



Kautilya on economics as a separate science

Balbir S. Sihag

*Department of Economics, University of Massachusetts,
Lowell, Massachusetts, USA*

Abstract

Purpose – The purpose of this paper is to explore the origin of economics as a separate science.

Design/methodology/approach – A very comprehensive approach is presented for determining the origin of economics as a science. Three kinds of inter-related issues are discussed: how to interpret and evaluate earlier, particularly ancient, writings, the specification of the requirements for declaring economics as a science and the definition, scope and methodology of economics.

Findings – Application of the most stringent requirements for declaring economics as a separate science to Kautilya's Arthashastra validated A.K. Sen's claim that it is the first book on economics.

Research limitations/implications – According to Kautilya, economics is a separate science but not independent of other disciplines and particularly of ethics. Whereas, most of the current research ignores this inter-dependence and consequently does not fully capture reality.

Practical implications – It implies that the inter-dependence between economics and other disciplines should be encouraged and vigorously explored.

Originality/value – It validates Redman's assertion, "The history of economics as a science is, in my view, still waiting to be properly written".

Keywords Economics, Sciences, Optimization

Paper type Research paper

1. Introduction

The history of economics as a science is, in my view, still waiting to be properly written (Redman, 1997, p. 7).

What is a science? Is economics a science? Who should be given credit for founding it? Has there been progress in economic knowledge? Such questions may seem settled but in science nothing is ever settled for all times. Groenewegen (2002) considers the determination of the origin of economics very important and explores it in depth[1]. Similarly, Backhouse (1997) attempts to answer the questions related to the growth (or lack of it) in economic knowledge. Although economists seldom agree on an issue it is amazing that for almost 200 years, there had actually been almost a consensus among economists that economics originated in the eighteenth century and that Adam Smith was its sole founding father[2]. This was accepted despite the fact that there has been no consensus regarding the requirements to be fulfilled for declaring economic as a

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science. However, in recent years strong doubts have been raised on accepting Adam Smith as the sole father of economics.

All these explorations have been limited only to Europe. Recently, Pack (2001, p. 179) remarks, "There must be an Indian, a Chinese, a Japanese, and other traditions of economic thought". Indeed India has an ancient tradition of appreciating and applying economic analysis to a wide range of problems. Sen (1987) believes that there are two ancient origins of economics: one ethics-based and the other technique-based, which he calls "engineering". He credits the Greek philosophers particularly Aristotle for originating the ethical approach to economics and Kautilya (in the tradition of Walras) for the engineering approach to economics. Sihag (2005b) shows that Kautilya's *Arthashastra* actually has much more ethical content than the contributions of Plato or Aristotle implying that it is the first origin of the ethics-based approach to economics. According to Sen, Kautilya's *Arthashastra* is the first book on the origin of the "engineering approach" to economics. He (p. 4) states, "The 'engineering' approach also connects with those studies of economics which developed from the technique-oriented analyses of statecraft. Indeed, in what was almost certainly the first book ever written with anything like the title 'Economics', namely, Kautilya's *Arthashastra* (translated from Sanskrit, this would stand for something like 'instructions on material prosperity'), the logistic approach to statecraft, including economic policy, is prominent".

A justification for such an outstanding claim that Kautilya's *Arthashastra* is the first origin of the "engineering approach" to economics was obviously beyond the scope of Sen's lectures. Since the determination of the origin of economics as a science demands an involved discussion on three kinds of issues:

- (1) how to interpret earlier, particularly ancient, writings;
- (2) the specification of the requirements for declaring economics as a science; and
- (3) the definition, scope and methodology of economics.

Section 1 offers the views of the leading economics on how to interpret, evaluate and accredit earlier works. At present there are no uniformly accepted requirements for declaring economics as a science. In the literature, at least three types of requirements have been advanced for tracing the origin of economics as a science:

- (1) by who and when economics was established as a separate or autonomous discipline;
- (2) by who and when a reasonable number of economic concepts and hypotheses were developed; and
- (3) who passed the Schumpeter's test, which is to display an understanding of the economy as a system of inter-dependent elements.

Almost invariably these three types of requirements have been advanced as alternatives but it seems that Schumpeter implicitly suggests requirements (2) and (3) as complementary in the determination of the origin of economics. Section 2 contains a discussion on these requirements for declaring economics as a science. It is also indicated that Ekelund and Heberts' claim that microeconomics is of French origin falls far short of the requisites of a science. Section 3 presents the views of a few prominent economists on Adam Smith as the founder of economics.

Kautilya specifies a very broad scope for economics. He applies economic analysis not only to core topics like taxation and economic growth, but also to other areas, such as law, war and peace. In fact, economics might have acquired the status of an imperial

science during his time, the fourth century BCE. After a lapse of two millennia, economics re-originated but initially its scope was limited primarily to issues related to economic growth. However, from the later half of the nineteenth century, its scope has been increasing steadily and it has been colonizing other disciplines[3,4]. In section 5, Kautilya's views on the scope of economics are discussed. In section 6, Kautilya's methodology, which is very similar to Marshall's, is offered. Kautilya adopts a partial equilibrium approach and very frequently but implicitly, uses phrases similar to the phrase "all other things being equal". Also, he implicitly uses the discrete marginal analysis. I present a few examples to illustrate Kautilya's partial equilibrium approach. Applications of the methodology of constrained optimization and an inter-temporal analysis by Kautilya are discussed in sections 7 and 8, respectively. In section 9, Kautilya's *Arthashastra* is examined against the most stringent requirements for declaring it as the first origin of the engineering approach to economics and it comes out faring far better than Adam Smith's *Wealth of Nations* or the contributions of Dupuit and the other French engineers.

2. Interpretation, evaluation and accreditation of earlier works

How does one interpret or evaluate earlier works? Should one use today's beliefs and standards for evaluation, or those prevailing at the time? At present, there is no consensus that any specific method or approach is superior to the others. To a large extent, it depends on the purpose of the study, availability of the appropriate material and the competence or the comfort level of a researcher with the particular approach.

Grapp (2000) is concerned about the possibility of excessive imagination on the part of some researchers in interpreting earlier writers. Accordingly, he lays some ground rules to avoid such tendencies. He proposes, "A way to get things straight about Smith or anyone else. It is to begin by distinguishing between (a) what the author actually said, (b) what is implied by what he said, (c) what can reasonably be inferred from it, (d) what we may conjecture he meant, (e) what he conceivably could have meant, and (f) what it would be convenient to believe what he meant. The next step is to stay as close as possible to points (a) and (b), to know that about point (c), the operative word is 'reasonably', and to move as far as point (d) only when all else fails, or never at all. Distinctions (e) and (f) are left to those who, to paraphrase George Stigler, make the study of economic ideas a work of the imagination".

Backhouse (1997) adds another perspective to the interpretation of the works of earlier writers. He remarks, "This debate has centered on whether it is appropriate to read the past from the perspective of present-day ideas. The opponents of 'Whig' history argue that it is important to read past writings against the contexts in which they were written, and the concerns of past economists, their presuppositions and beliefs may be very different from those of present-day economists. In its most extreme form, this position denies that there can be progress in economic thought: there are merely changes in the questions".

Blaug (2001) labels this controversy as "rational reconstruction" vs "historical reconstruction". Essentially, the rational reconstruction approach involves the use of modern methods and concepts to interpret earlier writings. Its proponents believe that it adds rigor to the analysis and helps in making any inconsistencies or implicit assumptions in the older writings explicit. On the other hand, the historical reconstruction approach consists of going back to the time of the writer under consideration, construct a picture of his time and interpret his writings in terms of what he meant and not what we think he meant. For example, Tribe (1999) asks,

“Is there any real point in laboriously excavating, cleaning down, and presenting a newly restored ‘Adam Smith’, whose features would have been recognizable to few of his contemporaries, and a diminishing series of successors?” Blaug, Tribe and others who advocate the historical reconstruction approach strongly defend such an undertaking and deplore the rational reconstruction approach.

Blaug concedes, however, that while, “Rational reconstruction makes past thinkers appear to be a bit more like us than they were; historical reconstruction make them out to be a little less like us than they were”. It is obvious that these approaches are not substitutes, but rather complements of one another, meaning that the pursuit of both approaches helps in the reconstruction of a more complete picture of the past. However, sometimes, rational reconstruction approach is possible whereas the historical reconstruction approach is likely to fail due to lack of supporting writings.

2.1 *Limiting the role of hindsight*

Walker (1999) notes, “The activity of describing, interpreting and evaluating past theory is undertaken under the powerful influence of current economic thought”. That is, knowledge of current theories and the availability of mathematical and statistical tools do help in a better understanding of past theories. However, one should guard against two possible pitfalls in the interpretation or evaluation of past contributions.

First, De long (2000) points out, “In Patinkin and Johnson’s view, Old Chicago Monetarism was a retrospective construction by Milton Friedman (1956). In their view, Friedman used ‘Keynesian’ tools and insights to provide a retrospective *post hoc* theoretical justification for policy recommendations that had little explicit theoretical base at the time, and to construct for himself some intellectual antecedents”.

