

**THE INTERACTION BETWEEN ECONOMETRICS, INFORMATION SYSTEMS
AND STATISTICAL INFRASTRUCTURES:
Anticipation and Comparative Analysis in a Decisional Structure**

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ABSTRACT

The aim of this paper is to show how econometrics, information systems, and statistical infrastructures are independent, and can be viewed together as a means to optimally impact the decisional structure in any given society. This paper also aims to formulate some ideas on econometrics towards the coming years as a tool for analyzing international interdependency.

With the advent of the information age, tremendous amounts of highly disaggregated information flows have had an increased influence over the social sciences both theoretically and empirically, as well as over the decision making structures. This necessitates a reexamination of the existing economic theories in order to accurately reflect today's realities. In this sense, econometrics can be used as the primary tool in terms of the quantitative aspect for increasing the value added to economic theory and the social sciences as a whole.

Additionally, this reexamination should take advantage of the advances in information systems and in statistical infrastructures. To the extent that information is received in a timely and thorough manner, and is utilized through statistical analysis, decisional structures will succeed in achieving their targets in a rapidly changing world environment.

In conclusion, this paper sets out to show that the intense flow of information and the improvement in quantification techniques will have a strong impact on the social sciences. Furthermore, there will be a corresponding revision of the theoretical aspect of the social sciences due to the strong link between the empirical and theoretical aspects of the social sciences. This will be essential because the large new flows of disaggregated information and wide use of quantification techniques and data processing, assisted by information technology, will render the existing theories insufficient. The reformulation of the theories will be based on the increased information available, and will be based on an interdisciplinary approach. This will necessitate the reform of the existing theories and quantification techniques.

1. Introduction

Over the past few decades, the world has been experiencing a phenomenon which has seen the proliferation of information at exponential rates. Thus, this era has been

appropriately termed the "information age", and has been likened in its significance to the Industrial Revolution in terms of its impact on the entire *modus operandi* of the global system.

The challenge at hand is how to utilize or design information systems that will appropriately and efficiently optimize the availability of information in a manner that will most favorably impact the decisional structure of policy makers. The most effective means for doing so is through the extensive coordination of econometrics, information systems, and statistical infrastructures.

As each phase of technological advancement propels the reverberations of change throughout the global system, the existing static models for installing and accessing information systems, which allow decision makers to know their alternatives and to make decisions on the most up to date information, become insufficient.

The aim of this paper is to review the interaction between econometrics, information systems, and statistical infrastructures and to demonstrate the need for further examination of this interaction so as to create a dynamic model of information processing, analyzing and accessibility. The ultimate goal is to produce an optimal coordination of the aforementioned components so that decision makers can function most productively in the global system to the benefit of all the countries, institutions, and individuals within this system.

This paper also aims to formulate some ideas on econometrics towards the coming years as a tool for analyzing international interdependency. Finally, one additional aim of this paper is to demonstrate how the existing theories will be rendered insufficient due to the large flows of disaggregated information and the wide use of quantification techniques and data processing, assisted by information technology. This will necessitate the reform of the existing theories and quantification techniques in the social sciences.

2. Some Comments on the Specification Methodology of Social and Economic Phenomena

The specification of social and economic phenomena presents numerous and substantial difficulties arising from biases in the specification methodology and from measurement problems.

In particular, the uniqueness of social and economic phenomena, in the sense of taking place at a particular point in history, geography, and society, makes it difficult to undertake controlled experiments as in the natural sciences. The problem is compounded further due to the close relationship between human behavior and the existing social and economic phenomena.

Individuals, or decision makers, are affected by the existing social and economic phenomena when making decisions. Once decisions are made and acted upon, the social and economic phenomena that form the basis of future decisions change. Additionally, the continuous structural changes taking place due to the dynamic nature of social and economic phenomena add to the difficulties in making generalizations.

To alleviate these problems, the analysis and quantification of any social and economic phenomena requires the understanding of the global structure which is of one of a chaotic, complex, and stochastic nature.

As shown in Diagrams 1 and 2, the nature of specification methodology may limit our understanding of social and economic phenomena. As Diagram 1 implies, a certain information set is collected as is determined by our own perceptions of reality or by the paradigm in which we find ourselves. Our biases in quantification and in quantitative interpretation put further restrictions on our understanding of social and economic phenomena.

