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# Efficiency and utility: an evolutionary perspective

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## Abstract

**Purpose** – The purpose of this paper is to develop the argument that the link between efficiency and utility was strongest in the twentieth century. This would not only explain the growing focus on efficiency in the past, but also suggest that the importance of efficiency in society is set to decrease from now on.

**Design/methodology/approach** – The two arguments in support of the claim were: first, the growing importance of the service sector where an exaggerated focus on efficiency may decrease utility and second, the utility that is generated by different working environments and identities where heterogeneity is increasing.

**Findings** – Good reasons are found why the strong correlation between utility and efficiency that could be found in the process of industrialization is loosening.

**Research limitations/implications** – The findings imply that the role of economic science is probably rather decreasing.

**Social implications** – Social indicators for utility will probably gain importance.

**Originality/value** – This paper puts the importance of efficiency into a historical context.

**Keywords** Service industries, Utilitarianism, Economic history, Working practices, Input/output analysis

**Paper type** Research paper

## 1. Introduction

Economists have become used to the notion that efficiency is an intrinsic objective. Even in heterodox schools such as socialism (Miller, 1989) or ecological economics (Jollands, 2005), the primate of efficiency in the world of economic research is rarely questioned. This argument set out in this paper is that, while efficiency consistently remains important in some spheres, the degree to which it is connected with human utility – and therefore its significance – is dependent to a major extent on the historic situation. Referring to the rise of efficiency during the last centuries, it argues that the link between efficiency and utility is likely to decrease in present times and in the near future.

In order to elaborate on this claim, Section 2 provides a definitional introduction to efficiency and utility. Section 3 depicts the rise of efficiency since medieval times and in particular at the dawn of industrialization, while Section 4 presents arguments as to why the link between utility and efficiency has begun to weaken. A summary of conclusions can be found in Section 5.



## 2. Defining utility and efficiency

Since, utility is a more basic concept than efficiency, it is worthwhile to begin with the definition of utility which may subsequently be of help in defining efficiency. According to Jevon (1871), utility is the power of a commodity or a service to satisfy human wants. However, since Broome (1991) made some effort to analyse the concept of utility, his paper represents, a thorough reflection on the possible and historic meanings of utility. Broome offers the choice between two distinct concepts: utility as the mere collection of everything that is good and utility as the degree to which our preferences are matched. While Broome himself prefers the latter possibility, it should be emphasized that only in cases when we do not choose what would be best for us will there be a relevant distinction to be drawn between the two concepts.

The term “efficiency” is more technical in nature as it deals with the relationship between input and output. Efficiency contains two components: a part that is called “X-efficiency” (Leibenstein, 1976) or “technical efficiency” (Coelli, 2005) and a part that is called “allocative efficiency”.

The first part represents a highly simplistic approach to efficiency as (usually) only one input and one output are considered. Efficiency, in this case, describes the relationship between input and output: the fewer inputs that are needed for one unit of output, the higher the technical efficiency will be. Typical applications for measuring and comparing technical efficiencies include insurances (Gardner and Grace, 1993), schools (Levin, 1997) and banks (Miller and Parkhe, 2002).

For estimating allocative efficiency, consideration has been given to the premiss that more than one input or output exists. Efficiency continues to describe the relationship between input and output, but now allows for the possibility that one input (or output) may be substituted by another. On a farm, the quantity of a resource (say, the acreage) on which one ton of wheat is produced describes the technical efficiency but, if land can be substituted by fertilizer so that the costs for producing a ton of wheat can be reduced, it is the allocative efficiency that is improved. Likewise, if the farm can make more money by producing oats instead of wheat, it is once again the allocative efficiency that can be increased.

Comparing fertilizer with land and comparing wheat with oats both presuppose a common benchmark. In the first case, it is the cost and therefore a monetary unit with which land and fertilizer are compared, whereas in the second case it is the revenue, also resulting in a monetary scale. More generally speaking, this is where utility comes in. More often than not, economists measure utility in terms of money. Economists have become used even to converting non-economic amenities like mountains or health into monetary terms in order to create a one-dimensional scale for utility. To come back to our farm example, costs are considered as negative utility while revenue counts as positive utility. Therefore, in the model world of economists, an increase in allocative efficiency will proportionally increase utility. Likewise, improving technical efficiency would increase utility, too, because more positive utility is maintained per unit of input.