A second pitfall may arise due to the failure to distinguish the current state of our knowledge from what existed in the earlier times. Thaler (2000) advances the hypothesis that “Once we know something, we can’t imagine ever thinking otherwise”. It means if this hypothesis is valid, then the answer to Blaug’s (2001) question that “Given the fact that texts must be reconstructed, the question is how are we to do so: in the light of all that we now know or as faithfully as possible to the times in which they were written?” is not possible implying that the historical reconstruction cannot be differentiated from the rational reconstruction.

2.2 *Use of modern methods to interpret earlier writers*

Unfortunately, those who adopt historical reconstruction approach try to steer clear of mathematical and statistical tools since these modern tools are used as complements, and not as substitutes, to gain insight or intuition. Commenting on Samuelson (1978), Hollander (1980) advised economic historians to get acquainted with modern methods. He remarked, “It is probable that Professor Samuelson’s statement of the ‘canonical classical model of political economy’ will become the *locus classicus* for the next generation of textbook writers; teachers of the history of thought would be advised to familiarize themselves with the ingenious diagrams in particular”.

2.3 *Accreditation*

Schaffer (1996 14) quotes Brannigan (1981, p. 90) when he states, “Events are discoveries not in virtue of how they appear in the mind, but how they are defined in and by a cultural criterion”. He (p. 19) remarks, “Much recent work on discovery and invention in the sciences demonstrates that retrospection and celebration play key roles in the production of discovery. Because discoveries acquire their status as the

result of subsequent work within the relevant community, the “fetishism” of discovery is therefore the consequence of the whole process through which change is analyzed, debated and assessed”.

There is a major difference of opinion between the philosophers and the sociologists. Philosophers, like Kuhn, discuss the paradigm-shifts and attribute those to certain individuals. Sociologists believe, “It is not the genius who creates the paradigm, but the paradigm that creates the genius who gives expression to it”. Sociologists concentrate on social factors and stress that a discovery is not a discovery unless authorized by the community. And, there is a lengthy process of review before authorship is granted. Schaffer (p. 43) notes that according to Gooding (1985, p. 234), “Herschel wrote ‘He who proves, discovers’”. However, this standard of accreditation has not been used in economics. If economists had used such a standard, Adam Smith, for example, could not be given credit for the Invisible Hand theorem, not that it was already in the air, but because of the fact that he merely stated it and did not prove it. As Rosenberg (1998) remarks, “Whether Walras’s theorem that a general market clearing equilibrium exists, that it is stable and unique, follows from the axioms of microeconomic theory. Walras offered this result in 1874, as a formalization of Adam Smith’s conviction about decentralized economies, but he was unable to give more than intuitive arguments for the theorem. It was only in 1934 that Abraham Wald provided an arduous and intricate satisfactory proof, and much work since his time has been devoted to producing more elegant, more intuitive, and more powerful proofs of new wrinkles on the theorem”.

Similarly, Adam Smith discussed the regulation of monopolies and provision of public goods by the government but he did not label them as “market failures”. He was not aware of the concept of the deadweight loss. Therefore, the undesirability of monopoly as argued by Adam Smith was not based on the ground that it created a deadweight loss but it was considered unfair. Economists still credit him for recognizing these problems. The point is that if an earlier writer recognized a problem and suggested a reasonable solution, later day economists have given him credit for its origination. As another illustration, during the 1860s Scottish chemist Peter Tait simply started cataloging knots. He could not imagine that today Knot theory would be one of the hottest topics in mathematics and useful in learning DNA and making computers more efficient. If an earlier writer initiated and advanced a concept further than Mr Tait (i.e. beyond making a classification) and well short of our current understanding, has been given credit for originating that concept. This methodology is followed in the author’s evaluation of Kautilya’s work. In other words, economists do follow a very liberal approach in evaluating earlier writings but it does not imply, for example, that Aristotle should get credit for originating the concept of “law of gravitation” based on his argument that a stone falls to the ground since it has a tendency to return to its natural resting place.

3. Requirements for establishment of economics as a science

According to Schumpeter (1954), it is futile to search for the origin of economics. He (p. 9) remarks, “As regards economics, bias or ignorance alone can explain such statements as that A. Smith or F. Quesnay or Sir William Petty or anyone else ‘founded’ that science, or that the historian should begin his report with one of them. But it must be admitted that economics constitutes a particularly difficult case, because common-sense knowledge goes in this field much farther relatively to such scientific knowledge as we have been able to achieve, than does common-sense knowledge in almost any other field. The layman’s knowledge that rich harvests are associated with low prices

of foodstuffs or that division of labor increases the efficiency of the productive process are obviously prescientific and it is absurd to point to such statements in old writings as if they embodied discoveries. The primitive apparatus of the theory of demand and supply is scientific. But the scientific achievement is so modest, and common sense and scientific knowledge are logically such close neighbors in this case, that any assertion about the precise point at which the one turned into the other must of necessity remain arbitrary”.

On the other hand, Groenewegen (2002) argues, unlike Schumpeter, for dating the emergence of economics as a science. However, Spiegel hints at some arbitrariness in the search for the origin of economics. He (1991, p. xxii) remarks, “Where should a history of economics start? Often the nationality of an author makes him inclined to open up the discussion with the contributions of fellow nationals. Even in the absence of an explicit claim the whole matter then appears to be part of the national heritage, perhaps even a national invention – thus French historians of economics are apt to open up the story with the Physiocrats, while the English may prefer the mercantilists or the classics”.

The above remark by Spiegel may be interpreted in more than one way. Since it may mean that the requirements to declare economics as a science either are not standardized regarding its definition, scope and method, inconsistently followed or have been changing over time[5]. Any one of these possibilities could allow some arbitrariness in determining the origin of economics as a science but in this case all of the above seem to hold. For example, Groenewegen (2002, p. 49) observes, “A study of the literature of the history of economics quickly reveals that the question of the emergence of economics as a science has been treated in different ways, and that these different ways not infrequently can be explained by differences in the scope, subject matter and objectives of economics accepted by the historian. Hence there is a strong relationship between the treatment of the emergence of economics as a science, and the definition of economics as a science, different definitions generally, but not always, leading to different periods of time, and to different individuals or groups to whom or to which the emergence can be assigned”.

There are indeed no uniform standards. For example, (a) Spiegel emphasizes only the autonomous aspect, and (b) Ekelund and Hebert (1999) concentrate only on the development of a reasonable number of concepts. However, (c) Schumpeter is much more demanding as to the requirements although he himself is inconsistent in their applications[6]. According to him, the author, who understood the economy as a system of inter-dependent elements should be acknowledged as the founder of economics as a science. These requirements are discussed in turn. It may be added, however that Marshall (1920) singles out only the writing of a treatise on economics, and Barber (1967) and Landreth and Colander (1994) consider only the providing of a brilliant synthesis as the requirements for declaring an author (in this case Adam Smith) as the founder of economics[7].

3.1 Economics as an autonomous discipline

Spiegel (1991, pp. XXIII-IV) asserts, “Economics as an autonomous and systematic science is of comparatively recent origin; it arose as part of the science of man in the seventeenth and eighteenth centuries. Before that time, economic ideas were presented in the context of philosophy in classical Greece, in the context of theology during the Middle Ages, and again in the context of philosophy, but at times in the somewhat more emancipated form of separate essays, during the era of Locke and Hume. The

economic thought of the mercantilists may have been autonomous – that is, independent of religion and philosophy – but it touched only certain aspects of economics and did not cover the entire field in systematic fashion. The same can be said of the Physiocrats. With Adam Smith economics became established as an autonomous and systematic field of study”.

According to Spiegel, establishment of economics as an autonomous discipline – independent of religion and philosophy – is the only requirement and Adam Smith was the first one, who accomplished this during the eighteenth century. As explained below this is neither necessary nor sufficient to declare economics as a science. Also still economics was not separated from political science. But more important, Adam Smith not only made economics independent of religion and philosophy but also of ethics and thus *The Wealth of Nations* is solely responsible for causing “the lack of bonhomie” in modern economics.

3.2 Development of a reasonable number of concepts

Ekelund and Hebert (p. 6) quote Dupuit “All sciences undergo a period when they are considered mere practice. A few sparse principles based on observation or reason do not constitute a science. For a science to merit its title, its principles must be numerous and sufficiently well established to explain a particular order of phenomenon. Therefore, each science undergoes a period of gestation before its birth; but little by little, through successive discoveries, a more or less comprehensive body of doctrine is formed. This body of doctrine, accepted by all those adept in the field, constitutes the science’s lifeblood. It is the unanimous consent of the scholars in the field that imposes itself on the public (1863b, 238)”. They (p. 7) further quote Dupuit “Then, one glorious day the new principle is demonstrated through observation or reason”.

Several remarks are in order. According to Dupuit, the true criterion to be a discipline is that it must have “numerous and sufficiently well established” principles. The word “numerous” is a little vague since it does not specify a lower limit on the required number of principles. The phrase “sufficiently well established” is used by Dupuit to indicate that a principle must be demonstrated by “observation or reason” and must be “accepted by all”. However, if unanimous consent were used as a criterion to declare a body of knowledge as a separate discipline, economics, most likely, would not qualify to be a discipline. Moreover, the phrases “little by little” and “accepted by all” together imply that probably more than one founding father would be needed to establish a discipline. Therefore, the only meaningful requirement to be called a new discipline may be whether there is a distinctly identifiable core consisting of, at least, a respectable number of basic concepts and testable hypotheses. The words respectable number and distinctly identifiable core need some explanation.