Diagram 1

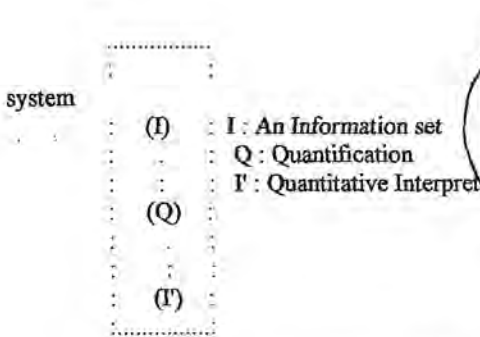


Diagram 2

G : Global
 E: Economics

Within the existing mathematical tools currently being utilized, the global structure remains indefinable. What actually occurs then in analyzing and quantifying social and economic phenomena is a subset approach which is a partial analysis of the phenomena disconnected from the global structure (Diagrams 3 and 4)

Diagram 3

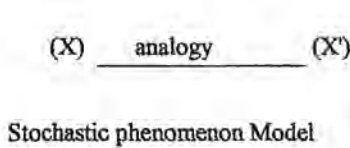
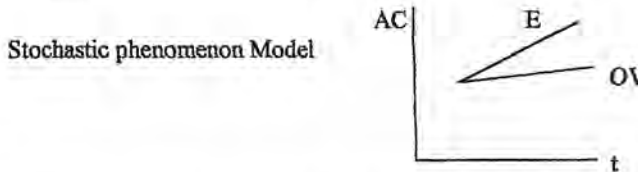


Diagram 4

Specification — Estimation — Use

AC : Alternative cost
 E: Impact of E type specification variable
 OV: Impact of other variables



At the first stage, analysis and understanding of the global structure is processed within an interdisciplinary approach; then, via this information, the elaboration of any specification at the structural level occurs. This approach would lead to a different specification, which represents less alternative costs in the medium and long terms, compared to a specification, which limits itself to the structural level.

However, even if our specification methodology is free of the problems mentioned above, certain specification problems arising from the lack of data or from mis-measurement problems exist because the specification methodology is determined independently of the data collection process. Thus, a social scientist has to rely on a data base which answers to the needs of governments and businesses. That is, some data required by the specification methodology "may not be available in published form, or may not exist at all" (Johnson, 1991). The best example of this is expectation data. If expectations play an

important role in our specifications, then the lack of data on expectations poses a great difficulty.

In this respect, this problem might be overcome to some extent if the data base creation process, or if institutions, pay attention to the needs of different specification methodologies as well as to the needs of the governments and businesses.

3. The Link Between Economic Theory, Information Theory, Econometrics , Information Systems , and Statistical Infrastructures

In this section , the roles of econometrics , information system and statistical infrastructures in particular are reviewed. This section demonstrates why the link between these three areas is so important to structural efficiency in the decision making process , and therefore to the global system.

3.1. Information Theory

The decision making process depends upon receiving timely and accurate information. Furthermore , the decision making process is only optimized depending upon the value of the information circulating throughout the organization and to the decision makers. Information theory is a framework approach that allows quantification measures to be applied to information systems so as to quantify the information in a meaningful way for the decision makers. The emphasis of information theory is on facilitating the information receiving the users, as opposed to data processing, which is concerned with processing data almost irrespective of the users ability to use that data.

3.2. Econometrics and Economic Theory

The economic issues that are studied naturally relate to that area within the social sciences that is concerned with the description and analysis of production, distribution, and consumption of goods and services within a society. While econometrics has traditionally been limited to the field of economics, it can in fact be considered as a quantification method for all of the social sciences. The validity of this claim derives from the fact that social sciences are concerned primarily with human society or with individuals as members of that society. All social sciences use statistical data to assess or project models measuring various aspects of such societies. Statistics scientifically reinforce the theories or models of society that are being studied, and in this sense they provide a system of measurement used to understand the status of societies.

Thus, the embetterment of society, which necessitates the analysis of social data, requires that a quantitative methodology be employed to determine trends and the effectiveness of policy. Specifically, econometrics is constantly used as the means to bring a value added to not only economics, but to the whole of social sciences by adding the irreplaceable value of scientific measurement.

Indeed, the role of econometrics is more important in social sciences today than ever. Given the advent of the information age, tremendous amounts of highly disaggregated information flows have had an increased influence over the social sciences both theoretically and empirically as well as over the decision making structures.

With this dramatic increase in disaggregated information, the absorption of the relevant information can be done most efficiently when the information has been quantified. This has resulted in an increase in the level of quantification in the social sciences , and thereby a change in the structure of social sciences. This quantification process faces two fundamental and related issues.

The first one is rapid changes in the world economy, which brings up the question of the ability of detecting structural changes. Relationships estimated by econometrics are time , data and location specific. If there is a continuous change in the structural aspects , then not

only do we need to alter our model specifications, but also revise our data base. If we use econometrics without paying attention to these structural changes, then the coefficients of the models will be misleading us rather than guiding us.

