estimation. They could in principle, passively receive the information from the model, simply report this result and stop their investigation. However, they can be more active, and apply their judgement to the result, perhaps to interpret it in a specific way. This employment of judgement can be interpreted as the interaction of economist with model, and thus is a form of triangulation." Several types of triangulation can also be referred: (i) data triangulation, involving time, space and people; (ii) the triangulation of researchers, which is the use of several researchers, and not a single observer; (iii) theoretical triangulation, which consists of use more than one theoretical scheme in the interpretation of the phenomenon, and finally; (iv) methodological triangulation, which involves more than one method. Methodological triangulation offers a stronger answer for complex questions. In practical terms it means that some methods are more robust than others dealing with a specific topic or dimension of the topic that is not covered by the implementation of a single technique.

Dow (2007) advocates the theoretical and methodological plurality, introducing a cynical view about the economics when too focused on the mathematical formalism, and avoidance of ideology. Dow shows evidence of growing pluralism in economics. The notions of rationality and uncertainty become more complex which would suggest the economy as an open system in which it is impossible to base models of absolute causal mechanisms because it considers human action with all the unpredictability that underlies in it. New methodologies should reflect how the construction of reality is made by the researcher. For this author, current economics has remained often linked to an excessive technocratic character, where a monistic approach meant that economists do not need to justify used methods. There is no need of methodological justifications in times of orthodoxy. Mathematical formalism has often been the mark of identity of what is economics. Sheila Dow suggests that analyzing economics in the lens of concepts introduced by the social studies of science may be relevant to include reflexivity in economic science. The pluralism that is emerging allows the emergence of a diversity of ideas that consolidate the own scientific building of economics. Analogous to the genetic diversity that strengthens a living organism from outside threats, the theoretical and methodological variety allows economics to respond more successfully to challenges and to understand the economic phenomena more satisfactorily. Although Sheila Dow defends pluralism, she does not believe that anything goes and suggests caution. The cross-fertilization is a positive aspect to toughen a science but it requires even greater attention to inaccuracy which may arise in this context with different meanings.

Chick (1998) presents two very important arguments in favour of the plurality of methods. The first is that the existing formalism is too confident in its methods, which are not as robust or independent of its proponents advocate. The second is that formal methods are not accurate. The vagueness that more formal methods appear to remove only happens in theory, because the object, the economic, remains vague and complex as when any other method is used. The methods are largely dependent on a priori choices of the researcher. For example, the common use of static analysis completely eliminates the notion of evolution and change, while the analysis of time series end up focusing on a case study as a closed and independent system. The notion that there is a permanent disequilibrium, that systems are in constant evolution, greatly limits the success of the dominant reference framework. To resolve this contradiction Chick defends the openness of systems. Open systems have path dependencies, are non-ergodic and show no regularities or equilibriums. Neves (2007) proposes a complementary idea of pluralism in economics to promote discussion and permeability with other scientific disciplines and its surroundings. An open system allows the absorption of new ideas and knowledge through a series of semi-permeable barriers.

Economic research must take into account two central concepts: the exploration and composition (Swann, 2006). Exploration refers to entering into uncharted and uncomfortable areas but that allow the deeper understanding of economies. This exploration should happen using a comprehensive set of tools and approaches that can respond to a diversity of dimensions and objects, the composition. This multiplicity of approaches ensures thinking on several levels, the genesis of creative thought and theoretical and methodological advances. Where econometrics fails the applied economist should have alternative means to achieve useful results and satisfactory explanations of reality, even if initially result in paradoxes. The plurality is especially interesting when techniques are very different, compensating in strengths and weaknesses, for example, econometrics is strong where the case studies fail and vice versa. Prigogine and Stengers (1984) [quoted by Chick (1998)] show how these problems of a narrow view of objectivity have been taken into account in the hard sciences that served as inspiration to eco-

nomics: “Both at the macroscopic and microscopic levels, the natural sciences have [...] rid themselves of a conception of objective reality that implied that novelty and diversity had to be denied in the name of immutable universal laws. They have rid themselves of a fascination with a rationality taken as closed and a knowledge seen as nearly achieved. They are now open to the unexpected, which they no longer define as the result of imperfect knowledge or insufficient control.”