An evaluation of Dupuit’s contributions. Some of the contributions of Dupuit and the French engineers are quite remarkable[8]. However, the claim by Ekelund and Hebert “that microeconomics, as we know it today, is uniquely of French origin” is not justified. Since Dupuit’s contributions both in terms of depth and breadth are far too insubstantial to bestow him with the fatherhood of microeconomics.

3.3 Schumpeter’s test for declaring economics as a science

According to him (p. 7), “A science is any kind of knowledge that has been the object of conscious efforts to improve it. Such efforts produce habits of mind – methods or ‘techniques’ – and a command of facts unearthed by these techniques which are beyond the range of the mental habits and the factual knowledge of everyday life. Hence we may also adopt the practically equivalent definition: a science is any field of knowledge

that has developed specialized techniques of fact-finding and of interpretation or inference (analysis)". He (p. 173) further adds that one has to "show how they hang together and how they determine each other, which is where scientific economics begin". That is, until the economy was seen as a system consisting of inter-dependent elements, economics would remain in the pre-scientific stage.

It may be pointed out that although Schumpeter specified a rigorous standard for qualifying to be declared as scientific but he himself did not follow it. It should also be noted that Schumpeter's requirements as to what is scientific are much different than those prevalent during the eighteenth century. For example, Redman (1997, p. 104) remarks, "I have said that doing science, or philosophy, in the eighteenth century meant systematic inquiry. What exactly did this entail? For the Scots, science was a body of coherent knowledge organized around a few simple principles of explanation". In other words, according to Scots, science was concerned with systematic analysis not with systemic analysis as required by Schumpeter.

4. Prominent economists' views on *The Wealth of Nations*

How Adam Smith came to be known as the Father of Economics: Schumpeter (1954, p. 194) explains, "But outside of England, most economists were not quite up to Ricardo, and Smith continued to hold sway. It was then that he was invested with the insignia of 'founder' – which none of his contemporaries would have thought of bestowing on him-and that earlier economists moved into the role of 'precursors' in whom it was just wonderful to discover what nevertheless remained Smith's ideas".

4.1 Traditional views on Adam Smith

Three kinds of arguments have been advanced to accredit Adam Smith as the originator of economics. The first is that he wrote the first treatise on economics: *The Wealth of Nations*; the second that he provided a brilliant synthesis of existing ideas in economics; and, thirdly, that he, upon closer examination, was also a great theoretician who made truly original contributions. Obviously, if Adam Smith is accepted as the founder of economics, then the study and formulation of economic thought could not have begun much earlier than the eighteenth century.

Samuelson (1962) remarks that, "Past experience at these annual gatherings of the sons and daughters of Adam Smith suggests that the popular subject of discussion among economists is not so much economics as economists". In fact, at least from Ricardo onwards, Adam Smith has been declared as the father of economics, which various prominent writers at different times have reaffirmed. A representative listing of their views is provided below. Ricardo (1821) in the preface to his *Principles of Political Economy and Taxation* states, "The writer, in combating received opinions, has found it necessary to avert more particularly to those passages in the writings of Adam Smith from which he sees reason to differ; but he hopes it will not, on that account, be suspected that he does not, in common with all those who acknowledge the importance of the science of Political Economy, participate in the admiration which the profound work of this celebrated author so justly excites".

Deane (1978, pp. 3-4) asserts, "It was not until the eighteenth-century philosophers – primarily the Physiocrats and Adam Smith – began systematically, and not merely incidentally, to apply to economic phenomena their theories of natural order underlying the real world that economic theory began to develop into a unified system of explanation, a definitive technique of analysis". She (p. 6) adds, "Karl Marx too had no doubt where modern economics effectively began. Adam Smith 'must be given

credit', he wrote, 'for having closely determined the abstract categories and for having securely labeled the differences analyzed by the Physiocrats'".

Samuelson (1980) provides a different perspective in evaluating the contributions of earlier writers. He observes, "Every historian of science appreciates how vague are the brilliant perceptions of the earliest writers and how constructive is the achievement of later writers in synthesizing and clarifying ideas". He emphasizes originality, rather than the synthesis in Smith's work. In fact, Samuelson (1977, 1978, 1980) has attempted to establish Adam Smith as a first-rate theorist, contrary to the traditionally established view that he was merely a synthesizer of ideas. It is beside the point that if Adam Smith were to read the interpretation of his own work by Samuelson, being a humble Scotchman (having completed the evolution from "savage to Scotchman"), he would declare Samuelson to be the father of economics and agree with Wordsworth that, "child is the father of man".

4.2 Recent revisions of the initial views on Adam Smith

Miller (1997) points out that the classical economists before J.S. Mill did not consider economics as a separate discipline and the style was non-technical. He remarks, "From Adam Smith until the middle of the nineteenth century, leading social thinkers made little distinction between their economic and political writing. The methods of analysis were similar, using largely verbal arguments dominated by normative concerns". Similarly, Redman (1997, p. 4) observes, "Binding the eighteenth and early nineteenth-century thinkers was a belief in a common method for the social sciences. This strand of thought stops, however, with J.S. Mill, who developed the idea of political economy as a separate science". It is obvious from the above assessments by Miller and Redman of Adam Smith's work that he alone really did not establish economics as a separate discipline implying that he cannot be declared as the sole father of economics.

Ekelund and Hebert (1999, p. 1) assert, "The popular wisdom is that classical economic inquiry, which extends from Adam Smith to John Stuart Mill, focused on macroeconomics, whereas neoclassical economic inquiry, which begins with William Stanley Jevons and Carl Menger and culminates with Alfred Marshall, centered on microeconomics". That is, they believe that the classical economists may be declared as the founders only of macroeconomics. But they (p. 2) claim "That microeconomics as we know it today, is uniquely of French origin".

Robinson (1953) did remark that neoclassical thought paid too much attention to little issues like "why does an egg cost more than a cup of tea" and ignored the big issues like growth and distribution, which were pursued by the classical economists. However, no one has ever credited Adam Smith for originating the macroeconomics. Keynes acknowledged the contribution only of Malthus and derided that of Ricardo. Stewart (1986, pp. 23-24) while commenting on *The Wealth of Nations* remarks, "Yet, despite its great sweep, and its pre-eminent concern with what we would now call "economic growth", the book contains no real discussion of why the level of employment is what it is. Clearly, this was not a question which interested the author; indeed it probably never occurred to him."

Deane also wonders about the recognition of Adam Smith as the father of macroeconomics. She (pp. 5-6) states, "The case for beginning a study of the evolution of economic ideas with Adam Smith rather than with the Physiocrats does not rest, however, either on the innate superiority of his analytical framework, or on his claims to chronological priority in the unified methodological approach which both shared. No doubt Francois Quesnay has as much right as Adam Smith to be regarded as the founder

of modern political economy. Indeed his concept of a circular flow of incomes and his *Tableau Economique*, which can be interpreted as kind of input–output table, will strike economists used to operating with social accounting tools of analysis as more relevant to modern macroeconomics than any part of mainstream classical political economy from Smith onwards”. Thus according to Deane, the credit for originating macroeconomics if at all should go to Francois Quesnay but definitely not to Adam Smith.

The “Invisible Hand Theorem” and the gains from “Division of Labor” have immortalized Adam Smith. The famous lines from his work, *The Wealth of Nations* (p. 119), “It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own self-interest”, bestowed respect on the emerging business classes and helped in liberating the British and other economies from over-regulation by their respective governments.

Recently, Grampp (2000) sheds new light, or perhaps cast a shadow, on Adam Smith’s contribution related to the “invisible hand” theorem. He asserts, “The invisible hand of the *Essays* is remote from that of *The Wealth of Nations* and also from that of the *Theory of Moral Sentiments*. The three present a pretty puzzle to readers who would like to make the ideas of Smith consistent, an honor he was not sure he merited”. He adds, “If there is a relation among them, as has been claimed, it has not been demonstrated with evidence from what Smith actually wrote”. In fact, he goes as far as stating that, “It is more interesting than important, I simply mean it does not have a principal place in *The Wealth of Nations* or even a salient place”.

Grampp also comments on the “Division of Labor”. He states, “Smith did say exchange yields a benefit to both buyers and sellers as did a number of writers before him. Cicero among them (from whom Smith could have and may have also gotten an idea or two about the benefits of the division of labor and of material welfare) (Cicero 44 B. C., ii, 3, 4; North 1691, 13; *Wealth of Nations*, 26-27)”.

4.3 Rationality assumption

The current methodology of economics also would be foreign to Adam Smith. For example, Redman (p. 234) remarks, “Unlike twentieth-century usage, Smith’s self-interest is not rooted in a concept of rationality. He did not believe that reason should be the primary guide of human destiny; in *The Theory of Moral Sentiments* he asserts nature implants a consciousness in the human breast that is wiser than reason, for nature intends the good of the species and endows people with social sentiments (1976b, p. 80)”.