## 3. The rise of efficiency

Whereas different degrees of efficiency have always existed in human activities, the concept only became conscious and explicit at a somewhat late stage in human development. The Middle Ages provide a rather convenient starting point for an

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historic overview of the significance of efficiency as an economic concept. Looking for the most important driving forces in medieval times, Panigrahi (2002, p. 26) finds that:

[...] faith in a divine order, in an anthropomorphic God and a rational universe held intact his [Man's] conception of a moral order in which he could find happiness and certitude.

This citation shows that rights rather than output were what primarily mattered to medieval decision makers. Several of the economic structures were determined by a rights perspective rather than by the objective of efficiency, such as the obligation incumbent on peasants to work for a number of days each week on their lord's land. Applebaum (1992) and Schulze (1995) describe the low level of productivity to which this system led. Similarly, Aloisio (2007, p. 308) finds that "towns and urban elites were often more concerned with protecting their particular fiscal and commercial privileges than in reducing the cost of regional trade". It appears that capital accumulation was not perceived as an objective and was usually neglected if privileges for the upper classes could be manifested in a material way with any surplus available. Such short-term thinking contradicts any long-term notion of efficiency. Other scholars (McCloskey, 1991; Richardson, 2005) emphasize risk avoidance as an important objective during this period in history. Contemporary sources (Duby and Postan, 1998, p. 44) promote self-sufficiency as another important objective of the medieval economy, stating that "it should not be necessary to buy anything in from outside".

All of this indicates that the economy in medieval Europe was not geared towards any single objective of increasing efficiency. Nevertheless, a slow move towards greater efficiency can sometimes be observed from a study of economic history during medieval times. One example is the introduction of coins in the fifteenth century which made tax collection more efficient (Spufford, 1989), another might be the first written instructions on how to avoid losses on farms (Fitzherbert, 1534). Nagel (2006) described nicely how the Cistercians started their order by promoting the ideal of asceticism, and how they subsequently moved slowly towards a more or less explicit adoration of economic efficiency. While religious boundaries have often reduced economic efficiency (Hirsch, 1980), also the reformation in Central and Northern Europe has been hailed as an important step towards increasing efficiency in society (Weber, 1905). In most cases, however, efficiency was a rather "instinctive" and implicit longing on the part of human protagonists, not an explicit objective. This applies as well for the efficiency gain being attained through the centralization of executive power in the hands of the worldly rulers (Dilcher, 2002).

If the importance of efficiency were to be portrayed as a graph over time, it would probably illustrate an exponential movement upwards over the last 1,000 years. Several scholars have concerned themselves with the preconditions for the birth of capitalism in the nineteenth century which was to a great extent responsible for raising efficiency. Sombart's (1916) thesis that the introduction of double entry bookkeeping played a key role was among the first explanatory approaches. Others emphasized the central role of a conducive social environment (Mokyr, 1992) or appropriate organizational foundations (North, 1994). In any event, the dawn of the industrial age provided plenty of opportunities for increasing efficiency by providing a wealth of incentives. One reason for this was the straightforward nature of industrial output which could be readily measured in labour units per hour or in kilograms per invested capital and year. Another reason was the additional dimension of wealth which was

triggered by the Industrial Revolution. The invention of radios, cars, telephones and computers meant that it became obvious that an increase in efficiency had the potential to effect a clear upward shift in the quality of life of the masses. In the medieval economy, with its concentration on agricultural production and crafts, this was the case to a far lesser degree, for the increase in food production, in textiles and even jewellery had a more limited impact on overall utility as soon as basic needs had been covered.

Therefore, it would appear that the connection between efficiency and utility has never been so close as in the age of industrialization. If a given set of resources is available, the degree of efficiency determines the amount of output, and the amount of output will be in relative proportion to overall utility. Whilst economic science has often been criticized for adopting a “reductionist” approach (Daley and Cobb, 1989; Stern, 1997; Hoover, 2006), this kind of reduction was justifiable as long as an increase in efficiency had few other effects other than to increase utility.