This brings up to the second question on the methodology of econometrics. Today, there are three main approaches to econometric methodology, the Bayesians, Classical, and the Agnostics. The pioneering works in the Bayesian tradition include Zellner (1971) and Leamer (1978). The Classical who dominate their field estimate their parameters on the basis of economic theory and proceed with tests such as t , F and χ^2 statistics to support the validity of their theorizing. However, as Johnston (1991) mentions, "charges of data mining and other abuses have confused this tribe and they are presently in some disarray." On the other hand, Agnostics, led by Sims (1980), argue that economic theory is no help in

...specifying the form of relationships. This approach relies on vector autoregressions (VAR's) methods. However, this method has many problems arising from collinearity and too many coefficients, and suffers from empiricism. This requires, then, a reevaluation of the tools, theories and estimations to be used by decision makers in the coming decades. International macro modeling is an example of such a search. Its importance is heightened by the need for better international policy coordination.

Specifically, though, several proposals for reconsidering international macroeconomic modeling can be made. These might include 1) the need for further theoretical and empirical studies on the interdependence of the world economy, transmission of fluctuations, and internationally coordinated policies, 2) the impact of structural changes on the capacity of international macroeconomic models in exploring and forecasting the economic phenomena; and a closer link between micro and macro economic considerations, 3) more emphasis on medium-term modeling, 4) the identification of institutional, national, regional, behavioral specification, and some economic behavioral changes, 5) more international coherence on the trade of goods, services, and financial and information flows, 6) the identification of the socioeconomic behavioral changes and the increasing importance of social protection and public expenditure, and 7) a policy oriented problem solving approach through sectoral disaggregation of structural models on the one hand, and central and satellite modelling, exploration modelling, and valid reduced forms for policy analysis on the other (Artus, Güvenen, 1986).

3.3. Information Systems

Information systems are necessary at almost all levels in society. All organizations need a sufficient flow of information in order for decision makers to make the decisions that face them each day. Indeed, the entire decisional structure depends on the free flow of information. The information system, in order to be useful to the decision makers, must be in a form so as to promote the dissemination of information in a useable form and in a timely fashion. In the context of the present information age, an information system will be considered successful based on its ability to condense the most significant information quickly to its users. Additionally, since decision-making is usually an interdisciplinary process, the information used must suit the nature of this process, and be therefore, of use in this regard.

When examining information system in the context of understanding social and economic phenomena, it is necessary to point out the uniqueness of social and economic phenomena in a particular point in history, geography, and society. This makes it difficult to undertake controlled experiments as in the natural sciences. Although recent literature has propounded the "birth of a new science", where order and pattern replace what was formerly

considered random (Gleick, 1987), there still exist many gaps in our knowledge base. The issue is further complicated because of the close relationship between human behavior and the existing social and economic phenomena.

As was mentioned earlier, individuals, or decision makers, are affected by the existing social and economic phenomena when making decisions. Once decisions are made and acted upon, the social and economic phenomena that form the basis of future decisions are changed. As was also mentioned, alleviating these problems requires the analysis and quantification of any social and economic phenomena within the context of understanding the global structure. Understanding the global structure necessitates the use of the quantification methodology of the social sciences, which are intimately tied to behavior patterns.

Because the social sciences are primarily linked to behavior patterns, the strong bond between behavior patterns and information flows will be a main determinant in the evolution of the social sciences and the decision making structure. As mentioned above, the volume of the disaggregated information available necessitates quantification for simplification purposes; and the underlying tool for simplification purposes; and the underlying tool for this within the context of behavioral patterns in human society is econometrics. Thus, in the 1990s and the decades that follow, we will be witnessing a phase where an interdisciplinary and quantitative approach, both theoretically and empirically, will become a necessary precondition. With this, the endogenization of information flows, and thus information systems, will also become a necessary precondition. These trends are already having a strong impact on the decisional systems, and this has shown the need for a reconsideration of the existing theories and research being undertaken from this perspective.

Other extremely important factors in creating optimal decisional structures by extracting the maximum value possible from information flows are the freedom of opinion and the freedom of expression. These allow the creation of information and its transmission in the broadest possible terms, which positively impact the decisional structure in that decision makers have wider scope from which to view their alternatives. This is the basis on which policy makers rely in making economic, social and political decisions. Clearly then, a clear link and interdependency can be seen between the scientific process of collecting, and disseminating information on the one hand, and decision making on the other. In this regard, the independence of science is most essential to the decision making process, and the means for transforming the information flows generated by scientists into digestible form, namely econometrics, is the bridge between scientists and decision makers.