4.4 Optimization assumption

Similarly, according to Redman, Adam Smith was averse to the assumption of optimization, which is the underlying foundation of all economic decisions. She (p. 218) asserts, “Smith was not interested in optimization problems, ‘which offer an irresistible invitation to mathematical treatment’”. She continues, “Thus, the many modern interpretations of Smith’s theory that mathematize and axiomatize his theory are not Smith at all but a transformation of Smith”.

4.5 Adam Smith’s methodology

Over the last 200 years, economists have argued over the methodology used by Adam Smith, i.e. whether it was inductive or deductive. Recently, Redman (p. 189) clarified this issue. She states, “The confusion is easier to understand if we keep in mind that until their time the words infer and deduce were used as synonyms and inference (whether inductive or deductive) seems to have been equated with induction”.

She (fn. 31, p. 189) adds, “Smith’s dislike of deductive systems was a reaction to the systems of Descartes, Hobbes, and others and not just to the Church”.

4.6 Absence of marginal analysis and “Ceteris Paribus” from Adam Smith’s analysis
However, a few observations regarding Adam Smith’s methodology may be added here. First of all, he did not use the marginal analysis and “all other things equal”. Regarding the marginal analysis, Redman (fn., 24, p. 217) quotes Worland as stating, “Adam Smith did not appreciate the difference between the value of a variable, and the rate of change in the value, and his economic theory suffers for it”. Marshall (p. 37) notes, “Adam Smith and many of the earlier writers on economics attained seeming simplicity by following the usages of conversation, and omitting conditioning clauses. But this has caused them to be constantly misunderstood, and has led to much waste of time and trouble in profitless controversy; they purchased apparent ease at too great a cost even for that gain”.

4.7 Core of economic knowledge offered by Adam Smith

Schumpeter (p. 184) assesses *Wealth of Nations* as: “But no matter what he actually learned or failed to learn from predecessors, the fact is that the *Wealth of Nations* does not contain a single analytic idea, principle, or method that was entirely new in 1776”. The invisible hand theorem, the division of labor, and importance of capital accumulation have attracted most of the attention and recently, his understanding of the diminishing returns and moral hazard have been added to his contributions. Although it would be a worthwhile project to list all of his contributions and examine his understanding of the interdependence of various disciplines, but it is beyond the scope of this study.

Deane (1978, p. 11) asserts, “If we were to define a theoretical science as a set of ‘general laws which can serve as instruments for systematic explanation and dependable prediction’ and a scientific methodology as a technical apparatus for logically or empirically verifying these laws it would be too much to say that Adam Smith had founded a science of economics. But it is reasonable to claim that he had at any rate made the first steps in this direction by devising a system and testing it. By postulating a logical system of economic relationships based on an underlying law of human nature (analogous to Newton’s law of gravity), he set the course of the theoretical political economy towards a system-building discipline”. She adds, “However, what accounted for the tremendous impact that this book had on economic thought was not its components which, taken out of context, are easily criticized, but the way it built up into a logically interdependent whole, the first unified socioeconomic model”. Thus Deane specifies the requirements for the establishment of a new discipline but she is not sure whether Adam Smith fulfilled those requirements. It may be noted that she does not specify how large a set of “general laws” should be to qualify as a separate discipline. Essentially her conclusion is similar to that of Miller and Redman that Adam Smith is one of the founders of economics. Since he just initiated the discussion and did not develop the required set of general principles.

5. Kautilya’s *Arthashastra* on definition and scope of economics

The word *Arthashastra* is a combination of two words: Artha and Shastra. Kautilya uses the word Artha (p. 100), as “wealth” and (p. 145) as “material well-being”. There is no ambiguity regarding the word *Shastra*: it means science. As Varma (1995-1996, p. 583) observes, “The name of the book is shastram, which means a philosophical and

theoretical exposition and not a historical presentation". However, in later time periods, the original meaning of the word *Shastra* was diluted and was used to denote even inconsequential works.

According to Deane (1983), the social needs of the time should determine the scope of a discipline. She states, "The scope and method of our discipline needs at all times to be described in relation to the social problems which give purpose to it and there is room for more than one progressive research program in operation at the same time". I believe that in addition to the social needs, the progress in other fields and the capabilities of its practitioners may be important determinants of scope and method of a discipline.

5.1 Kautilya on the scope of economics

Kautilya (p. 99) described his work as: "This *Arthashastra* is a compendium of almost all similar treatises, composed by ancient teachers, on the acquisition and protection of territory. Easy to grasp and understand, free from verbosity, Kautilya has composed this treatise with precise words, doctrines and sense (1.1)". It has 150 chapters distributed among 15 books. Books 1, 2 and 8 deal primarily with economic policies and economic administration, Books 3 and 4 discuss crime and punishment and administration of justice, Books 6, 7, 9, 11 and 12 primarily deal with foreign policies and Books 10 and 13 deal with issues related to war. Interestingly, "The Method of Science", is placed at the end rather than in the beginning of *The Arthashastra*. Kautilya's classification of topics might have been appropriate for his time but it would look odd today. In fact, that may hold for other important works also. As Samuelson notes that Adam Smith mentioned the law of diminishing returns while discussing colonies, an unusual context. Therefore, the subject matter in Kautilya's *Arthashastra* is reclassified according to the current practice.

Kautilya covers a wide range of topics, such as economic growth, taxation, government expenditure, administration, crime and punishment, property laws, consumer protection laws, labor laws, foreign trade, war and peace, principal-agent problem, diversification to reduce risk and many others. Essentially, anything related to the wealth and welfare of citizens is covered in *The Arthashastra*. He (p. 100) summarizes the scope of *The Arthashastra* as: "The science by which territory is acquired and maintained is Arthashastra – the science of wealth and welfare (15.1)". Ray (1999) believes that Kautilya's *Arthashastra* may be considered as the first treatise on conceptualizing a state based on Loksamgraha (welfare of all). He (p. 108) observes, "Another element which was important was the motive. Since we do not have any control over outer conditions, we are permitted to act according to time, place and circumstances so long as our motive, over which we have absolute control, is clear, transparent; so long as we are inspired by the idea of the welfare of all (Loksamgraha) and not personal gratification, we are permitted everything. In formulating the entire statecraft on this principle, his system has not been superseded by any subsequent thinker. This was no doubt a departure from popular notions but in the time in which the idea of Loksamgraha was expressed, it had surely radical implications, decisively influencing the organization of the central state in India during the Mauryan and Gupta periods".

Similarly, Drekmeier (1962, p. 76) states, "Now the king must concern himself directly with the common good, an idea anticipated in the *Arthashastra*". Thus according to Kautilya, the scope of economics is more like that of the contemporary economics, that is, it is limited only by one's imagination. However, it took more than two thousand years to restore its original scope.

6. Kautilya's methodology: a partial equilibrium approach

Adhishthanam tatha karta, karanam cha prithagvidham, vividhashcha prithakcheshta, daivam chaivaatra panchamam, i.e. Success (output) depends on five factors: initial conditions, doer (labor), tools (capital), managerial efforts and random variables (luck). Gita (2nd BCE, Chap. 18, Verse 14).

6.1 Kautilya on the role of methodology

At the time of Kautilya or that of Adam Smith, there were no theoretical models, as we know them today[9]. There were just statements of hypotheses, and no formal proofs were offered. Also there were no tools available to test the acceptance or rejection of these hypotheses. There are only verbal arguments in Kautilya's *Arthashastra*. Surprisingly, Book 15, which is the last one in *The Arthashastra*, has just one chapter and it deals exclusively with methodology adopted in writing it. Kautilya (p. 101) stated, "Thirty-two stylistic and logical devices are used in this work". Some of them are just stylistic rules like the ones in "University of Chicago Manual of style". But others are more substantive such as stating a hypothesis, reasoning to prove it, a conclusion and a recommendation.

He (p. 101) explained, "A statement is used to describe a conclusion or a rule. For example, {1.4.16}: 'The people of the four Varnas and the four walks of life follow their own dharma and pursue with devotion their occupations if they are protected by the king and the just use of danda'. That is, he puts forward the hypothesis that the maintenance of security, and law and order is essential for people to pursue their occupations. He (p. 103) stated, 'Reasoning is used to prove an assertion. In asserting [in {1.7.7}] that artha alone is supreme, the reason is given: 'because dharma and kama depend on artha'". He wrote, "An analogy is used to establish an unknown with the help of the known. [For example, {2.1.18}:] '(the king) should treat leniently, like a father would treat his son, those settlers whose exemptions from taxes have ceased to be effective'". Kautilya's goal in establishing methodological rules was not to accelerate the creation of knowledge, rather to ensure that the reader understands him clearly. The sentence "Easy to grasp and understand, free from verbosity, Kautilya has composed this treatise with precise words, doctrines and sense" reflects simplicity of expression as his overriding concern. Occasionally, he used historical facts to support his arguments[10].

6.2 Usages of the phrase "Ceteris Paribus"

Whitaker (1987, Vol. 1, pp. 396-7) distinguishes among its three different usages:

- (1) The validity of a theory must assume the stability of a model's structure. The quote from Gita uses this phrase in this sense, that is, no change in background conditions, particularly the place of operation;
- (2) Constancy of the certain exogenous variables; and
- (3) Assumptions regarding certain endogenous variables.