The start of the “age of efficiency” (Callahan, 1964) is often deemed to coincide with the managerial revolution (Clark, 1984), and most notably with active phase of Frederick W. Taylor. By introducing his concept of scientific management, he placed the idea of efficiency at the very forefront of his work and was always very close to the industrial production process in his activities and writings. His book on “concrete costs” for example (Taylor and Thompson, 1912) was an excellent example of how, by concentrating on the relationship between input and output, it was possible to open up new possibilities for increasing efficiency. On a global scale, the emergence of a functioning world market is probably the most suitable indicator for the hegemony of efficiency (Studer, 2008).

The merits of this focus on efficiency can hardly be overemphasized. Without the millions of businessmen and engineers who have optimized production processes, cut costs and improved products, we would be very far from enjoying the standard of living that we have today. Indeed, for the sake of millions of undernourished and underprivileged people in less developed countries, there is still plenty of work to do to further enhance the efficiency of the economy so that some more basic needs can be fulfilled.

#### 4. Questioning efficiency

The first doubts about the proportionate relationship between the output of material goods and utility originated from the environmental movement. In the third quarter of the twentieth century, the potential side effects of industrial production such as sicknesses and ruined landscapes became increasingly clear. In the early environmental movement, pollution by industry put the Taylorian concept of efficiency into a negative light. However, this was only a temporary blip as far as the dominance of the efficiency concept was concerned. Environmental economists were quick to introduce monetary valuation methods for environmental amenities during the last quarter of the twentieth century. Either by interviews (Mitchell and Carson, 1990) or by appropriate comparisons (Freeman, 1979), dollar values were attached to all kind of natural resources. This made it possible to revise efficiency calculations to take account of a new definition of input and output in production processes that now included a figure for emissions or the costs of a depleted forest. People realised that maximum output does not necessarily lead to higher efficiency. The work of Georgescu-Roegen (1971) in particular and his application of the second law of thermodynamics to the economic

process highlighted the different output values within the production process. From now on, efficiency also meant an improvement of the production system aimed at a reduction of “valuable” input (e.g. natural resources) and a reduction of harmful output (pollution, etc.). It was the first time that anyone had considered efficiency that was not merely based on the quantity but also on the quality of input and output.

#### 4.1 Efficiency in the service sector

Ahead of us lie challenges to the concept of efficiency that are far greater than those posed by environmental concerns and one of the arguments can best be understood by adopting a sector-centred viewpoint, i.e. a mesoeconomics perspective. The industrial sector has been found to represent an ideal environment for efficiency studies, as both input and output are clearly defined, even if natural resources are included. However, while the industrial sector continues to register rising output, the very process of increasing efficiency has led to a decrease in the number of workers in this sector. While the industrial sector remains important as a source of most goods we consume, it is not as important as it has been as a workplace. The majority of working realities exhibit a clear shift to the service sector. Soubbotina (2004) estimates that 43 per cent of gross domestic product in low-income countries is produced in the service sector; the figures for middle- and high-income countries are 55 and 64 per cent, respectively. The proportion of labour in the service sector is rather above these figures.

The service sector comprises a wide diversity of branches, such as the health sector, the education sector or research and development. What is common to a large part of the sector is the fact that services are firmly connected with human interaction. Value is generated by a teacher through speaking in front of a class, by a doctor treating a patient or by a waiter serving a meal. Coming back to the issue of efficiency, the human interaction factor is both input of the economic activity (as it requires time as a resource) and an important part of its output.

The latter proposition requires more in-depth explanation. We know from happiness research that human interaction matters a great deal for human well-being. A detailed analysis has been carried out by Kahneman *et al.* (2004) who asked their respondents to recall the past 24 hours and attach negative and positive values to their experiences. On a scale of zero to six, the least positive feelings (3.41) are linked with being alone. This value is readily supplanted by interaction with co-workers (3.76) or clients (3.79), let alone interaction with friends (4.36).