For some authors (e.g., Landreth and Colander, 2004) the evolution of economics is a swinging pendulum between formalist and non-formalist approaches. The fact that today formalism still has a prevalent word is not a problem in itself. These authors support that currently formalism is essentially methodological and the profession seems to be moving towards a more intuitive paradigm. A very wide range of heterodoxies has gained increased relevance in economic theory (Davis, 2006). If we think that a science depends on education and research we understand that, despite the instruction remains highly connected to the orthodoxy, research is increasingly characterized by a high degree of theoretical and methodological pluralism. Successful research programs will be synthesized and incorporated into the education, which first occurs in advanced programs, such as doctoral programs, which force the extension of research frontier. Davis illustrates his idea of expansion and contraction of orthodoxy to the intrinsic capacity to enhance its explanatory component in the mainstream, which is reflected in the ability to export theoretical and methodological approaches to other scientific areas, or conversely, increasing pluralism in mainstream importing content from other sciences. This view of the consolidation of a theoretical body of orthodoxy as a trade balance can be illustrated by the times known as the imperialism of economics where, for example, Gary Becker led the rational choice theory to issues such as crime or marriage, or moreover, the current situation of extended pluralism that Davis defines as reversed imperialism. In moments of expansion of the dominant paradigm, normal science, economists do not feel the need to understand the evolutionary history of the discipline and to justify their methodological choices. At present there remains a clear separation between orthodoxy and heterodoxy, and Davis says that is happening a selective appropriation of heterodox content by the mainstream. In this way the mainstream of economics is becoming less the orthodoxy of economics, an increasingly broad group of heterodox thinkers see themselves as members of the mainstream and are recognized by the elite of the mainstream as an integral part of this group. Theoretical pluralism, rooted in various heterodox approaches, research and advanced training, may induce the emerging of new methodological approaches. But defending now the death of the Neoclassical school (Colander, 2000) and the fall of the orthodoxy can be excessive when the teaching is still dominated by the ideas of rational choice and economists are still in a very high proportion, using these conceptual and methodological frameworks in their everyday life.

All collectives of thought have ways of expressing themselves, to socialize, integrate members and create scientific facts (Fleck, 1979). Econometrics is one way of sharing among economists that continues to consolidate but will have in the future a more modest role, although indispensable, in economics. The excessive codification can be sterile and a way to hide the results from the possibility of a more general discussion to find flaws in the scientific building. Latour (1987) shows how this is a common defensive strategy in the production of science today. The core of a discipline in a scientific field like economics is characterized by a large population that encourages excessive use of jargon, intense debate over irrelevant topics and a safe and routine work carried out by a broad intellectual community that tries to protect its status quo costly obtained with their intellectual training.

6. Final remarks: a place for econometrics in economics

The distinction between a positive and pure economics and other, with a normative dimension is an inappropriate fiction. The field of economics, the economic, is impure (Reis, 2007). Businesses, individuals, countries, institutions, and finally what is the material, the texture of the object of economic science, are normative *a priori*. Economists are unable to purge the normative content of economy and took it as a positive science. Ideology will be always relevant in the study of the economy.

Objectivity remains, for many economists, dependent on basic aspects of orthodox economics, as the mathematical formalism or marginalist analysis. But objectivity is dependent upon the relation of subject and object and not a particular method. The specific method that is used is just one of issues to consider for the economic understanding. The objectivity of economics is not called into question by its normative character. It is not possible to take from the enterprises, the individuals, nor the countries or institutions the values which determine their actions and shape the individual behaviour that is reflected in economic performance. The traditional view of objectivity, imported from the natural sciences to social sciences (Prpic, 2009) is largely inadequate to the central assumptions of economics like human agency or non-ergodicity. It is necessary to consolidate a useful notion of objectivity to economics. Work to be done.

It is worth remembering how two of the greatest economists, Alfred Marshall and John Maynard Keynes, took part in this debate. Despite the fact that quantitative methods in the time of these thinkers do not had the same degree of sophistication of current methods, they departed from analogous assumptions. The methodological agendas of Marshall and Keynes to analyze complex economic systems allowed Marchionatti (2002) to systematize some common features. Quantitative methods were seen as important tools, not only useful but needed, for both economists, but that required careful analysis to generalizations, since the economic domain was distinct from other sciences. The mathematization was only useful when the approach was consistent with the properties of the system to be analyzed. The search for general results for all situations was a utopia, a quasi-formal style was considered often more appropriate to connect ideas, a mixture of intuition, value judgments and analytical skills, a trained common sense, were indicated as requirements to deal with the interpretation of the complexity of the economy.