The usage in this sense has three interpretations:

- (a) use of a partial equilibrium analysis as an approximation;
- (b) as a transitional step to a general equilibrium; and
- (c) "experiments as heuristic aids sustaining general equilibrium theory".

6.3 Implicit use of “Other Things Being Equal” by Kautilya

The use of this phrase has been more widespread than acknowledged by the modern writers. Kautilya was possibly the first economic thinker who implicitly used phrases similar to the phrase “all things being equal” in economics. Two examples from his Book 7 are presented to support this claim[11].

Kautilya (p. 665) suggested (to the king), “Where there is a choice between kings equally immune to the diplomacy of the aggressor, the weak king shall seek the protection of one who has better counselors and who surrounds himself with wise elders. When there is a choice between kings equally immune to the diplomacy and might of the aggressor, the one who had made more extensive preparations for war shall be preferred. When there is a choice between kings equally immune to the diplomacy, might and energy of the aggressor, he who has battlefields favorable to him shall be preferred; among those having equally favorable battlefields, he who can fight at a time suitable to him shall be preferred; among those equal in place and time of war, he who has better weapons and armor shall be preferred (7.15)”.

A few points may be noted. First, Kautilya is engaged in thought experiments as to how a weak king should explore his choice set. Second, he first compares two kings in terms of just two variables, adds the third variable while holding the other two variables constant and so on. This is essentially Whitaker’s case (2) in which only certain exogenous variables are held constant, that is, Kautilya adopts a partial equilibrium approach. According to him, a weak king seeking protection should compare the relative physical might, intellectual power, war preparedness, weapons and other factors of all the kings under consideration. Formally, this may be expressed as:

$$U = f(\Delta M, \Delta H, \Delta R, \Delta W, \dots)$$

where U = a weak king’s utility; the difference between the strengths of two other kings, $\Delta M = M^1 - M^2$; the difference between their intellectual powers, $\Delta H = H^1 - H^2$; the difference between their readiness for war, $\Delta R = R^1 - R^2$; and the difference between the quality of their weapons, $\Delta W = W^1 - W^2$. Since Kautilya assumes $\Delta M = \Delta I = \Delta R = 0$. Then, Kautilya’s analysis implies that the partial derivative

$$\frac{\partial U}{\partial W} > 0.$$

In other words, if two kings were equal in might, intellectual powers and readiness for war (this amounts to the Marshallian phrase “all other things being equal”), and $\Delta W > 0$ (i.e. the quality of weapon of king one was better than that of king two), then the weak king should seek protection from the first king. Thus his analytical approach is identical to that of Marshall.

Kautilya (p. 609) wrote, “When, among a group of allies, many give equal help in terms of manpower, it is specially advantageous to get the troops from one whose troops are valorous, able to tolerate hardship, loyal and versatile (7.9)”. Formally this may be specified as:

$$U = U(\Delta L, \Delta V)$$

where $\Delta L = L_1 - L_2$, $\Delta V = V_1 - V_2$, L and V indicate manpower and valor, respectively.

According to Kautilya, if $\Delta L = 0$ (i.e. the two kings supplied the same number of soldiers), $\partial U / \partial V > 0$ implying that the soldiers with a higher level of valor should be preferred. There are many additional situations to which this methodology that “all other things being equal” was used by Kautilya.

6.4 Use of marginal analysis by Kautilya

Kautilya implicitly used discrete marginal analysis[12]. It is shown in the three examples from Books 2, 6 and 7, which are also related to foreign policy.

Kautilya (p. 259) stated, “With increased wealth and a powerful army more territory can be acquired, thereby further increasing the wealth of the state (2.12)”. Two points are in order. First, he was referring to a dynamic process and secondly to increments in wealth, army and territory.

He (p. 553) stated, “Applying these [active and passive policies] may result in any one of the following: decline, progress, or no change in one’s position (6.2)”. He (p. 553) proceeded to define these concepts as follows: “A king makes progress by building forts, irrigation works or trade routes, creating new settlements, elephant forests or productive forests, or opening new mines. Any activity, which harms the progress of the enemy engaged in similar undertakings, is also progress. However, a king may ignore an enemy’s progress if his own progress will be quicker or greater [than that of his enemy] or if there is a prospect of greater future gain. A king suffers a decline when his own initiatives are ruined or when the enemy’s undertakings prosper. When there is neither progress nor decline, the situation is said to be one of “no change” (7.1)”. Thus according to him, progress, and no change, may be indicated by $\Delta Y = [\Delta Y_d - \Delta Y_e] \geq 0$ and a decline by $\Delta Y < 0$, where ΔY_d and ΔY_e represent changes in incomes of domestic and enemy’s economies, respectively.

He (p. 565) argued, “When the degree of progress is the same in pursuing peace and waging war, peace is to be preferred. For, in war, there are disadvantages such as losses, expenses and absence from home (7.2)”. Kautilya clearly emphasized the concept of additional net gain in making comparisons between choices. Interestingly, in calculating the net gain, he netted out the disutility of staying away from home. Thus according to Kautilya, a king should not wage a war unless the net gain from a war ($\Delta Y_w - C$) was greater than that in pursuing peace (ΔY_p), that is, unless $(\Delta Y_w - C) > \Delta Y_p$, where C = loss of men, material and disutility of staying away from home.

7. Kautilya on optimization subject to constraints

At present, utility maximization by the consumer subject to his budget constraint or output maximization by a firm subject to its resource constraint or some other optimization problem subject to constraints, is a well-established practice. However, its reemergence is not that old. Allingham (1987, p. 883) points out, “The wealth constraint first appears explicitly in the writings of the neoclassical school, and particularly in the work of Walras (1874-1877). However, it is first made use of rigorously by Slutsky (1915) and then Hicks (1946)”.

Kautilya (p. 115) explained, “If only one method is recommended, it is defined as ‘placing a restriction’, if a choice is suggested, it is an ‘option’ and if two or more are to be used together, it is a ‘combination’ (9.7)”. Kautilya used optimization subject to resource constraints. He (pp. 199-200) suggested, “The five aspects of deliberating on any question are: (i) the objectives to be achieved; (ii) the means of carrying out the

task; (iii) the availability of men and material; (iv) deciding on the time and place of action and (v) contingency plans against failure (1.15)".

Specification of an objective and the phrase "availability of men and material" clearly establish optimization subject to constraints. Of course, the non-availability of calculus or the method of Lagrange multipliers would not allow him to undertake any formal analysis. Kautilya (p. 166) explained the phrase "means of carrying out" as "Of the four means of dealing with dangers, [conciliation, placating with gifts, sowing dissension and use of force], it is easier to employ a method earlier in the order (9.6)".

Another insight in formulating a policy may be noted. According to Kautilya, a contingency planning against unexpected outcomes was an essential ingredient of a sound policy. Stein (1996) asserted, "The CEA, like the government as a whole, is deficient in contingency planning. I think the council has been good about giving the President a fair picture of his options. It has been less good about preparing him for the possibility that the option he selects turns out not to have the expected consequences".

8. Kautilya on inter-temporal choice

Usually, the credit for inventing the inter-temporal choice goes to John Rae (1934)[13]. Apparently, Kautilya also offered many applications involving inter-temporal choices. Similarly, the credit for making the distinction between short-run and long run is given to Marshall. Although, Kautilya did not analyze the short-run and long run cost curves like Marshall but he was aware of the analytical relevance of such a distinction. Let me provide a few instances of such a distinction.

Kautilya (p. 158) stated, "A king shall employ, without hesitation, the methods of secret punishment against traitors in his own camp and against enemies; but he should do so with forbearance keeping in mind the future consequences as well as immediate results (5.1)".

Similarly, He (p. 636) asserted, "When the gains from two campaigns are equal, the king shall compare the following qualities and choose the one which has more good points: place and time; the power and the means required to acquire it; the pleasure or displeasure caused by it; speed or slowness of getting it; the proximity or distance; the immediate and future consequences; its high value or constant worth; and its abundance or variety (9.4)".

He (p. 642) discussed the immediate and future impacts of several policies. For example, "helping a neighbor on the flank of the enemy with money or troops [without asking for payment; immediate loss of money or troops but long-term gain]" (9.7). That is, the immediate effect was negative but long-term impact might be positive.

Kautilya (p. 594) asserted, "A king may agree to forego a large immediate gain and seek [only] a small future benefit if he intends to use again the partner who is being helped (7.8)". Along with the distinction between short-run and long run, it is also apparent that Kautilya believed in reputation building.

Kautilya (p. 596) stated, "If a king believes that the one to whom troops are lent will, after achieving the objective for which they were hired, appropriate them himself, send them to hostile lands or jungles, or, in some fashion make them useless, the forces shall not be lent, using the pretext that they are needed elsewhere.

If, however, he is obliged to lend his troops, they shall be lent only for the limited period of that campaign, on condition that they shall stay and fight together and be protected from all dangers till the end of the campaign; as soon as the campaign is over, they shall be withdrawn on some pretext (7.8)".