It has been shown that there is no defined borderline between services carried out on the market and good turns among people who are acquainted with each other (Mann, 2008). The utility which you get out of a service can usually not be reduced to service in a narrow sense (like learning chemistry or having your hair cut). Its utility is also dependent on the quality of the human interaction linked with the services. To illustrate this notion with some examples:

- (1) The placebo effect yields beneficial clinical results in 60-90 per cent of diseases that include angina pectoris, bronchial asthma, herpes simplex and duodenal ulcer (Benson and Friedman, 1996). The fact that placebos in medical research show this surprising degree of success shows that curing consists, *inter alia*, of human attention and care devoted to the patient.
- (2) In purchasing services, the objective is increasingly to gain some relaxation. In a massage studio, for example, the best way to ensure that this relaxation is

- achieved is if customers are perceived as individual human beings rather than as mere clients. Sharing some coffee and thoughts about the weather for an hour after a massage can lift the utility of the experience considerably.
- (3) Most big companies nowadays work with automated answering services if you dial the main number. This saves labour, but serves as a permanent source of nuisance for customers who would, in most cases, prefer more direct communication in relation to their issues (Kipnis and Kaplan, 2008).
  - (4) The psychological counselling sector has witnessed growing demand over a number of decades. This is one example of where human interaction in the form of specific regard for individual characteristics has created a significant market. Kvale (2003) describes the situation of psychological services between the market and personal bonds.

For all four examples, the concept of efficiency is difficult to define. If it is defined in a classical manner, the strong link to utility dissolves. What exactly are the input factors to be considered if an ailment is cured by placebos? If the relationship between massage (output) and time (input) is maximized, this is not what is likely to generate maximum utility as far as the customer is concerned. Likewise, a high level of efficiency in terms of company telephone services is likely to reduce consumer utility. In both cases, it may still be economically beneficial to increase efficiency, but this notion does not readily translate into utility terms. For psychological counselling, the concept of efficiency does not lead very far. Although terms like “treatment efficiency” are occasionally used (Jinks, 1999), they do not refer to an easily measurable output of psychological services.

The jointness of producing utility through defined services and through scarcely defined interpersonal relations makes it difficult to implement the concept of efficiency in a meaningful way. A great deal of what matters in the service sector cannot be quantified, let alone be put into monetary terms. Attempts to grasp the full output of a service in a quantitative manner will usually fail. Rizzo (1979) was among the first to identify this measurement and uncertainty problem for the concept of efficiency in general terms.

All the examples above deal with interactions among people as a utility generating process. In other segments of the service sector, this interaction is either indirect or even of rather secondary character. As an example for an indirect bonding in the service sector, consider a piano player. Usually, his interaction with his customers happens only through playing for them. However, it is unclear how increasing any simple measure of efficiency could increase the utility of his listeners. As a case in point for services where personal relations are even relatively unimportant, the market for financial services may be mentioned. I approach the financial sector mainly to increase my wealth and to administer my funds, not to have valuable personal experiences. If we assume that rising profits in the financial sector do indeed generate rising levels of societal utility, then not all segments of the service sector show a blurring link between utility and efficiency.

In some parts of the service sector, the importance of the personal component of transactions can be estimated by observing the competition between web-based and local services. This is true for the banking and insurance sector, but also for large parts of retailing. In many cases, there are not many arguments in favour of choosing local services over virtual companies except the preference for personal interaction. This means that a large market share of local pharmacies over internet pharmacies

indicates that customers desire personal information and interaction when buying medicals.

All this does not indicate that efficiency in the service sector is entirely unimportant. It indicates, however, that it is far more difficult in the service sector, if compared to the industrial sector, to define efficiency for most activities in the sector, and that utility is often produced through factors that do not open themselves to simple quantification.

#### *4.2 Utility through working*

“The human intercourse that was formerly associated with traditional ways of working was destroyed by modern technology” (Applebaum, 1992, p. 552). This harsh statement indicates some regret for the changed nature of labour. We should probably be careful not to romanticize the time when farmers and industrial workers often ruined their health by hard and exhausting work. There are reasons to assume that today’s working realities in offices or seminar rooms are, in some respect, more comfortable than the realities of coal mining or manuring, typical examples of predominant practices 100 years ago. In any case, it is probably true that the heterogeneity of working conditions has increased steadily over the last few centuries. In the medieval economy, the vast majority of the population were peasants, whereas today there are still peasants whose work is similar to that carried out 500 years ago, while webpage designers or hedge fund traders face very different realities.