The role of having flexible, information system cannot be underestimated. So, the first stage in this process is the analysis and understanding of the global structure within an interdisciplinary approach. Via this information, the elaboration of any specification at the structural level may then occur.

Information flows are the core ingredients in the functioning of open market economies in democratic societies. The markets would be unable to function properly without transparency and unrestricted access to the most current information. While information system are at the center of the world's economic structure, it is also widely appreciated that the transparency that result from free information flows, and appropriate statistical infrastructures to present this information in a useable format, is vital to achieving the highest possible level of democracy in any given society.

However, it must also be acknowledged that certain specification problems arise from the lack of data or from mismeasurement problems because the specification methodology is determined independently of the data collection process. In other words, social scientists must rely on database which basically answer to the needs of governments and business, thus causing an alteration in scope of the specification methodologies (Güvenen, 1991).

3.4. Statistical Infrastructures

The main purpose of a statistical infrastructure is to provide information services. Thus, it may be considered a subset of a given information infrastructure, or of the information system. The statistical infrastructure uses an information system to collect, store, retrieve, transform, process and communicate information through the latest available technology.

Today, as mandated by the United Nation's "Fundamental Principles of Official Statistics in the Region of the Economic Commission for Europe," the primary aim of official statistics, and therefore of the statistical infrastructures, is to "provide an indispensable element in the information system of a democratic society, serving the government, the economy, and the public with data about the economic, demographic, social and environmental situation... to be compiled and made available on an impartial basis by official statistical agencies to honor citizens entitlement to public information." This adoption of the 47th session of the United Nations Economic Commission for Europe goes on to include the resolution "to facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics." It adds that "the coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system. The use of statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels. Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries." These points clearly show the emphasis being placed today on the scientific approach to information systems and the standardization of statistical infrastructures to the benefit of the global system of collecting and utilizing the voluminous amount of disaggregated information flows.

Given the enormous amount of change that technological advancements and information technology are causing in the global system, the statistical infrastructure becomes increasingly important in collecting, sorting and producing the information in a meaningful way. The flexibility of the statistical infrastructure must be proportional to the speed at which information flows are generated.

At present, information structures are insufficient and have not been maximizing the potential of the information flows in terms of their beneficial possibilities for the decision making structure. This is largely due to the fact that the existing economic theories are limited in their current ability to optimize the use of the massive amount of information for the decision making structure. What is needed is a new, interdisciplinary approach that combines the scientific quantification and statistical-economic methodologies.

By combining these elements, statistical infrastructures can achieve improved levels of accurate and timely information. This is the direction, it would seem, that future research needs to be directed towards to reach a flexible statistical infrastructure that decision makers can utilize to make their decisions among a given set of alternatives.

To conclude this section, it should be emphasized once again that the overall goal is to benefit the global system by enhancing the choose of alternatives for decision makers. This can be realized by quantifying the information flows into viable means of analyzing and absorbing information at the institutional and individual levels so as to produce standardized and globally accessible data sets. In short, this is the equivalent to the optimization of the interaction between econometrics, information systems and statistical infrastructures.

4. The Interdependence Between Information Structures and Decision Making Structures

In rapidly changing economic conditions, an information structure should alert decision making structures so that they may undertake timely policy measures. Even in the most developed countries, such as the United States, it is well known that monthly and quarterly figures are revised several times before the actual numbers are finalized. This implies that the preliminary numbers may suggest a downturn in the economy when actually there is an upward trend. Or, forecasts of the economy may be in the wrong direction. Especially when the outside and inside lags are taken into account, policy action may worsen the situation rather than helping to solve it. That is, the information structure of the economy and the capacity of the decision making structure to take advantage of the information structure become crucial in determining the performance of the economy.

The relationship between the information structure and the decision making structure should develop in such a way that it will lead to continuous improvements in both structures. That is, information structures should provide the decision making structure with the necessary information, whereas the decision making structure should convey its demands on the information structure in a clear manner. Through this relationship, both structures should be able to focus on and sort out the information that is crucial for decision makers out of the numerous information points seemingly relevant for policy making.

In democratic societies, information systems facilitate the transmission of information which can always be verified for validity and regenerated according to scientific criteria. The existence of such an information system is the means by which a market economy is able to function properly, for in a market economy, all agents need a credible statistical infrastructure and reliable information. This is necessarily true because decentralized decision making is inherent in any market economy. In other words, the existence of reliable and timely information are the exact reasons why market uncertainties are reduced to a viable level. This is indeed the reality of the impact that information systems have on decision making structures.