9. Kautilya’s Arthashastra on economics as a science

The interpretations of Kautilya’s *Arthashastra* are confined to Grampp’s points (a) and (b) and only occasionally, with recourse to point (c), but points (d), (e) and (f) are avoided altogether. In other words, these interpretations are limited to what Waterman (1999) calls “can be found-or read into”. Secondly, the origin of a concept is attributed to Kautilya only if he provided at least as much substantive material on it as Adam Smith did. The work is undertaken as a challenge to minimize the pitfalls of hindsight. Ultimately, for Kautilya’s *Arthashastra* to qualify as the first word on economics, it has to cross the high bar set by Schumpeter (1954).

Economics as a separate discipline. According to Kautilya (pp. 105-6), “Traditionally, philosophy, the three Vedas, economics and the science of government are considered to be the four branches of knowledge. [However,] the followers of [the Arthashastra of Prachetasa] Manu say that there are only three branches – the three Vedas, economics and the science of government. For [to them,] philosophy is only a special branch of Vedic studies. The School of Brihaspati considers only economics and politics to be true branches of knowledge; [they argue that] those experienced in the ways of the world use the Vedas only as a cover [in order to avoid the accusation of being materialistic atheists.] The school of Ushanas, maintains that politics is the only science; because, they say, it is in that science all other sciences have their beginning and end. Kautilya holds that there are, indeed, four branches of knowledge. Because one can know from these four all that is to be learnt about Dharma [spiritual welfare] and artha [material well-being], they are called ‘knowledge’. Philosophy is the lamp that illuminates all sciences; it provides the techniques for all action; and it is the pillar, which supports dharma.

Samkhya, Yoga and atheistic are [the?] three schools of philosophy. One should study philosophy because it helps one to distinguish between dharma and adharma [evil] in the study of the Vedas, between material gain and loss in the study of economics and between good and bad policies in the study of politics. [Above all,] it teaches one the distinction between good and bad use of force. When the other sciences are studied by the light of philosophy, people are benefited because their minds are kept steady in adversity and prosperity and they are made proficient in thought, speech and action (1.2)”.

The above statements make it abundantly clear that Kautilya identifies economics as a separate discipline. It is claimed, as explained in Table I, that Kautilya carved out the very first inter-disciplinary matrix.

9.1 Interdependence among different disciplines

Just like an industry, a discipline may make a contribution in three ways. Ideas in a discipline may provide the seeds to create more ideas in its own field, in other disciplines and may help in developing better public policies or better products. It may be noted that the elements of this matrix could be matrices themselves. Kautilya

	Political science	Economics	Vedas	Philosophy
Political science	A_{11}	A_{12}	A_{13}	A_{14}
Economics	A_{21}	A_{22}	A_{23}	A_{24}
Vedas	A_{31}	A_{32}	A_{33}	A_{34}
Philosophy	A_{41}	A_{42}	A_{43}	A_{44}

Table I.
Kautilya’s inter-disciplinary matrix

establishes economics as a separate discipline. However, according to Kautilya, establishment of economics as a separate discipline does not mean its independence from other disciplines. That is, economics can provide to and receive inputs from other disciplines. Whereas Waterman (2001, p. 56) after his exhaustive research concludes, “The boundary between political economy and Christian theology, now so obvious and impermeable, was thus erected for the first time in 1831 by Whately – in response to an ideological crisis that was ultimately traceable to the publication thirty years before of Malthus’s first *Essay on Population*. It is important to realize that this boundary, which is a corollary of Whately’s rigorous specification of the scope and nature of political economy, is the *fons et origo* of all subsequent boundaries between economics and other inquiries”.

9.2 Economics and political science

Kautilya’s inter-disciplinary matrix is essentially hierarchical. Economics does provide inputs to political science but it does not receive any direct input from political science. For example, the king is supposed to carry out the cost-benefit analysis before undertaking a project, that is, economic concepts are used to improve the functioning of the government. Clearly, economics has been colonizing the other disciplines since antiquity.

9.3 Political science and vedas (moral values)

According to Kautilya, it was the spiritual duty of a king to take care of his subjects. He expressed the need for both the citizens and the king to be ethical. He emphasized dharma (ethics) through out *The Arthashastra*. He (p. 107) observes, “The observance of one’s own dharma leads to heaven and eternal bliss. Whoever upholds his own dharma, will find joy here and in the hereafter (1.3)”. Kautilya (p. 177) summarized his advice as: “Ever victorious and never conquered shall be that *Kshatriya*, who is nurtured by Brahmins, made prosperous by the counsels of able ministers and has, as his weapons, the precepts of the *shastras* (1.9.11)”. He wanted that a king be benevolent, and energetic public servant implying that he be guided by public interest and not by his self-interest. That means some of the elements of matrices A_{13} and A_{31} may be non-empty.

9.4 Economics and vedas

Sen (1987, p. 6) comments on *The Arthashastra*, “The motivations of human beings are specified by and large in very fairly simple terms, involving *inter alia* the same lack of bonhomie which characterizes modern economics. Ethical considerations in any deep sense are not given much role in the analysis of human behavior. Neither the Socratic question nor the Aristotelian ones figure in this other ancient document of early economics, by a contemporary of Aristotle”. However, Sihag (2005b) points out that he does not fully explore Kautilya’s ideas on ethics and its interface with economics.

According to Kautilya, unless the survival of the state was threatened, ethical values should set the boundaries for all endeavors including economic ones. He (p. 107) emphasized the basic dharmic (moral) duties of individuals as “Duties common to all: Ahimsa [abstaining from injury to all living creatures]; satyam [truthfulness]; cleanliness; freedom from malice; compassion and tolerance (1.3)”. Incidentally, the use of the word “tolerance” is significant since John Locke (1689) is usually given the credit for emphasizing its virtue. Independence of economic thought from religion in itself

was not a small feat since even almost two thousand years later Galileo, who only indirectly challenged religion, was faced with Inquisition.

9.5 *Anviksiki (philosophy) and economics*

Kautilya believed that philosophy was “privileged knowledge”, and was an input to all other branches of knowledge. According to him, philosophy provided the reasoning in distinguishing between good and bad and between ethical and unethical actions. Also the line “it provides the techniques for all action” is note-worthy. Since it implies that philosophy sheds light on methodological issues in all branches of knowledge including economics. Kautilya dedicates his work to Om (God or moral values) and Brihaspati and Sukra (political thinkers) implying that his goal was to strike a proper balance between material well-being and spiritual well-being.

9.6 *Economic knowledge and public policy*

Marshall (1920, p. 757) in acknowledging the contributions of the Physiocrats asserted, “They thus gave to economics its modern aim of seeking after such knowledge as may help to raise the quality of human life”. Regarding the aim of *The Arthashastra*, Kautilya (p. 100) writes, “By following [the principles set out in] this treatise one cannot only create and preserve dharma [spiritual good], artha [material well-being] and kama [aesthetic pleasures] but also destroy [their opposites, i.e.] unrighteousness, material loss and hatred. It is a guide not only for the acquisition of this world but also the next (15.1)”. Thus contrary to Marshall’s assertion, the above statement by Kautilya and the presentations of his views on various public policies in other studies indicate that such a change in the goals of economic knowledge had occurred much earlier than the Physiocrats.

Concepts originated by Kautilya. Some of the concepts may be as old as mankind. Therefore, the critical question is: how did Kautilya use these concepts? And was he coherent in their use? Kautilya refers to eleven schools of thought before him. It indicates that there must have existed some library where he could access the earlier works, although the practice of oral transmission from teacher to disciple cannot be excluded. These schools existed at different times and there were no “competing research programs” at one single time. Rangarajan (p. 817), the editor of *The Arthashastra* observes, “The subjects on which Kautilya disagrees with earlier teachers are not many: the nature of the sciences, the number of ministers, the process of deliberation, fines for erring officials, the punishments for perjury and robbery, and calamities, including the discussion on anger and lust, are the more important ones. Most of the disagreements with the unidentified teachers are concentrated in the books on calamities and foreign policy”.

Two points are worth noting. First, it is important to point out that Kautilya originates several of the important concepts in economics while discussing calamities (Book 8) and foreign policy (Books: 6, 7, 9, 11 and 12). Second, what matters are the method, coherence and level of reasoning and not on how many topics Kautilya differs from his predecessors. He does not accept any point without sound reasoning. His scientific methodology blended with rich content sets him apart from his predecessors. Kautilya’s *Arthashastra* has many concepts, which may be classified into two categories: those originated by pre-Kautilyan writers and he refined them and those originated by Kautilya himself.

Refinements of the existing concepts by Kautilya. Some concepts, like bounded rationality were advanced by Kautilya’s predecessors as the primary reason for the establishment of a bureaucratic set-up. However, Kautilya elevated the discussion to a

higher level by adding the importance of designing a bureaucratic system, which minimized the scope for conflict of interest possibilities. The identification of wage, rent, profit and interest as different factor payments by his predecessors was remarkable. But Kautilya saw the role of land, labor and capital as sources of economic growth and thus provided a modern interpretation. Finances were always critical to the maintenance of any kingdom and therefore, some fiscal issues were discussed by his predecessors. However, Kautilya extended that in two directions that: there are limits to taxation and suggested that tax revenue be directed to the provision of infrastructure, which increased income and consequently to more tax revenue, that is, instead of increasing the tax rate, he suggested increasing the tax base. Similarly law and order issues were considered critical to the stability of the kingdom and therefore, reducing criminal activity through punishment was discussed by pre-Kautilyan writers. But Kautilya (p. 377) added, "It is the power of punishment alone, when exercised impartially in proportion to the guilt, and irrespective of whether the person punished is the King's son or an enemy, that protects this world and the next". Kautilya's predecessors understood the logic of backward induction but Kautilya added the role of asymmetric information in bargaining and the time inconsistency problem. There are numerous other extensions and refinements undertaken by Kautilya.