A challenge to the concept of efficiency has always been the fact that it is only output that is perceived to generate utility, while input is seen as generating costs (negative utility) only. Very recent attempts to attach monetary values to the process of working call this concept into question. Lips and Gazzarin (2008) have calculated by means of a discrete choice experiment that dairy farmers demonstrate an average willingness-to-accept factor for giving up farming of 33,000 Swiss Francs. Similarly, Key and Roberts (2009) estimate, on the basis of revealed preferences, non-pecuniary benefits for farming at \$43,000, a very similar value.

You would probably expect such high levels of utility from working in branches rather different from farming and would, for example, look at the art sector. As the protagonist of “Smoke, lilies and jade” (Bruce, 1926) muses to himself, “oh the joy of being an artist and of blowing blue smoke through an ivory holder inlaid with red jade and green.” It becomes clear that the utility from being an artist (and probably a farmer, too) is derived through two different ways: first, by doing work that matches my preferences, and second, through matching the professional identity that I prefer.

Even without this second part of creating a professional identity, there are surprisingly many leisure activities that prove that the utility of many professional activities is definitely greater than zero. Playing chamber music, making pottery, gardening or even to jaunt with a bunch of children are all activities that many people, on a regular base, undergo because they love to. There are few reasons why their utility should vanish because they are done by musicians, potters, gardeners or nursery teachers.

One of the more attractive points of Marxism in the nineteenth and twentieth centuries could well have been the fact that this school of thinking made it clear that working itself can have very different levels of utility. The exploited employee was deemed to be much more miserable than the liberated labourer in a factory that was co-owned by himself. If, however, the heterogeneity of working conditions has steadily

increased since the times of Marx, it is likely that today some professional situations will provide a very high non-pecuniary benefit, while others may even generate non-pecuniary damage.

A change in efficiency in almost any labour environment, however, may have a significant effect on its non-pecuniary value, both positively and negatively. Switching from milking with a bucket to milking with a machine may not only increase labour efficiency, but also the physical well-being of the farmer. Nevertheless, if the human input required for milking is minimized and labour efficiency maximized, much valuable contact with the animal may be lost and non-pecuniary working benefits may decrease considerably. This latter aspect is at the core of Applebaum's (1992) complaint cited above.

In traditional estimates of efficiency, the quality of labour conditions is usually neglected. However, if they form a considerable part of the utility generated by labour and if the change in technology and organization leads to a change of this utility, the link between efficiency and overall utility is blurring. Again, a mesoeconomics perspective is best placed to illustrate this theory. If working in agriculture generates more utility than working in the banking sector, an "efficient" structural change from farming to banking may well reduce overall utility.

## 5. Conclusions

The focus of economics on efficiency has, over the decades, contributed to a high standard of living and to a correspondingly high level of utility for billions of consumers. From a purely consumer perspective, the major importance of efficiency in maintaining or increasing this high level of utility is sustained. However, things take on a different perspective if we leave our consumer role and focus on our role in life where we are either members of a social community or part of the workforce.

In the rapidly growing service sector, our identity as social beings plays a far greater role than in the agricultural or industrial sector. This often makes it difficult to define measures of efficiency for services that are clearly linked with the quality of human interaction. Likewise, the growing diversity of working realities increases the importance of the utility (positive and negative) derived from working, so that the measure of efficiency in the professional world becomes less practicable.

Efficiency will probably always remain a core concept for production processes, for example in industry, and for a number of other processes in the economic world. However, there are strong arguments for the fact that the concept of efficiency had its most significant impact on society in the twentieth century because the link between societal utility and simple efficiency measures is set to weaken in the future. As economic science is largely defined as a science concerned with efficiency, it is also likely that the importance of economic science as compared to other disciplines will rather decrease.

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