The main tool of today economics, econometrics, should serve firstly and foremost to understand the economic to good life where human happiness can be reached. The choice of method depends on its suitability to the object under review. The econometric forecasts are often the most robust and accurate estimates, but must be understood as a vague picture of the process and not a high resolution image of it. An example, is forecasting, one of the most criticized elements by the opponents of econometrics, if well done, is very important in economic analysis. In the short term, econometric forecasts are usually accurate. This is particularly useful to help agents like firms in their planning. The great difficulty is to realize the cyclical turning moments. In the long run, the problems regarding forecasting are different in nature, one can predict that something will happen, for example, the systematic accumulation of external deficits without investment in improved competitiveness will provoke a crisis, but the difficulty is knowing when it will happen. Anyway, these long-term forecasts help us to prepare for the risks of the future (Cardoso, 2008).

There is at present more theoretical than methodological heterogeneity. Economic science is faced with a series of new challenges that may constrain the evolution of the discipline. Institutional and evolutionist schools have shown the limitations of

orthodoxy of economics. The financial market crisis has also left, for all to see, that the markets do not always work, and how the institutions created by the Washington Consensus, consolidated and underpinned by ideas of the Chicago School, failed to promote a fair globalization. It is worth taking in this context attention to methodological choices that serve the economists. Formal methods like econometrics have their place in a satisfactory economics. We must find this place. The working table of the applied economist should be prepared to benefit from all the complementarities of the various methods. A place, among many other methods, such as multivariate analysis, the case studies or even other qualitative analysis, that economists have to find. The complexity of the economic demands increasing theoretical pluralism that requires methodological pluralism. Triangulation of methodologies are essential to reduce the limits of a single technique. Even Krugman (1998:1836) in an article that intended to be a defence of the formalism in economic science, showed that it is important to leave room for other approaches in economics: "In short, two cheers for formalism – but reserve the third for sophisticated informality."

Econometrics can be used as a preliminary approach to underline broad trends and patterns. It can be used to define factors that are central to certain relations and test suggestions from the results of case studies and other multivariate statistical methods. Macro-econometrics is crucial to underline long-run relations and providing predictions in the case of less volatile contexts. Micro-econometrics is central to comprehend the behaviour of actors, controlling clustering effects, by giving insights on the relevance hierarchy of certain variables for a certain phenomena.

Like any tool, econometrics will only be effective if well applied. Econometric models should always pay attention to data collection, estimation procedures and verification of statistical quality. General-to-specific modelling reduces the problems of subjectivity in the definition of the models. The subjectivity, one of the central limitations from the point of view of formalist approaches to other methods, is obviously present when a specific to general modelling approach is preferred.

But econometrics is not only statistics. It is also economics so the theoretical understanding and interpretation of a model is essential to learn about the economic significance of the models. That is why I agree with the vision of Swann (2006), where "econometric estimates should be taken with a pinch of salt", with the awareness that in several domains econometrics is of very limited use. Econometrics is surely no universal solvent but will always have a place in applied economics. A more modest role than now, when it is assumed in many schools that a thesis without advanced econometrics is not a thesis in economics.

Plurality in methods is essential for innovative economics, this idea of Swann (2006:71) for a science that guarantees economic dialogue with adjacent fields of economics and cross-fertilization. Innovative economics is convergent with the notion of a satisfactory economics that should be able to create such a diverse new framework in economic science (Pinto, 2008).

To conclude, I am very far from extreme positions, for example of Lawson (2009), that underlines that econometrics and other statistical methods are irrelevant and that economists should eliminate them from their daily research and work practices. As Juselius (2009:11) claims even John Maynard Keynes would appreciate a well applied econometrics: "As Keynes was a scholar with a deep respect for the complexity of economic life, he would probably have been convinced that econometric models, when adequately used, are indispensable as tools for improving our grasp of the complicated economic life." Econometrics is not only a tool to measure economic relations and variables. Used wisely it is an instrument that facilitates greater depth understanding of the economy and, in this way, to engage with more power the goal of economic science, the promotion of good life.

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