Creation of a core of economic knowledge by Kautilya. First, it may be noted that most of the words we use today, such as, principal-agent, asymmetric information, time inconsistency have been coined only very recently. But that does not mean that the earlier writers did not understand them or use them. In fact, Kautilya initiated the exploration of "science of man". For example, He (p. 283) suggested, "The king shall have the work of Heads of Departments inspected daily, for men are, by nature, fickle and, like horses, change after being put to work (2.9)". Second, as discussed above, the origin of a concept is attributed to Kautilya only if it can be "found or read into" *The Arthashastra*, has a reasonably substantive discussion and correct application. Based on these criteria, more than a score of basic ideas in economics can be found in Kautilya's *Arthashastra*.

A partial list of some important concepts contained in *The Arthashastra* is:

- opportunity cost;
- rudimentary demand and supply apparatus;
- the law of diminishing returns;
- externalities;
- undesirability of monopoly and need for its regulation;
- moral hazard;
- role of law and order[14];
- public goods;
- Kautilya-curve (nowadays called Dupuit–Laffer curve);
- producer surplus;
- importance of human and physical capital accumulation to economic growth;
- role of infrastructure to economic growth;
- theory of gains from trade and terms of trade;
- principal-agent problem;
- efficiency wages[15];

- specification of explanation and prediction as the goals of an economic inquiry;
- role of asymmetric information in bargaining; and
- time inconsistency problem.

Kautilya synthesized and refined the existing ideas at his time. But his true genius lay in innovating the novel concepts, such as the optimization principle (in this case minimization of effort). Kautilya (p. 609) states, “When equal monetary help is given, it is specially advantageous to get it from one who readily complies with requests, is generous, gives continuously and without much effort (7.9)”.

9.7 A set of hypotheses proposed by Kautilya

He advances several hypotheses. A few of them may be listed here:

- human effort and capital accumulation are the sources of economic growth;
- heavy taxation leads to the erosion of tax base;
- prosperity changes peoples’ minds;
- information is the key to better decision making;
- justice and rule of law are the pre-requisites for economic growth; and
- consumer durable goods face unstable demand.

Schumpeter’s test. It is noteworthy to point out that Kautilya understood the working of the economy in which the growth in income affected other elements, such as governance and which in turn affected income. Sihag (2007a) presents Kautilya’s implicit model as follows:

$$H^\circ = \frac{\Delta H}{\Delta t} = \alpha_0 + \alpha_1 L_H + \alpha_2 H + \alpha_3 Y \quad (1)$$

$$GG = \beta_0 + \beta_1 H + \beta_2 Y + \beta_3 M \quad (2)$$

$$M = \delta_0 + \delta_1 Y + \delta_2 H_{PV} \quad (3)$$

$$Y = A(GG, H_E, M)F(K \cdot L) \quad (4)$$

where, H° = increase in knowledge of all four disciplines (H), L_H = knowledge creating workers (Brahmins), H_E = knowledge of economic principles and accounting methods, GG = good governance, Y = *per capita* income, H_{PV} = knowledge of philosophy and Vedas (religious scriptures), M = ethical conduct and $F(K \cdot L)$ is the production function.

In summary, Kautilya’s *Arthashastra* does contain what Schumpeter (p. 248) called a “theoretical skeleton” and thus it cannot be labeled pre-scientific. The above analysis establishes that Kautilya’s *Arthashastra* declares economics as a distinct discipline and thus satisfies the first requirement to declare it as the first word on economics. It is also indicated that *The Arthashastra* considers economics as the “science of man” and contains a logically consistent and adequate core of economic knowledge. These concepts, at least in some moderate detail, are presented in other studies implying that economics originated as a separate discipline for more than two millennia ago.

Incidentally, Kautilya shows that Hindu-civilization has no intrinsic aversion to economic growth and there is no such thing as Hindu growth rate: The analysis in Kautilya's *Arthashastra* dispels the myth that Hindu civilization is inimical to economic growth and also sheds some light on the "second generation" economic reforms in India. Since it is essentially a treatise on the imperative of economic growth.

10. Conclusion

Recent works question Adam Smith as the biological father of economics since both the "content and method" of contemporary economics do not find their origins in *The Wealth of Nations*. For example, Ekelund and Hebert claim that he is not the father of microeconomics and others note that he is not the father of macroeconomics. Redman asserts that the assumptions of rationality and optimization, which are the corner stones of economics, are incorrectly attributed to Adam Smith. On the other hand, according to Kautilya, the scope of economics is very broad, more like that of postmodern era with some imperialistic tendencies of colonizing other disciplines. His methodology is essentially Marshallian: the use of partial equilibrium approach and the making of a distinction between the short-run and the long run. Kautilya recommended the use of optimization subject to constraints methodology. But the mode of implementing this methodology was beyond his capabilities. Also, discrete marginal analysis is discernible from his analysis. Contrary to the claim by Ekelund and Hebert, Dupuit was not the first one to use *ceteris paribus* clause or the marginal analysis. Besides Kautilya, Bernoulli also used the *ceteris paribus* clause earlier than Dupuit. On the other hand, despite the availability of calculus, Adam Smith did not use either the marginal analysis or the *ceteris paribus* clause.

Table II provides a summary of the contributions of Kautilya, Adam Smith and Dupuit regarding the scope and methodology, etc. of economics.

Groenewegen (2002) identifies three origins of economics based on the definition of economics: (i) at the end of the seventeenth century if application of scientific method to

Requirements proposed by	Characterization of economics as a science	Kautilya's Arthashastra fourth century BCE	Adam Smith's Wealth of Nations 1776	Dupuit and other engineers 1830-1870
Groenewegen	Definition Scope	Broad like today Broad like today	Narrow Narrow	Narrower Narrower
Spiegel	Separate	Yes	No	
Marshall	Writing a treatise	Yes	Yes	No
Barber, Dupuit and Landreth and Colander	Number of concepts Original Synthesis Consistent	Reasonable Many Yes Yes	Reasonable Just one or two Yes Not always	Very few A few No Yes
Schumpeter	Economy as a system Method or tooled knowledge Recognized existence	Yes Scientific Yes	Yes Pre-scientific Yes	No Scientific Yes

Table II.
A summary of various requirements and origins of economics

economic phenomenon is considered its definition, (ii) to the third quarter of the eighteenth century if its subject matter consists of production and distribution of wealth, and (iii) at the end of nineteenth century if Robbins' definition of economics is taken (i.e. allocation of scarce resources among alternative ends). Actually, Kautilya's *Arthashastra* is broader in scope than Robbins' definition of economics and therefore, qualifies to be the true origin of the engineering approach to economics.

Kautilya was the first one, who wrote a treatise on economics, carried out brilliant synthesis of existing ideas, originated more than a score of basic concepts in economics, provided coherent interpretations and most importantly understood the economy as an inter-dependent system of various elements and thus clearing the high bar set by Schumpeter. The above analysis provides the necessary justification for Sen's claim that *The Arthashastra* is the first origin of the engineering approach to economics.

Notes

1. Groenewegen (2002, pp. 67-8) approaches the question related to the origin of economics very methodically. He believes that the answer to this question depends on which definition of economics is used. As an illustration, if Robbins' definition is used then the later half of the nineteenth century may be declared as the origin of economics. He (pp. 48-68) lists "concerted scientific effort", "the widening scope", "the analysis of capital and the development of a three factor model" and "the development of some general, unifying principles" as the four unique characteristics of the third quarter (1748-1776) of the eighteenth century to declare it as the period of the origin of economics. He (p. 87) adds, "The evidence marshaled by Hutchison reinforces the now widely held belief that economics emerged as a separate science during the period of just over a quarter of a century ending with the publication of the *Wealth of Nations* in 1776".
2. *Current Views on the Time Period of the Origin of Economics*: Similarly, Backhouse (1997, p. 22) remarks, "Economics, since its origins in the seventeenth century, has been concerned with understanding the world, and with the provision of advice to policy makers".
3. *Scope of Economics since Adam Smith*: The scope of economics has broadened. According to Spiegel, this trend of broadening the scope of economics started with Wicksteed. He (p. 528) states, "His (Wicksteed's) reference to the 'the purposeful selection between alternative applications of resources' was to resound later in Robbin's definition of economics as the science that treats of the allocation of scarce resources among different uses". He adds, "The elevation of the logic of choice to an all-encompassing rule guiding human behavior in all its aspects has encouraged later writers to claim for economics a far wider scope than is conventionally accorded to it". However, Manski (2000) believes, "Throughout much of the twentieth century, mainstream economics traded breadth for rigor. The narrowing of economics ended by the 1970s. Since then a new phase has been underway, in which the discipline seeks to broaden while maintaining the rigor that has become emblematic of economic analysis". This narrowing of its scope during the last century may be partly due to the fact that sociology as a separate discipline was carved out of economics.