It is noteworthy to point out that the dissemination of the information coming from the information flows are, in fact, the most reliable source of data when observing economic and social trends. Clearly then, the soundness of the information infrastructure has a direct impact on how the decision making process operates. The next logical deduction is that since statistics are the foundation of information systems, and since democratic forms of governments rely heavily on the free flow of information, statistics, and their method of arriving at their quantified state, namely econometrics, play a fundamental role in the democratic process.

5. Conclusion

Because the world is entering an era of globalization, where local and national economies are becoming increasingly interdependent, economic, technological, and social trends are quickly transcending regional and national boundaries. This makes it imperative for each country to harmonize its interests with others to have updated information on the latest developments and advances.

Globalization is occurring very rapidly primarily because a new element in the global system has been introduced, namely disaggregated information flows at unprecedented levels. There is also an entirely new system of explanatory variables because of this. This implies that there will be rapid change in both economic theory and quantification techniques which will thereby incur a transformation in these areas. With respect to the social sciences, the impact will be possible to explain the interaction between the global structure and the "E" as well as other social sciences.

The challenge for social scientists is to restructure the formulation of the specification methodology so that it is formed in relation to the data collection process according to the needs of these scientists as opposed to only the needs of businesses and governments. In other words, the data collection process and the formulation of the data bases must also be based on the specification methodologies of social scientists. In light of the abundance of the free flow of disaggregated information, the current economic theory and quantification methods can be reformulated so as to better understand the global structure with the available tools, and perhaps with the creation of newer and more efficient tools. It is inevitable that there will be changes in the theoretical and quantification methodologies of the social sciences since the world, the global structure and therefore the basis of our quantification methods are changing.

Ideally, such a reformulation will bring about more coherence in the system. Through the flow of information and the optimal formulation of statistical infrastructures, economic theory will be improved because the global structure will be closer to being explained in analytical terms.

The era of information will mark a higher level in the progression of mankind because an inseparable link has been formed between statistical infrastructures and democracy. Freedom of opinion and expression lie at the center of establishing scientific and transparent information flows. These freedoms allow the creation of information and its subsequent transmission to occur in an optimal manner. This benefits decision making and the decisional structure at the highest level because it broadens the scope for the realm of the data in methodology specifications.

Furthermore, in market economies, where decentralized decision making is inherent to the system, the existence of reliable and timely information reduce market uncertainties to viable levels. By reducing the imperfections in the market structure through optimizing the use of information flows, the market structure functions more efficiently and results in an improved allocation of resources. Increases in the volume of information flows also mean that problem solving will occur at increasingly disaggregated levels, and by using the appropriate quantitative techniques, there will be a revision of the economic theory and of the quantification techniques that will best suit needs of the agents in the free market economy.

To summarize, the transmission of information, through its accumulation and quantification, is the definition of the statistical production process. Econometrics is the tool by which this is achieved, and is irreplaceable in quantifying the social sciences to the maximum extent possible. The availability of reliable information at all levels within a given society facilitates the decentralized decisional structure. This allows societies to successfully confront the challenges presented by the rapidly changing conditions sweeping through the global structure. Because statistical information is a tool for knowledge, analysis, decision making and evaluation, decision makers are empowered with the necessary information to advance their societies' standard of living and the overall progression of mankind. Thus, through an interdisciplinary approach, the global structure and explanatory variables used to understand it will reach higher planes.

At present, changes in the focus of modeling for achieving the above mentioned goals are vitally needed. It is hoped that subsequent discussions and further research will be stimulated according to the needs of new economic theory and quantification formulations, and of a growing and improving decisional structure.

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Özet

Ekonometri, bilgi sistemleri ve istatistik alt yapılar bir birine bağımlı olup beraberce bir toplumda karar sistemlerini optimal olarak etkileyen araçlardır. Mevcut ekonomi ve sosyal bilimler kavramlarının yoğun bilgi akışı ve niceliklendirme tekniklerindeki ilerlemelerden önemli ölçüde etkilendiği görülmektedir. İstatistik alt yapıların hızlı ve güvenilir bilgi

sunumları ve etkili veri işleme araçları hızla artan bilgi akışı sağlamakla sosyal bilimlerin deneysel ve kuramsal yönlerinde güçlü bağların oluşumuna yol açmaktadır. Bu ise, sosyal bilimlerde varolan teorilerin ve çözümlene yöntemlerinin reforma uğratılması anlamına gelmektedir.