Classical Economists on the Scope of Economics: Dorfman (1991) notes, "Wealth of Nations was primarily a treatise on economic development". Indeed, according to the classical economists, the scope of economics was essentially limited to economic growth. Since they talked about other topics like income distribution and value but offered very little. As Samuelson (1978) notes, "For all their talk about the importance of the problem of distribution between land rent, labor wages, and profits, the classicists succeeded in saying little definite (and correct) on levels of and changes in relative factor shares". Similarly, according to Deane, classical economists contributed very little to the theory of value. She (p 107) remarks, "For the moment what needs to be said is that the mature neo-classical school replaced the fragmented, often vaguely-defined, philosophically-oriented

analysis of the classical school with an integrated theory of value-in-use and value-in-exchange in which market price was mathematically determined by the intersection of the schedules of demand and supply”.

Neoclassical Economists on the Scope of Economics: Robinson (1953) did remark that neoclassical thought paid too much attention to little issues like “why does an egg cost more than a cup of tea” and ignored the big issues like growth and distribution of the classical economists. According to Marshall (1920, p. 1), “Political Economy or Economics is a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of well-being”. He (p. 42) adds, “Economics is thus taken to mean a study of the economic aspects and conditions of man’s political, social and private life; but more especially of his social life”.

Current scope of economics: Myerson (1999) remarks, “A generation before Nash could have accepted a narrower definition of economics, as a specialized social science concerned with the production and allocation of material goods”. He adds, “But today economists can define their field more broadly, as being about the analysis of incentives in all social institutions”. Samuelson (1968) summarizes aptly, “Harriet Martineau, who made fairy tales out of economics (unlike modern economists who make economics out of fairy tales)”.

4. Stigler (1984) and Lazear (2000) label economics as an imperial science because of its colonization of other disciplines such as: sociology, history, political science and law. Similarly, Spiegel (1991, p. xxiv) asserts, “In the twentieth century economics came to be called an ‘imperial science’; its theoretical patterns of analysis came to be applied in other fields such as political science, law and sociology”.
5. Certainly our ideas about the significance of past ideas or the methodology to evaluate their significance do change. As Schaffer (p. 43) quotes Gooding’s (1989, p. 70) conclusion that “The identity of an experiment – its importance and significance – is not fixed: it is plastic”.
6. Viner (1954) reviewed Schumpeter’s *History of Economic Analysis* as: “The fact remains that in the case of some authors he emphasizes their defects as analysts and admits their merits only grudgingly whereas with others he draws attention only to their strong points and leaves unmentioned or strains himself to find some sort of defense for the weak points in their analysis”.
7. Marshall (1920, p. 757) asserts, “Since he was the first to write a treatise on wealth in all its chief social respects, he might on this ground alone have a claim to be regarded as the founder of modern economics”.

Barber (1967, p. 17) observes, “In the main, pre-classical literature had been more disposed to judge economic performance than to analyze it”. In fact, he goes as far as to say, “Little of the content of *The Wealth of Nations* can be regarded as original to Smith himself. Most of the book’s arguments had in one form or another been in circulation for some time. But this fact in no way diminishes Smith’s achievement. He was the first to draw the threads together, to fit them into a coherent system, and to communicate the findings to a wider audience”.

However, the following lengthy statement by Landreth and Colander is typical of assessments of Adam Smith’s contributions. They (Landreth and Colander, 1994, p. 74) observe, “Some historians of economic theory have attempted to rank economists according to their technical brilliance – their ability to develop new techniques of economic analysis and their virtuoso performance in applying technique. Judged by this criterion, Adam Smith ranks low. Other historians have attempted to rank past writers by originality. Judged in this way, Smith ranks behind Cantillon, Quesnay and Turgot. But viewed historically, Smith’s abilities and his contribution to the flow of economic ideas represent a much scarcer resource than either originality or technical competence: his role was to take up the best ideas of other men and meld them, not with technique but with

judgment and wisdom, into a comprehensive system that not only revealed the essential functioning of the economy but also provided rich insights into policy questions”.

8. *Dupuit's contributions*: until recently, Dupuit was credited only with the concept of consumer surplus, Dupuit–Laffer curve and the deadweight loss of taxation. Ekelund and Hebert bring to light his many additional contributions related both to “content and method”. According to them, he developed the concept of marginal utility, resolved the “water-diamond paradox” and provided a firm foundation for the derivation of demand. They believe that he was concerned not just with the consumer surplus but with producer surplus as well. They attribute to him the development of analysis related to monopoly, various kinds of price discrimination, product differentiation, the link between incentives and institutions, intellectual property rights and the application of mathematical methods to economic issues.
9. The methodological issues have attracted philosophers since antiquity. Redman notes that notwithstanding some fuzziness, the distinction between induction and deduction goes back to ancient Greece. She (fn. 3, p. 160) states, “Aristotle first used the word (induction) in no less than three ways to mean the passage from the individual or particular to the universal, the enumeration of all instances, and the abstraction by intuition of a general truth by considering a particular case. It is the first definition that forms the basis for the modern discussion”. The use of methodology in economics has come under attack from so many sides that Backhouse felt compelled to defend it. He (1997) devotes three chapters in its defense. He (p. 5) asserts, “The first stage is to defend the thesis that methodology matters. This involves taking on not only the ‘practical’ objections to methodology raised by economists, but also the philosophical case made by McCloskey and Weintraub and other ‘postmodern’ critics of methodology”.
10. Drekmeier (1962, p. 189) writes, “Dharmashastra is of an essentially deductive nature, Arthashastra, by contrast, introduces inductive reasoning and a greater realism”.
Similarly, Parmar (1987, p. 14) states, “Kautilya’s method has two main ingredients – reason and experience gathered from history. The former helps him analyze the principles of politics and the latter enables him to draw sound general conclusions”.
11. *A History of “All Other Things Being Equal” Phrase*: Marshall is generally credited for popularizing the phrase “all other things being equal”. He (1920, p. 36) justifies its use, “Almost every scientific doctrine, when carefully and formally stated, will be found to contain some proviso to the effect that other things are equal: the action of the causes in question is supposed to be isolated; certain effects are attributed to them, but only on the hypothesis that no cause is permitted to enter except those distinctly allowed for”. Similarly, Cartwright (1998, p. 239) asserts, “Most scientific explanations use *ceteris paribus* laws”.
Bernoulli (1738) was probably the first one to use this phrase. John Stuart Mill too used this methodology. Redman (p. 346) notes, “Most frequently he uses laws to state how things would be if certain conditions hold. At least once he uses a *ceteris paribus* statement; and, as Hausman notes, *ceteris paribus* is often consistent with much of what Mill says (133)”.
Ekelund and Hebert (p. 12) also note, “Already before 1850 we find Cournot and Dupuit utilizing the *ceteris paribus* method, as Marshall later named it”. However, Backhouse notes that a mere use of “*ceteris paribus*” clause is not enough to ensure a sound scientific analysis. He (p. ix) provides Kincaid’s list of the barriers to good science and “failure to investigate *ceteris paribus* clauses in the ways necessary to prove theories trustworthy” is listed as number one barrier to good science.
12. *A History of Marginal Analysis*: Today, it appears that the contribution of economics would be “marginal” without the marginal analysis. It is hard to imagine the state of economics without it and what kind of marginal analysis would there be without calculus. Faulhaber and Baumol (1988) make several points about marginal analysis.

First, they note that Newton and Leibniz developed the differential calculus during the seventeenth century but its general acceptance in economics occurred only by the end of the nineteenth century. According to them, Turgot, Thunen and Cournot used the marginal analysis but Walras, Menger, Javons, Marshall and Clark are given the credit for creating the “marginal revolution”. However, they remark, “No one is certain just when marginal reasoning entered the economic literature, because hints of it are sure to occur in any careful discussion of the logic of optional decision making”.

Similarly, Blaug (1973, p. 14) concludes, “Classical political economy did not begin in 1776, and the birth of marginal utility economics – marginalism, modern economics, whatever name we choose to characterize it – similarly, cannot be pinned down to any particular date”. He adds that the marginal revolution “was a process, not an event”. Indeed as indicated by Kautilya’s analysis this process started a long time ago.

Recently, Ekelund and Hebert brought to light the contributions of Dupuit. They (p. 88) claim, “On the one hand, Dupuit’s invention of marginal utility as a foundation for value culminated a long and circuitous tradition in econo-engineering. On the other hand, it was the beginning of a new tradition in economic analysis that focused on the microeconomic nature of individual markets”.

13. Fredrick, Shane, George Loewenstein and Ted O’Donoghue (2002) observe, “Along with inventing the topic of intertemporal choice, Rae also produced the first in-depth discussion of the psychological motives underlying intertemporal choice”.
14. Kautilya’s understanding of Public goods and the role of law and order are discussed in Sihag (2005a).
15. Sihag (2007b) presents Kautilya’s ideas on efficiency wages and principal-agent problem.

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Corresponding author

Balbir S. Sihag can be contacted at: balbir_sihag@uml.edu